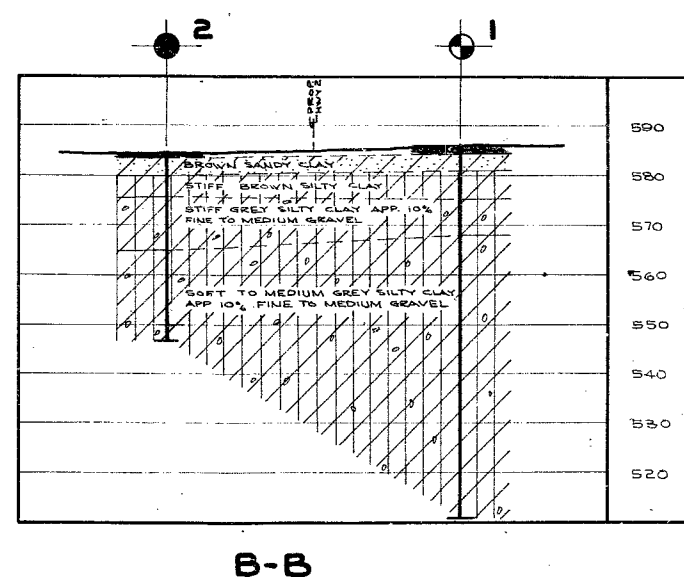
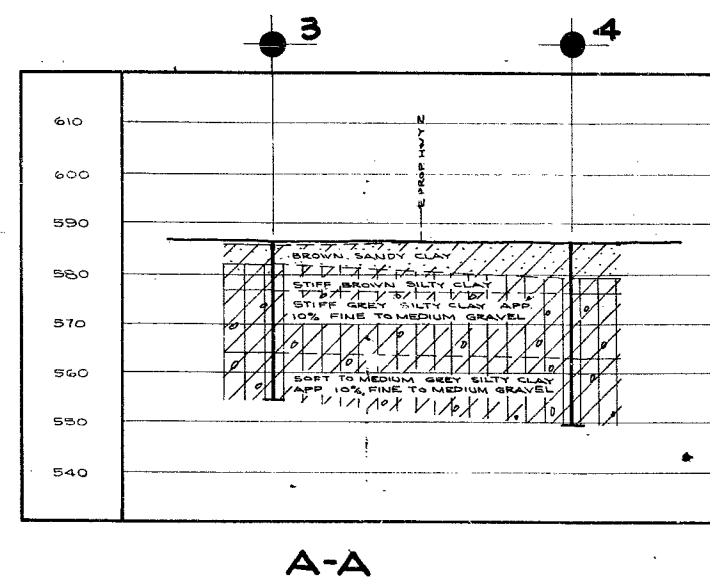
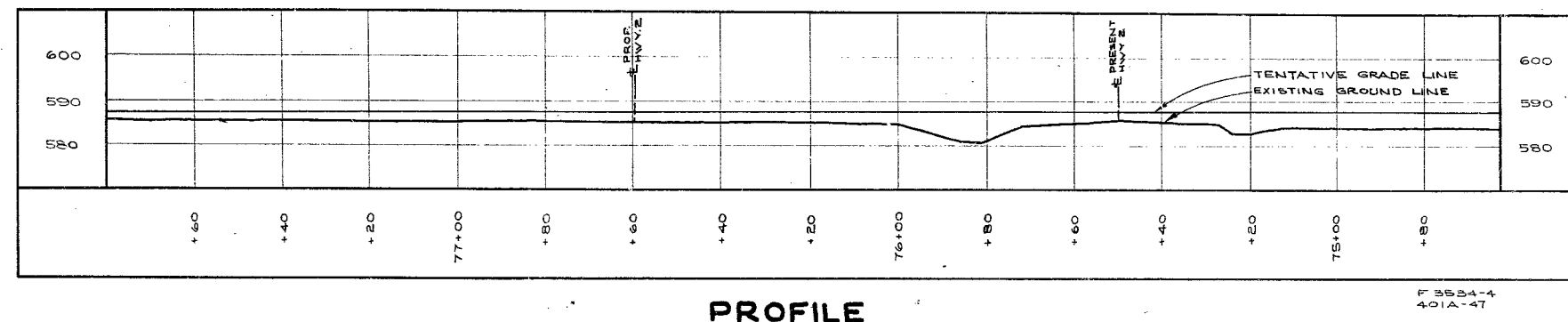
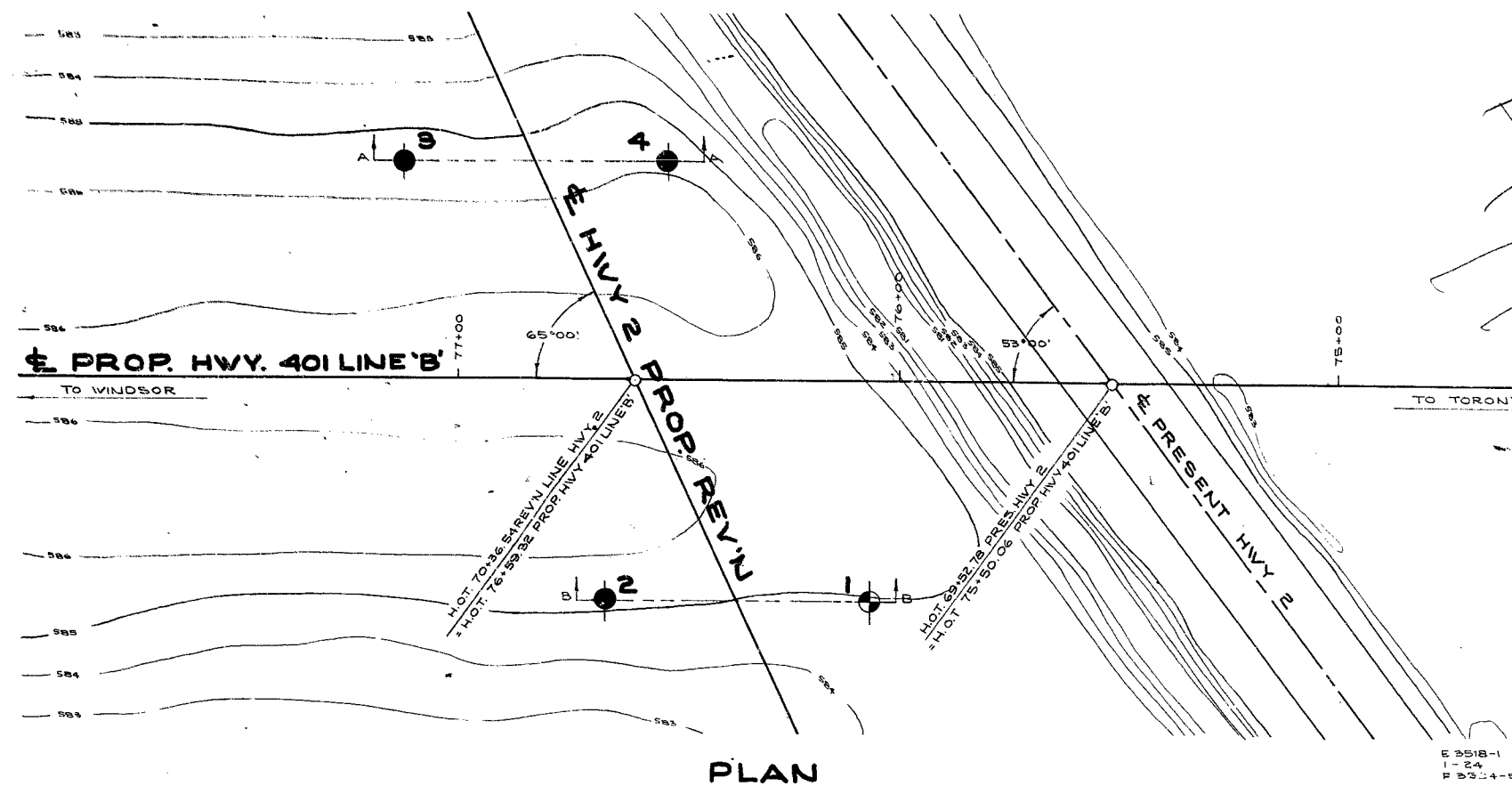


