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GEOCRES No. 30M13-57

DIST. 6 REGION

W.P. No. 88-78-10

CONT. No.

W. O. No.

STR. SITE No. 37-73-1113

HWY. No. 407

LOCATION MARTIN GROVE RD UNDERPASS

No. of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

OVERSIZE DRAWING

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 88-78-10 DIST 6

HWY 407 STR SITE 37-73-1113

Highway 407 Underpass at Martingrove Road

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GEOCRES 30M13-57

DATE

FOUNDATION INVESTIGATION REPORT

For

W.P. 88-78-10, Site 37-73-1113

Highway 407 Underpass at Martingrove Road

District 6, Toronto

INTRODUCTION:

This report contains the results of a foundation investigation carried out at the above mentioned site for a proposed structure between 82 09 07 and 82 09 09. The fieldwork consisted of advancing four sampled boreholes for depths ranging from 10.0 to 24.0 metres below ground surface. In addition, dynamic cone penetration tests were carried out in the vicinity of three of the four boreholes.

SITE DESCRIPTION AND GEOLOGY

The site is located on Martingrove Road, some 400 metres north of Steeles Ave. W. in the Township of Vaughan.

Topography across the site is fairly flat to gently undulating, with land use consisting of non-cultivated grassy open fields.

Physiographically, the site is located within the region known as the Peel Lake Plain, which is characterized by underlying till or boulder clay deposits.

SUBSURFACE CONDITIONS

Generally competent subsurface conditions were encountered across the site. The predominent subsurface deposit is a very stiff to hard glacial till comprised of a silty clay of low plasticity, some sand, and a trace of gravel. In addition, silty sand and silt layers were encountered within the till deposit. The glacial till was encountered from the ground surface to a maximum depth of 20 metres. Underlying the till is a deposit of very dense well graded silty sand with varying amount of gravel and a trace of clay. This stratum was penetrated to a minimum thickness of 4.3 metres at which point borings were terminated.

Reference should be made to the Record of Borehole Sheets contained in the Appendix of this report. These sheets contain the description and

extent of the soil types encountered, and in summarized form, field and laboratory test results. The stratigraphical profile shown on Drawing No. 887810-A is based on this information and shows the location and elevation of the borings.

A detailed description of the various strata are given below:

Silty Clay, Some Sand, Trace of Gravel (Glacial Till)

Extending from the ground surface and explored to a maximum depth of 20.4 metres is a glacial till comprised of silty clay of low plasticity, some sand, and a trace of gravel. Occasional seams and layers of silty sand and silt were also encountered within the deposit.

Typical grain size distribution curves for the deposit are shown in envelope form on Figure 1.

Physical properties of the overall deposit as determined from Atterberg Limits and water content testing are as follows:

	Range	Aver.
Natural Moisture Content (w) %	8-15	13
Liquid Limit (W_L) %	17-30	24
Plastic Limit (W_p) %	12-18	14
Plasticity Index (I_p) %	5-16	10

A plot of plasticity index versus liquid limit (Figure 2) indicate the glacial till deposit to be comprised mainly of silty clay of low plasticity (CL).

Based on an interpretation of Standard Penetration Test 'N' values and augering operation, the consistency of the till is assessed as being very stiff to hard throughout.

Silty Sand to Sand, Varying Amounts of Gravel

The till deposit is underlain by a stratum consisting of a well graded silty sand to sand with trace of clay and varying amounts of

gravel. The deposit was encountered at depths ranging from 17.1 to 20.4 metres below ground surface, and explored to a minimum thickness of 4.3 metres before borings were terminated.

Typical denseness of this deposit based on Standard Penetration Test 'N' values can be assessed as being very dense throughout.

GROUNDWATER CONDITIONS

Overnight borehole water level readings taken in four boreholes indicate groundwater level varied from elevation 165± to elevation 156± across the site. In lieu of the variable water levels encountered, a higher stabilized water level can be anticipated at an approximate elevation of 165±.

DISCUSSION AND RECOMMENDATIONS

A single two span 22 x 76 metre structure is proposed to carry Martingrove Road over the new Highway 407. A proposed profile grade of elevation 163.0 for Highway 407 and elevation 171± for Martingrove Road will require excavation and cut slopes in the order of 8 metres since only a slight grade change is proposed for Martingrove Road.

In consideration of the competent subsoil condition across the site, recommendations pertaining to the foundation of the new structure are summarized below.

Perched abutments can be founded on spread footings located within the glacial till deposit at or below elevation 168.0 at the north abutment and 167.0 at the south abutment. An allowable capacity at the S.L.S. Type II of 350 kPa and a factored capacity at the U.L.S of 600 kPa may be used for design purposes. The centre pier and alternatively, full height abutments can also be founded in spread footings located at or below elevation 161.5 within the glacial till for a design capacity at the S.L.S. Type II of 450 kPa and a factored capacity at the U.L.S. of 800 kPa.

Earth pressure against the abutment wall should be computed as per Subsection 6.6.1.2.2 of the O.H.B.D.C. Manual.

The underside of all footing element should be provided with a minimum 1.3 metre of earth cover for frost protection purposes.

No dewatering problems are anticipated since excavation will take place above the groundwater table. However, excavation for Hwy. 407 and the placement of toe drains should be done prior to the footing excavations. Any localized seepage that may occur can be controlled by perimeter ditches and pumping from corner sumps.

Cut slopes constructed to a 2:1 geometry in the glacial till are not expected to result in any stability or maintenance problems.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. K. Chak, Trainee Engineer, utilizing equipment owned and operated by Master Soil Ltd., Toronto. This report was written by Mr. K. Chak under the direction of Mr. T. J. Kazmierowski, Foundation Engineer, and reviewed by Mr. M. Devata, Senior Foundation Engineer.

K. D. Chak
Trainee Engineer

M. Devata, P. Eng.
Senior Foundations Engineer

APPENDIX

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 1

METRIC

W P 88-78-10 LOCATION Co-ords. N 4 846 603.2; E 296 286.6 ORIGINATED BY KC

DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY KC

DATUM Geodetic DATE 82 09 07 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	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
170.6	Ground Surface										
0.0	Weathered		1	SS	47		170				
			2	SS	31						4 18 47 31
			3	SS	50						
			4	SS	63		168	100/23 cm			
	Brown		5	SS	46						
	Grey		6	SS	24		166				1 21 53 25
	(Glacial Till)		7	SS	28	▼					
	Silty Clay of Low Plasticity		8	SS	17		164				2 19 55 24
	Some Sand		9	SS	21						
	Trace of Gravel		10	SS	41						1 21 56 22
	Very Stiff to Hard		11	SS	58		162				
			12	SS	36		160				
	varying amounts of Sand		13	SS	35		158				
			14	SS	48						
			15	SS	55		156				
153.5							154				
17.1	Grey										
	Well graded Sand		16	SS	100/20 cm		152				24 60 (16)
	Some Silt and Gravel										
	Very Dense						150				
149.2			17	SS	100/8 cm						
21.4	End of Borehole										
	Note: Cave-in @ 6.0 m										

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

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 2 METRIC

W P 88-78-10 LOCATION Co-ords. N 4 846 527.7; E 296 307.2 ORIGINATED BY KC
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY KC
DATUM Geodetic DATE 82 09 08 CHECKED BY GP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
169.5	Ground Surface										
0.0	Weathered		1	SS	49		168				
			2	SS	56						
			3	SS	56						
	Brown		4	SS	78		166	100/23 cm			
	Grey		5	SS	25						1 16 51 32
	(Glacial Till)		6	SS	17		164				4 18 47 31
	Silty Clay of Low Plasticity		7	SS	30						
			8	SS	51		162				3 33 46 18
	Some to with Sand		9	SS	54						
	Trace of Gravel		10	SS	95		160				
			11	SS	54	▼	158				
	Silty Sand and Gravel		12	SS	56						
	Very Stiff to Hard		13	SS	59		156				
			14	SS	62		154				
	increased amounts of Sand		15	SS	100/18 cm		152				
149.1							150				
20.4	Grey Well graded Silty Sand Trace Gravel and Clay		16	SS	100/20 cm		148				9 45 38 8
	Very Dense						146				
144.8			17	SS	125						
24.7	End of Borehole										
	Note: Cave-in @ 11.5 m										

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 3 METRIC

W P 88-78-10 LOCATION Co-ords. N 4 846 556.4; E 296 279.8 ORIGINATED BY KC
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY KC
DATUM Geodetic DATE 82 09 09 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 (○ 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 (%) GR SA SI CL
169.9	Ground Surface										
0.0	Brown		1	SS	57		168	100/15 cm			
	Grey (Glacial Till) Silty Clay of Low Plasticity Some to with Sand Trace of Gravel		2	SS	66		166				
			3	SS	28				○		15 17 39 29
			4	SS	31		164				
			5	SS	42				○		
			6	SS	58		162				
	Silty Sand		7	SS	62				○		3 22 59 16
			8	SS	106/28 cm						0 45 44 11
	Very Stiff to Hard		9	SS	69		160		○		1 14 57 28
			10	SS	74						
			11	SS	31		158				
			12	SS	26						
	Silty Sand Some Gravel		13	SS	37	▼	156				
			14	SS	98						
152.2			15	SS	53		154				
17.7	Grey Well graded Sand Some to with Gravel Trace Silt & Clay		16	SS	100/28 cm		152				
148.3	Very Dense		17	SS	100/8 cm		150				
21.6	End of Borehole										

