



FOUNDATION TECHNICAL MEMORANDUM

For

**GOVERNMENT DRAIN BRIDGE NO. 3 EBL ON HIGHWAY 401
MTO WEST REGION 59 STRUCTURE REHABILITATIONS
SITE 13-227-1, CONTRACT 7
GWP 3084-11-00
GEOGRAPHIC TOWNSHIP OF RALEIGH
KENT COUNTY, ONTARIO**

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FOUNDATION TECHNICAL MEMORANDUM

For

Government Drain Bridge No. 3 EBL, Highway 401
MTO West Region 59 Structure Rehabilitations
Contract 7, GWP 3084-11-00
Geographic Township of Raleigh
Kent County, Ontario

1. INTRODUCTION

The Foundation Engineering Service for the present project involve the detail foundation investigation and design for the rehabilitation of 59 structures in MTO West Region along Highways 4, 6, 401, 402 and 403. Ten (10) Group Work Projects (GWP's) are contemplated to be completed between 2014 and 2020.

This technical memorandum summarizes the factual results of geotechnical data based on the review and compilation of existing subsurface information from relevant reports in the MTO GEOCRES Library for the Highway 401 Government Drain Bridge No. 3 EBL (Eastbound Lanes). The Foundation Engineering recommendations from the existing bridge foundation reports are summarized with reference to the "Canadian Highway Bridge Design Code" (CHBDC) and follow in general the "Guidelines for Professional Engineers providing Geotechnical Engineering Services".

From the Minutes of Meeting Report, dated July 24, 2014, it is understood that the bridge will be rehabilitated in a single stage using median crossovers.

The purpose of the Technical Memorandum is to summarize the subsurface and groundwater conditions and foundation recommendations based on available reports at the bridge location for the design project team's reference.

The elevations in this report are expressed in meters, unless otherwise noted.



2. PROJECT SITE BACKGROUND AND GEOLOGY

The Highway 401 Government Drain Bridge No. 3 is located approximately 12.8 km south of Chatham in the Geographic Township of Raleigh, Kent County, Ontario. The Government Drain No. 3 (Jeannette Creek) passes between the bridge structure. A key plan is shown in Figure 1.

The existing structure is a single span reinforced concrete rigid frame structure that carries two lanes of Highway 401 Eastbound traffic. The surrounding areas around the site location are generally flat farming lands on both sides of Highway 401.

Physiographically, the site is located in the St. Clair Clay Plain, which consists of flat and relatively deep, typically very stiff clayey silt and silty clay till deposits. The bedrock underlying the Highway 401 alignment throughout the Geographical Township of Raleigh comprises mostly of the black bituminous shale containing locally grey shale of the Kettle Point Formation. According to local residents in the immediate vicinity of the site, limestone bedrock was encountered at approximate elevation 154.8 to 156.0 (508 to 512 ft.). The bedrock surface lies at about 23 to 38 m (75 to 125 ft.) below ground surface in the Geographical Township of Raleigh area (Quaternary Geology of the Chatham-Wheatley Area, Southern Ontario, 1995).

3. SOURCE OF INFORMATION

The following foundation report and drawing, appended in Appendix A, were available for review and provided information for the bridge structure, subsoil information and original foundation recommendations.

1. Foundation Report on Hwy 401, W.J. F-59-61. W.P. 12-59, Line "C" and Jeannette Creek & Gravel Road Proposed Crossing, Lots 12 & 13, Con. VII, Township of Raleigh, Approximately 8 miles south of Chatham by Materials and Research Section, Department of Highways Ontario, September 4, 1959. GEOCRE NO. 40J08-011. (Reference 1)
2. Raleigh Township Bridge No. 9 - General Plan, Elevations & Sections', The King's Highway No. 401, Lot 12 & 13, Con. VII, District No. 1, W.P. 12-59, Department of Highways Ontario, October 1959. (Reference 2)



4. SITE RECONNAISSANCE

As part of the current foundation engineering assessment study, a site reconnaissance of the Government Drain Bridge No. 3 EBL was carried out on October 20, 2013. A photographic record of the site visit is attached in Appendix B.

The adjacent slopes of the abutments were observed to be vegetated and visually stable (Photograph 1). No erosion of the slope faces or scouring of the slope toes were observed. The front earth slope of the east abutment wall (Photograph 2) was mostly covered with rip-rap and some grass. Slight scouring of the slope face and scouring of the slope toe was observed. The west abutment wall slope was exposed (Photograph 3) and minimum rip-rap protection was observed. The exposed earth was observed to be affected by erosion/scouring, most likely due to repeated cycles of fluctuation of the creek water level throughout the season. No obvious major cracks were observed on the abutment walls except for some minor surface cracks. Open weep holes were observed in the abutment walls (Photographs 2 and 3). Concrete deteriorations and exposed rebar were observed on the wingwalls, deck and barriers. No visual inspection could be made of the foundations below ground.

At the time of the site reconnaissance, the water level of the creek was about 0.5 m deep and the direction of the water flow was towards the north.

5. PREVIOUS INVESTIGATIONS AND SUMMARIZED SUBSURFACE CONDITIONS

The site is located on Highway 401 in the Geographic Township of Raleigh, Kent County, Ontario. The general subsurface conditions presented in this section are based on the Foundation Report, GEOCRE 40J08-011 dated September 4, 1959.

The foundation report includes the borehole location plan (Drawing No. F59-61A), Record of Borehole sheets and summary of the Field and Laboratory tests.

The previous Foundation Report included three separate field investigations which were carried out on three separate occasions. The first investigation was carried out for the proposed bridge structures at the existing Jeannette Creek. A total of four boreholes, 1 to 4, were drilled between February 2 and 13, 1959. The second investigation was conducted following the first investigation when consideration for the creek diversion was proposed. Two additional boreholes, 5 and 6, were



drilled on June 16, 1959. A third investigation was completed when an underpass structure was proposed for the contemplated gravel road revision, which was proposed 30.5 m (100 ft.) away from the proposed bridge structures. This investigation included three boreholes, 7 to 9, which were drilled on July 22 and 23, 1959.

For the purpose of summarizing the subsoil conditions at the bridge location, only the first investigation is considered. Boreholes, 1 to 4, were drilled to depths between 8.2 and 12.8 m (27 to 42 ft.), elevation 166.3 to 171.0 (545.6 to 561.0 ft.). Two dynamic cone penetration tests (DCPT) were conducted directly adjacent to the location of boreholes 1 and 2 to depths of 6.9 and 7.2 m (22.5 and 23.5 ft.), elevation 171.5 and 171.0 (562.5 and 561.5 ft.), respectively. The investigation was carried out by using a standard diamond drill adapted for soil sampling.

Generally, the subsoil condition revealed firm to hard silty clay in all four boreholes from ground surface to termination depths of the boreholes at 8.2 to 12.8 m (27 to 42 ft.), elevation 166.3 to 171.0 (545.6 to 561 ft.).

Silty Clay

A continuous silty clay stratum was encountered surficially in all four boreholes and extended to termination depths of 8.2 to 12.8 m (27 to 42 ft.), elevation 166.3 to 171.0 (545.6 to 561 ft.). In general, the upper 2.1 to 3.0 m (7 to 10 ft.) silty clay had been oxidized to its brownish colour and extended to elevation 175.2 to 176.2 (575 to 578 ft.). Sand seams were encountered within the silty clay layer in boreholes 3 and 4 between elevations 176.8 and 177.4. N values recorded generally ranged from 16 to 60, with local N values of 8 and 10 in the upper 1.5 m. The consistency of the stratum was typically very stiff to hard, with firm consistency in the upper 1.5 m zone. Bedrock was not encountered in any of the four boreholes during the site investigation.

The silty clay samples contained approximately of 49% clay, 27% silt, 18% sand and 6% gravel sized particles throughout. Laboratory shear strengths obtained ranged from 292.1 to 54.5 kPa (6100 to 1140 psf). The Atterberg liquid limit ranged from 23.2 to 27.8 and the plastic limit ranged between 14.9 and 16.6 for the silty clay samples. The plasticity index ranged from 7.1 to 11.8. Further, the unit weight of the silty clay samples varied from 18.9 to 21.4 kN/m³. The moisture content determinations ranged between 12.7 to 22.2%.



Groundwater

Groundwater was observed in boreholes 3 and 4 at 1.5 and 1.2 m (5 and 4 ft.) elevation 177.6 (582.6 ft.) and 177.9 (583.6 ft.), respectively. Due to the low permeability of the silty clay subsoil, it was not feasible to accurately establish the ground water table at the site during the investigation. The groundwater table at the site was assumed to be at the seasonal water level of the Government Drain No. 3 (Jeannette Creek) at approximate elevation 175.6 to 177.7 (576 to 583 ft.).

