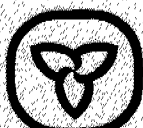


FOUNDATION INVESTIGATION REPORT

CONTRACT NO. 92-19



Ontario

**Ministry of
Transportation**

INDEX

<u>Page No:</u>	<u>DESCRIPTION</u>
1	Index
2	Abbreviations & Symbols
3 - 17	Foundation Investigation Report for Trussler Road Overpass W.P. 143-88-01/02 Site 33-358 Hwy. 7 & 8, District 3, Stratford

Note: For purposes of the contract, this report supersedes all other Foundation Reports prepared by, or for the Ministry in connection with the above mentioned project.

EXPLANATION OF TERMS USED IN REPORT

2

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'_{v0}	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	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kn/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kn/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kn/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	kn/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kn/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kn/m^2	SEEPAGE FORCE
γ'	kn/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

FOUNDATION INVESTIGATION REPORT
For
Trussler Road Overpass
Hwy. #7 & #8
W.P. 143-88-01/02; Site No. 33-358
District #3, Stratford

INTRODUCTION

This report contains the results of a foundation investigation carried out at the Junction of Trussler Road and Hwy. #7 & #8 during the period of July 12 - August 10 1988. The fieldwork consisted of nine sampled borholes and nine dynamic cone penetration tests. The borings were advanced by a continuous flight auger machine mounted on a muskeg vehicle and equipped with hollow stem augers or with BW casings.

SITE DESCRIPTION

The site is located at the boundary line between City of Kitchener and TWP. of Wilmot on Hwy. #7 & #8.

Physiographically the site is located in the Region referred to as the Stratford Till Plain.

SUBSURFACE CONDITIONS

The field investigation carried out at this site revealed the presence of fluvial deposits such as gravels, sands, silt and also clayey silt and organic zones in the vicinity of the original ground surface. Due to the complexity (elevation, thickness, composition etc.) of the encountered different deposits, it is not practical to give detailed description for the individual strata. References should be made to the Record of Borehole sheets where details of the stratification at a particular boring locations are given.

In addition, these sheets also contain the observed groundwater levels, together with the obtained field and laboratory tests results.

The summarized stratigraphical profiles are shown on Drawing No. 143880102-A.*

GROUNDWATER CONDITIONS

The following groundwater levels were observed during the field investigation:

<u>BH No.</u>	<u>Elevation</u>
1	347.9
2	355.2
3	356.0
4	355.9
5	357.7
6	347.7
7	346.7
8	348.1
9	356.9

No artesian conditions were observed.

MISCELLANEOUS

The fieldwork for this project was supervised by M.G. Kotsifas, Co-op student. The equipment used was owned and operated by Master Soil Investigation Ltd. This report was prepared by P. Payer and reviewed by Mr. M. Devata.



P. Payer
 P. Payer, P. Eng.
 Sr. Foundation Engineer

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

* DWG NO 2 OF THE CONTRACT DWG'S

APPENDIX

RECORD OF BOREHOLE No 1

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 807 960.4; E 219 927.0 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Augers COMPILED BY GK
 DATUM Geodetic DATE 88 07 12 - 88 07 13 CHECKED BY _____

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20 40 60 80 100		W _p	W	W _L		
359.2	Ground Level												GR SA SI CL
0.0	Gravelly Sand Some Silt Trace of Clay Loose to Compact		1	SS	17								24 51 22 3
			2	SS	17								
			3	SS	11								
			4	SS	8								
			5	SS	20								
356.2			6	SS	13								
			7	SS	13								
3.0	Clayey Silt Silty Sand Layers Stiff to V. Stiff		8	SS	21								0 1 85 14
			9	SS	16								0 3 (98)
354.3			10	SS	16								
			11	SS	47								
4.9			12	SS	41								21 22 47 10
			13	SS	40								
	Silty Sand to Sandy Silt Occ. Clayey Silt Layers Trace of Clay Dense to V. Dense		14	SS	48								
			15	SS	46								
			16	SS	64								
			17	SS	69								
347.5			18	SS	70								
11.7			19	SS	59								
	Sand & Gravel Some Silt Trace of Clay V. Dense		20	SS	86								29.66 (5)
343.5													
15.7	End of Borehole												

+3, x5: Numbers refer to
Sensitivity

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

RECORD OF BOREHOLE No 2

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 807 984.3; E 219 929.8 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger COMPILED BY GK
 DATUM Geodetic DATE 88 07 13 - 88 07 14 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
359.5	Ground Level												
0.0	Sandy Silt to Silty Sand Traces of Gravel and Clay Loose to Compact		1	SS	14								3 47 44 6
			2	SS	7								
			3	SS	8								
			4	SS	14								
			5	SS	20								
356.8			6	SS	19								
2.7	Clayey Silt, Some Sand Trace of Gravel Stiff to V. Stiff		7	SS	12								5 18 (77)
			8	SS	18								
355.4			9	SS	21								
4.1			10	SS	20								
			11	SS	29								
			12	SS	29								
			13	SS	32								
			14	SS	39								
	Silty Sand to Sandy Silt		15	SS	51								
	Occ. Clayey Silt Layers Trace of Clay		16	SS	82								
			17	SS	58								
	Compact to V. Dense		18	SS	57								
			19	SS	46								
			20	SS	57								0 0 88 12
342.7													
16.8			21	SS	88 / 15 cm								
	Sand and Gravel												
	Some Silt Trace of Clay		22	SS	68								
	V. Dense												
333.4													
26.1	End of Borehole												

RECORD OF BOREHOLE No 3

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 807 975.4; E 219 885.6 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger, BW Casing, Washboring COMPILED BY GK
 DATUM Geodetic DATE 88 07 14 - 88 07 21 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p 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						
358.4	Ground Level		1	SS	8		358				
0.0	Organic Silt Some Sand and Undecayed Matters		2	SS	7		356				
	Soft to Firm		3	SS	8						
			4	SS	9						
			5	SS	11						
			6	SS	4						
			7	SS	4						
355.0			8	SS	6						
3.4			9	SS	4						
	Silty Sand to Sandy Silt		10	SS	7						
			11	SS	10						
			12	SS	15						
			13	SS	12						
			14	SS	12						
			15	SS	14						
	Occ. Clayey Silt Layers Trace of Clay		16	SS	37						
			17	SS	98						
	Loose to V. Dense		18	SS	75						
			19	SS	89						
			20	SS	41						
343.6			21	SS	64						
14.8			22	SS	123						
	Sand and Gravel		23	SS	106						
	Some Silt Trace of Clay		24	SS	183						
	V. Dense		25	SS	179						
330.5											
27.9	End of Borehole										

RECORD OF BOREHOLE No 4

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 808 029.9; E 219 861.6 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger COMPILED BY GK
 DATUM Geodetic DATE 88 07 20 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH kPa							WATER CONTENT (%)			
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE	W _p						W	W _L	10 20 30	
367.3 0.0	Ground Level														GR SA SI CL				
	Clayey Silt Some Sand Trace of Gravel Occ. Silty Sand and Gravelly Layers V. Stiff to Hard Fill Material		1	SS	35		366								3 20 (77)				
			2	SS	18														
			3	SS	48														
			4	SS	47			364											
			5	SS	33														
			6	SS	44														
			7	SS	116			362											
			8	SS	31														
			9	SS	28			360											
			10	SS	35														
			11	SS	28			358											
			12	SS	24														
357.2 10.1	Organic Silt Some Sand and Clay Stiff		13	SS	28		356							2 59 34 5					
			14	SS	14														
			15	SS	18														
			16	SS	21														
354.5 12.8	Sandy Silt to Silty Sand Traces of Gravel and Clay		17	SS	36		354												
			18	SS	13														
			19	SS	7														
352.4 14.9	End of Borehole																		

+3, x5: Numbers refer to
Sensitivity

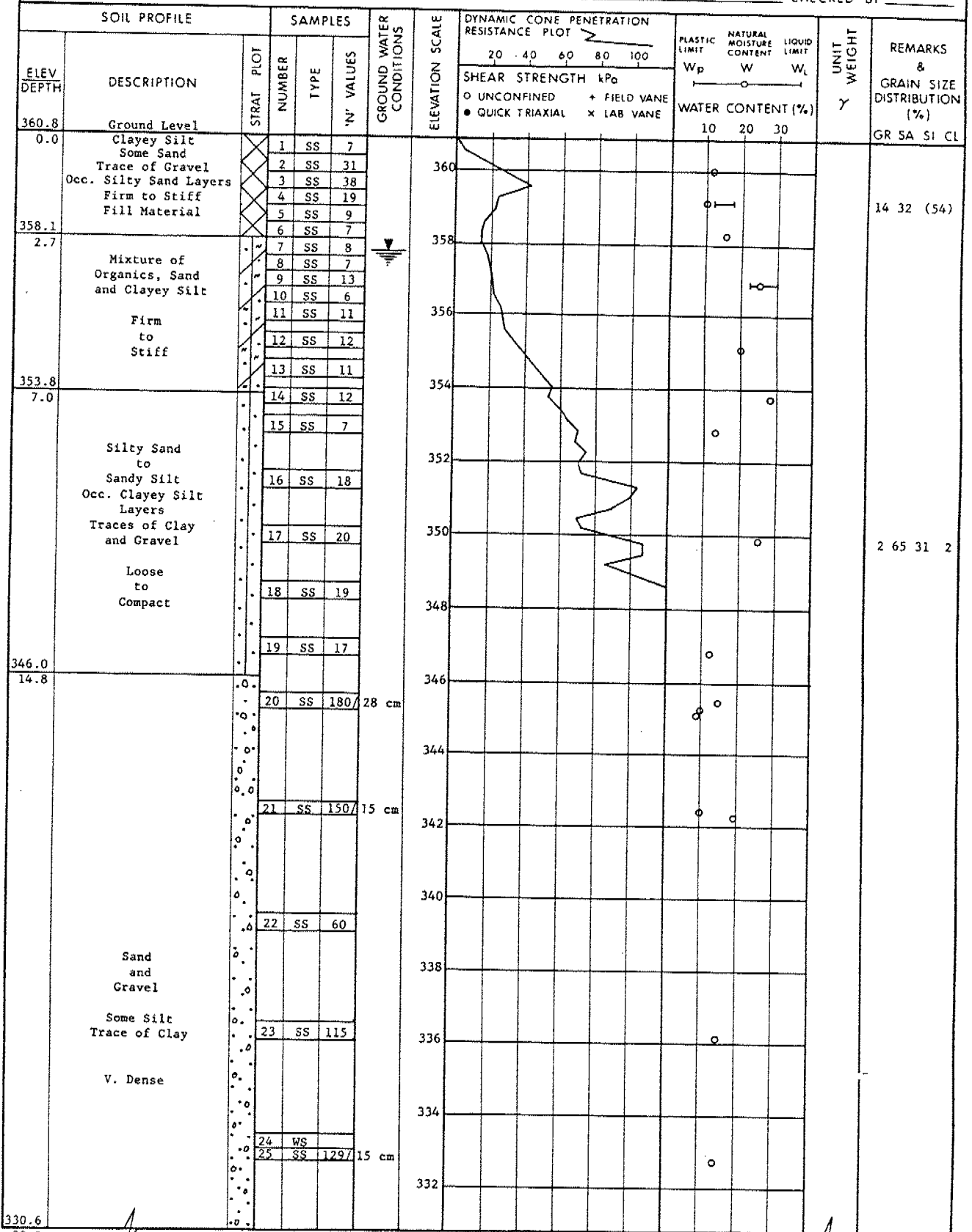
20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 5

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 807 990.6; E 219 874.9
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger, BW Casing, Washboring
 DATUM Geodetic DATE 88 07 21 - 88 07 26
 ORIGINATED BY GK
 COMPILED BY GK
 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION



Continued

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

Continued

RECORD OF BOREHOLE No 5

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 807 990.6; E 219 874.9 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger, BW Casing, Washboring COMPILED BY GK
 DATUM Geodetic DATE 88 07 21 - 88 07 26 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20					
330.6	Continued		26	SS	164								
30.2													
329.9													
30.9	End of Borehole												

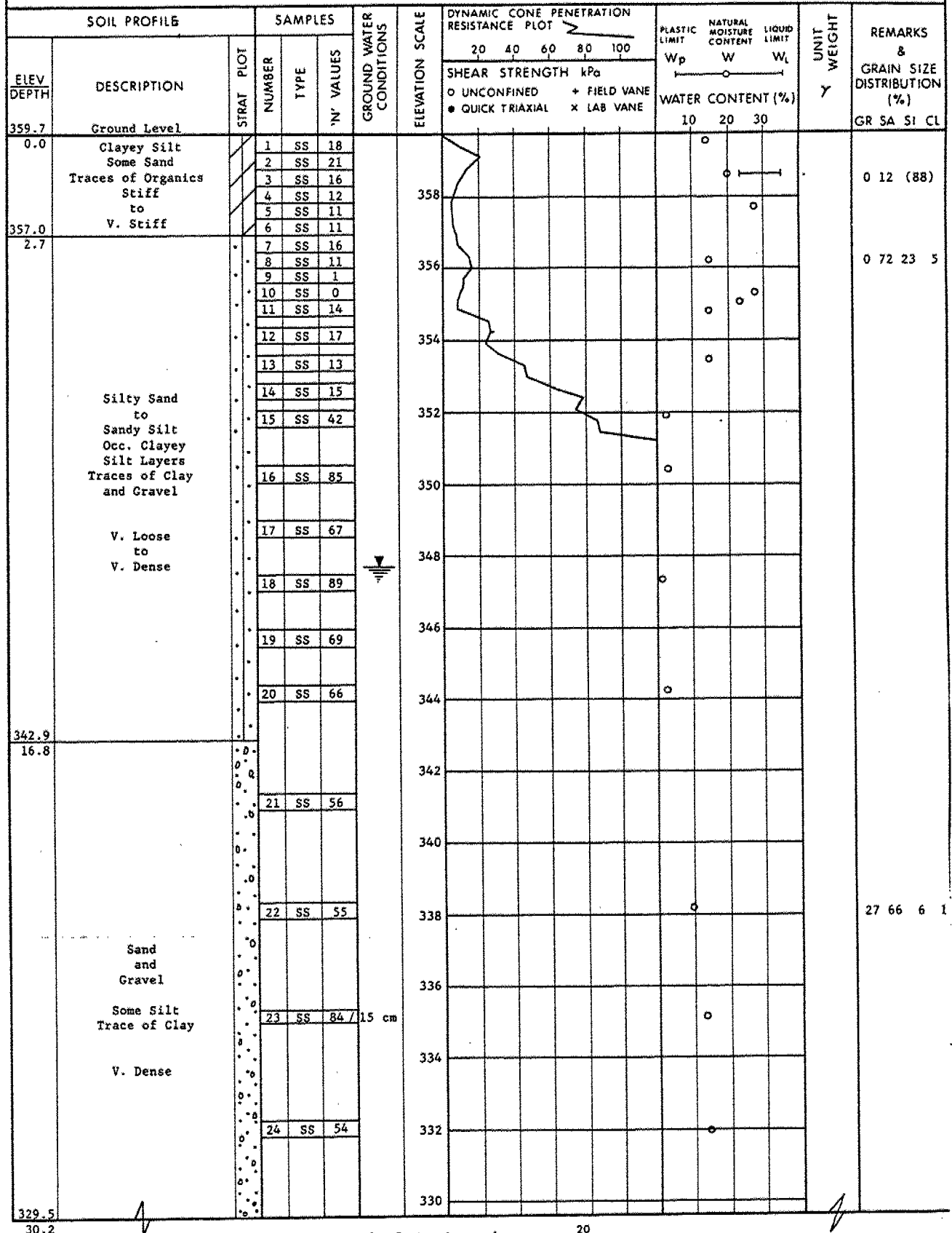
OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 6

