



**PRELIMINARY FOUNDATION INVESTIGATION REPORT
for
CNR OVERHEAD REPLACEMENT
HIGHWAY 11, STATION 21+331
SITE NO. 30-079
TOWNSHIP OF SEVERN
SIMCOE COUNTY, ONTARIO
CENTRAL REGION, G.W.P. 2177-10-00**

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PML Ref.: 12KF069A-C1
Index No.: 069FIR
GEOCRES No.: 31D-557
May 1, 2013



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Drawing CNR-1 – Borehole Locations and Soil Strata

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 Geocres No. 31D-250, January 1978

PRELIMINARY FOUNDATION INVESTIGATION REPORT

for
CNR Overhead Replacement
Highway 11, Station 21+331
Site No. 30-079
Township of Severn
Simcoe County, Ontario
Central Region, GWP 2177-10-00

1. INTRODUCTION

This report summarizes the results of the foundation investigation carried out at the site of the existing CNR overhead on the Highway 11 at approximate Station 21+331 located in the Township of Severn. The investigation was carried out by Peto MacCallum Ltd. (PML) for AECOM Canada Ltd. (AECOM) on behalf of the Ministry of Transportation of Ontario (MTO).

The existing overhead will be removed and the opening filled-in. The General Arrangement Drawing 'HWY 11 CNR REPLACEMENT C. I. P. BOX CULVERT' prepared by AECOM dated January 13, 2013 was used for reference.

The purpose of this report was to summarize the subsurface stratigraphy and groundwater conditions encountered in the foundation investigation. The results of one borehole that was drilled in 1977 based on the Geocres Report 31D250 are included in this report.

2. SITE DESCRIPTION AND GEOLOGY

The contemplated overhead removal is located at about 400 m south of the existing Highway 11 Northbound Lanes (NBL) / Huronia Road at-grade intersection. The site is at the Orillia / Severn boundary in the Geographic Township of Severn, Simcoe County.

Land use in the vicinity of the site includes commercial activities to the east and west and residential houses to the east. Locally, the existing Highway 11 is a four lane highway. The local topography of the site is generally sloping down to the west and east and up southerly. The existing Highway 11 embankment is about 9.5 m high at the overhead location. The abandoned



CNR tracks pass through the existing overhead in an approximate south to north direction. The ground cover includes grasses, bushes and trees.

The soil cover at the project site is derived from glaciolacustrine plain deposits (clayey silts and sands) which overlie Paleozoic (Middle Ordovician) age Simcoe Group, Bobcaygeon Formation (limestone) bedrock. The bedrock is estimated at 20 to 30 m depth at the existing CNR overhead location based on Aggregate Resources Inventory Paper 80, Simcoe County from the Ontario Geological Survey, Ministry of Northern Development and Mines, 1994.

3. INVESTIGATION PROCEDURES

The subsurface investigation was carried out on January 10, 2013. A total of two boreholes (CNR-101 and CNR-102) were drilled to 9.6 and 9.8 m depths at the locations shown on Drawing CNR-1, appended. Although the results of the investigation are considered representative due to the uniform 9.6 and 9.8 m thick soil cover in the two drilled boreholes, allowances should be made for local variations in subsurface stratigraphy.

The locations of the boreholes were selected by PML allowing for drill rig accessibility and buried utilities. The ground surface elevations at the borehole locations were surveyed by exp Geomatics in March 2013. All elevations in this report are expressed in metres.

The boreholes were advanced using continuous flight solid stem augers through the soil cover with a track-mounted CME-55 drill rig, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a PML field supervisor.

Soil samples were recovered from the boreholes at regular 0.75 and 1.5 m intervals of depth using the standard penetration test method. Standard penetration tests were conducted to assess the strength characteristics of the substrata. Soils were identified in accordance with the MTO soil classification Manual procedures.



The groundwater conditions in the boreholes were assessed during drilling by visual examination of the soil, the sampler and drill rods as the samples were retrieved and, where encountered, by measuring the groundwater level in the open holes.

The boreholes were backfilled with a bentonite/cement mixture where required in accordance with the MTO guideline and MOE Reg. 903 for borehole abandonment.

The recovered soil samples were returned to the PML laboratory in Toronto for detailed visual examination, laboratory testing and classification. The laboratory testing program included the following tests:

- Natural moisture content determinations (21)
- Atterberg Limits (2)
- Grain size distribution analyses (6)

The laboratory grain size distribution charts are presented in Figures CNR-GS-1 and CNR-GS-2. The Atterberg Limits results are presented in Figure CNR-PC-1. All of the test results are summarized on the Record of Borehole sheets.

4. SUMMARIZED SUBSURFACE CONDITIONS

Reference is made to the appended Record of Borehole sheets for details of the subsurface conditions including soil classifications, inferred stratigraphy, standard penetration test results and groundwater observations. The results of laboratory grain size distributions, Atterberg Limits and moisture content determinations are also shown on the Record of Borehole sheets.

The borehole locations, stratigraphic profile and cross-sections prepared from the borehole data are shown on Drawing CNR-1. The boundaries between soil strata have been established at the borehole locations only. Between and beyond the boreholes, the soil boundaries are assumed and may vary.



One previous borehole was drilled in 1977 based on the Geocres Report 31D250 and the results of the borehole are included in Appendix A. Clayey silt with sand deposit was encountered in the borehole. The deposit extended to a termination depth of 11.0 m. Boulders, sand and gravel layers were also encountered during drilling.

The subsurface stratigraphy revealed in the boreholes is generally consistent with the Geocres Report 31D250 in Appendix A and generally comprised of fill layer underlain by deposit of clayey silt and sand till over sand with gravel deposit. Cobbles and boulders were encountered within the clayey silt and sand till deposit in borehole CNR-101. Groundwater was observed in both boreholes.

4.1 Fill

A 0.7 to 1.4 m thick gravelly sand and sand/silty clay fill was encountered surficially in both boreholes. The fill extended to 0.7 m (elevation 233.2) in borehole CNR-101 and to 1.4 m (elevation 232.5) in borehole CNR-102. N values varied from 5 to 17 indicating loose to compact / firm compactness/consistency. The moisture content determinations ranged from 14 to 18%.