6. FOUNDATION

6.1 Previous Foundation Recommendations

The foundation report recommended spread footings to be founded at elevation 172.5 (566 ft.) or below for the proposed bridge structure. Further, for footings of 2.1 to 3.0 m (7 to 10 ft.) wide, an allowable bearing pressure of 215.5 kPa (2.25 tsf) was recommended for spread footing design at the proposed founding elevation. It was considered that footings founded at this proposed elevation 172.5 (566 ft.) or below, would provide adequate protection from stream erosion and scour and would allow for future deepening of the creek channel. The report considered that the total and differential settlements anticipated due to the applied load would be tolerable for a single span structure.

Because sand seams were encountered in the boreholes, the report recommended that if high water table conditions were observed during footing excavation, pumping operations might be necessary in the immediate vicinity of the banks of the creek; however, if the excavation was carried out during the normal creek water level period, excavation below the streambed could be carried out in the dry. The critical elevation below which 'piping' could occur during dewatering or footing excavations was estimated to be at approximately elevation 160.0 (525 ft.).

A maximum height of 2.7 m (9 ft.) fill was anticipated at the proposed approaches at the bridge structure. It was considered that the subsoil could safely support the embankment loading. Further, it was recommended that to avoid endangering the stability of the canal, a minimum of 5.2 m (17 ft.) was to be maintained between the toe of the embankment slope at the gravel road crossing and the top of the canal bank.



Based on the Reference 2 drawing, titled 'Raleigh Township Bridge No. 9 - General Plan, Elevations & Sections', dated October 1959, the footings were to be founded at about elevation 172.5 (566 ft.). The original ground slopes were shown to be cut back and were to be graded at 2H:1V at the bridge site location. A maximum height of 2.7 m was shown at the proposed approaches to the bridge structure. Rip-rap protection of the banks was to be provided to mitigate erosion and scour. The proposed widening of the drainage channel was shown to be 3.4 m± (11 ft.±).

6.2 Assessment of Foundation Parameters

Based on the previous investigation and subsurface conditions encountered, the following table summarizes the foundation design parameters that were recommended in the previous report and the updated geotechnical reaction at SLS and factored geotechnical resistance at ULS are provided.

FOUNDATION DESIGN PARAMETERS

Foundation and Type	Elevation of Footings (m)	Previous Safe Bearing Resistance (tsf) ¹	Previous Equivalent Limit State Design Values		Limit State Design Values Updated to current industry practices ²	
			SLS Geotechnical Reaction (kPa)	ULS Factored Geotechnical Resistance (kPa)	SLS Geotechnical Reaction (kPa)	ULS Factored Geotechnical Resistance (kPa)
East Abutment on Spread Footing	172.5 (566 ft.)	2.25	215	320	325	485
West Abutment on Spread Footing						

- Notes:**
1. Working stress design values. The Ultimate Limit State design values are based on the working stress. No field verifications were made.
 2. Resistance Factor = 0.5 for shallow foundation (CFEM 4th edition)
Assumed Factor of Safety is 3 (CFEM 4th edition)

The seismic site coefficient for the conditions at this site is 1.0 (soil profile Type 1, Canadian Highway Bridge Design Code (CHBDC) 2006 Edition, clause 4.4.6). The bearing resistance for inclined loads should be reduced in accordance with the requirements of clause 6.7.4 of the CHBDC. The foundation frost penetration depth at the site is 1.2 m according to OPSD 3090.101.



7. DISCUSSION

From a geotechnical point of view, at the present time, foundation work for the Government Drain Bridge No. 3 EBL structure is not expected provided that the total dead load on the bridge does not increase or decrease by more than 10%.

It is understood that the bridge will be rehabilitated in a single stage using median crossovers.

Further, it is suggested that the weep holes in the abutment walls should be maintained and cleaned on a regular basis to prevent any clogging of the holes. Regular maintenance of the weep holes will keep the water flowing from behind the abutment walls and will mitigate hydrostatic pressure from building up behind the abutment walls.

In addition to rehabilitating the bridge, the earth in front of the abutment walls may be protected from scouring effects with rock protection, rip-rap or equivalent materials. The aggregate materials should conform to OPSS.PROV 1004 and the construction of the rock protection, rip-rap or equivalent should conform to OPSS 511.

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8. CLOSURE

This Technical Memorandum was prepared by Mr. Nazibur Rahman, P.Eng with the assistance of Mr. Mansoor Khorsand, EIT and was reviewed by Mr. Robert Ng, PhD, P.Eng. Mr. Brian R. Gray, MEng, P.Eng., MTO Designated Principal Contact conducted an independent review of the report.

We trust this memo is sufficient for your immediate needs. Please do not hesitate to contact us if you have any inquiries and/or comments.

Yours very truly,

Peto MacCallum Ltd.



Nazibur Rahman, P.Eng.
Project Engineer, Geotechnical Services



Robert Ng, MBA, PhD, P.Eng.
Senior Project Engineer



Brian R. Gray, MEng, P.Eng.
MTO Designated Principal Contact

NR/RN/BRG:jk

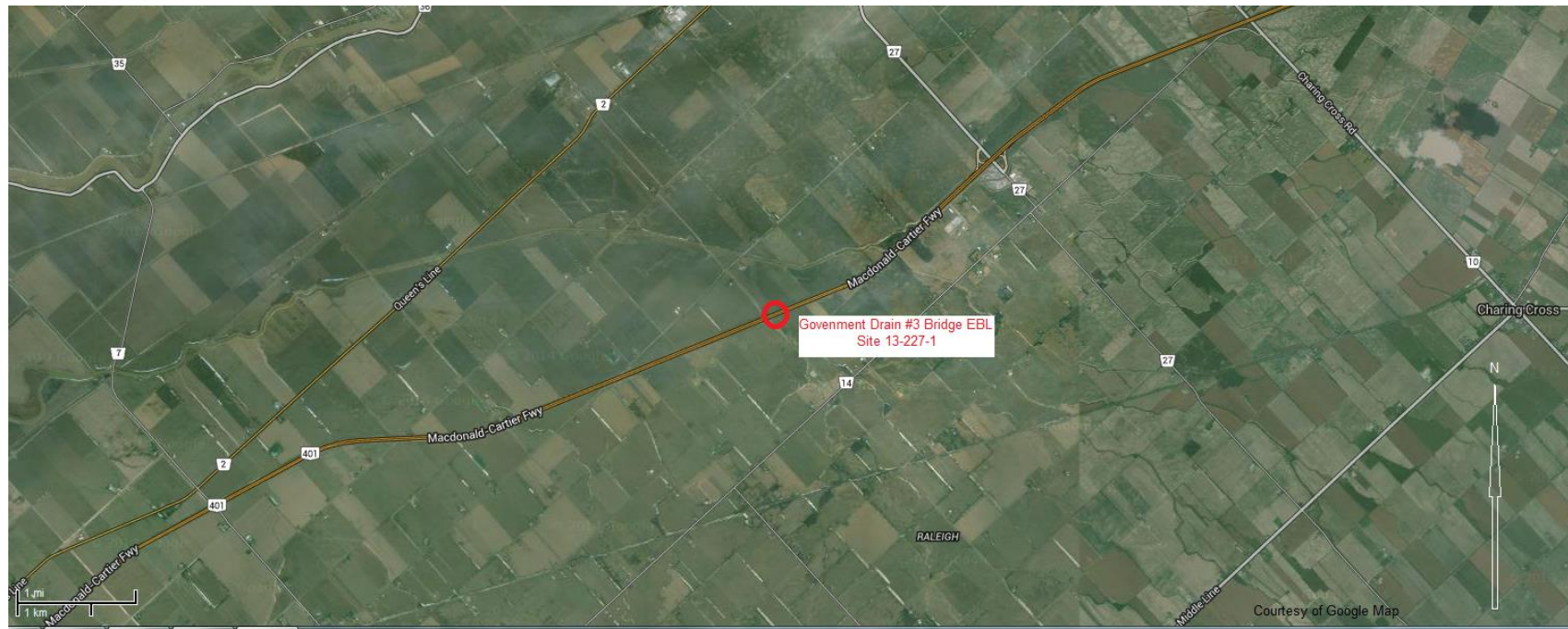


TABLE 1

LIST OF STANDARD SPECIFICATIONS REFERENCED IN REPORT

DOCUMENT	TITLE
OPSS 511	Construction Specification for Rip-Rap, Rock Protection, and Granular Sheeting
OPSS.PROV 1004	Material Specification for Aggregates - Miscellaneous
OPSD 3090.101	Foundation Frost Depth for Southern Ontario

Figure 1 – Key Plan





APPENDIX A

Foundation Report at Government Drain Bridge No. 3 (GEOCRES 40J08-011)

General Plan and Elevation Raleigh - Township Bridge No. 9, dated October 1959

#

59-F-61

W.P. [#] 12-59

Hwy [#] 401

GRAVEL RD.