+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 4 METRIC

W P 88-78-10 LOCATION Co-ords. N 4 846 563.5; E 296 297.8 ORIGINATED BY KC
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger COMPILED BY KC
DATUM Geodetic DATE 82 09 09 CHECKED BY

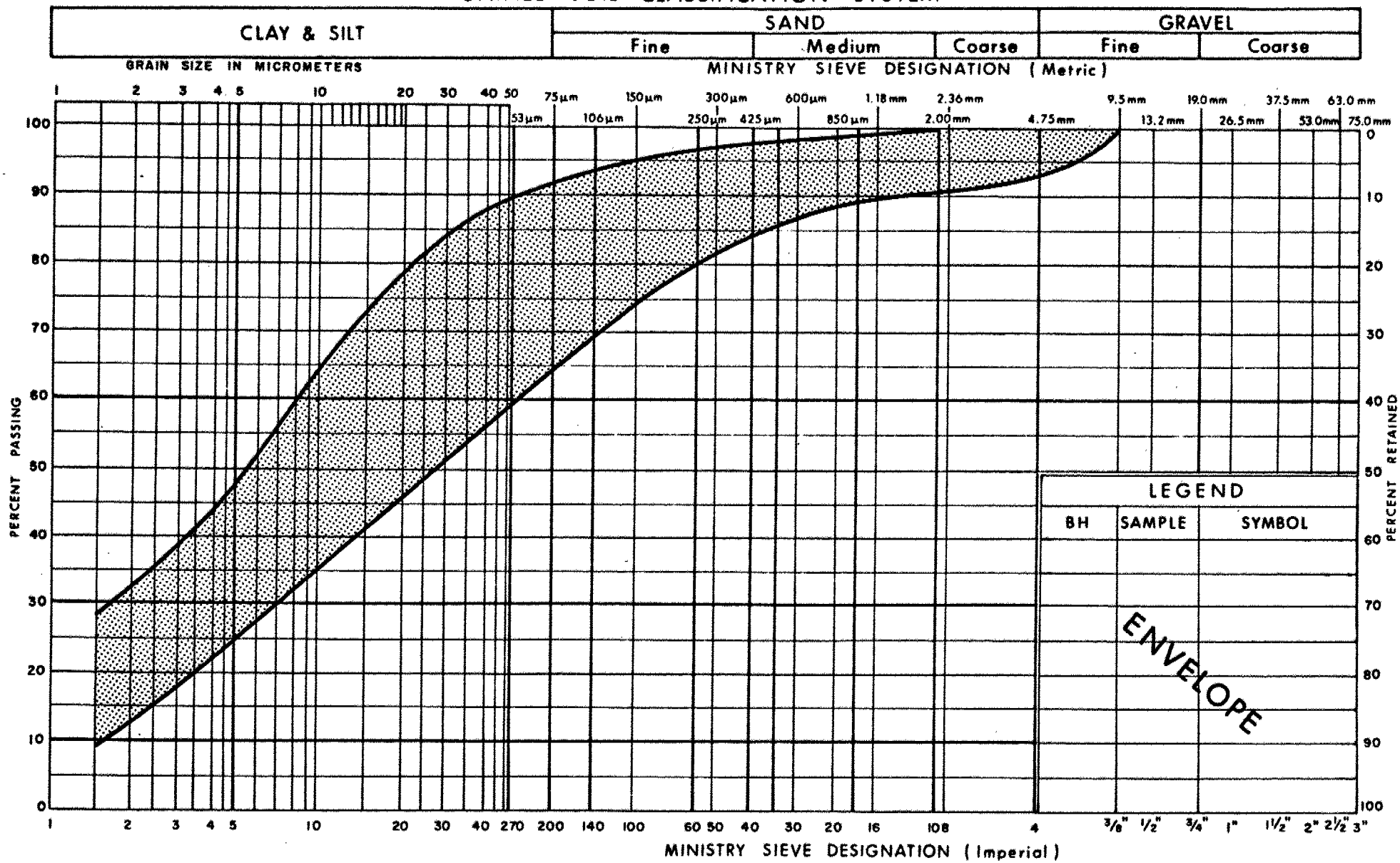
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT N (20 40 60 80 100) SHEAR STRENGTH o UNCONFINED + FIELD VANE • QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
170.4	Ground Surface										
0.0	Grey (Glacial Till) Silty Clay of Low Plasticity Some to with Sand Trace of Gravel		1	SS	24		170				
			2	SS	25		168				
							166				
	Silt		3	SS	68		164		o		0 9 66 25
							162				
	Very Stiff to Hard		4	SS	88	▼			o		6 23 57 14
159.3			5	SS	68		160				
11.1	End of Borehole Note: Cave-in @ 10.0 m										

+3, x5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation and Communications
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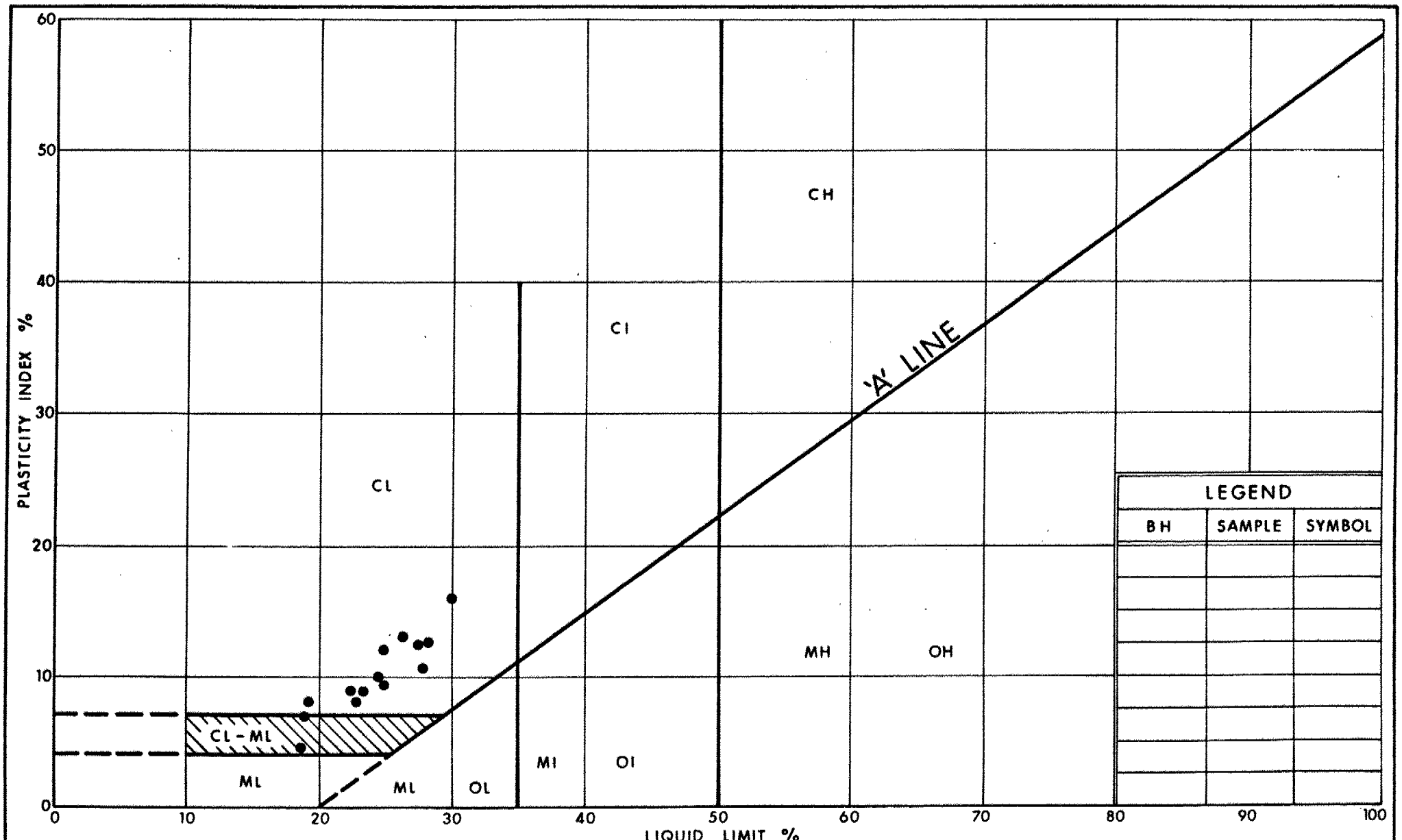
GRAIN SIZE DISTRIBUTION
(Glacial Till)
SILTY CLAY SOME TO WITH SAND, TRACE OF GRAVEL