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 807 995.0; E 219 918.0 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger, Washboring COMPILED BY GK
 DATUM Geodetic DATE 88 07 27 - 88 08 02 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION



Continued

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (% STRAIN AT FAILURE

Continued

METRIC

ORIGINATED BY GK

COMPILED BY GK

CHECKED BY _____

OFFICE REPORT ON SOIL EXPLORATION

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 7

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 808 054.3; E 219 868.0 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger COMPILED BY GK
 DATUM Geodetic DATE 88 08 03 - 88 08 04 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPo ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT Wp NATURAL MOISTURE CONTENT W LIQUID LIMIT Wl WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
358.7	Ground Level		1	SS	8						
0.0	Sandy Silt Traces of Clay and Organics Loose		2	SS	5						
357.2			3	SS	5						
1.5	Clayey Silt Some Sand Stiff		4	SS	8						
			5	SS	14						
			6	SS	9						
			7	SS	9						
354.7			8	SS	9						
4.0			9	SS	10						
			10	SS	5						
			11	SS	2						
			12	SS	2						
			13	SS	2						
	Silty Sand to Sandy Silt Occ. Clayey Silt Layers Trace of Clay		14	SS	2						
			15	SS	3						
			16	SS	11						
	V. Loose to V. Dense		17	SS	38						
			18	SS	53						
345.3			19	SS	68						
13.4			20	SS	130/	15 cm					
	Sand and Gravel Some Silt Trace of Clay V. Dense										
340.0			21	SS	100						
18.7	End of Borehole										

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 8

METRIC

W P 143-88-01/02

LOCATION Co-ords: N 4 808 074.5; E 219 852.8

ORIGINATED BY GK

DIST 3 HWY 7/8

BOREHOLE TYPE H.S. Auger

COMPILED BY GK

DATUM Geodetic

DATE 88 08 04 - 88 08 05

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER TYPE N° VALUES								
359.8	Ground Level		1 SS 11								
0.0	Sandy Silt Traces of Clay and Organics Loose to Dense		2 SS 35								
358.0			3 SS 5								
1.8			4 SS 6								
			5 SS 9								
	Clayey Silt Some Sand Firm to Hard		6 SS 8								
			7 SS 25								
			8 SS 48								
			9 SS 30								
354.6			10 SS 25								
5.2			11 SS 24								
			12 SS 31								
			13 SS 69								
	Silty Sand to Sandy Silt Occ. Clayey Silt Layers Trace of Clay		14 SS 58								
			15 SS 101	15 cm							
			16 SS 85								
	Dense to V. Dense		17 SS 85								
346.5			18 SS 84								
13.3			19 SS 92								
	Sand and Gravel Some Silt Trace of Clay		20 SS 109	15 cm							
	V. Dense										
341.1			21 SS 98								
18.7	End of Borehole										

RECORD OF BOREHOLE No 9

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 808 054.5; E 219 887.9 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger, BW Casing, Washboring COMPILED BY GK
 DATUM Geodetic DATE 88 08 08 - 88 08 10 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p 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						
359.3	Ground Level		1	SS	8					
0.0	Mixture of Organics and Sand, Firm		2	SS	8					
358.3			3	SS	6					
1.0			4	SS	6					
			5	SS	4					
			6	SS	6					
			7	SS	8					
			8	SS	4					
			9	SS	2					
			10	SS	2					
			11	SS	5					
			12	SS	7					
			13	SS	16					
			14	SS	15					
			15	SS	22					
			16	SS	27					
			17	SS	51					
			18	SS	44					
			19	SS	59					
344.7			20	SS	134/15 cm					
14.6			21	SS	75					
			22	SS	134					
			23	SS	123					
			24	SS	94					
329.1										
30.2										

Continued

+3, x5: Numbers refer to Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

Continued

METRIC

OFFICE. REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100					
329.1	Continued	100 90.9	25	SS	126								
30.2													
328.4													
30.9	End of Borehole												

+3, x⁵ : Numbers refer to Sensitivity

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



Ministry of
Transportation and
Communications

FILE COPY

FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

cont. 92-19

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 143-88-01/02 DIST 3
HWY 7/8 STR SITE 33-358

Trussler Road Overpass

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FOUNDATION INVESTIGATION REPORT
For
Trussler Road Overpass
Hwy. #7 & #8
W.P. 143-88-01/02; Site No. 33-358
District #3, Stratford

INTRODUCTION

This report contains the results of a foundation investigation carried out at the Junction of Trussler Road and Hwy. #7 & #8 during the period of July 12 - August 10 1988. The fieldwork consisted of nine sampled borholes and nine dynamic cone penetration tests. The borings were advanced by a continuous flight auger machine mounted on a muskeg vehicle and equipped with hollow stem augers or with BW casings.

SITE DESCRIPTION

The site is located at the boundary line between City of Kitchener and TWP. of Wilmot on Hwy. #7 & #8.

Physiographically the site is located in the Region referred to as the Stratford Till Plain.

SUBSURFACE CONDITIONS

The field investigation carried out at this site revealed the presence of fluvial deposits such as gravels, sands, silt and also clayey silt and organic zones in the vicinity of the original ground surface. Due to the complexity (elevation, thickness, composition etc.) of the encountered different deposits, it is not practical to give detailed description for the individual strata. References should be made to the Record of Borehole sheets where details of the stratification at a particular boring locations are given.

In addition, these sheets also contain the observed groundwater levels, together with the obtained field and laboratory tests results.

The summarized stratigraphical profiles are shown on Drawing No. 144880102-A of the appendix.

GROUNDWATER CONDITIONS

The following groundwater levels were observed during the field investigation:

<u>BH No.</u>	<u>Elevation</u>
1	347.9
2	355.2
3	356.0
4	355.9
5	357.7
6	347.7
7	346.7
8	348.1
9	356.9

No artesian conditions were observed.

DISCUSSION AND RECOMMENDATIONS

General

It is proposed to construct grade separation and interchange at the junction of Hwy. #7 & 8 and Trussler Road. The existing Hwy. #7 & 8 will serve as the westbound lanes (Grade El. 369±), while the eastbound lanes will be constructed some 10 m above the original ground surface. Trussler Road will be realigned some 33 m easterly and its grade will be lowered from El. 367.5 to El. 360±. The structure will have single spans, about 32 m long (measured on a skew).

STRUCTURE FOUNDATIONS

It is recommended that the proposed structures be founded on end-bearing steel 'H' piles (HP310 x 110) driven into the very dense sand and gravel deposit, using a safe design load of 850 kN per pile. The pile tips should be reinforced with pile driving shoes. The piles should be driven in accordance with standards SS103-10 or SS103-11 using an ultimate capacity of 2550 kN per pile but must be driven below El. 336.

The pile driving hammer should have an actual capacity of not less than 50,000 kilojoule (kJ).

For purposes of the O.H.B.D.C. The following values are recommended:

Factored Capacity at U.L.S.: 1200 kN
Capacity at S.L.S. II : 850 kN

The granular backfill should be in accordance with Special Provision No. 109F03 (latest revision).

For the backfill material, the following parameters are recommended:

	<u>Granular 'A'</u>	<u>Granular 'B'</u>
Angle of Internal Friction	$\phi = 35^\circ$	$\phi = 30^\circ$
Unit Weight (kN/m ³)	$\gamma = 22.8$	$\gamma = 21.2$

Earth pressures should be computed (assuming 'Active' conditions) as per subsection 6.6.1.2. of the code.

Approach Embankments

The existing embankment will be widened to accomodate the proposed eastbound lanes. The new fill should be benched into the existing embankment as OPSD 208-01. The slopes of the approaches (new and existing) should not be steeper than 2:1. The material in the embankment should not contain larger grain sizes than 75 mm at locations where piles have to be driven.

Organic material was encountered in the south-east quadrant of the proposed interchange and should be removed to its full horizontal extent before placing any fill material.

The side slopes of the propose Trussler Road cuts should not be steeper than 2:1.

OTHER CONDITIONS

The frost protection recommendations in this area is a minimum of 1.2 m of earth cover. The pile caps should be formed in the 'Dry'.

MISCELLANEOUS

The fieldwork for this project was supervised by M.G. Kotsifas, Co-op student. The equipment used was owned and operated by Master Soil Investigation Ltd. This report was prepared by P. Payer and reviewed by Mr. M. Devata.



P. Payer
P. Payer, P.Eng.

Senior Foundation Engineer

M. Devata
M. Devata, P.Eng.

Chief Foundation Engineer

APPENDIX

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:

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

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	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m ³	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m ³	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m ³	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m ³ /s	RATE OF DISCHARGE
γ_d	kN/m ³	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m ³	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kn/m ²	SEEPAGE FORCE
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No 1

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 807 960.4; E 219 927.0 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Augers COMPILED BY GK
 DATUM Geodetic DATE 88 07 12 - 88 07 13 CHECKED BY _____

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
359.2	Ground Level															GR SA SI CL
0.0	Gravelly Sand Some Silt Trace of Clay Loose to Compact	0.0 0.0 0.0 0.0 0.0	1	SS	17											24 51 22 3
			2	SS	17											
			3	SS	11											
			4	SS	8											
			5	SS	20											
			6	SS	13											
356.2		0.0	7	SS	13											
3.0	Clayey Silt Silty Sand Layers Stiff to V. Stiff		8	SS	21											0 1 85 14
			9	SS	16											0 3 (98)
354.3			10	SS	16											
			11	SS	47											21 22 47 10
4.9			12	SS	41											
	Silty Sand to Sandy Silt Occ. Clayey Silt Layers Trace of Clay Dense to V. Dense		13	SS	40											
			14	SS	48											
			15	SS	46											
			16	SS	64											
			17	SS	69											
347.5			18	SS	70											
11.7			19	SS	59											
	Sand & Gravel Some Silt Trace of Clay V. Dense		20	SS	86											29.66 (5)
343.5																
15.7	End of Borehole															

RECORD OF BOREHOLE No 2

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 807 984.3; E 219 929.8 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger COMPILED BY GK
 DATUM Geodetic DATE 88 07 13 - 88 07 14 CHECKED BY _____

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20 40 60 80 100		W _p	W	W _L		
359.5	Ground Level												
0.0	Sandy Silt to Silty Sand Traces of Gravel and Clay Loose to Compact		1	SS	14								GR SA SI CL 3 47 44 6
			2	SS	7								
			3	SS	8								
			4	SS	14								
356.8			5	SS	20								
			6	SS	19								
2.7	Clayey Silt, Some Sand Trace of Gravel Stiff to V. Stiff		7	SS	12								5 18 (77)
			8	SS	18								
355.4			9	SS	21								
4.1			10	SS	20								
			11	SS	29								
			12	SS	29								
			13	SS	32								
			14	SS	39								
	Silty Sand to Sandy Silt		15	SS	51								
	Occ. Clayey Silt Layers Trace of Clay		16	SS	82								
			17	SS	58								
	Compact to V. Dense		18	SS	57								
			19	SS	46								
			20	SS	57								0 0 88 12
342.7													
16.8													
			21	SS	88	15 cm							
	Sand and Gravel												
	Some Silt Trace of Clay		22	SS	68								
	V. Dense												
333.4													
26.1	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

METRIC

W P 143-88-01/02

LOCATION Co-ords: N 4 807 975.4; E 219 885.6

ORIGINATED BY GK

DIST 3 HWY 7/8

BOREHOLE TYPE H.S. Auger, BW Casing, Washboring

COMPILED BY GK

DATUM Geodetic

DATE 88 07 14 - 88 07 21

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
358.4	Ground Level											
0.0	Organic Silt Some Sand and Undecayed Matters		1	SS	8							
			2	SS	7							
			3	SS	8							
			4	SS	9							
	Soft to Firm		5	SS	7							
			6	SS	4							
			7	SS	4							
			8	SS	6							
355.0			9	SS	4							
3.4			10	SS	7							
	Silty Sand to Sandy Silt		11	SS	10							
			12	SS	15							
			13	SS	12							
	Occ. Clayey Silt Layers Trace of Clay		14	SS	12							
			15	SS	14							
			16	SS	37							
	Loose to V. Dense		17	SS	98							
			18	SS	75							
			19	SS	89							
			20	SS	41							
343.6			21	SS	64							
14.8			22	SS	123							
	Sand and Gravel		23	SS	106							
	Some Silt Trace of Clay		24	SS	183							
	V. Dense		25	SS	179							
330.5												
27.9	End of Borehole											

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 4

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 808 029.9; E 219 861.6 ORIGINATED BY GK
 DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger COMPILED BY GK
 DATUM Geodetic DATE 88 07 20 CHECKED BY _____

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p 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						
367.3	Ground Level										
0.0			1	SS	35						
			2	SS	18						
			3	SS	48						
			4	SS	47						
			5	SS	33						
			6	SS	44						
			7	SS	116						
			8	SS	31						
			9	SS	28						
			10	SS	35						
			11	SS	28						
			12	SS	24						
357.2			13	SS	28						
10.1			14	SS	14						
			15	SS	18						
354.5			16	SS	21						
12.8			17	SS	36						
			18	SS	13						
352.4			19	SS	7						
14.9											

