

N.P. 100-55 1. ten  
split

new being Sacrum By Pass.  
23-60-292

and 100-55-1 being  
Olympe St. Thomas  
including new Sacrum  
By Pass  
23-62-28

Mr. W. L. Fraser,  
District Engineer,  
London, Ontario.

May 12, 1961.

FOOTING EXCAVATION INSTABILITY

Materials & Research Section.

(Foundations Office).

Attention: Mr. J. Callaghan, Const. Engr.

Re: Nineteen Mile Creek Crossing, Hwy. #3,  
Contract No. ~~4-59-13~~ -- District #2.

In response to a request from your Mr. O'Dell, an inspection of the excavation for the South-East footing of the above noted arch culvert was made by the author on May 10/61. Observations made, confirm Mr. O'Dell's statement that a serious piping condition has developed which has resulted in a significant reduction in the bearing capacity of the silty sand stratum upon which the spread footings are to be founded. The corrective measures recommended in this report have been discussed in detail with Mr. Callaghan.

Soil Conditions:

A detailed foundation investigation was made of the site by the Foundation Sub-Section of the Materials and Research Section, and the factual data and recommendations pertaining to design, are presented in Report No. F-59-13, W.P. 100-55, dated April 8, 1959. The significant findings presented in this report were: (1) the soil type at and below the recommended footing founding elevation of 718.0', is a permeable granular material, predominantly a fine

cont'd. /2 ...

Soil Conditions: (cont'd.) ...

sand containing minor percentages of silt and gravel size.

(2) The water table elevations were determined in each of the boreholes and reported as: 721.8' in Boreholes 1 & 2, 721.6' in Borehole 3, and 721.3' in Borehole 4. In addition, the necessity of dewatering and shoring of the excavations was pointed out in the Foundation Report. Ground water conditions were not specifically noted on the structure drawings.

Construction Procedure Followed:

Information obtained from District field forces, indicate that the contractor made no effort to depress the ground water table prior to excavating for the footing. An open excavation was attempted to footing founding elevation, and the excavation was swatered by a sump pump. This resulted in piping, and loss of stability of the excavation bottom, with a resultant raising of the excavation bottom. A corrective measure of removing the loosened material in the excavation bottom and placing of a granular pad to effect stability, was suggested by the District forces and attempted by the contractor. This proved to be ineffective and the contractor was then granted approval to remove the granular pad and to pour a concrete working slab. This was done and upon dewatering the excavation, piping again occurred with a heaving of the working slab as much as 12 inches at the extreme South end. After the above attempt had been tried, the Foundation Section was notified of the problem.

cont'd. /3 ...

Recommended Corrective Procedures:

The classical problem of carrying out a relatively narrow excavation below the water table in permeable fine grained materials such as occur at this site, can be solved most economically by either:-

(1) Driving interlocking steel sheet piling around the excavation perimeter to such a depth that the total pressures (i.e., water + dry weight of soil) within the enclosed area at an elevation coincident with the tip elevation of the sheet piling, is equal to the pore pressure (i.e., water pressure) outside the enclosed area at the sheet pile tip elevation. This allows dewatering of the excavation and pouring concrete in the dry.

(2) Depressing ground water table elevation such that the water table within the excavation area is at least 2 feet below the proposed excavation depth. This can be accomplished by installing well points around the perimeter of the excavation area and continuously pumping until the footing concrete is poured and backfilled. Concreting can be done in the dry. Lateral support of the excavation side-walls is required in this procedure.

It is our recommendation that solution (2) above, be adopted at this site. Once piping has occurred, the relative density of the material is reduced and, consequently, the bearing capacity of the stratum is reduced. This has happened at the South-East footing and the design footing pressure of 3 tons/sq.ft. can not be assured at the footing location if solution No. 1 is adopted. Well pointing will result in an increase in density of the material below the footing elevation and also allow a dry excavation to be made, and a

cont'd. /

Recommended Corrective Procedures: (cont'd.) ...

removal of the loose silty material which is now in place immediately below the in-place slab. The necessity of well pointing the excavation makes it more economical to follow this same procedure for the remaining three excavations.

In view of the sensitivity of the structure to differential settlement, it is imperative that the condition of the soil underlying the slab now in place at the South-~~East~~ \* footing), be inspected and approved prior to pouring the footing concrete.

The remedial measure recommended above, has been discussed with Mr. H. A. Tregaskes, Construction Engineer, and a representative from a competent dewatering organization, namely, Construction Equipment Co., Ltd., has been instructed to meet with the District Construction Engineer to discuss the necessary details and contractual arrangements.

*L. G. Soderman*

LCB/WdeF

L. G. Soderman,  
PRINCIPAL FOUNDATIONS ENGINEER.

cc: Messrs. A. M. Foye (2)  
H. A. Tregaskes  
H. D. McMillan  
A. Cater  
J. Roy  
*L. G. Soderman*  
Foundations Office  
Gen. Files.