JEANNETTE CREEK

OVER

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division.
Attention: Mr. K. G. Bassi

FROM: Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

DATE: September 7, 1966

OUR FILE REF.

IN REPLY TO

SUBJECT:

Hwy. 401 & Dillon Side Road
District No. 1 (Chatham) -
W.P. 12-59 - W.J. 59-F-61

As requested by you, we have reviewed the subsoil conditions and submit the following comments pertaining to the abutment foundations:

The proposed abutments can be supported on end-bearing piles driven to bedrock. Allowable loads will depend upon the section chosen (e.g., 12 BP 74 steel H-piles may be designed for 90 tons per pile). As an alternative, the abutments can be supported on 45-ft. long friction piles. In such a case, a safe load of 15 tons/pile may be used for #14 timber piles.

Based on 2' with original ground.

MD/MdeF

cc: Foundations Office
Gen. Files

M. Devata

M. Devata,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

Look at El. 510.00 ± (definitely)

*Differential Settlement with Abt. on H Piles & pier on spread footings
between End pier & Abt (1 1/2')
between End pier & Centre pier 1 ±*

D.H.O. TORONTO RECEIVED SEP 8 1966 BRIDGE OFFICE

check Cost

Steel H Piles

14 Treated lumber

OVER

DEPARTMENT OF HIGHWAYS

MEMORANDUM

Cost	Supply	5.55	(@150/ton)	2.00
------	--------	------	------------	------

From: Mr. C. S. Grebner,
 District Engineer,
 Bridge Division,
 Attention: Mr. K. G. Bader

To: Mr. C. S. Grebner,
 District Engineer,
 Bridge Division,
 Attention: Mr. K. G. Bader

2500 kip

0.26 10 0.22

Our File Ref

8.11/84 3.29/84

Cost/Pile

95x11.11x5770.00 45x3.29x149.00

"/ton Capacity

\$ 8.56

\$ 9.86

300 Ton

As indicated by you, no further review of the
 conditions and submit the following comments:
 bearing 20' x 10' x 2' = 4720

Piers

The proposed abutments can be supported on
 end-bearing piles driven to bedrock. Allowable loads
 will depend upon the section chosen (e.g., 12 SP 14
 steel H-piles may be designed for 90 tons per pile).
 As an alternative, the abutments can be supported on
 12' long friction piles. In such a case, a pile load
 of 15 tons/pile may be used for the timber piles.

Line loss of Girders

87.00
 15 x 197 = 2955

2960

5746

Increase in cost of all

footings are found on piles

Structure fully semi continuous

5746
 - 720
 \$ 5026

Use Timber piles at Abts & Spread footings at Piers

BA940
RALEIGH Twp. #9



ONTARIO
DEPARTMENT OF HIGHWAYS

emo to Mr. A. M. Toye, Date September 10, 1959.
Bridge Engineer. Subject _____
rom Materials & Research Section. _____

Attention: Mr. S. McCombie.

Re: Foundation Report - W.J. F 59-61 : W.P. 12-59,
Hwy. 401, Line 'C' and Jeannette Creek &
Gravel Road Proposed Crossing, Lots 12 & 13,
Con. VII, Twp. of Raleigh, Approx, 8 Miles
South of Chatham.

Please find enclosed, additional log sheets for
boreholes 7, 8 & 9, to be inserted under Appendix I
of the above report which was mailed to you recently.

Due to the fact that these sheets were submitted
to the blueprinters at a later date than the others,
their return to our office was consequently delayed.

We hope this hold-up has not caused you too much
inconvenience.

/MdeF
Encls.

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

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

[Handwritten signature]
Secretary

SUMMARY OF FIELD & LABORATORY TESTS

JOB F 59-61

W.P. 12-59

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
7	T 1	5'-6.5'	Stiff brown silty clay.	P	25.4	22.0	28.2	2030	121.4	Approx. 6% fine to medium gravel.
	T 2	10'-11.5'	Stiff grey silty clay.	P	30.0	20.7	38.0	-	108.2	
	T 3	15'-16.5'	" " " "	P	19.0	18.3	30.0	2060	130.5	
	T 4	20'-21.5'	" " " "	P	19.0	16.5	27.0	1430	130.4	
	T 5	25'-26.5'	" " " "	P	19.0	17.4	27.9	1210	131.5	
	T 6	30'-31.5'	" " " "	P	18.4	17.1	21.3	1395	132.0	
	T 7	36'-37.5'	" " " "	P	18.7	17.6	27.0	2060	130.8	
	T 8	45'-46.5'	" " " "	P	21.4	17.2	26.2	-	126.7	
	T 9	55'-56.5'	" " " "	P	18.9	15.3	23.5	1410	130.0	
8	T 1	5'-6.5'	Stiff brown silty clay.	11	28.8	-	-	6300	127.0	Approx. 6% fine to medium gravel.
	T 2	10'-11.5'	Stiff grey silty clay.	P	17.6	-	-	1700	136.4	
	T 3	15'-16.5'	" " " "	P	19.8	-	-	1205	132.1	
	T 4	20'-21.5'	" " " "	P	20.1	-	-	1128	131.6	
	T 5	25'-26.5'	" " " "	P	19.3	-	-	1410	130.8	
	T 6	30'-31.5'	" " " "	P	19.4	-	-	1280	129.9	
	T 7	35'-36.5'	" " " "	P - 6" 46 for 12"	18.0	-	-	1655	133.0	
	T 8	40'-41.5'	" " " "	P	18.5	-	-	1832	129.9	
9	T 1	5'-6.5'	Stiff brown silty clay.	P	25.6	-	-	1740	122.2	Sens: 1.0 cont'd.
	T 2	10'-11.5'	Stiff grey silty clay.	P	27.3	-	-	1685	122.0	
	T 3	15'-16.5'	Med. grey silty clay.	P	29.2	-	-	940	119.2	
	Vane	18'	" " " "	-	-	-	-	960	-	

SUMMARY OF FIELD & LABORATORY TESTS

JOB F 59-61

W.P. 12-59.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION



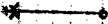
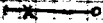





W.P. 12-59 BORE HOLE NO. 7
JOB F 59-61 STATION 257+84 (58'Rt.)
DATUM Elev. 586' COMPILED BY B.K.
BORING DATE July 22/59 CHECKED BY A.L.

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

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u) — O
VANE TEST (C) AND SENSITIVITY (S) — +^S
NATURAL MOISTURE AND LIQUIDITY INDEX — LI
LIQUID LIMIT — X
PLASTIC LIMIT —

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				500	1000	1500	2000
	↓ Ground Level			B.S.F.			
	Top soil	586.0	0	BLOWS/FT.			
	Stiff brown silty clay.	579.0	10				
	Stiff grey silty clay - Approx. 6% fine to medium gravel.		20				
			30				
			40				
			50				
			60				
			70				
	Probably bedrock. End of hole.	508.0	80				

CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT- % DRY WT. 10 20 30			
		T1	121.4
		T2	108.2
		T3	130.5
		T4	130.4
		T5	131.5
		T6	132.0
		T7	130.8
		T8	126.7
		T9	130.0

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 12-59

BORE/HOLE NO. 8.

JOB F 59-61

STATION 257+62 (58' Lt.)

DATUM Elev. 586'

COMPILED BY B.K.