4.2 Clayey Silt and Sand Till

A clayey silt and sand till deposit was encountered below the fill at 0.7 m (elevation 233.2) in borehole CNR-101 and at 1.4 m (elevation 232.5) in borehole CNR-102. The layer was 4.4 to 6.6 m thick extending to the sand with gravel at 7.3 m (elevation 226.6) in borehole CNR-101 and at 5.8 m (elevation 228.1) in borehole CNR-102. N values ranged from 24 to 118. The stratum had very stiff to hard consistency.

The results of grain size distribution analyses for the clayey silt and sand till samples are included in Figure CNR-GS-1. The Atterberg plasticity charts are presented in Figure CNR-PC-1. The liquid and plastic limits of the clayey silt and sand till samples were 16, and 10 to 11, respectively with the corresponding plasticity index values of 5 to 6. The moisture content determinations ranged from 6 to 13%.



Wet seams were encountered in the deposit during drilling. Cobbles and boulders were encountered within the clayey silt and sand till deposit below 3.0 m (elevation 230.9) in borehole CNR-101.

4.3 Sand

A cohesionless sand with gravel deposit was encountered below the clayey silt and sand till at 7.3 m (elevation 226.6) in borehole CNR-101 and at 5.8 m (elevation 228.1) in borehole CNR-102. The boreholes were terminated in the sand at 9.6 and 9.8 m (elevations 224.3 and 224.1). N values ranged from 85 to 113 indicating very dense compactness.

Wet seams were encountered during drilling.

The results of grain size distribution analyses for the sand samples are included in Figure CNR-GS-2. The moisture content determinations ranged from 7 to 15%.

4.4 Groundwater

Groundwater was encountered in both boreholes. During drilling, groundwater was observed at 2.0 m and 0.3 m (elevations 231.9 and 233.6) in boreholes CNR-101 and CNR-102, respectively. Upon completion of drilling, groundwater was measured at 4.5 m and 0.3 m (elevations 229.4 and 233.6) in boreholes CNR-101 and CNR-102, respectively. The groundwater level is subject to seasonal fluctuations and rainfall patterns. Perched groundwater may likely have accumulated within fill or more pervious layers in the deposits. In wet or spring thaw seasons, the perched groundwater level may be high and rise close to the ground surface.



5. CLOSURE

Mr. F. Portela carried out the field investigation for this study under the supervision of Mr. B. Rao, P. Eng., and Mr. C. M. P. Nascimento, P. Eng., Project Manager. Walker Drilling Ltd. supplied the drill rig for the subsurface exploration. The laboratory testing of the selected samples was carried out in the PML laboratory in Toronto.

This Foundation Investigation Report was prepared by Mr. B. Rao, P. Eng., and reviewed by Mr. B. R. Gray, MEng, P. Eng., MTO Designated Principal Contact. Mr. C. M. P. Nascimento, P. Eng., Project Manager conducted an independent review of the report.

Yours very truly

Peto MacCallum Ltd.



Bin Rao, P.Eng.
Project Engineer

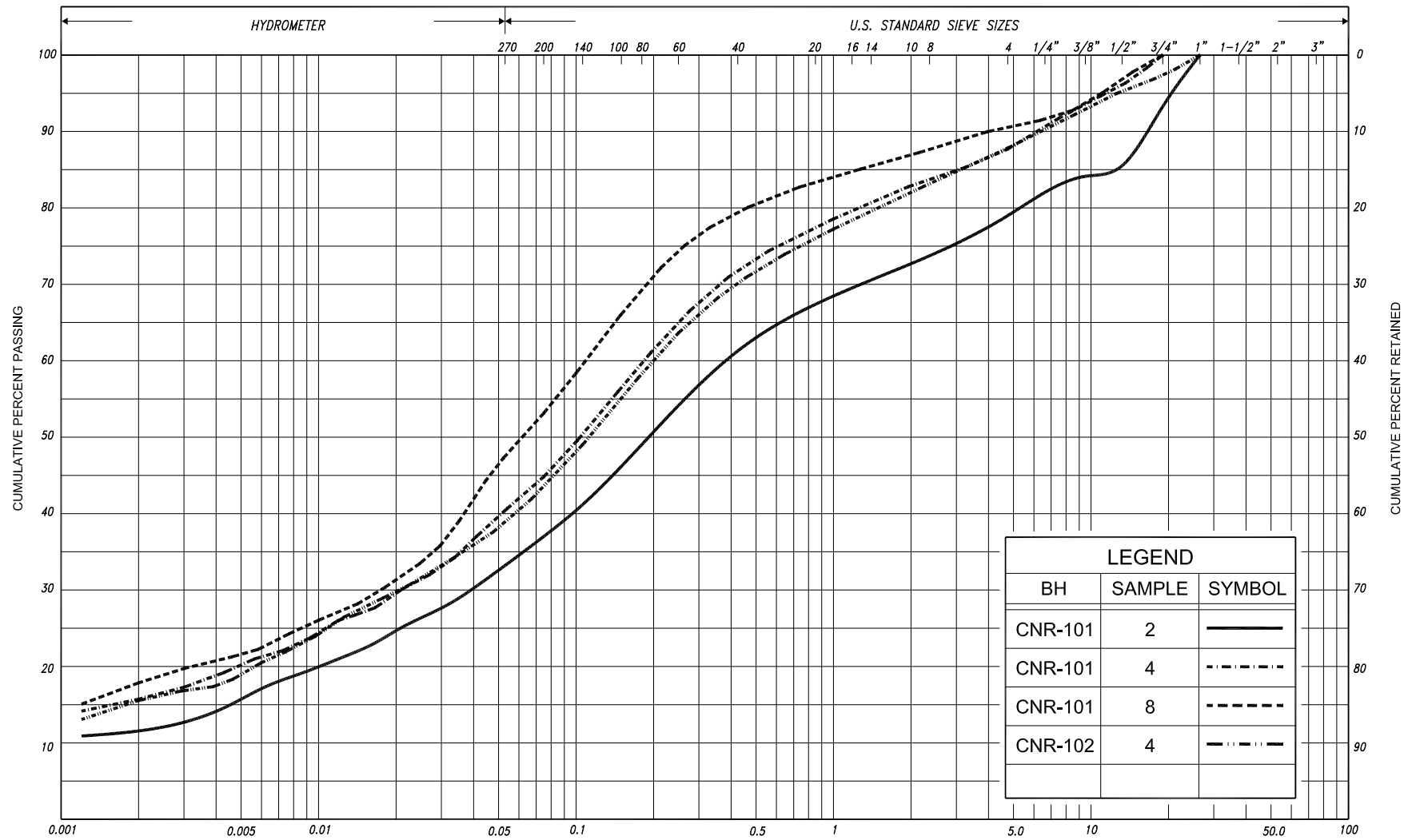


Carlos M.P. Nascimento, P.Eng.
Project Manager



Brian R. Gray, MEng, P.Eng.
MTO Designated Principal Contact

NB/CN/BRG:nb-mi-sq



SILT & CLAY				FINE SAND			COARSE SAND	GRAVEL	COBBLES	UNIFIED
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL	COBBLES	M.I.T.	
CLAY	SILT	V. FINE	FINE	MED.	COARSE	GRAVEL	COBBLES	U.S. BUREAU		