June 22/59.

Re: Nineteen Mile Creek Crossing.

Hy. # 3

W.P. ~~100~~ 100-55-

E-59-18.

Advice S. McNamee of Bridge Office by phone.  
3 1/2 t.s.f. being capacity in design at Elev. 71.6  
(2 ft. below existing footing elevation) for footings of  
4 ft. <sup>wide</sup> ~~in~~ <sup>min.</sup>

C. K. C.

Mr. A. M. Foye,  
Bridge Engineer.

April 8, 1959.

FOUNDATION REPORT --

Materials & Research Section.

Attention: Mr. S. McCombis.

Re: Hwy. No. 3 & Nineteen Creek Crossing,  
Structure Widening - 3.5 Miles S. of  
St. Thomas, Lot 19, Con. 13, Twp. of  
Yarmouth. - W.P. 100-55.

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Enclosed herewith, is our Foundation Report showing the subsoil conditions existing at the above noted site. Reference to the contents of this report shows that the site is underlain by alluvial deposits of silts, sands and clays, followed by dense sand & gravel and stiff silty to sandy clay till.

Recommendations pertinent to the foundation design are summarized as follows:-

- (1) Subsoil conditions are such that an allowable bearing capacity of 2 t.s.f. can be used for spread footings of 5 to 6 feet in width, founded at Elev. 718, where footings of the existing culvert structure were placed. Settlements resulting from the above load intensity, will be of the order of one inch.
- (2) To avoid further erosion of the stream-bed and banks in the vicinity of the structure, it has been recommended that corrective measures such as widening or sheet piling, should be taken to realign the Creek on both the upstream and downstream sides of the structure.

cont'd. /2 ...

- (3) In view of the seasonal ground water conditions and the presence of sandy subsoil of high permeability immediately below the ground surface, provisions should be made for dewatering or shoring and pumping operations during excavations and placing of footings.
- (4) The subsoil has sufficient strength to safely support the proposed embankment loadings. Prior to the placing of embankment fills, however, all the alluvial topsoil should be removed. Bank slopes on the upstream side of the structure should be protected by rip-rap.

L. G. Soderman,  
PRINCIPAL SOILS & FOUNDATION ENGR.)

per:

*Abraham Loh*

AL/MdeP  
Attach.

(A. Loh,  
FOUNDATION ENGR.)

cc: Messrs. A. M. Toye,  
H. A. Tregaskes  
D. G. Fassay  
W. L. Fraser  
J. Roy  
A. Watt  
Dr. P. Harrow

Foundation Section.

File



# FOUNDATION REPORT

on

Hwy. No. 3 and Nineteen Creek Crossing  
- Structure Widening -  
3.5 Miles E. of St. Thomas, Lot 19, Con. IX,  
Twp. of Yarmouth.

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Plan No: 9B-120.  
Profile No: F-3829-3

## Distribution:

Mr. A. M. Teye, Bridge Engineer.	(2)
Mr. H. A. Tregaskes, Construction Engineer.	(1)
Mr. D. G. Ramsay, Design Engineer.	(1)
Mr. W. L. Fraser, District Engineer, London, Ontario.	(1)
Mr. J. Roy, Regional Engineer, London, Ontario.	(1)
Mr. A. Watt, Water Resources Commission	(1)
Dr. P. Karrow, Department of Mines.	(1)
Foundation Section.	(1)
File.	(1)

W.P. 100-55.  
W.J. F-59-18.

## INTRODUCTION:

Presented in this report are the results of an investigation carried out recently at a structure location some 3.5 miles east of St. Thomas where Hwy. No. 3 crosses the Nineteen Creek in Lot 19, Con. IX, Township of Yarmouth.

The object of the investigation was to examine the sub-soil conditions that may affect the contemplated extension of the existing culvert structure to be constructed and the stability of the approach embankments required in connection with the proposed increase in grade line.

The field work commenced on March 3, 1959 and was completed on March 11, 1959.

## DESCRIPTION OF THE SITE & GEOLOGY:

The site is located on the flood plain of the Nineteen Creek, a tributary of the Kettle Creek which drains into Lake Erie. The Nineteen Creek meanders slightly in the vicinity of the existing culvert structure and flows in a steep-sided but broad flat-floored valley. Apart from a few elm trees and bushes, there is very little vegetation in the vicinity of the site.

Physiographically, the site is located on the Mount Elgin Ridges of the St. Thomas Moraine, built by a broad stream of ice advancing through the lowlands of Lakes Ontario and Erie. The ridges are generally moraines of clay till produced by the thrust of the glacier, but it is believed that the Kettle Creek follows glacial drainage channels marked by deposition rather than erosion, resulting in its broad valley being lined with silt and clay, as

DESCRIPTION OF THE SITE & GEOLOGY: (cont'd.) ...

well as sand and gravel. At this site a shallow surface veneer of alluvial deposit of silts, sands and clays overlies the dense sand and till stratum.

