#67-F-240 M

VIDAL ST. BRIDGE

SARNIA

NISBET LETHAM LIMITED
206 WATER STREET
SARNIA ONTARIO

Report on SOIL INVESTIGATION for VIDAL STREET BRIDGE SARNIA, ONTARIO.

by

DOMINION SOIL INVESTIGATION LIMITED
369 Queens Avenue
LONDON ONTARIO

Reference No 7-3-L11
May 2nd, 1967.

CONTENTS

ENCLOSURES

I INTRODUCTION

In accordance with authorization from Nisbet Letham Limited, Consulting Engineers, a soil investigation has been carried out in the City of Sarnia where it is proposed to reconstruct a section of Vidal Street. The proposed structure is an overhead road crossing the approach cutting to the St. Clair railway tunnel and a spur line about 300 feet to the north. Vidal Street at this point connects the main city area to the industrial section to the south.

The objects of this investigation as defined by discussions with the client have been:-

(a) to reveal the subsurface conditions and to determine the relevant soil properties for the design and construction of the piers and abutments

(b) to investigate the stability of the existing railway cutting

(c) to recommend the thickness of subbase and base course for the approach road construction

II THE GEOLOGY OF THE SITE

The site is situated in the southern part of the City of Sarnia, in an area of little surface relief. The general ground surface elevation is about El. 602 feet Geodetic datum, and the railway cutting extends down to El. 563 where it crosses the centre line of the road.

The physiographic region, known as the St. Clair Clay Plains, consists of deep clay deposits with a thickness of about 120 feet, overlying black shale bedrock. The surface of the bedrock is usually very flat.

III FIELD WORK

The field work, consisting of 22 boreholes, was carried out during the period April 5 to 27, 1967, at the locations indicated on the site plan, Enclosure 2. The holes were advanced by a continuous flight power auger, except for those put down in the railway cutting which were advanced by a diamond drill machine.

Standard penetration tests were carried out at frequent intervals of depth, as detailed on Appendix 'A', and the results are recorded on the Geotechnical Data Sheets as 'N' values.

Undisturbed samples were obtained in 2-inch diameter thin walled Shelby tubes which were sent to the laboratory for testing. The ends of the samples were sealed in the field to prevent loss of moisture.

The undrained shear strength of the cohesive soil was measured insitu by means of a 4-inch long by 2-inch diameter four bladed rotating vane. The vane was pushed 18-inches in the undisturbed soil below the bottom of the borehole and a torque was applied until the soil failed. The vane was then rotated 10 times to remould the soil and after one minute the torque test was repeated. The shear strength of the soil was calculated from the torque and the dimensions of the vane, and the sensitivity of the material estimated from the ratio of the original torque to the final torque after remoulding.

Elevations were referred to Geodetic benchmarks which were obtained from the City of Sarnia Engineering Department.

IV SUBSURFACE CONDITIONS

Detailed descriptions of the strata encountered in each borehole are given on the Geotechnical Data Sheets, comprising Enclosures 3 to 19. The following notes are intended only to amplify this data:-

Underlying thin surface layers of topsoil, sand and gravel road ballast, and clay fill, the boreholes penetrated a deep clay stratum which extends down to El. 483. Black shale bedrock was encountered at this elevation and was penetrated 5 feet in borehole 4. A core recovery of 100% was obtained which indicates that the bedrock is in a sound condition.

The clay stratum has an upper weathered zone extending down to El. 597. Below the weathered zone, the clay stratum has a very stiff crust which extends down to El. 589.

Unconfined compression tests carried out on samples taken from the crust zone gave values of undrained shear strength ranging from 2750 to 7400 p.s.f.

The colour of the crust is generally brown, however with increasing depth the colour changes to grey and is characterized by an increase in the moisture content and a decrease in the shear strength. The shear strength reaches a minimum value of 1400 p.s.f. at El. 580. Below El. 580 the undrained shear strength increases gradually, as would be expected due to the overburden pressure.

A shear strength against depth relationship is plotted on Enclosure 20, together with the shear strength profile used for design purposes. The high values of undrained shear strength as measured by insitu vane shear tests could be a result of the vane encountering gravel particles thus increasing the normal resistance which would be attributed to the clay.

Classification tests carried out on samples of the brown and grey clay types are listed as follows:-

	Brown Silty Clay	Grey Silty Clay
Bulk density (p.s.f.)	132 to 137	123 to 124
Dry Density "	114 to 124	98 to 101
Moisture Content %	12 to 16	22 to 27
Plastic Limit %	13 to 15	15 to 18
Liquid Limit %	29 to 33	31 to 38
Plasticity Index	13 to 15	22 to 27
Liquidity Index	0	0.1 to 0.5
Sensitivity	-	1.1 to 2.7

V GROUNDWATER CONDITIONS

Over the level part of the site, the groundwater reached equilibrium at an average El. 598. However due to the impermeable nature of the silty clay subsoil a seasonal fluctuation in the water table may be anticipated.

From a visual and tactile examination of the soil samples the groundwater table may be assumed to fluctuate between El. 592 and El. 598.

The groundwater table in the lower part of the railway cutting may be assumed to coincide with the invert elevation of the drainage system.

VI DISCUSSION AND RECOMMENDATIONS

It is understood that the piers and abutments will be about 100 feet in length, and that where the soil conditions permit, they will be supported on strip footing foundations.

The total of the live and dead loads on the pier footings for spans of 100 feet will be about 38 kips per linear foot, and of this total the live loading will constitute 7 kips per linear foot.

The total of the live and dead loads on the abutment footings will be about 25 kips per linear foot and of this total the live loading will constitute 6 kips per linear foot.

PIERS & ABUTMENTS LOCATED NORTH OF THE RAILWAY CUTTING

The critical factor in the prevailing soil conditions is the magnitude of the total loads, and whether the very stiff brown silty clay crust is strong enough to withstand them without imposing too high a load on the relatively compressible grey silty clay layer below. The footings should also be located below the upper layer of weathered silty clay to minimise settlement.

On the basis of the borehole results the optimum elevation which may be considered applicable to the above comments is at El. 596. However due to other circumstances a deeper footing grade may be necessary, and the following table may be used in estimating allowable soil pressures for various footing dimensions and grades.

Footing Elevation feet	Maximum Allowable Soil Pressure tons per square foot						
	Footing Widths Feet						
	Up to: 6	7	8	9	10	11	12
596	3.0	2.9	2.8	2.7	2.6	2.5	2.4
595	2.8	2.8	2.7	2.6	2.5	2.4	2.3
594	2.7	2.6	2.5	2.4	2.3	2.2	2.2
593	2.5	2.4	2.3	2.2	2.2	2.1	2.1
592	2.4	2.3	2.2	2.1	2.1	2.0	2.0
591	2.2	2.2	2.1	2.0	2.0	1.9	1.9
590	2.1	2.0	2.0	1.9	1.9	1.8	1.8

589	1.9	1.9	1.9	1.8	1.8	1.7	1.7
588	1.8	1.8	1.8	1.7	1.7	1.6	1.6
587	1.6	1.6	1.6	1.6	1.5	1.5	1.5
586	1.5	1.5	1.5	1.5	1.4	1.4	1.4

The above soil pressures incorporate a factor of safety of 3 against shear failure of the underlying soil and are calculated on the basis of the undrained shear strength profile shown on Enclosure 20.

