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STR. SITE No. 37-1110

HWY. No. 427

LOCATION Albion Rd. Underpass

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

GEOTECHNICAL INVESTIGATION
PROPOSED ALBION ROAD UNDERPASS
STRUCTURE AT HIGHWAY 427
W.P. 153-80-03, DISTRICT 6
(TORONTO) CENTRAL REGION
FOR
MINISTRY OF TRANSPORTATION AND
COMMUNICATIONS

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JOB NO. 82 F 18

MARCH, 1982

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Job No. 82 F 18

March 29, 1982

Ministry of Transportation and
Communications
Pavement and Foundation Design Section
Room 315, Central Building
1201 Wilson Avenue
DOWNSVIEW, Ontario
M3M 1J8

Attention: Mr. M. Devata, P.Eng.
Senior Foundation Engineer

Dear Sirs:

Re: Geotechnical Investigation
Proposed Albion Road Underpass Structure
at Highway 427, W.P. 153-80-03,
District 6 (Toronto) Central Region

We are pleased to present our report for the geotechnical investigation carried out for the underpass structure referenced above, as authorized in Agreement No. 4242-9081-208.

The attached report provides complete details of the field and laboratory work carried out, the soils and groundwater conditions encountered at the proposed bridge site and engineering discussion and recommendations for foundation design and construction.

The stratigraphy encountered at the bridge site generally comprises thin surficial topsoil over a major competent silty clay to silty sand glacial till deposit extending to about 16.1 m below grade, underlain by very dense sand.

Subsurface conditions are favourable for the use of spread footings to support the proposed bridge structure. However, various alternative foundation schemes, which are particularly applicable to supporting the abutments are discussed. These include supporting structures on a Granular 'A' engineered fill, augered concrete caissons or driven piles.

The report presents parameters for design of abutment walls and approach embankments and discusses situations that will be encountered during the bridge construction including excavation slopes and groundwater control.

We believe this report has been completed within our terms of reference and trust the information presented herein is sufficient for your present requirements. Should you have any questions, or when we may be of further assistance to you during the construction phase of the project, please do not hesitate to contact our office. We appreciate this opportunity to be of service to the Ontario Ministry of Transportation and Communications.

Yours very truly
PETO MacCALLUM LTD.

Brian R. Gray

BRG/jad

Brian R. Gray, P.Eng.
Manager, Geotechnical Services

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1. INTRODUCTION

Peto MacCallum Ltd. was authorized by The Ministry of Transportation and Communications, Agreement No. 4242-9081-208 to carry out a geotechnical investigation at the site of the proposed Albion Road underpass structure at Highway 427, located between Steeles Avenue and the CNR tracks in Etobicoke, Ontario. The subject project is part of a northerly extension of Highway 427.

A summary of the proposed development plans was provided in a copy of The Ministry of Transportation and Communications internal memorandum to Mr. M. Devata, dated December 7, 1981 and accompanying Preliminary Site Plan Drawing No. X-81197-G2.

The proposed underpass will be twin two-span structures, each about 26 m long, with provision for future widening. Albion Road will be relocated some 25 m south of the existing Albion Road alignment location. Approach embankments up to 9 m in height are proposed to carry Highway 427 over Albion Road which will be relocated close to its existing grade.

The purpose of this investigation is to determine the sub-surface soils and groundwater conditions at the proposed construction site and based on this information to comment on and provide geotechnical engineering recommendations pertinent to the design and construction of the proposed Albion Road underpass structure at Highway 427.

2. FIELD WORK

The scope of the present investigation was established based on the subsurface information available in the general area, particularly from MTC investigations for other structures in the Highway 427 proposed extension, and generally competent glacial till soils were anticipated.

A total of six (6) boreholes were scheduled for the proposed underpass structure, two along each of the pier and abutment lines. Two deep and four relatively shallow boreholes were planned.

The field work was carried out during the period of February 17 to 19, 1982, at the locations shown on the appended plan. The holes were extended to a depth of 9.39 to 18.57 m below existing grade using a CME-75 Nodwell mounted drillrig equipped with continuous flight hollow stem augers, supplied and operated by a specialist drilling contractor.

Representative samples of the overburden were obtained at frequent intervals using a conventional split spoon sampler in conjunction with standard penetration tests. Relatively undisturbed samples of the cohesive soils encountered at the site were recovered in thin walled Shelby tubes. Dynamic cone penetration tests were carried out from the ground surface in two (2) boreholes.

The groundwater conditions in the open boreholes were closely monitored during and on completion of drilling. Piezometers were installed in two (2) boreholes and monitored

to determine the stabilized groundwater conditions. Details of the piezometer installations are described on the appended Record of Borehole sheets 1 and 5.

The field work was supervised throughout by a member of our engineering staff who directed the drilling and sampling operations, documented the soil stratigraphy encountered, monitored the groundwater condition in the open boreholes, detailed the piezometer installations and cared for the recovered samples.

The location and ground surface elevation at the boreholes were established in the field by Peto MacCallum Ltd. The following geodetic benchmark, provided by The Ministry of Transportation and Communications was used as a reference for vertical control:

E-BM 1010 - elevation 173.217 (metric); Tablet in centre at north end of west concrete pier of bridge over CNR tracks on Albion Road, 1.16 m above ground level. (benchmark elevation has been adjusted per information from MTC).

3. LABORATORY TESTING PROGRAMME

All the recovered samples were brought to our laboratory for detailed visual examination and routine testing to confirm field classifications.

The following tests were conducted:

	Record of Borehole Sheets
Moisture content on all samples	
Six (6) Atterberg Limits	Table I
Three (3) "Quick" Triaxial Compression tests	Table II
One (1) pH and Sulphate Content on Groundwater Sample	Table III
Five (5) Grain Size Analyses tests	Figures 1 to 4

4. SITE DESCRIPTION, SUBSURFACE SOILS AND GROUNDWATER CONDITIONS

The site comprises relatively flat open fields and slopes gently down in a north to south direction. The site was snow covered at the time of drilling. Existing Albion Road is raised about 0.5 m about the surrounding area.

Reference is made to the appended Record of Borehole sheets for details of the field work including soil classifications, inferred stratigraphy, standard penetration 'N' values, dynamic cone penetration tests, the results of laboratory undrained shear strength testing, groundwater observations in the open boreholes and installed piezometers, laboratory moisture content determinations and Atterberg Limit test results. Summarized subsurface profile conditions are shown on the appended drawing.

The stratigraphy at the bridge site generally comprises surficial topsoil overlying a major glacial till deposit comprising shallow silty clay of intermediate plasticity grading to silty clay of low plasticity and then to silty sand with depth. The deepest borehole encountered very dense sand at a depth of 16.15 m.

4.1 TOPSOIL

Surficial topsoil, described as dark brown silty clay with relatively low organic content, was found to a depth ranging from 310 to 760 mm in all the boreholes.

4.2 SILTY CLAY OF INTERMEDIATE PLASTICITY (GLACIAL TILL)

Silty clay glacial till of intermediate plasticity was contacted in all the boreholes under the topsoil, and extended to depths of 2.13 to 3.66 m below ground surface, about elevation 169 to 170. This stratum was typically described as very stiff brown silty clay with sand, trace of gravel, fissured, thin fine sand layers. Based on the standard penetration test 'N' values the consistency, locally, ranged from firm to hard.

The results of three (3) "Quick" triaxial compression tests on this stratum are shown in Table II and on Records of Borehole 3 and 6, and indicated shear strengths of 99, 154, and 204 kPa, a very stiff consistency. Wet unit weights of the triaxial test specimens ranged from 20.1 to 20.9 kN/m^3.

Atterberg limits on four (4) samples of the silty clay are shown on Table I, and indicate liquid limits ranging from 32 to 49, plastic limits from 16 to 22 and plasticity indices from 15 to 27, all typical of a plastic clay soil of intermediate plasticity (CI). Natural moisture contents were as high as 26% directly under the topsoil, but generally the silty clay stratum showed moisture contents of 18 to 22%, about the plastic limit, typical for over-consolidated clays.

A grain size distribution curve of the silty clay is shown on Figure 1.

4.3 SILTY CLAY OF LOW PLASTICITY (GLACIAL TILL)

The silty clay till of intermediate plasticity graded to a silty clay glacial till of low plasticity in all the boreholes at depths ranging from 2.13 to 3.66 m, and extended to depths of 4.88 to 7.01 m, about elevation 168.04 to 165.31, sloping down in a north to south direction.

This stratum was typically described as brown to grey silty clay with sand, trace gravel; fissured, thin fine sand layers. Based on the standard penetration test 'N' values, the consistency ranged from hard to very stiff.

Atterberg limits are shown in Table I and indicate a liquid limit of 23, a plastic limit of 16, and a plasticity index of 7. Natural moisture contents for this stratum were typically 10 to 12%, well below the plastic limit indicative of the over-consolidated state of this stratum.

A unit weight determination on a silty clay specimen showed a wet unit weight of 22.2 kN/m^3, typical for hard glacial till soils. A grain size distribution curve is shown on Figure 2.

4.4 SILTY SAND (GLACIAL TILL)

Silty sand glacial till underlay the silty clay in all the boreholes, at depths from 4.88 to 7.01 m, and was not fully penetrated except in borehole 1, at a depth of 16.15 m, elevation 156.17.

This stratum was described as grey silty sand, fine to coarse, with gravel. Based on the standard penetration test 'N' values, the relative density was very dense throughout.

A unit weight determination showed a value of 22.4 kN/m^3, typical for dense glacial till soils. An Atterberg Limit determination confirmed the non-plastic nature of this silty sand glacial till soil. Natural moisture contents were typically 7 to 10% in the upper part of the stratum and as high as 12%, at depth, below the groundwater level.

Typical silty sand glacial till grain size distribution curves (2) are shown on Figure 3.

4.5 SAND

The deepest borehole 1, contacted sand at a depth of 16.15 m, elevation 156.17 and this stratum was not fully penetrated at the termination depth of the borehole, 18.57 m.

This stratum was described as grey sand, fine with silt; occasional thin layers of silty clay. Based on the standard penetration test 'N' values, the relative density was very dense throughout.

A typical sand grain size distribution curve is shown on Figure 4.

4.6 GROUNDWATER

The groundwater conditions observed in the boreholes during and on completion of drilling, and the piezometer readings afterward, are shown on the individual Record of Borehole sheets. Generally, on completion of drilling most of the boreholes indicated a depth of groundwater below about 8 m.

Subsequent readings in the piezometer installed at 18.0 m depth in borehole 1 indicated a groundwater level at 5.3 m (elevation 167.0). The piezometer in borehole 5, at a depth of about 9.0 m, indicated a groundwater level at 2.38 m; however, it is suspected that this may be due to perched water infiltration.

5. ENGINEERING DISCUSSION AND RECOMMENDATIONS

The structure to carry Highway 427 over Albion Road is proposed as twin two-span bridges, each about 26 m long with approach embankments up to 9 m in height adjacent to the structure.

The soil and groundwater conditions at the site are favourable for the use of shallow spread footing foundations. However, alternate foundation systems are described, and because of structural or economic considerations may be selected, particularly for the abutments.

5.1 SPREAD FOOTINGS

The piers and abutments for the proposed structure may be supported on shallow spread footings in the very stiff to hard silty clay till of intermediate plasticity or if a higher bearing capacity is required for the piers, on the deeper hard silty clay till of low plasticity.

Considering the footing foundations at a minimum depth of 1.5 m below the existing ground surface, that is, below the zone of seasonal effects, at about elevation 171.0, in the

very stiff silty clay till, of intermediate plasticity the factored bearing capacity has been determined as outlined in the new Ontario Highway Bridge Design Code. Based on the results of "Quick" triaxial compression tests the factored bearing capacity at Ultimate Limit States (ULS) is 375 kPa. Taking into account structure configurations, and neglecting all transient loading, it is estimated that settlement will be less than 25 mm for a bearing capacity at Servicibility Limit States Type II (SLS) of 250 kPa.

If higher spread footing bearing capacities are required for the piers, foundations can be placed on the hard silty clay of low plasticity at about elevation 169.5 to 168.9. The factored Ultimate Limit States bearing capacity on this stratum is 500 kPa. Since the hard till soil is relatively unyielding, the Servicibility Limit States Type II bearing capacity will be much larger; therefore, the ULS bearing capacity of 500 kPa controls.

Because of the high 9 m approach fills, it may be advantageous to consider shallow abutments supported on a section of granular fill in the approach embankment. The Standard MTC method of constructing abutments on compacted fill embankments with a Granular 'A' core is shown on appended Figure 5. Abutment footing design can be based on a Servicibility Limit States Type II bearing capacity of 300 kPa, considering a settlement of about 25 mm. The Ultimate Limit States bearing capacity for the dense compacted Granular 'A' is estimated to be 750 kPa. If this method of abutment design and construction is adopted, all materials and methods of construction should conform to current MTC Standards.

5.2 DEEP FOUNDATIONS

While the foundation soils are generally competent for shallow foundations, there may be structural or economic reasons for utilization of deep foundations, and the following types are suitable for this site.

5.2.1 Augered Caissons

Concrete filled augered caissons founded in the underlying very dense silty sand till are an acceptable type of deep foundation.

Considering a penetration of one caisson diameter into this very dense stratum, the presumptive factored bearing capacity at Ultimate Limit States is 1,000 kPa. Because of the relatively unyielding till foundation soil, the Servicibility Limit States Type II bearing capacity would be much larger, and would therefore, not control.