+3, x5: Numbers refer to Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 5

METRIC

W P 143-88-01/02

LOCATION Co-ords: N 4 807 990.6; E 219 874.9

ORIGINATED BY GK

DIST 3 HWY 7/8

BOREHOLE TYPE H.S. Auger, BW Casing, Washboring

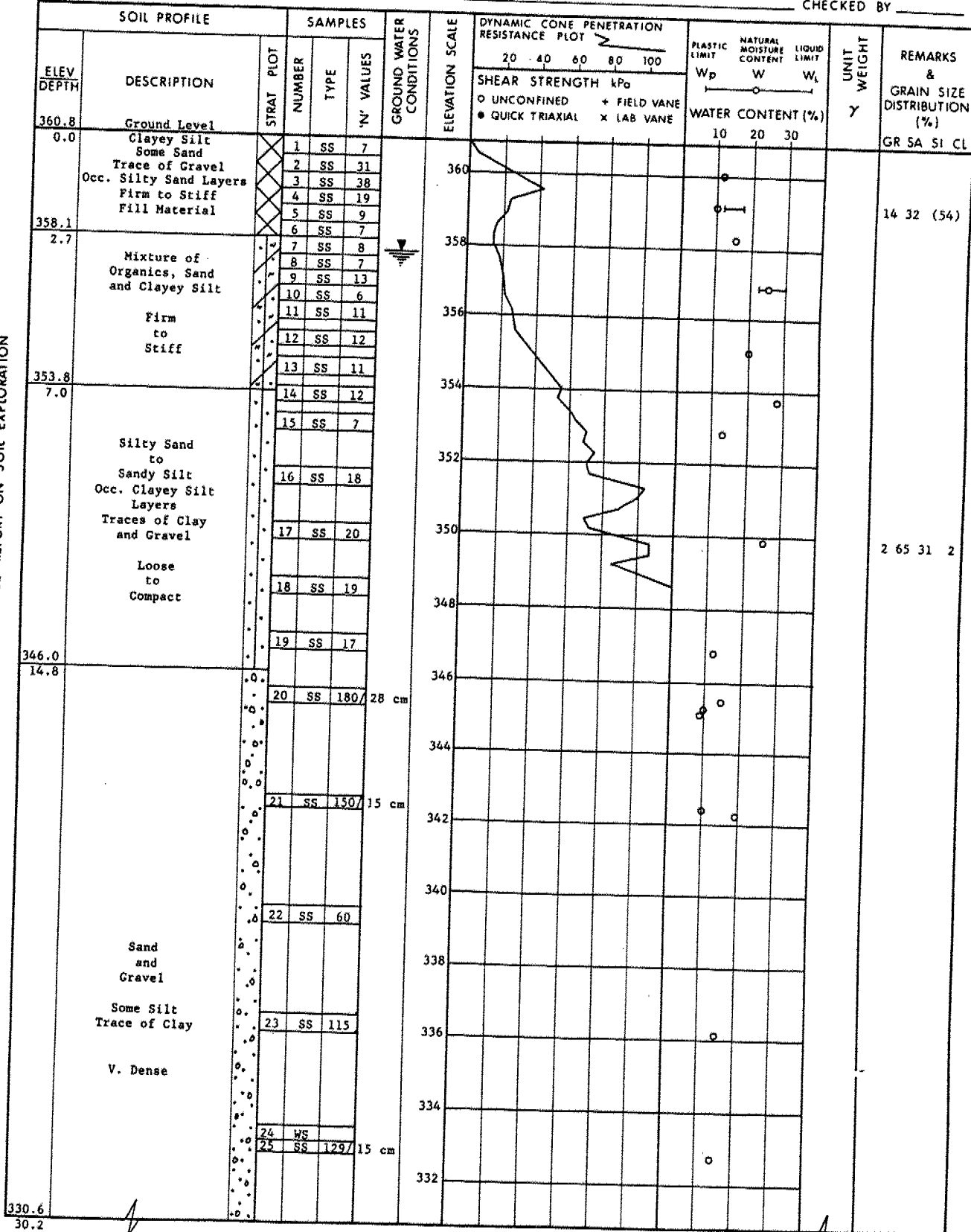
COMPILED BY GK

DATUM Geodetic

DATE 88 07 21 - 88 07 26

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

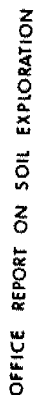


Continued

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

Continued



METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 807 990.6; E 219 874.9 ORIGINATED BY GK
DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger, BW Casing, Washboring COMPILED BY GK
DATUM Geodetic DATE 88 07 21 - 88 07 26 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 (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60	80	100
								SHEAR STRENGTH kPa									
330.6	Continued	1	26	SS	164												
30.2																	
329.9																	
30.9	End of Borehole																

+3, x5: Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 6

METRIC

W P 143-88-01/02 LOCATION Co-ords: N 4 807 995.0; E 219 918.0 ORIGINATED BY GK
DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger, Washboring COMPILED BY GK
DATUM Geodetic DATE 88 07 27 - 88 08 02 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100						
								SHEAR STRENGTH kPa						
359.7	Ground Level													
0.0	Clayey Silt Some Sand Traces of Organics Stiff to V. Stiff		1	SS	18								0 12 (88)	
			2	SS	21									
			3	SS	16									
			4	SS	12									
			5	SS	11									
357.0			6	SS	11								0 72 23 5	
2.7			7	SS	16									
			8	SS	11									
			9	SS	1									
			10	SS	0									
			11	SS	14									
			12	SS	17									
			13	SS	13									
			14	SS	15									
	Silty Sand to Sandy Silt Occ. Clayey Silt Layers Traces of Clay and Gravel		15	SS	42									
			16	SS	85									
			17	SS	67									
	V. Loose to V. Dense		18	SS	89									
			19	SS	69									
			20	SS	66									
342.9														
16.8			21	SS	56									
			22	SS	55								27 66 6 1	
	Sand and Gravel		23	SS	84 / 15 cm									
	Some Silt Trace of Clay		24	SS	54									
	V. Dense													
329.5														
30.2														

Continued

γ^3, γ^5 : Numbers refer to
Sensitivity

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

Continued

RECORD OF BOREHOLE No 6

METRIC

W P 143-88-01/02

LOCATION Co-ords: N 4 807 995.0; E 219 918.0

DIST 3 HWY 7/8

BOREHOLE TYPE H.S. Auger, Washboring

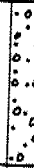
ORIGINATED BY GK

DATUM Geodetic

DATE 88 07 27 - 88 08 02

COMPILED BY GK

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
329.5	Continued		25	SS	136								
30.2													
326.2													
33.5	End of Borehole		26	SS	113 / 15 cm								

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 7

METRIC

W P 143-88-01/02

LOCATION Co-ords: N 4 808 054.3; E 219 868.0

ORIGINATED BY GK

DIST 3 HWY 7/8

BOREHOLE TYPE H.S. Auger

COMPILED BY GK

DATUM Geodetic

DATE 88 08 03 - 88 08 04

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPo ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT Wp	NATURAL MOISTURE CONTENT W	LIQUID LIMIT Wl	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
358.7	Ground Level		1	SS	8								
0.0	Sandy Silt		2	SS	5								
	Traces of Clay		3	SS	5								
	and Organics		4	SS	8								
357.2	Loose		5	SS	14								
1.5	Clayey Silt		6	SS	9								
	Some Sand		7	SS	9								
	Stiff		8	SS	9								
354.7			9	SS	10								
4.0			10	SS	5								
	Silty Sand		11	SS	2								
	to		12	SS	2								
	Sandy Silt		13	SS	2								
	Occ. Clayey Silt		14	SS	2								
	Layers		15	SS	3								
	Trace of Clay												
	V. Loose		16	SS	11								
	to												
	V. Dense		17	SS	38								
			18	SS	53								
345.3													
13.4			19	SS	68								
	Sand												
	and												
	Gravel		20	SS	130/	15 cm							
	Some Silt												
	Trace of Clay												
	V. Dense												
340.0													
18.7	End of Borehole		21	SS	100								

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 8

METRIC

W P 143-88-01/02

LOCATION Co-ords: N 4 808 074.5; E 219 852.8

ORIGINATED BY GK

DIST 3 HWY 7/8

BOREHOLE TYPE H.S. Auger

COMPILED BY GK

DATUM Geodetic

DATE 88 08 04 - 88 08 05

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100	W _p	W	W _L		
359.8	Ground Level		1	SS	11								
0.0	Sandy Silt Traces of Clay and Organics Loose to Dense		2	SS	35								
358.0			3	SS	5								
1.8			4	SS	6								
	Clayey Silt Some Sand Firm to Hard		5	SS	9								
			6	SS	8								
			7	SS	25								
			8	SS	48								
			9	SS	30								
354.6			10	SS	25								
5.2			11	SS	24								
	Silty Sand to Sandy Silt Occ. Clayey Silt Layers Trace of Clay		12	SS	31								
			13	SS	69								
			14	SS	58								
			15	SS	101	15 cm							
			16	SS	85								
	Dense to V. Dense		17	SS	85								
346.5			18	SS	84								
13.3			19	SS	92								
	Sand and Gravel Some Silt Trace of Clay		20	SS	109	15 cm							
	V. Dense												
341.1			21	SS	98								
18.7	End of Borehole												

+3, x5: Numbers refer to Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 9

METRIC

W P 143-88-01/02

LOCATION Co-ords: N 4 808 054.5; E 219 887.9

ORIGINATED BY GK

DIST 3 HWY 7/8

BOREHOLE TYPE H.S. Auger, BW Casing, Washboring

COMPILED BY GK

DATUM Geodetic

DATE 88 08 08 - 88 08 10

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			N' VALUES	20 40 60 80 100					
359.3	Ground Level												
0.0	Mixture of Organics and Sand, Firm		1	SS	8								
358.3			2	SS	8								
1.0			3	SS	6								
			4	SS	6								
			5	SS	4								
			6	SS	6								
			7	SS	8								
			8	SS	4								
			9	SS	2								
			10	SS	2								
			11	SS	5								
			12	SS	7								
			13	SS	16								
			14	SS	15								
			15	SS	22								
			16	SS	27								
			17	SS	51								
			18	SS	44								
			19	SS	59								
344.7			20	SS	134/	15 cm							
14.6			21	SS	75								
			22	SS	134								
			23	SS	123								
			24	SS	94								
329.1													
30.2													

Continued

+3, x5: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

Continued



METRIC

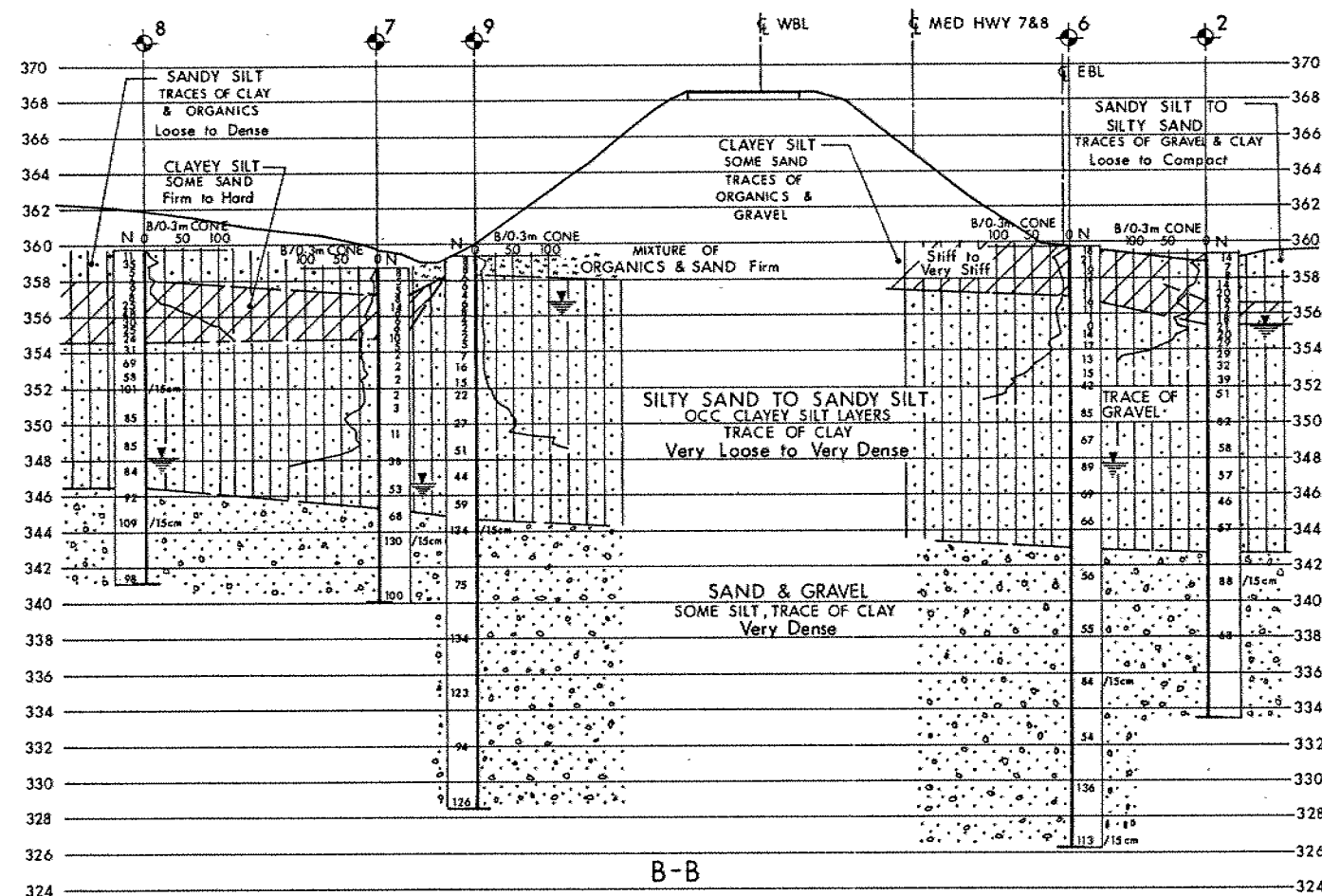
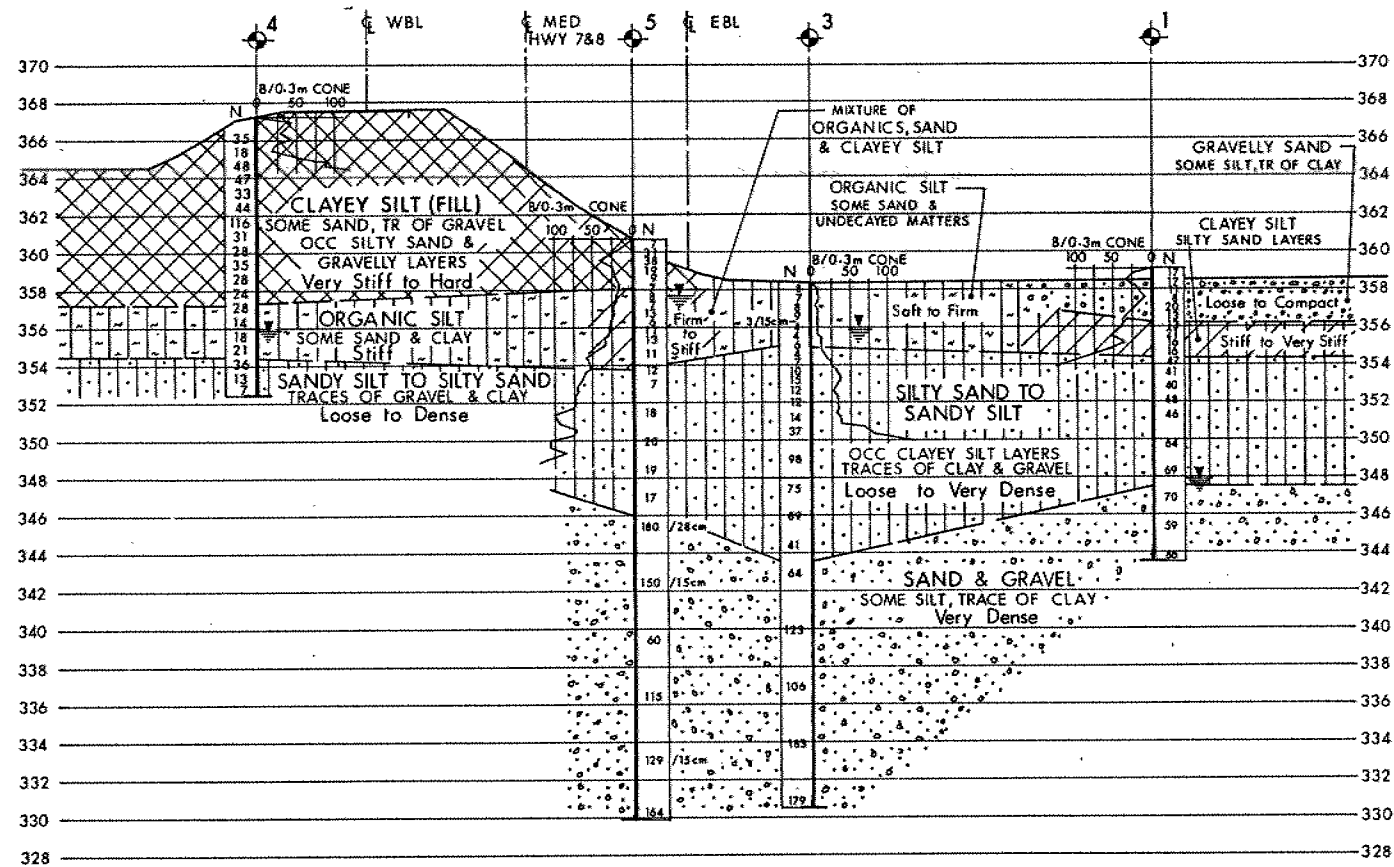
W P 143-88-01/02 LOCATION Co-ords: N 4 808 054.5; E 219 887.9 ORIGINATED BY CK
DIST 3 HWY 7/8 BOREHOLE TYPE H.S. Auger, BW Casing, Washboring COMPILED BY CK
DATUM Geodetic DATE 88 08 08 - 88 08 10 CHECKED BY _____