DESCRIPTION OF FIELD & LABORATORY WORK:

Field work consisted of 4 sampled boreholes, carried out by a skid-mounted coredrill machine, adapted for soil sampling. Boreholes were advanced by conventional wash boring procedures and samples were recovered at depth intervals of 3 to 5 feet. In the cohesive clayey subsoil, relatively undisturbed 2" I.D. thin walled shelby tube samplers were used. In the cohesionless granular material, samples were recovered by means of a 2" O.D. split barreled spoon sampler. The dimensions of this sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test. In addition, a dynamic cone penetration profile was obtained adjacent to each sampled borehole.

Upon receipt in the laboratory, samples were visually examined and identified. Routine index tests were performed on selected representative samples. Laboratory test results have been presented in the borehole logs and detailed in tabular form.

The location plan and subsoil profile are presented in Drawing No. F-59-18A.

SUBSOIL CONDITIONS:

The site is underlain by shallow alluvial deposits of silts, sands and clays, followed by dense sand and gravel and

cont'd. /3 ...

SUBSOIL CONDITIONS: (cont'd.) ...

stiff silty to sandy clay till.

On the south side of the existing Hwy. No. 3 in Borings No. 1 & 2, the alluvial topsoil was found to be underlain by a layer of dense gravel-sand and fine grey sand extending from Elevations 724 to 714 in Boring 1 and Elevations 721 to 713 in Boring 2. In Boring 1, underneath the dense sand layer, the stratum of dense grey silty sand and sandy silt interbedded with occasional thin layers of clay, was encountered at Elevation 714'. This stratum of dense silty sand and sandy silt in Boring 1 was explored to a depth of 35' below the ground surface (i.e., - Elev. 694'.) In Boring 2, however, the dense sand layer was found to be underlain by a stratum of stiff grey clay silt and silty clay at Elev. 713'. It was explored to a depth of 27' below the ground surface (i.e. - Elev. 670'.)

On the north side of the existing Hwy. No. 3 in Borings No. 3 & 4, the alluvial deposits of clay silts and clays were found to be underlain by the stratum of dense gravel-sand at approximately Elev. 721'. This stratum of dense gravel-sand was explored to a depth of 31' below the ground surface (i.e. - Elev. 697'.)

In general, the soil types encountered, are as follows:-

1. Alluvial Deposits:

This alluvial material of silts, sands and clays is believed to be the result of stream deposition in recently geological times. It contains a considerable amount of organic matter and exists in a soft and saturated state. It was encountered

cont'd. /4 ...

SUBSOIL CONDITIONS: (cont'd.)

1. Alluvial Deposits: (cont'd.)

immediately below the ground surface in each of the sampled boreholes, and extended to depths of 5 to 6 feet.

2. Dense Sand & Gravel:

This formation is believed to be deposits left by earlier glaciations, overridden and rearranged by the Wisconsin glacier, resulting in its present densely compacted state. The sand contains a considerable amount of gravel and its texture ranges from fine-grained to coarse-grained. The colour is predominantly grey. The averaged moisture content was found to be 18%. Field penetration test results show an "N" value - - (penetration resistance expressed in number of blows per foot) of 30 to be a minimum for the formation. This stratum was encountered immediately below the alluvial deposits, and extended from an average elevation of 722 to an elevation of 713, at boreholes 1 & 2. At boreholes 3 & 4, the depth of this layer was not proven beyond Elevation 697.0.

3. Stiff Silty to Sandy Clay Till:

This formation is believed to be of glacial-fluvial origin existing in a stiff till state. The colour is predominantly grey and its texture ranges from fine-grained sand to clay size particles. Very little gravel was encountered throughout the depth of boring. The averaged moisture content was found to be 20%. Its unit weight ranged from 134 p.c.f. to 152 p.c.f.

cont'd. /5 ...

SUBSOIL CONDITIONS: (cont'd.) ...

3. Stiff Silty to Sandy Clay Till: (cont'd.)

Laboratory shear strength tests show an average of 2800 p.s.f. to be representative for the cohesive portion of the strata. Field penetration test results show an "N" value of 40 to be a minimum for the entire formation. This formation was encountered below the dense sand layer at approximately Elev. 713 in Borings 1 & 2 only, and was not encountered in Borings 3 & 4.

Laboratory and field test results have been summarized in Table No. 1 and are included in this report under Appendix I.

WATER CONDITIONS:

Observations and measurements carried out during the boring and sampling operations indicate that the ground water table at the site is at or close to the seasonal creek water level - i.e., between Elevations 726' and 722'. No artesian water conditions were encountered.