FIG No 1

W P 88-78-10

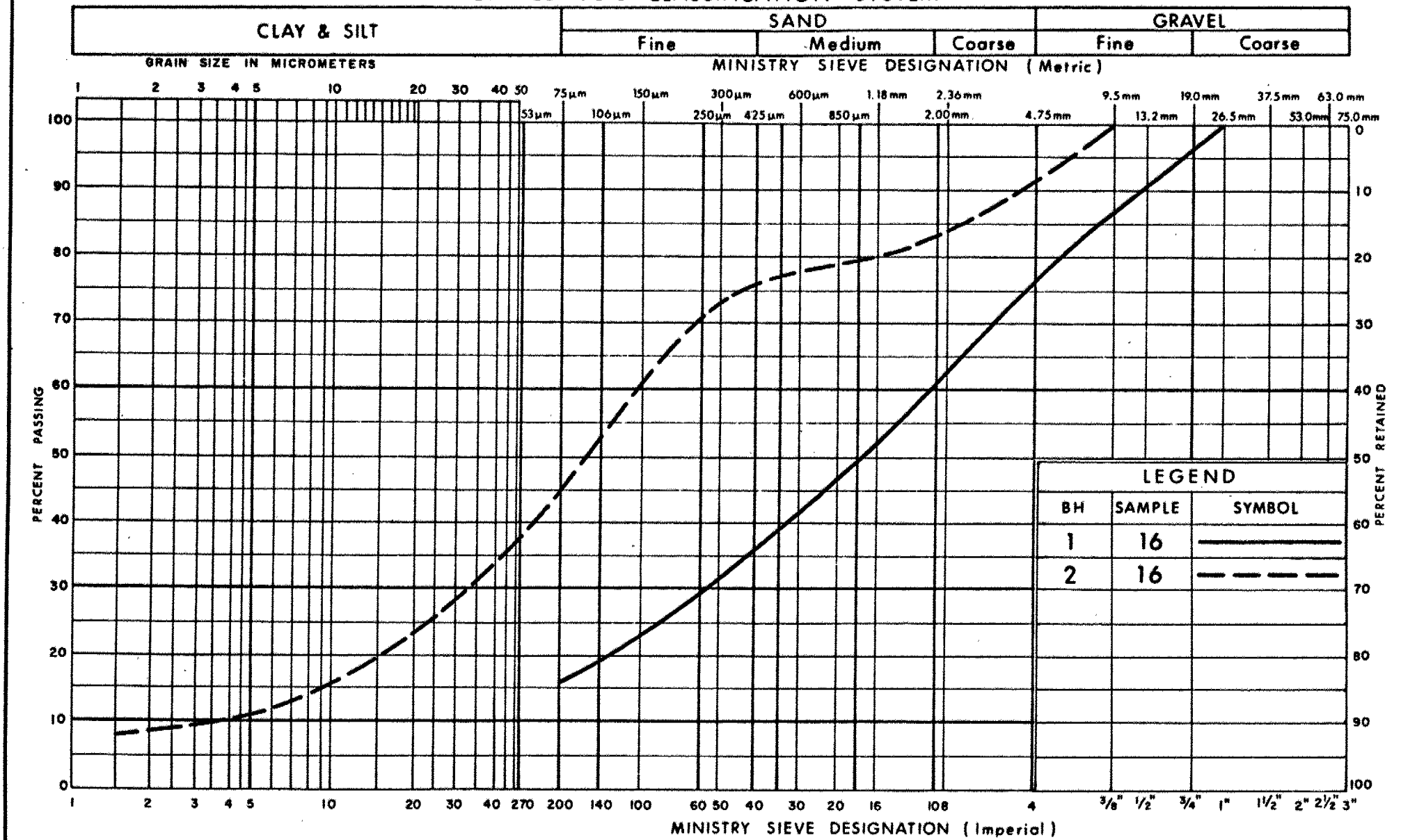


Ministry of Transportation and Communications
Ontario

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

FIG No 2
WP 88-78-10

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION
SAND TO SILTY SAND
VARYING AMOUNTS OF GRAVEL, TRACE OF CLAY

FIG No 3
WP 88-78-10

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-D-207 87 04

METRIC

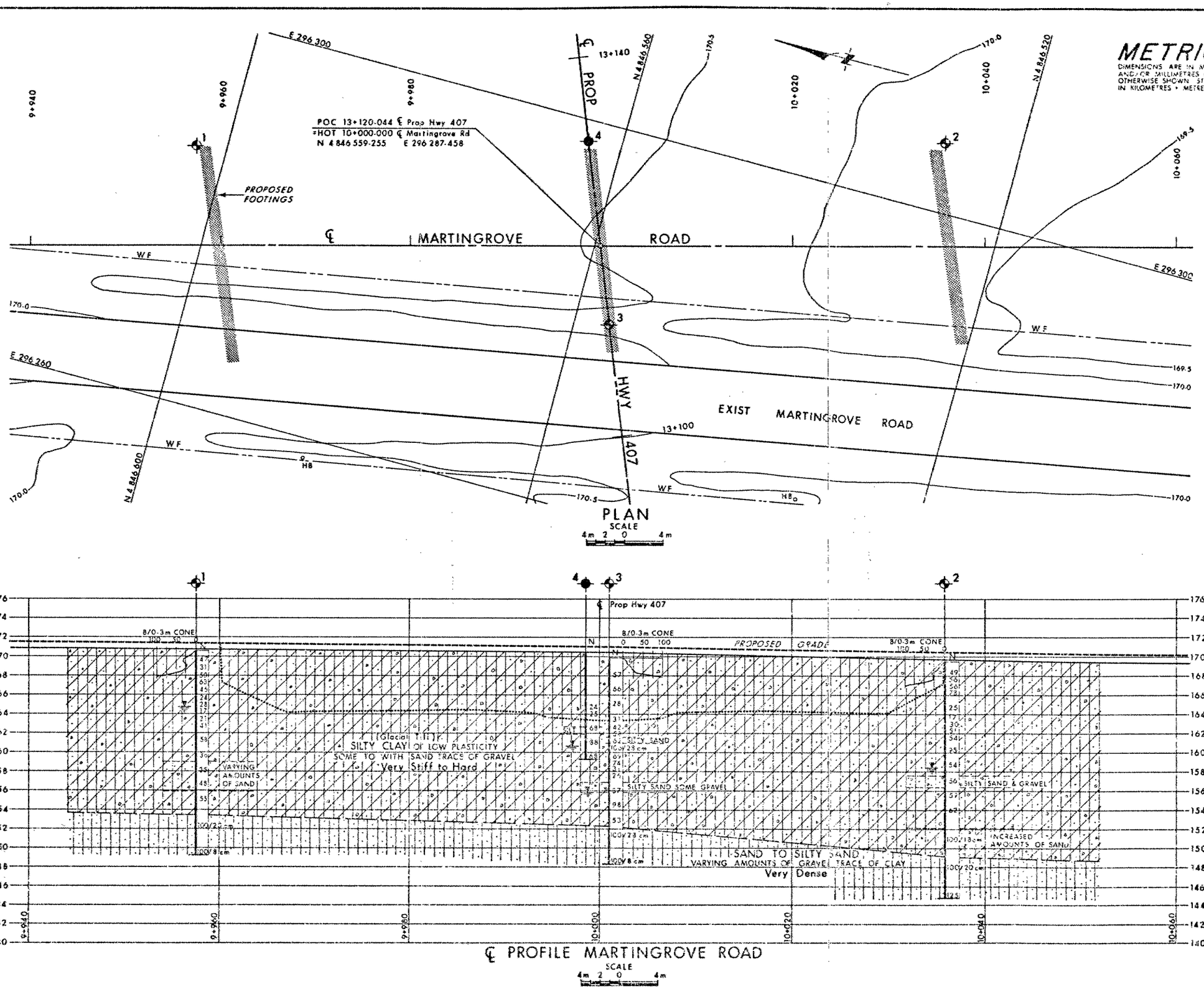
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

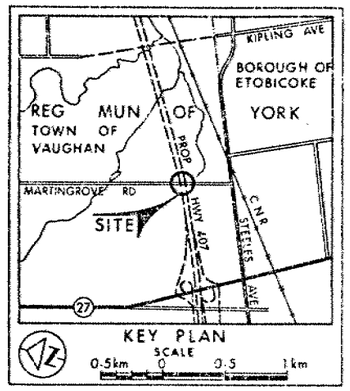
CONT No
WP No 88-78-10

MARTINGROVE RD UNDERPASS

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)
- WL at time of investigation 1982 09

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	170·6	4 846 603·2	296 286·6
2	169·5	4 846 527·7	296 307·2
3	169·9	4 846 556·4	296 279·8
4	170·4	4 846 563·5	296 297·8

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 Queensview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV	DATE	BY	DESCRIPTION

Geocres No 30M13-57

REF COLE SHERMAN & ASSOC LTD
DWG No 5581-S1F ; 1982 09 24

HWY No Prop 407			DIST 6
SUBMD KC	CHECKED	DATE 1982 11 04	SITE 37-73-1113
DRAWN	CHECKED	APPROVED	DWG 88810-A

Nov 15/94

WP 88-78-10
407 Mutingwa

George Al-Bazi asked if Integral Abutment is possible at this Site.

Geo said Ron Kuroli of D16 claimed FDS would not permit Integral abutment.

I searched the file and discovered no reference to exclusion of integral abutment. Further, I reviewed report and made recommendation to Geo that Integral Abutments are feasible.

I asked Geo to advise Ron L. that once we have sealed the impression that Bob Adams had determined that consultant was fully responsible and that our review is not necessary was disadvantageous to the Ministry.