BORING DATE July 23/59

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				
				500	1000	1500	2000	PS F.
	↓ Ground Level							
	Topsoil	586.0	0					
	Stiff brown silty clay.	577.0	10					6300
	Stiff grey silty clay.		20					
			30					
		545.0	40					
	End of Borehole.		50					
			60					
			70					
			80					

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
		x	T 1	127.0
	x		T2	136.4
	x		T3	132.1
	x		T4	131.6
	x		T5	130.8
	x		T6	129.9
	x		T7	133.0
	x		T8	129.9

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION








 W.P. 12-59 BORE HOLE NO. 9.
 JOB F 59-61 STATION 256+70 (Q)
 DATUM Elev. 587' COMPILED BY B.K.
 BORING DATE July 23/59 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) \circ
 VANE TEST (C) AND SENSITIVITY (S) $+s$
 NATURAL MOISTURE AND LIQUIDITY INDEX LI
 LIQUID LIMIT X
 PLASTIC LIMIT \circ

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				500	1000	1500	2000
	↓ Ground Level	587.0	0	BLOWS/FT.			
	Stiff brown silty clay.	576.0	10				
	Stiff grey silty clay.		20				
			30				
			40				
	End of Borehole.	540.0	50				
			60				
			70				
			80				

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			T 1	
			T 2	
			T 3	
			T 4	
			T 5	
			T 6	
			T 7	



Memo to Mr. A. M. Teye, Date September 4, 1959.
Bridge Engineer. Subject Re: Foundation Report -
From Materials & Research Section. W.P. 12-59 - W.J. F-59-61

Attention: Mr. S. McCombie.

Hwy. 401, Line 'C' and Jeannette Creek
& Gravel Road Proposed Crossing,
Lots 12 & 13, Con. VII, Twp. of Raleigh,
Approximately 8 Miles South of Chatham.

This memo accompanies our detailed foundation report at the above site. For your convenience, the results are summarized as follows:-

- (1) In general, the site is underlain by a medium stiff silty clay, followed by a limestone or shale bedrock.
- (2) An allowable bearing pressure of 2 1/4 tons/sq. ft. may be used for the foundations of the bridge structure, or the proposed underpass, provided that these foundations are founded at elevation:-
 - (a) 566' (or lower) for the bridge crossing at Jeannette creek; 582.50
 - (b) 579' (or lower) for the proposed revised gravel road location; *Based on G.L. 586 (original)*
 - (c) 566' (or lower) for the gravel road crossing at the present location.

The elevation of 566' for the Jeannette Creek Bridge is believed to provide adequate protection from scour and erosion, and also takes into consideration possible dredging of the channel.

- (3) If excavations for footings are to be left open for any period of time, a thin layer of weak concrete should be placed to prevent softening of the silty clay.

Talked to M. Devata on phone Oct 6/66. Above footing cont'd. /2 ...
elevation (El. 579.00) is based on frost cover from original
Ground Level of 585'. According to M. Devata, since the
present G.L. is approx. 590', the footing elevations can be
raised to El. 582.50 with the bearing pressure of 2 1/4 Tons/sq. ft.
still being applicable.

R. Sassi

How much?

- (4) Settlements associated with the allowable bearing pressure of 2 1/4 tons/sq. ft. will be within tolerable limits for the type of structure proposed.
- (5) The impermeable nature of the subsoil should enable excavations to be made without serious inflow of water. An exception to this may be in the vicinity of the Jeannette Creek where thin sand seams may allow considerable water to enter the excavations. A minimum of 17 ft. as indicated in the report, should be provided from the toe of the embankment to the top edge of the creek bank.
- (6) Steel 'H' piles are not recommended at this site since refusal depth cannot be accurately predicted. If steel 'H' piles are required, pile load tests will be required to determine the pile length.

If any further information is required with respect to this project, please contact our office.

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

K. Peaker

(K. Peaker,
FOUNDATION FIELD SUPERVISING ENGR.)

KP/MdeF
Encl.

cc: Messrs. A. M. Teye
H. A. Tregaskes,
D. G. Ramsay
A. Gater
G. U. Howell
J. Roy
A. Watt

Foundation Section
Gen. Files

FOUNDATION REPORT

on

Hwy. 401, Line 'C' and Jeannette Creek
& Gravel Road Proposed Crossing,
Lots 12 & 13, Con. VII, Twp. of Raleigh,
Approximately 8 Miles South of Chatham.

Plan No: F-3533-4

Profile No: F-3533-5

Distribution:

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

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

Mr. D. G. Ramsay,
Road Design Engineer. (1)

Mr. A. Gater,
Sr. Project Design Engr. (1)

Mr. G. U. Howell,
District Engr., Chatham. (1)

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

Mr. A. Watt,
Ontario Water Resources Commission. (1)

Foundation Section. (1)

Gen. Files. (1)

W.J. F-59-61

W.P. 12-59

INTRODUCTION:

Presented in this report are the results of a subsoil investigation carried out at a site approximately 8 miles south of Chatham where proposed Hwy. 401, Line 'C' crosses the existing Jeannette Creek and underpasses the contemplated gravel road revision in Lots 12 & 13, Con. VII, Twp. of Raleigh (Sta. 256+40), at existing creek crossing & Sta. 257+71 at gravel road-revision crossing, Profile No. F-3533-5). This report contains the detailed results of field and laboratory findings and recommendations for the foundation of the structures.

The field investigation was carried out on three separate occasions due to changes in the location of the structures. Initially, a closing of the existing gravel road was proposed with a crossing at approx. Sta. 256+40 at the existing Jeannette Creek. This initial investigation, consisting of 4 sampled boreholes, Borings 1, 2, 3 & 4) was carried out between Feb. 2nd and Feb. 13th, 1959. After the completion of this investigation, a diversion of the creek was proposed at approx. Sta. 255+83. As a result of this proposed creek diversion, a second investigation, consisting of 2 sampled boreholes (Borings 5 & 6) was carried out on June 16th, 1959, to confirm similar subsoil conditions. Immediately after the second investigation, an underpass structure was suggested at the contemplated gravel road revision. In view of the fact that the contemplated gravel road revision is located at a distance of over 100 feet from our previous borings, a third investigation, consisting of 3 sampled boreholes (Borings 7, 8 & 9) was carried out between July 22nd & July 23rd, 1959. Subsoil conditions at the site, as revealed by the three investigations, are relatively uniform.

INTRODUCTION: (cont'd.) ...

For structures located between approximately Sta. 255+00 and Sta. 258+00, either at the gravel road revision and existing creek, or the existing gravel road and creek diversion crossings, recommendations contained in this report can be followed.

DESCRIPTION OF THE SITE & GEOLOGY:

The site and its surrounding areas are generally flat farmland presently under cultivation. Jeannette Creek has been dredged and widened to the existing drainage channel. The normal water level of the creek is at an elevation of approximately 2 or 3 feet above its stream-bed. During spring run-off, it has been reported that the high water level reached the top of the creek banks. Erosion due to scour, is evidenced along the banks of the creek.

The site under consideration, is located on a clay plain. According to available geological information, the area is covered by deep deposits of clay overlying limestone bedrock. At this site the clay exists in a medium to stiff condition to a depth of approximately 72 ft. where probably bedrock commences.

DESCRIPTION OF FIELD & LABORATORY WORK:

Field work consisted of 9 sampled boreholes carried out on three separate occasions. An initial boring programme consisting of Borings 1, 2, 3 & 4, was carried out by a standard diamond drill adapted for soil sampling, between Feb. 2nd & Feb. 13, 1959. A second boring programme consisting of Borings 5 & 6 and a third

cont'd. /3 ...

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

consisting of Borings 7, 8 & 9, was carried out by a continuous flight auger on June 16th, 1959 and July 22nd to July 23rd, 1959, respectively.

Samples were recovered at the depth required by means of 2" I.D. thin-walled Shelby samplers, or a 2" O.D. split barrelled spoon sampler. The dimension of this spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test. Upon recovery, samples were examined, identified and wax-sealed or placed in moisture proof containers for transport to our laboratory. In addition to the sampled boreholes, a dynamic cone penetration profile was obtained adjacent to Borings 1 & 2 and in-situ vane shear tests were carried out in Borings 5, 6 & 9.

Upon receipt in the laboratory, samples were visually examined and identified. Triaxial shear and consolidation tests in addition to routine index tests, were carried out on selected representative samples. Laboratory test results have been presented in the borehole logs and are detailed in Table No. 1 under Appendix I.

SUBSOIL CONDITIONS:

In general, the site is composed of a medium to stiff silty clay stratum overlying probably bedrock.

In each of the sampled boreholes, the topsoil was found to be underlain by the medium to stiff silty clay stratum. The upper 7' to 10' of the clay stratum has been oxidized to its present brownish colour. Below the oxidized zone, the colour is

cont'd. 4/ ...

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

predominantly grey. This stratum of medium to stiff silty clay was explored to a depth of 78 ft. (i.e. Elev. 508') in Boring 7, and 72 ft. (i.e. Elev. 512') in Borings 5 & 6, where probably bedrock was encountered. Bedrock has not been proven by core-drilling since the auger was not equipped to take rock core samples. According to local residents in the immediate vicinity of the site, limestone bedrock was encountered at approximately Elev. 512' to 508'.