FOUNDATION CONSIDERATIONS:

The dense sand and gravel stratum in which the existing culvert structure was founded, can provide satisfactory foundation support for the contemplated extension of the structure. It was learned that the existing barrel arch structure was founded on spread footings at approximately Elev. 718'. At this elevation, the strength characteristics of the sandy subsoil are such that, for footings of 5 to 6 feet in width, an allowable bearing capacity of 2 t.s.f., incorporating a safety factor of 3, can be used for spread footing design. Maximum settlement consequent upon application of this bearing pressure, will be of the order of one inch.

FOUNDATION CONSIDERATIONS: (cont'd.) ...

In view of the fact that the sandy subsoil in the stream-bed is scour susceptible and that there was evidence of erosion exhibited on the north-west bank of the creek, consideration should be given to founding footings below the stream-bed at the same elevation as the footings for the existing structure. Footings for the existing structure are founded at an elevation approximately 4 ft. below the stream-bed and provide evidence of satisfactory performance. To avoid further erosion of the stream-bed and banks in the vicinity of the structure, however, it appears that corrective measures such as widening or sheet piling should be resorted to, in order to realign the creek on both the upstream and downstream sides of the structure.

In view of the seasonal ground water conditions and the presence of sandy subsoil of high permeability immediately below the ground surface, provisions should be made for dewatering or shoring and sump pumping operations during excavations and placing of footings.

Under the proposed grade line the maximum height of fill is some 25 feet. The subsoil has sufficient strength to safely support this embankment loading. Prior to the placing of embankment fills, however, all the alluvial topsoil should be removed. Rip-rap protection should be provided for bank slopes on the upstream side of the structure.

cont'd. /7...

CONCLUSIONS & RECOMMENDATIONS:

- (1) The site is underlain by alluvial deposits of silts, sands and clays, followed by dense sand gravel and stiff silty to sandy clay till.
- (2) Subsoil conditions are such that at Elev. 718, where footings of the existing culvert structure were founded, allowable bearing pressure of 2 t.s.f. for footings of 5 to 6 feet in width, can be used for spread footing design. Maximum settlement consequent upon application of this bearing pressure, will be of the order of one inch.
- (3) To avoid further erosion of the stream-bed and banks in the vicinity of the structure, it has been suggested that corrective measures such as widening or sheet piling should be taken to realign the creek on both the upstream and downstream sides of the structure.
- (4) Provisions should be made for dewatering or shoring and pumping operations during excavations and placing of footings.
- (5) No approach fill stability problem is anticipated provided that prior to the placing of embankment fills, all the alluvial topsoil is removed. Rip-rap protection should be provided for the bank slopes on the upstream side of the structure.

*Forahan*  
A. Loh,  
Foundations Engineer -  
for:

B. Mackenzie,  
Foundations Engineer.



APPENDIX I.

TABLE NO. I.

## SUMMARY OF FIELD &amp; LABORATORY TESTS

JOB F-59-18.W.P. 100-55.

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	T1	3'-5'	Dense brown gravel-sand.	23	6.3	-	-	-	-	Interbedded with occasional thin layers of clay.
	S2	6'-7'6"	Dense fine grey sand.	15	22.4	-	-	-	-	
	S3	9'-10'6"	" " " "	43	18.3	-	-	-	-	
	S4	15'-16'6"	Dense grey fine silty sand.	65	15.2	-	-	-	-	
	T5	20'-21'	Dense grey silty sand.	55	16.9	-	-	-	134.0	
	T6	25'-26'	Dense grey sandy silt.	65	20.1	-	-	2090	134.8	
	S7	29'-30'6"	Dense grey silty sand.	66	21.2	-	-	-	-	
	S8	33'-34'6"	Dense grey sandy silt.	61	16.5	-	-	-	-	
2	S1	3'-4'6"	Sandy topsoil.	5	-	-	-	-	-	
	S2	6'-7'6"	Dense coarse gravel and fine grey sand.	26	19.6	-	-	-	-	
	S3	9'-10'6"	Dense gravel-sand.	57	12.4	-	-	-	-	
	S4	15'-16'6"	Stiff grey clay silt.	67	24.3	-	-	2775	141.0	
	S5	20'-21'	Stiff grey clay silt.	80	17.9	-	-	-	-	
	S6	25'-26'6"	Stiff grey silty clay.	66	21.3	-	-	3450	152.3	
3	S1	6'-7'6"	Brown gravelly clay silt.	37	13.5	-	-	-	-	
	S2	9'-10'6"	Dense gravel-sand.	51	10.9	-	-	-	-	
	S3	12'-13'6"	" " "	62	15.1	-	-	-	-	
	S4	15'-16'	" " "	110	12.3	-	-	-	-	

cont'd. /2 ...

JOB F-59-18

W.P. 100-55.