D. J. Dunlop

MEMORANDUM

(416)235-3731

To: V.F. Boehnke, P. Eng.
Head, Structural Section
Central Region

1994 05 02

Attn.: Wade F. Young, P. Eng.

From: Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: Highway 407 U'Pass @ Martingrove Rd
W.P. 88-78-10, Site: 37-1113
District 6, Toronto

This is in response to your memo dated April 26, 1994.

It is feasible to drive piles after the box culvert is constructed and backfilling around the culvert, up to the underside of the abutment footing is taken place. However, the piles should be driven through pre-augured holes. The pre-augured holes should extend to the founding elevation of the culvert which is about 5m below the underside of the north abutment footing.

If there are any questions please call.

K.S.Q. Ahmad, P. Eng.
Foundation Engineer

For

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

cc: G. Al-Bazi, P. Eng.
D. Smith, P. Eng. (407 Project Office)

Ontario

MINISTRY OF TRANSPORTATION
Structural Section
1201 Wilson Avenue
Atrium Tower, 4th Floor
Downsview, Ontario, M3M 1J8
Telephone: 235-5510

memorandum

DATE: April 26, 1994

TO: D. Dundas, P. Eng.,
Acting Head, Foundation Design Section

Attention: K.S.Q. Ahmad, P. Eng.

RE: Hwy. 407 Underpass at Martingrove Road
W.P. 88-78-10, Site 37-1113
G.W.P. 88-78-01
District 6, Toronto

Thank you for your previous comments and recommendations, in particular, with regard to the construction problems at the north abutment where there is an adjacent box culvert.

You may have already received a copy of the General Arrangement from the Structural Office. Another copy is provided however for your convenience.

As shown on the drawing, piles will be driven after construction of the box culvert and back filling to the underside of abutment footing. Do you have any concerns that pile driving may cause settlement of the culvert and if so would it be more appropriate to drive piles prior to culvert construction? Kindly advise if the construction sequence as now detailed is acceptable or whether it should be revised. Thanks.

Wade F. Young, P. Eng.,
Sr. Structural Engineer
for:
V. F. Boehnke, P. Eng.,
Head, Structural Section

WFY:vn

cc: G. Al-Bazi
D. Smith (407 Project Office)

MEMORANDUM

(416)235-3731

To: G. Al-Bazi
Principal Design Engineer
Structural Office

1994 03 28

From: Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: Highway 407 U'Pass @ Martingrove Rd
W.P. 88-78-10, Site: 37-1113
District 6, Toronto

This is further to our memo of March 18, 1994 and our subsequent conversation of March 24, 1994.

It is now understood that piles foundations are considered for all footing elements of the above mentioned bridge structure. The abutments and pier may be founded on end bearing piles equipped with driving shoe reinforced tips as per MTO Standard No. DD-3301.

For design purposes the tip elevations of the piles are expected to be at the following elevations:

Foundation Location	Estimated Tip Elevation (m)
North Abutment	150.0
Pier	149.5
South Abutment	149.0

The piles should be advanced to elevation 152.0 after which pile driving should be controlled by the Hiley Formula as per MTO Standard SS 103-10 or SS 103-11, assuming ultimate capacities as indicated below. The piles should be advanced with a driving hammer capable of developing a minimum energy of 50,000 Joules per blow.

For design purposes, the following values, according to the O.H.B.D.C. are recommended for each pile.

	HP 310X79	HP 310X110
Factored Axial capacity at U.L.S.	1150 kN	1600 kN
Axial Capacity at S.L.S. Type II	825 kN	1150 kN
Factored Lateral Capacity at U.L.S.	60 kN	80 kN
Lateral Capacity at S.L.S. Type II	40 kN	60 kN
Ultimate Pile Capacity for Hiley Formula	2475 kN	3450 kN

The lateral capacities may be supplemented by the horizontal component of the battered piles.

If there are any questions please call.

K.S.Q. Ahmad, P. Eng.
Foundation Engineer

For

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

cc: Wade F. Young, P. Eng
D. Smith, P. Eng.

MEMORANDUM

(416)235-3731

To: V.F. Boehnke, P. Eng.
Head, Structural Section
Central Region

Attn.: Wade F. Young, P. Eng.

1994 03 18

From: Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: Highway 407 U'Pass @ Martingrove Rd
W.P. 88-78-10, Site: 37-1113
District 6, Toronto

This is in response to your memo dated January 25, 1994. Our comments to your queries are as follows:

No major dewatering will be required for excavation above elevation 161m. In our opinion normal sump pumping will be adequate to control groundwater seepage into the excavation. No dewatering NSSP is required.

It is understood that in order to reduce the potential conflicts between the north abutment footing and the box culvert, it is proposed to lower the abutment footing by about 3.5m to elevation 161 to 162m. The proposal is acceptable as the culvert foundation would remain outside the limit of an imaginary line drawn at 1H:1V from the north edge of the north abutment footing. The design pressures for the abutment of 300 kPa at SLS Type II and 550 kPa at ULS is valid for footing resting directly on glacial till between elevations 161 to 162m at the north abutment.

Alternatively, pile foundation at the north abutment driven to elevation 150m is also feasible.

If there are any questions please call.

K.S.Q. Ahmad, P. Eng.
Foundation Engineer

For

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

cc: G. Al-Bazi, P. Eng.
D. Smith, P. Eng.

Issue #1 Dewatering at pier location

material = mainly Glacial till
W.L. = 160.8
Excavation = 161 m.

- No major dewatering requirement
- perimeter ditches OK.
- no dewatering WSSP

Issue #2
- A Culvert exist near north abutment.
- location (exact) and culvert elevation not given
- if pile foundation a viable option
- if north abutment could be found at glacial till at elevation 161 and 162 m.
- water level is 164.6m.
- If abutment on spread footing on fill at Elev. 161 - 162m SCS Type II 300 kPa & U.C.S. ~~Type~~ 550 kPa OK.
- South abutment to be on granular pad at higher elevation (say 167.0m).
- Effect of one on the other.

Response.
- Pile foundation OK. @ elevation ~~WARRIOR~~ 150.m. (160 known till)
- spread footing feasible at 161m to 162m. However we would like to review the footing elevation in terms of culvert invert. Also, we would like to know culvert location to determine if excavation inside culvert is feasible, ~~water~~ or to comment on construction sequence and dewatering requirements at the north abutment.
- SCS. Type II of 300 kPa and U.C.S 550 kPa is OK on Glacial till at elevation 161 m to 162m.

Perched abutments on Glacial Till

North abutment @ 168.0 m
South abutment 167.0 m
} SLS - Type II 350 kPa, ULS 600 kPa.

Centre pier @ 161.5 m } S.L.S. - Type II 450 kPa U.L.S. 800 kPa

Frost Cover 1.3 m.

Profile grade of Hwy 407, 163.0 m (Excavation 161.7 m)

Cut slope 2H:1V (no stability problems).

Proposed excavation elev. @ pier = 161.0 m.

Borrow ave on either side of Martingrove. ditch elevation 162.5 m

Lowering abutment footing to elevation 161 to 162 m.

- Yes, perimeter ditches ~~would~~ will be adequate
- Yes, pile foundation is feasible (a variation) pile spread footing
- location & elevation of existing Culvert not known.
- for footing on glacial till at elevation 161 to 162.
  the design pressure quoted ~~on~~ in your letter Jan. 25, 94
  300 SLS II & 550 U.L.S OK.

7540-1021

SEND TO: Balu Iyer, P. Eng.
Sr. Foundation Engineer

FROM George Al-Bazi DEPT. Structural Office DATE Feb 3rd, 1994

SUBJECT Hwy 407 Underpass at Martingrove Rd. W.P. 88-78-10

Attached is a letter from UMA Engineering Ltd requesting some explaination regarding the recommendation given in the foundation report.

There is a box culvert located behind the north abutment. Now that the bridge is being re-designed, please advise whether piled foundation for this site is a viable option.

George Al-Bazi P. Eng.
Head, Structural Design

REPLY

RECEIVED
FEB 11 1994
FOUNDATION DESIGN SECTION

REPLY FROM | REPLY DATE

TO WRITE: HANDWRITE OR TYPE. REMOVE AND RETAIN YELLOW COPY. FORWARD BALANCE OF SET.

TO REPLY: WRITE REPLY IN BOTTOM AREA. SNAP SET APART.

Ontario

FOLD AT MARKS FOR USE IN #9 OR # 10 WINDOW ENVELOPE

RETAIN ORIGINAL AND RETURN PINK COPY

Received
March 18, 94
KA

Culv. Extn.

INTER OFFICE MEMO

UMA Engineering Ltd.

TO George Al-Bazi, MTO

DATE February 2, 1994

FROM Kester Augustinas, UMA

OUR FILE NO. 6000-224

RE **Structural Design Report for Highway 407 Underpass at Martingrove Road, W.P. 88-78-10**

The following are some questions related to the correspondence included in the Report.

Memorandum dated January 8, 1994

1. Clarification of two of the FDR recommendations have been initiated by the Central Region. When and who is going to convey the completed clarification to UMA?

2. Who is going to fulfill the need to investigate carefully "the effect of one on the other" and how are the results of such investigation are to be documented?