The medium to stiff silty clay contains approx. 27% silt, 18% sand and 6% fine to medium gravel throughout. The average unit weight and moisture content were found to be 130 p.c.f. and 19%, respectively. Liquid and plastic limits averaged 27% and 17%. Field and laboratory tests show a minimum shear strength of 1000 p.s.f. A plot of shear strength vs. depth, has been presented and is included in this report under Appendix I.

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

WATER CONDITIONS:

Due to the low permeability of the clayey subsoil, it was not feasible to accurately establish the ground water table at the site during the boring programmes. Samples obtained below the creek water level were saturated and the ground water table at the site has been assumed to be at the seasonal water level of Jeannette Creek, approximately Elev. 576' to 583'. Artesian water conditions were noted when bedrock was encountered during the boring operations. The excess hydrostatic head reached Elev. 544'.

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

The critical elevation below which "piping" occurs during dewatering or footing excavations, has been estimated to be at approx. Elev. 525'. Sand seams were encountered in the upper 20 ft. of the subsoil in Borings 3, 4 & 9 that were located close to the bank of the creek. If high water table conditions were present during construction, pumping operations might be necessary during footing excavations in the immediate vicinity of the banks of the creek.

FOUNDATION CONSIDERATIONS:

1. Bridge at Jeannette Creek:

Subsoil conditions are such that spread footing support can be obtained at Elev. 566' or below. At this elevation or below, for footings 7' to 10' wide, an allowable bearing pressure of 2 1/4 tons/sq. ft. can be used in spread footing design. For a single-span structure, total and differential settlements, consequent upon application of this bearing pressure, are considered tolerable. Footings founded at Elev. 566' or below, are believed to have adequate protection from stream erosion and scour and allowances for future deepening of the creek channel.

In view of the presence of sand seams in the upper 20 ft. of the subsoil that were encountered in Borings 3, 4 & 9, (all located close to the creek bank) if high water table conditions are present during footing excavations, pumping operations might be necessary. If footing excavations are carried out during the

cont'd. /6 ...

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

1. Bridge at Jeannette Creek: (cont'd.) ...

normal creek water level period, the impermeable nature of the clayey subsoil will allow excavations below the stream-bed of the creek to be carried out in the dry.

Under the proposed grade line, the maximum height of fill is approximately 9 ft. The subsoil can safely support this embankment loading. In order to avoid endangering of the stability of the canal of the creek (existing or diversion), the toe of the embankment slope at the gravel road crossing (existing or revision), should be maintained at a minimum clearance distance of 17 ft. from the top of the canal bank. This distance is exceeded in Drawing - No. F 59-61A which shows the proposed gravel road revision and existing Jeannette Creek as well as the existing gravel road and Jeannette Creek diversion.

2. Underpass Structure at Gravel Rd. Revision:

Adequate foundation support for this underpass structure can be obtained in the medium to stiff clay stratum. At elevation 579' or below, subsoil conditions are such that for footings of 7' to 10' in width, an allowable bearing pressure of 2 1/4 t.s.f. can be used in spread footing design. For a single-span structure, total and differential settlements are considered tolerable. Footings founded at Elev. 579' or below are believed to have adequate protection from frost action.

cont'd. /7 ...

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

2. Underpass Structure at Gravel Rd. Revision: (cont'd.) ...

No serious ground water problems during construction, are anticipated. Due to the impermeable nature of the clayey subsoil, if seepage does occur during footing excavations, seepage inflow will be local and of minor quantities, only.

Under the proposed grade line of the gravel road revision, the maximum height of fill is approximately 28 ft. The subsoil can safely support this embankment loading.

If an underpass structure is to be constructed at the existing gravel road crossing, footings shall be founded at elevation 566' or lower. This elevation is recommended because of the softening action of the creek on the upper 10 to 15 feet of silty clay. At this elevation or below, an allowable bearing pressure of 2 1/4 t.s.f. can be used in spread footing design.

CONCLUSIONS AND RECOMMENDATIONS:

1. The site is underlain by a medium to stiff silty clay stratum overlying limestone bedrock.

2. Bridge at Jeannette Creek:

(A) Subsoil conditions are such that at Elev. 566' or below, for footings of 7' to 10' in width, an allowable bearing pressure of 2 1/4 t.s.f. can be used in spread footing design. Footings founded at this elevation or below, are believed to have adequate protection from stream erosion and scour and allowances for future deepening of the creek channel. For a single-span structure, total and differential settlements are considered tolerable.

cont'd. /8 ...

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

2. Bridge at Jeannette Creek: (cont'd.) ...

- (B) If high water table conditions are present during footing excavations, pumping operations may be necessary. If footing excavations are carried out during the normal creek water period, excavations below the stream-bed of the creek can be carried out in the dry with only minor water removal problems.
- (C) No approach fill stability problems are anticipated.

3. Underpass Structure at Gravel Rd. Revision:

- (A) Spread footings at Elev. 579' or below are recommended. For footings of 7' to 10' in width, an allowable bearing pressure of 2 1/4 t.s.f. can be used.
- (B) No excess seepage problems with respect to footing excavations are anticipated.
- (C) No approach fill stability problems are anticipated.
- (D) For a single-span structure settlements resulting from application of 2 1/4 t.s.f. bearing pressure and the embankment load are considered tolerable.

4. Existing Gravel Road:

If an underpass structure is to be constructed at the existing gravel road crossing, it is recommended that footings be founded at Elev. 566' or below.

A. K. Loh
for A. K. Loh,
Project Foundation Engr.

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB F-59-61

W.P. 12-59

[illegible]

SUMMARY OF FIELD & LABORATORY TESTS

JOB F-59-61
W.P. 12-59

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
6	T8	50'-52'	Stiff grey silty clay with approximately 6% fine to medium gravel.	38	16.6	16.7	24.1	2700	131.1	
			S. Denotes Split Spoon Sample T. " Thin Walled Shelby Tube							

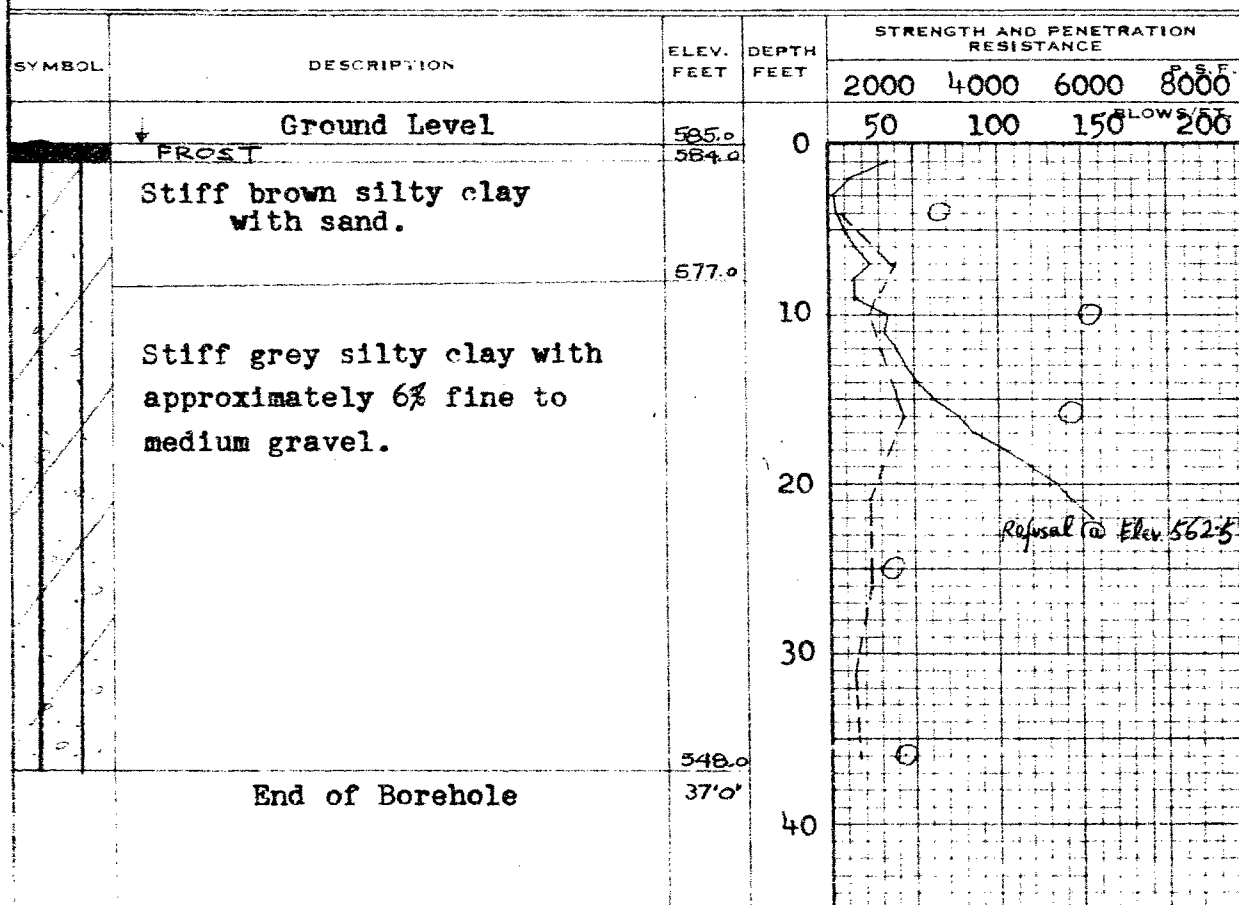
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 12-59 BORE HOLE NO. 1
JOB F-59-61 STATION 256+08 (37' Rt.)
DATUM Geodetic COMPILED BY B.K.
BORING DATE Feb. 14/59 CHECKED BY A.L.