Considering augered caissons at the pier location, boreholes 3 and 4 indicate a founding elevation of about 165.0. Groundwater is not expected to pose any major problems based on the borehole data.

Downhole inspection from within a temporary liner is recommended to verify the competency of the founding surface and to confirm that the base is properly cleaned.

5.2.2 Driven Piles

Alternatively, driven piles may be used to support the bridge structure. Based on the subsurface stratification and the two (2) dynamic cone penetration tests carried out in boreholes 1 and 6, it appears that displacement type piles would be difficult to drive. Therefore, if piles are considered, a suitable type would be a non-displacement type such as steel H-pile driven into the underlying very dense silty sand till. A steel H-pile driven to practical refusal into the silty sand till could be designed on the basis of its factored structural capacity.

For estimating purposes, it can be assumed that steel H-piles will penetrate approximately 5 m into the very dense silty sand till to about elevation 165 to 163, sloping down in a north to south direction.

The piles should be driven with a hammer of sufficient energy to attain the required capacity, and a pile load test should be carried out at the start of construction to verify that the required pile capacity is being obtained with the contractor's equipment and construction procedures.

The installation operations should be inspected on a full time basis by qualified geotechnical personnel to ensure uniformity of set, founding elevation, alignment, plumbness as well as proper splice welds.

5.3 ABUTMENTS

Both closed and open ended type abutments are feasible depending on spacial limitations and the bridge design chosen. Abutment walls should be designed to resist the unbalanced lateral forces acting on the wall. In this regard, provided that MTC standard practice is followed involving the provision of free draining granular backfill and the installation of weepholes or weeping tiles behind the wall to prevent the build up of hydrostatic pressures, design can be based on the following geotechnical parameters:

Friction angle of compacted granular backfill, $\phi = 30^0$

Friction angle between granular fill and concrete, $\delta = 24^0$

Adhesion between footing and silty clay till of intermediate or low plasticity, 50 kPa

Bulk density for compacted granular fill behind the wall, $\gamma = 21.2$ kN/m^3

Alternatively, lateral earth pressures for the granular backfill can be determined from the Highway Bridge Design Code, Section 6.6.1.2.2, using equivalent fluid pressures:

Ultimate Limit States (active state) 8.0 kPa/m
Servicibility Limit States (active state) 6.5 kPa/m

5.4 APPROACH EMBANKMENTS

The proposed construction will involve approach embankments some 9 m in height. Prior to construction of the embankment, or granular structural fill, all topsoil, and any obviously

deleterious materials should be sub-excavated and the exposed surface proof rolled to ensure at least 95% Standard Proctor maximum dry density.

We recommend longitudinal and transverse slopes of 2 horizontal to 1 vertical for the approach embankment. Provided suitable borrow material is employed and MTC standard construction procedures are observed, we do not anticipate any slope or base stability problems. Standard MTC slope protection involving seeding or sodding should be observed to control erosion due to surface runoff.

5.5 CONSTRUCTION AND GROUNDWATER CONTROL

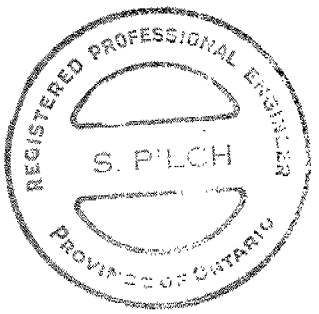
No real advantage is derived from construction of the approach fill in advance of construction (surcharging the site). However, the construction sequence of the approach embankment should be designed so as to facilitate construction of the foundation type that is utilized.

Excavation slopes should be cut at 1 horizontal to 1 vertical, above a 1.2 m vertical height, subject to geotechnical inspection. All excavation should be carried out in accordance with The 1978 Ontario Occupational Health and Safety Act.

Groundwater should not pose any special problems. Local nuisance seepage or surface runoff that enters any proposed excavation should be handled readily by conventional sump pumping.

5.6 ANCILLARY CONSIDERATIONS

At the site for the proposed bridge, the results of chemical testing on one water sample (Table III) indicate a negligible degree of soluble sulphate attack on buried concrete structures. Reference is made to The Canadian Standard Association, CSA Standard A23 and MTC Specifications for recommendations regarding the type of cement required.



PETO MacCALLUM LTD.

SP/jad

S. Pilch, P.Eng.
Chief Geotechnical Engineer

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MARCH, 1982

TABLE I

ATTERBERG LIMIT TEST RESULTS

Albion Road Underpass
at Highway 427

BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	NATURAL WATER CONTENT (w) %	LIQUID LIMIT (w_L)	PLASTIC LIMIT (w_p)	PLASTICITY INDEX (I_p)	REMARKS
1	1	0.76-1.22	25	44	22	22	silty clay (CI)
3	2	1.52-1.98	22	49	22	27	silty clay (CI)
3	2	1.52-1.98	18	32	17	15	silty clay (CI)
6	3	2.29-2.74	21	32	16	16	silty clay (CI)
1	4	3.05-3.50	12	23	16	7	silty clay (CL)
1	8	7.62-8.07	9	Non-Plastic			silty sand

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TABLE II

"QUICK" TRIAXIAL COMPRESSION TEST RESULTS

Albion Road Underpass
at Highway 427

BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	NATURAL WATER CONTENT (w) (%)	UNIT WEIGHT WET (γ) (kN/m^3)	UNIT WEIGHT DRY (γd) (kN/m^3)	VOID RATIO (e)	DEGREE OF SATURATION (S_r) (%)	CELL PRESSURE ($\sigma 3$) (kPa)	FAILURE STRAIN (εf) (%)	SHEAR STRENGTH (τf) (kPa)	REMARKS
3	2	1.52-1.98	22.1	20.9	17.1	0.55	100	37.2	5.0	154	silty clay (CI)
			17.9	20.6	17.4	0.51	94	37.2	5.8	204	silty clay (CI)
6	3	2.29-2.74	20.6	20.1	16.6	0.59	94	49.6	5.2	99	silty clay (CI)

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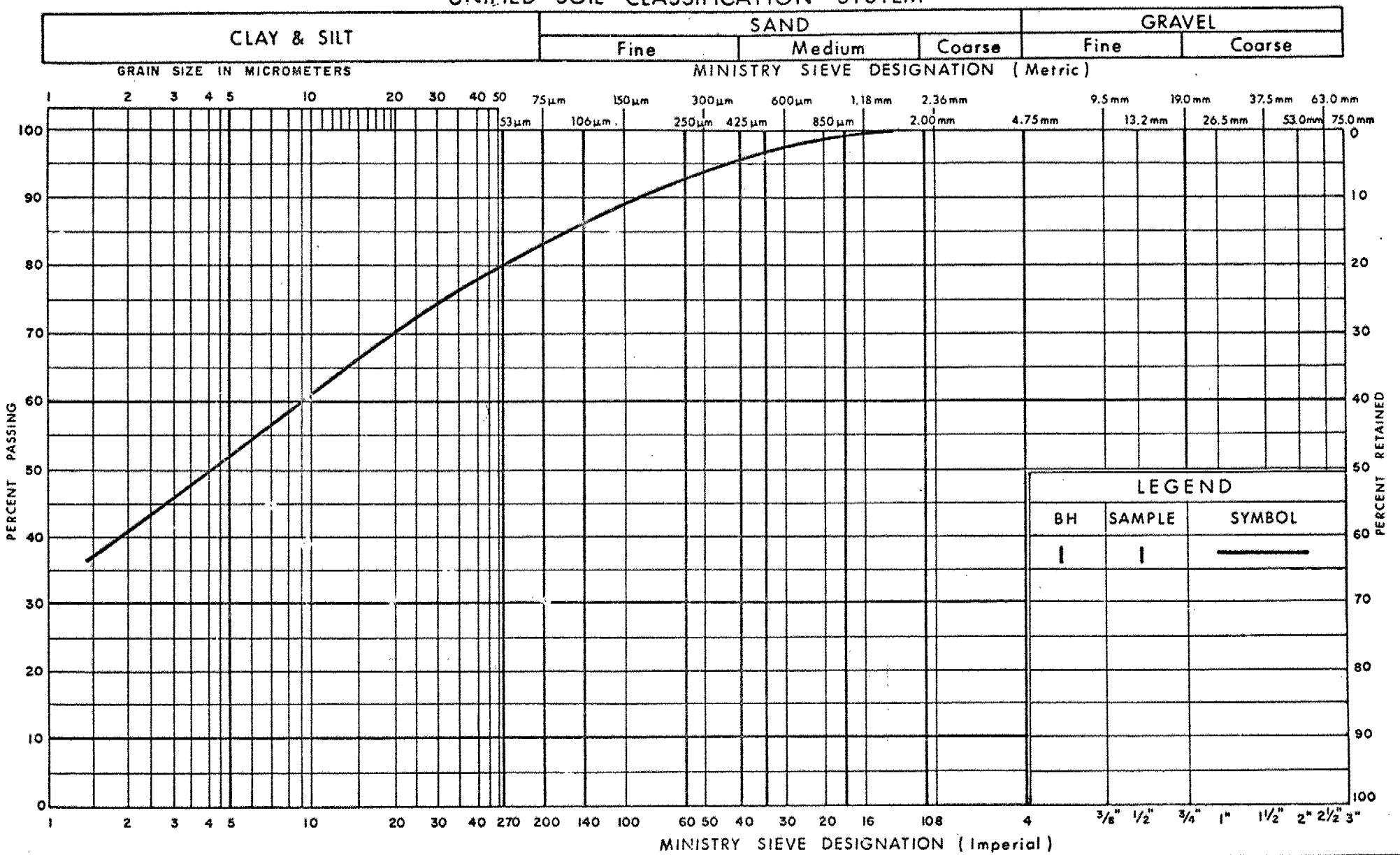
TABLE III

pH VALUE AND SULPHATE CONTENT OF WATER SAMPLES

Albion Road Underpass
at Highway 427

BOREHOLE NO.	DEPTH (m)	pH VALUE	SULPHATE CONTENT ppm as SO_4	RELATIVE DEGREE SULPHATE ATTACK ON CONCRETE
1	12.0	7.8	70	'negligible'

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation and Communications
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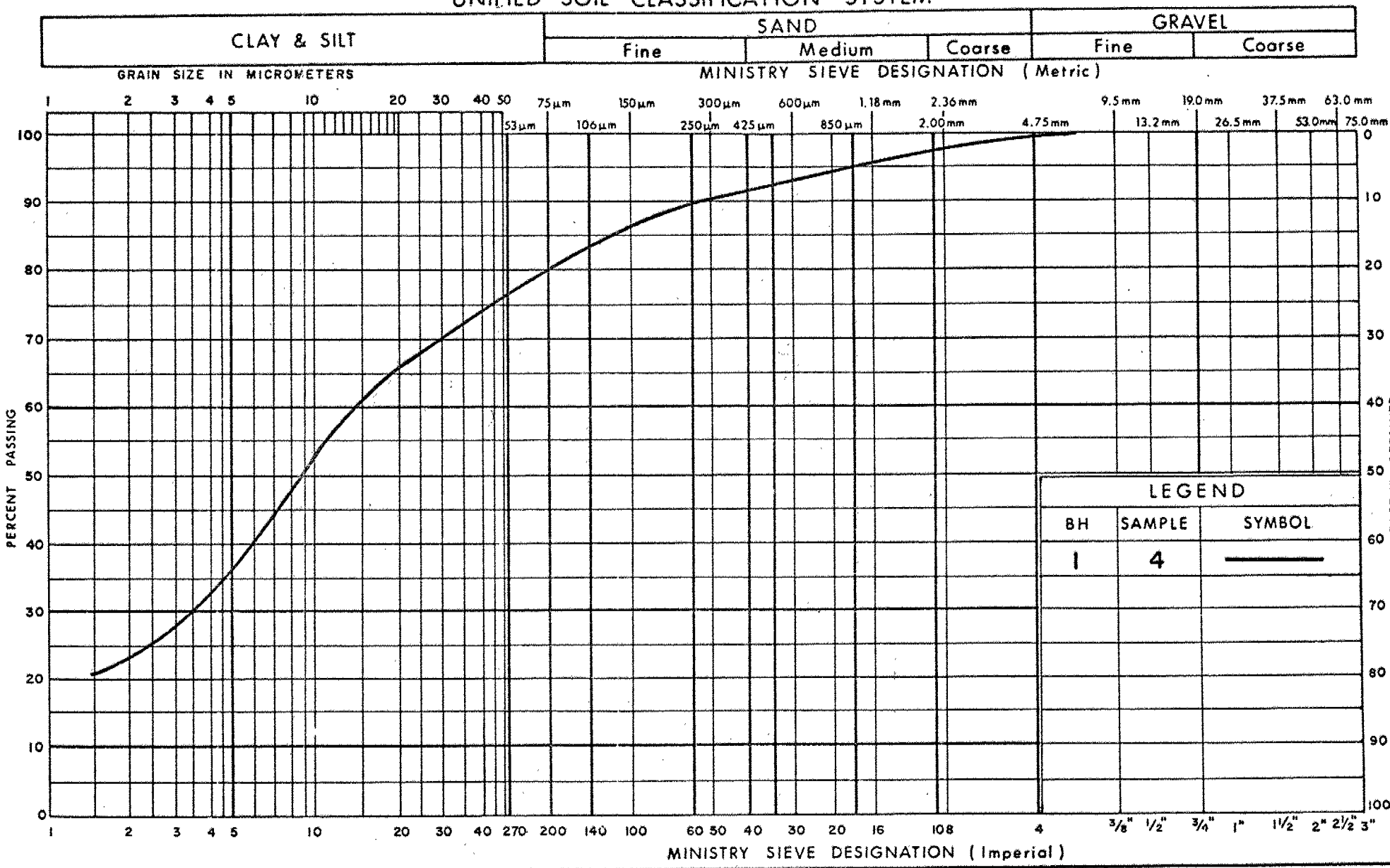
GRAIN SIZE DISTRIBUTION
SILTY CLAY (GLACIAL TILL)
WITH SAND