PILE NO.	SAMP. NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
3	S5	20'-21'	Dense gravel-sand.	126	17.5	-	-	-	-	
	S6	25'-26'6"	" " "	56	-	-	-	-	-	
	S7	30'-31'	Dense grey medium sand.	112	20.1	-	-	-	-	
4	S1	5'-6'6"	Medium-fine to medium sand	15	19.0	-	-	-	-	
	S2	10'-11'6"	" " " with gravel.	51	21.1	-	-	-	-	
	S3	15'-16'6"	Dense medium sand with gravel.	55	22.8	-	-	-	-	
	S4	20'-21'6"	Dense gravel-sand.	64	15.5	-	-	-	-	
	S5	25'-26'6"	" " "	98	14.4	-	-	-	-	
T1 - Denotes thin walled Shelby sample.										
S1 - Denotes split spoon sample.										

DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG CORE DRILL: 54-5 OPERATION BORE & PENETN  
 CASING B X (standard samplers to fit unless noted)  
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES

JOB F-59-18 WP. 100-55  
 DATUM GEODETIC  
 COMPILED BY B.M. CHECKED BY

BORING 1 STA. 155+86.53' LEFT  
 DATE REPORT MARCH 1959  
 DATE BORING 3 MARCH 1959

## ABBREVIATIONS

## SAMPLE TYPES

## SAMPLE CONDITION

V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY  
 M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION  
 U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING  
 Q - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL  $\gamma$  - UNIT WEIGHT

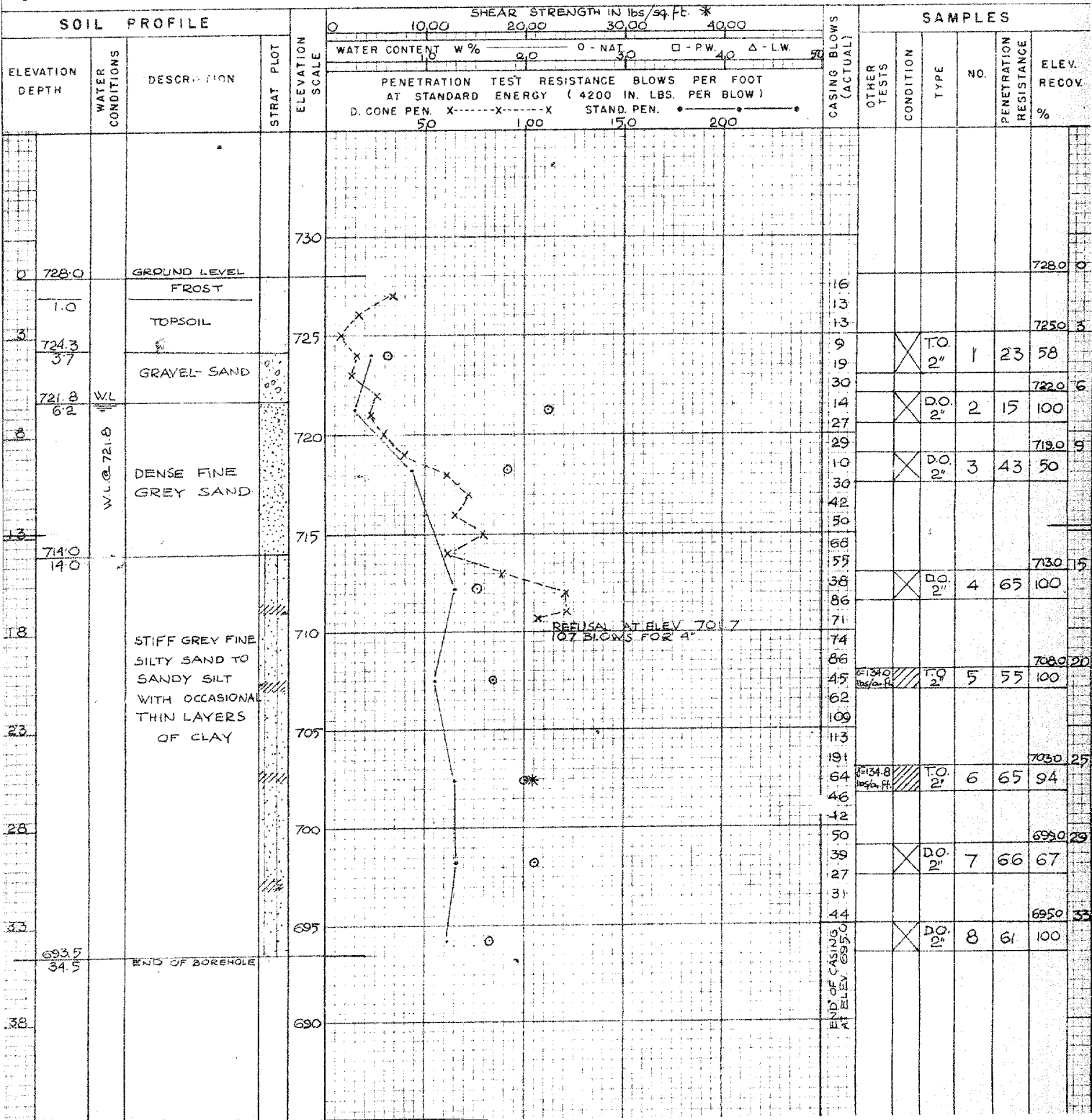
C.S. - CHUNK DO - DRIVE OPEN S.S. - SLEEVE SAMPLE  
 DO - DRIVE OPEN PS - PISTON SAMPLE  
 DF - DRIVE FOOT VALVE W.S. - WASHED SAMPLE  
 TO - THIN WALLED OPEN RC - ROCK CORE