3. Which of the Foundation recommendations were compromised in the previous design?

4. Who is going to obtain the Foundation Section approval and of what?

Memorandum dated January 25, 1994

5. Is it correct to understand that pressures of 550 kPa and 300 kPa were given for the elevation 163 m (preliminary memorandum dated January 22, 1988) and for the elevation below 161.5 m the original report gave rather 800 kPa and 450 kPa?

6. Will the Foundation Design Section comments upon the bridge designer's sketch be considered equivalent to the approval mentioned above?

7. What is meant by "detailing of the relationship between the north abutment footing and the box culvert" and why not to request that the Foundation Section append their report with their recommendations pertaining to that relationship?

Kester Augustinas

KA/pm

uma

memorandum

Ontario

To: V. Boehnke
Head, Structural Section
4th Floor, Atrium Tower

Date: 1993 11 02

Atten: W. Young

From: Foundation Design Section
Room 315, Central Building

RE: Hwy. 407 U'Pass at Martin Grove Rd.
W.P. 88-78-10
District 6, Toronto

This is in response to your memo dated 1993 10 18. We have reviewed our files and have the following comments.

1. The recommendations given in our foundation report and subsequent correspondence, referred to in your memo, are valid for the structure as presently proposed.

2. No new foundation investigation is warranted at this site. We would therefore, not issue a new report for this project.

Please call our office if your need additional input from us on this project.

Balu Iyer, P.Eng.
Sr. Foundation Engineer

cc. G. Al-Bazi

memorandum

Ontario

To: V. Boehnke
Head, Structural Section
Central Region

Date: 1990 09 17

Attn: W. Young
Sr. Structural Engineer

From: Foundation Design Section
Room 315, Central Building

Re: Excavation for Box Culvert Adjacent to Bridge
Hwy. 407 U'Pass at Martingrove Rd.
W.P. 88-78-10, Site 37-1113
District 6, Toronto

In response to your memorandum dated 90 09 10, the proposal outlining the excavation scheme for the construction of the concrete box culvert adjacent to the bridge foundation as illustrated on the submitted sketch, is acceptable.

T. Sangiuliano, P. Eng.
Foundation Engineer

for

Dr. B. Iyer, P. Eng.
Sr. Foundation Engineer

BI/TS/jb

MINISTRY OF TRANSPORTATION

memorandum

TO: Dr. B. Iyer
Senior Foundation Engineer
Foundation Design Section
3rd Floor, Central Building

Attention: Tony Sangiuliano

Date: 1990-09-10

From: Structural Section
Central Region

RE: Hwy. 407 U'Pass at Martingrove Rd.
W.P. 88-78-10, Site 37-1113
District 6, Toronto

Excavation for Box Culvert Adjacent to Bridge

Please find attached a typical cross-section at the north abutment showing both the abutment footing and box culvert. We believe that your concerns expressed in your recent memorandum dated 1990-08-30 and our discussions have been properly addressed. We wish to highlight the following:

a) The excavation slope between the Granular 'A' pad supporting the north abutment and the box culvert has been flattened to approximately 1.4H:1V by the use of a perforated pipe instead of an open ditch for groundwater control.

b) The 0.2m thick granular blanket has been incorporated.

c) The 1st stage of excavation has been limited to elevation 164.8 immediately below the abutment footing. The block of earth, which will be replaced by the Granular 'A' pad, will remain in place while the box culvert is constructed and will not be removed until the culvert has been partially backfilled. By doing this, we can better insure that the Granular 'A' pad will be placed soon after excavation to elevation 163.0 and the native material will not be exposed for a long period.

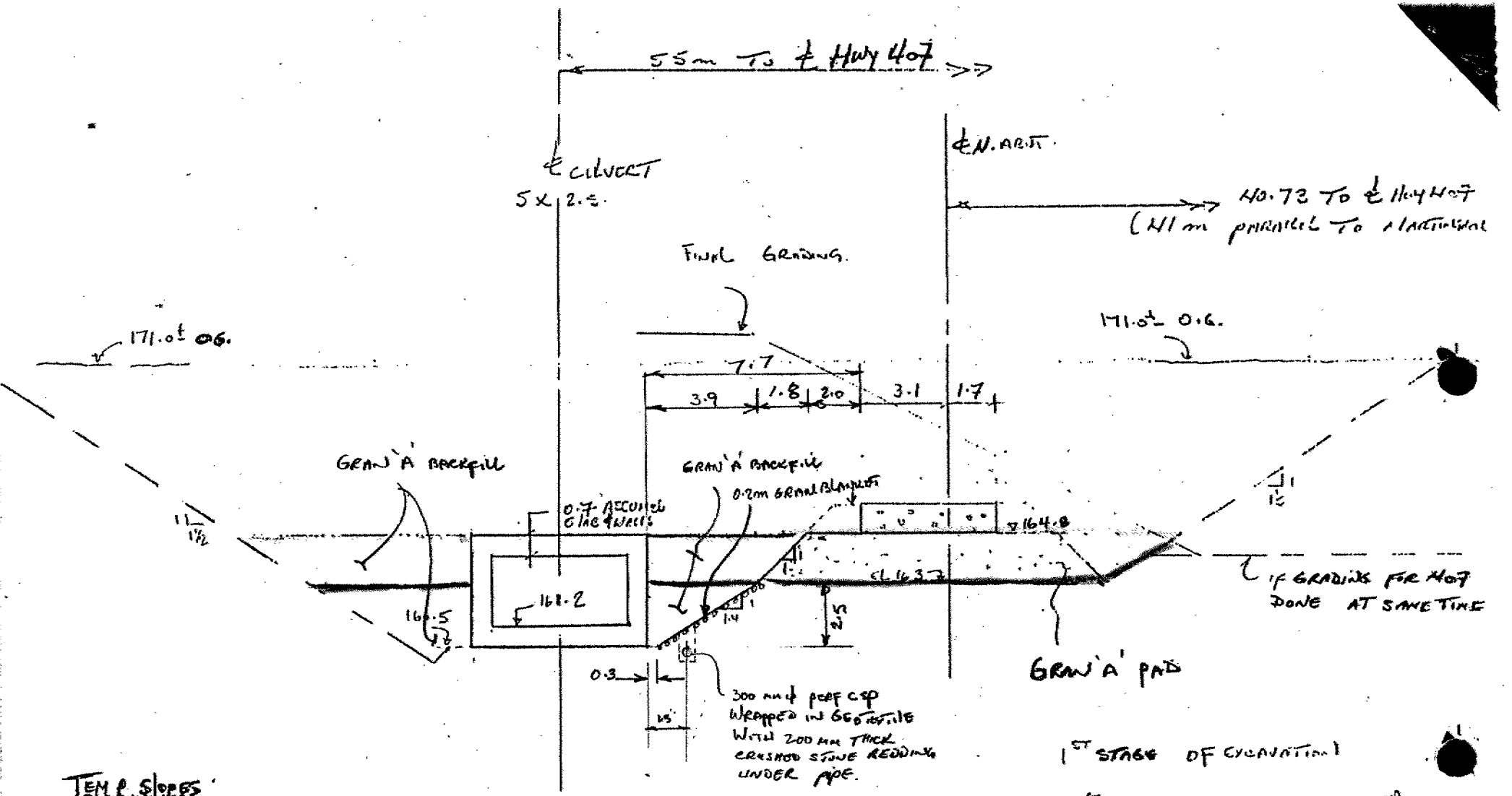
Please review the cross-section and notes and advise me if this proposal is acceptable. If yes, then we can proceed to incorporate the changes on the contract drawings. Thanks Tony.

Wade F. Young
Senior Structural Engineer
for:
V.F. Boehnke
Head, Structural Section

WFY/
attachment

cc: J. Klowak *
B. Hurd (Cole Sherman)

* memo only



TEMP. SLOPES

1:1 up to 6m

1½:1 > 6m

TYPICAL X-SECTION 1:200

memorandum

Ontario

To: V. Boehnke
Head, Structural Section
Central Region

Date: 1990 08 30

Atten: W. Young
Sr. Structural Engineer

From: Foundation Design Section
Room 315, Central Building

Re: Excavation Slope Geometry in conjunction with
Proposed Martingrove O'Pass and adjacent Box Culvert
Highway 407/Martingrove
W.P. 88-78-10, W.P. 88-78-01, Site 37-1113
District 6, Toronto

Further to our telephone conversations dated 90 08 20/22 and previous correspondence, including our letters dated 89 08 15 and most recently 90 07 26, it is our understanding that the recommended cut slope geometry of 1.5H:1V between the granular 'A' pad supporting the north abutment and the proposed culvert cannot be implemented because of spacing restrictions. It is hereby reiterated that the preservation of the integrity of this slope beneath the foundation is imperative during construction so that the foundation bearing capacity is maintained at the recommended value. Consequently, if 1.5H:1V slopes cannot be achieved, a slope as steep as 1H:1V can be employed provided an adequate slope protection scheme is used. A 0.2 m granular blanket as illustrated in the sketch accompanying our letter dated 89 08 15 is recommended as a cover to the slope.

As discussed, flatter slopes can perhaps be achieved by revising the V-shape drainage ditch illustrated at the toe of the cut slope to a rectangular trench drain system that includes a perforated pipe wrapped in filter fabric and entrenched in crushed stone. The flatter slope will certainly enhance the confidence of the performance of the founding soil under these conditions.