FIG No 1

W P 153-80-02

UNIFIED SOIL CLASSIFICATION SYSTEM



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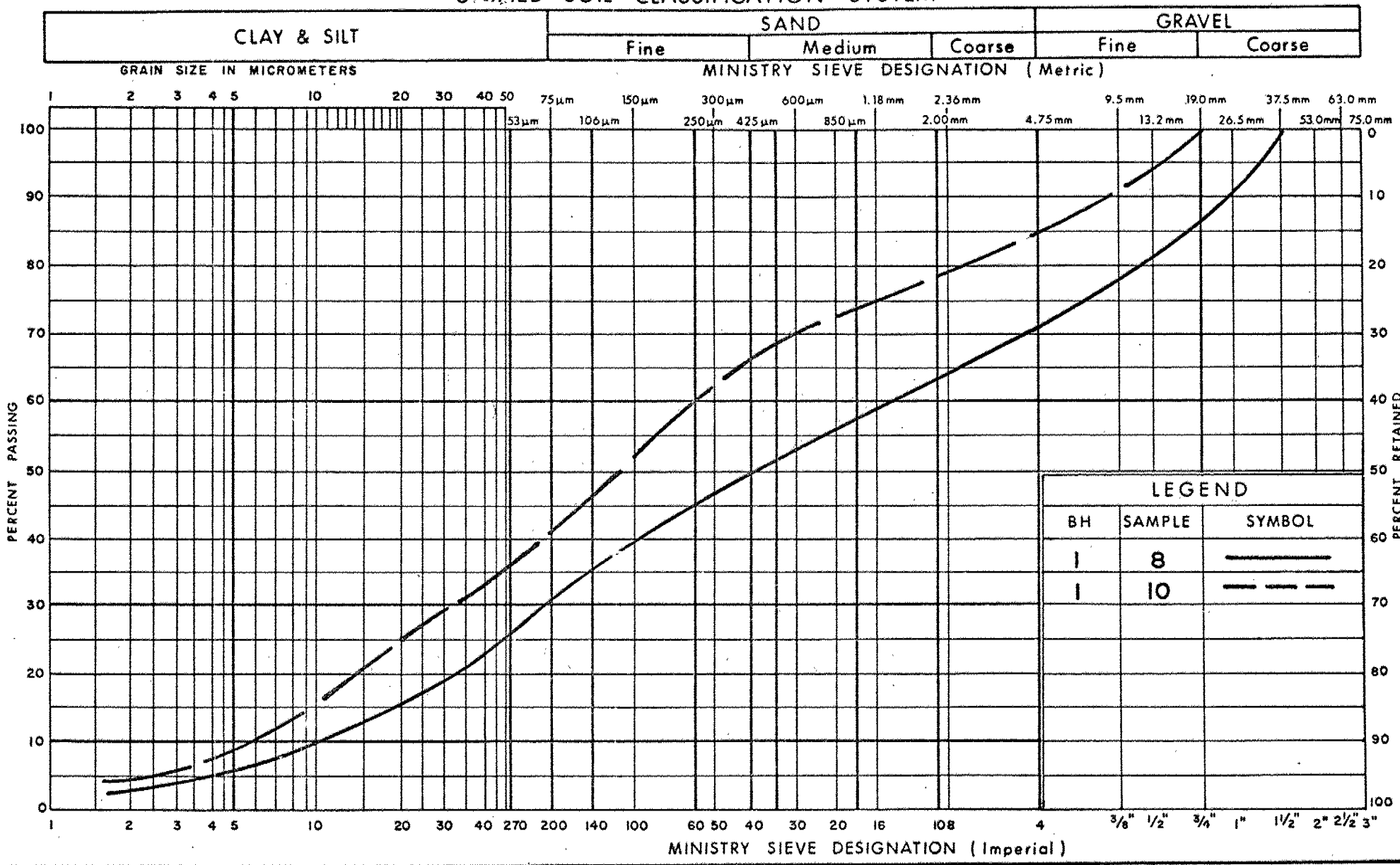
GRAIN SIZE DISTRIBUTION
SILTY CLAY (GLACIAL TILL)
WITH SAND

FIG No 2
W P 153-80-02

UNIFIED SOIL CLASSIFICATION SYSTEM



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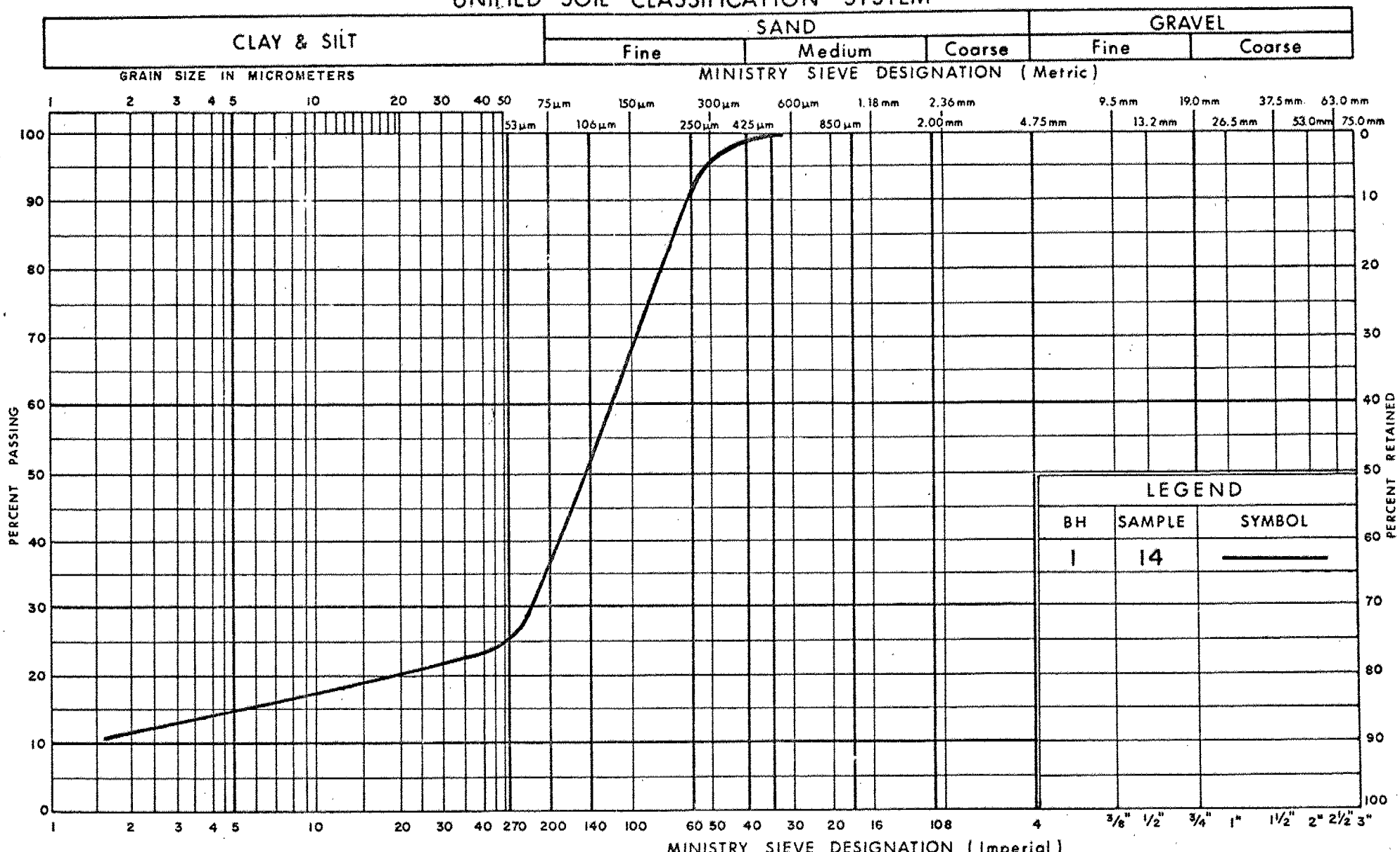
GRAIN SIZE DISTRIBUTION
SILTY SAND (GLACIAL TILL)
FINE TO COARSE WITH GRAVEL

FIG No 3
W P 153-80-02

UNIFIED SOIL CLASSIFICATION SYSTEM



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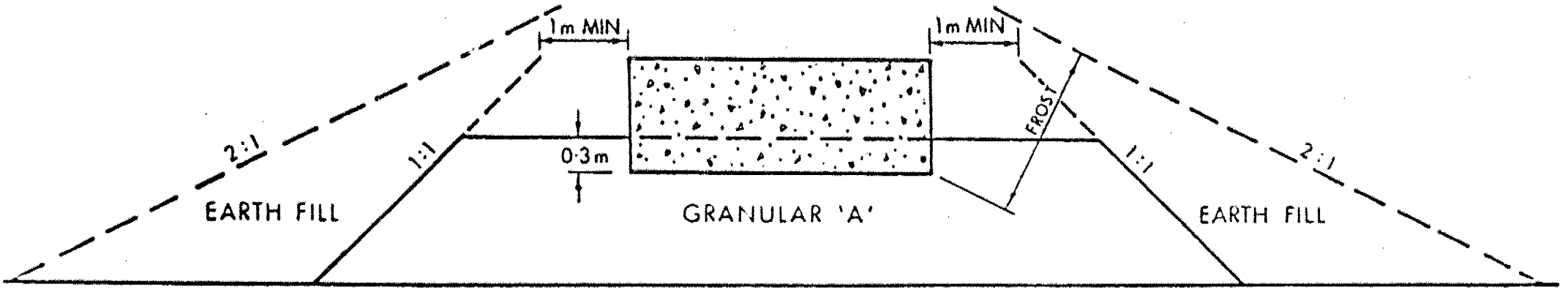
GRAIN SIZE DISTRIBUTION
SAND
FINE WITH SILT, OCCASIONAL THIN LAYERS OF SILTY CLAY

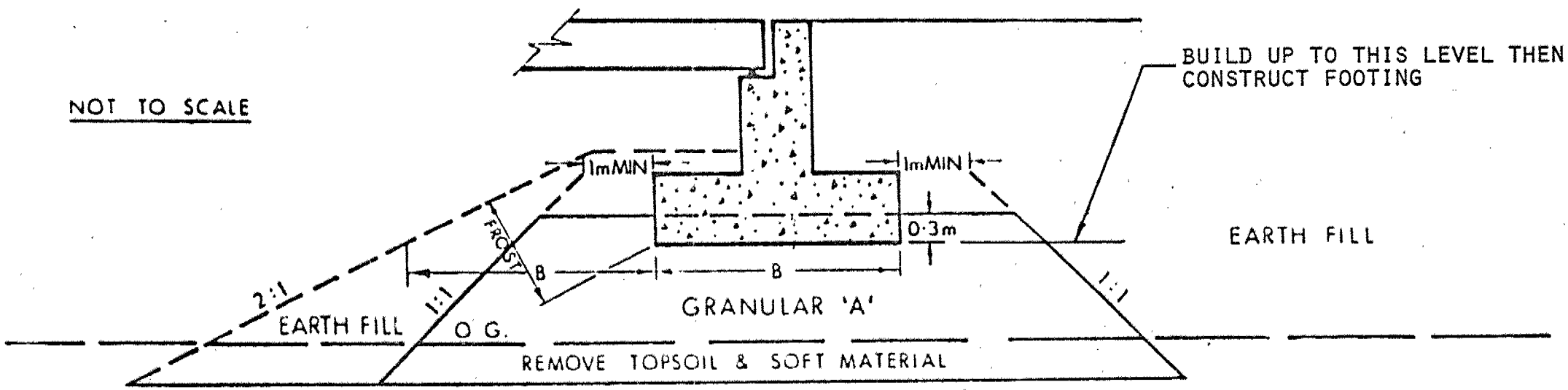
FIG No 4
W P 153-80-02

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 BOTTOM OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M.T.C. STANDARDS
3. CONSTRUCT CONCRETE FOOTING
4. PLACE REMAINDER OF GRANULAR 'A' & EARTH FILL AS REQUIRED

FIG. 5

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

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

STRESS AND STRAIN

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

MECHANICAL PROPERTIES OF SOIL

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

PHYSICAL PROPERTIES OF SOIL

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

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

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

Ministry of Transportation and Communications
Ontario

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 1

Metric

W P 153-80-02 LOCATION Co-ords, 4,845, 115N; 294, 281E ORIGINATED BY M.R.

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.