GRAIN SIZE DISTRIBUTION

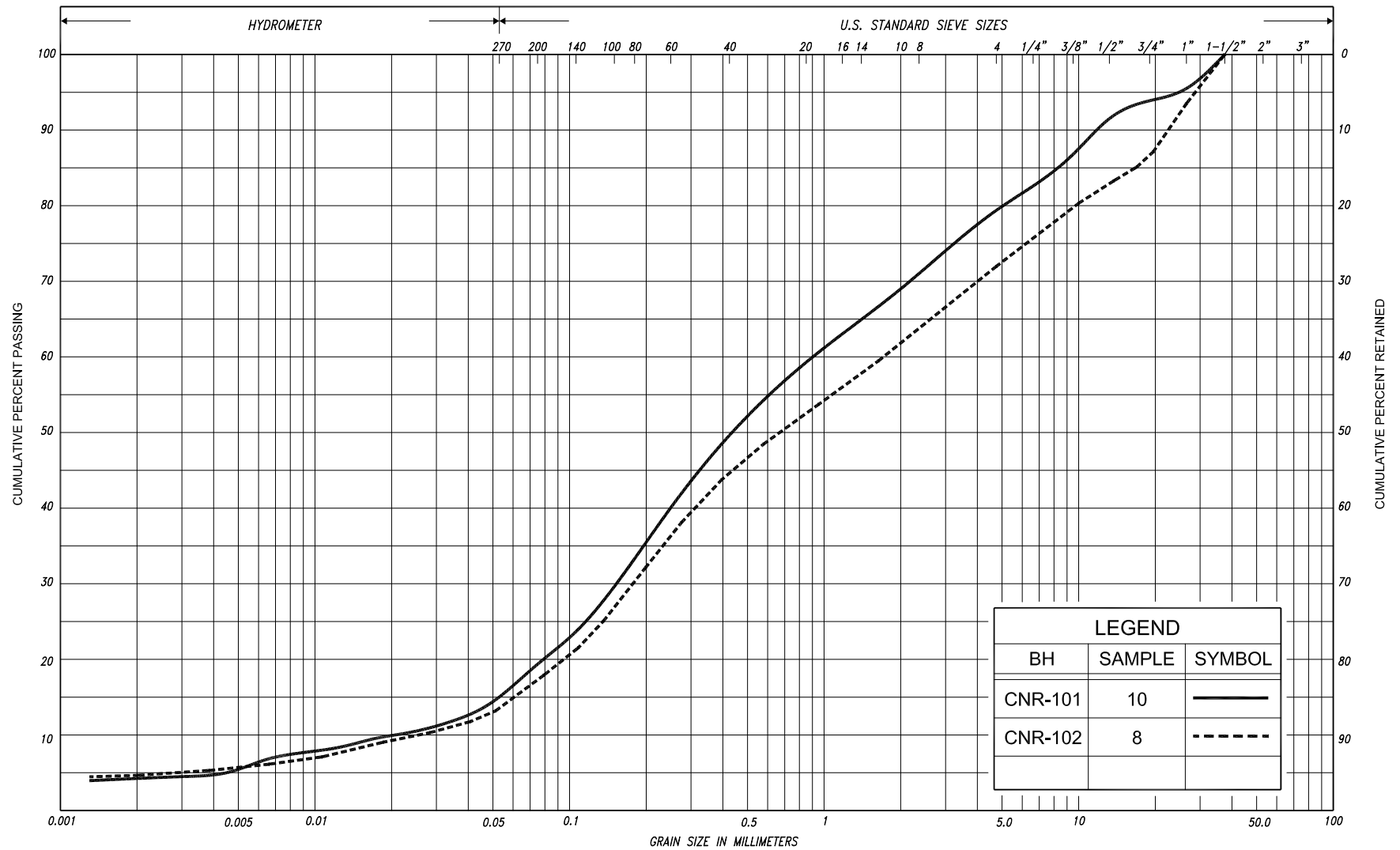
CLAYEY SILT and SAND, some gravel
(TILL)

FIG No. CNR-GS-1

HWY: 11

G.W.P. No. 2177-10-00





SILT & CLAY				GRAIN SIZE IN MILLIMETERS			COBBLES	UNIFIED
				FINE	MEDIUM	COARSE		
CLAY	FINE	MEDIUM	COARSE	SAND			GRAVEL	M.I.T.
	SILT			FINE	MEDIUM	COARSE		
CLAY		SILT		V. FINE	FINE	MED.	COARSE	U.S. BUREAU
				SAND			GRAVEL	



