

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 31D-264

DIST. 5 REGION

W.P. No. 162-75-10

CONT. No. 81-21

W. O. No.

STR. SITE No. 30-486

HWY. No. 11

LOCATION Orillia Twp. Rd.

Underpass

No. of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

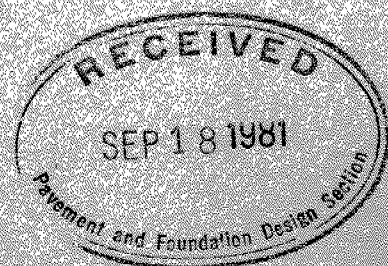
FOUNDATION INVESTIGATION REPORT

CONTRACT NO 81-21



Ontario

Ministry of
Transportation and
Communications



INDEX

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NOTE: For purposes of the contract these reports
supercede all other foundation reports prepared
by or for the Ministry in connection with the
above mentioned projects.

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
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_a	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 ³	SEEPAGE FORCE
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

FOUNDATION INVESTIGATION REPORT

For

Orillia Township Road Underpass
9.8 km North of North Junction Hwy. 11B
W.P. 162-75-10, Site 30-486
Hwy. 11, District 5, Owen Sound

INTRODUCTION

This report contains the results of the foundation investigation carried out at the above mentioned site. The fieldwork which consisted of two sampled boreholes accompanied by cone tests, was carried out on October 26, 1978. The boreholes were advanced using solid stem augers and BXL rock coring techniques to depths up to 6.2 metres below the ground surface.

SITE DESCRIPTION

The site is located on Hwy. 11 approximately 100 metres south of the intersection of Hwy. 11 and County Road 38 in the Township of Orillia, County of Simcoe. At this site the terrain generally slopes southeast toward Lake Couchiching. Limestone bedrock is evident on the sides of Hwy. 11 approximately 200 metres north-east of County Road 38.

A number of small commercial establishments (motels, gas stations and restaurants) are present in the vicinity of the site. The land immediately to the southeast of the site is forested with hardwoods.

Physiographically the site lies in the region generally known as the Simcoe Lowlands. In the area of the site this region is characterized by a sand plain overlaying limestone bedrock.

SUBSURFACE CONDITIONS

Generally, 4.7 to 6.1 metres of overburden were found to cover limestone bedrock. The overburden consists of a granular deposit of fine sand with silt and occasional layers of silt.

For a detailed description of the soil and rock types encountered in each borehole refer to the Record of Borehole Sheets. The estimated stratigraphical profile shown in Drawing #2 of the Contract Drawings is based upon this information. The following is a summary of the soil types encountered from ground level downwards

Fine Sand With To Traces of Silt, Trace of Clay

Immediately below the ground surface a granular deposit of fine sand with to traces of silt and traces of clay was found to exist. Generally, the silt content increased with depth. Within this stratum a layer of silt up to 1.3 metres in thickness was encountered. In B.H. #2 a layer of coarse to fine sand 0.7 metres thick was encountered above the bedrock.

Standard Penetration Tests carried out within this stratum yielded N values ranging from 9 to 52 blows/0.3 metres indicating a denseness ranging from loose to very dense. Generally, the denseness is compact.

The natural moisture content as determined in laboratory testing ranged from 10 to 23% with an average of 21%. Figure 1 shows the grain size distribution of two split spoon samples obtained from this stratum.

Limestone Bedrock

Immediately below the granular deposit sound limestone bedrock exists. The bedrock surface was encountered 4.7 to 6.1 metres below the ground surface which corresponds to elevations 231.1 and 230.4. Refer to the Diamond Drill Record located in the Appendix for a complete rock description.

Groundwater

The groundwater level was observed by measuring in the open boreholes after the completion of the investigation. The groundwater level was found to vary between elevation 234.0 and 234.1 or 1.8 to 2.4 metres below the ground surface. The groundwater levels are shown on the Record of Borehole Sheet, as well as on Drawing #2.

P. Payer, P. Eng.
Foundations Engineer

K.G. Selby, P. Eng.
Senior Foundations Engineer



APPENDIX



RECORD OF BOREHOLE No 1

METRIC

W P 162-75-10 LOCATION Coords. N 4 953 431.7; E 314 639.7 ORIGINATED BY C.T.J.
DIST 5 HWY 11 BOREHOLE TYPE Solid Stem Auger, BXL Rock Core & Cone Test COMPILED BY C.T.J.
DATUM Geodetic DATE 1978 10 26 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ 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								
235.8	Ground Level												
0.0	Occasional Cobbles												
	Fine Sand, With to Traces of Silt, Trace of Clay, Silt Content Increases With Depth		1	SS	23		235						0 61 37 2
	Loose to Compact		2	SS	14		234						
	Silt, Some Sand		3	SS	9		233						0 23 75 2
	Occasional 2 mm Seams of Clayey Silt		4	SS	14		232						
231.1	Limestone Bedrock Sound		5	BXL	100% Rec.		231						RQD = 80%
229.6	End of Borehole						230						

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 2

METRIC

7

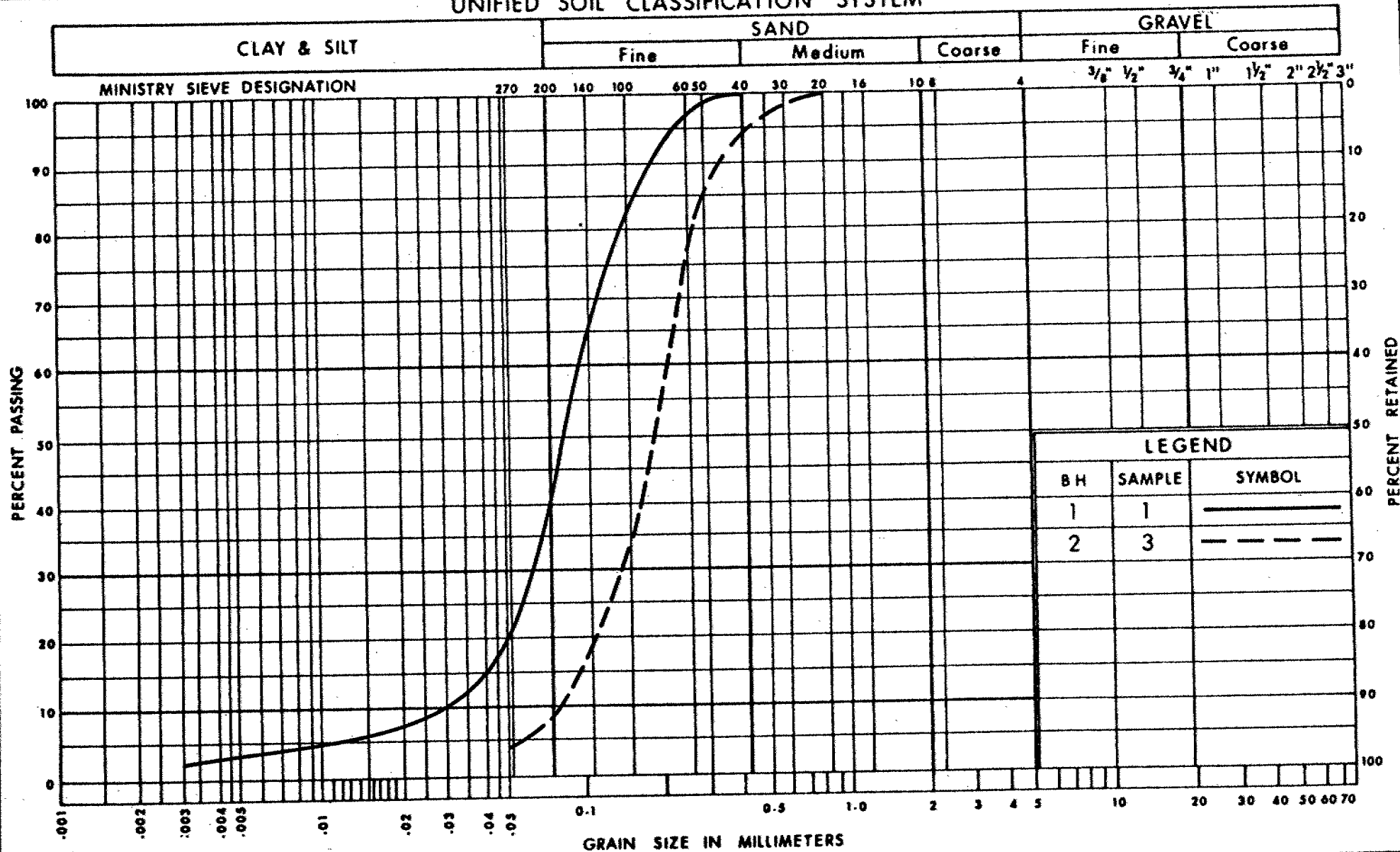
W P 162-75-10 LOCATION Coords. N 4 953 464.5; E 314 609.7 ORIGINATED BY C.T.J.
DIST 5 HWY 11 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY C.T.J.
DATUM Geodetic DATE 1978 10 26 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ 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						
236.5	Ground Level										
0.0	Fine Sand, With to Trace of Silt, Trace of Clay Silt Content Increases With Depth Very Dense to Compact		1	SS	52		236				
			2	SS	24		235				
			3	SS	23		234				
			4	SS	13		233				
	Silt Some Sand		5	SS	24		232				
	Coarse to Fine Sand						231				
230.4	Refusal to Augering		6	SS	19	0.10 m Bouncing					
6.1	End of Borehole Probable Bedrock										

+3, x5: Numbers refer to Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
FINE SAND,
WITH TO TRACE OF SILT, TRACE OF CLAY

FIG No 1

WP 162-75-10



HOLE NO. _____ SHEET NO. _____

218

PROPERTY	W.P. 162-75-10
LOCATION	Hwy. 11 Orillia Vicinity
LATITUDE	
DEPARTURE	
BEARING	

900

ELEV. COLLAR

DATUM

DATE STARTED

DATE COMPLETED

DRILLED BY

LOGGED BY

TOTAL FOOTAGE _____

[illegible]

DATE OF EXAMINATION November 10, 1978

06-MY-113

FOUNDATION INVESTIGATION REPORT

For

Orillia Township Road Underpass
13.0 km North of North Junction

Hwy. 11B

W.P. 162-75-12, Site 30-487
Hwy. 11, District 5, Owen SoundINTRODUCTION

This report contains the results of the foundation investigation carried out at the above mentioned site. The fieldwork was carried out on October 26, 1978 and consisted of two boreholes along with four cone penetration tests. The boreholes were advanced employing solid stem augers and BXL rock coring techniques to depths of up to 3.4 metres below the ground surface.