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

LEGEND

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



CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
		X	TW 1	126.0
	*		TW 2	127.2
X	1	10	TW 3	128.8
	X		TW 4	133.0
	IX	0	TW 5	129.0
	X		TW 6	131.8
	IX	0	TW 7	120.3
	I X	0	TW 8	130.2

Borehole No. 1.

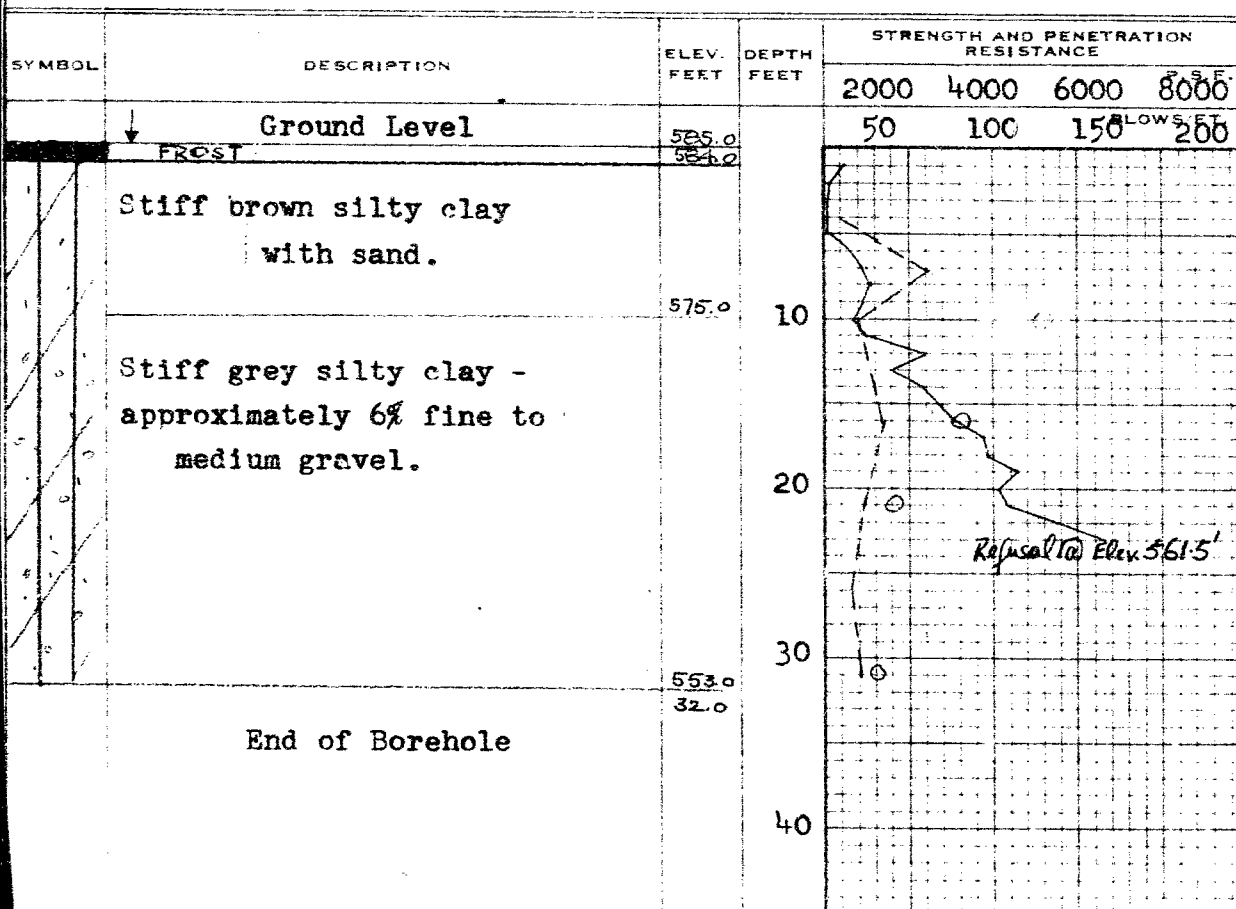
OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 12-59 BORE HOLE NO. 2
 JOB F-59-61 STATION 255+82 (37' Lt.)
 DATUM Geodetic COMPILED BY B.K.
 BORING DATE Feb. 14/59 CHECKED BY A.L.

LEGEND

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



CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
		X	TW 1	126.0
	X		TW 2	129.4
	X		TW 3	122.8
	X	O	TW 4	136.0
	X		TW 5	132.0
	X	O	TW 6	127.8
	X		TW 7	128.0

Borehole No. 2

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 12-59 BORE HOLE NO. 3
 JOB F-59-61 STATIC 256+83 (37'Rt.)
 DATUM Geodetic COMPILED BY B.K.
 BORING DATE Feb. 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) O
 TW VANE TEST (G) AND SENSITIVITY (S) +S
 NATURAL MOISTURE AND LIQUIDITY INDEX LI
 LIQUID LIMIT X
 PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				2000	4000	6000	8000 P.S.F.
	Ground Level	587.6		50	100	150	200 BLOWS/FT.
	Stiff brown silty clay with sand. W.L. ∇ 582.6						
		578.0	10				
	Stiff grey silty clay - approx. 6% fine to medium gravel interbedded with 1" sand seams between Elev. 582 & 580.		20				
			30				
			40				
	End of Borehole	545.6					

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 12-59

BORE HOLE NO. 4

JOB F-59-61

STATION 256+57 (37' Lt.)

DATUM Geodetic

COMPILED BY B.K.

BORING DATE Feb. 13/59

CHECKED BY A.L.

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPL.

2" DIA. CONE


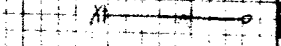
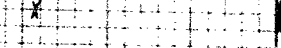
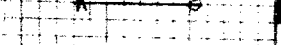
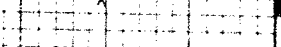
2" SHELBY

CASING

LEGEND

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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				2000	4000	6000	8000
	Ground Level	587.6		50	100	150	200
	Stiff brown silty clay with sand. W.L. ▽	583.6					
		577.0	10				
	Stiff grey silty clay - approximately 6% fine to med. gravel interbedded with 1" sand seams between Elevations 582 & 580.		20				
		561.0	30				
	End of Borehole	27.0	40				