59-F-11
W.P. # 159-58
Hwy. # 401
REV. CROSSING
Hwy. # 2
1 MILE W. OF
TILBURY



LEGEND			
BORE HOLE			
PENETRATION HOLE			
BORE & PENETRATION HOLE			
HOLE NO.	ELEVATION	STATION	DISTANCE FROM E.
1	585.75'	76+07	50' LT.
2	584.50'	76+46	50' LT.
3	586.50'	77+12	50' RT.
4	586.28'	76+52	50' 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			
HWY 2 PROP. REV'N. PROPOSED CROSSING			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
HWY 401	DISTRICT 1	COUNTY ESSEX	
TOWNSHIP TILBURY NORTH	LOT 19	CON IV	
LOCATION	MATERIALS & RESEARCH SECTION		
DRAWN BY: T. MELLOR	CHECKED BY:	W.P. 159-58	
DATE: APR. 3, 1955	APPROVED BY:	DRAWING NO.	
SCALE: 1" = 20'		F59-11A	

Mr. A. M. Toye,

May 5, 1959.

Bridge Engineer.

Materials and Research Section.

Attention: Mr. S. McCombie.

Re: Foundation Report -
W.J. F-59-11 -- W.P. 159-58,
Hwy. 401 Line 'B' & Hwy. 2 Revision
Crossing, Lot 19, Con. IV, Twp. of
Tilbury North.

Please note that the following corrections with regard to site location of the proposed structure, should be made to the above noted Foundation Report, which was forwarded on this date.