[illegible]

OFFICE. REPORT ON SOIL EXPLORATION

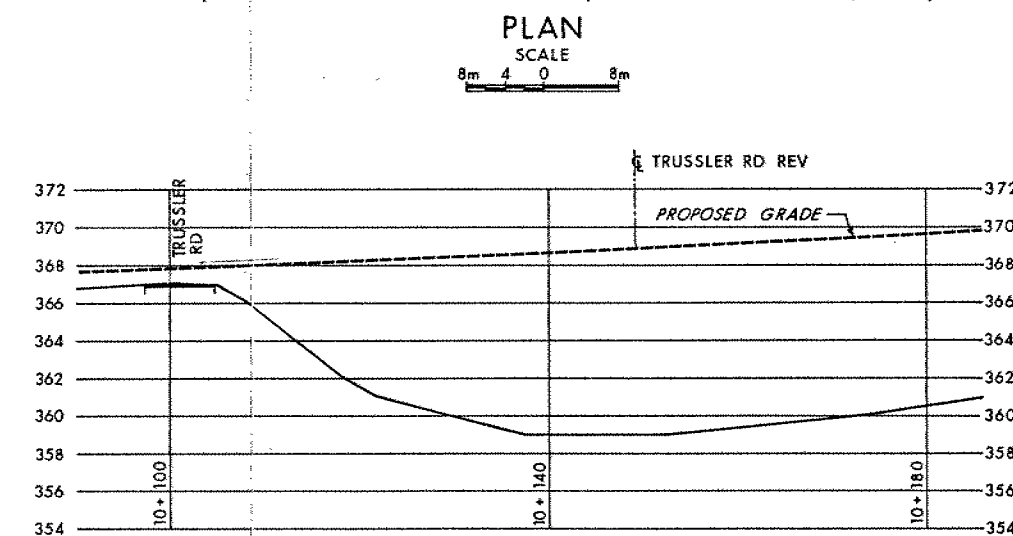
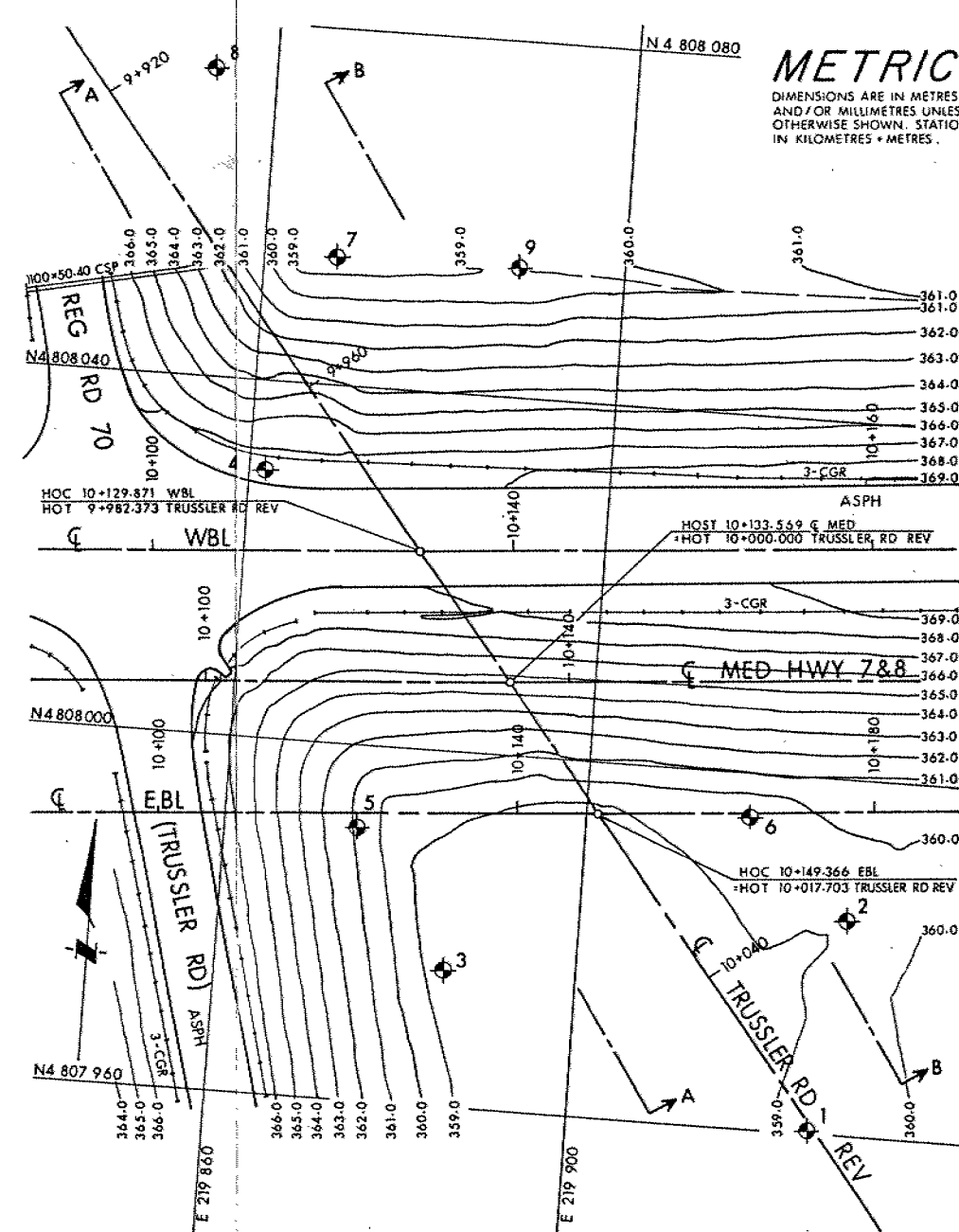
+3, x5 : Numbers refer to Sensitivity

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

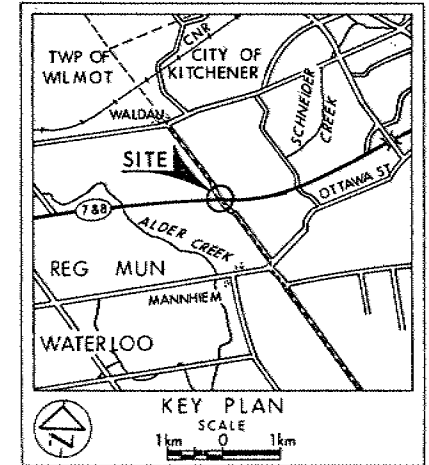


SECTIONS

SCALE
 8m 4 0 8m Hor
 4m 0 4m Vert



CONT No
 WP No 143-88-01/02
TRUSSLER RD OVERPASS
 (EBL)
 BORE HOLE LOCATIONS & SOIL STRATA

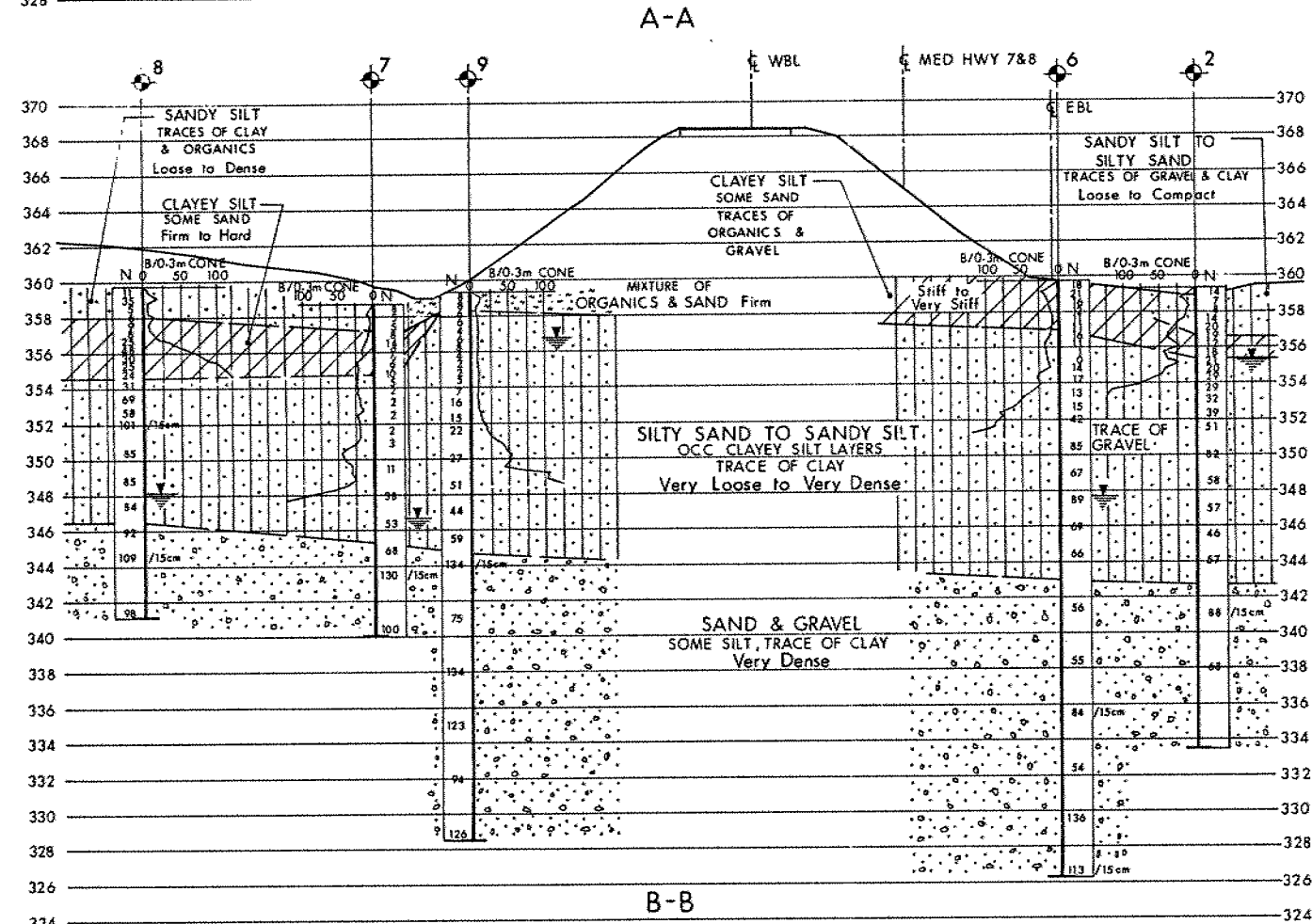
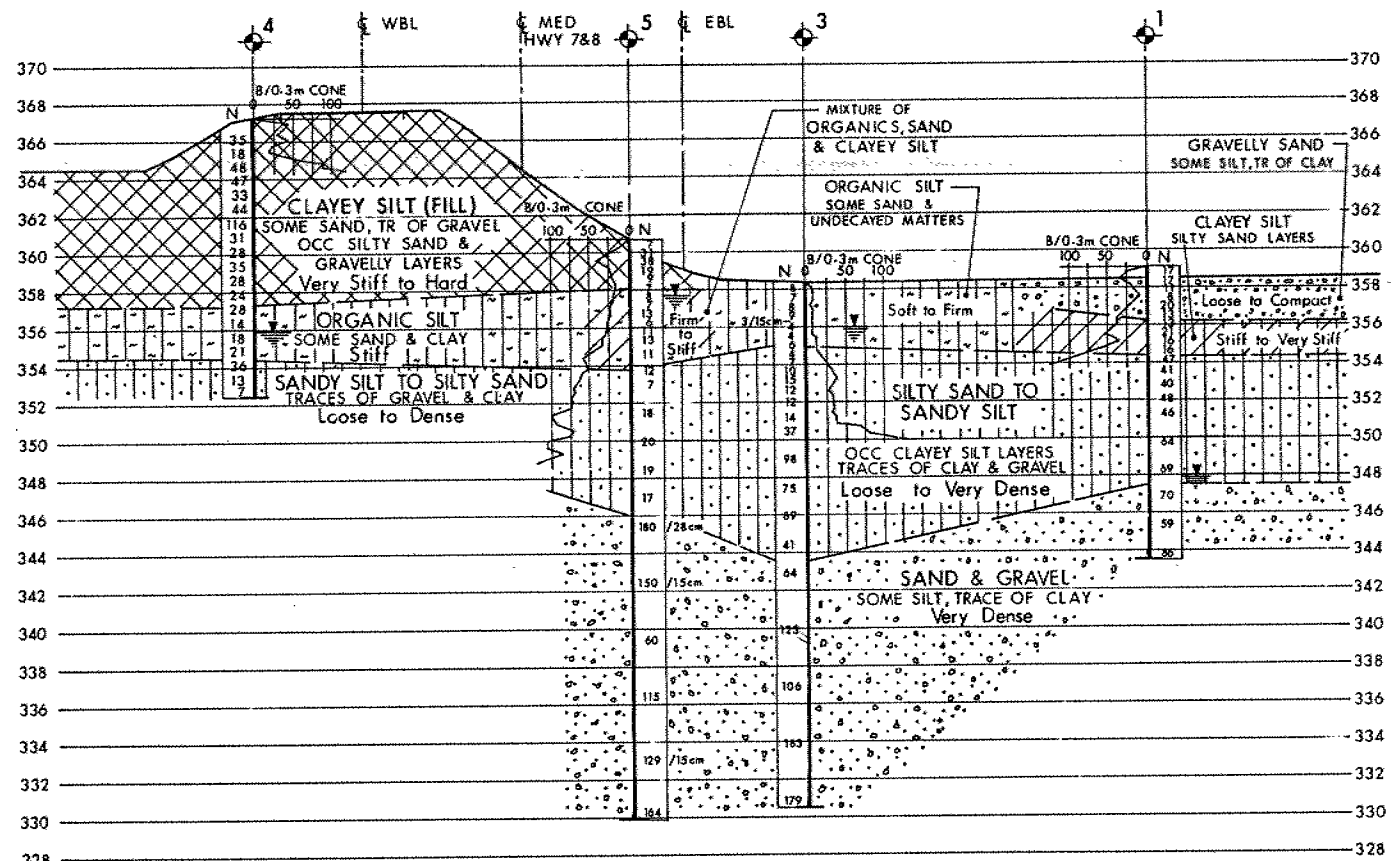