SITE DESCRIPTION

The site is located on Hwy. 11 approximately 100 metres northeast of the existing intersection of Hwy. 11 and the township road between Concessions XIII and XIV, Township of Orillia, County of Simcoe. At this site the terrain is partly forest covered and slopes gently southeast toward Lake Couchiching. Located approximately one kilometre south of the site an outcrop of granite was observed.

In the general area of the site some commercial establishments and residential housing is present.

Physiographically the site lies in the region known as the Simcoe Lowland. In the area of the site this region is characterized by clay and sand plains overlying bedrock.

SUBSURFACE CONDITIONS

The subsurface conditions consist of up to 1.9 metres of silt with pockets of clayey silt overlying Precambrian bedrock.

For a detailed description of the soil and rock type encountered in each borehole refer to the Record of Borehole Sheets located in the Appendix. The estimated stratigraphical profile shown on Drawing #2 of the Contract Drawings is based upon this information. The following is a summary of the soil and rock type encountered from ground level downwards.

Silt With Pockets of Clayey Silt, Trace of Sand

Immediately below the ground surface a shallow deposit of silt of slight plasticity containing pockets of clayey silt and traces of sand was encountered. The depth of this stratum varied from 1.9 to 1.7 metres below the ground surface.

Laboratory testing on the obtained samples yielded a natural moisture content of 25 and 27%. The grain size distribution of the soil is 0% gravel, 4% sand, 86-90% silt and 6-10% clay as determined by two tests. Figure 1.

The consistency of the soil can be described as stiff.

Gneiss Bedrock

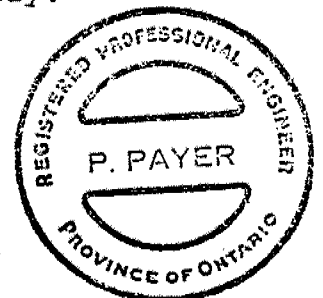
Sound gneiss bedrock was found to exist 1.6 to 1.9 metres below the ground surface which corresponds to an elevation between 217.7 and 218.3. The bedrock is hard, grey pink in colour with a medium to coarse texture. For a detailed description of the bedrock refer to the Diamond Drill Record attached to the Appendix.

Groundwater Conditions

The groundwater level was observed by measuring in the open boreholes after the completion of the investigation. The groundwater level ranged from 0.4 metres to the ground surface. This corresponds to elevation 219.8 and 219.4 respectively.

P. Payer, P. Eng.
Foundations Engineer

K.G. Selby, P. Eng.
Senior Foundations Engineer



APPENDIX



RECORD OF BOREHOLE No 1

METRIC

13

W P 162-75-12 LOCATION Coords. N 4 955 625.4; E 316 866.2 ORIGINATED BY C.T.J.
DIST 5 HWY 11 BOREHOLE TYPE Solid Stem Auger, BXL Core and Cone Test COMPILED BY C.T.J.
DATUM Geodetic DATE 1978 10 26 CHECKED BY CP.

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					
220.2	Ground Level																
0.0	Silt of Slight Plasticity, With Pockets of Clayey Silt, Trace of Sand Stiff		1	SS	11												0 4 86 10
218.3																	
1.9	Gneiss Bedrock Sound		2	BXL	100% Rec.												RQD = 100%
216.8																	
3.4	End of Borehole																

RECORD OF BOREHOLE No 2

METRIC

W P 162-75-12 LOCATION Coords. N 4 955 621.8; E 316 869.9 ORIGINATED BY C.T.J.
DIST 5 HWY 11 BOREHOLE TYPE Cone Test COMPILED BY C.T.J.
DATUM Geodetic DATE 1978 10 26 CHECKED BY CP.

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					
219.6	Ground Level																
0.0																	
217.7																	
1.9	End of Cone Test Probable Bedrock																

*3, *5: Numbers refer to
Sensitivity

20
15 * 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 3

METRIC

14

W P 162-75-12 LOCATION Coords. N 4 955 580.8; E 316 889.0 ORIGINATED BY C.T.J.
DIST 5 HWY 11 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY C.T.J.
DATUM Geodetic DATE 1978 10 26 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N VALUES			20 40 60 80 100	100	W _p	W	W _L		
219.4	Ground Level													
0.0	Silt of Slight Plasticity, With Pockets of Clayey Silt, Trace of Sand Very Stiff						219							
			1	SS	16		218							0 4 90 6
217.7	Refusal to Augering													
1.7	End of Borehole Probable Bedrock													

RECORD OF BOREHOLE No 4

METRIC

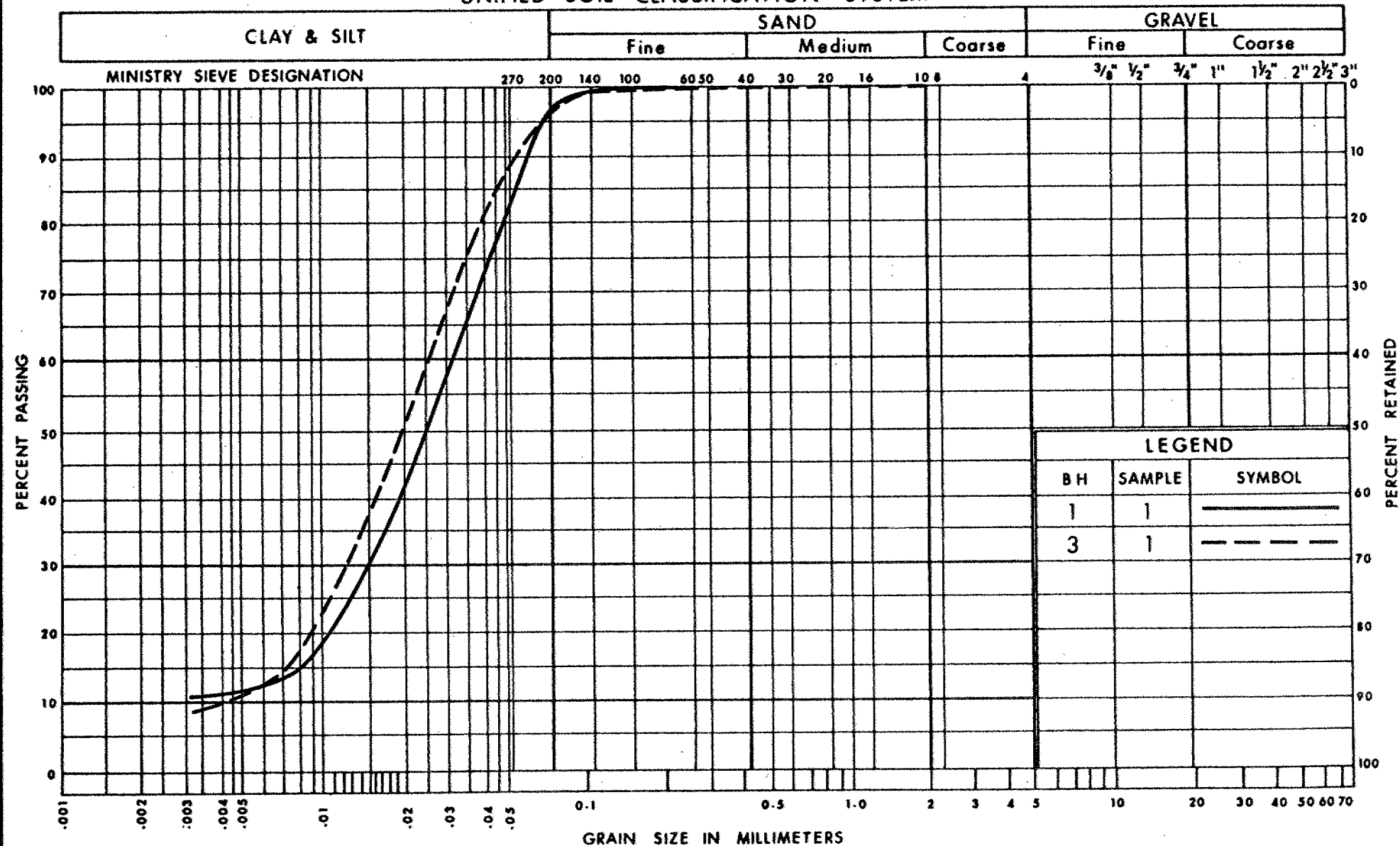
W P 162-75-12 LOCATION Coords. N 4 955 587.9; E 316 895.2 ORIGINATED BY C.T.J.
DIST 5 HWY 11 BOREHOLE TYPE Cone Test COMPILED BY C.T.J.
DATUM Geodetic DATE 1978 10 26 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N VALUES			20 40 60 80 100	100	W _p	W	W _L		
219.4	Ground Level													
0.0							219							
							218							
217.8														
1.6	End of Cone Test Probable Bedrock													

*³, *⁵: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

 Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
 SILT OF SLIGHT PLASTICITY
 WITH POCKETS OF CLAYEY SILT, TRACE OF SAND

FIG No 1

WP 162-75-12



HOLE NO. 1 SHEET NO. _____

DIP

90°

TOTAL FOOTAGE _____

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____

[illegible]

DATE OF EXAMINATION November 9, 1978

09-47-113



METRIC

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

ORILLIA TWP. RD. U.PASS.
K.3 KM. N. OF JCT. HWY. 11B ORILLIA
GENERAL PLAN

NOTES:

CLASS OF CONCRETE

DECK & BARRIER WALLS 30 MPa
REMAINDER 20 MPa

REINFORCING STEEL

GRADE 400
BAR MARK WITH SUFFIX C DENOTES
COATED BAR.

CLEAR COVER TO REINFORCING STEEL

ITEM	mm
FOOTINGS AND ABUTMENTS	75
DECK TOP	30
DECK BOTTOM	40
OR AS NOTED ON DRAWINGS	

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR
FINISHING THE BEARING SEPTS. TO LEVEL
TO THE SPECIFIED ELEVATIONS WITH A
TOLERANCE OF ± 3 mm.
NO CONCRETE SHALL BE PLACED ABOVE THE
ABUTMENT BEARING SEATS UNTIL THE
CONCRETE IN THE DECK HAS BEEN PLACED.
TO ACHIEVE THE MINIMUM CLEAR COVER OF
50 mm SPECIFIED AT TOP OF DECK, THE
TOP LAYER OF REINFORCEMENT SHALL BE
PLACED PRIOR TO CONCRETING, WITH A
CLEAR COVER OF 25 ± 15 mm TOLERANCE.