- DISTURBED  
 - FAIR  
 - GOOD  
 - LOST

## SOIL PROFILE

SHEAR STRENGTH IN lbs/sq. ft. \*



DRILL RIG CORE DRILL: 54-5 OPERATION BORE & PENET'N  
CASING BX (standard samplers to fit unless noted)  
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES

BORING 2 STA. 156+60 53' LT.  
DATE REPORT MARCH 1959  
DATE BORING 6TH MARCH 1959

## SAMPLE TYPES

SAMPLE CONDITION

V - INSITU VANE SHEAR TEST	Q - TRIAXIAL QUICK	K - PERMIABILITY
M - MECHANICAL ANALYSIS	S - TRIAXIAL SLOW	C - CONSOLIDATION
U - UNCONFINED COMPRESSION	WL - WATER LEVEL IN CASING	CA - CASING
D - TRIAXIAL CONSOLIDATED QUICK	WT - WATER TABLE IN SOIL	$\gamma$ - UNIT WEIGHT

C.S. - CHUNK	S.S. - SLEEVE SAMPLE
DO - DRIVE OPEN	PS - PISTON SAMPLE
DF - DRIVE FOOT VALVE	WS. - WASHED SAMPLE
TO. - THIN WALLED OPEN	R.C. - ROCK CORE



- DISTURBED
- FAIR
- GOOD
- LOST

SHEAR STRENGTH IN LBS/SQ FT. \*

## SAMPLES

[illegible]



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG CORE DRILL: 54-5 OPERATION BORE & PENET'N JOB F-59-18 WP 100-55 BORING 4 STA. 156+04 71' BT.  
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT MARCH 1959  
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES COMPILED BY B.M. CHECKED BY DATE BORING 10th MARCH 1959

## ABBREVIATIONS

V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY  
M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION  
U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING  
Qc - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL γ - UNIT WEIGHT