DATUM Geodetic DATE February 17, 1982 CHECKED BY SP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
172.32	Ground Level						
172.01	Topsoil, silty clay, low organic, dark brown						172
0.31	Silty clay with sand, trace gravel, fissured, thin fine sand layers, (Glacial Till) Intermediate plasticity		1	SS	10		
170.19			2	SS	7		
2.13	Stiff to Firm, Brown		3	SS	37		170
	Silty clay with sand, trace gravel, fissured, thin sand layers (Glacial Till) Low plasticity		4	SS	53		
167.75	Hard Brown		5	SS	30		
4.57	becoming very stiff, Grey		6	SS	26		168
165.31			7	SS	27		166
7.01	Silty sand fine to coarse with gravel, (Glacial Till) Very Dense Grey		8	SS	93		
			9	SS	100/280 mm		164
			10	SS	100/200 mm		162
			11	SS	100/280 mm		160
			12	SS	100		
156.17			13	SS	100/200 mm		158
16.15	Sand, fine with silt, occasional thin layers of silty clay		14	SS	80/180 mm		156
153.75	Very Dense Grey		15	SS	100/280 mm		154
18.57	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

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

PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L

WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
44	
19.1	0 17 38 45
22.2	1 19 52 28
22.4	28 40 29 3
	14 44 37 5
	0 65 22 13

Note:
½ hr. after sample 11, water at elevation 160.42 inside augers

Upon completion of augering, water at elevation 161.42 inside augers

Piezometer installed at elevation 154.03 seal at elevation 163.48

Date	Water Elevation
Feb. 13/82	165.02
Feb. 19/82	165.42
Feb. 26/82	167.02

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

15 20/10 5 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 2

Metric

W P 153-80-02 LOCATION Co-ords. 4,845, 110N; 294, 317E ORIGINATED BY B.Y.K.
DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.
DATUM Geodetic DATE February 19, 1982 CHECKED BY SP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
172.70	Ground Level										
172.09	Topsoil, silty clay, low organic Dark Brown										
0.61	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till) Intermediate plasticity		1	SS	18		172				
			2	SS	28						
169.65	Very Stiff Brown		3	SS	28		170				
3.05	Silty clay with sand trace gravel, fissured, thin fine sand layers (Glacial Till) Low plasticity		4	SS	42						
			5	SS	32		168				
			6	SS	35						
	Hard Brown to Grey		7	SS	41		166				
165.69											
7.01	Silty sand fine to coarse with gravel (Glacial Till)		8	SS	100						
							164				
163.28	Very Dense Grey		9	SS	100/ 30 mm						
9.42	End of Borehole										

Note:
After removal of augers upon completion of drilling, borehole caved at elevation 164.24, no free water

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 3

Metric

W P 153-80-02 LOCATION Co-ords. 4, 845, 141 N; 294, 277E ORIGINATED BY B.L.K.

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.

DATUM Geodetic DATE February 18, 1982 CHECKED BY SP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100 — 50 100 150 200 250 kPa	10 20 30		
172.57	Ground Level										
171.81	Topsoil, silty clay, low organic, Dark Brown						172				
0.76	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till) Intermediate plasticity		1	SS	30				o	20.9	
			2	TW	PH			•	•	20.6	
			3	SS	34		170		o		
169.52	Very Stiff to Hard Brown										
3.05	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till) Low plasticity		4	SS	55				o		
			5	SS	48				o		
			6	SS	25		168		o		
166.17	Hard to Very Stiff Brown to Grey		7	SS	44				o		
6.40	Silty sand fine to coarse with gravel (Glacial Till)						166				
			8	SS	100/250 mm				o		
						▼	164				
163.18	Very Dense Grey		9	SS	100/250 mm				o		
9.39	End of Borehole										

Note:
After removal of augers upon completion of drilling, water level at elevation 163.89
Borehole caved at elevation 164.04

+³, ×⁵ : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 4

Metric

W P 153-80-02 LOCATION Co-ords. 4, 845, 145 N. 294, 313E ORIGINATED BY B.I.K.
DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.
DATUM Geodetic DATE February 19, 1982 CHECKED BY SP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
172.59	Ground Level										
172.28 / 0.31	Topsoil, silty clay, low organic Dark Brown						172				
	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till) Intermediate plasticity		1	SS	18						
			2	SS	21						
			3	SS	28		170				
168.93	Very Stiff Brown		4	SS	24						
3.66	Silty clay with sand, trace gravel, fissured, thin fine sand layers, (Glacial Till) Low plasticity		5	SS	39						
			6	SS	45		168				
166.49	Hard Grey										
6.10	Silty sand fine to coarse with gravel (Glacial Till)		7	SS	91	▽	166				
			8	SS	88						
							164				
163.09	Very Dense Grey		9	SS	100/200 mm						
9.50	End of Borehole										

Note:
After removal of augers on completion of drilling, water level and elevation 165.78 and borehole caved at elevation 165.68

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 5

Metric

W P 153-80-02 LOCATION Co-ords. 4, 845, 161N; 294, 274E ORIGINATED BY B.L.K.

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.

DATUM Geodetic DATE February 18, 1982 CHECKED BY SP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
172.89	Ground Level										
172.28	Topsoil, silty clay, low organic Dark Brown										
0.61	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till) Intermediate plasticity Very Stiff to Hard Brown		1	SS	26		172				
			2	SS	27						
			3	SS	31	▼	170				
169.84											
3.05	Silty Clay with sand, trace gravel, fissured, thin fine sand layers, (Glacial Till) low plasticity		4	SS	49						
			5	SS	59						
168.01	Hard Brown		6	SS	43		168				
4.88	Silty sand, fine to coarse with gravel (Glacial Till)										
			7	SS	63		166				
			8	SS	93						
163.36	Very Dense Grey		9	SS	100/230 mm		164				
9.53	End of Borehole										

Note:
After removal of augers upon completion of drilling, water level at elevation 164.97 and borehole caved at elevation 165.57

Piezometer installed at elevation 163.44 seal at elevation 171.06

Date	Water Elevation
Feb. 19/82	169.92
Feb. 26/82	170.51

(possible perched water infiltration)

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 6

Metric

W P 153-80-02 LOCATION Co-ords. 4, 845, 168N; 294, 309E ORIGINATED BY B.L.K.

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.

DATUM Geodetic DATE February 17/18, 1982 CHECKED BY SP

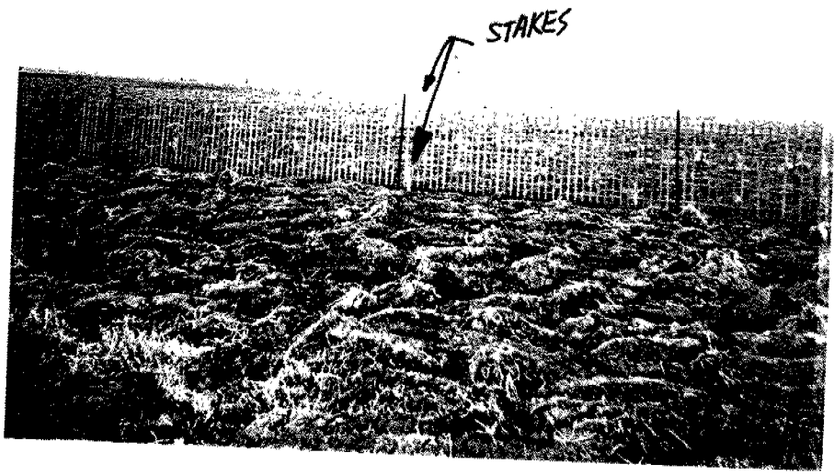
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE; 50 100 150 200 kPa)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
173.22	Ground Level										
172.61	Topsoil, silty clay, low organic Dark Brown										
0.61	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till) Intermediate plasticity		1	SS	15		172				
			2	SS	21						
170.48	Very Stiff Brown		3	TW	PH					20.1	
2.74	Silty clay, with sand, trace gravel, fissured, thin fine sand layers, (Glacial Till) Low plasticity		4	SS	59		170				
			5	SS	52						
168.14	Hard Brown to Grey		6	SS	27		168				
5.18	Silty sand, fine to coarse with gravel (Glacial Till)		7	SS	88/250 mm						
			8	SS	100/200 mm		166				
	Very Dense Grey		9	SS	100/200 mm	▽	164				
			10	SS	100/180 mm						
			11	SS	94		162				
			12	SS	100/150 mm		160				
157.57			13	SS	100/250 mm		158				
15.65	End of Borehole										

Note:
After removal of auger upon completion of drilling, water level at elevation 163.47 and borehole caved at elevation 167.43

+3, ×5 : Numbers refer to Sensitivity

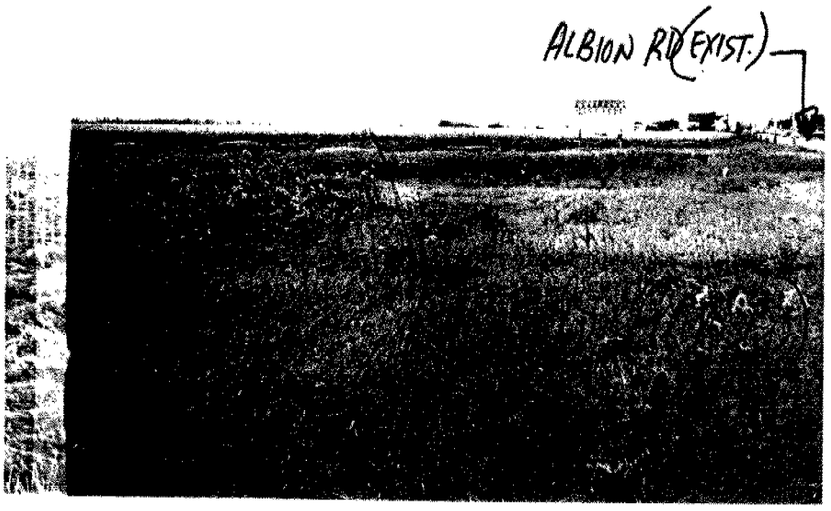
20
15 ◇ 5 (%) STRAIN AT FAILURE
10

ALBION RD/427 WP. 3-80-03 SITE 37-1110



NORTH ALONG ℄ 427 FROM ALBION RD TO STEELES AVE

SOUTH ALONG ℄ 427 AT EXISTING ALBION RD.



WEST ALONG RELOCATED ALBION RD ℄
(STAKE IN FOREGROUND GIVES EQUATION 17+479.2 = 10+000 ALBION RD)

G.I.-30 SEPT. 1976

GEOCRES No. 30M12-164

DIST. 6 REGION

W.P. No. 662-93-01

CONT. No.

W. O. No.

STR. SITE No. 37-1110

HWY. No. 427

LOCATION Albion Rd. Overpass
NBL & SBL

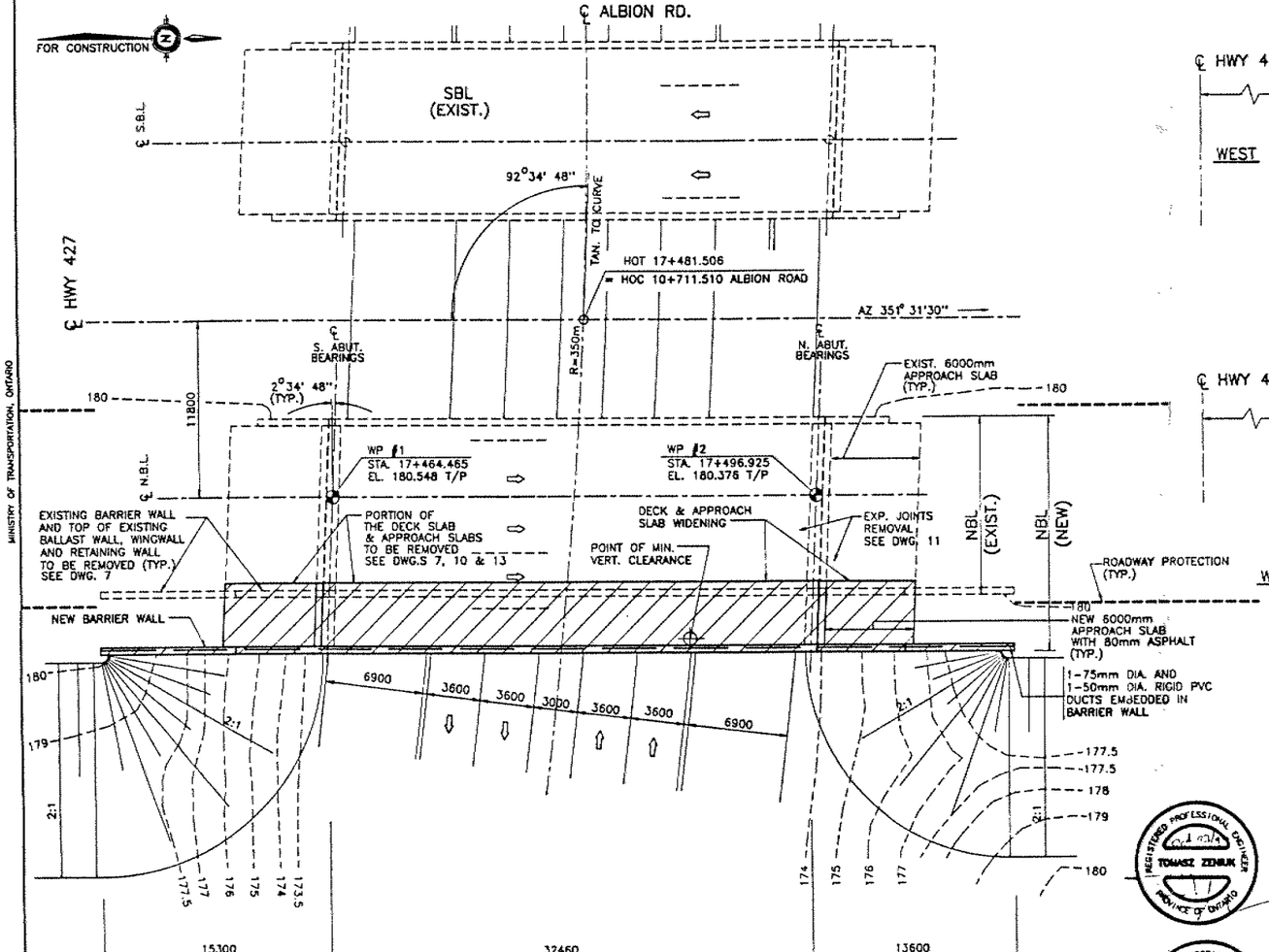
No OF PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