If you have any queries regarding the above comments or require additional information, please do not hesitate to contact this office.

T. Sangiuliano, P. Eng.
Foundation Engineer

for

Dr. B. Iyer, P. Eng.
Sr. Foundation Engineer

TS/mmj

MEMORANDUM

To: V. Boehnke 90 07 26
Head, Structural Section
Central Building

Attn: W. Young
Senior Structural Engineer

From: Foundation Design Section
Room 315, Central Building

Re: Final Design Drawing Review
Hwy. 407 U'pass at Martingrove Rd.
Wp. 88-78-10, Site 37-1113
District 6, Toronto

Further to your memorandum dated 1990-07-06 and previous correspondence regarding the implications of the concrete culvert construction behind the proposed north abutment at the aforementioned site, this office has reviewed the submitted drawings that identifies the proposed sequence of excavation and construction for the two structures. The following comments are hereby provided.

DESIGN

The proposed construction sequence scheme on dwg.3 illustrates a 0.95:1 excavation slope between the culvert and abutment foundations. This office does not endorse such a steep slope in the native soil particularly in close proximity of the abutment foundation.It is therefore recommended that the 0.95:1 cut slope identified between the compacted granular "A" pad and the box culvert foundation be revised to 1.5H:1V and the backfill material adjacent to the culvert (including the 1st and 2nd stage backfill) consist of granular "A" material.

In addition, the influence of applied loadings at each structure imposed on the adjacent structure for the 1.5H:1V condition described above was verified by this office. Based on Steinbrenner's method of stress determination of uniformly loaded rectangular areas and bearing pressures as recommended in the respective reports (see Table 1 below, it has been computed that the abutment bearing pressure will have a negligible influence on the culvert foundation.

Similarly, the additional stresses imposed by the bearing pressures of the culvert on the abutment foundation were examined and found to exist at a significant depth below the proposed abutment footing (estimated at El^n 154.5 m). Hence no bearing capacity are anticipated.

..2

CONSTRUCTION

The method of construction illustrated dwg.3 is acceptable from a foundation point of view and hence no additional comments provided the design criteria discussed above are satisfied.

TABLE 1

STRUCTURE	BEARING CAPACITY at S.L.S. Type II (kPa)	FACTORED CAPACITY at U.L.S. (kPa)
Martingrove U'pass	350	600
Concrete Box Culvert	250	375

If you have any questions regarding the above comments or require additional information, please do not hesitate to contact this office.

T. Sangiuliano, P. Eng
Foundation Engineer

for

M. Devata, P. Eng
Chief Foundation Enigineer

TS/lh

MINISTRY OF TRANSPORTATION

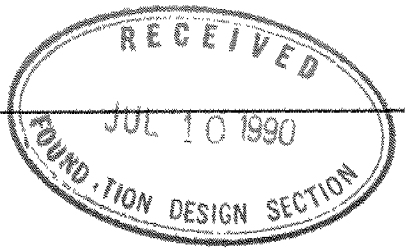
M E M O R A N D U M

To: M. Devata
Chief Foundation Engineer
Foundation Design Section
3rd Floor, West Building

Date: July 06, 1990

Attention: Dr. B. Iyer

From: Structural Section
Central Region



Re: Hwy. 407 U'Pass at Martingrove Road
W.P. 88-78-10, Site 37-1113
G.W.P. 88-78-01
District 6, Toronto

Further to your memo of 1990-02-20, regarding the excavation for the box culvert behind the north abutment and its effect on the abutment footing, please find enclosed herewith one revised full-size set of bridge drawings.

We wish to draw your attention to Drawings #1 & #3; the latter drawing shows the detailed construction sequence.

Wade F. Young
Senior Structural Engineer
for:
V. F. Boehnke
Head, Structural Section

WFY/vn
encls.

cc: G. Al-Bazi

memorandum

Ontario

To: G. Al-Bazi
Design Engineer
Structural Office
Central Region

Date: 1990 02 20

From: Foundation Design Section
Room 315, Central Building

RE: Hwy. 407 Underpass at Martingrove Road
W.P. 88-78-10, Site 37-73-1113
District 6, Toronto

The final drawings 1, 3 and 4 for aforementioned structure have been reviewed by this Section and the following comments are being made.

1. Detail for the culvert, subexcavation, and backfilling beside the north abutment should be sent to this office showing slopes and granular blanket for review.

2. A note should be inserted on Drawing 1 indicating staging in construction and any other critical comments regarding the above-mentioned culvert.

Dr. B. Iyer, P. Eng.
Sr. Foundation Engineer

for

M. Devata, P. Eng.
Chief Foundation Engineer

BI/PM/mmj

FOUNDATION DESIGN SECTION

REVIEW OF DESIGN DRAWINGS W.P. 88-48-10

W.O. .....

Foundation Report By: K. Clark .....

Design Drawing No.'s: 1, 3, 4, ...

1. Does footing design comply with our report or subsequent memos? 163 / 161, 163.5
2. If answer to 1. is No, is present design acceptable?
3. Has sufficient field work been done?
4. Are estimated pile lengths shown on Drawings correct? If not, make a new list. N/A
5. If excavation of unsuitable soil is recommended, is this shown on Drawings?
6. Are approaches designed in accordance with our report? Check slopes and berm lengths. 2:1
7. Do you anticipate any construction problems? i.e., dewatering, stability of temporary slopes or excavations. - not N.A. oversized perimeter ditches + pumping of groundwater.
8. Summarize your comments; on separate sheet if necessar.

Drawings Received Feb. 14 19 90

Reviewed Feb. 14 19 90

Talked to G. Al-Bazi Feb 19
W. Young Feb 20

Signed

memorandum

Ontario

To: Mr. G.C.E. Burkhardt
Head, Structural Section
Central Region

Date: 1989 08 15

Attn: W. Young
Structural Engineer

From: Foundation Design Section
Room 315, Central Building

RE: Highway 407 and Martingrove Road, Excavation
W.P. 88-78-10, Site No. 37-73-113

Regarding our discussion on 89 08 14 concerning the excavation proposal for the North Abutment footing and the culvert crossing Martingrove Road, we have the following comments:

The subsurface material is a cohesive glacial till with intermittent water-bearing sand seams. During excavation, it is possible that such seams will be intersected. To minimize the disturbance of the bearing area for the North Abutment footing, the 1H:1V slope to the base of the culvert excavation [EL. 160.1 - EL. 163.0] should be treated with a layer of gravel. (Refer to attached sketch).

Dewatering should be undertaken with caution since the non-cohesive seams are susceptible to boiling conditions. In the event that boiling occurs, dewatering should be discontinued and our office contacted.

The proposed excavation configuration is otherwise acceptable.

If there are any questions, please advise.

B. Bennett, P. Eng.
Foundation Engineer

BB/sp

Attach.

memorandum

Ontario

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

Date: 1989 06 19

From: Foundation Design Section
Room 315, Central Building

RE: Preliminary Drawing Review
Hwy. 407 Underpass at Martin Grove Road
W.P. 88-78-10, Site 37-1113
District 6, Toronto

Further to your memo dated May 31, 1989, the General Arrangement Drawing 37-113-P1 for the aforementioned structure has been reviewed by this section and the following comments are provided.

Forward Slope

A 2H:IV forward slope should be indicated in the longitudinal section both on north and south abutments.

Dewatering

As discussed in our previous memo dated March 16, 1989, some dewatering measures will be required during the excavation and backfilling for the granular "A" core at north abutment since the existing water level is higher than the proposed excavation elevation. One method of achieving this is by carrying out oversize excavation and pumping out water from perimeter ditches.

We have no further comments. If you have any questions, please contact us.

Tae C. Kim, P. Eng.
Foundation Engineer

TCK/jb

MINISTRY OF TRANSPORTATION

M E M O R A N D U M

To: M. Devata
Foundation Design Section
3rd Floor
Central Building
Downsview

Date: August 16, 1989

Attention: B. Bennett

From: Structural Section
Central Region

Re: W.P. 88-78-01, W.P. 88-78-10, Site 37-1113
Box Culvert Parallel to Highway 407
at Martingrove Road Bridge
District 6, Toronto

Further to our discussion yesterday, please find attached sketch showing the cross-section at the above location. The red lines indicate the "critical zone" mentioned in the Foundation Investigation. The blue lines represent the limits of excavation, if the depth of cut is considered to be greater than 6 metres and also shows the resulting culvert location (58 m from ℄ Hwy.).

As discussed, this location is unacceptable from a property viewpoint. At the same time, we would prefer to avoid shoring during construction if at all possible. We are therefore proposing that the box culvert be located 55 m from ℄ Hwy. 407 and that the limit of excavation be represented by the yellow lines. This proposal is based on:

(a) The "critical zone" would be disturbed even if there was no culvert in order to excavate for the Granular `A' pad (black lines). (Possibly the critical zone was identified in the event that this culvert was built after the bridge. However both items will be built in the same contract and presumably from the bottom (culvert) upwards).

(b) The depth of cut facing Hwy. 407 is less than 6 m and therefore 1:1 slopes are acceptable. (The cut slopes to the north, away from Hwy. 407 will have to be made at a 1•5:1 inclination).