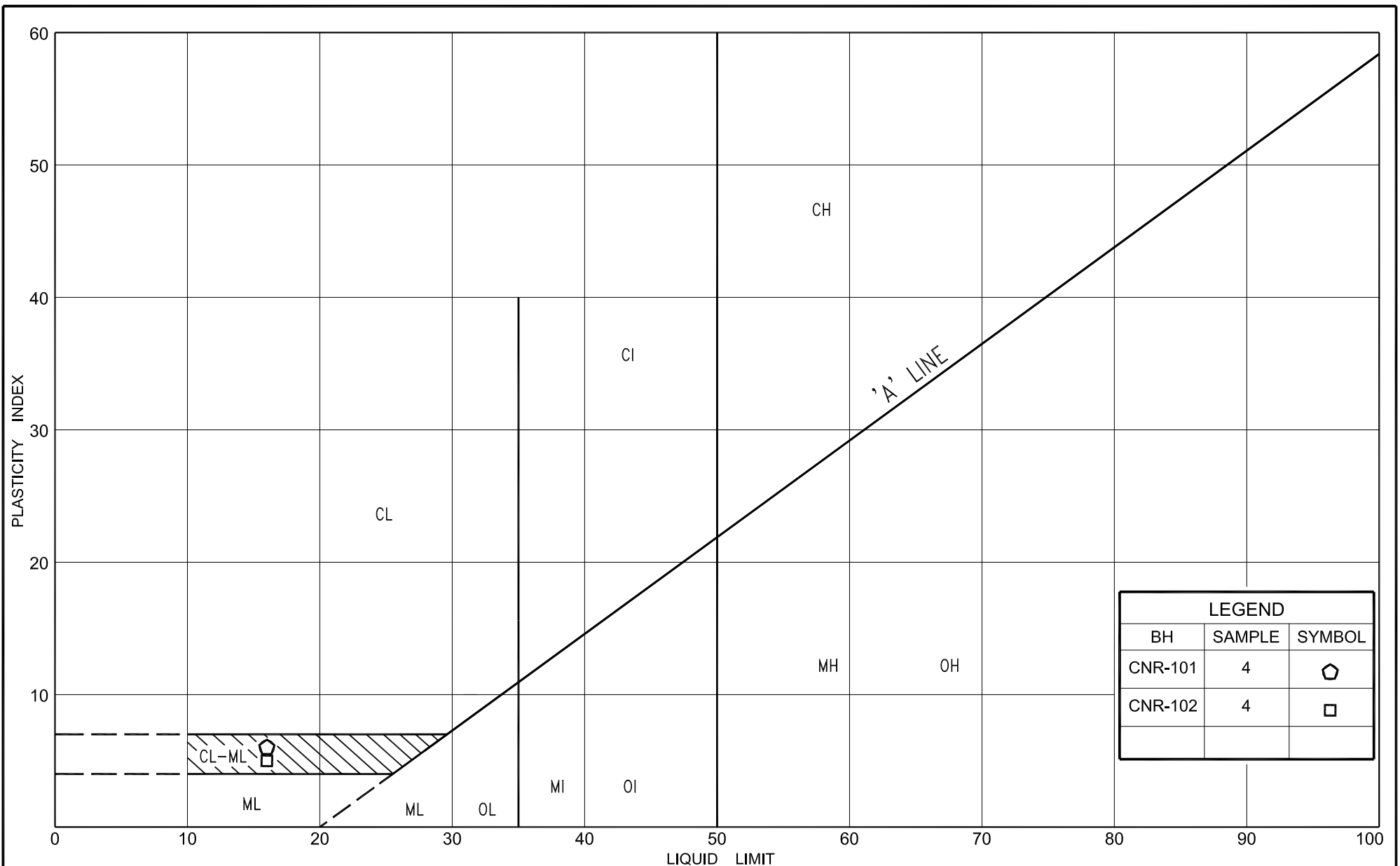
GRAIN SIZE DISTRIBUTION

SAND with gravel, some silt, trace clay

FIG No. CNR-GS-2

HWY: 11

G.W.P. No. 2177-10-00



PLASTICITY CHART
CLAYEY SILT and SAND, some gravel
(TILL)

FIG No.	CNR-PC-1
HWY:	11
W.P. No.	2177-10-00

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.

COMPOSITION: SECONDARY SOIL COMPONENTS ARE DESCRIBED ON THE BASIS OF PERCENTAGE BY MASS OF THE WHOLE SAMPLE AS FOLLOWS:

PERCENT BY MASS	0 - 10	10 - 20	20 - 30	30 - 40	> 40
	TRACE	SOME	WITH	ADJECTIVE (SILTY)	AND (AND SILT)

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:

R Q D (%)	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
F V FIELD VANE	

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
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_i	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	n	1, %	POROSITY	e_{max}	1, %	VOID RATIO IN LOOSEST STATE
γ_s	kN/m ³	UNIT WEIGHT OF SOLID PARTICLES	w	1, %	WATER CONTENT	e_{min}	1, %	VOID RATIO IN DENSEST STATE
ρ_w	kg/m ³	DENSITY OF WATER	S_r	%	DEGREE OF SATURATION	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
γ_w	kN/m ³	UNIT WEIGHT OF WATER	w_L	%	LIQUID LIMIT	D	mm	GRAIN DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_p	%	PLASTIC LIMIT	D_n	mm	n PERCENT - DIAMETER
γ	kN/m ³	UNIT WEIGHT OF SOIL	w_s	%	SHRINKAGE LIMIT	C_u	1	UNIFORMITY COEFFICIENT
ρ_d	kg/m ³	DENSITY OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	h	m	HYDRAULIC HEAD OR POTENTIAL
γ_d	kN/m ³	UNIT WEIGHT OF DRY SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	q	m ³ /s	RATE OF DISCHARGE
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	v	m/s	DISCHARGE VELOCITY
γ_{sat}	kN/m ³	UNIT WEIGHT OF SATURATED SOIL				i	1	HYDRAULIC GRADIENT
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	DTPL		DRIER THAN PLASTIC LIMIT	k	m/s	HYDRAULIC CONDUCTIVITY
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL	APL		ABOUT PLASTIC LIMIT	j	kN/m ³	SEEPAGE FORCE
e	1, %	VOID RATIO	WTPL		WETTER THAN PLASTIC LIMIT			

RECORD OF BOREHOLE No CNR-101

1 of 1

METRIC

G.W.P. 2177-10-00 **LOCATION** Coords: 4 945 025.0 N; 311 151.6 E **ORIGINATED BY** F.P.
DIST Central **HWY** 11 **BOREHOLE TYPE** Continuous Flight Solid Stem Augers **COMPILED BY** B.R.
DATUM Geodetic **DATE** January 10, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE										○		
								● QUICK TRIAXIAL × LAB VANE												
233.9	Ground Surface						20	40	60	80	100									
0.0	Gravelly sand, trace clay		1	SS	17	▽*							○			21 42 25 12				
233.2	Compact Black Moist																			
0.7	(FILL)																			
	Clayey silt and sand trace to some gravel wet seams		2	SS	30								○							
	Hard Brown Moist to grey		3	SS	87								○							
	(TILL)																			
	wet seams at 2.0 m depth		4	SS	55								○H							
	cobbles and boulders at 3.0 m depth		5	SS	49								○							
			6	SS	69								○							
	cobbles and boulders at 4.4 m depth		7	SS	35								○							
			8	SS	107								○							
			9	SS	118							○								
226.6	Sand, with gravel some silt, trace clay					▽*										10 37 35 18				
7.3	Very dense Grey Moist to wet		10	SS	113								○							
	wet seams at 8.8 m depth																			
224.3	End of borehole		11	SS	106								○			21 60 15 4				
9.6																				

* 2013 01 10

▽ Water level observed during drilling

▽* Water level measured after drilling

Borehole open upon completion of drilling.