1. Covering Letter:

Hwy. 401, Line 'B' & Hwy. 2 Revision Crossing,
Lot 19, Con. IV, Twp. of Tilbury North --
Approximately 1 1/4 Miles N.E. of Tilbury -

Should be changed to:

Hwy. 401, Line 'B' & Hwy. 2 Revision Crossing,
Lot 19, Con. IV, Twp. of Tilbury North --
Approximately 1 Mile West of Tilbury.

2. Front Page of Report:

Hwy. 401, Line 'B' & Hwy. 2 Revision Crossing,
Lot 19, Con. IV, Twp. of Tilbury North --
Approximately 1 1/4 Miles N.E. of Tilbury.

Should be changed to:

Hwy. 401, Line 'B' & Hwy. 2 Revision Crossing,
Lot 19, Con. IV, Twp. of Tilbury North --
Approximately 1 Mile West of Tilbury.

cont'd. /2 ...

3. Page 1 of Report:

First paragraph under "INTRODUCTION" -

An investigation proposed
structure located at approximately 1 1/4 miles
N.E. of Tilbury

Should be changed to:

An investigation proposed
structure located at approximately 1 mile West
of Tilbury

4. Drawing F-59-11A -

A. Key plan should be discarded.

B. Location: 1 1/4 Miles N.E. of Tilbury -
should be changed to:

1 Mile West of Tilbury.

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

Per:

A. Leh

AL/MdeF

(A. Leh,
FOUNDATION ENGR.)

BA892



ONTARIO
DEPARTMENT OF HIGHWAYS

Memo to Mr. S. McCombie, **Date** June 15, 1959.
Bridge Planning Engineer. **Subject** _____
From Materials & Research Section.

Re: Foundation Report - F 59-11,
W.P. 159-58, Hwy. 401, Line 'B'
and Hwy. #2, Revision Crossing
Lot 19, Con. IV, Twp. of Tilbury North.

The proposed change in alignment of the above crossing to Highway 401 Line 'B' and present Highway 2, has been reviewed by our office. We are of the opinion that the conclusions presented in Report F 59-11 will apply at the new location. The recommendations for a footing elevation of approximately 580, and not below elevation 575, with an allowable footing pressure of 2 1/2 tons/sq. ft., should be followed.

Power auger borings at the new location indicate that some ground water may be encountered in seepage zones found near the ground surface.

KP/MdeF

cc: Messrs. A. M. Toye
H. A. Tregaskes
D. G. Ramsay
H. Orlando
G. U. Howell
J. Roy

Foundation Office

File

L. G. Soderman,
PRINCIPAL SOILS & FOUNDATION ENGR.
per:

K Peaker

(K. Peaker,
FOUNDATION FIELD SUPERVISING ENGR.)

P.J. Harvey

July 23, 1959

Location Plans Engineer

Materials & Research Section

Re: W.P. 159-58 Hwy 401 Interchange W. of Tilbury
Plans F3534-5 Profile F3534-9 Sta. 72+50 Approx.

Further to your memorandum of July 10, 1959, we would agree that the alignment and grade at this structure site, as shown on the above plan and profile, which were received July 23, 1959, appears to be satisfactory.

A foundation investigation has been completed by this Section, and the report, F99-11, was submitted May 4, 1959. The material was determined to be predominantly cohesive silty clay, and no approach fill stability problems are anticipated. Spread footings were recommended in the report.

NDS/tt

Copies to: S. McCombie
R. Strain
J. Roy (2)
K. Peaker
Files
N. D. S. —

L.G. Soderman
Principal Soils & Foundation Engineer

NDS
Per: N. D. Smith

col

Mr. A. M. Toye,
Bridge Engineer.

May 4, 1959.

FOUNDATION REPORT --

Materials & Research Section.

Attention: Mr. S. McCombie.

Re: Hwy. 401, Line 'B' & Hwy. 2 Revision Crossing
Lot 19, Con. IV, Twp. of Tilbury North --
Approximately 1-1/4 Miles ~~N.E.~~^{WEST} of Tilbury.

See Correcting letter Hwy. 5th 1959

Reported herewith are the results of a foundation investigation recently completed at the above noted structure location.

Reference to the contents of this report show that:-

- (1) The subsoil stratigraphy consists of a deep deposit of cohesive silty clay. The upper 20 feet of this soil type exists in a stiff preconsolidated state. Underlying the stiff upper crust the strength is markedly lower and the soil is normally consolidated. The vertical extent of this stratum was not proven beyond a depth of 75 feet.
- (2) The strength and compressibility characteristics of the upper 20 feet of subsoil is such that spread footings can be used. The recommended footing elevation is 580.0 and the safe allowable footing pressure that can be applied at this elevation is 2 1/2 tons/sq.ft.
- (3) Long-term settlements resulting from footing and approach embankment loadings have been estimated not to exceed 8 inches at the abutment locations. If a single span structure is to be used, resultant differential settlements are considered to be tolerable. If a multi-span structure is to be used, the estimated differential movement between the abutment and adjacent intermediate piers is of the order of 4 inches. This amount of differential settlement has led to the conclusion that a simply-supported structure should be specified for a multi-span bridge.