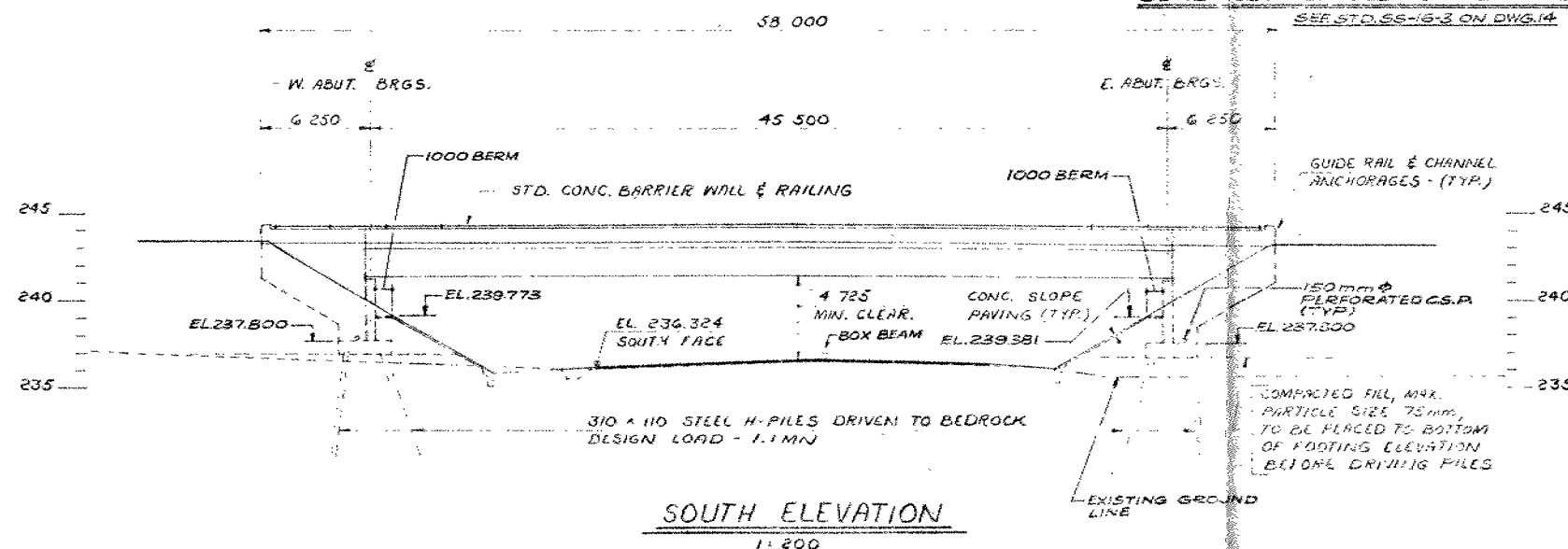
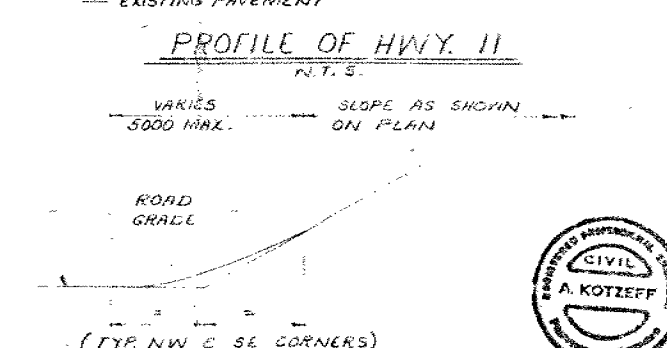
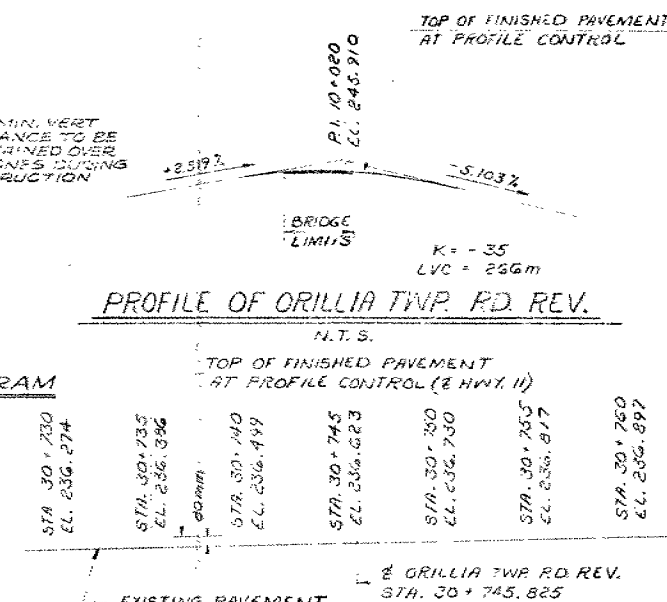
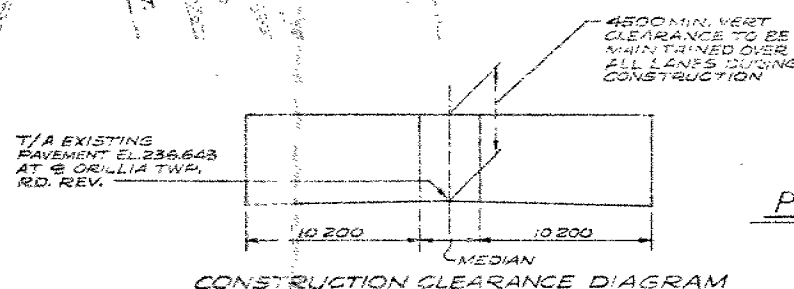
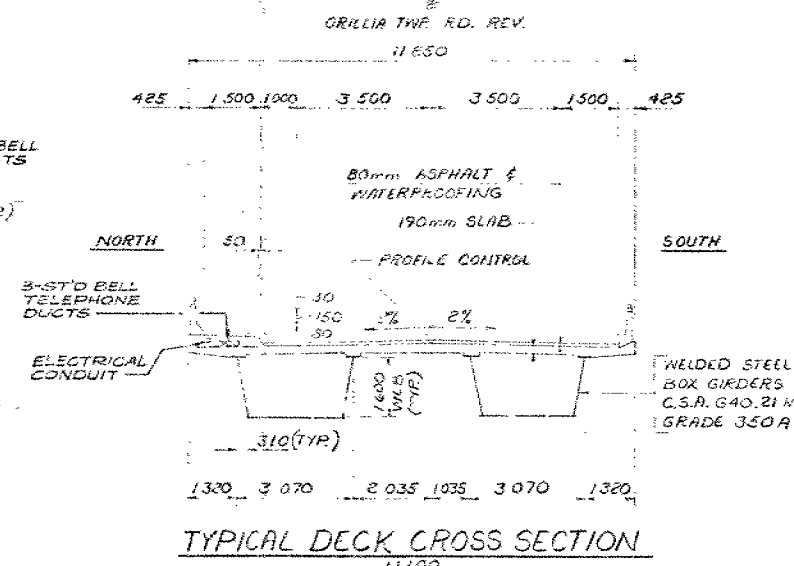
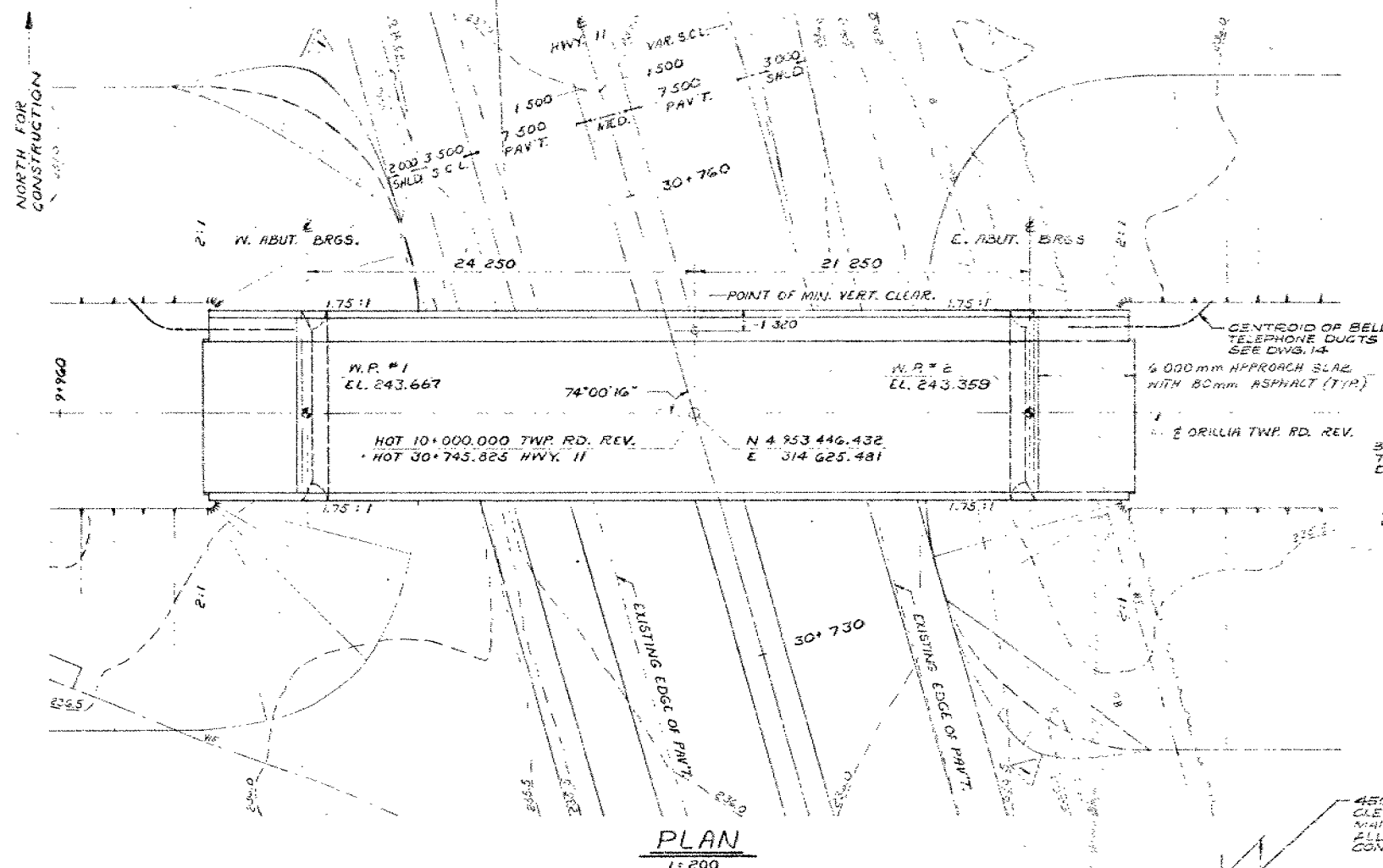
CONCRETE & STRUCTURAL STEEL QUANT.