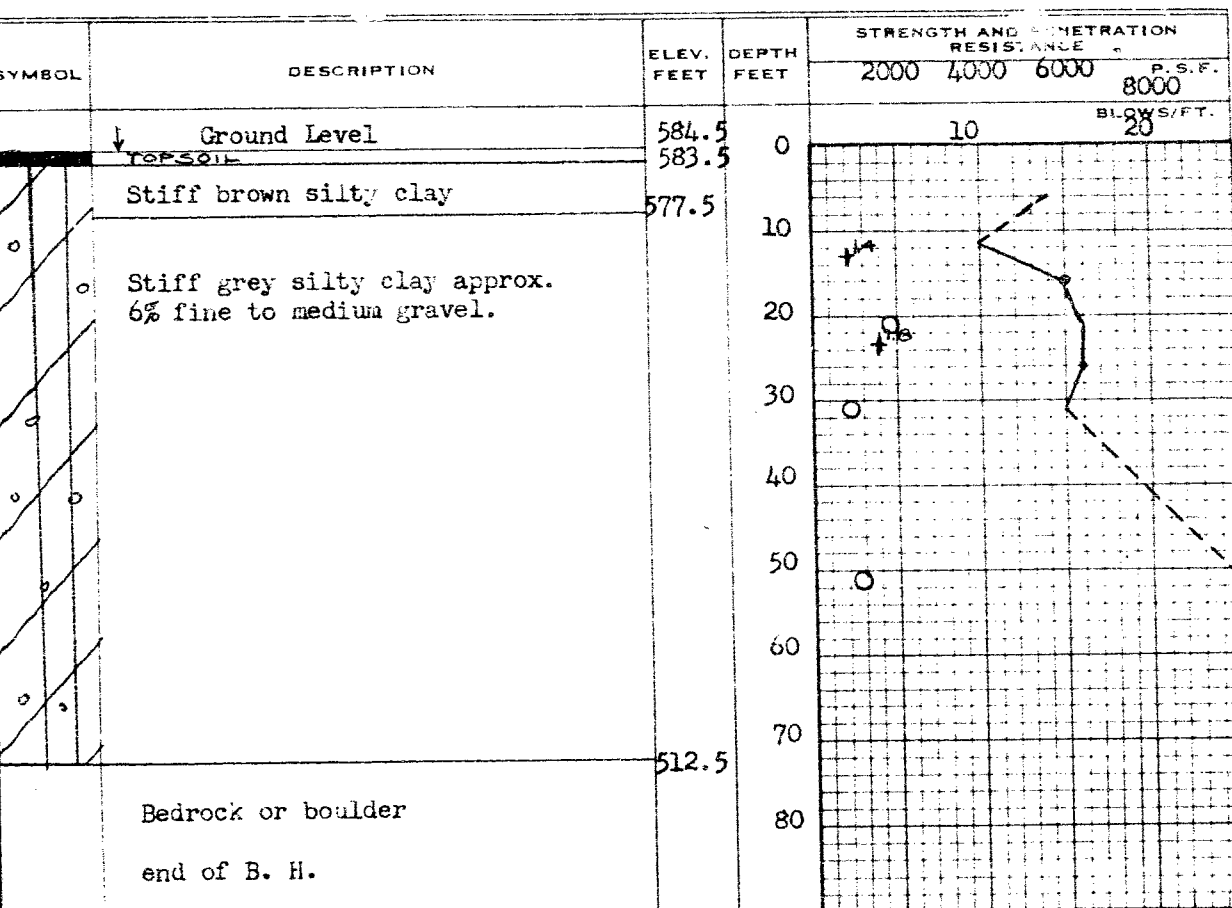
CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT. 10 20 30				
			TW 1	118.0
			TW 2	123.4
			TW 3	137.5
			TW 4	131.5
			TW 5	127.5

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

N.P. 12-59 BORE HOLE NO. 5
 JOB R-59-61 STATION 254 + 84 (45' RT)
 DATUM Elev. 584.2' COMPILED BY B. K.
 BORING DATE June 15/59 CHECKED BY A. L.

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u) — O
 VANE TEST (C) AND SENSITIVITY (S) — +
 NATURAL MOISTURE AND LIQUIDITY INDEX — LI
 LIQUID LIMIT — X
 PLASTIC LIMIT —



CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			T1	-
	X		T2	130.1
			S3	-
	X	O	T4	130.8
			S5	-
	X	O	T6	128.4
</				

Borehole No. 5

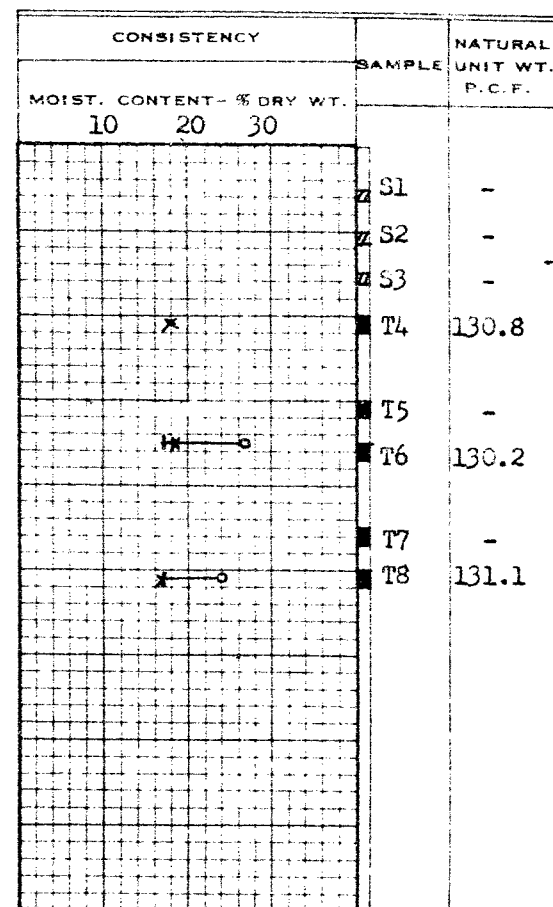
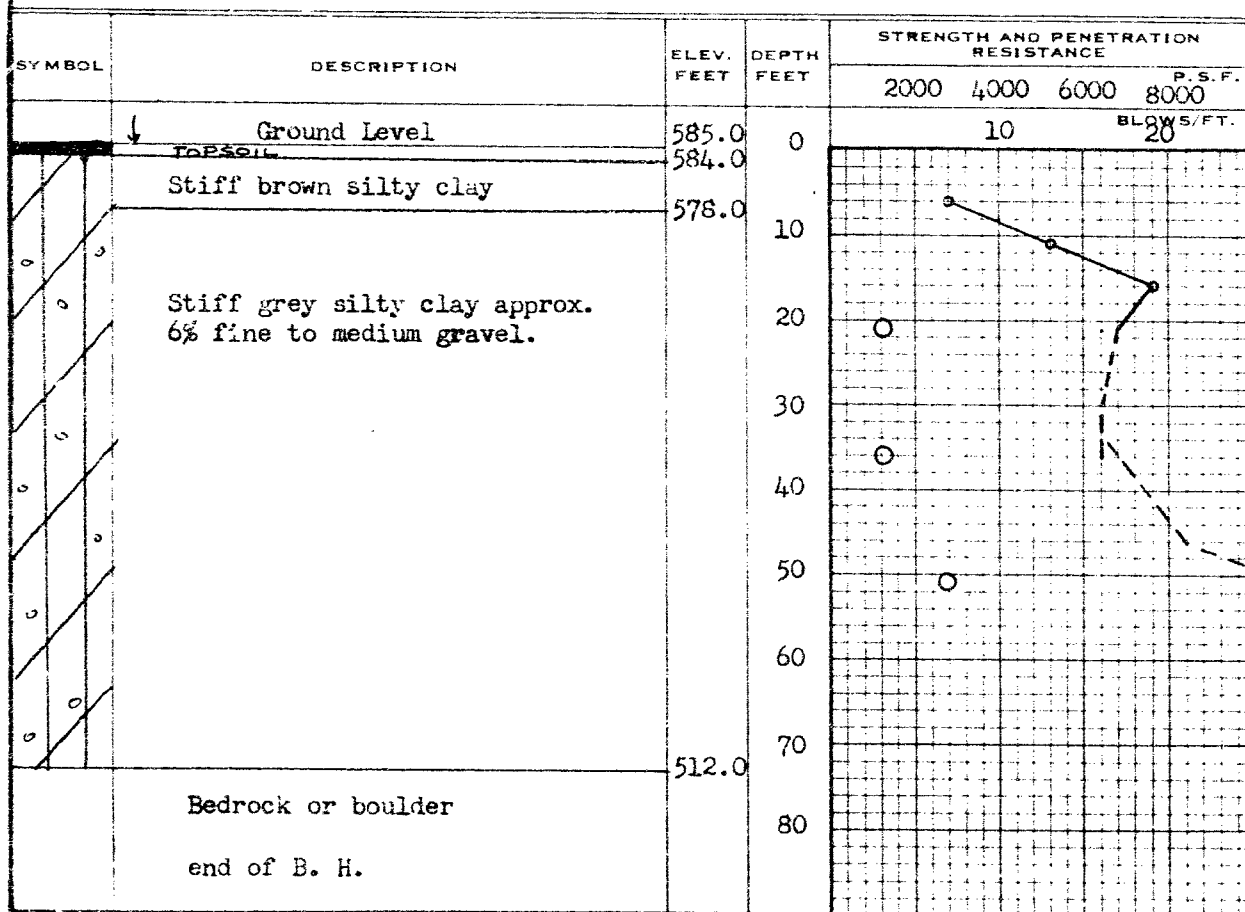
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 12-59 BORE HOLE NO. 6
JOB E-59-61 STATION 255 + 26 (45' LT.)
DATUM Elev. 584.5' COMPILED BY B. K.
BORING DATE June 16/59 CHECKED BY A. L.