RECORD OF BOREHOLE No CNR-102

1 of 1

METRIC

G.W.P. 2177-10-00 **LOCATION** Coords: 4 945 075.9 N; 311 124.6 E **ORIGINATED BY** F.P.
DIST Central **HWY** 11 **BOREHOLE TYPE** Continuous Flight Solid Stem Augers **COMPILED BY** B.R.
DATUM Geodetic **DATE** January 10, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE										○		
								● QUICK TRIAXIAL × LAB VANE												
233.9	Ground Surface						20	40	60	80	100									
0.0	Sand, trace silt		1	SS	9	▽* ▼*							○							
	Loose Black Wet (FILL)		2	SS	5		233						○							
232.5	Silty clay, organics																			
1.4	Firm Dark Moist grey		3	SS	24		232						○							
	Clayey silt and sand trace to some gravel																			
	Very stiff Grey Moist to hard		4	SS	57								○H			12 44 28 16				
	(TILL)						231													
			5	SS	49		230						○							
			6	SS	40								○							
			7	SS	60		229						○							
228.1	Sand, with gravel some silt, trace clay						228													
5.8	Very dense Grey Wet		8	SS	102								○			28 55 13 4				
							227													
			9	SS	109		226						○							
							225													
224.1			10	SS	85								○							
9.8	End of borehole																			



APPENDIX A

GEOCRES REPORT

Foundation Investigation Report for CNR Overhead Widening,
Geocres No. 31D-250, January 1978

G.I.-30 SEPT. 1976

REMARKS: _____

DIST No 5
CONT No
WP No 162-75-03

HIGHWAY 11 WIDENING OVER C.N.R.
0.5 MILES NORTH OF NORTH JUNCTION
OF HIGHWAY 11 AND HIGHWAY 11
GENERAL LAYOUT

MAKSYMIEC & ASSOCIATES LIMITED
CONSULTING PROFESSIONAL ENGINEERS
TORONTO, ONTARIO

NOTES

CLASS OF CONCRETE:

CONCRETE IN DECK — 4000 PSI
BARRIER WALLS — 4000 PSI
RETAINING WALLS — 4000 PSI
FOOTINGS (RET & WALLS) — 3000 PSI

MASS CONCRETE — 2000 PSI

CLEAR OVER TO REIN. STEEL:

TOP OF DECK SLAB — 2'
BOTTOM OF DECK SLAB — 2'
FOOTINGS — 2'
BACK AND FRONT FACE — 2'
RETAINING WALLS — 2'
OR AS NOTED ON DRAWINGS

REINFORCING STEEL:

GRADE 400 REINFORCING STEEL
REINFORCING BARS WITH THE DESIGNATION 'C'
AT THE END OF BAR MARKS SHALL BE COATED BARS
CONSTRUCTION NOTES:
BACKFILL TO DISTURBED AREAS AT EACH
END OF SLAB WIDENING TO BE
COMPACTED GRANULAR 6"
DIMENSIONS OF EXISTING STRUCTURE
ARE TO BE CHECKED IN FIELD

CONCRETE QUANTITIES

CONCRETE QUANTITIES ARE LISTED BELOW
FOR THE APPROPRIATE CONCRETE LUMP
SUM TENDER ITEMS

	CU. YD.
CONCRETE IN DECK 4000 PSI 3000 +	81 10
CONCRETE IN NEW RETAINING WALLS AND CAPPING TO EXISTING RETAINING WALLS	61
CONCRETE IN BARRIER WALLS	11



EXISTING PROFILE AT E HWY. 11 TO BE MAINTAINED

N.T.S.

FOR TRAFFIC DIVERSION AND TRAFFIC PROTECTION DURING
CONSTRUCTION SEE DWG. N.T.S.

SECTION B-B

SCALE 1" = 1'-0"

LIST OF DRAWINGS

DWG. N.T.S. GENERAL LAYOUT.

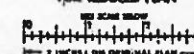
1. BOREHOLE LOCATIONS & SOIL STRATA.
2. DECK WIDENING DETAILS.
3. RETAINING WALLS - LAYOUT & REIN.
4. BARRIER WALL.
5. STEEL RAILING (SINGLE TUBE)
6. STANDARD DETAILS.
7. TRAFFIC DIVERSION DURING CONSTRUCTION

④ D.M. 124-60 - EL. 796-754
TABLET IN EAST FACE OF NORTH ABUTMENT OF C.N.R. BRIDGE
27'-4" RIGHT AT STA. 47+97
ROUTE 52 ORILLIA.