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

CONCRETE IN ABUTS. & WING WALLS	138 m ³
CONCRETE IN DECK	124 m ³
CONCRETE IN BARRIER WALLS	22 m ³
CONCRETE IN APPROACH SLABS	30 m ³
CONCRETE IN SLOPE PAVING	29 m ³
STRUCTURAL STEEL	102 TONNE

LIST OF DRAWINGS

30-485-1 GENERAL PLAN
11 -2 BORE HOLE LOCATION & SOIL STRATA
11 -3 FOOTINGS
11 -4 WEST ABUTMENT
11 -5 EAST ABUTMENT
11 -6 STRUCTURAL STEEL
11 -7 DECK
11 -8 BARRIER WALL
11 -9 BARRIER WALL WITH SIDEWALK
11 -10 STEEL RAILING
11 -11 6 000 APPROACH SLAB
11 -12 DETAILS OF CONC. SLOPE PAVING
11 -13 STANDARD DETAILS I
11 -14 STANDARD DETAILS II
11 -15 STANDARD DETAILS III
11 -16 STANDARD DETAILS IV
11 -17 AS CONSTR. ELEV. & DIM.



DRAWINGS NOT TO BE SCALED
100 mm IN ORIGINAL DRAWING

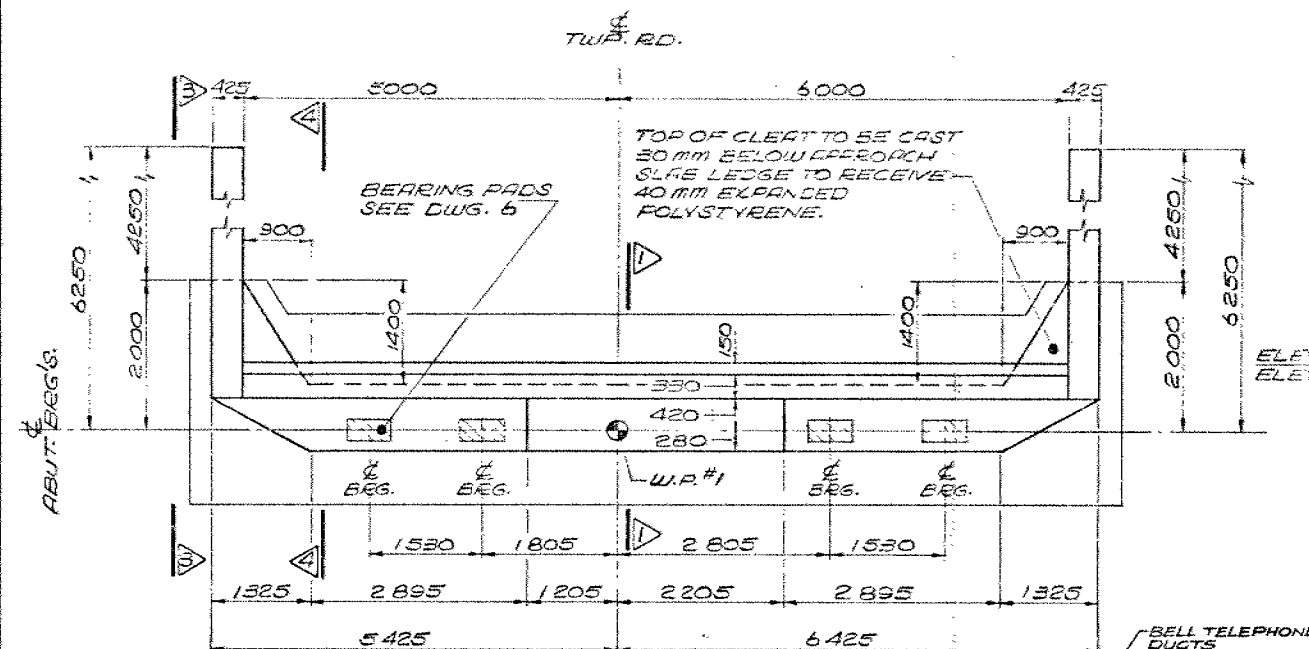
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ABUTMENT ELEVATIONS

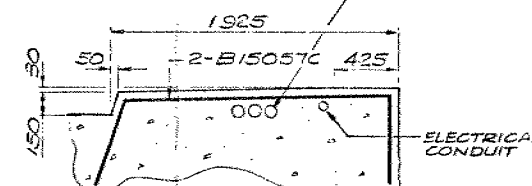
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METRIC

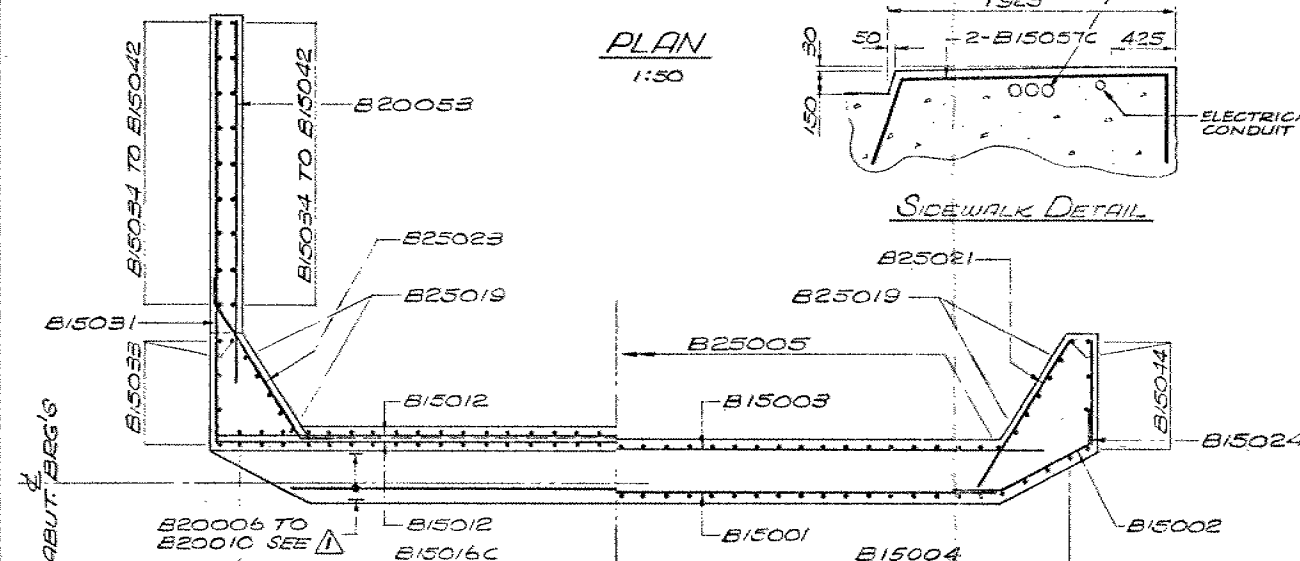
DIMENSIONS ARE IN MILLIMETRES
UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE
AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES



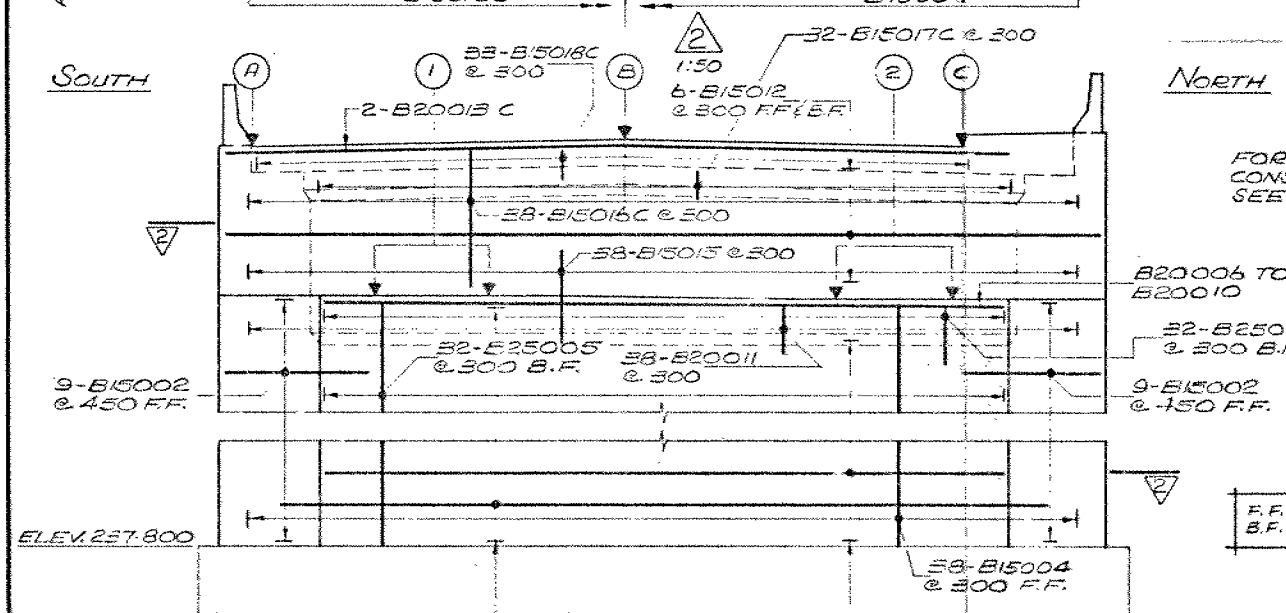
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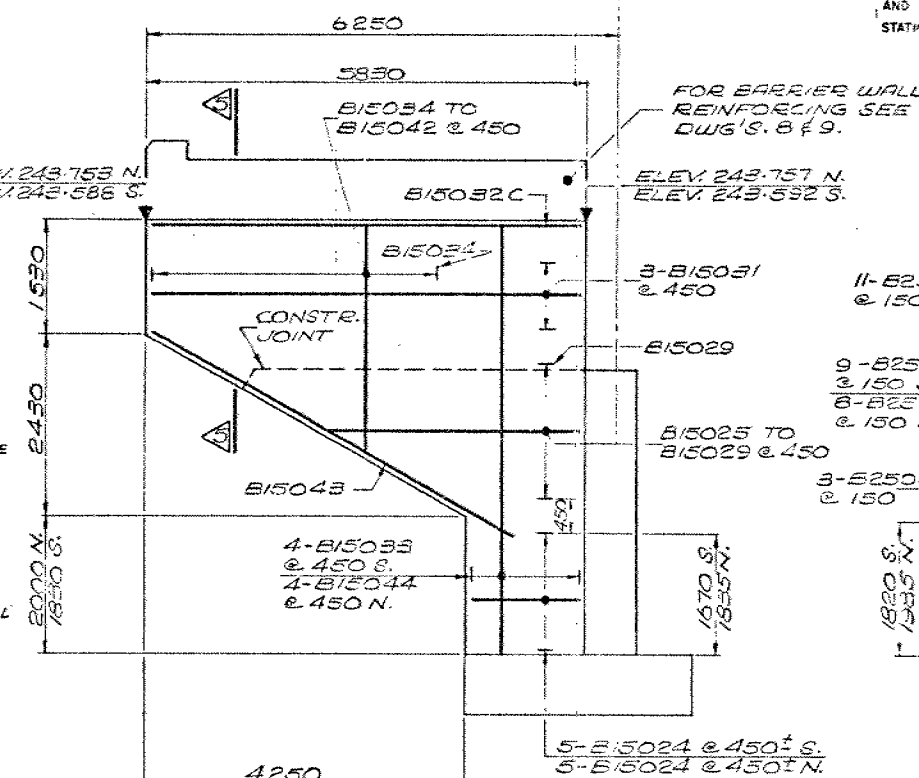
SIDEWALK DETAIL