Construction

The footing grade should be inspected by a competent soils engineer prior to placing of the concrete and any 'soft' areas removed and replaced by lean concrete.

It is anticipated that seepage will be restricted to any rainfall which occurs during the construction period and in this respect particular care should be taken to protect the footing grade and prevent softening when it is exposed.

Settlement

On the basis of previous laboratory testing carried out on this site and in the same area, the following values of the modulus of compressibility 'K' have been assumed:-

	Modulus of Compressibility tons/sq.foot
Very stiff brown silty clay	140
Stiff grey silty clay	60

Using these values the computed theoretical settlement is about 1.5 inches. However this oedometer value of settlement must be corrected for the effect of rigidity of the foundation and lateral strain taking place during consolidation. Applying these correction factors the most probable value of settlement is estimated to be 0.8 inch. Since the settlement will be due to the long term consolidation of the subsoil, in the settlement analysis only the dead weight of the structure was considered.

A deformation of the clay stratum will take place immediately as the load is applied due to the elastic deformation of the clay, which takes place without dissipation of pore pressure. Based on an assumed modulus of elasticity of 200 tons per square foot it is estimated that the maximum elastic deformation will be about 0.5 inch.

SOUTH ABUTMENT

The layer of weathered silty clay extends down to El. 595.8 at borehole 3 location therefore it is recommended that the footing grade be established at El. 595. For design purposes the allowable soil pressures can be estimated from the table shown in the preceding discussion.

The stability of the railway cutting embankment will depend on the location of the south abutment and approach fill and in this respect calculations indicate that the forward toe of the abutment should be a minimum distance of 10 feet from the edge of the cutting to maintain adequate slope stability.

PIERS LOCATED ON THE SLOPE OF THE RAILROAD CUTTING

The ultimate bearing capacity of foundations on slopes depends on the geometry of the slope and also on the properties of the soil. A method of calculating the ultimate bearing capacity was developed by G. G. Meyerhof which applies a correction to the bearing capacity factor Ncq in the standard formula for bearing capacity.

$$q = c . N_{cq} + \gamma D$$

where q is the ultimate bearing capacity

c is the undrained shear strength

γ is the unit weight

D is the depth of the footing below the ground surface

According to Meyerhofs graphs, using values of slope angle of 20 degrees and a height of slope of 40 feet, the value of the bearing capacity factor is 2.0. The ultimate bearing capacity is therefore 2800 pounds per square foot at the surface of the slope.

It is usual to apply a factor of safety of 3 in bearing capacity design, therefore the allowable bearing capacity of footings on the slope will be 930 p.s.f. plus an additional 40 p.s.f. for each foot of cover above the footing grade.

The above design necessitates a footing width of about 40 feet which is impractical, therefore it is recommended that the piers be supported on friction piles which will transfer the load to the stiffer clays at a much lower depth.

The following estimates of working loads and pile penetrations are based on the shear strength profile shown on Enclosure 20. It is also assumed that the minimum spacing of the piles in each pile cap will be 3 times the pile diameter.

Timber Piles

An adhesion corresponding to 75% of the undrained shear strength of the soil has been assumed for the design of a timber pile foundation.

It is estimated that nominal 12-inch diameter timber piles will achieve a suitable set corresponding to a working load of 30 tons with a penetration of 35 feet. Additional penetration will increase the working load by 1 ton per foot of penetration, however if a working load in excess of 30 tons is proposed, pile loading tests should be performed.

Steel Tube Piles

An adhesion corresponding to [illegible]0% of the undrained shear strength of the soil has been assumed for the design of a steel tube pile foundation.

It is estimated that 12-inch diameter tube piles will develop working loads of 40 and 50 tons capacity with penetrations of 50 and 60 feet respectively.

Steel H-piles

The friction load which may be applied to a steel H-pile will depend on the dimensions of the pile rather than the weight of section used.

The following estimates of working load have been made for different pile sizes and penetrations:-

Type of Pile	Penetration (feet)	Working Load (tons)
BP 8	50	40
BP 8	60	50
BP 10	50	50
BP 10	60	62

Settlement of Piled Foundations

In estimating the consolidation settlement of friction pile foundations, the load from the structure may be considered to act as a spread footing at a depth equal to two thirds of the penetration distance of the pile. Therefore in the estimation of settlement it has been assumed that the load will act at about El. 540.

Based on the assumed modulus of compressibility 'K' of 60 tons per square foot, the estimated consolidation settlement of a typical pile group is 2.0 inches. However this oedometer value of settlement must be corrected for the effect of lateral strain taking place during consolidation, which results in a most probable value of settlement of 1.5 inches.

STABILITY OF THE RAILWAY CUTTING

The stability of the slope of the existing railway cutting was calculated using Taylors stability chart and using the following data:-

Slope angle 20 degrees
Height of Slope (H) 40 feet
Unit weight 124 lb.per cu.ft.

The average undrained shear strength for a factor of safety of 1.0 is 750 p.s.f. therefore based on the minimum shear strength value of 1400 p.s.f. taken from the shear strength profile, it can be assumed that the actual factor or safety is 1.9. This does not take into account the higher shear strength which may be attributed to the very stiff crust and can therefore be considered a conservative value.

The stability of three slip circles were calculated taking into account the load from the south abutment footing and the weight of fill above it. The geometrical layouts of the slip circles are shown on the cross-section of the railway cutting, Enclosure 21.

The results of the slip circle analyses are as follows:-

Slip Circle No.	Factor of Safety
1	2.2
2	2.0
3	1.7

From these results it can be assumed that the critical surface is a deep-seated slip with the arc passing below the toe of the slope and intersecting the ground surface in the level part of the cutting.

The overturning moment due to the load from the abutment footing and approach fill, as calculated in Slip Circle No. 3, amounted to 11.5% of the total overturning moment, therefore the reduction in factor of safety from 1.9 (Taylor's Chrt) to. 1.7 may be attributed to the additional loading from the abutment and approach fill.

CONSTRUCTION OF APPROACH FILLS

The main body of the approach fills may be constructed with granular (sand and gravel) or cohesive silty clay material possessing suitable compaction characteristics. The fill should be placed in layers of six to eight inches in thickness and compacted to at least 95% of the maximum Standard Proctor dry density of the particular material used.

It is usual for granular material to be compacted with a vibratory roller and cohesive material with a sheeps-foot roller to achieve the required compaction. Insitu density tests should be made on the compacted fill to determine whether the required density is being achieved, and to ensure that the moisture content compares favourably with the optimum moisture content for the particular material.

DESIGN OF ROAD SUBBASE AND BASE

Flexible Pavement

There are a great many methods of pavement design differing in their reliability and in their method of approach to the problem. In Ontario, the Department of Highways have established standards of road base which have been proven practically although they may apply only to one particular area.