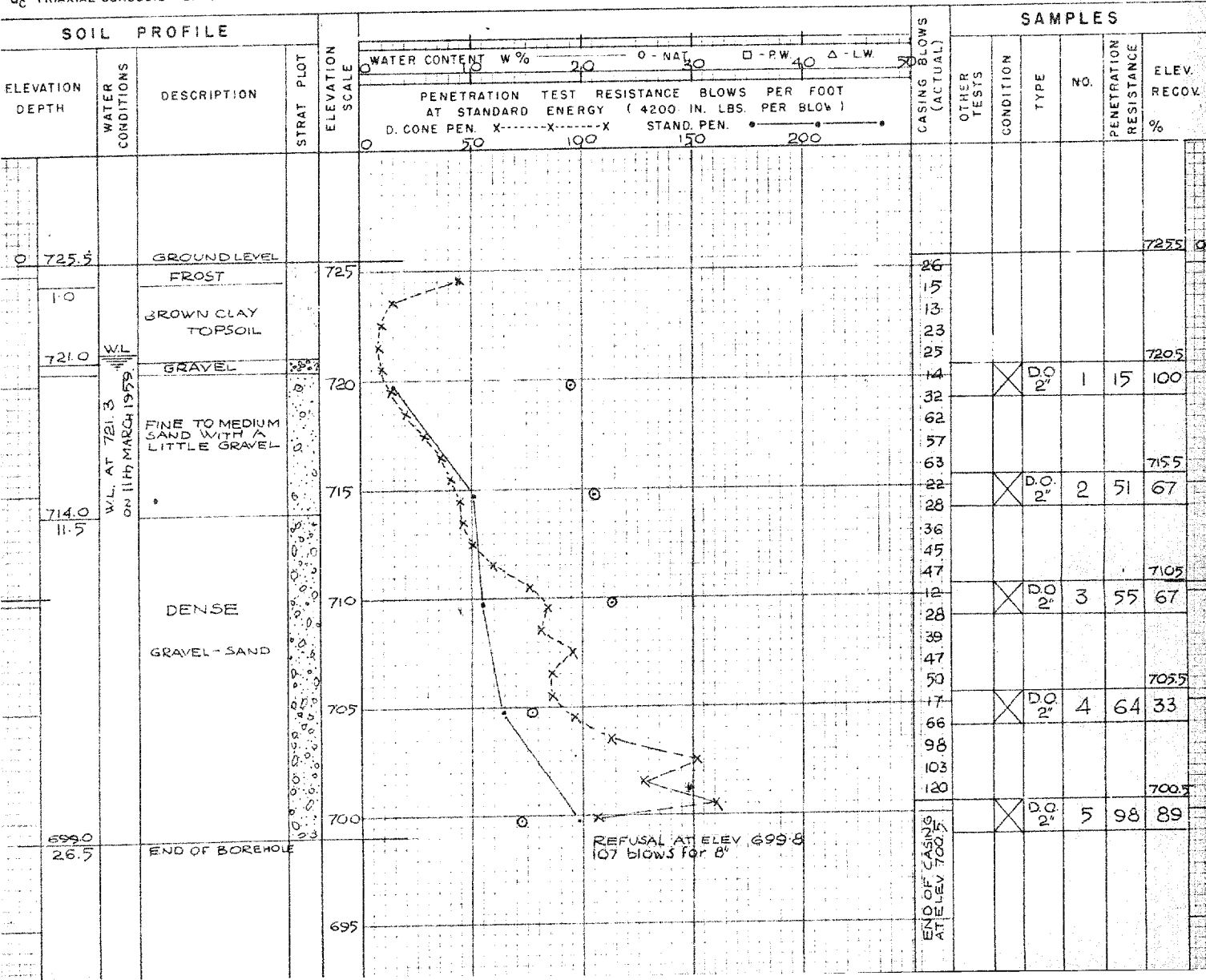
## SAMPLE TYPES

CS - CHUNK SS - SLEEVE SAMPLE  
DO - DRIVE OPEN PS - PISTON SAMPLE  
DF - DRIVE FOOT VALVE WS - WASHED SAMPLE  
TO - THIN WALLED OPEN RC - ROCK CORE

## SAMPLE CONDITION

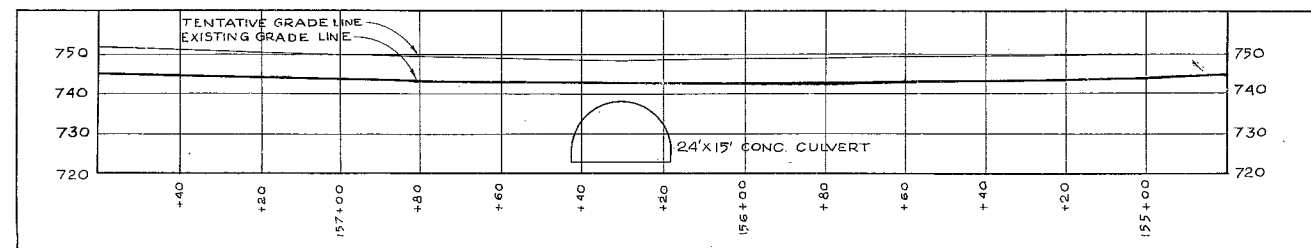
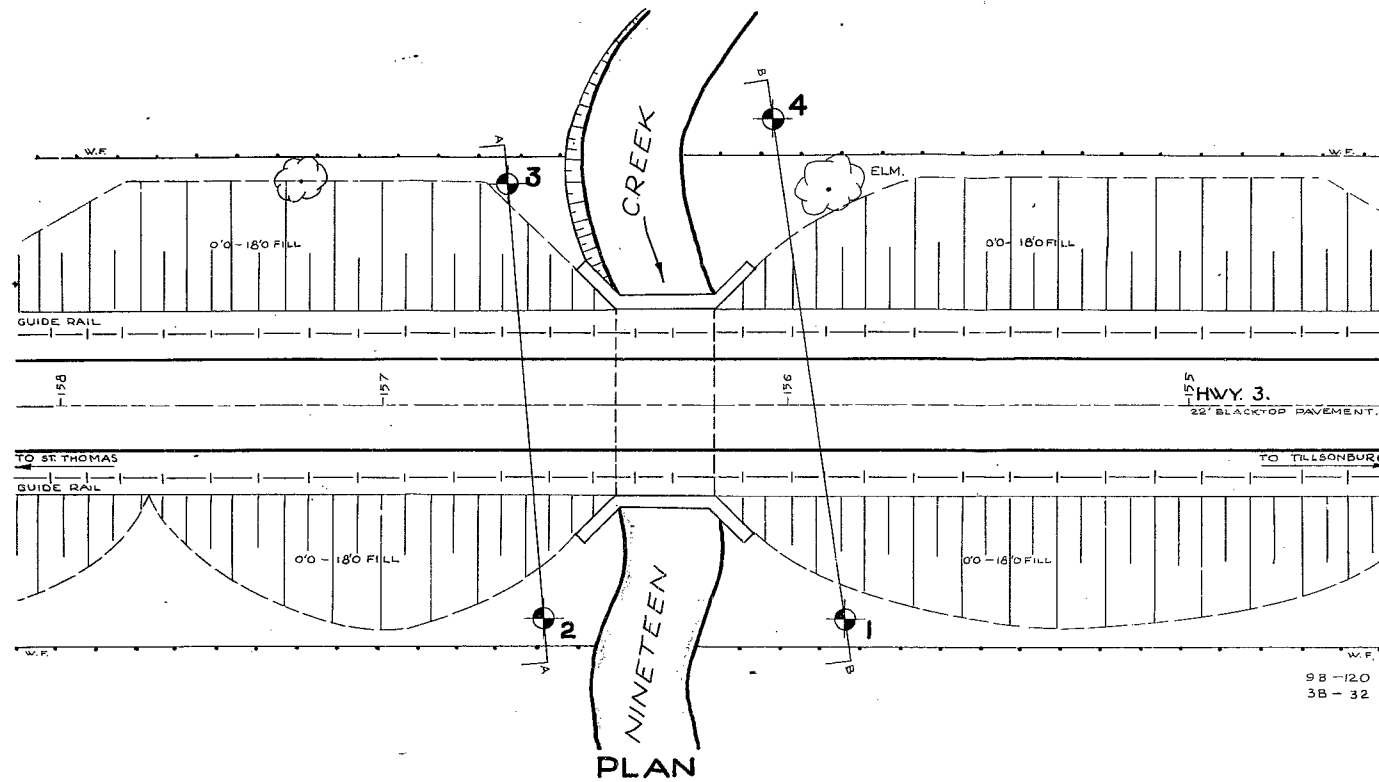