LEGEND				
●	Bore Hole			
⊕	Dynamic Cone Penetration Test (Cone)			
⊙	Bore Hole & Cone			
N	Blows/0.3m (Std Pen Test, 475 J/blow)			
CONE	Blows/0.3m (60° Cone, 475 J/blow)			
W.L.	W.L. at time of investigation 88 07 and 88 08			
No	ELEVATION	CO-ORDINATES		
		NORTH	EAST	
1	359.2	4 807 960.4	219 927.0	
2	359.5	4 807 984.3	219 929.8	
3	358.4	4 807 975.4	219 885.6	
4	367.3	4 808 029.9	219 861.6	
5	360.8	4 807 990.6	219 874.9	
6	359.7	4 807 995.0	219 918.0	
7	358.7	4 808 054.3	219 868.0	
8	359.8	4 808 074.5	219 852.8	
9	359.3	4 808 054.5	219 887.9	

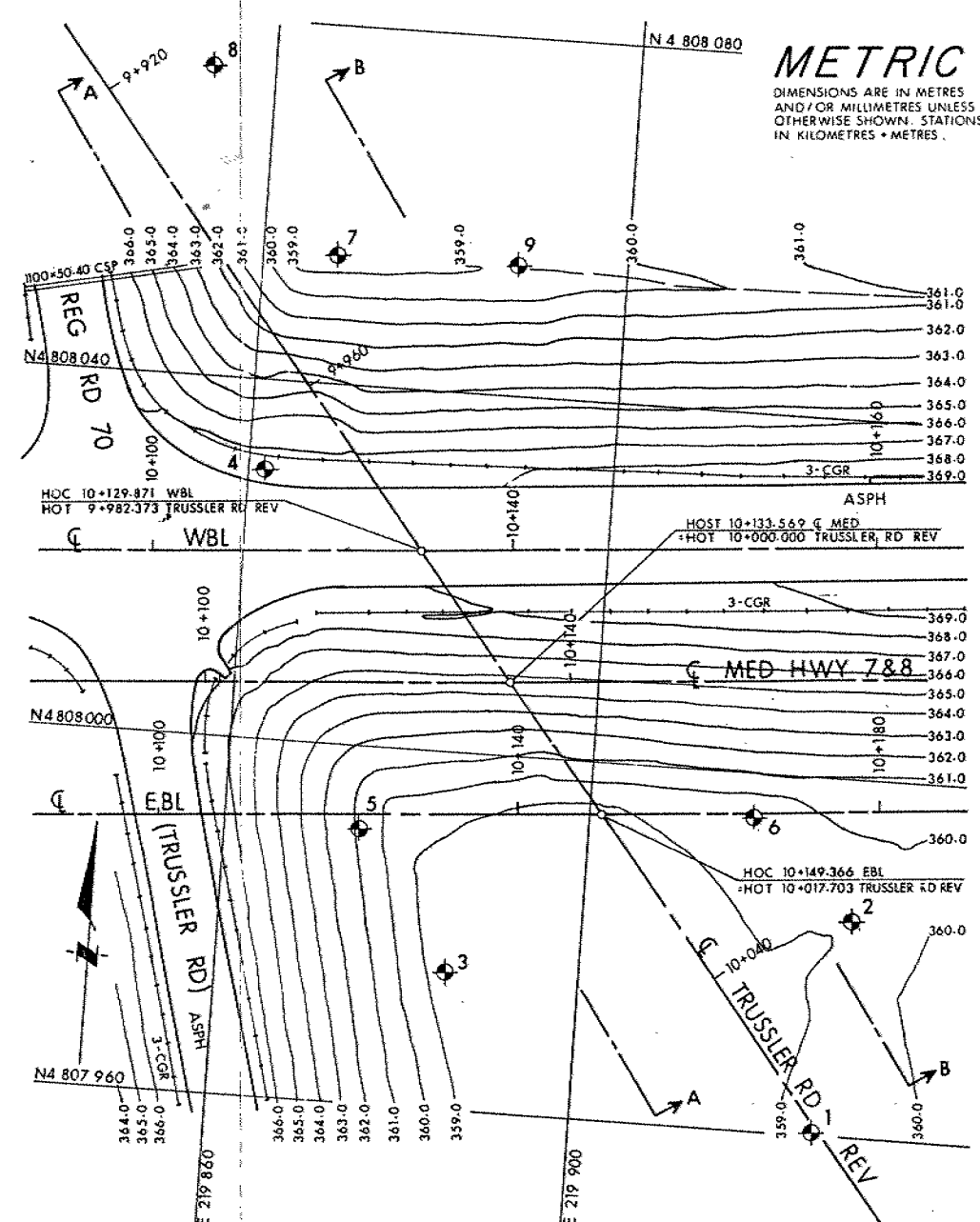
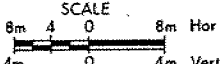
NOTE
 The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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

REV	DATE	BY	DESCRIPTION
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SECTIONS



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

DIST 3
CONT No 92-19
WP No 143-88-01



TRUSSLER ROAD OVERPASS
E.B.L. STRUCTURE
GENERAL ARRANGEMENT

SHEET
159

GENERAL NOTES

- CLASS OF CONCRETE

PRECAST GIRDERS 40 MPa
REMAINDER, UNLESS OTHERWISE NOTED 30 MPa

- CLEAR COVER TO REINFORCING STEEL

FOOTINGS 100 ± 25
ABUTMENTS & WINGWALLS : FRONT FACE 80 ± 20
BACK FACE 70 ± 20
PIERS 80 ± 20
DECK : TOP 70 ± 20
BOTTOM 40 ± 10
REMAINDER, UNLESS OTHERWISE NOTED 70 ± 20

- REINFORCING STEEL

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

- CONSTRUCTION NOTES

IF THE ACTUAL BEARING HEIGHTS ARE DIFFERENT FROM
THE ASSUMED HEIGHTS GIVEN WITH THE BEARING DESIGN
DATA, THE CONTRACTOR SHALL ADJUST THE BEARING
SEAT ELEVATIONS AND THE REINFORCING STEEL TO
SUIT THE ACTUAL HEIGHTS.

LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. BOREHOLE LOCATION & SOIL STRATA
3. LAYOUT OF WORKING POINTS
4. FOOTING LAYOUT
5. FOOTING REINFORCEMENT
6. WEST ABUTMENT
7. EAST ABUTMENT
8. WEST ABUTMENT WINGWALLS
9. EAST ABUTMENT WINGWALLS
10. WEST AND EAST PIERS
11. GIRDER & BEARING LAYOUT
12. PRESTRESSED GIRDERS I
13. PRESTRESSED GIRDERS II
14. DECK LAYOUT & SCREED ELEVATIONS
15. DECK REINFORCING I
16. DECK REINFORCING II
17. JOINT ANCHORAGE AND ARMOURING
18. NORTH BARRIER WALLS
19. SOUTH BARRIER WALLS
20. 6000 mm APPROACH SLAB
21. DETAILS OF CONCRETE SLOPE PAVING
22. AS CONSTRUCTED ELEV. & DIM.
23. STANDARD DETAILS I
24. STANDARD DETAILS II
25. PILE DRIVING - STEAM & DIESEL HAMMER
26. ELECTRICAL EMBEDDED WORK
27. QUANTITIES I
28. QUANTITIES II

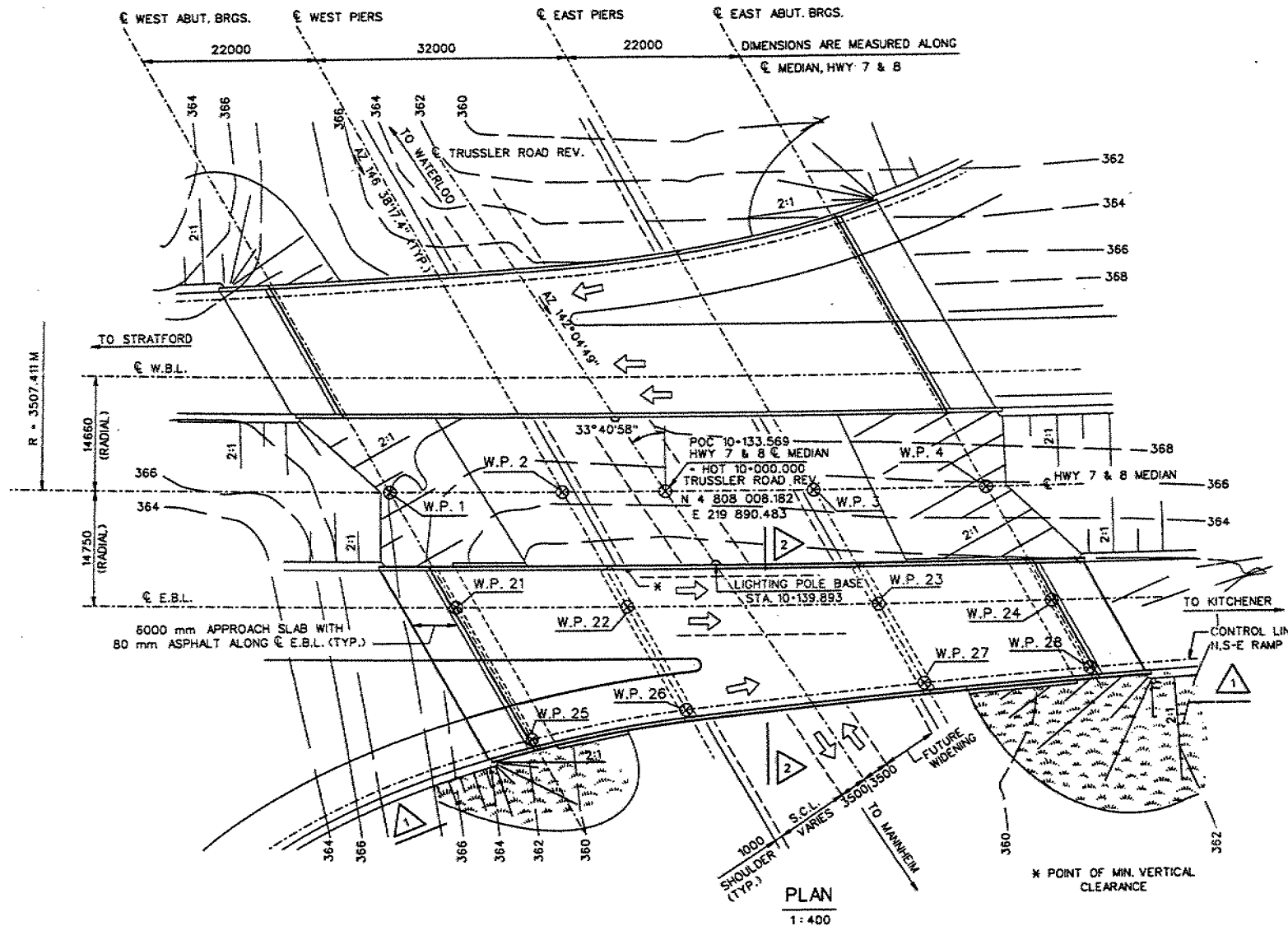
APPLICABLE STANDARD DRAWINGS

OPSD-3501.00 MINIMUM GRANULAR BACKFILL REQUIREMENTS ABUTMENTS



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DESCRIPTION
DESIGN AJM	CHK CCT CODE OHBC-83 LOAD CL. - A DATE JAN.
DRAWN YC	CHK AJM SITE 33-358E STRUCT ISCHEME DWG 1