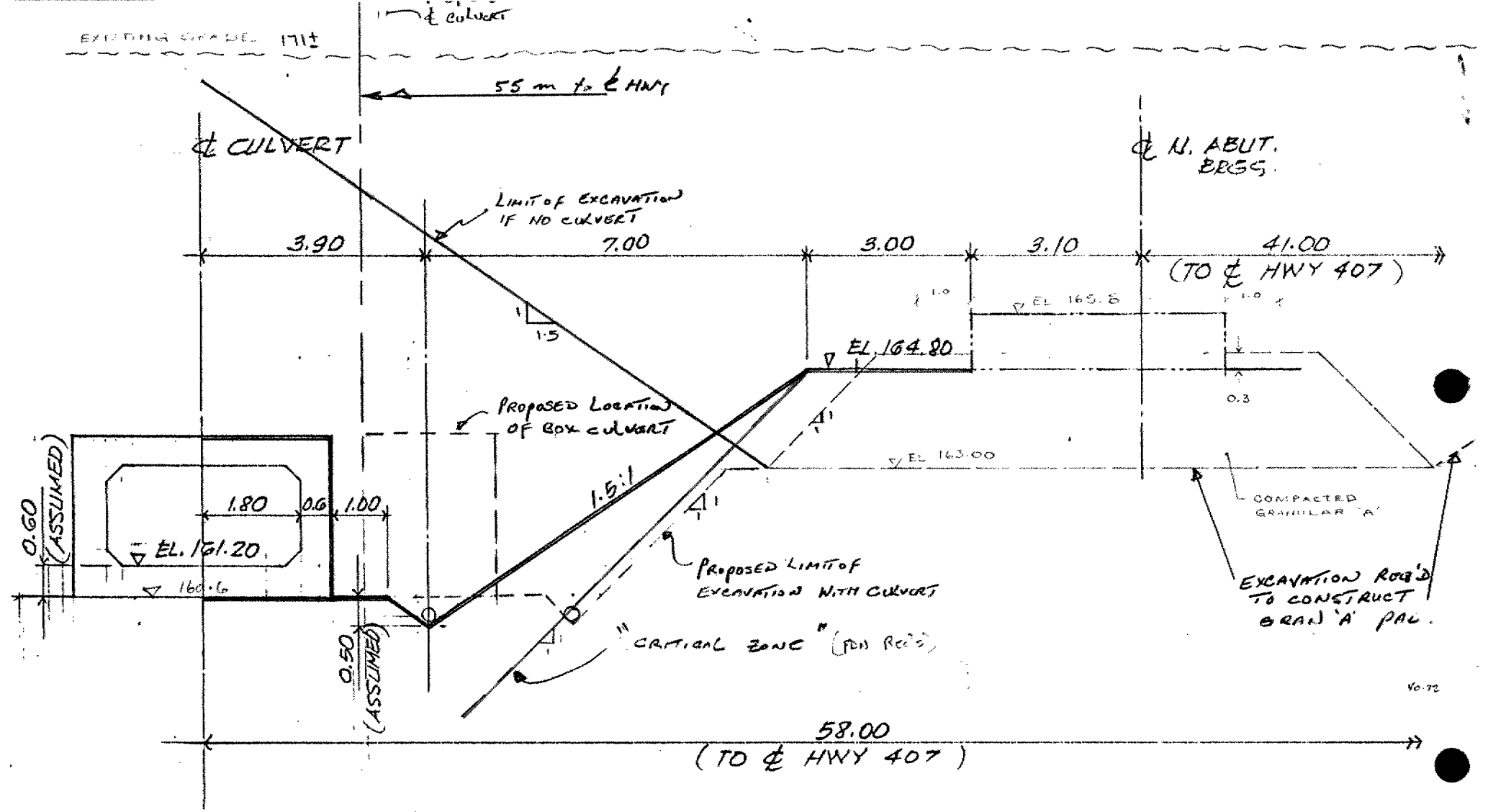
Would you kindly review this proposal to insure that it is acceptable? Thank you.

If any clarification is required, please call.

W. F. Young
Senior Structural Engineer
For:
G. C. E. Burkhardt
Head, Structural Section

WFY/lf

c.c.: J. Klowak
G. Al-Bazi
B. Hurd (Cole Sherman)



HWY 407 UNDERPASS
AT MARTIN GROVE ROAD

1: 100

memorandum

Ontario

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

Date: 1989 03 16

From: Foundation Design Section
Room 315, Central Building

RE: Hwy. 407 Underpass at Martin Grove Road
W.P. 88-78-10, Site 37-1113
District #6, Toronto

Further to your memo dated March 9, 1989, this letter summarizes our review on the submitted Preliminary General Arrangement Drawing P1.

Based on our review, it is concluded that the designer generally complied with our recommendation. However, it should be noted that a 2H:1V forward slope be indicated in the longitudinal section both on north and south abutments.

It should be also noted that since the water level at the north abutment is higher than the proposed excavation elevation, some dewatering measures be required during the excavation and backfilling. One method of achieving this is by carrying out excavation by means of oversize perimeter ditches and pumping out water from the ditches.

We have no further comments. If you have any questions, please contact us.

Taechul Kim

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

TCK/ms

memorandum

Ontario

Tel: 3731

To: G.C.E. Burkhardt
Head, Structural Section
Central Region

Date: 1988 01 22

Atten: W. Young

From: Foundation Design Section
Room 315, Central Building

RE: Highway 407 Underpass at Martingrove Road
W.P. 88-78-10, Site 37-73-1113
District 6, Toronto

Further to your memorandum on 1987 12 31, with the preliminary drawing P1 for the above structure, this letter summarizes our review on our previous investigation and recommendations for the Highway 407 underpass at Martingrove Road.

As you are aware, the Foundation Design Section submitted a detailed Foundation Investigation Report for this structure, W.P. 88-78-10, 1982 11 09, which included our recommendations for the two span structure. However, it should be noted that during early 1983, based on a preliminary General Arrangement Drawing, an additional review was carried out for this structure. The additional recommendations pertianing to the footing elevations of the structure were submitted in our memoradum dated 1983 03 30, W.P. 88-78-10. The following comments were provided in our memorandum:

1. Due to the presence of somewhat weaker soil conditions at the proposed north and south abutment footing locations, we recommend that the bases of both abutment footings be lowered to elevation of 163.0 m rather than an elevation 164.5 m at the north abutment and an elevation 163.5 m at the south abutment.

2. At the north abutment, an alternative is to excavate to an elevation of 163 m and replace with a well compacted "A" core as shown on the attached figure, allowing the base of the footing to remain at an elevation of 164.5 m as indicated on the preliminary design drawing.

Based on our review for this structure, it is our opinion that the original and additional recommendations are still applicable for this structure. As mentioned in our previous recommendations, the most viable alternative is to construct the abutments and pier on the spread footings. The following new design parameters can be used.

	Factored Capacity at U.L.S. (kPa)	Allowable Capacity at S.L.S. Type II(kPa)
Abutments	550	300
Pier	800	450

.....2

Alternatively, 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 Footing on Granular 'A' Core	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.

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	$\phi = 35°$	30°
Unit Weight (kN/m^3)	$\gamma = 22.8$	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 two 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 appropriate 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 Foundation Engineer

for

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

TCK/mmj

c.c. - K. Bassi
J. Klowak
B. Steeves

THE MINISTRY OF TRANSPORTATION
M E M O R A N D U M

TO: Mr. M. Devata
Chief Foundation Engineer - East
Central Building

DATE: 1987-12-31
Central Region

FROM: Structural Section - Central Region

RE: Highway 407 Underpass at Martingrove Road
W.P. 88-78-10, Site 37-73-1113 District 6, Toronto

A Foundation Investigation Report was prepared by your office for the above structure on 1982-11-09. Due to the reactivation of the Hwy 407 project, we are requesting that you review this report in light of the information below and possible updated procedures to determine if any additions or revisions are necessary.

Subsequent to the initial Foundation Request in 1982, the variable gore area on the bridge was eliminated resulting in a constant 20 m wide structure. The span lengths were not changed (40±m and 36±m) nor was the structure type (voided cast in place concrete slab).

Since reactivation of the project, we have been informed by Regional Planning & Design that the location, spans etc., of the bridge has not changed. The Martingrove Road - Steeles Avenue intersection to the south has been reconstructed in the interim but this will have no effect on the final bridge location.

We wish however, to draw your attention to a couple matters. In early 1983, a preliminary General Arrangement Drawing was prepared by Cole, Sherman & Associates. A copy is attached for your information. This drawing indicates underside of footing elevations (assuming 1 metre thick footings) as follows:

North Abutment	164.5
Pier	161.0
South Abutment	163.5

Comparing these elevations with the soil strata information, it appears that the footing elevation for the north and south abutment coincide with a zone of reduced 'N' values. (At the pier, this is not the case). Would the design bearing pressures and other recommendations still be applicable?

We would appreciate your comments and any required revisions by 1988-02-26.

Please call if additional information is required.