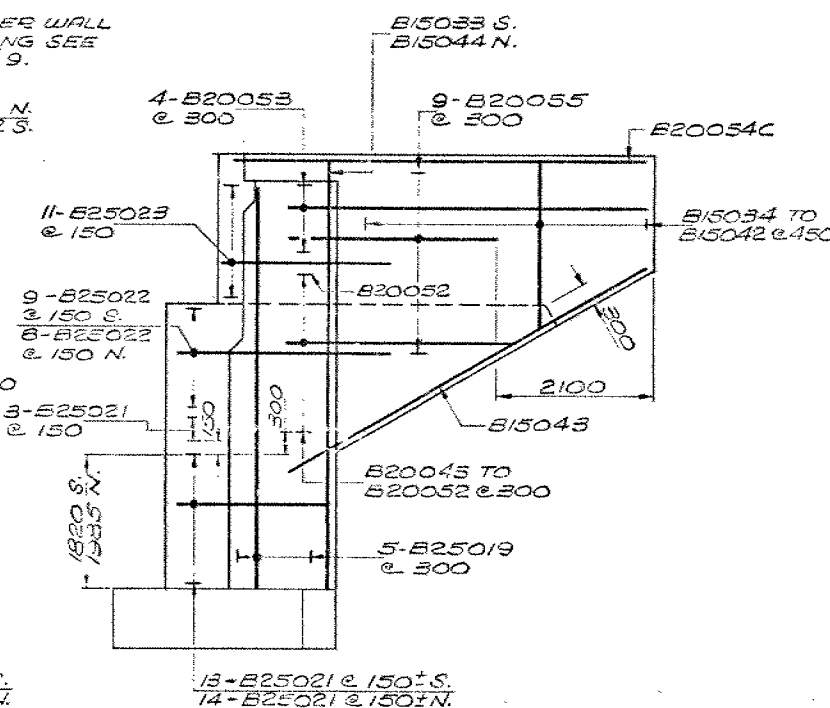
SOUTH



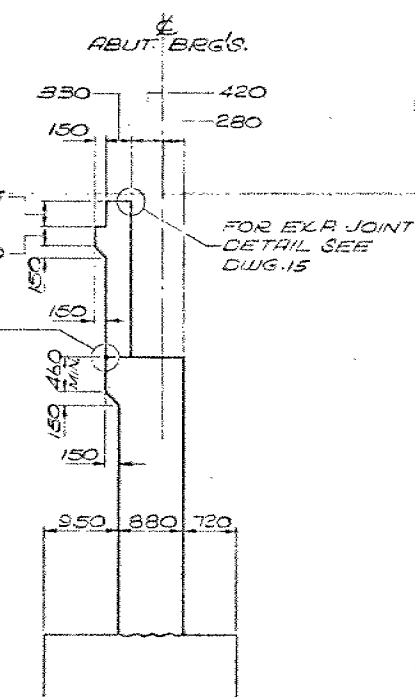
ELEVATION
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3

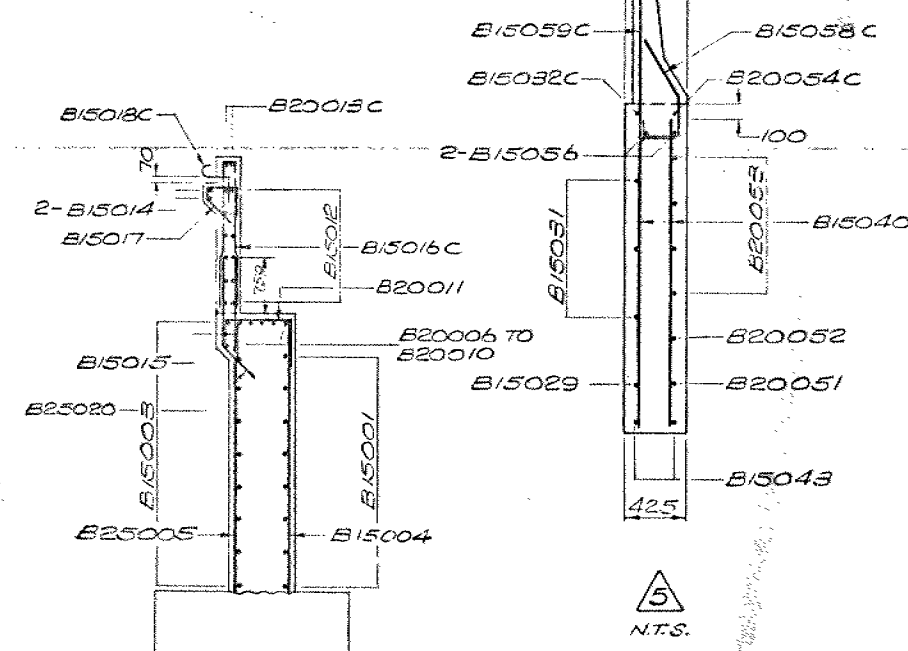


4



DIMENSIONS

NOTE:
TOP OF BALLAST WALL TO BE CAST
TO SUIT PAVEMENT PROFILE



5
N.T.S.

REINFORCING

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	11/1	CHK	LOADING AND
DRAWING	11/1	CHK	SITE No. 10-10-10
			DWG. 1

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

WP 162-75-10 DIST 5
HWY 11 STR SITE 30-486

Orillia Township Road Underpass
9.8 km North of
North Junction Hwy. 11B

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)

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SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	78-12-13	12/88
TUBES	78-12-13	12/87
ROCK CORES	78-12-13	12/85

FOUNDATION INVESTIGATION REPORT

For

Orillia Township Road Underpass
9.8 km North of North Junction Hwy. 11B
W.P. 162-75-10, Site 30-486
Hwy. 11, District 5, Owen Sound

INTRODUCTION

This report contains the results of the foundation investigation carried out at the above mentioned site. The fieldwork which consisted of two sampled boreholes accompanied by cone tests, was carried out on October 26, 1978. The boreholes were advanced using solid stem augers and BXL rock coring techniques to depths up to 6.2 metres below the ground surface.

SITE DESCRIPTION

The site is located on Hwy. 11 approximately 100 metres south of the intersection of Hwy. 11 and County Road 38 in the Township of Orillia, County of Simcoe. At this site the terrain generally slopes southeast toward Lake Couchiching. Limestone bedrock is evident on the sides of Hwy. 11 approximately 200 metres north-east of County Road 38.

A number of small commercial establishments (motels, gas stations and restaurants) are present in the vicinity of the site. The land immediately to the southeast of the site is forested with hardwoods.

Physiographically the site lies in the region generally known as the Simcoe Lowlands. In the area of the site this region is characterized by a sand plain overlaying limestone bedrock.

SUBSURFACE CONDITIONS

Generally, 4.7 to 6.1 metres of overburden were found to cover limestone bedrock. The overburden consists of a granular deposit of fine sand with silt and occasional layers of silt.

For a detailed description of the soil and rock types encountered in each borehole refer to the Record of Borehole Sheets. The estimated stratigraphical profile shown in Drawing #1627510-A is based upon this information. The following is a summary of the soil types encountered from ground level downwards.

Fine Sand With To Traces of Silt, Trace of Clay

Immediately below the ground surface a granular deposit of fine sand with to traces of silt and traces of clay was found to exist. Generally, the silt content increased with depth. Within this stratum a layer of silt up to 1.3 metres in thickness was encountered. In B.H. #2 a layer of coarse to fine sand 0.7 metres thick was encountered above the bedrock.

Standard Penetration Tests carried out within this stratum yielded N values ranging from 9 to 52 blows/0.3 metres indicating a denseness ranging from loose to very dense. Generally, the denseness is compact.

The natural moisture content as determined in laboratory testing ranged from 10 to 23% with an average of 21%. Figure 1 shows the grain size distribution of two split spoon samples obtained from this stratum.

Limestone Bedrock

Immediately below the granular deposit sound limestone bedrock exists. The bedrock surface was encountered 4.7 to 6.1 metres below the ground surface which corresponds to elevations 231.1 and 230.4. Refer to the Diamond Drill Record located in the Appendix for a complete rock description.

Groundwater

The groundwater level was observed by measuring in the open boreholes after the completion of the investigation. The groundwater level was found to vary between elevation 234.0 and 234.1 or 1.8 to 2.4 metres below the ground surface. The groundwater levels are shown on the Record of Borehole Sheet, as well as on Drawing #1627510-A.

DISCUSSION AND RECOMMENDATIONS

General

The proposed erection of a steel beam median barrier along the centreline of Hwy. 11 at this location will necessitate the construction of a flyover to carry the proposed realigned county road over the existing Hwy. 11. The proposed underpass is to be a 45 metre single span structure.

The proposed profile grade of the county road at the structure location will be at about elevation 243.2 which would necessitate fills of up to 7.2 metres in height above the existing ground surface. The profile grade of Hwy. 11 will not be changed.

Structure Foundation

Due to the relatively loose state of the subsoil it is recommended that the structure be supported on end bearing steel H piles driven to the limestone bedrock. The estimated tip elevation at the east and west abutment locations are 231.0 and 230.0 respectively. Tip reinforced piles should be employed to ensure that the piles are well seated on the bedrock. Piles so placed can be designed to carry the structural capacity of the particular pile section chosen. For Example, HP 310 X 110 steel piles may be designed for a load/pile of up to 1.1 MN.

Approach Embankment

The proposed embankments will have a maximum height of about 7.2 metres above the original ground. The fill should consist of well compacted acceptable materials. Care should be taken to ensure that no material larger than 75 mm is placed within the approaches through which piles may have to be driven. No stability problems are anticipated for forward slopes constructed at 1 3/4:1 and side slopes of 2:1. It is anticipated that any settlement of the subsoil will occur as the embankment fill is constructed.

Other Considerations

For frost protection purposes the base of all pier caps should be provided with a minimum earth cover of 2 metres.

For estimating the earth pressure on the abutment wall due to a granular backfill having a bulk density of 2.16 t/m^3 a coefficient of active earth pressure (K_A) of 0.33 may be used if some movement at the top of the wall is permitted. However, if no movement at the top is anticipated, a coefficient of earth pressure at rest (K_0) of 0.5 should be used for design purposes.