- (4) Ground water table observations and the low permeability of the clayey subsoil indicate that no excavation difficulties due to seepage, etc., need be anticipated.
- (5) The subsoil has sufficient strength to safely support the approach fills designed with 2:1 side slopes.

If you require clarification of data or recommendations contained in this report, please contact our office.

L. G. Soderman

LGS/MdEF
Encl.

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

cc: Messrs. A. Teye
H. A. Tregaskes
D. G. Ramsay
G. U. Howell
J. Roy
Dr. P. Karrow

Foundation Office
File

FOUNDATION REPORT

on

Hwy. 401, Line 'B' & Hwy. 2 Revision Crossing
Lot 19, Con. IV, Twp. of Tilbury North -
Approximately 1 ~~1/4~~ Miles ~~N.E.~~ of Tilbury.
WEST

Site Plan No: E 3518-1

Plan No: F-3534-5

Profile No: F-3534-4

Distribution:

Mr. A. M. Toye,
Bridge Engineer. (2)

Mr. H. A. Tregaskes,
Construction Engineer. (1)

Mr. D. G. Ramsay,
Design Engineer. (2)

Mr. G. U. Howell,
District Engineer,
Chatham, Ontario. (1)

Mr. J. Roy,
Regional Soils Engr.
London Region. (1)

Dr. P. Karrow,
Department of Mines. (1)

Foundation Section. (1)

File. (1)

W.P. 159-58.

W.J. F-59-11.

INTRODUCTION:

An investigation has been carried out to determine the competence of the subsoil layers for supporting the foundations of the proposed structure located at approximately 1 ~~1/4~~ ^W miles ~~N.E.~~ of Tilbury where proposed Hwy. 401 Line 'B' underpasses proposed Hwy. 2 Revision in Lot 19, Con. IV, Township of Tilbury North (Sta. 76+59.32, Profile No. F-3534-4).

The field work commenced on February 3, 1959 and was completed on February 5, 1959.

DESCRIPTION OF THE SITE & GEOLOGY:

The site is located between the existing Hwys. No. 2 and 401; the areas surrounding the existing highways are generally flat farmlands presently under cultivation. At the time of the investigation, the area was covered by ice and snow.

Physiographically, the site under consideration is located on the Essex Clay Plain of the St. Clair Clay Plains, inundated by glacial lakes, Whittlesey and Warren. According to available geological information, these extensive plains covering a large area of South-Western Ontario, are covered by deep deposits of clay, underlain by limestone or shale bedrock. At this site, the upper zone of the clay stratum was found to be desiccated and exists in a stiff condition for a depth of approximately 20 feet.

DESCRIPTION OF FIELD & LABORATORY WORK:

Field work consisted of 4 sampled boreholes, carried out by a trailer-mounted continuous flight auger adapted for soil sampling. Conventional auger boring procedures were followed and samples were recovered at depth intervals of five feet. Relatively

cont'd. /2 ...

DESCRIPTION OF FIELD & LABORATORY WORK: (cont'd.) ...

undisturbed 2" I.D. thin walled shelby tube samplers were used in the clayey subsoil encountered. In addition to the sampled boreholes, one dynamic cone penetration test adjacent to Boring 1, and 4 in-situ vane shear tests in Boring 2 were carried out.

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

The location plan and subsoil profile are presented in Drawing No. F-59-11A.

SUBSOIL CONDITIONS:

The site is underlain by a stiff crust of silty clay followed by the thick stratum of soft to medium silty clay.

In each of the sampled boreholes the frozen topsoil was found to be underlain by a 20 ft. stiff crust of silty clay extending from Elevations 586.0' to 566'. Underneath the stiff crust the stratum of soft to medium silty clay was encountered. This stratum was explored to a depth of 75 feet below the ground surface (i.e. Elev. 511'). In general, the soil types encountered are as follows:-

1. Stiff Silty Clay:

This stiff condition of the upper zone of clay is believed to be the result of desiccation, and has been subjected to oxidation resulting in its present brownish colour. Below the oxidized zone the colour is predominantly grey. The material contains approximately

cont'd. /3 ...

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

1. Stiff Silty Clay: (cont'd.) ...

25% silt, 15% sand and 10% fine to medium gravel throughout. The average unit weight and moisture content were found to be 130 p.c.f. and 20%, respectively. Liquid and plastic limits averaged 31% and 18%. Laboratory shear strength tests show an average of 2500 p.s.f. to be representative for the 20 ft. layer. Judging from its moisture content and Atterberg limits, the stiff silty clay appears to be saturated and preconsolidated. This is borne out by the consolidation test results.

2. Soft to Medium Silty Clay:

Underneath the stiff clay crust the thick stratum of soft to medium silty clay was encountered. The colour is predominantly grey. It contains approximately 25% silt, 15% sand and 10% fine to medium gravel throughout. The average unit weight was found to be 124 p.c.f. Its consistency is defined by moisture content of 28%, liquid and plastic limits of 32% and 18%, respectively. Laboratory tests show that the shear strength of the silty clay decreases with depth and reaches a constant value of 600 p.s.f. below approximately Elev. 551.0'. A plot of shear strength versus depth has been presented and is included in this report under Appendix I. The silty clay is fully saturated and consolidation test results indicate that it is normally consolidated.