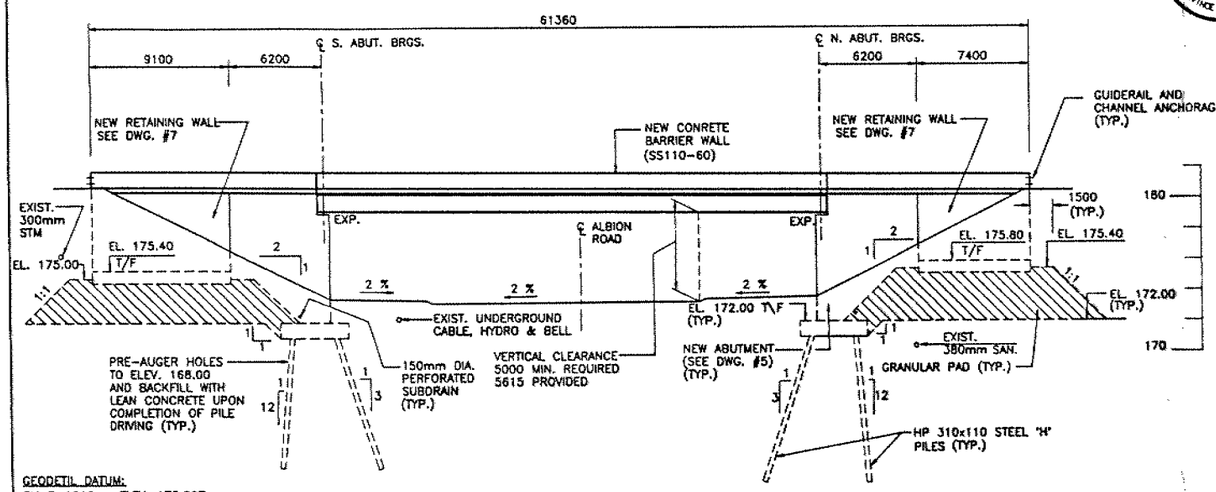
MINISTRY OF TRANSPORTATION, ONTARIO

FOR CONSTRUCTION



NOTES:
W.P. DENOTES WORKING POINT
T/P DENOTES TOP OF ASPHALT PAVEMENT
T/F DENOTES TOP OF FOOTING

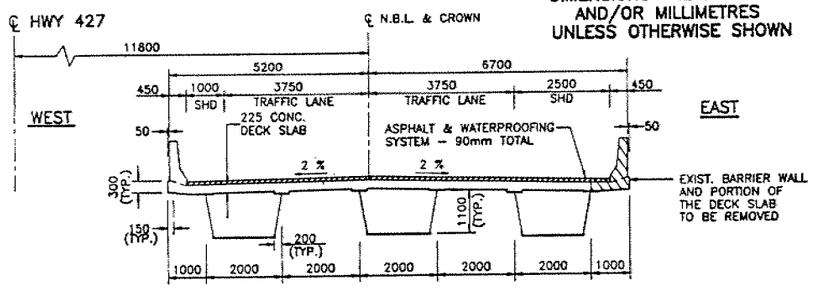
PLAN
1:200



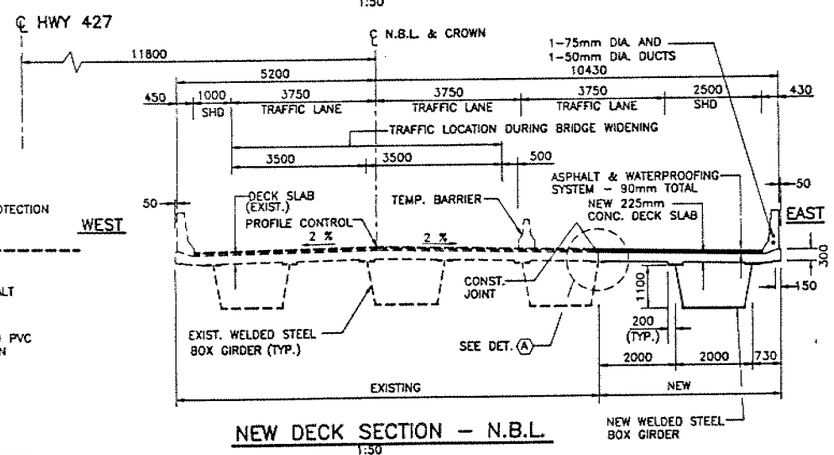
GEODETIL DATUM:
BM E-1010 - ELEV. 173.207
TABLET IN CENTRE AT NORTH END OF WEST CONCRETE PIER OF BRIDGE OVER CNR TRACKS ON ALBION ROAD. 1.160m ABOVE GROUND LEVEL

ELEVATION
1:200

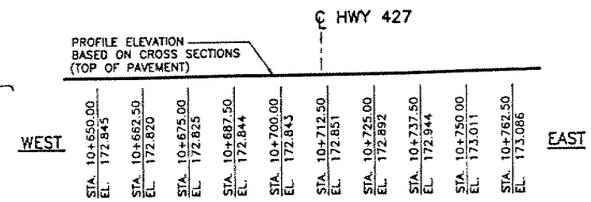
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



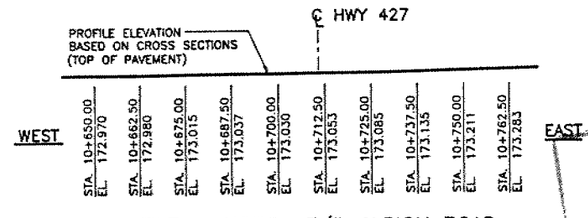
EXISTING DECK SECTION - N.B.L.
1:50



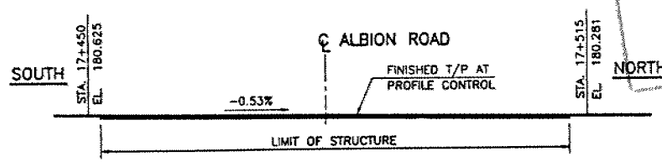
NEW DECK SECTION - N.B.L.
1:50



PROFILE - ℄ ALBION ROAD
N.T.S.

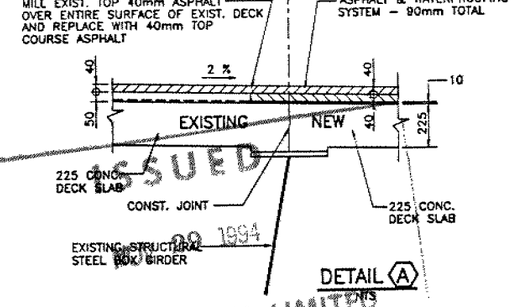


PROFILE - NORTH E/P ALBION ROAD
N.T.S.



PROFILE - HWY 427
N.T.S.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



DETAIL (A)
NTS

DIST No. 6	
CONT No	
WP No 662-93-01	
ALBION RD OVERPASS NBL HWY 427 WIDENING GENERAL ARRANGEMENT	SHEET

Wyllie & Ufnal
consulting engineers

GENERAL NOTES:

1. CLASS OF CONCRETE
   - ALL — 30 MPa
2. CLEAR COVER TO REINFORCING STEEL
   - FOOTINGS — 100 ± 25
   - DECK: TOP. 70 ± 20; BOT. 40 ± 10
   - REMAINDER — 70 ± 20 UNLESS OTHERWISE NOTED
3. REINFORCING STEEL
   REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX 'C' DENOTE COATED BARS.
4. CONSTRUCTION NOTE
   THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESSES FROM THE TOP OF BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESSES ARE DIFFERENT FROM THOSE GIVEN WITH BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE REINFORCING STEEL TO SUIT.

NOTE TO CONTRACTOR:

CONTRACTOR TO CHECK ALL RELEVANT EXIST. STRUCTURE DIMENSIONS AND ELEVATIONS SHOWN ON THE DRAWINGS AND ADJUST ELEVATIONS AS REQUIRED TO MATCH EXIST. STRUCTURE AS APPROVED BY THE ENGINEER.

LIST OF DRAWINGS:

APPLICABLE STANDARD DRAWINGS:

OPSD - 3501.00 GRANULAR BACKFILL REQUIREMENTS-ABUTMENTS
OPSD - 4010.00 GUIDE RAIL & CHANNEL ANCHORAGE
OPSD - 4604 FALSWORK CLEARANCES

ISSUED 09 1994

WYLLIE & UFNAL LIMITED

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	MK	CHK	TZ	CODE	OHBDC-91	LOAD	DATE OCT. 1994
DRAWN	ADG	CHK	MK	SITE	37-1110	STRUCT	SCHEME DWG. 1

REGISTERED PROFESSIONAL ENGINEER — TOMASZ ZENIUK — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — M. KOBIELA — PROVINCE OF ONTARIO

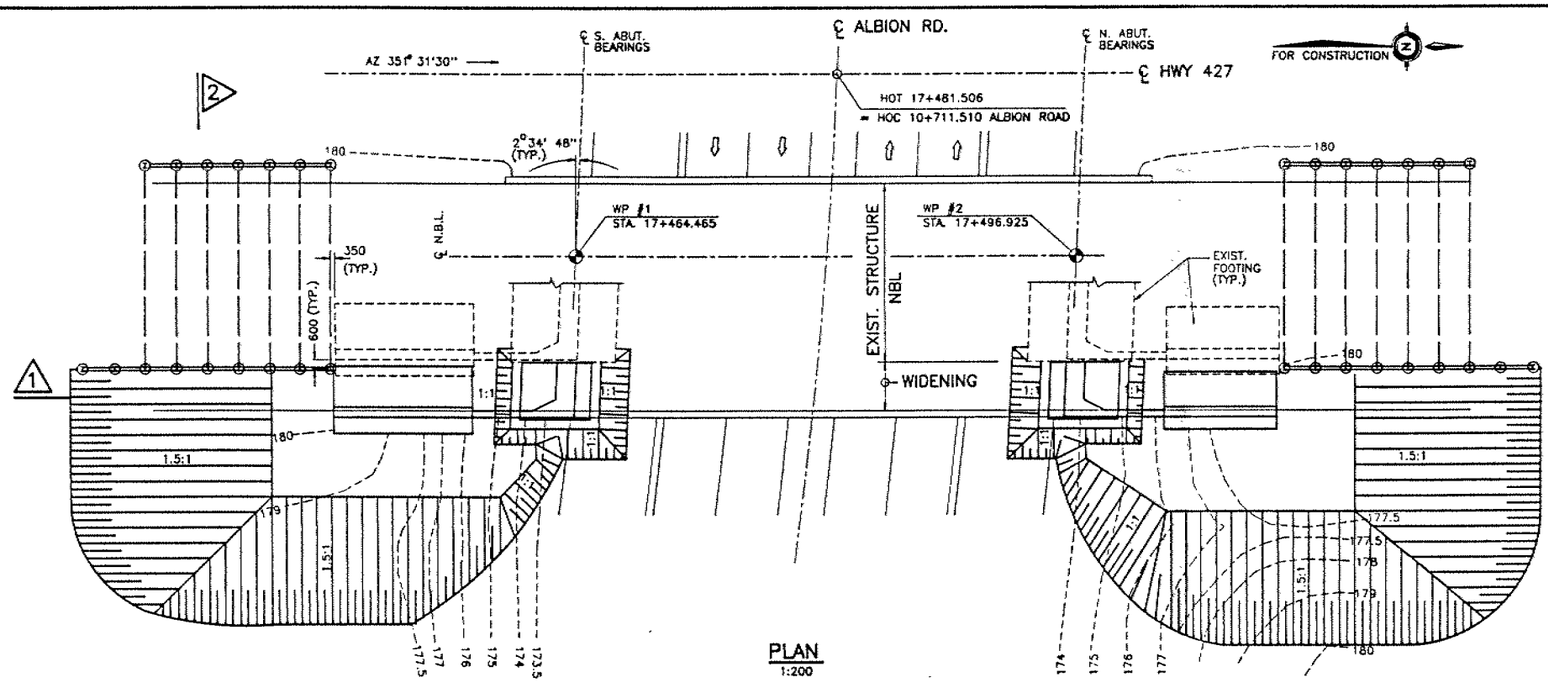
MINISTRY OF TRANSPORTATION, ONTARIO

METRIC

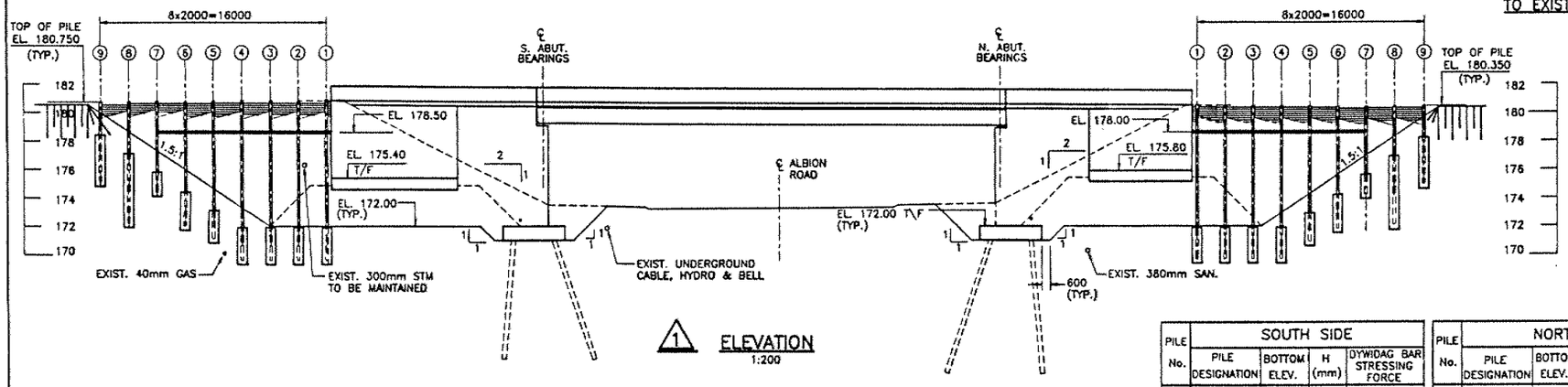
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No	
WP No 662-93-01	
ALBION RD OVERPASS NBL HWY 427 WIDENING ROAD PROTECTION	SHEET