In order to relieve the build up of excess hydrostatic pressure behind the abutment walls suitable drainage measures should be provided.

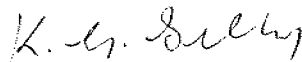
MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. C.T. Johnson who also wrote this report. The rock core obtained was examined in detail by Mr. B.K. Glassford, Geologist. This report was reviewed by Mr. K.G. Selby.

The equipment used was owned and operated by Atcost Soil Drilling Incorporated, Concord, Ontario.



C.T. Johnson, P. Eng.
Project Engineer



K.G. Selby, P. Eng.
Supervising Engineer

December, 1978

APPENDIX

RECORD OF BOREHOLE No 1

METRIC

W P 162-75-10 LOCATION Coords. N 4 953 431.7; E 314 639.7 ORIGINATED BY C.T.J.
DIST 5 HWY 11 BOREHOLE TYPE Solid Stem Auger, BXL Rock Core & Cone Test COMPILED BY C.T.J.
DATUM Geodetic DATE 1978 10 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					
235.8	Ground Level																
0.0	Occasional Cobbles Fine Sand, With to Traces of Silt, Trace of Clay, Silt Content Increases With Depth Loose to Compact		1	SS	23		235										0 61 37 2
			2	SS	14		234										0 23 75 2
	Silt, Some Sand		3	SS	9		233										
			4	SS	14		232										
231.1	Occasional 2 mm Seams of Clayey Silt						231										
4.7	Limestone Bedrock Sound		5	BXL	100% Rec.		230										RQD = 80%
229.6																	
6.2	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 2

METRIC

W P 162-75-10 LOCATION Coords. N 4 953 464.5; E 314 609.7 ORIGINATED BY C.T.J.
DIST 5 HWY 11 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY C.T.J.
DATUM Geodetic DATE 1978 10 26 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ 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						
236.5	Ground Level										
0.0	Fine Sand, With to Trace of Silt, Trace of Clay Silt Content Increases With Depth		1	SS	52		236				
	Very Dense to Compact		2	SS	24		235				
			3	SS	23		234				
			4	SS	13		233				
	Silt Some Sand		5	SS	24		232				
	Coarse to Fine Sand						231				
230.4	Refusal to Augering		6	SS	19	0.10 m Bouncing					
6.1	End of Borehole Probable Bedrock										



HOLE NO. 1 SHEET NO. _____

90°

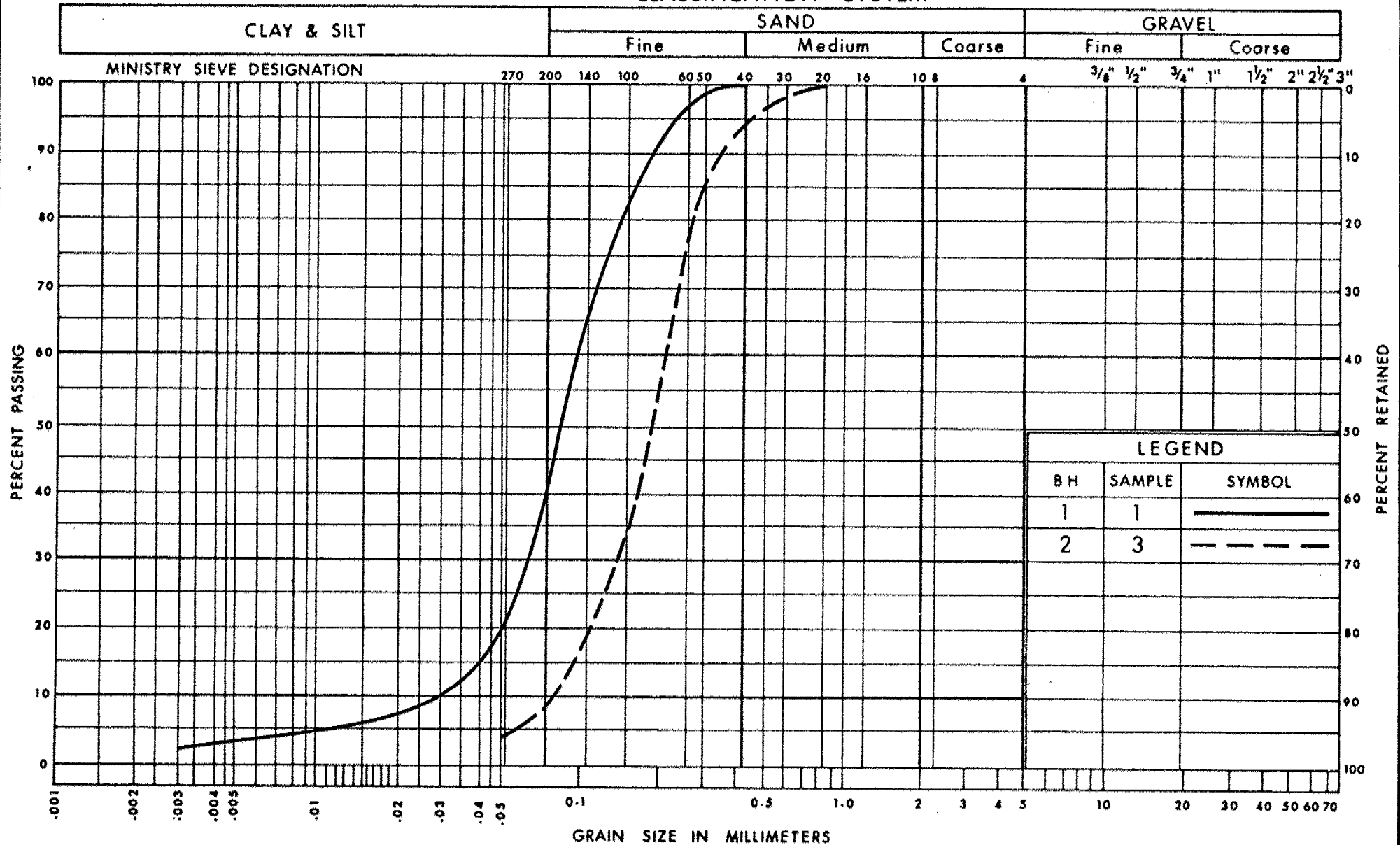
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ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____

[illegible]

DATE OF EXAMINATION November 10, 1978

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
FINE SAND,
WITH TO TRACE OF SILT, TRACE OF CLAY

FIG No 1

W P 162-75-10

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 350 FT-LB IMPACTS ON "A" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

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

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

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

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

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

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

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

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

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

JOINTING AND BEDDING:

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

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG. CUU = 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 OSTERBERG SAMPLE
F S FOIL 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_q, N_c BEARING CAPACITY FACTORS
 D_f DEPTH OF FOOTING
B.L. FOOTING DIMENSIONS

INDEX PROPERTIES

γ UNIT WEIGHT OF SOIL (BULK DENSITY)
 γ_w UNIT WEIGHT OF WATER
 γ_d UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
 γ' UNIT WEIGHT OF SUBMERGED SOIL
 G_s SPECIFIC GRAVITY OF SOLIDS
 e VOIDS RATIO
 e_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 = $w_L - w_p$
 I_L LIQUIDITY INDEX = $\frac{w - w_p}{w_L - w_p}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{w_L - w_p}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu m \text{ soil fraction}}$
 Om ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

STRENGTH PARAMETERS

ϕ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_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_s MODULUS OF SUBGRADE REACTION
 m, n 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
 m_v COEFFICIENT OF VOLUME CHANGE
 c_v COEFFICIENT OF CONSOLIDATION
 C_c COMPRESSION INDEX
 C_r RECOMPRESSION INDEX
 d DRAINAGE PATH DISTANCE
 T_v TIME FACTOR
 U DEGREE OF CONSOLIDATION
 O_c OVERCONSOLIDATION RATIO (OCR)