In this area the following design standards are applicable to the design of road bases on compacted fills:-

	Thickness Granular 'B' or Sand Cushion inches	Thickness Granular 'A'
Clay Fill	18	6
Granular Fill	9	6

Cement Stabilized Base

In the Sarnia area where there is a scarity of granular fill material, the cement stabilized road base may prove more economical.

For design purposes it may be assumed that one inch of cement stabilized soil is equivalent to 2-inches of Granular 'A', or 3-inches of Sand Cushion. It therefore follows that a 6-inch layer of cement stabilized soil on 6-inches of Sand Cushion is equivalent to 4-inches of Granular 'A' on 18-inches of Sand Cushion.

Compaction

Each layer of subbase and base shall be thoroughly compacted to the satisfaction of the Engineer. In the case of controversy a minimum of 100% of the maximum Proctor dry density as determined by the Department of Highways procedure, will be required.

SUMMARY

(i) It is recommended that the footing grade be established at El. 596 for piers and abutments constructed on the north side of the railway cutting.

Allowable soil pressures for the design of spread footing foundations are presented in the report.

(ii) It is recommended that the footing grade for the south abutment be established at El. 595.

Allowable soil pressures for the design of a spread footing may be estimated from the table referred to in the preceding item.

(iii) To maintain the stability of the slopes of the railway cutting the south abutment footing and the footing of the pier closest to the north edge of the cutting shall be a minimum distance of 10 feet from the edge of the cutting.

(iv) It is recommended that piers constructed on the slope of the cutting be supported on friction pile foundations. The working loads which can be developed by timber, steel-tube and steel H-piles are discussed in the report.

(v) The factor of safety with regard to slope failure of the existing cutting is estimated to be 1.9. After completion of the structure the factor of safety is estimated to be 1.7.

Yours very truly,

DOMINION SOIL INVESTIGATION LIMITED

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Branch Manager

REGISTERED PROFESSIONAL ENGINEER
C. J. W. ATKINSON
PROVINCE OF ONTARIO

CJWA:jms

APPENDIX A

STANDARD PENETRATION TESTS

In order to determine the relative density of non-cohesive soils, such as sands and gravels, the standard penetration test has been adopted. The test also gives an indication of the consistency of cohesive soils.

A two-inch external diameter thick-walled sample tube is driven into the ground at the bottom of the borehole by means of a 140 lb. hammer falling fre[illegible]ly through 30 in. The tube is first driven [illegible]ial 6 in. [illegible]llow for the presence of disturbed m[illegible] the bottom of the borehole. The number of standa[illegible], required to drive the sampler a further 12 in. is recor[illegible]. The sample tube used is one originally developed by the Raymond Concrete Pile Company in the United States, where a sufficient number of tests have been made in conjunction with field investigations to show that the results, although essentially empirical, may be applied to foundation design.

For sands:

Values of N	Density
Less than 10	Loose
Between 10 and 30	Compact
Between 30 and 50	Dense
Greater than 50	Very dense

Enclosures

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE.

SOIL COMPONENTS AND GROUND WATER CONDITIONS.

BOULDER	COBBLE	GRAVEL		SAND			SILT	CLAY	ORGANICS	BEDROCK	GROUND WATER LEVEL	DEPTH OF CAVE-IN
		COARSE	FINE	COARSE	MEDIUM	FINE						
Ø > 8"	3"	3/4"	4.76mm	2.0	0.42	0.074	0.002	>	NO SIZE LIMIT			

U.S. Standard Sieve Size: No.4 No.10 No.40 No.200

SAMPLE TYPES.

AS	Auger sample	RC	Rock core	TP	Piston, thin walled tube sample
CS	Sample from casing	%	Recovery	TW	Open, thin walled tube sample
ChS	Chunk sample	SS	Split spoon sample	WS	Wash sample

SAMPLER ADVANCED BY static weight : w
" pressure : p
" tapping : t

OBSERVATIONS MADE WHILE CORING: Steady pressure; No pressure; Intermittent pressure; Washwater returns; Washwater lost

PENETRATION RESISTANCES.

SYMBOL:

DYNAMIC PENETRATION RESISTANCE : to drive a 2"ϕ, 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

STANDARD PENETRATION RESISTANCE, -N- : to drive a 2" outside dia, split spoon sampler 1 foot into the ground, expressed in blows per foot.

EXTRAPOLATED -N- VALUE 322

The energy for the penetration resistances is supplied by a 140 lb. hammer falling 30 inches

SOIL PROPERTIES.

W %	Water content	γ	Natural bulk density (unit weight)	k	Coeff. of permeability
LL %	Liquid limit	e	Void ratio	C	Shear strength — in terms of total stress
PL %	Plastic limit	RD	Relative density	ϕ	Angle of int. friction — in terms of total stress
PI %	Plasticity index	C_v	Coeff. of consolidation	C'	Cohesion — in terms of effective stress
LI	Liquidity index	m_v	Coeff. of volume compressibility	ϕ'	Angle of int. friction — in terms of effective stress

UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —

TRIAXIAL / UNCONFINED COMPRESSION TEST; LABORATORY / FIELD VANE TEST; POCKET PENETROMETER TEST

St St St St

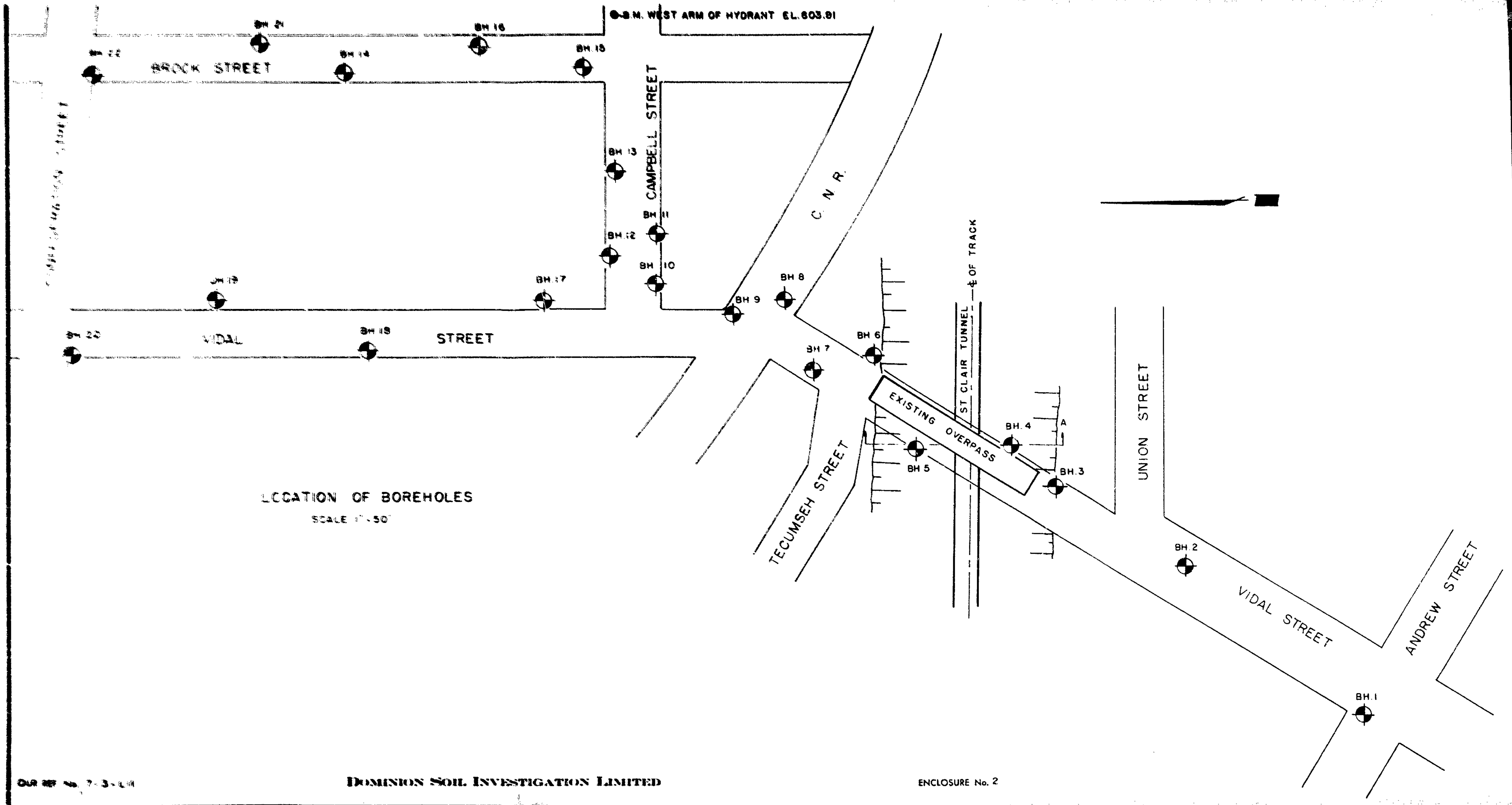
Strain at failure is represented by direction of stem: 20% 15% 5% 10%

St : sensitivity = $\frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$

SOIL DESCRIPTION.

COHESIONLESS SOILS :	RD :
Very loose	0 – 15 %
Loose	15 – 35 %
Compact	35 – 65 %
Dense	65 – 85 %
Very dense	85 – 100 %

COHESIVE SOILS :	C lbs/sq.ft.
Very soft	less than 250
Soft	250 – 500
Firm	500 – 1000
Stiff	1000 – 2000
Very stiff	2000 – 4000
Hard	over 4000



LOCATION OF BOREHOLES

SCALE 1"=50'

GEOTECHNICAL DATA SHEET FOR BOREHOLES 1 & 2.

OUR REFERENCE NO. 7-3-L11

CLIENT: Nisbet Letham Limited
PROJECT: Vidal Street Bridge
LOCATION: Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING: Auger
DIAMETER OF BOREHOLE: 4-inch
DATE: April 5 & 6, 1967

ENCLOSURE NO. 3

Columns: Elevation ft | Depth ft | Stratification Description | Stratification Symbol | Samples (Number, Type, Blows per 6" of sampler) | Penetration Resistance (blows per foot: 20 40 60 80 100); Shear Strength (100 lbs sq ft: 10 20 30 40 50) | Consistency (water content %: PL, W, LL; 10 20 30 40) | Remarks

Borehole 1

Elevation ft	Depth ft	Stratification Description	Sample No.	Type	Blows
602.5	0.0	Ground Surface			
		4" Asphalt			
		Stiff grey weathered silty clay trace of organics	1	SS	8
	5.0	Silty clay, containing traces of sand and gravel (Glacial Till) — Very stiff brown, stiff grey	2	SS	12
			3	SS	39
			4	SS	29
			5	SS	12
	17.5	End of Borehole			

Shear strength: St=1.8

Remarks: W. L. El.598.7 11/4/1967

Borehole 2

Elevation ft	Depth ft	Stratification Description	Sample No.	Type	Blows
603.2	0.0	Ground Surface			
		Sand and gravel (Fill)			
	3.0	Stiff grey weathered silty clay	1	SS	12
			2	SS	6
	6.5	Silty clay containing traces of sand and gravel (Glacial Till) — Very stiff brown, stiff grey	3	SS	25
			4	SS	25
			5	SS	6
	17.5	End of Borehole			

Shear strength: St=1.6

Remarks: W. L. El.599.4 11/4/1967

Elevation scale: 600, 595, 590, 585

VERTICAL SCALE 1 IN TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

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GEOTECHNICAL DATA SHEET FOR BOREHOLE 3

OUR REFERENCE NO 7-3-L11

CLIENT Nisbet Letham Limited
PROJECT Vidal Street Bridge,
LOCATION Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 6, 1967

ENCLOSURE NO 4

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	SAMPLES NUMBER	TYPE	No. of Blows per ft of Sample	PENETRATION RESISTANCE (blows per foot: 20 40 60 80 100) / SHEAR STRENGTH 100 lbs sq ft (10 20 30 40 50)	CONSISTENCY water content % (PL W LL: 10 20 30 40)	REMARKS
603.8	0.0	Ground Surface						
		4" Asphalt Sand & Gravel						
	2.5	Stiff grey/brown weathered silty clay trace of organics	1	SS	8			
			2	SS	8			
	8.0	Very stiff silty clay, traces of sand and gravel. Brown ---- Grey	3	SS	29		PL–W–LL plotted	
			4	SS	31			
			5	SS	17			
			6	SS	7	St=1.8		
	20.0	Compact to dense grey silt	7	SS	26			
			8	SS	31			
	27.0	Stiff to very stiff grey silty clay, traces of gravel.	9	SS	9	St=1.7		
			10	TW		St=1.7		
			11	SS	5	St=1.8		
			12	SS	5	St=1.8		
			13	SS	12	St=1.6		
	52.5	End of Borehole						

Elevation scale: 600, 595, 590, 585, 580, 575, 570, 565, 560, 555, 550

VERTICAL SCALE: 1 IN TO FT

DOMINION SOIL INVESTIGATION LIMITED

MADE CH'D

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLE 4

OUR REFERENCE NO. 7-3-L11

CLIENT: Nisbet Letham Limited
PROJECT: Vidal Street Bridge
LOCATION: Sarnia, Ontario.
DATUM ELEVATION:

METHOD OF BORING: Washboring
DIAMETER OF BOREHOLE: NX (3-inch)
DATE: April 26 & 27, 1967
ENCLOSURE NO. 5

Elevation ft	Depth ft	Stratification Description	Sample Number	Type	Blows per ft (N)	Penetration Resistance / Shear Strength	Remarks
582.4	0.0	Ground Surface					
		4" Topsoil					
580		Stiff to very stiff grey silty clay, containing traces of sand and gravel	1	SS	11	o	
			2	TW		+ St=1.3	
575			3	SS	9	o	
						+ St=1.4	
			4	TW			
570						+ St=1.5	
			5	SS	8	o	
						+ St=1.6	
			6	SS	10	o	
565						+ St=1.3	
			7	TW			
560						+ St=1.4	
			8	SS	10	o	
555						+ St=1.5	
			9	SS	26	o	
550							
			10	SS	21	o	
545						+ St=1.4	
			11	SS	20	o	
540	42.5					+ St=1.7	
		End of Borehole					

Penetration Resistance (blows per foot): 20 40 60 80 100
Shear Strength (100 lbs sq ft): 10 20 30 40 50
Consistency (water content %): P W L

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: CH'D:

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLE 5

OUR REFERENCE NO. 7-3-L11

CLIENT: Sisbet Lethaw Limited
PROJECT: Vidal Street Bridge
LOCATION: Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING: Washboring
DIAMETER OF BOREHOLE: Bx (3-inch)
DATE: April 25 & 26, 1967
DIA. CORE NO.