ELEVATION A-A

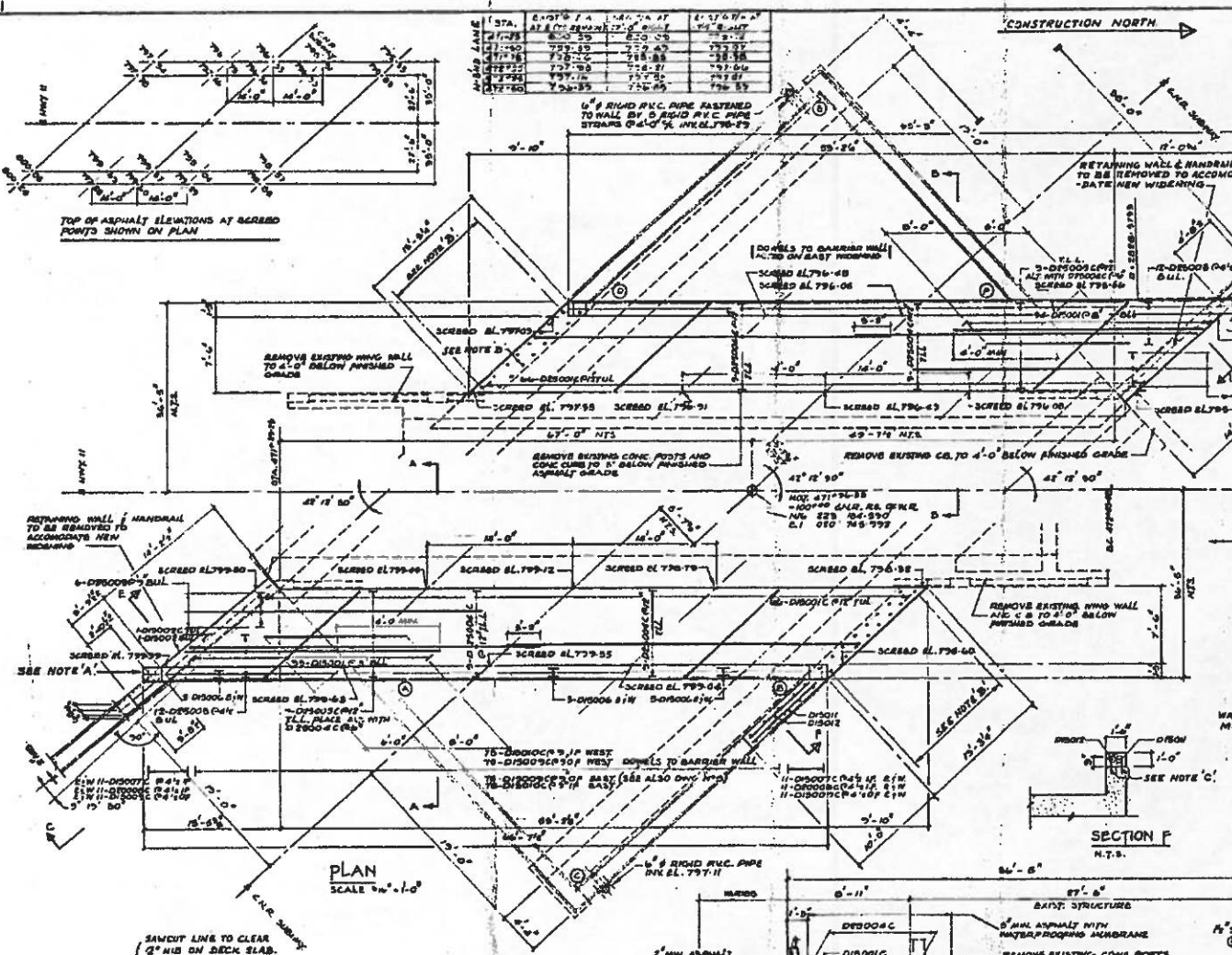
SCALE 1" = 10'-0"

FOR REDUCED PLAN



NO.	DATE	BY	CHKD.	APP'D.
1	1975-05-10	J.E. Lemay		
2	1975-05-10	J.E. Lemay		
3	1975-05-10	J.E. Lemay		
4	1975-05-10	J.E. Lemay		
5	1975-05-10	J.E. Lemay		
6	1975-05-10	J.E. Lemay		
7	1975-05-10	J.E. Lemay		
8	1975-05-10	J.E. Lemay		
9	1975-05-10	J.E. Lemay		
10	1975-05-10	J.E. Lemay		

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS OFFICE OF THE SECRETARY



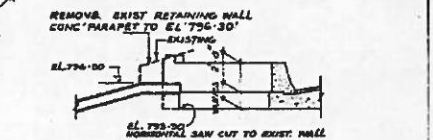
NOTES:
A. SLAB DEPTH IS EXTENDED THRU TO END OF BARRIER WALL TO ANCHOR BARRIER WALL REINFORCEMENT.
B. SLAB WIDENING IS TO BE ANCHORED BY 20 MM THREADED STUDS DRILLED INTO EXISTING WALL (1:3 PROJECTION) SEE QUANTITY AND SPACING BELOW.
C. PARAPET WALL ADDITION DRILL EXISTING WALL FOR #20 SYNTHETIC RESIN CAPSULES TO RECEIVE 20 MM THREADED STUDS. (3" PROJECTION) SEE

DIST	No 5
CONT	No
WP	No 162-75-03
PROJECT	HIGHWAY 11 WIDENING OVER C.N.R. 0.3 MILES NORTH OF NORTH JUNCTION OF HIGHWAY 11 & HIGHWAY 11 DECK WIDENING DETAILS
SHEET	

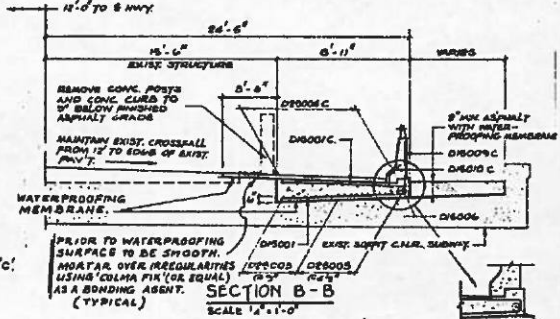
MAKSYMEC & ASSOCIATES LIMITED
CONSULTING PROFESSIONAL ENGINEERS
BARBARA
N20 SYNTHETIC RESIN CAPSULES AND 20 MM # THREADED STUDS.
DECK SLABS - TOTAL = 32 @ 18' 6" (1:3 LONG.)
PARAPET - TOTAL = 10 @ 24' 6" (1:3 LONG.)

LOCATION	POINT	PT. B	PT. C	PT. D	PT. E	PT. F
DEPTH OF ASPHALT	2' 6"	2' 6"	2' 6"	2' 6"	2' 6"	2' 6"

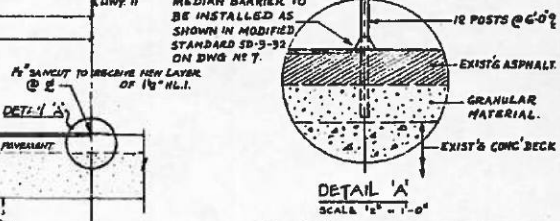
LENGTH OF BARRIER WALL AFFECTED BY CURVE IN HWY. 11 - 18' 0"
OVERSEEN LENGTH AT END OF WALL 11 - WALL TO CONTINUE STRAIGHT THROUGHOUT LENGTH - REMAIN OFFSET



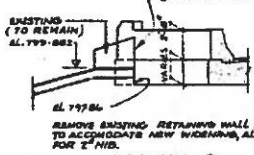
SECTION D
SCALE 3/4" = 1'-0"



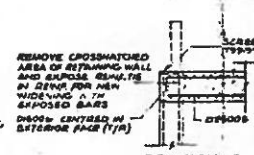
SECTION B-B
SCALE 1/2" = 1'-0"