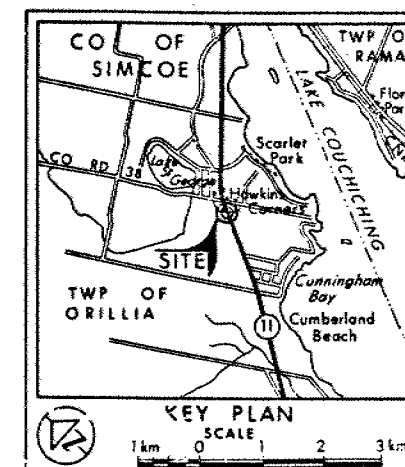
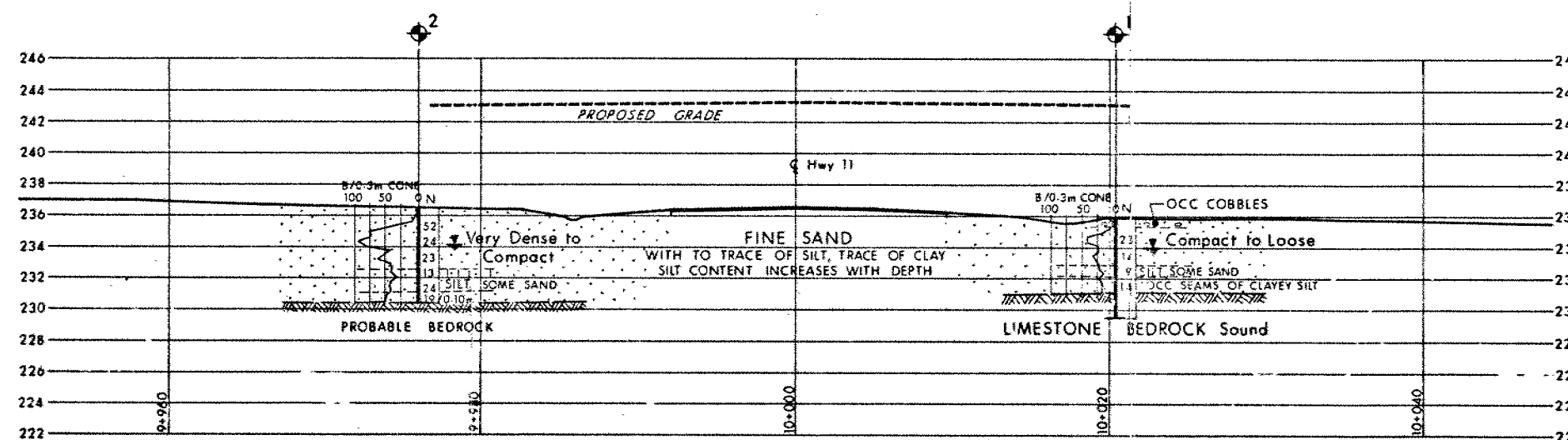
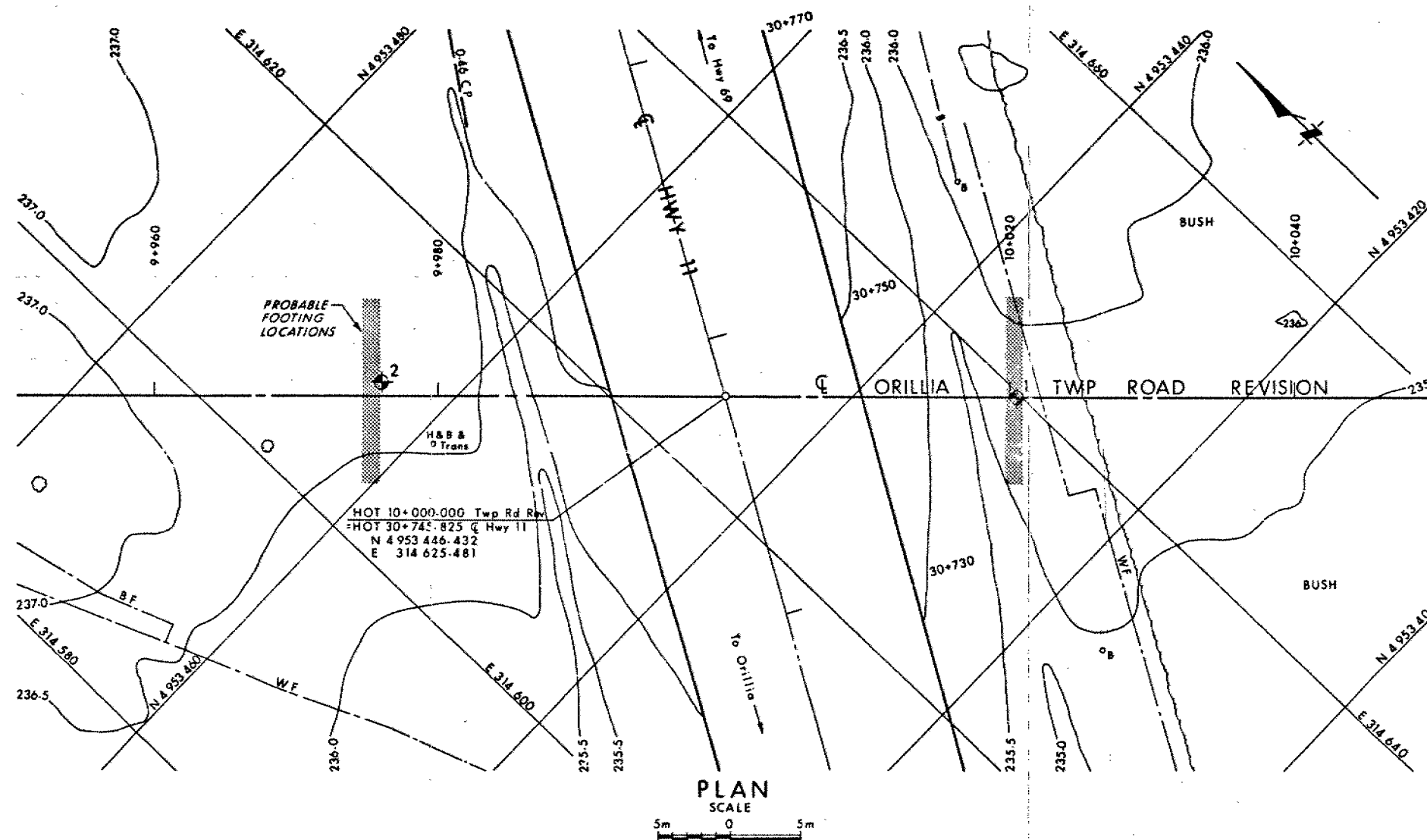
METRIC

CONT No
WP No 162-75-10



ORILLIA TWP ROAD U'PASS
(9.8 km North of North Jct Hwy 118)
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ◆ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation 1978 10 26

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	235.8	4 953 431.7	314 639.7
2	236.5	4 953 464.5	314 609.7

NOTE

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

REVISIONS	DATE	BY	DESCRIPTION

Geocres No 31D-264

HWY No 11	SUBMITTED	CHECKED	DATE 1978 12 03	DIST 5
DRAWN	CHECKED	APPROVED		SITE 30-486
				DWG 1627510-A



Memorandum

To: Mr. A.P. Watt
Head, Structural Section
Southwestern Region
London

From: Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building

Attention:

Date: 78 11 17

Our File Ref.

In Reply to

Subject: Re: 1) W.P. 131-75-14, Site 30-490
Hwy. 11B Interchange Underpass
South Junction Hwy. 11 & 11B
Hwy. 11, District 5, Owen Sound
2) ✓ W.P. 162-75-10, Site 30-486
Orillia Township Road Underpass
Hwy. 11, District 5, Owen Sound
3) W.P. 163-75-12, Site 30-487
Orillia Township Road Underpass
Hwy. 11, District 5, Owen Sound

As requested a soil investigation was recently carried out at the above three sites. Due to the urgent nature of these projects a brief description of the subsoil and applicable foundation recommendations at each respective site are being given at this time. A detailed foundation investigation and design report will be forwarded for each project as soon as possible.

1) W.P. 131-75-14

The subsoil at this site was found to consist of up to 4.0 feet of gravelly sand fill material overlying competent clayey silt with sand and some gravel (glacial till). Our recommendations are as follows.

Pier

The pier can be supported on a spread footing located at or below elevation 745.5 and designed for a load of up to 5 tsf.

Abutment

Three possible foundation alternatives are possible depending on economic considerations.

(a) Spread footings placed in the original soil: The base of the footings should be located at or below elevation 744.5 and 748.0 for the west and east abutments, respectively. Footings so placed may be designed for a load of up to 5 tsf.

(b) Spread footings placed on a compacted granular 'A' pad: At the east abutment location this alternative would require the removal of all previously placed fill material (i.e. to elev. 749+) and culverts before placement of the compacted

cont'd.....

granular 'A'. Footings placed on well compacted granular 'A' may be designed for up to 3.5 tsf. See Figure 1 for design standard.

(c) Piles: Alternatively, the abutments may be perched within the fill and supported on steel 'H' piles driven into the glacial till. HP 12X74 may be designed for a load of up to 100 tons/pile. The estimated pile tip elevations are:

East Abutment	740+
West Abutment	738+

No stability problems are anticipated for embankment side slopes of 2:1 and forward slopes of 1.75:1.

2) W.P. 162-75-10 (Metric)

The subsoil encountered at this site consists of 4.7 to 6.1 metres of generally compact medium to fine sand with silt overlying sound limestone bedrock. The structure should be founded on steel 'H' piles driven to the limestone. HP 310X110 piles may be designed for a load/pile of 1100 kN. The estimated pile tip elevations are:

West Abutment	230.0+ metres
East Abutment	231.0+ metres

No stability problems are anticipated.

3) W.P. 162-75-12 (Metric)

At this site the subsoil consists of approximately 1.7 to 1.9 metres of stiff clayey silt to silt overlying granite bedrock. The bedrock is located at elevations:

West Abutment	218.0+ metres
East Abutment	217.5+ metres

Three alternative foundation schemes are possible at this site.

(a) Spread footings founded on bedrock: The structure may be supported on spread footings placed on the bedrock and designed for up to 5 MPa.

(b) Spread footings placed on a compacted granular 'A' pad: This scheme would require the removal of all subsoil to the bedrock within the area of the compacted granular 'A'. Footings founded on the granular 'A' may be designed for a load of up to 350 kPa. See Figure 2 for design standard.

cont'd.....

(c) End bearing piles: Alternatively, the abutments may be perched within the approach fill and supported on short 'H' piles driven to bedrock. For design the full structural capacity of well seated piles may be utilized. For example, HP 310X110 piles may be designed for a load/pile of 1100 kN.

No stability problems are anticipated.

For all three projects 6 feet or 2 metres of earth cover should be provided to the base of all footings or pier caps for frost protection purposes.



C.T. Johnson
Project Engineer

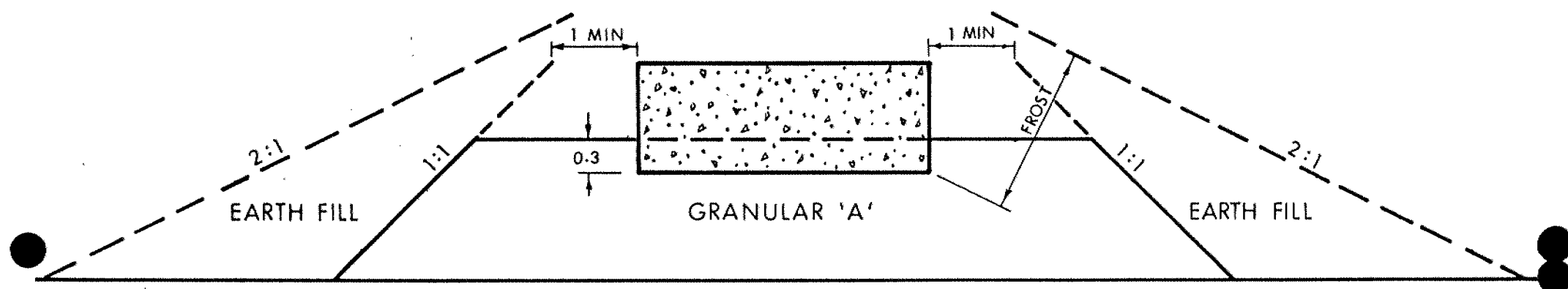
For: K.G. Selby
Supervising Engineer

CTJ/KGS/gs

Attach.