PENETRATION RESISTANCE (blows per foot): 20 40 60 80 100
SHEAR STRENGTH 100 lbs sq ft: 10 20 30 40 50
CONSISTENCY (water content %): PL W LL

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	SAMPLE NUMBER	TYPE	BLOWS PER FOOT	SHEAR (VANE)	REMARKS
580.3	0.0	Ground Surface					
		4" Topsoil					
		Stiff	1	SS	24		
575		brown	2	SS	13		
		to ---- grey	3	SS	6	St=1.3	
570			4	TW		St=1.5	
		very	5	SS	4	St=1.6	
565			6	TW		St=1.5	
		stiff				St=1.5	
560			7	SS	10	St=1.3	
		silty					
555			8	SS	12	St=1.5	
		clay,					
550			9	SS	11	St=1.5	
		containing					
545			10	TW		St=1.3	
		traces					
540			11	SS	21		
		of					
535						St=1.4	
		sand					
530			12	SS	21		
525		and					
520		gravel	13	SS	21		
515						St=1.7	
510			14	SS	13		
505						St=1.8	
500			15	SS	13		
495						St=1.8	
490			16	SS	13		
485	97.0	Black shale (Bedrock)	17	AXT	Rec. 100%		
480	102.0	End of Borehole					
475							

VERTICAL SCALE: 1 IN. TO 5 FT. — DOMINION SOIL INVESTIGATION LIMITED — MADE — CHD

GEOTECHNICAL DATA SHEET FOR BOREHOLE 6.....

OUR REFERENCE NO. 7-3-L11

CLIENT Nisbet Letham Limited
PROJECT Vidal Street Bridge,
LOCATION Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 5, 1967

ENCLOSURE NO. 7

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	SAMPLE NUMBER	TYPE	"N" or Advancement of Sampler	SHEAR STRENGTH (lbs sq ft)	REMARKS
604.1	0.0	Ground Surface					
		8" Topsoil					
	4.0	Loose black cinder Fill	1	SS	9		
600		Stiff brown weathered silty clay	2	SS	9		W. L. El.598.1 21/4/1967
	7.5						
595		Silty clay containing traces of sand and gravel; Very stiff brown	3	SS	16		
			4	SS	24		
590			5	SS	12	St=1.3	
			6	SS	12	St=1.4	
585		Stiff grey	7	SS	8	St=2.0	
580			8	SS	11	St=2.7	
575	29.0	Very dense grey silt	9	SS	77		
570	33.5	Stiff grey silty clay trace of fine gravel	10	SS	8	St=1.8	
565			11	SS	4	St=2.0	
	42.5	End of Borehole					
560							

PENETRATION RESISTANCE blows per foot: 20 40 60 80 100
SHEAR STRENGTH 100 lbs sq ft: 10 20 30 40 50
CONSISTENCY water content %: PL W LL

VERTICAL SCALE 1 IN. TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE CH'D

GEOTECHNICAL DATA SHEET FOR BOREHOLE 7

OUR REFERENCE NO. 7-3-L11

CLIENT Nisbet Letham Limited
PROJECT Vidal Street Bridge
LOCATION Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 10, 1967

ENCLOSURE NO. 8

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	SAMPLE NUMBER	TYPE	Blows per foot	PENETRATION RESISTANCE (blows per foot) / SHEAR STRENGTH (100 lbs. sq ft)	REMARKS
601.8	0.0	Ground Surface					
		4" Asphalt; Sand & gravel					
600	2.0	Stiff grey brown weathered silty clay	1	SS	11		W. L. El.597.3 21/4/1967
	5.0	Silty clay containing traces of sand and gravel (Glacial Till) — Very stiff brown / Stiff grey	2	SS	20		
595			3	SS	33		C=6960 p.s.f.
			4	SS	19		
590			5	SS	13	St=1.2	
			6	SS	16	St=2.1	
585							
580			7	SS	5	St=1.3	
575			8	SS	8	St=1.3	
570			9	TW		St=1.4	
565			10	SS	12	St=1.1	
560	42.5		11	SS	11	St=1.3	
		End of Borehole					

Penetration resistance scale: 20 40 60 80 100 (blows per foot); Shear strength scale: 10 20 30 40 50 (100 lbs. sq ft); Consistency: water content % (PL, W, LL)

VERTICAL SCALE: 1 IN. TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE CH'D

GEOTECHNICAL DATA SHEET FOR BOREHOLE 8

OUR REFERENCE NO. 7-3-L11

CLIENT: Nisbet Letham Limited
PROJECT: Vidal Street Bridge
LOCATION: Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING: Auger
DIAMETER OF BOREHOLE: 4-inch
DATE: April 13, 1967

ENCLOSURE NO. 9

Elevation ft	Depth ft	Stratification Description	Sample Number	Type	N (Blows per foot)	Shear Strength	Remarks
603.5	0.0	Ground Surface					
		6" Cinder Fill					
		Stiff brown weathered silty clay trace of organics	1	SS	9		W. L. El.600.0 21/4/67.
	5.5		2	SS	20		
		Very stiff silty clay, brown --- grey, containing traces of sand and gravel (Glacial Till)	3	SS	40		
			4	SS	29		
			5	SS	14	St=1.3	
			6	SS	11	St=1.6	
			7	SS	7	St=1.3	
			8	SS	8	St=1.3	
			9	TW		St=1.3	
			10	SS	9	St=1.4	
		stiff	11	SS	8	St=1.4	
	42.6	End of Borehole					

Elevation scale: 600, 595, 590, 585, 580, 575, 570, 565, 560

Penetration Resistance (blows per foot): 20 40 60 80 100
Shear Strength (100 lbs/sq ft): 10 20 30 40 50
Consistency (water content %): PL W LL — 10 20 30 40

VERTICAL SCALE: 1 IN. TO 5 FT

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLE 9

OUR REFERENCE NO 7-3-L11

CLIENT Nisbet Letham Limited
PROJECT Vidal Street Bridge
LOCATION Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 7, 1967