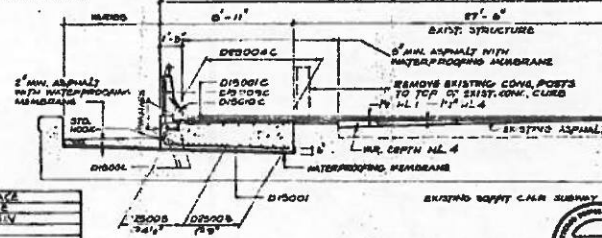
DETAIL 'A'
SCALE 1/2" = 1'-0"



SECTION C
SCALE 3/4" = 1'-0"



SECTION E
SCALE 3/4" = 1'-0"

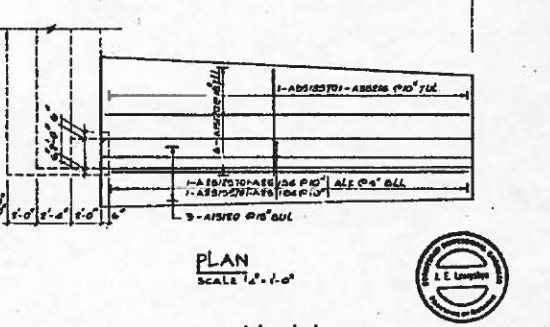
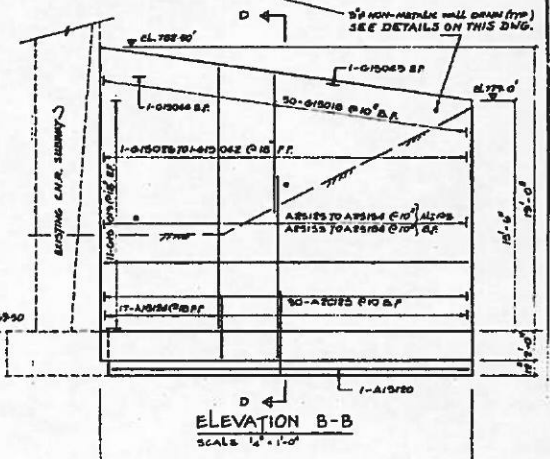
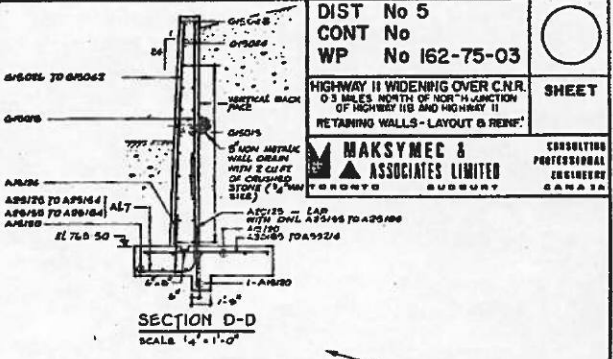
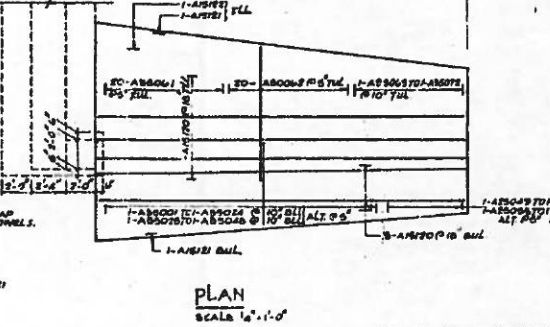
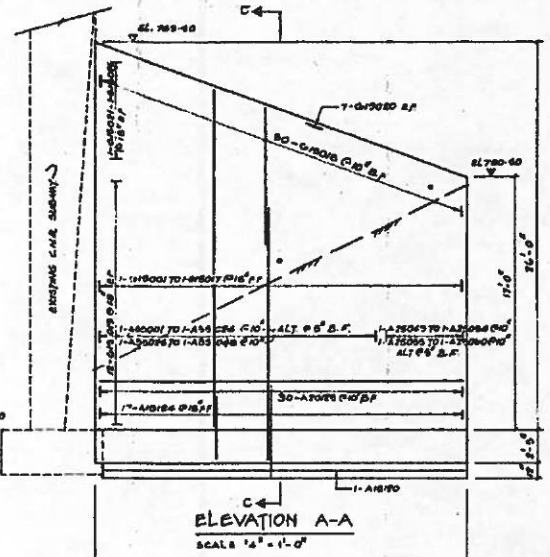
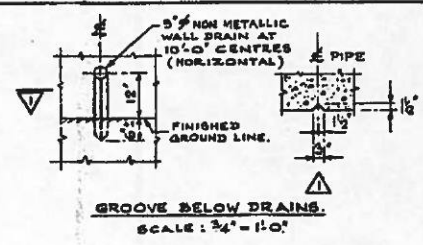
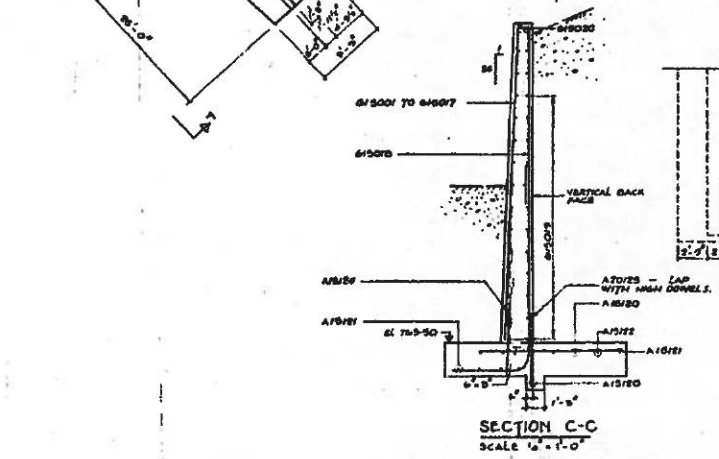
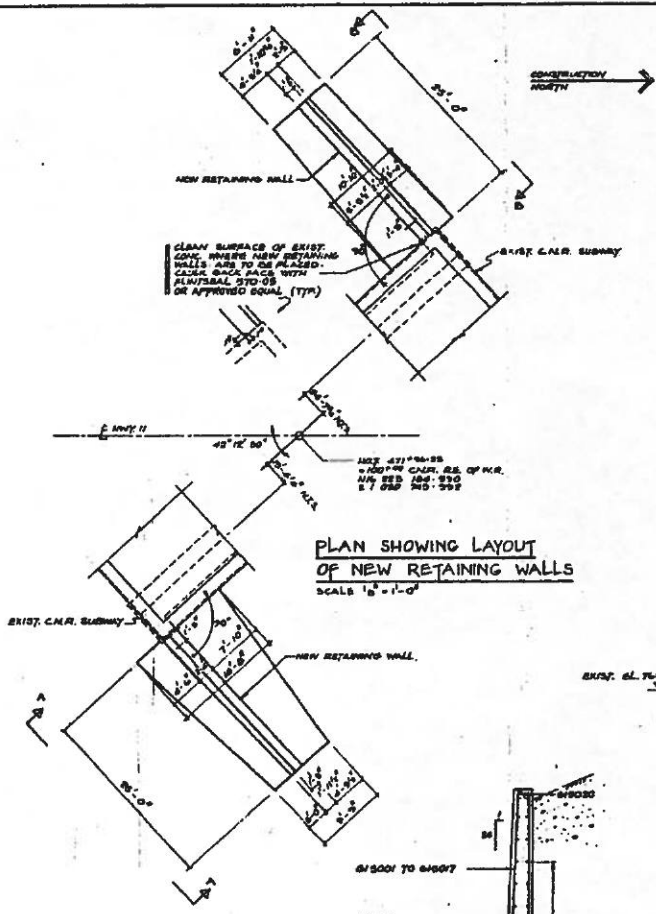