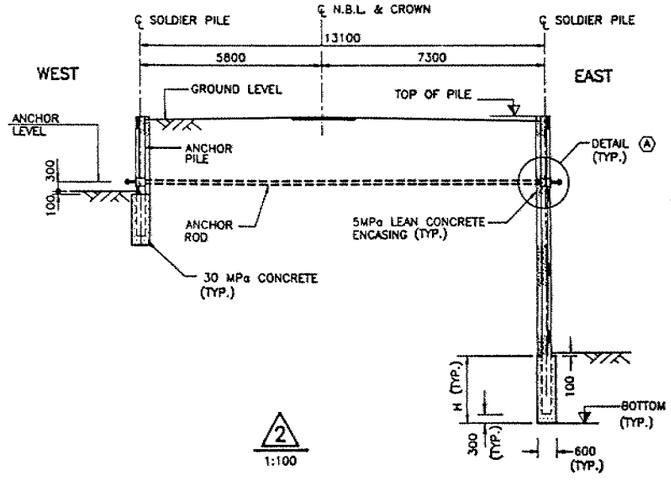
Wyllie & Ufnal consulting engineers



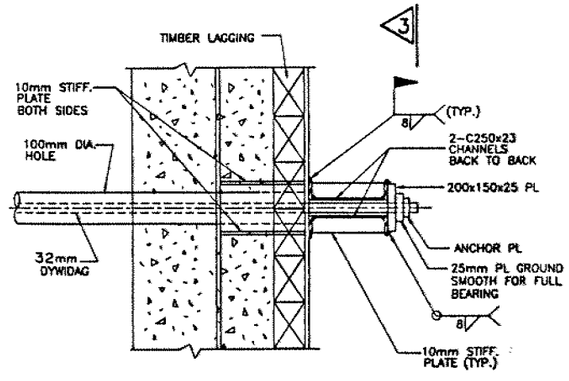
PLAN
1:200



1 ELEVATION
1:200



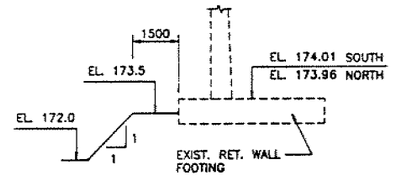
2 1:100



DETAIL (A)
1:10

NOTES:

- STEEL SHALL BE IN ACCORDANCE WITH CAN/CSA G40.21-M92 GRADE 350W.
- TIMBER LAGGING SHALL BE NEW, DOUGLAS FIR CONSTRUCTION GRADE
- MACHINE EXCAVATION SHALL NOT BE CARRIED OUT CLOSER THAN 600mm FROM THE FACE OF THE SOLDIER PILES.
- WELDING IS TO BE CARRIED OUT IN ACCORDANCE WITH CSA W59-M1984
- EXSTING STRUCTURE COMPONENTS LOCATED IN THIS DRAWINGS ARE BASED ON AVAILABLE DWG.S
- ALL DIMENSIONS MUST BE VERIFIED BY THE CONTRACTOR BEFORE PROCEEDING WITH THE WORK.
- PILES ARE TO BE AS DESIGNATED IN TABLE BELOW.
- IN PROXIMITY TO THE EXISTING RETAINING WALL FOOTINGS, EXCAVATION SHALL BE ONLY TO THE LIMIT SHOWN ON THIS DWG.
- THE CONTRACTOR SHALL VERIFY THE LOCATION OF EXISTING UTILITIES AND SHALL NOT DAMAGE ANY OF THE EXISTING UTILITIES WHILE DOING THE WORK



LIMIT OF EXCAVATION IN PROXIMITY TO EXISTING RET. WALL FOOTINGS
N.T.S.

CONSTRUCTION SEQUENCE

STAGE I

1. AUGER 600mm DIA. HOLE INTO NATIVE SOIL TO REQUIRED ELEVATION.
2. PLACE PILE UNITS CENTERED INTO THE HOLE.
3. PLACE 30 MPa CONCRETE TO REQUIRED ELEVATION.
4. PLACE 5 MPa LEAN CONCRETE TO GROUND LEVEL.
5. REPEAT STEPS 1 THRU 4 FOR ALL PILES.

STAGE II

1. INSTALL TIMBER LAGGING TO ELEVATION OF TIE-BACKS.
2. DRILL THROUGH EXISTING ROADWAY. INSTALL ANCHOR RODS 32mm DIA. "DYWIDAG" THREADBARS)
3. INSTALL ANCHOR PILES AND ANCHOR RODS.
4. STRESSING THE ANCHOR RODS (PRESTRESSING FORCE LISTED IN TABLE BELOW).
5. COMPLETE INSTALLATION OF LAGGING AS EXCAVATION CONTINUES.
6. COMPLETE EXCAVATION AND THEN CONSTRUCT STRUCTURE.

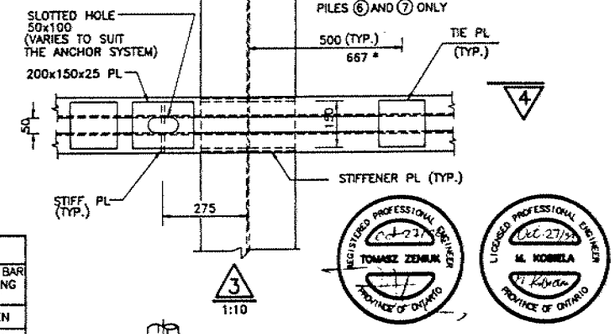
STAGE III

1. RESTRESS THE ANCHOR RODS IF NECESSARY TO AVOID EXCESSIVE DEFLECTION IN THE SOLDIER PILE WALL.
2. BACKFILL THE GROUND TO REQUIRED PROFILE AT PERMANENT STAGE.

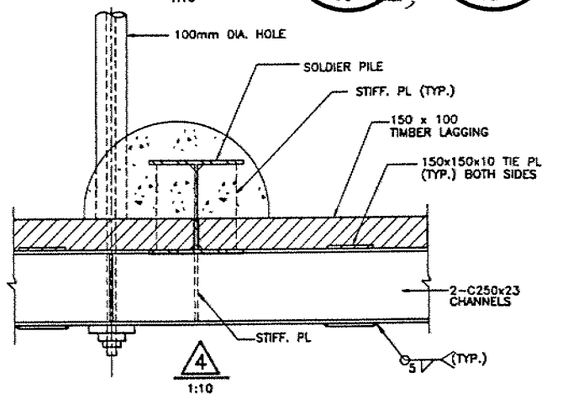
PILE No.	SOUTH SIDE PILE DESIGNATION	BOTTOM ELEV.	H (mm)	DYWIDAG BAR STRESSING FORCE
1	W310x179	169.30	2600	400 KN
2	W310x179	169.30	2600	400 KN
3	W310x179	169.30	2600	400 KN
4	W310x179	169.30	2600	400 KN
5	W310x118	170.80	2300	320 KN
6	W310x74	171.70	2700	240 KN
7	W310x60	174.10	1700	170 KN
8	W310x118	171.90	5200	——
9	W310x60	174.60	3600	——
1A	W310x118	174.10	4000	400 KN
2A	W310x118	174.10	4000	400 KN
3A	W310x118	174.10	4000	400 KN
4A	W310x118	174.10	4000	400 KN
5A	W310x74	174.90	3200	320 KN
6A	W310x60	175.80	2300	240 KN
7A	W310x60	176.60	1500	170 KN

NOTE: SUFFIX 'A' DENOTES ANCHOR PILE

PILE No.	NORTH SIDE PILE DESIGNATION	BOTTOM ELEV.	H (mm)	DYWIDAG BAR STRESSING FORCE
1	W310x179	169.40	2500	375 KN
2	W310x179	169.40	2500	375 KN
3	W310x179	169.40	2500	375 KN
4	W310x179	169.40	2500	375 KN
5	W310x118	170.60	2300	320 KN
6	W310x74	171.50	2700	240 KN
7	W310x60	173.90	1700	170 KN
8	W310x118	171.70	5200	——
9	W310x60	174.60	3600	——
1A	W310x118	173.80	3800	375 KN
2A	W310x118	173.80	3800	375 KN
3A	W310x118	173.80	3800	375 KN
4A	W310x118	173.80	3800	375 KN
5A	W310x74	174.40	3200	320 KN
6A	W310x60	175.30	2300	240 KN
7A	W310x60	176.10	1500	170 KN



3 1:10



4 1:10

REGISTERED PROFESSIONAL ENGINEER TOMASZ ZEMUK PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER M. KOSMELA PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION

DESIGN	MK	CHK	TZ	CODE	OHBDC-91	LOAD		DATE	OCT. 1994
DRAWN	AOG	CHK	MK	SITE	37-1110	STRUCT		SCHEME	DWG. 3

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No

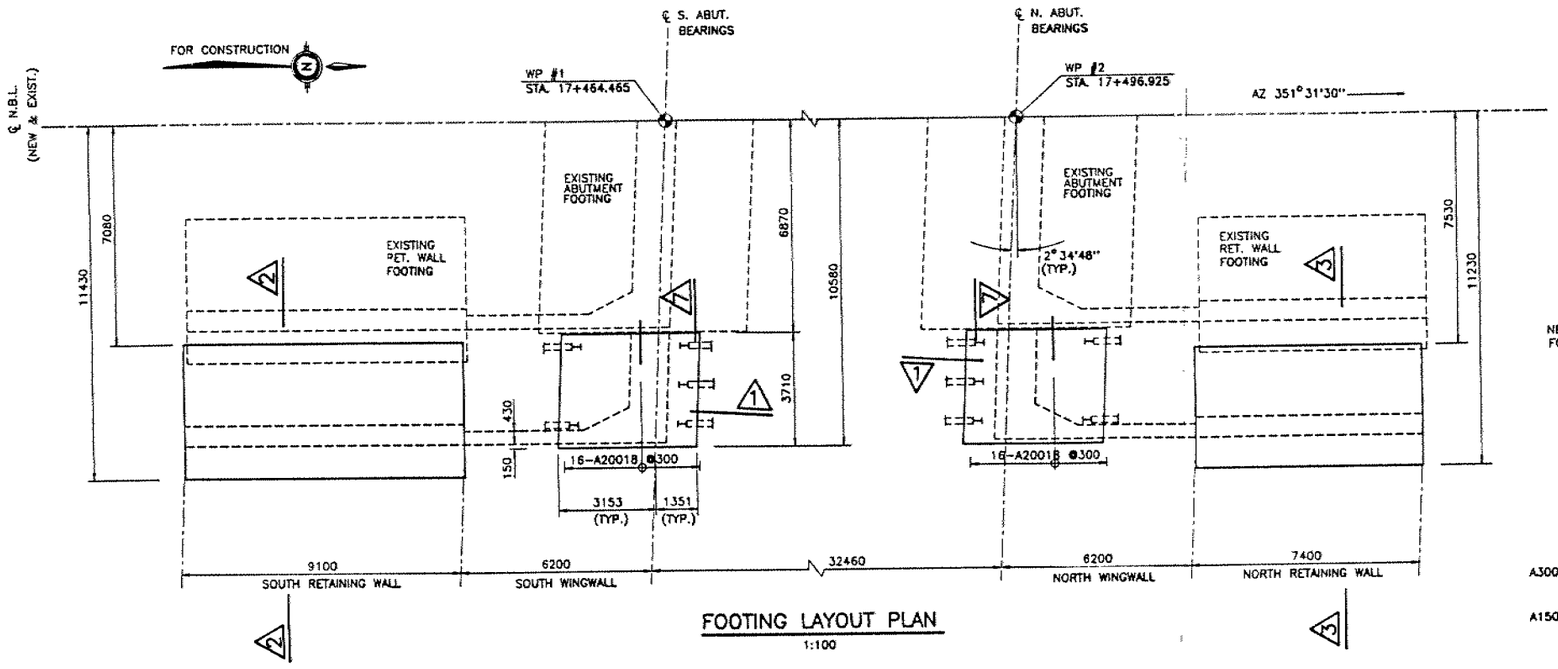
WP No 622-93-01

ALBION RD OVERPASS NBL
HWY 427 WIDENING

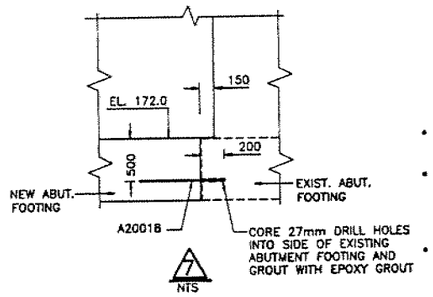
FOOTING LAYOUT & REINFORCING

SHEET

Wyllie & Ufnal
consulting engineers

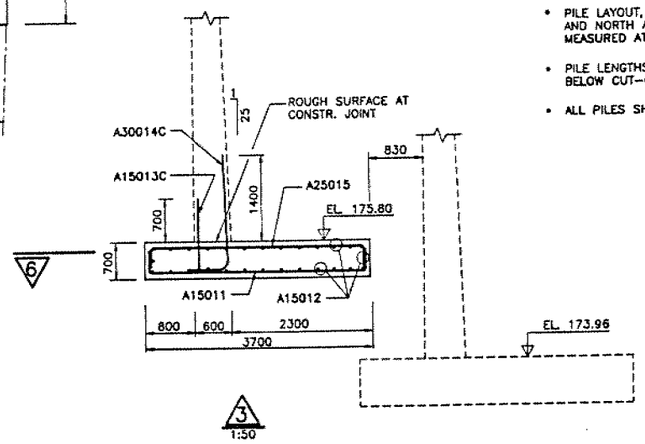


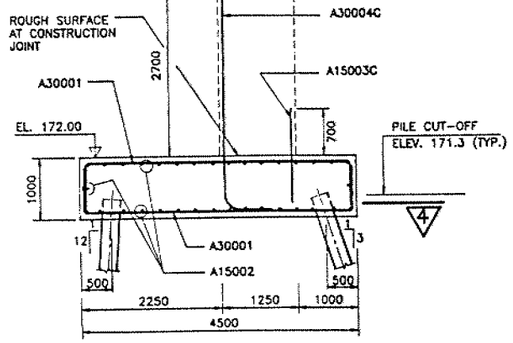
FOOTING LAYOUT PLAN
1:100

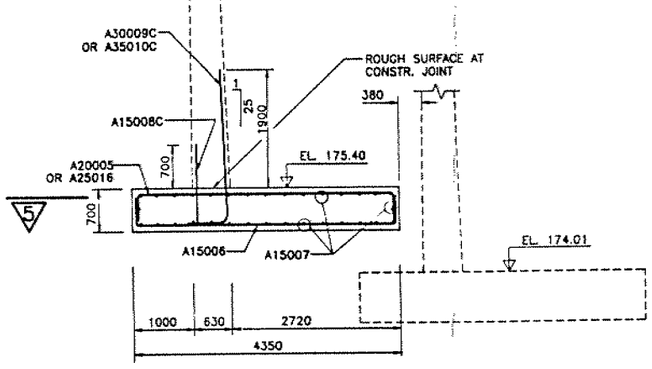


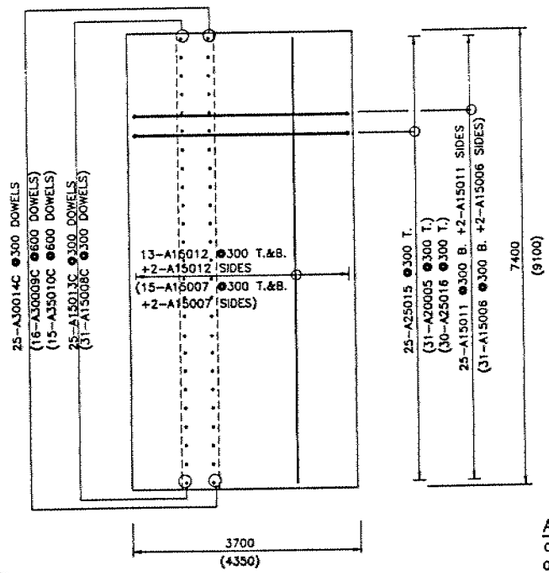
NOTES:

- PILES AT SOUTH AND NORTH ABUTMENTS TO BE HP 310x110 STEEL 'H' PILES.
- PRIOR TO DRIVING THE PILES, THE CONTRACTOR SHALL PRE-AUGER HOLES AT THE PILE LOCATIONS TO A DEPTH OF 3m BELOW THE EXISTING ABUTMENTS FOUNDATION (EL. 168.0) AND UPON COMPLETION OF PILE DRIVING BACKFILL THE HOLES WITH LEAN, 2MPa CONCRETE.
- PILES SHALL BE DRIVEN IN ACCORDANCE WITH STANDARD SS 103-10 OR SS 103-11 USING AN ULTIMATE CAPACITY OF 3450 KN/PILE BUT MUST BE DRIVEN BELOW MINIMUM PILE PENETRATION ELEVATIONS.
- PILE LAYOUT, FOOTING LAYOUT AND REINFORCING AT SOUTH AND NORTH ABUTMENTS SIMILAR - PILE SPACING TO BE MEASURED AT UNDERSIDE OF FOOTINGS.
- PILE LENGTHS SHOWN ARE THE THEORETICAL LENGTHS BELOW CUT-OFF ELEVATIONS.
- ALL PILES SHALL HAVE DRIVING SHOES.



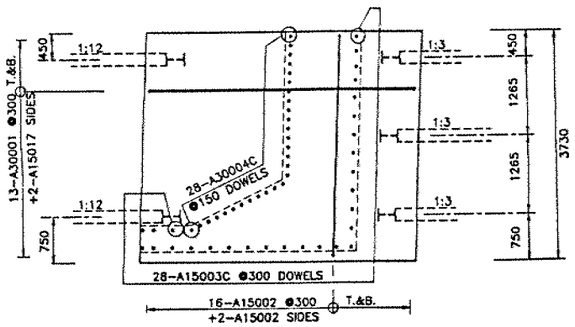






NOTE:
NUMBERS IN BRACKETS ARE FOR SOUTH RETAINING WALL FOOTING

WORKING POINTS LOCATIONS		
W.P. No.	STATION	COORDINATES
1	17+464.465	N 4 845 130.563 E 294 308.959
2	17+496.925	N 4 845 162.669 E 294 304.175



PILE DATA

LOCATION	No.	BATTER	LENGTH	TYPE	MINIMUM PILE PENETRATION ELEV.
SOUTH ABUT.	3	1:3	8750	HP 310x110	163.0 m
	2	1:12	8350		
NORTH ABUT.	3	1:3	7700		164.0 m
	2	1:12	7350		

PILE CAPACITY AT S.L.S. - 1150 KN/PILE
FACTORED PILE CAPACITY AT U.L.S. - 1600 KN/PILE

APPLICABLE STANDARD DRAWING:

OPSD 3301.00 SPLICE AND DRIVING SHOE DETAILS FOR STEEL H-PILES
OPSD 3922.00 SUPPORTS FOR BOTTOM REINFORCING STEEL

REGISTERED PROFESSIONAL ENGINEER TOMASZ ZEMIUK PROVINCE OF ONTARIO Oct 27

LICENSED PROFESSIONAL ENGINEER M. KOBIELA PROVINCE OF ONTARIO Oct 27/94

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION

DESIGN	MK	CHK	TZ	CODE	OHBDC-91	LOAD		DATE	OCT. 1994
DRAWN	ADG	CHK	MK	SITE	37-1110	STRUCT		SCHEME	DWG. 4

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

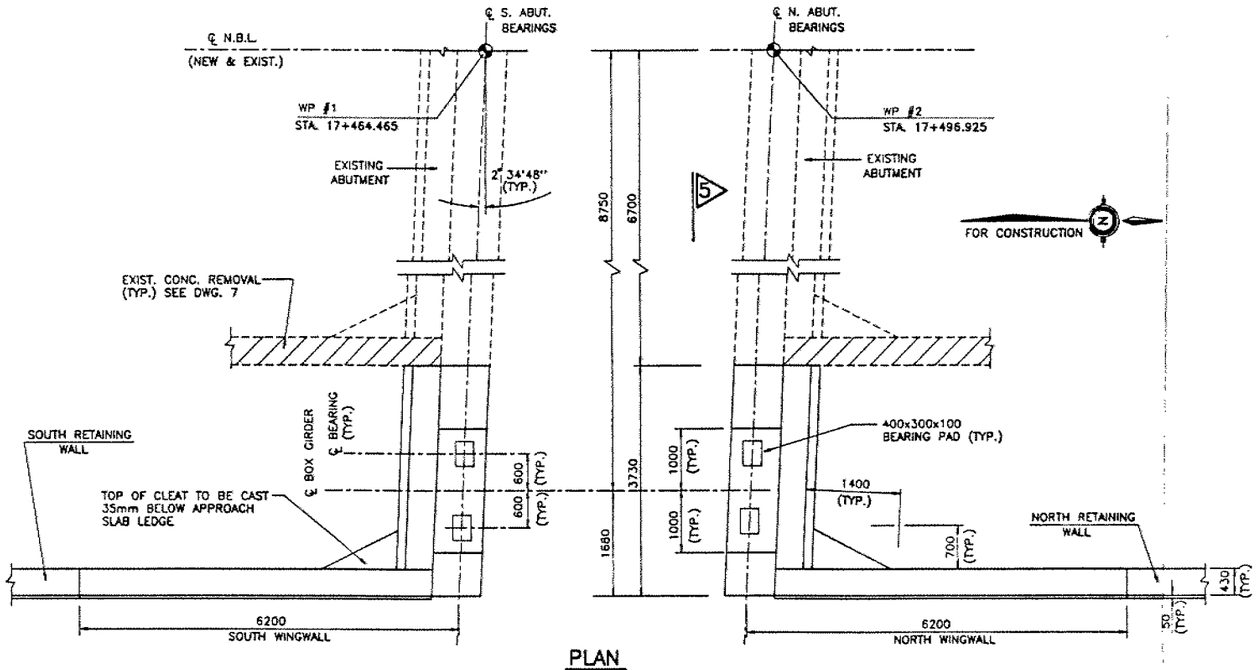
CONT No
WP No 622-93-01

ALBION RD OVERPASS NBL
HWY 427 WIDENING
ABUTMENTS

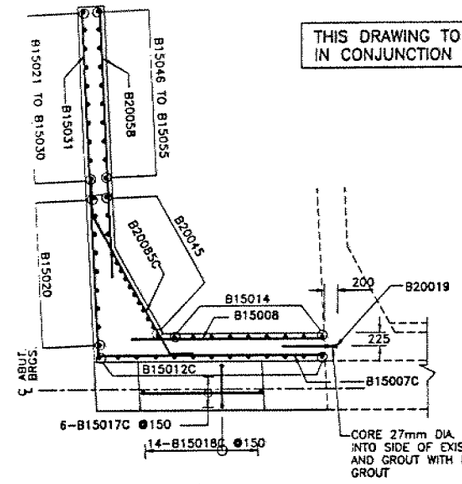
SHEET

Wyllie & Ufnal
consulting engineers

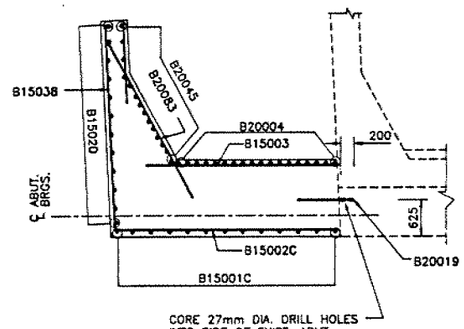
THIS DRAWING TO BE READ IN CONJUNCTION WITH DWG. 6



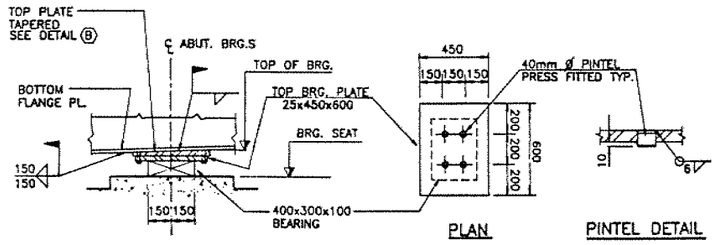
PLAN
1:50



2
1:50

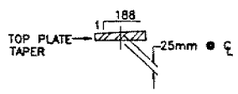


3
1:50



PLAN PINTEL DETAIL

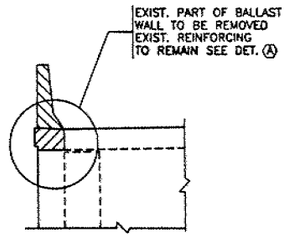
LAMINATED BEARING DETAILS – TYPICAL
NTS



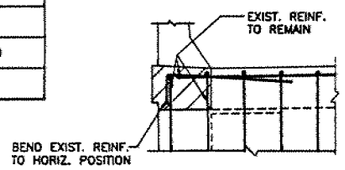
DETAIL Ⓑ
NTS

LAMINATED BEARING DESIGN DATA		
LOAD TYPES	LOCATIONS & REQUIREMENTS AT SLS	
	NORTH ABUT.	SOUTH ABUT.
DEAD LOAD	360 KN	360 KN
TOTAL LOAD	660 KN	660 KN
MAX. MOVEMENT	+\- 17mm	+\- 17mm
MAX. SHEAR RATE*	1.23 KN/mm	1.23 KN/mm
BEARING SIZE	400 x 300 x 100	400 x 300 x 100
NUMBER REQUIRED	2	2