- DISTURBED  
- FAIR  
- GOOD  
- LOT



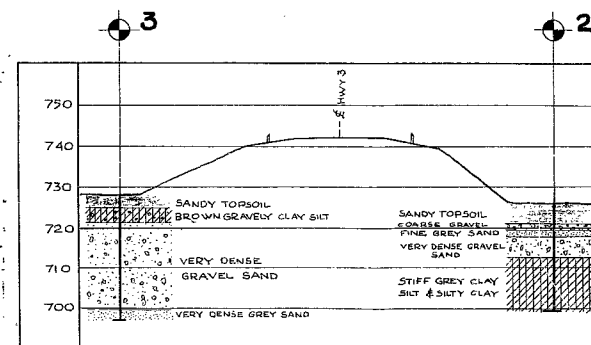
# 59-F-18  
W.P.# 100-55  
Hwy. #3  
CROSSING  
NINETEEN CR.  
3.5 MILES E. OF  
ST. THOMAS



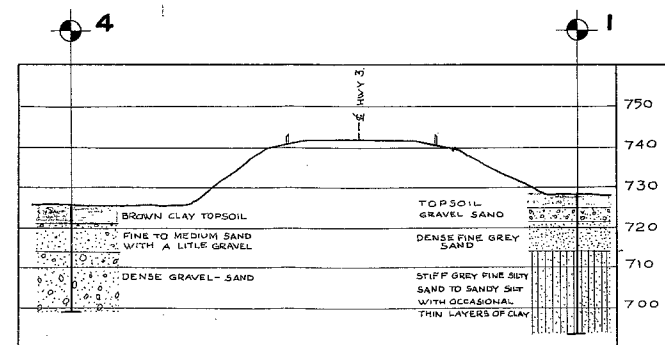


PROFILE

F 3829-3  
3B-31



A - A



B - B

LEGEND			
BORE & PENETRATION HOLE			
HOLE NO.	ELEVATION	STATION	DISTANCE FROM
1	728'0"	155 + 86	53' LT.
2	726'0"	156 + 60	53' LT.
3	728'0"	156 + 69	55' RT.
4	725'0"	156 + 04	71' RT.

— NOTE —

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS-ONTARIO.		
MATERIALS & RESEARCH SECTION		
<b>NINETEEN CREEK CROSSING</b>		
SHOWING POSITIONS & ELEVATIONS OF HOLES		
HWY. 3	DISTRICT 2	COUNTY ELGIN
TOWNSHIP YARMOUTH	LOT 19	CON. IX
LOCATION 35 MILES EAST OF ST. THOMAS.		
DRAWN BY: T. SZEGVARY	CHECKED BY:	WR 100-55
DATE 19 MARCH 1959	APPROVED BY:	DRAWING NO.
SCALE 1"=20'		F-59-18A