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

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

memorandum

Ontario

To: Mr. W. L. Lin,
Design Engineer (Central),
Structural Office

Date: 83 03 30

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

Re: Highway 407 Underpass
at Martin Grove Road,
W.P. 88-78-10, Site 37-73-1113
District 6, Toronto

We have reviewed the preliminary drawing P1 for the above project and provide the following comments:

1) Due to the presence of somewhat weaker soil conditions at the proposed north and south abutment footing locations, we recommend that the bases of both abutment footings be lowered to elevation 163 rather than elevation 164.5 at the north abutment and elevation 163.5 at the south abutment.

2) At the north abutment, an alternative is to excavate to elevation 163 and replace with a well compacted granular "A" pad, allowing the base of the footing to remain at elevation 164.5 as indicated on the preliminary design drawing.

M. Devata, P. Eng.
Senior Foundations
Engineer

KC:MD:bg

memorandum

Ontario

To: Mr. M. Devata,
Senior Foundations Engineer,
Pavement and Foundation
Design Section, Room 315,
Central Building, Downsview.

Date: 1982-06-09

Central Region

RE: Highway 407 Underpass at Martingrove Road,
W.P. 88-78-10, Site 37-73-1113,
District 6, Toronto

A Foundation Request is required for above structure. The above proposed bridge will be located on realigned Martingrove Road, some 16 m east of the existing road.

The deck width will accommodate two 3.5 m lanes per direction plus 1.0 m shoulder and 1.5 m sidewalk, at each side. In addition, a variable gore area (0 to 2± m max.) will separate the N.B. from the S.B. lanes. This will be reflected in an abutment 22± m wide at north side and 20 ± m wide at south side.

The structure deck will be of the cast-in-place post tension type, with north and south spans of respectively 40 ± m and 36 ± m. A centre pier will be located within the Highway 407 median.

Approximate footing locations have been located in red on the attached two prints of drawing 5581-S1 as prepared by Cole, Sherman and Associates, Consulting Engineers. These drawings also show approximate profiles for Highway 407 and relocated Martingrove Road, along with existing ground lines.

Both alignments have been co-ordinated.

Construction will be done in the clear as Highway 407 will not be operational and Martingrove will be detoured along the west side of the construction site.

The completed deck will be open to traffic as soon as the relocated Martingrove approaches are constructed.

No underground utilities have been detected at above location.

Permission to enter the property in question should be obtained from M.G.S. We recommend you to contact Mr. Leeson (Property Office) to know details of possible tenants, etc. 248-3432

To comply with present scheduling, kindly note that the Foundation Report should be ready by 1982-10-11.

Please call us if additional information is required.

MDB:gj
Attach.

c.c. R. Fitzgibbon
R. Kunkel

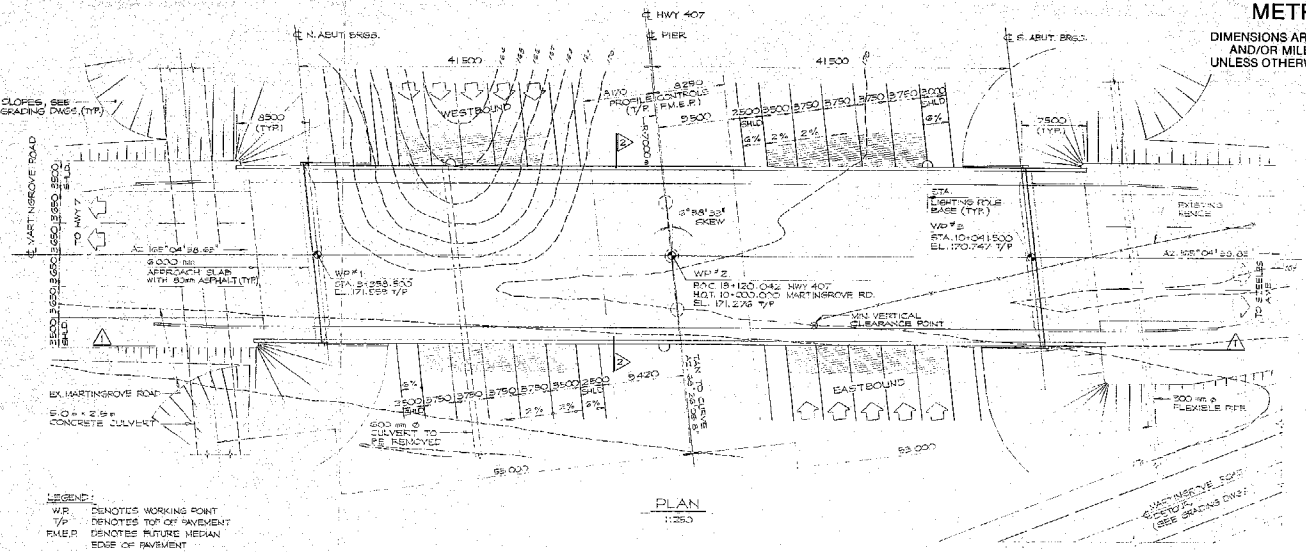
M.D. Bendayan,
Senior Structural Engineer,
for:
G.C.E. Burkhardt,
Head, Structural Section.

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

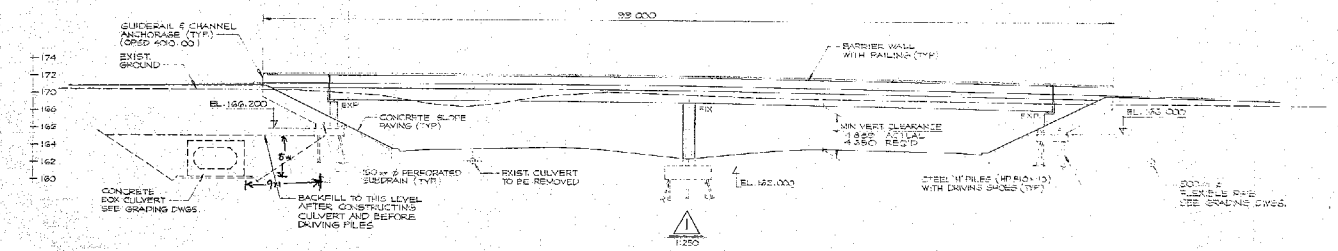
DISTRICT 6	12
CONT No	
WP No 88-78-10	
HWY 407 UNDERPASS AT MARTINGROVE ROAD	SHEET
GENERAL ARRANGEMENT	

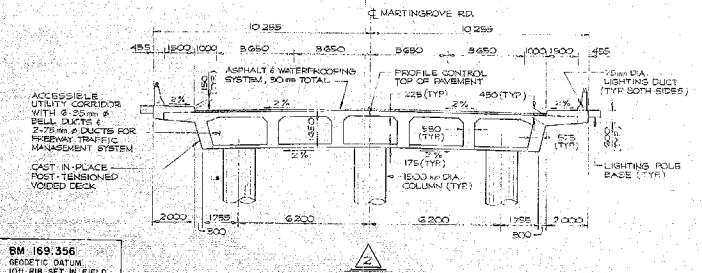
UMA Engineering Ltd. Engineers & Planners

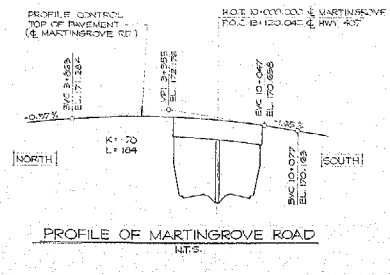


LEGEND:

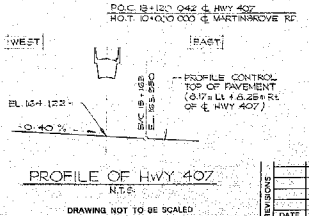
W.P.	DENOTES WORKING POINT
T/P	DENOTES TOP OF PAVEMENT
F.M.E.P.	DENOTES FUTURE MEDIAN EDGE OF PAVEMENT







PROFILE OF MARTINGROVE ROAD
N.T.S.



PROFILE OF HWY 407
N.T.S.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

BM. 169.356
GEODETIC DATUM.
1011. RIB SET. IN FIELD
19.0 Lt. 10+054.200

PRELIMINARY
ISSUED
APR 14 1994
UMA Engineering Ltd.

GENERAL NOTES

1. CLASS OF CONCRETE
   - DECK & SIDEWALKS 35 MPa
   - REMAINDER 30 MPa
2. CLEAR COVER TO REINFORCING STEEL
   - FOOTINGS 100 : 25
   - ABUTMENTS & WINGWALLS 70 : 20
   - PIERS 70 : 20
   - DECK TOP 70 : 20
     BOTTOM & SIDES 50 : 10
   - REMAINDER (UNLESS OTHERWISE SPECIFIED) 70 : 20
3. REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX 'C' DENOTE COATED BARS.
4. CONSTRUCTION NOTE
   THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESSES FROM THE TOP OF BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESSES ARE DIFFERENT FROM THOSE GIVEN WITH THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE REINFORCING STEEL TO SUIT.

LIST OF DRAWINGS

APPLICABLE STANDARD DRAWINGS

OPSD 3501.00	GRANULAR BACKFILL REQUIREMENTS ABUTMENTS
OPSD 4010.03	GUIDE RAIL AND CHANNEL ANCHORAGE

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	K.A.	CHK		CODE ONBDC-83	LOAD CLASS A	DATE	FEB 1994
DRAWN	E.M.	CHK	J.Y.	SITE 37-115	STRUCT.	SCHEME	DWG. F1