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

cont'd. /4 ...

WATER CONDITIONS:

No ground water was encountered throughout the depths of boring during the investigation. The water level of Lake St. Clair is presently at approximately Elev. 574.

Due to the impermeable nature of the subsoil strata, it was not possible to accurately establish the elevation of the ground water table during the boring programme. The samples obtained were fully saturated, and the ground water table has been assumed at the existing ground surface. In view of the fact that no water-bearing sand seams or artesian water conditions were encountered during the time of boring, the amount of seepage inflow during footing excavations will be of minor quantities, only.

FOUNDATION SUPPORT:

The stiff upper crust of silty clay is competent to provide adequate foundation support for the proposed structure. Laboratory and field test results are such that spread footing support can be obtained in the stiff upper crust of silty clay at Elev. 580' or below. At this elevation or below, for footings of 60 ft. long and 7 to 10 ft. wide, a bearing capacity of 2 1/2 t.s.f., incorporating a safety factor of 3, can be provided. Footings founded at Elev. 580' are believed to have sufficient protection from frost penetration.

No seepage problems with respect to shallow footing excavations are anticipated since no water-bearing sand seams were encountered in the upper 20' to 25' of the subsoil.

Under the proposed grade lines of Hwy. 401 and Hwy. 2 Revision, the maximum height of fill is some 30 feet. The subsoil

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

has sufficient strength to safely support this proposed embankment loading.

SETTLEMENT ANALYSIS:

Settlements under the footings as a result of the application of 2 1/2 t.s.f. abutment bearing pressure and embankment load of 1.8 t.s.f. due to the weight of 30 ft. of approach fills, based on footing sizes of 60' long and 7' to 10' wide, have been estimated and are tabulated as follows:-

<u>Footing Elev. in feet.</u>	<u>Footing Size.</u>	<u>Settlement due to Abutment Load.</u>	<u>Settlement due to Embankment Load.</u>	<u>Total Settlement due to Abutment & Embankment Loads.</u>
580'	60' x 7'	2.7"	4.6"	7.3"
580'	60' x 10'	3.7"	4.2"	7.9"

Reference to the above figures shows that long term settlements upon application of abutment and embankment loads can be as much as 8 inches. This is mainly due to the fact that the stresses caused by the applied loads will influence the deep deposits of soft clay for a considerable depth. In any event, in view of the slow rate of consolidation expected of clay, settlement will continue over a long period of years. Using coefficient of consolidation values obtained from laboratory consolidation test results for this material, it can be shown that 50% and 90% of settlement will take place over an approximate period of 23 and 96 years, respectively. In view of the relatively uniform soil conditions at the site, little differential settlement of any

cont'd. /6 ...

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

consequence should be anticipated of a single-span structure since each abutment should settle the same amount. This settlement, however, is significant in the design of a multi-span structure where centre piers are incorporated, since long term differential movement between the piers and abutments would result. If a multi-span design is contemplated, a simply-supported structure appears to be necessary.

CONCLUSIONS & RECOMMENDATIONS:

- (1) The site is underlain by a stiff crust of silty clay, followed by a deep deposit of soft to medium silty clay.
- (2) Subsoil conditions are such that an allowable bearing pressure of 2 1/2 t.s.f. for spread footings of 7' to 10' in width can be obtained in the stiff upper clay crust at Elev. 580' or below. Footings founded at Elev. 580' are believed to have sufficient protection from frost action.
- (3) Ultimate settlements consequent upon application of abutment and embankment loadings have been estimated as much as 8 inches. This estimate is believed to be somewhat excessive. For a single-span structure, little differential settlement should be anticipated since each abutment will settle sensibly the same amount. However, if centre piers are incorporated in the design, long term differential movement between the piers and abutments would result. It appears that if a multi-span design is contemplated, a simply-supported structure is recommended.

CONCLUSIONS & RECOMMENDATIONS: (cont'd.) ...

- (4) No seepage problems with respect to shallow footing excavations are anticipated.
- (5) The proposed grade line of either Hwy. 401 or Hwy. 2 Revision presents no approach fill stability problem.

Abraham Loh
A. Loh,
FOUNDATION ENGINEER.

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB F-59-11

W.P. 159-58.

[illegible]

SUMMARY OF FIELD & LABORATORY TESTS

JOB F-59-11

W.P. 159-58.