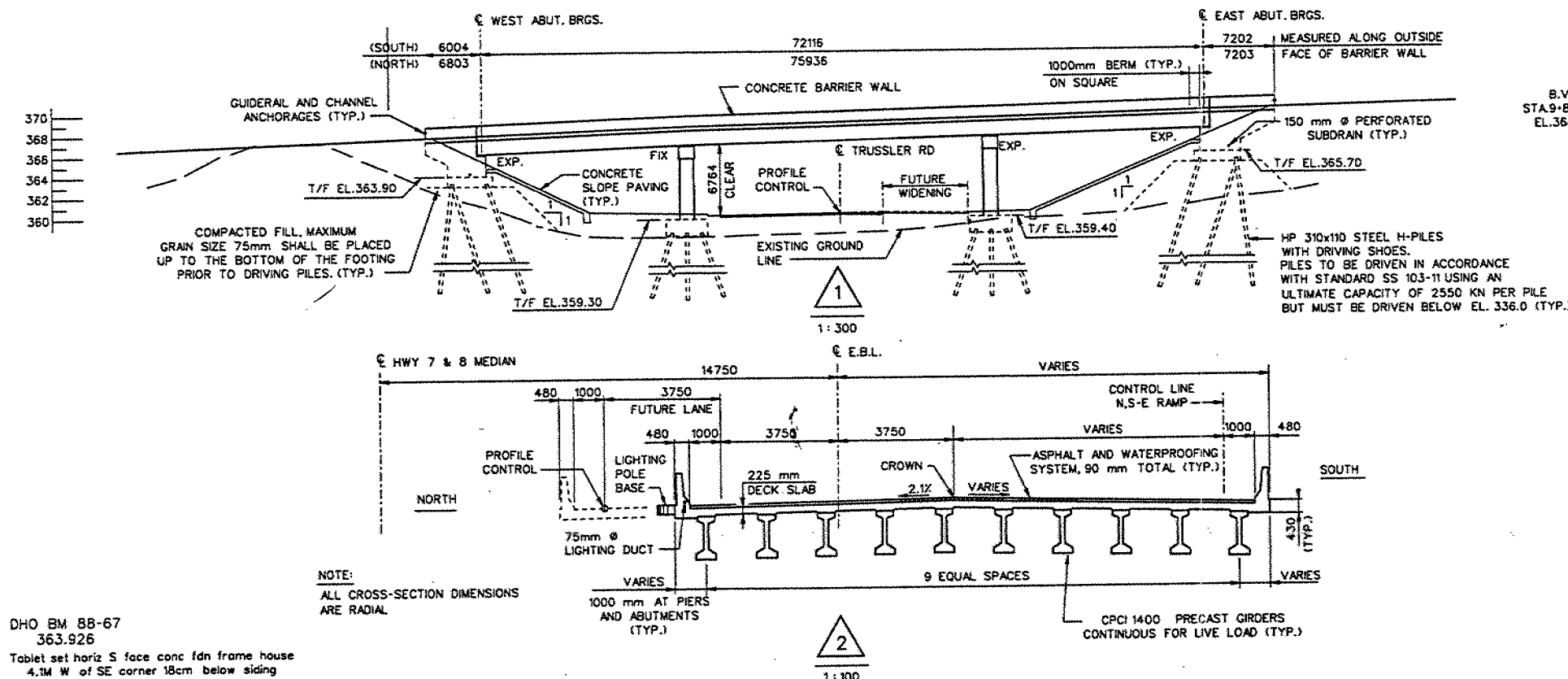
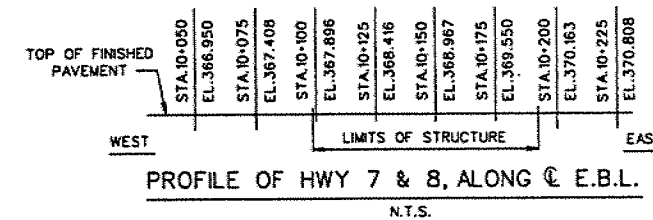
WORKING POINTS			
W.P.	CONTROL LINE	STATION	ELEVATION
1	E HWY 7 & 8 MEDIAN	10+098.300	
2		10+120.300	
3		10+152.300	
4		10+174.300	
21	E HWY 7 & 8 MEDIAN	10+106.673	368.032
22		10+128.551	368.493
23		10+160.377	369.205
24		10+182.257	369.727
25	N,S-E RAMP	10+291.734	367.955
26		10+312.199	368.536
27		10+342.620	369.395
28		10+363.823	370.028

NOTE:

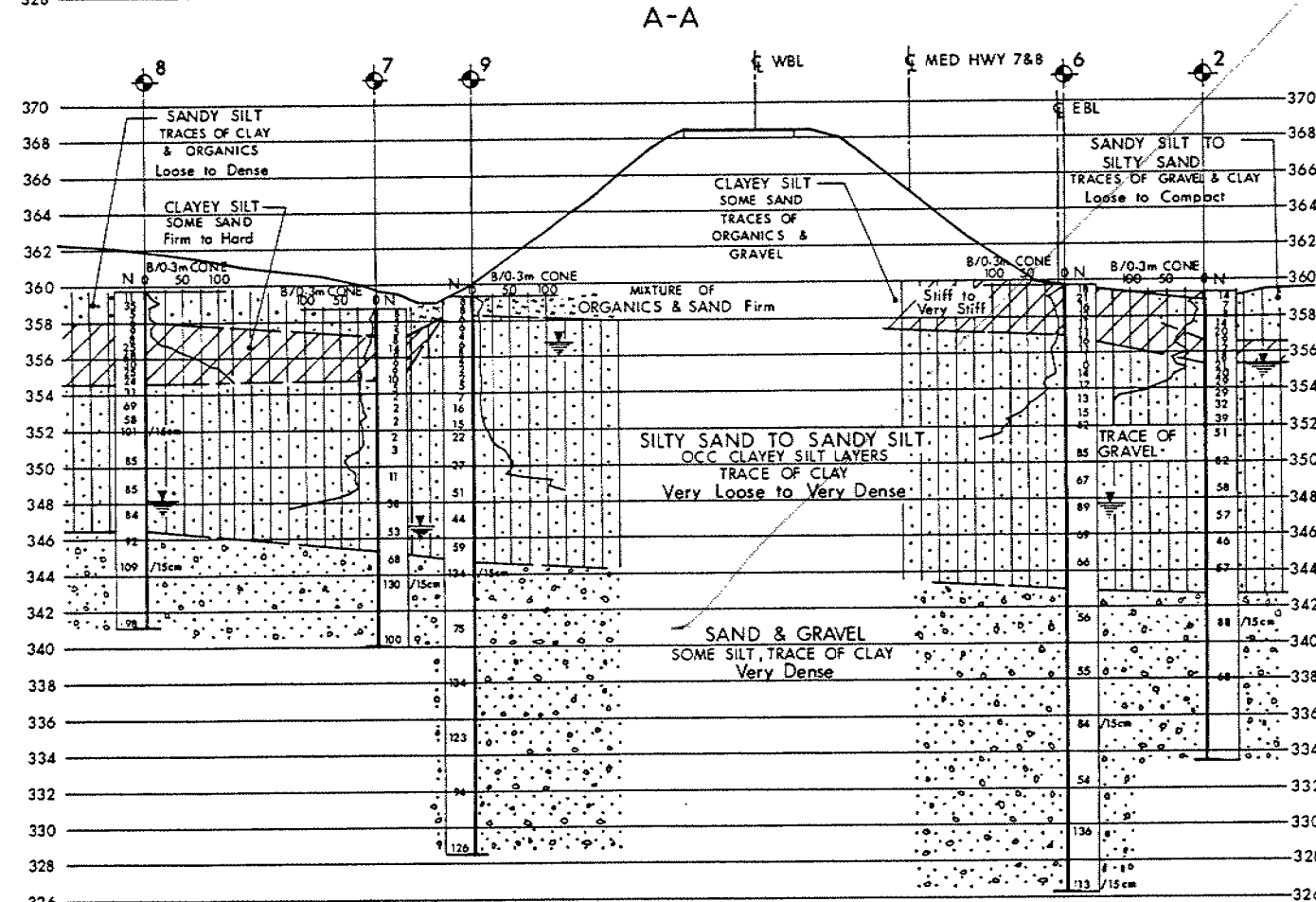
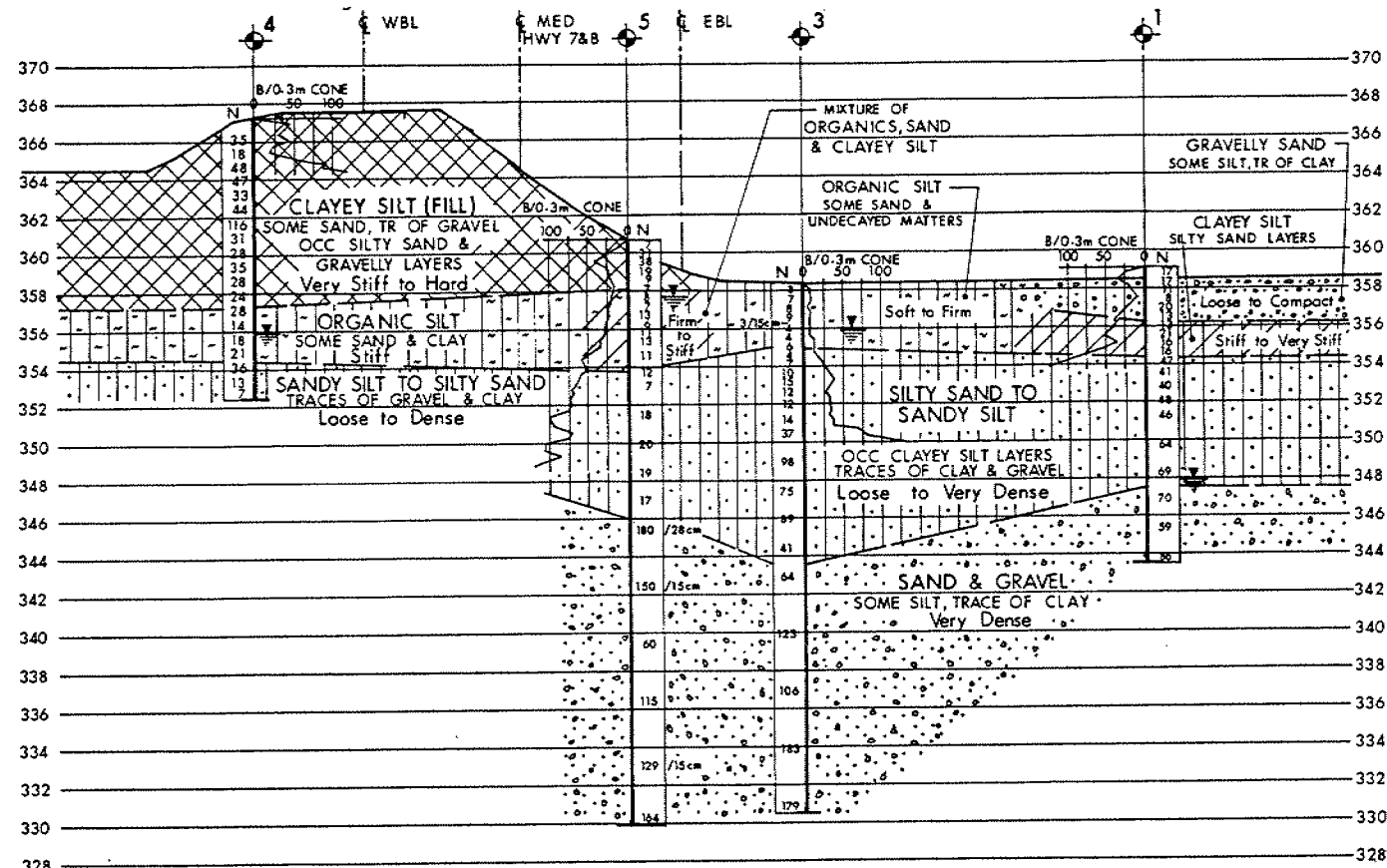
ALL STATIONS ARE IN REFERENCE
TO E HWY 7 & 8 MEDIAN.