ENCLOSURE NO 10

Elevation ft	Depth ft	Stratification Description	Sample Number	Type	Blows or Advancement of Sampler	Shear Strength notes	Remarks
603.4	0.0	Ground Surface					
		Sand, gravel and cinder (Fill)					
	3.0	Stiff brown weathered silty clay	1	SS	8		W. L. El. 598.4 21/4/67
	7.0	Silty clay containing traces of sand and gravel	2	SS	26		
		brown / grey	3	SS	24		
		very stiff	4	SS	15	St=1.8	
		stiff	5	SS	8	St=1.8	
			6	SS	10	St=1.7	
			7	TW		St=2.2	
			8	SS	7	St=1.4	
			9	SS	5	St=1.7	
			10	TW		St=2.2	
			11	SS	2	St=2.0	
		very stiff	12	SS	12	St=2.1	
	52.5	End of Borehole					

PENETRATION RESISTANCE blows per foot: 20 40 60 80 100
SHEAR STRENGTH 100 lbs sq ft: 10 20 30 40 50
CONSISTENCY water content %: Pl W Ll

VERTICAL SCALE: 1 IN. TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

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DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLE 10

OUR REFERENCE NO 7-3-L11

CLIENT Nisbet Lethem Limited
PROJECT Vidal Street Bridge
LOCATION Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 11, 1967

ENCLOSURE NO 11

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	SAMPLE NUMBER	TYPE	"N" or Advancement of Sampler	PENETRATION RESISTANCE (blows per foot) / SHEAR STRENGTH (100 lbs sq ft)	REMARKS
602.1	0.0	Ground Surface					
		4" Topsoil					
		Stiff brown weathered silty clay, trace of organics	1	SS	14		
	4.5	Very stiff silty clay, brown / grey, containing traces of sand and gravel, stiff (Glacial Till)	2	SS	26		
			3	SS	37		C=7400 p.s.f.
			4	SS	19		
			5	SS	13	St=1.4	
			6	SS	11	St=1.4	
			7	SS	11	St=1.4	W. L. El.582.1 21/4/67
			8	SS	11	St=1.5	
			9	SS	6	St=1.4	
570	32.5	End of Borehole					

Elevation scale: 600, 595, 590, 585, 580, 575, 570

Penetration resistance scale: 20 40 60 80 100; Shear strength scale: 10 20 30 40 50

CONSISTENCY water content %: PL W LL

VERTICAL SCALE: 1 IN TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

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DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLE 11

OUR REFERENCE NO. 7-3-L11

CLIENT: Nisbet Letham Limited
PROJECT: Vidal Street Bridge
LOCATION: Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING: Auger
DIAMETER OF BOREHOLE: 4-inch
DATE: April 11 & 12, 1967

ENCLOSURE NO. 12

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	SAMPLES NUMBER	TYPE	N or Advancement of Sampler	PENETRATION RESISTANCE blows per foot (20 40 60 80 100) / SHEAR STRENGTH 100 lbs sq ft (10 20 30 40 50)	CONSISTENCY water content % (PL W LL)	REMARKS
602.4	0.0	Ground Surface						W. L. El. 601.9 21/4/67
		5" Topsoil						
600	4.5	Stiff brown weathered silty clay	1	SS	13			
		Silty clay containing traces of sand and gravel (Glacial Till); very stiff brown / stiff grey	2	SS	20			
595			3	SS	42			C=5200 p.s.f.
			4	SS	30			
590			5	SS	14	St=5.8		
			6	SS	10	St=1.2		
585								
			7	SS	5			
580						St=1.0		
			8	SS	5			
575						St=2.0		
			9	SS	6			
570						St=1.4		
			10	TW				
565								
			11	TW				
560	42.5	End of Borehole						

VERTICAL SCALE 1 IN. TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

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DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLE 12 . . . .

OUR REFERENCE NO 7-3-L11

CLIENT: Nisbet Lethnm Limited
PROJECT: Vidal Street Bridge
LOCATION: Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING: Auger
DIAMETER OF BOREHOLE: 4-inch
DATE: April 8, 1967

ENCLOSURE NO 13

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	SAMPLE NUMBER	TYPE	"N" or Advancement of Sampler	SHEAR STRENGTH	REMARKS
602.5	0.0	Ground Surface					
		4" Asphalt					
	2.0	Sand & Gravel					W. L. El.600.0 21/4/67
600		Stiff brown weathered silty clay,	1	SS	11		
	5.5	trace of organics					
		Silty clay, brown	2	SS	25		
595			3	SS	30		
			4	SS	27		
590			5	SS	21		
		grey, containing	6	SS	11	St=1.4	
585		Very stiff					
		traces of sand and gravel, stiff	7	SS	7	St=1.3	
580							
			8	SS	7	St= 1.5	
575							
			9	SS	11	St=1.3	
570	32.5	End of Borehole					

PENETRATION RESISTANCE blows per foot: 20 40 60 80 100
SHEAR STRENGTH 100 lbs/sq ft: 10 20 30 40 50
CONSISTENCY water content %: PL W LL

VERTICAL SCALE: 1 IN. TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE: CH'D:

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CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLE 13

OUR REFERENCE NO 7-3-L11

CLIENT Nisbet Letham Limited
PROJECT Vidal Street Bridge
LOCATION Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 12, 1967

ENCLOSURE NO 14

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	SAMPLE NUMBER	TYPE	BLOWS PER FOOT (Advancement of Sampler)	PENETRATION RESISTANCE / SHEAR STRENGTH	CONSISTENCY	REMARKS
602.0	0.0	Ground Surface						
		4" Asphalt						
	2.0	Sand & gravel						
600		Stiff brown weathered silty clay	1	SS	8			W. L. El.598.0 11/4/67
	5.0							
		Silty clay brown (very stiff) containing traces of sand and gravel	2	SS	18			
595			3	SS	43			C=6830 p.s.f.
			4	SS	21			
590		grey	5	SS	15			
			6	SS	8			
585						St=2.0		
		stiff	7	SS	7			
580						St=1.4		
			8	TW				
575	29.0							
		Very dense grey silt	9	SS	74			
570	33.0							
		Stiff to very stiff grey silty clay traces of sand, & gravel	10	SS	7			
565						St=1.1		
			11	SS	9			
560						St=2.2		
			12	SS	17			
555						St=1.4		
			13	SS	15			
550	52.5					St=2.5		
		End of Borehole						

PENETRATION RESISTANCE blows per foot 20 40 60 80 100; SHEAR STRENGTH 100 lbs sq ft 10 20 30 40 50; CONSISTENCY water content % PL W LL 10 20 30 40

VERTICAL SCALE: 1 IN TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: CH'D:

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLE 14 . . . .