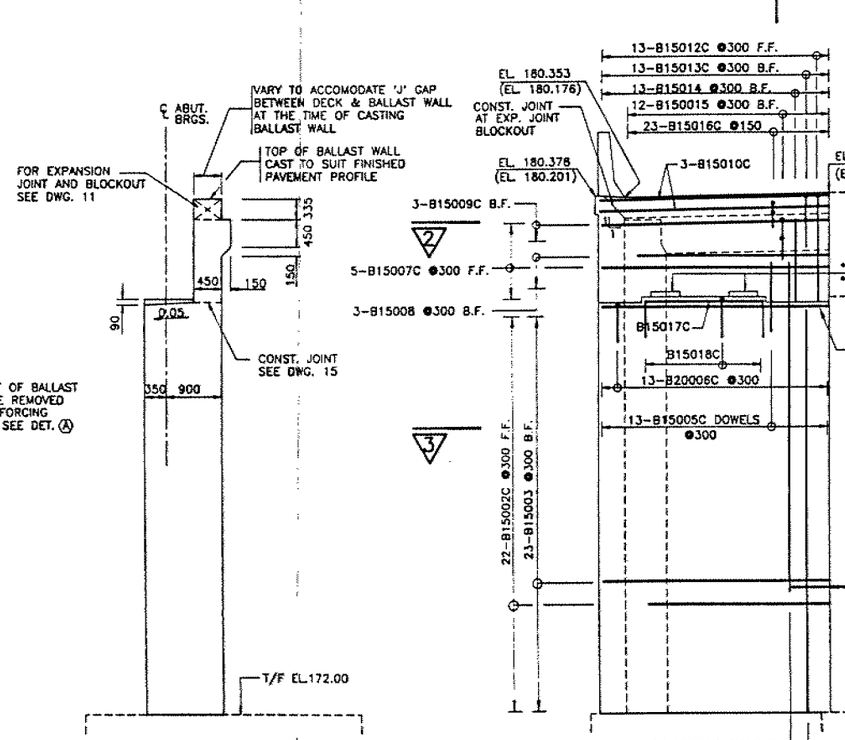
*NATURAL RUBBER OR NEOPRENE



5 EXISTING
1:50

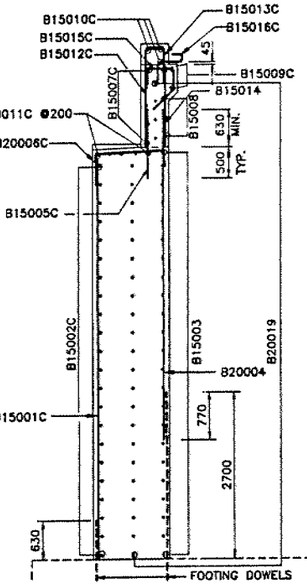


DETAIL Ⓐ
1:25



1 DIMENSIONS
1:50

NOTES:
- B.F. DENOTES BACK FACE
- F.F. DENOTES FRONT FACE
- NORTH ABUTMENT REINFORCING SIMILAR
- BAR MARKS FOR NORTH ABUTMENT STARTS FROM 100 (B15101)
- NORTH ABUTMENT ELEVATIONS ARE IN BRACKETS



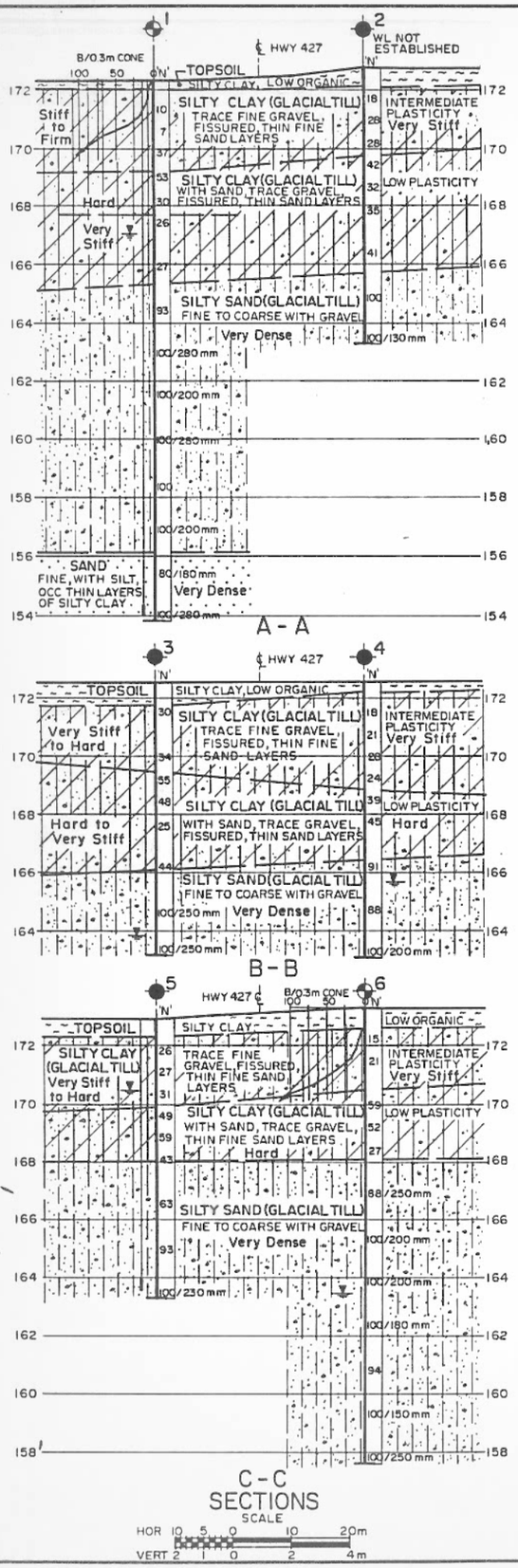
1 REINFORCING
1:50

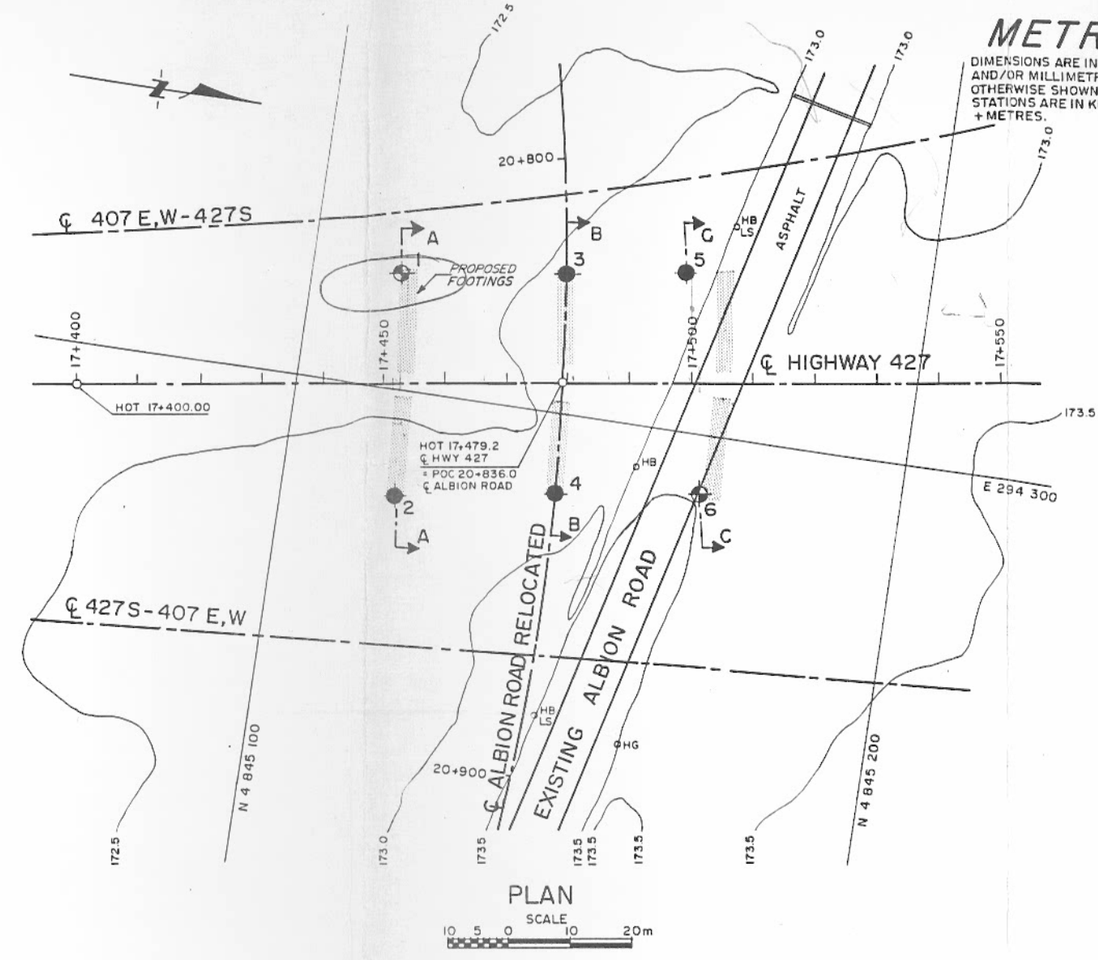
- THESE ELEVATIONS ARE AT THE TOP OF BEARINGS. THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS TO SUIT THE ACTUAL BEARING THICKNESS, WHERE THE ACTUAL BEARING THICKNESS IS DIFFERENT FROM THE ASSUMED BEARING THICKNESS AS SHOWN ON DWG. 11. THE CONTRACTOR SHALL ALSO ADJUST THE REINFORCING TO SUIT.

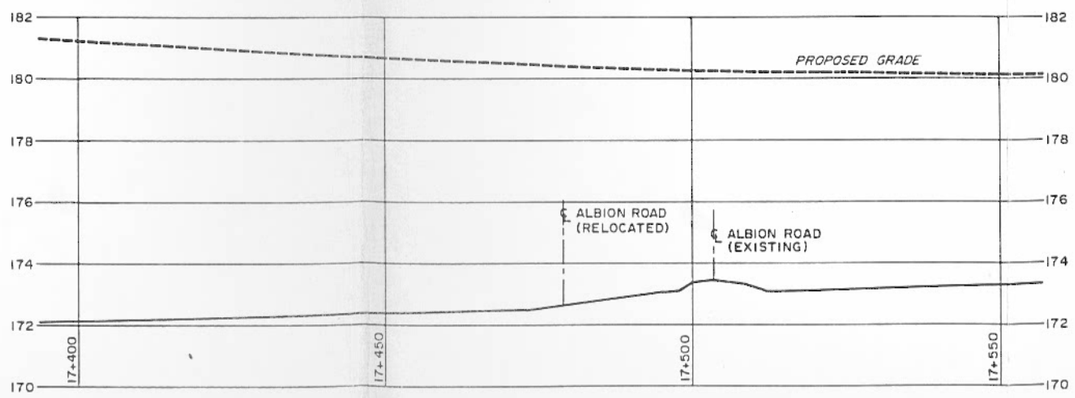
SOUTH ABUTMENT ELEVATION
1:50

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN MK	CHK TZ	CODE OHBDC-91	LOAD DATE OCT. 1994
DRAWN ADG	CHK MK	SITE 37-1110	STRUCT SCHEME DWG. 5





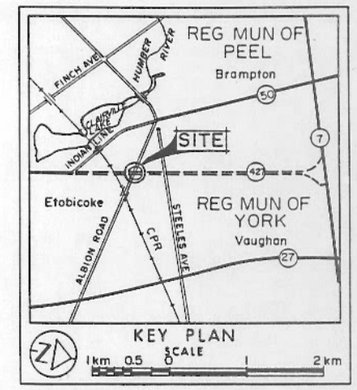


CONT No 03
WP No 153-80-02

ALBION ROAD UNDERPASS STRUCTURE AT HWY 427
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

PETO MacCALLUM LTD.



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 FEB 1982
- PIEZOMETER

No	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
1	172.32	4 845 115	294 281
2	172.70	4 845 119	294 317
3	172.57	4 845 141	294 277
4	172.59	4 845 145	294 313
5	172.89	4 845 161	294 274
6	173.22	4 845 168	294 309

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 30M12-164

HWY No 427			DIST 6
SUBM'D BLK	CHECKED	DATE March 17, 1982	SITE 37-1110
DRAWN K K	CHECKED SP	APPROVED BRG	DWG 1538002-A