LIST OF ABBREVIATIONS

W.P. - WORKING POINT
T/F - TOP OF FOOTING

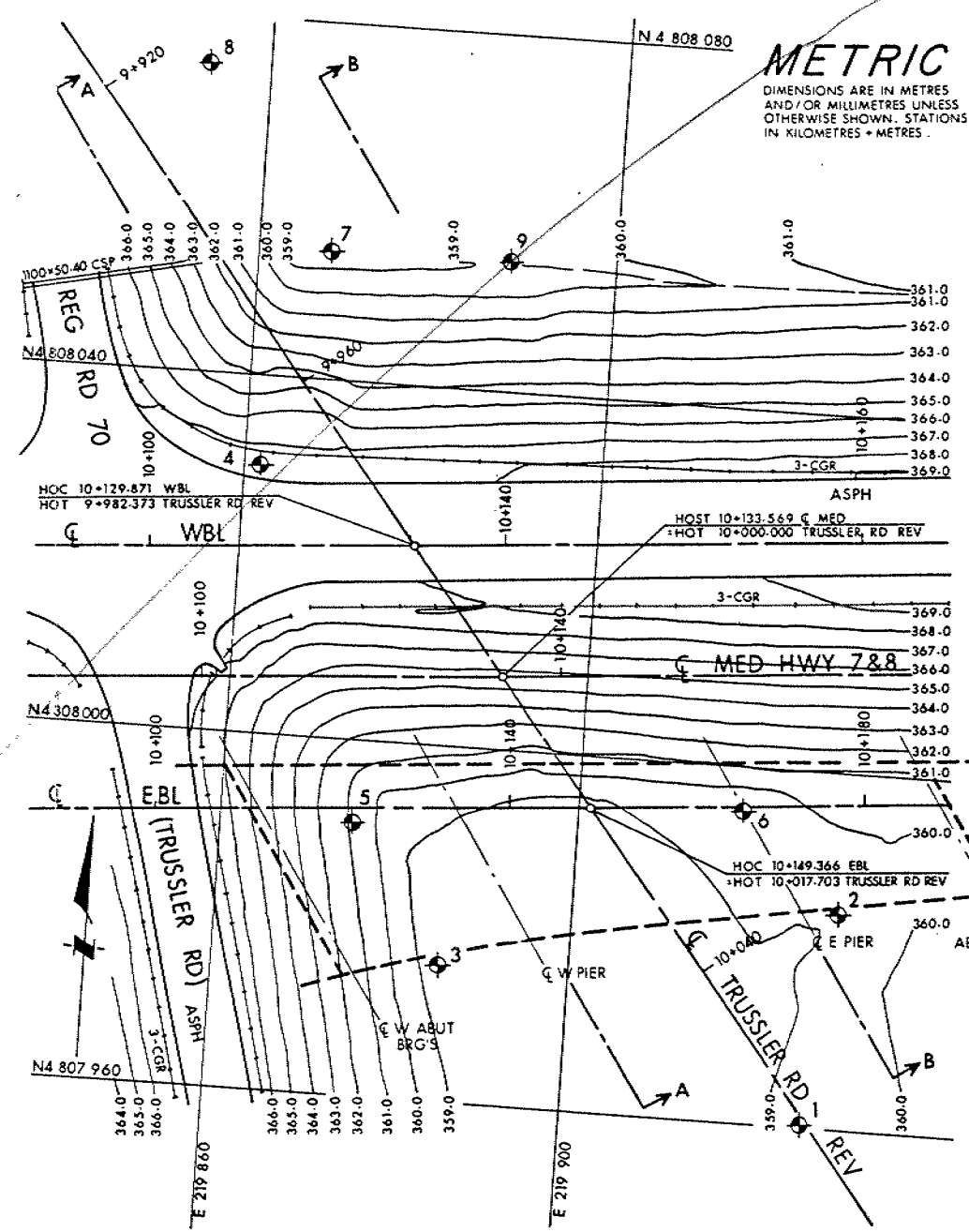


DHO BM 88-67
363.926
Tablet set horiz S face conc fdn frame house
4.1M W of SE corner 18cm below siding
102.2 Lt 10+020.0 L Med
ROUTE 8 PETERSBURG



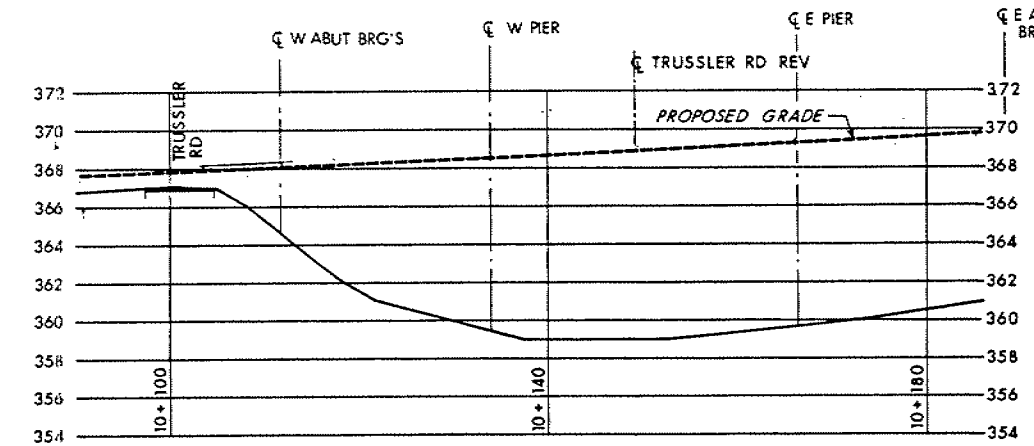
SECTIONS

SCALE
8m 4 0 8m Hor
4m 0 4m Vert



PLAN

SCALE
8m 4 0 8m Hor
4m 2 0 4m Vert



PROFILE EBL

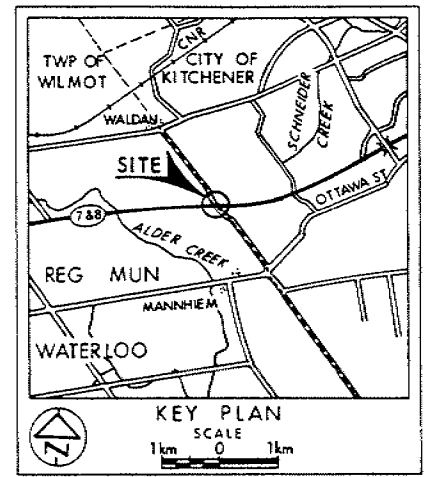
SCALE
8m 4 0 8m Hor
4m 2 0 4m Vert

CONT No 92-19
WP No 143-88-01

TRUSSLER RD OVERPASS
(EBL)

BORE HOLE LOCATIONS & SOIL STRATA

SHEET
160



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 88 07 and 88 08

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	359.2	4 807 960.4	219 927.0
2	359.5	4 807 984.3	219 929.8
3	358.4	4 807 975.4	219 885.6
4	367.3	4 808 029.9	219 861.6
5	360.8	4 807 990.6	219 874.9
6	359.7	4 807 995.0	219 918.0
7	358.7	4 808 054.3	219 868.0
8	359.8	4 808 074.5	219 852.8
9	359.3	4 808 054.5	219 887.9

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

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

REV.	DATE	BY	DESCRIPTION
1			

Geocres No 40P7-48

HWY No 7/8	DIST 3		
SUBM'D PP	CHECKED	DATE 89 08 25	SITE 33-358E
DRAWN DT	CHECKED	APPROVED	DWG 2

DIST 3
CONT No 92-19
WP No 143-88-02



SHEET
187

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PRECAST GIRDERS ..... 40 MPa
REMAINDER, UNLESS OTHERWISE NOTED ..... 30 MPa

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

REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED.

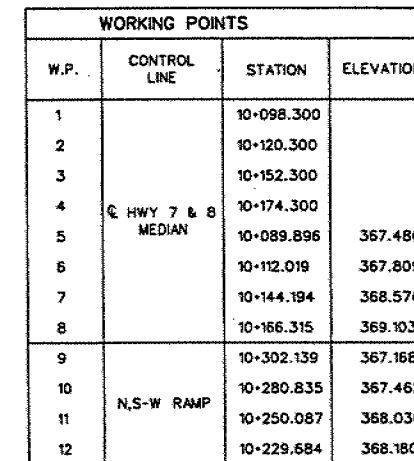
BAR MARKS WITH SUFFIX 'C' DENOTE COATED BARS.

IF THE ACTUAL BEARING HEIGHTS ARE DIFFERENT FROM THE ASSUMED HEIGHTS GIVEN WITH THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE BEARING SEAT ELEVATIONS AND THE REINFORCING STEEL TO SUIT THE ACTUAL HEIGHTS.

1. GENERAL ARRANGEMENT
2. BOREHOLE LOCATION & SOIL STRATA
3. LAYOUT OF WORKING POINTS
4. FOOTING LAYOUT
5. FOOTING REINFORCEMENT
6. WEST ABUTMENT
7. EAST ABUTMENT
8. WEST ABUTMENT WINGWALLS
9. EAST ABUTMENT WINGWALLS
10. WEST AND EAST PIERS
11. GIRDER & BEARING LAYOUT
12. PRESTRESSED GIRDERS I
13. PRESTRESSED GIRDERS II
14. DECK LAYOUT & SCREED ELEVATIONS
15. DECK REINFORCING I
16. DECK REINFORCING II
17. JOINT ANCHORAGE AND ARMOURING
18. NORTH BARRIER WALLS
19. SOUTH BARRIER WALLS
20. 6000 mm APPROACH SLAB
21. DETAILS OF CONCRETE SLOPE PAVING
22. AS CONSTRUCTED ELEV. & DIM.
23. STANDARD DETAILS I
24. STANDARD DETAILS II
25. PILE DRIVING - STEAM & DIESEL HAMMER
26. ELECTRICAL EMBEDDED WORK
27. QUANTITIES I
28. QUANTITIES II

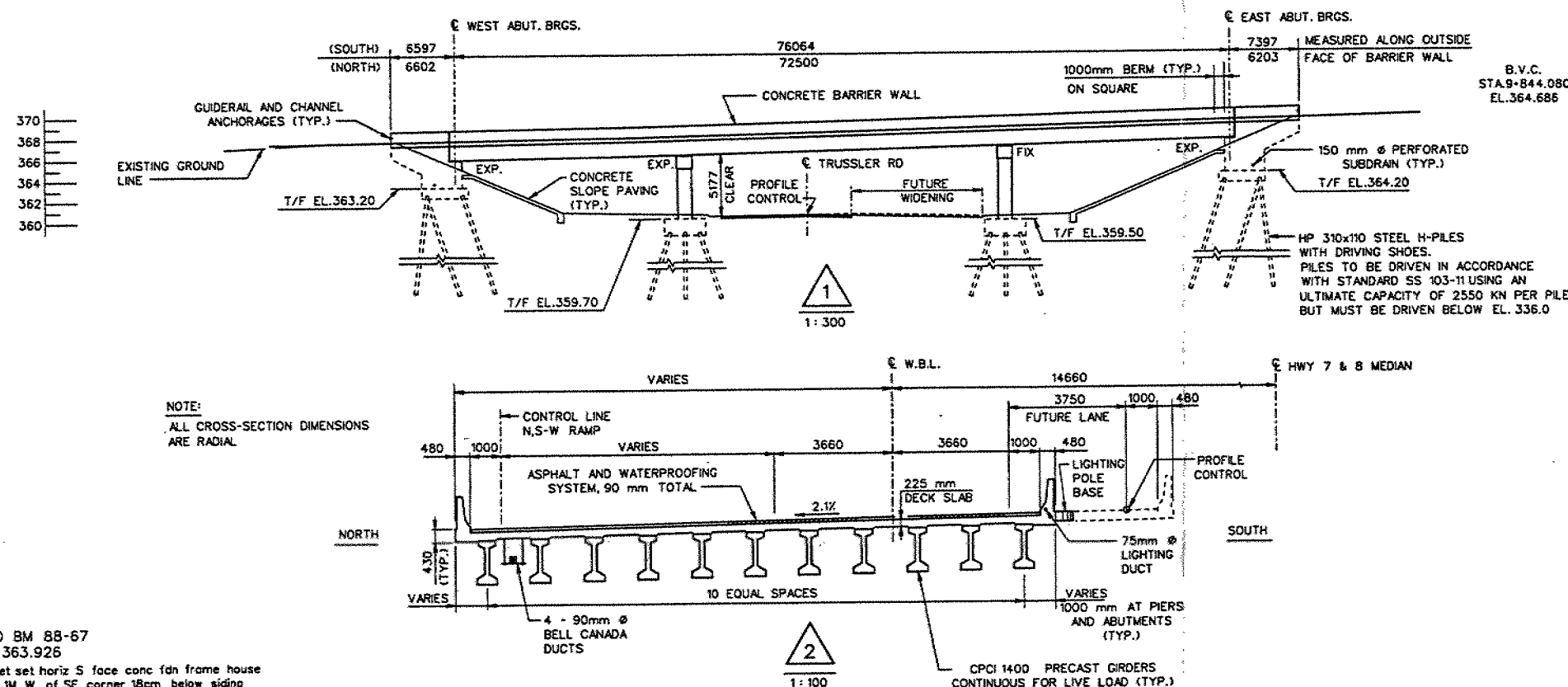
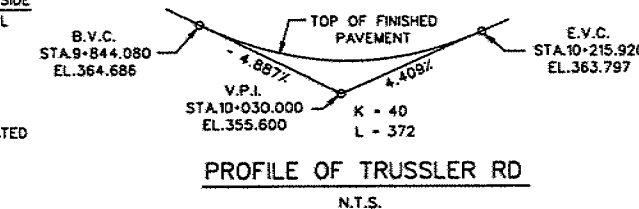
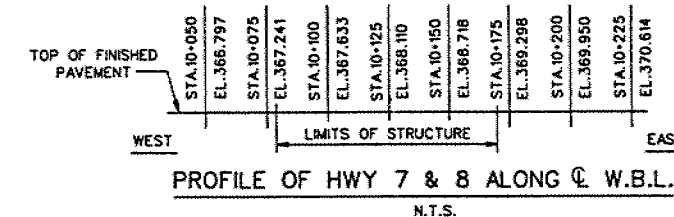
OPSD-3501-00 MINIMUM GRANULAR BACKFILL REQUIREMENT ABUTMENTS
DO-4613 TELEPHONE DUCT DETAILS TYPE IV
DO-4619 TELEPHONE DUCT TERMINATION DETAILS AT
BRIDGE APPROACHES

REVISIONS		DESCRIPTION							
DESIGN	AJM	CHK	CCT	CODE	OHBCD-83	LOAD	CL- A	DATE	JAN. 90
DRAWN	YC	CHK	AJM	SITE	33-358W	STRUCT	SCHEME	DWG	1



NOTE:
ALL STATIONS ARE IN REFERENCE
TO C HWY 7 & 8 MEDIAN.