OUR REFERENCE NO 7-3-L11

CLIENT Nisbet Letham Limited
PROJECT Vidal Street Bridge
LOCATION Sarnia, Ontario
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 13, 1967

ENCLOSURE NO 15

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES Advancement of Sampler	PENETRATION RESISTANCE blows per foot (20 40 60 80 100) / SHEAR STRENGTH 100 lbs sq ft (10 20 30 40 50)	CONSISTENCY water content % (PL W LL)	REMARKS
602.0	0.0	Ground Surface							
		4" Topsoil							
600		Stiff brown weathered silty clay		1	SS	8			W. L. El.599.2 21/4/67
	5.0								
		Silty clay, containing traces of sand and gravel; brown / grey; very stiff / stiff		2	SS	29			
595				3	SS	42			
				4	SS	30			
590				5	SS	15			
							St=1.6		
				6	SS	11			
585							St=1.2		
				7	SS	7			
580							St=1.3		
				8	TW				
575							St=1.1		
				9	SS	8			
570	32.5						St=1.3		
		End of Borehole							

VERTICAL SCALE 1 IN TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

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DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLES 15 & 16

OUR REFERENCE NO. 7-3-L11

CLIENT Nisbet Lethem Limited
PROJECT Vidal Street Bridge
LOCATION Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 10 & 13, 1967

ENCLOSURE NO. 16

Column headings: ELEVATION ft. | DEPTH ft. | STRATIFICATION DESCRIPTION | STRATIGRAPHY SYMBOL | SAMPLES (NUMBER, TYPE, N blows/ft of sampler) | PENETRATION RESISTANCE blows per foot 20 40 60 80 100; SHEAR STRENGTH 100 lbs sq.ft. 10 20 30 40 50 | CONSISTENCY water content % PL W LL | REMARKS

Borehole 15

Elevation	Depth	Stratification Description	Sample No.	Type	N	Remarks
602.1	0.0	Ground Surface				W. L. El.601.6 21/4/67
		4" Asphalt				
	2.0	Sand & gravel				
600	4.0	Stiff brown weather silty clay	1	SS	10	
		Very stiff silty clay, containing traces of sand and gravel. (brown / grey)	2	SS	21	
595			3	SS	41	
			4	SS	18	
590						
			5	SS	9	
585	17.5	End of Borehole				St=1.5

Borehole 16

Elevation	Depth	Stratification Description	Sample No.	Type	N	Remarks
602.2	0.0	Ground Surface				
		4" Topsoil				
600	4.0	Firm brown weathered silty clay	1	SS	5	W. L. El.597.0 21/4/67
		Very stiff silty clay containing traces of sand and gravel (brown / grey)	2	SS	19	
595			3	SS	23	
			4	SS	23	
590						
			5	SS	9	
585	17.5	End of Borehole				St=1.8

VERTICAL SCALE 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE CH'D

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLES 17 & 18

OUR REFERENCE NO 7-3-L11

CLIENT Nisbet Lethan Limited
PROJECT Vidal Street Bridge
LOCATION Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 10, 1967

ENCLOSURE NO 17

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" or Advancement of Sampler	PENETRATION RESISTANCE blows per foot (20 40 60 80 100) / SHEAR STRENGTH 100 lbs sq ft (10 20 30 40 50)	CONSISTENCY water content % (PL W LL) (10 20 30 40)	REMARKS
601.9	0.0	Ground Surface					Borehole 17		
		4" Asphalt							
600	2.0	Sand & gravel							
		Stiff to very stiff brown weathered silty clay		1	SS	8			
	6.0			2	SS	11			W. L. El.597.3 21/4/67
595		Very stiff silty clay, brown / grey, traces of sand and gravel		3	SS	15			
590				4	SS	18			
585				5	SS	11			
	17.5						St=1.6		
		End of Borehole							
601.3	0.0	Ground Surface					Borehole 18		
		4" Asphalt							
600	2.0	Sand & gravel							
		Stiff to very stiff brown weathered silty clay		1	SS	10			W. L. El.597.9 21/4/67
	6.0			2	SS	12			
595		Very stiff silty clay, traces of sand and gravel, brown / grey		3	SS	27			
590				4	SS	26			
585				5	SS	9			
	17.5						St=1.4		
		End of Borehole							

VERTICAL SCALE: 1 IN. TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE CH'D

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLES 19 & 20

OUR REFERENCE NO 7-3-L11

CLIENT Nisbet Lethar Limited
PROJECT Vidal Street Bridge
LOCATION Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 20, 1967

ENCLOSURE NO 18

Penetration resistance (blows per foot): 20 40 60 80 100. Shear strength (lbs/sq ft ×100): 10 20 30 40 50. Consistency (water content %): PL, W, LL.

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	SAMPLE NUMBER	TYPE	No. of blows / advancement of sampler	PENETRATION RESISTANCE / SHEAR STRENGTH	REMARKS
601.1	0.0	Ground Surface				Borehole 19	
		4" Asphalt					
600	2.0	Sand & gravel					
		Firm grey-brown weathered silty clay trace of organics	1	SS	3		
595	7.0		2	SS	3		W. L. El.595.6
		Silty clay, containing traces of sand & gravel; brown / grey; Very stiff / stiff	3	SS	43		
590			4	SS	30		
			5	SS	18		
585			6	SS	10	St=1.4	
580			7	SS	7	St=1.7	
575			8	SS	5	St=1.8	
	31.0						
570	31.5	Sandy silt	9	SS	26		
		End of Borehole					
600.3	0.0	Ground Surface				Borehole 20	
		4" Topsoil					
	2.0	Cinder Fill					Hole Dry
		Firm brown weathered silty clay	1	SS	5		
595	4.5	Very stiff silty clay, containing traces of sand & gravel; brown / grey	2	SS	17		
			3	SS	35		
590			4	SS	20		
585			5	SS	7	St=1.8	
	17.5	End of Borehole					

VERTICAL SCALE: 1 IN. TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE CH'D

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLES 21 & 22

OUR REFERENCE NO 7-3-L11

CLIENT Nisbet Lethar Limited
PROJECT Vidal Street Bridge
LOCATION Sarnia, Ontario.
DATUM ELEVATION

METHOD OF BORING Auger
DIAMETER OF BOREHOLE 4-inch
DATE April 13, 1967

ENCLOSURE NO 19

Column headings: ELEVATION ft | DEPTH ft | STRATIFICATION DESCRIPTION | STRATIFICATION SYMBOL | SAMPLES (NUMBER, TYPE, N or Advancement of Sampler) | PENETRATION RESISTANCE blows per foot 20 40 60 80 100; SHEAR STRENGTH 100 lbs sq ft 10 20 30 40 50 | CONSISTENCY water content % PL W LL | REMARKS

Borehole 21

Elevation	Depth	Description	Sample No.	Type	N	Remarks
601.5	0.0	Ground Surface				
		4" Topsoil				
600		Stiff brown weathered silty clay	1	SS	10	
	4.0	Very stiff silty clay, traces of sand and gravel. (brown / grey)	2	SSS	25	W. L. El.595.0 21/4/67
595			3	SS	30	
590			4	SS	29	
585			5	SS	12	St=1.6
	17.5	End of Borehole				

Borehole 22

Elevation	Depth	Description	Sample No.	Type	N	Remarks
601.0	0.0	Ground Surface				
		4" Topsoil				
600		Cinder Fill				
	3.0	Firm brown weathered silty clay. (Fill)	1	SS	4	
			2	SS	4	
595	6.5	Silty clay containing traces of sand and gravel. (very stiff brown / stiff grey)	3	SS	9	W. L. El.594.5 21/4/67
590			4	SS	13	
585			5	SS	10	St=1.6
	17.5	End of Borehole				