[illegible]

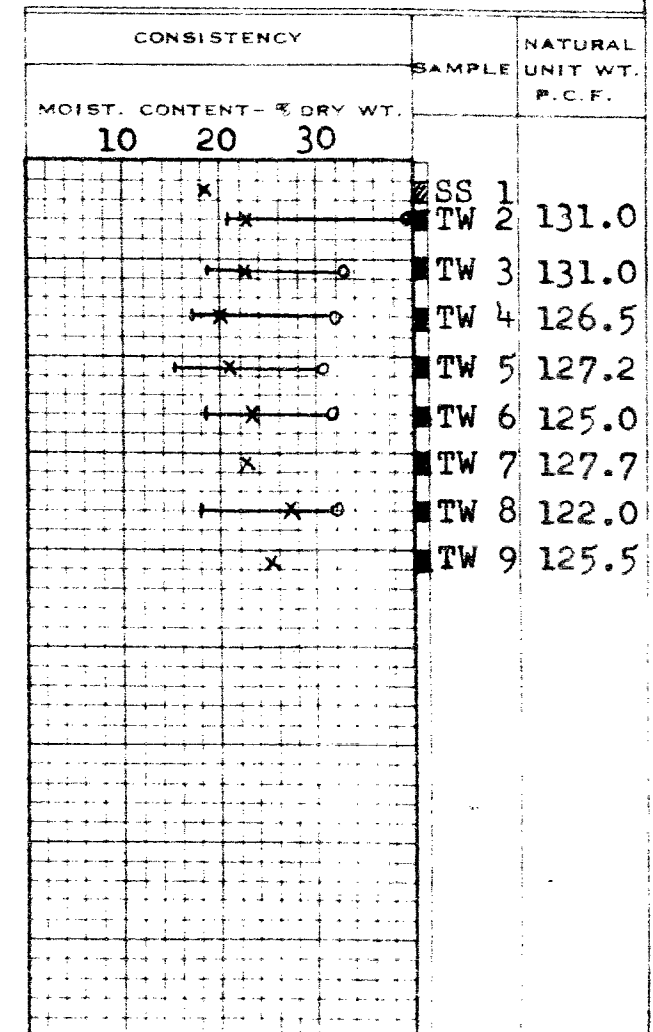
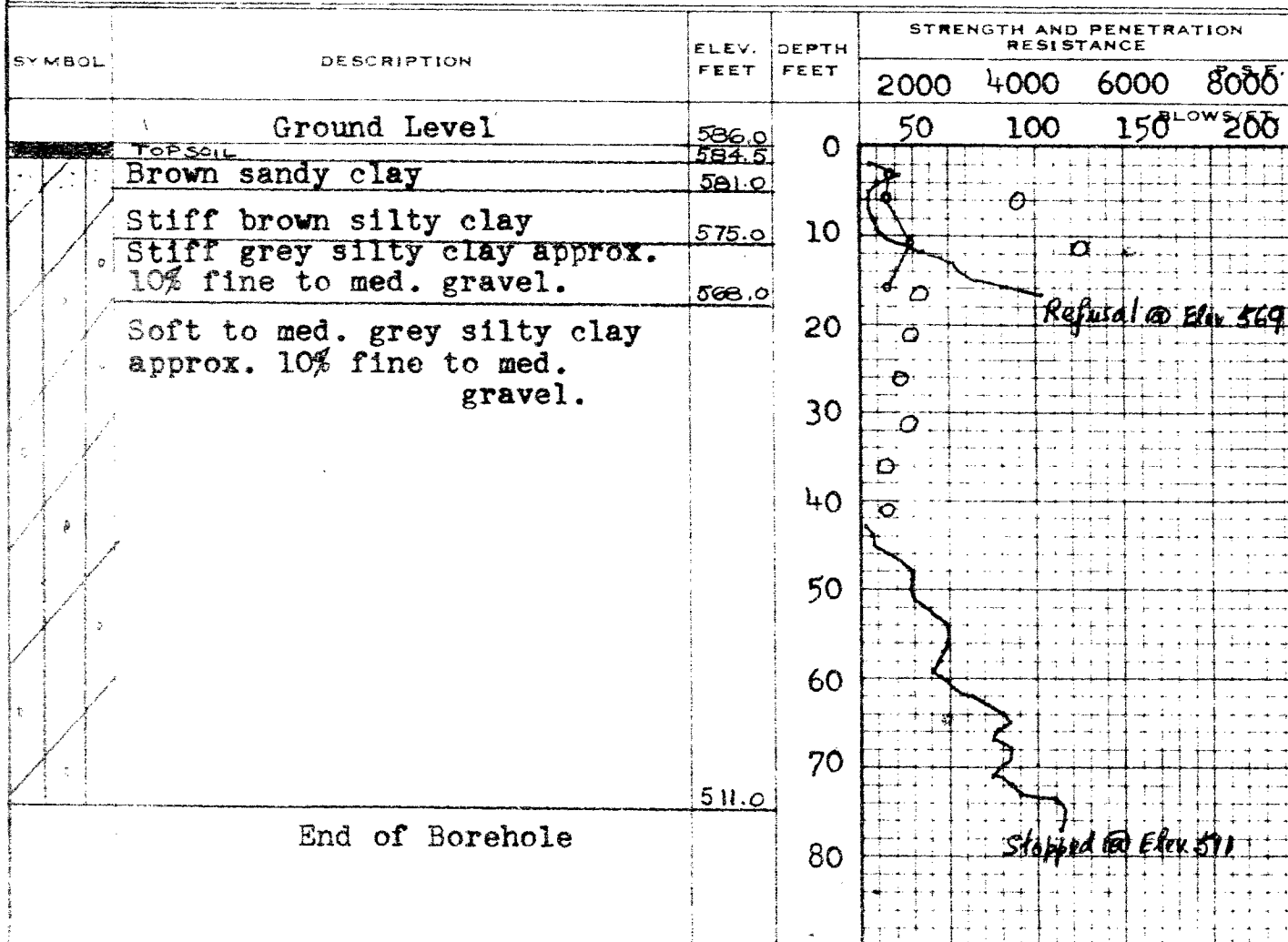
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 159-58 BORE HOLE NO. 1.
JOB F-59-11 STATION 76+07 (51' Lt.)
DATUM Geodetic COMPILED BY B.K.
BORING DATE Feb. 3/59. CHECKED BY A.L.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