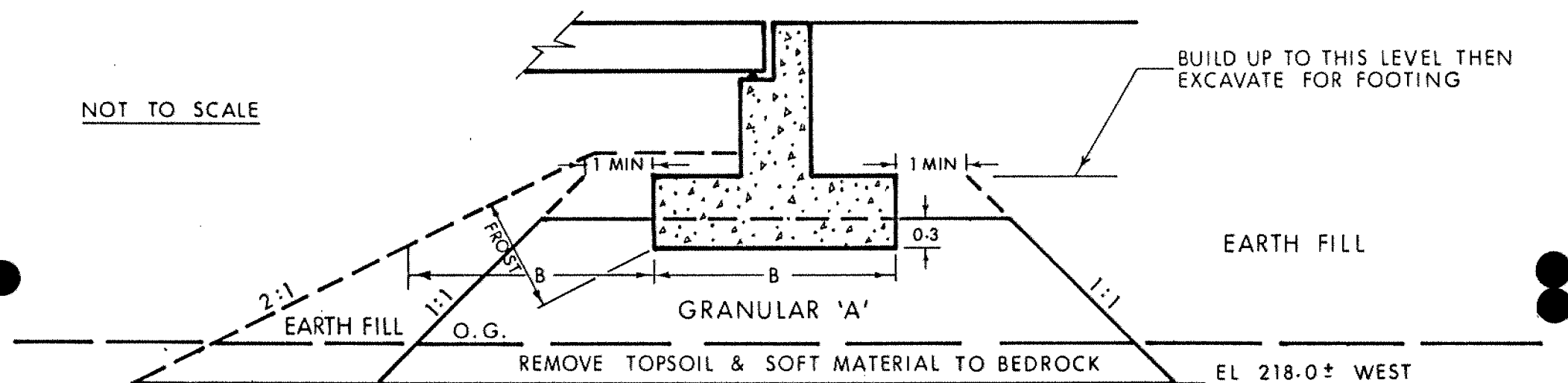
cc: J. Keen
A. Crowley)
J. Anderson) memo only
Files ✓

ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



X SECTION

NOT TO SCALE



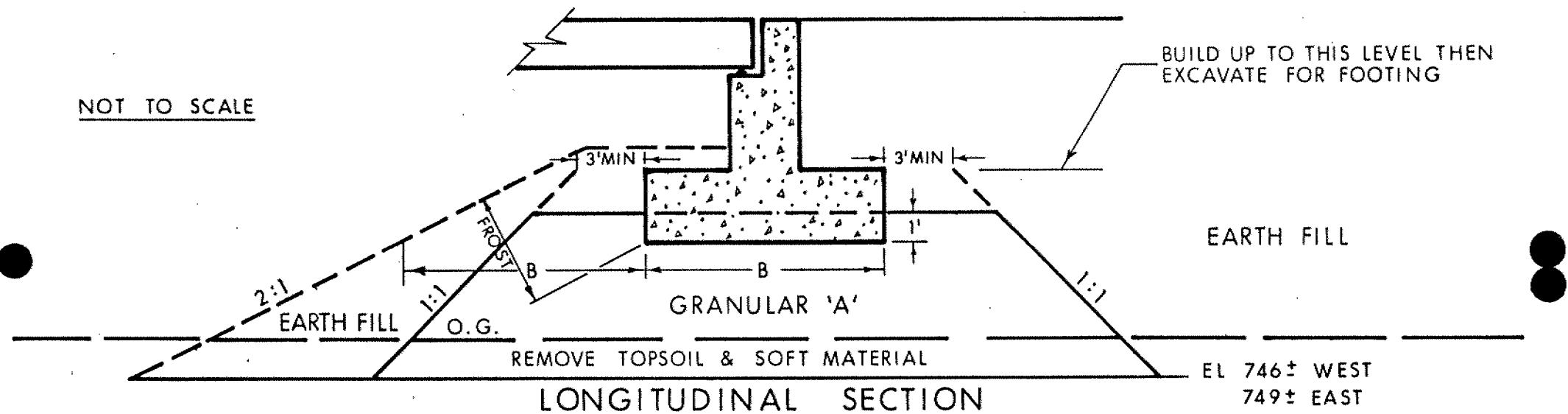
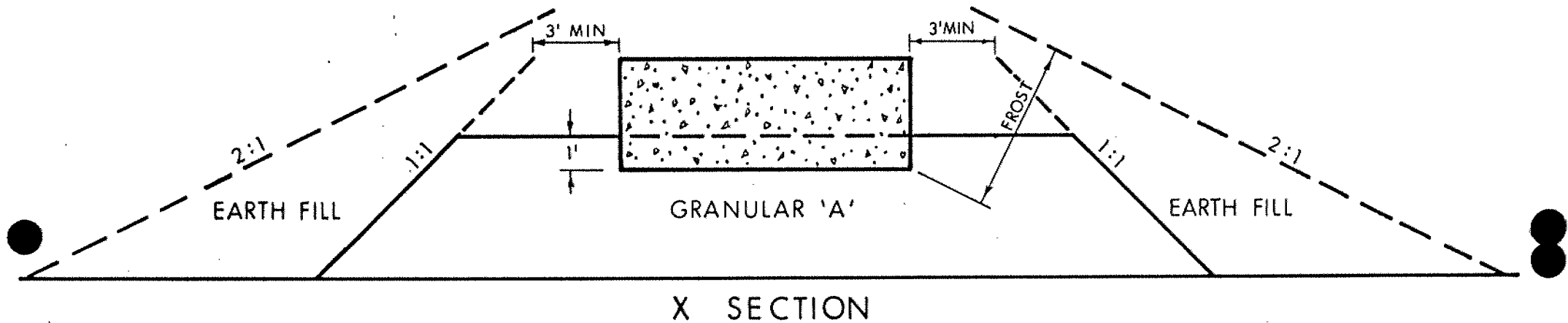
LONGITUDINAL SECTION

NOTES:

- 1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A' & EARTH FILL.
- 2 - PLACE GRANULAR 'A' & EARTH FILL TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M.T.C. STANDARDS.
- 3 - EXCAVATE COMPACTED GRANULAR 'A' & EARTH FILL FOR FOOTING.

FIG. 2

ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



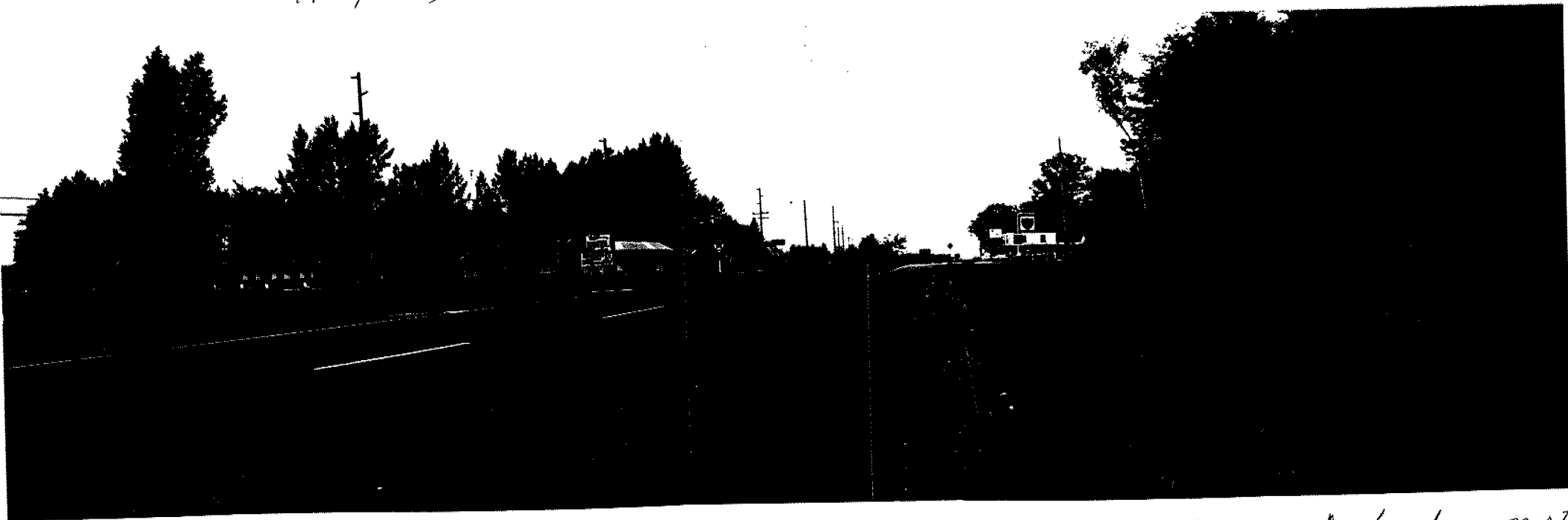
NOTES:

- 1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A' & EARTH FILL.
- 2 - PLACE GRANULAR 'A' & EARTH FILL TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M.T.C. STANDARDS.
- 3 - EXCAVATE COMPACTED GRANULAR 'A' & EARTH FILL FOR FOOTING.

FIG. 1

W.P. 162-75-10, Orillia Twp. Rd. U.P. (Co. Rd. #38) Site 30-486
Hwy 11, District 5 - Owen Sound

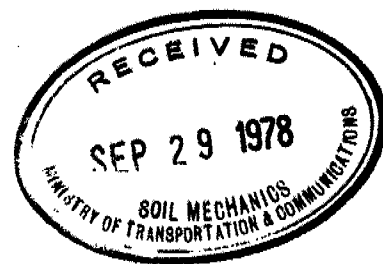
78-09-22



↑ looking north



Looking south
←



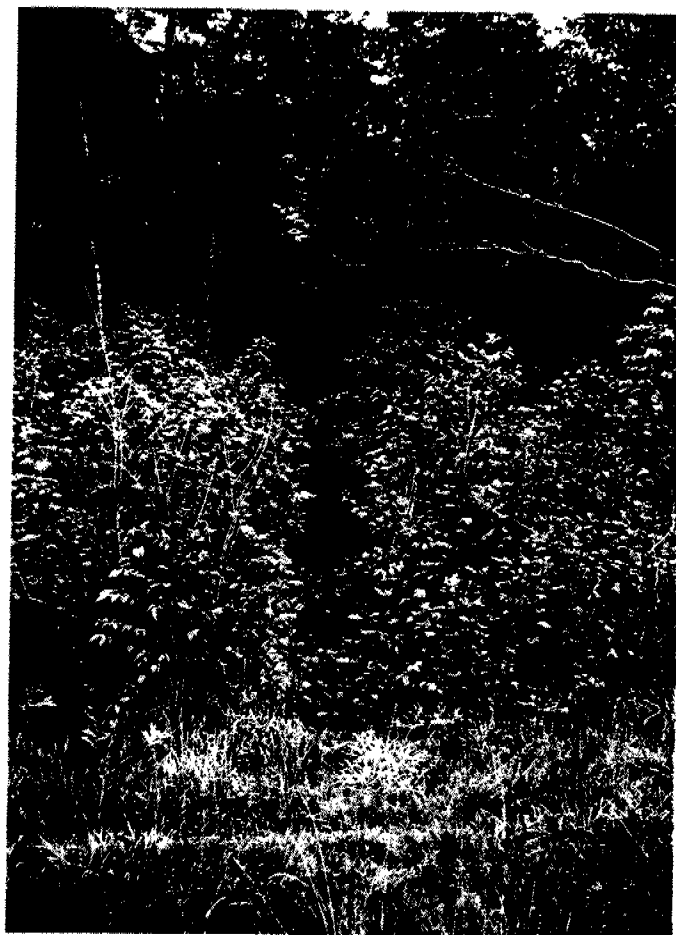
W.P. 162-75-10, Arillia Twp. Rd. U.P. (Co. Rd. #38) Site: 30-486

Hwy 11, District 5 - Owen Sound

78-09-22



Looking west



Looking east