SECTION A-A
SCALE 3/4" = 1'-0"



FOR REDUCED PLAN	DATE BY	DESCRIPTION
1" = 10' ON ORIGINAL PLAN	DATE BY	DESCRIPTION
	CHECKED	DATE
	CHECKED	DATE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS



DIST No 5
CONT No
WP No 162-75-03

Highway 11 Widening over C.N.R.
0.3 Miles North of Hwy 11 Junction
of Highway 118 and Highway 11
Retaining Walls - Layout & Reinf.

MAKSYMIEC & ASSOCIATES LIMITED
CONSULTING PROFESSIONAL ENGINEERS
TORONTO SUDBURY CANADA

FOR REDUCED PLAN
USE SCALE BELOW

REVISIONS

NO.	DATE	BY	DESCRIPTION
1			DESIGN
2			CHECK
3			LOADING
4			DATE
5			REVISION

1:1 SCALE

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

WP 162-75-03

DIST 5

HWY 11

STR SITE 30-79

CONT 79-92

C.N.R. Overhead Widening
0.3 Miles North of North Junction
Hwy. 11B and Hwy. 11

DISTRIBUTION

A.P. Watt (2)
J.R. Roy
A. Wittenberg
J.H. Blevins (2)

A.E. McKim
G.A. Wrong
B.J. Giroux
R.S. Pillar

R. Hore

A. Crowley)
J. Anderson) cover only
G. Sloan)

Files ✓

SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	78-01-07	<i>Watt</i>
TUBES	—	—
ROCK CORES	—	—

GEOCRE 31D-250

DATE JAN 10 1978

FOUNDATION INVESTIGATION REPORT

For
C.N.R. Overhead Widening
0.3 Miles North of North Junction
Hwy. 11B and Hwy. 11
Hwy. 11, District 5, Owen Sound
W.P. 162-75-03 Site 30-79

INTRODUCTION

A subsurface investigation was carried out at the existing C.N.R. overhead north of Orillia on the 22nd and 23rd of September, 1977. Fieldwork was completed by using a muskeg vehicle mounted continuous flight auger.

SITE DESCRIPTION

The site is located 0.35 miles north of the north junction of Hwy. 11 and 11B in the Township of Orillia.

A mixture of deciduous and coniferous trees make up the vegetation of the surrounding area.

Physiographically the site lies in the gently rolling sand plains of the Simcoe Lowlands.

SUBSURFACE CONDITIONS

Clayey Silt With Sand, Some Gravel

Clayey silt with sand, some gravel extends from original ground to around 36 feet, the depth of exploration. Standard Penetration 'N' values range from 74 blows to 100 blows for 5 inches of penetration. Within the deposit, sand and gravel layers are present from 20 feet downward and occasional boulders from 20 to 26 feet. Moisture contents range from 8% to 9% throughout the deposit.

An estimated stratigraphic profile, Drawing No. 1627503-A, has been prepared on the basis of the appended Record of Borehole Sheet.

Groundwater

Groundwater was observed in B.H. 1 at elevation 752. Some surface water was present west of the C.N.R. tracks under the existing structure. Large amounts of rain had fallen prior to field investigation.

APPENDIX

RECORD OF BOREHOLE No 1

W P 162-75-03 LOCATION Co-ords N 16 223 118; E 1 020 795 ORIGINATED BY JM
 DIST 5 HWY 11 BOREHOLE TYPE Continuous Flight Auger COMPILED BY JM
 DATUM Geodetic DATE September 22, 23, 1977 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N ^o VALUES			20	40	60	80	100					
768.0	Ground Level																GR SA SI CL
0.0			1	AS													5 45 38 12
	Clayey Silt with Sand Some Gravel		2	SS	74												17 39 30 14
			3	SS	74												
			4	SS	88												
			5	SS	98												
			6	SS	107	3"											8 59 24 9
	Occasional Boulders		7	SS	1007	5"											32 50 (18)
			8	SS	80												
	Sand and Gravel Layers		9	SS	1007	8"											24 60 (16)
731.8	Hard																
36.2	End of Borehole						730										

+³, x⁵: Numbers refer to
Sensitivity

20
15 \diamond 5 (%) STRAIN AT FAILURE
10

EXPLANATION OF TERMS USED IN REPORT

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

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 150 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

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

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

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

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

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

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

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

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

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

JOINTING AND BEDDING:

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

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

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

FIELD SAMPLING

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

EARTH PRESSURE TERMS

μ COEFFICIENT OF FRICTION
 δ ANGLE OF WALL FRICTION
 k_o COEFFICIENT OF EARTH PRESSURE AT REST
 k_a COEFFICIENT OF ACTIVE EARTH PRESSURE
 k_p COEFFICIENT OF PASSIVE EARTH PRESSURE
 i ANGLE OF INCLINATION OF SURCHARGE
 w SLOPE ANGLE-BACKFACE OF WALL
 β ANGLE OF SLOPE
 N_c, N_q, N_γ BEARING CAPACITY FACTORS
 D_f DEPTH OF FOOTING
 B, L FOOTING DIMENSIONS

INDEX PROPERTIES

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

STRENGTH PARAMETERS

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

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

HYDRAULIC TERMS

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