SS 1/2 UNCONFINED COMPRESSION (Qu)
TW VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

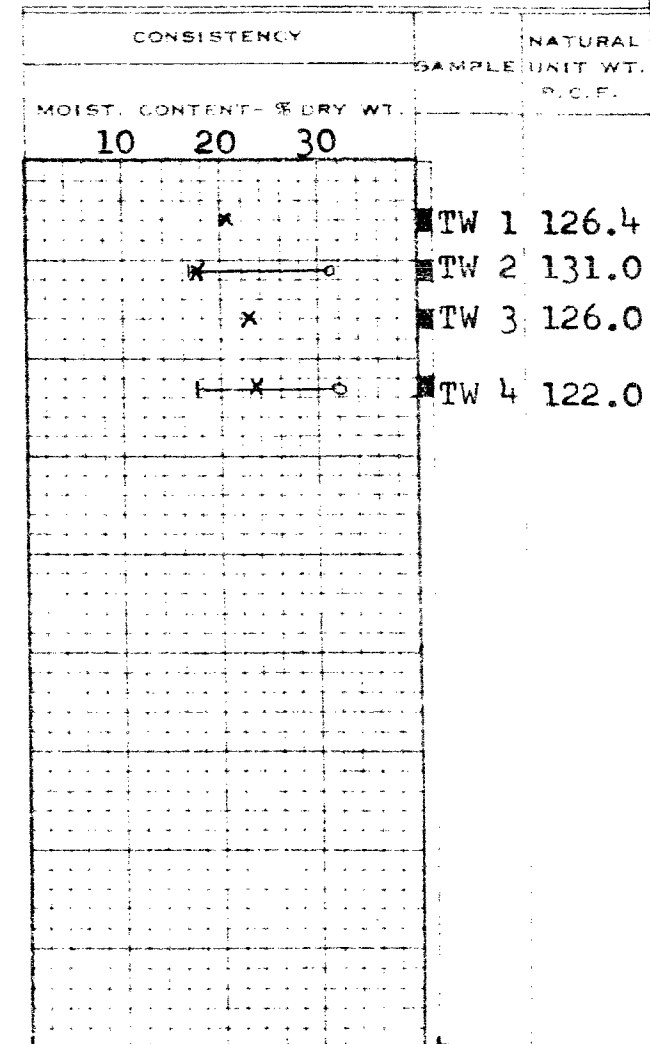
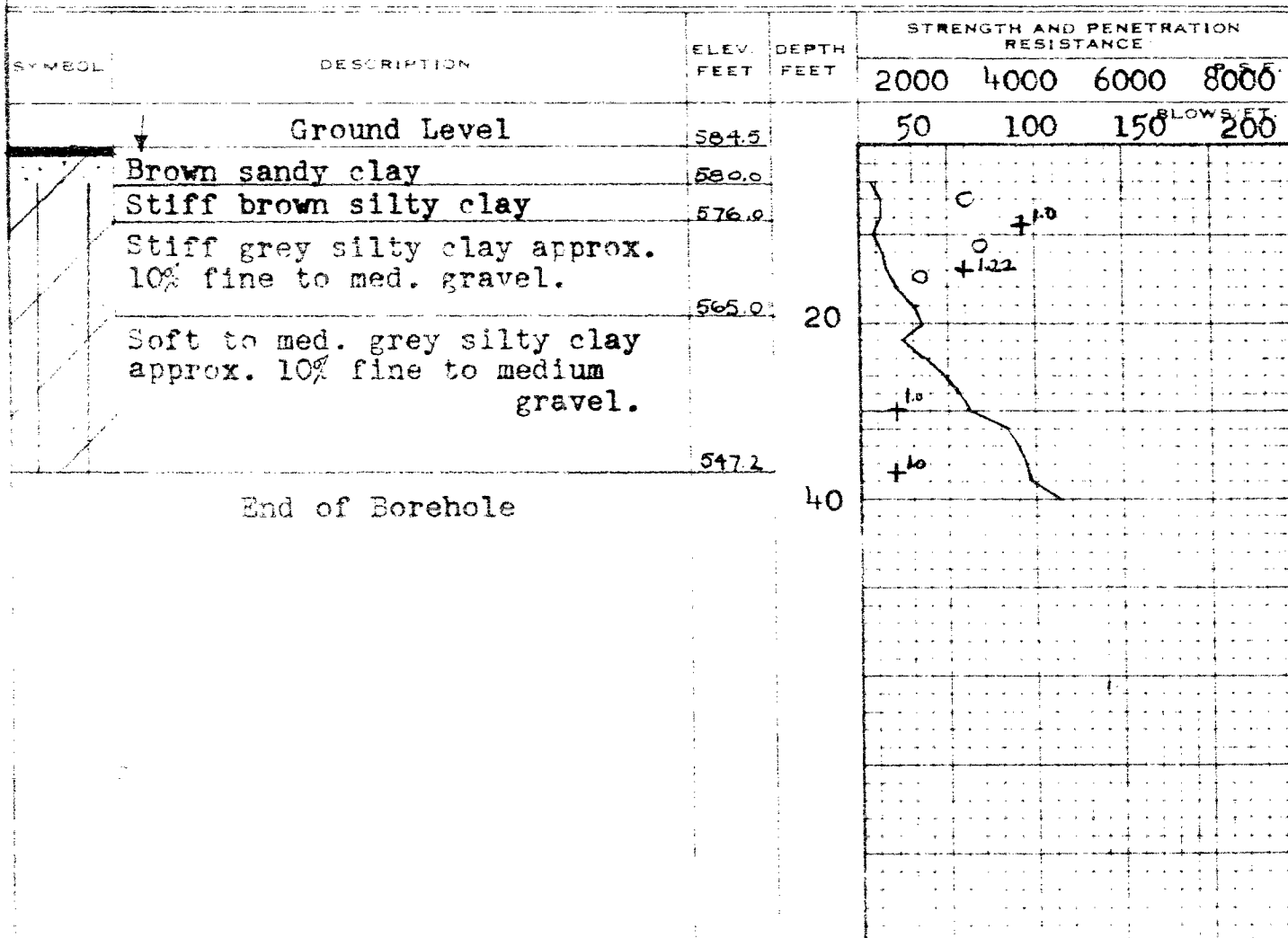


DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 159-58 BORE HOLE NO. 2
 JOB F-59-11 STATION 76+67 (51' Lt.)
 DATUM Geodetic COMPILED BY B.K.
 BORING DATE Feb. 4/59 CHECKED BY A.L.

LEGEND

2" DIA. SPLIT TUBE _____ SS 1/2 UNCONFINED COMPRESSION (Qu) _____ O
 2" SHELBY TUBE _____ TW VANE TEST (C) AND SENSITIVITY (S) _____ +S
 2" SPLIT TUBE _____ LI
 2" DIA. CONE _____ X
 2" SHELBY _____ LIQUIDITY INDEX _____ X
 CASING _____ PLASTIC LIMIT _____



OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 159-58 BORE HOLE NO. 3
 JOB F-19-11 STATION 27+13 (50' Rt.)
 DATUM Geodetic COMPILED BY B.K.
 BORING DATE Feb. 4/59 CHECKED BY A.L.

2" DIA. SPLIT TUBE _____
 2" SHELBY TUBE _____
 2" SPLIT TUBE _____
 2" DIA. CONE _____
 2" SHELBY _____
 CASING _____

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u) _____
 VANE TEST (C) AND SENSITIVITY (S) _____
 NATURAL MOISTURE AND LIQUIDITY INDEX _____
 LIQUID LIMIT _____
 PLASTIC LIMIT _____

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				2000	4000	6000	8000
	Ground Level	586.5		50	100	150	200
	Brown sandy clay	582.0					
	Stiff brown silty clay	576.5					
	Stiff grey silty clay - approx. 10% fine to medium gravel.	564.0	20				
	Soft to med. grey silty clay - 10% fine to med. gravel.	554.5					
	End of Borehole		40				
			60				

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			TW 1	123.8
			TW 2	130.0
			TW 3	127.8
			TW 4	127.8
			TW 5	125.8
			TW 6	123.0

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 159-58 BORE HOLE NO. 4
JOB F-59-11 STATION 76+52 (50' Rt.)
DATUM Geodetic COMPILED BY B.K.
BORING DATE Feb. 5/59 CHECKED BY A.L.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

SS 1/2 UNCONFINED COMPRESSION (Q_u)
TW VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				2000	4000	6000	8000
	Ground Level	586.3		50	100	150	200
	Brown sandy clay	579.8					
	Stiff brown silty clay	576.3					
	Stiff grey silty clay - approx. 10% fine to medium gravel.	563.3	20				
	Soft to med. grey silty clay - approx. 10% fine to medium gravel.	549.8	40				
	End of Borehole		60				

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			TW 1	
			TW 1A	131.5
			TW 2	131.5
			TW 3	129.1
			TW 4	126.5
			TW 5	120.2