VERTICAL SCALE 1 IN TO 5 FT

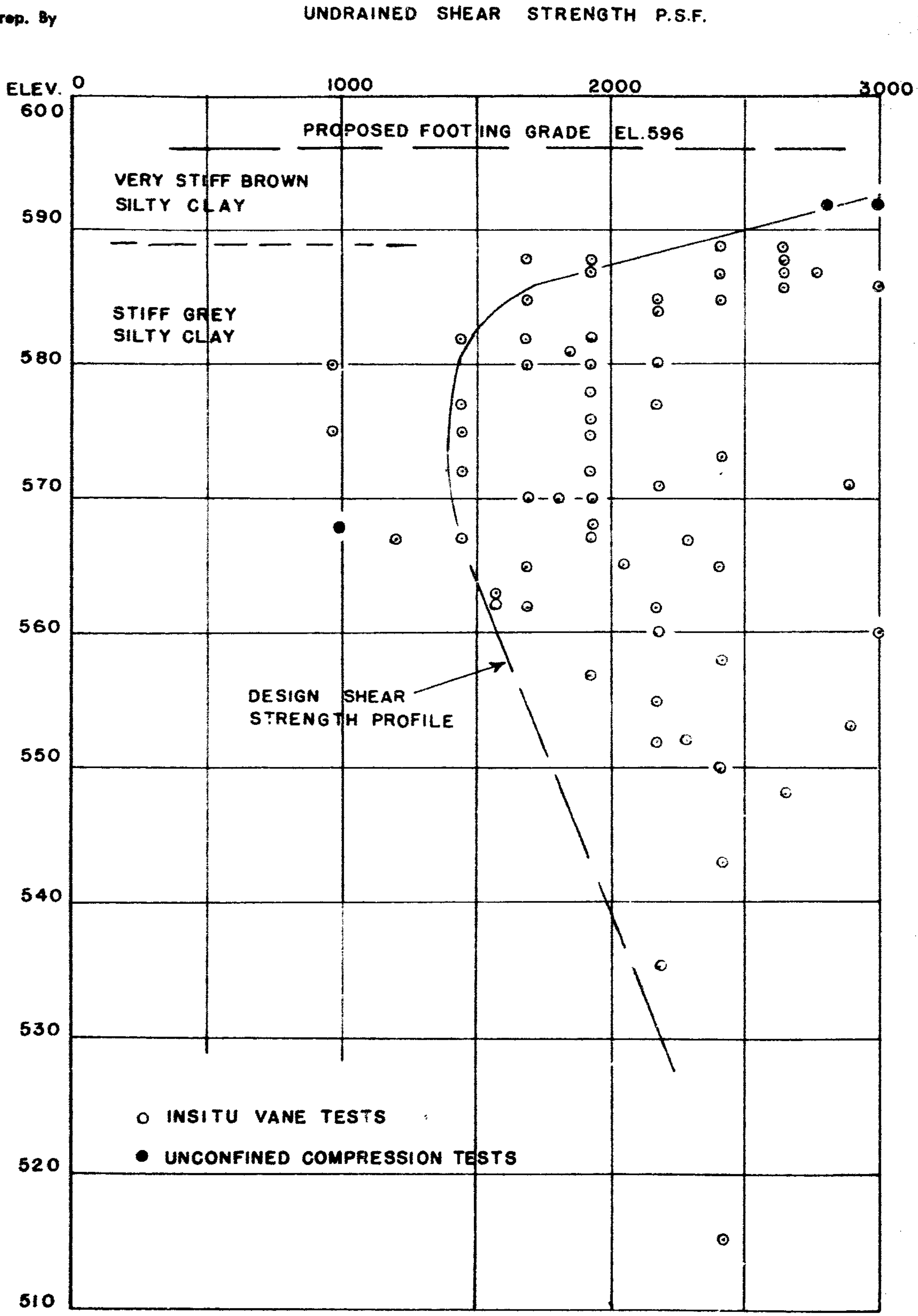
DOMINION SOIL INVESTIGATION LIMITED

MADE CH'D

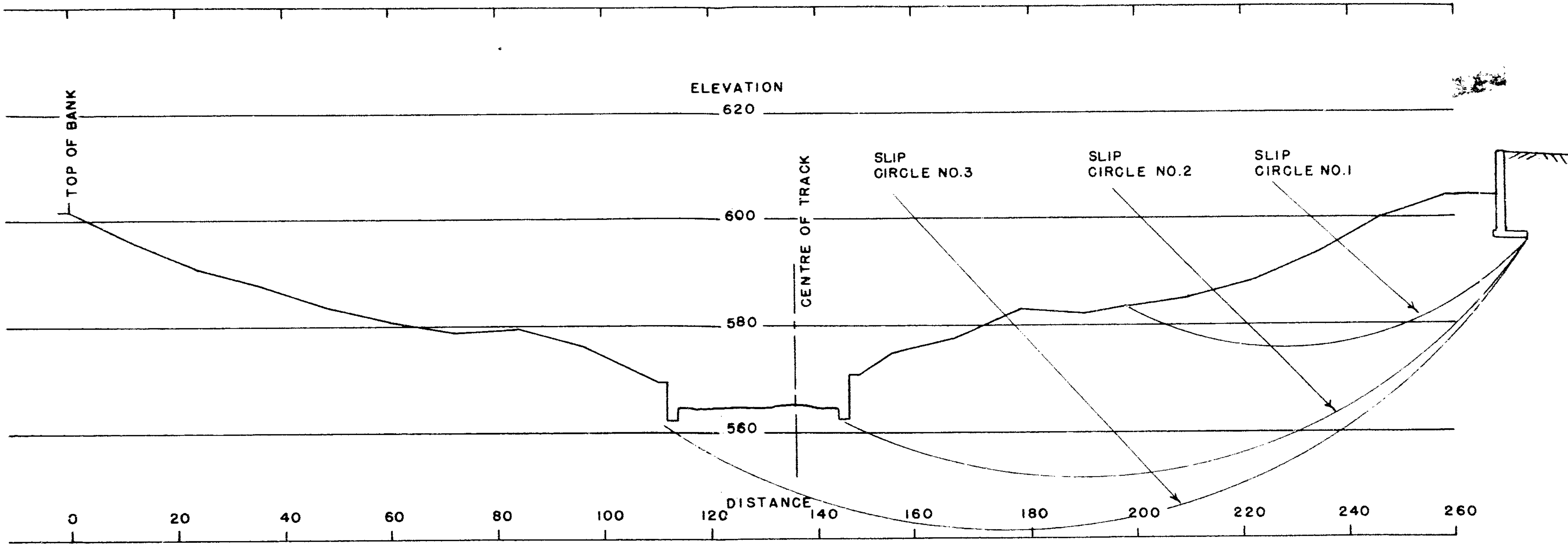
Our Ref. No. 7-3-L11

Enclosure No. 20

Prep. By



DOMINION SOIL INVESTIGATION LIMITED



SECTION A-A ST. CLAIR TUNNEL
HOR. SCALE 1"-20'
VERT. SCALE 1"-20'