W.P. - WORKING POINT
T/F - TOP OF FOOTING

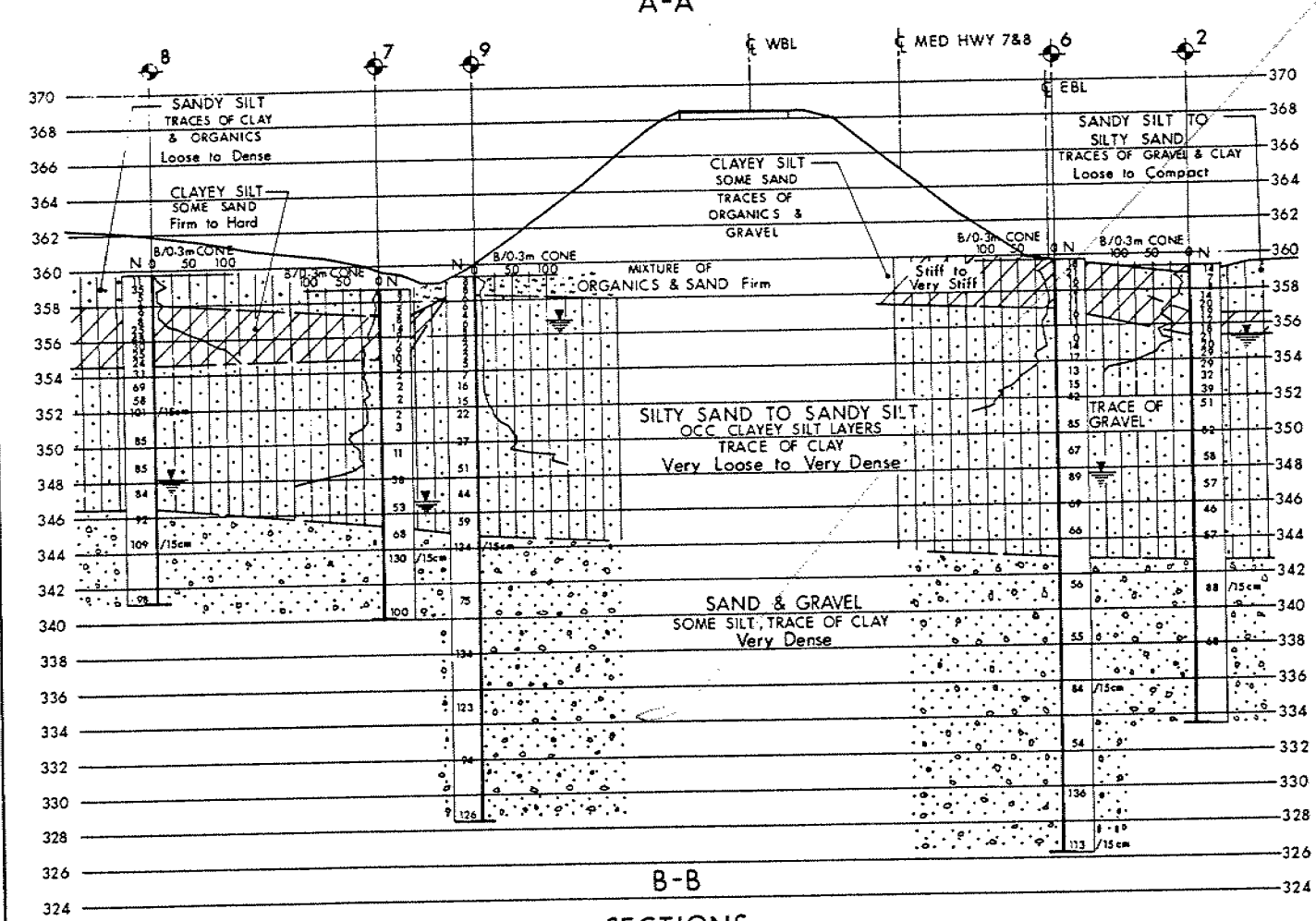
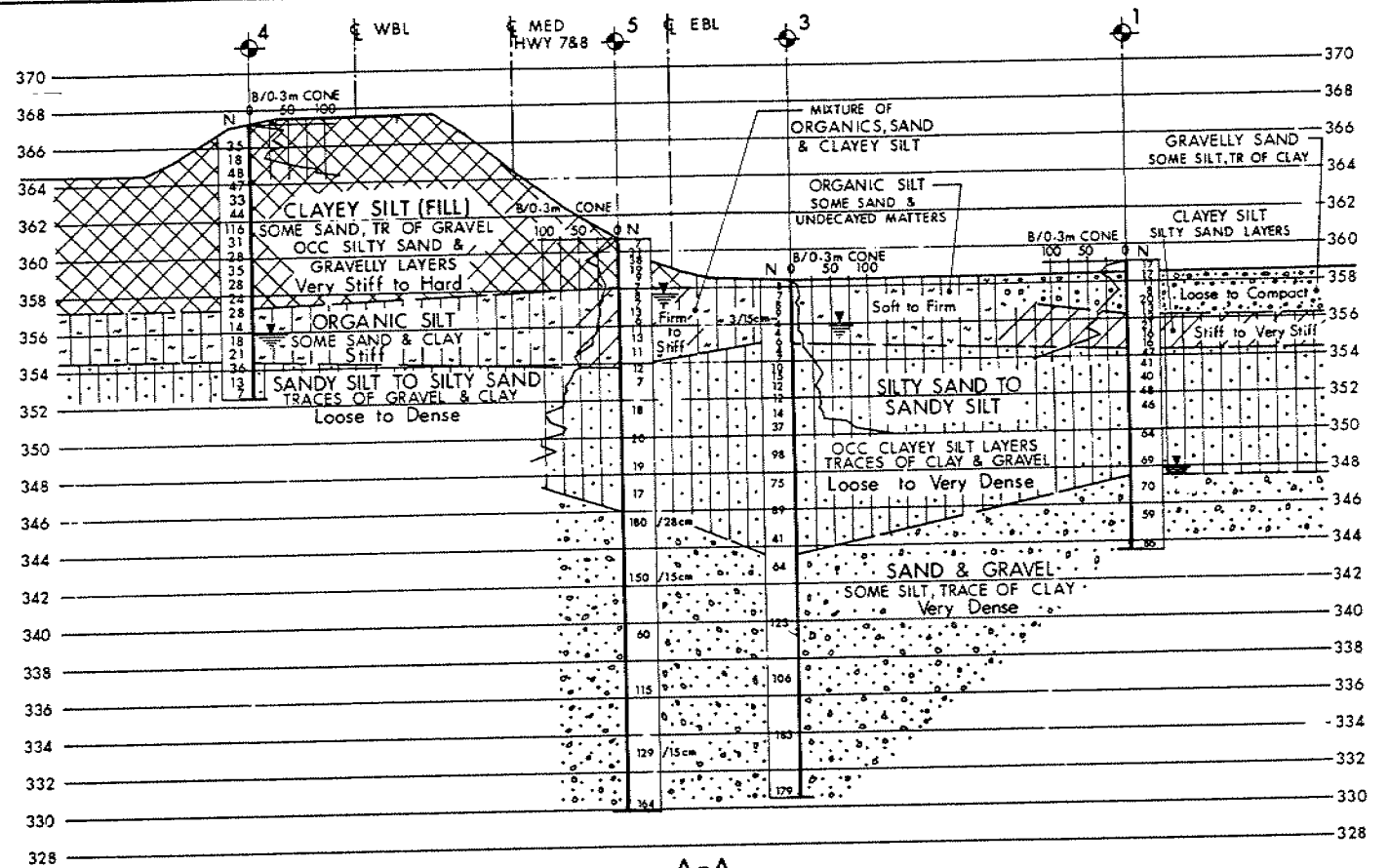


DHO BM 88-67
363.925
Tablet set horiz S face conc fdn frame house
4.1M W of SE corner 18cm below siding
102.2 Lt 10-020.0 @ Med
ROUTE 8 PETERSBURG

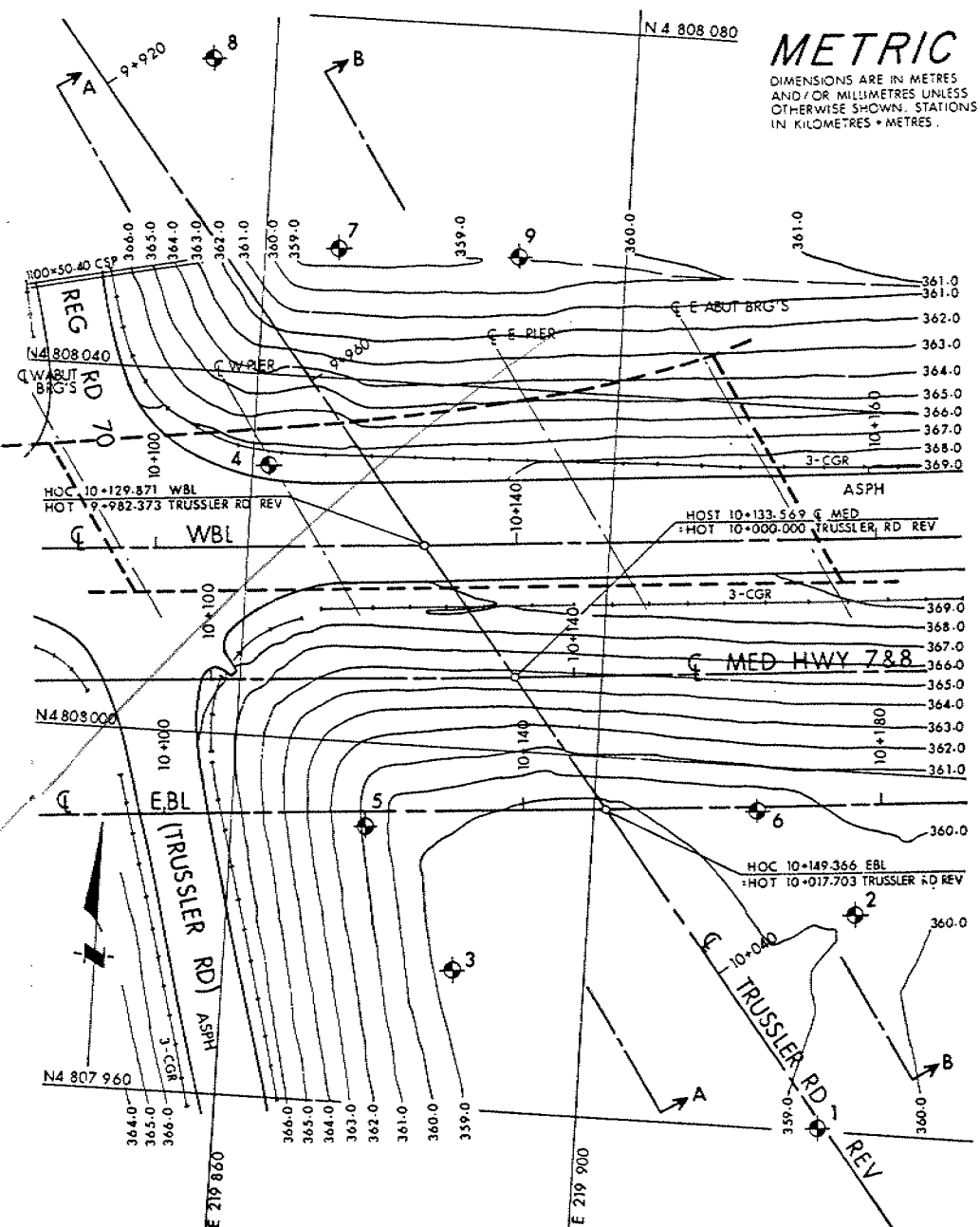


A circular professional engineer seal for the Province of Ontario. The outer ring contains the text "LICENSED PROFESSIONAL ENGINEER" at the top and "PROVINCE OF ONTARIO" at the bottom. The center of the seal features the name "A. J. NEALE" and the license number "1491" above it. There is a handwritten signature "A. J. Neale" across the bottom half of the seal.

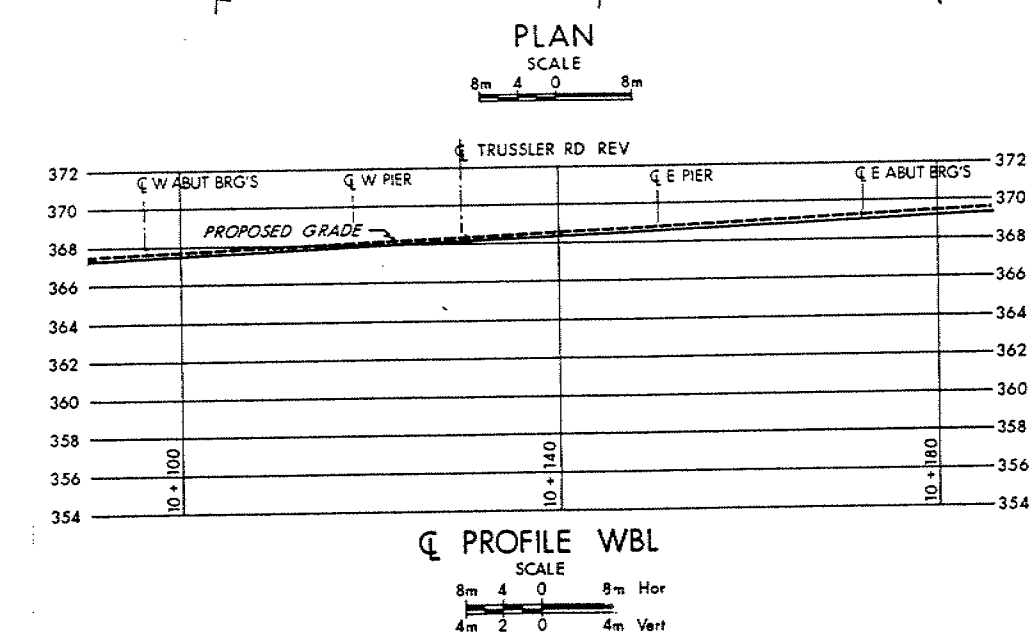
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



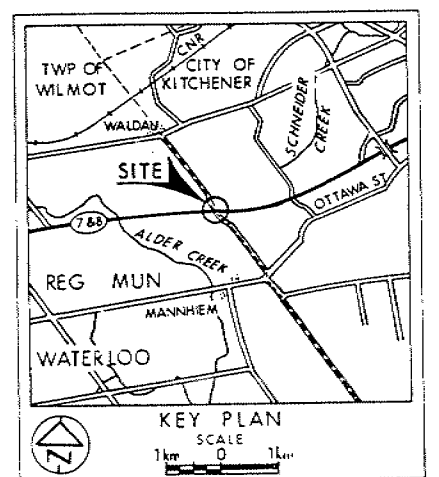
SECTIONS
SCALE
8m 4 0 8m Hor
4m 0 4m Vert



PLAN
SCALE
8m 4 0 8m
4m 2 0 4m Vert



PROFILE WBL
SCALE
8m 4 0 8m Hor
4m 2 0 4m Vert



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊙ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W/L at time of investigation 88 07 and 88 08

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	359.2	4 807 960.4	219 927.0
2	359.5	4 807 984.3	219 929.8
3	358.4	4 807 975.4	219 885.6
4	367.3	4 808 029.9	219 861.6
5	360.8	4 807 990.6	219 874.9
6	359.7	4 807 995.0	219 918.0
7	358.7	4 808 054.3	219 868.0
8	359.8	4 808 074.5	219 852.8
9	359.3	4 808 054.5	219 887.9

NOTE

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

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

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