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

LEGEND

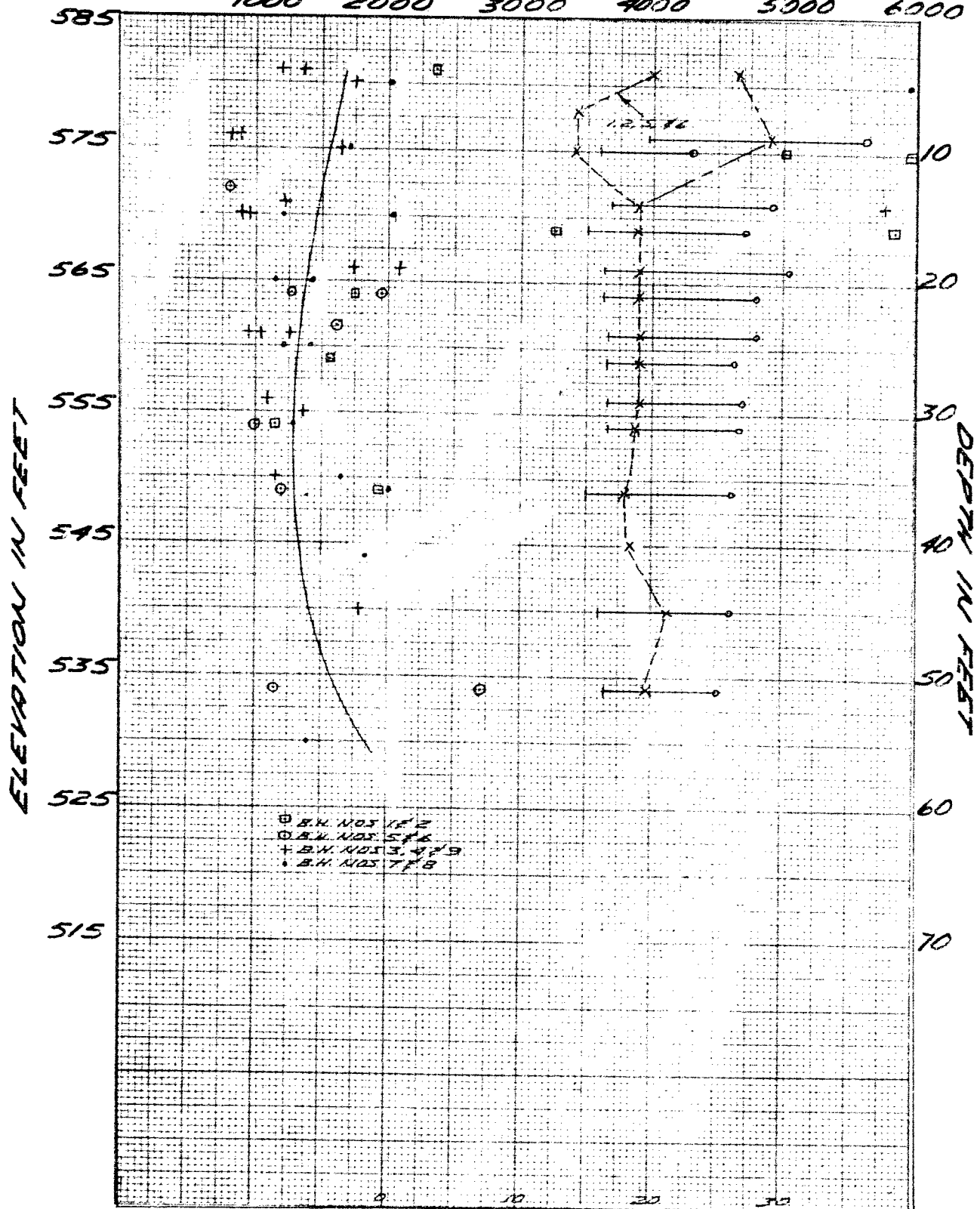
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VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

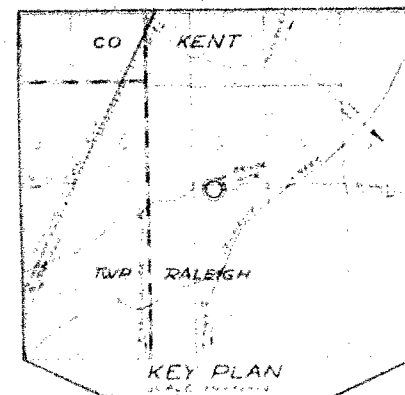
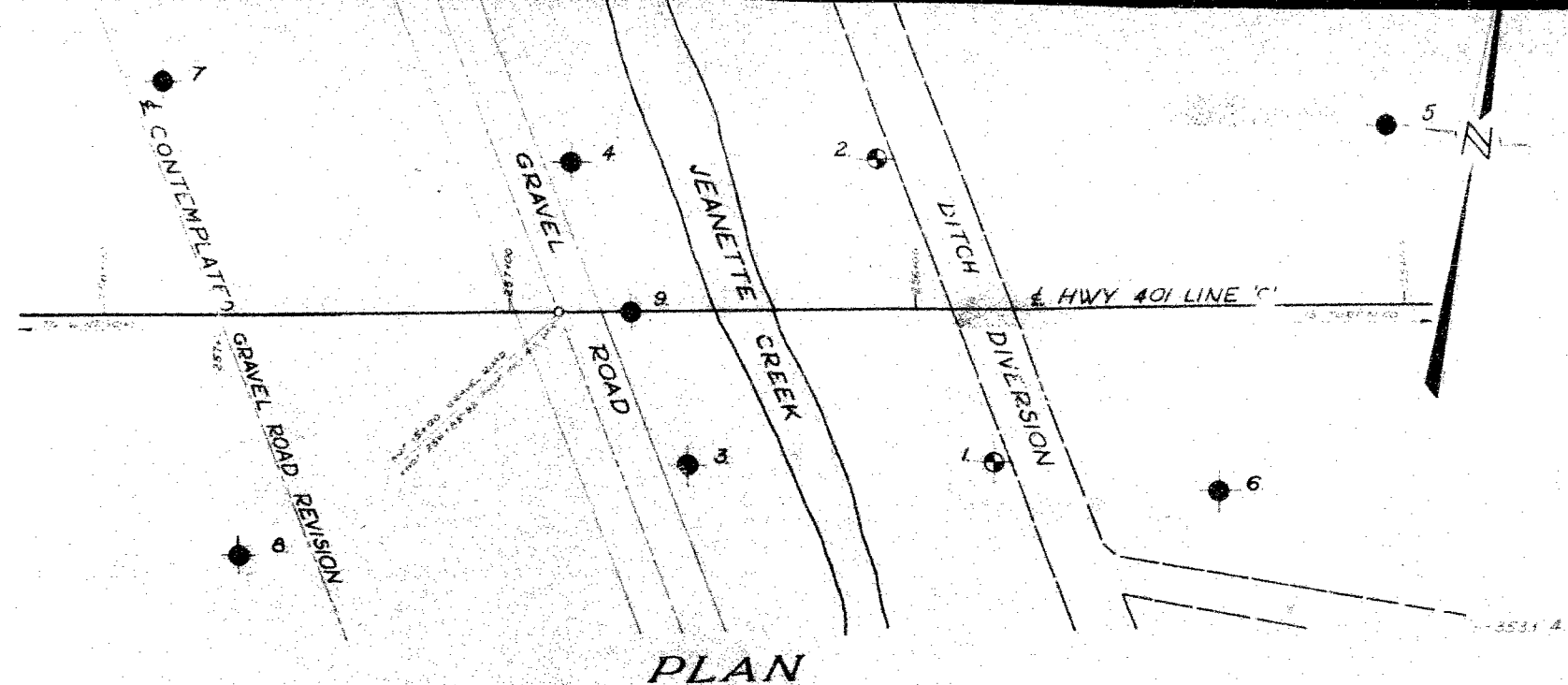


Borehole No. 6

SHEAR STRENGTH IN P. S. F.

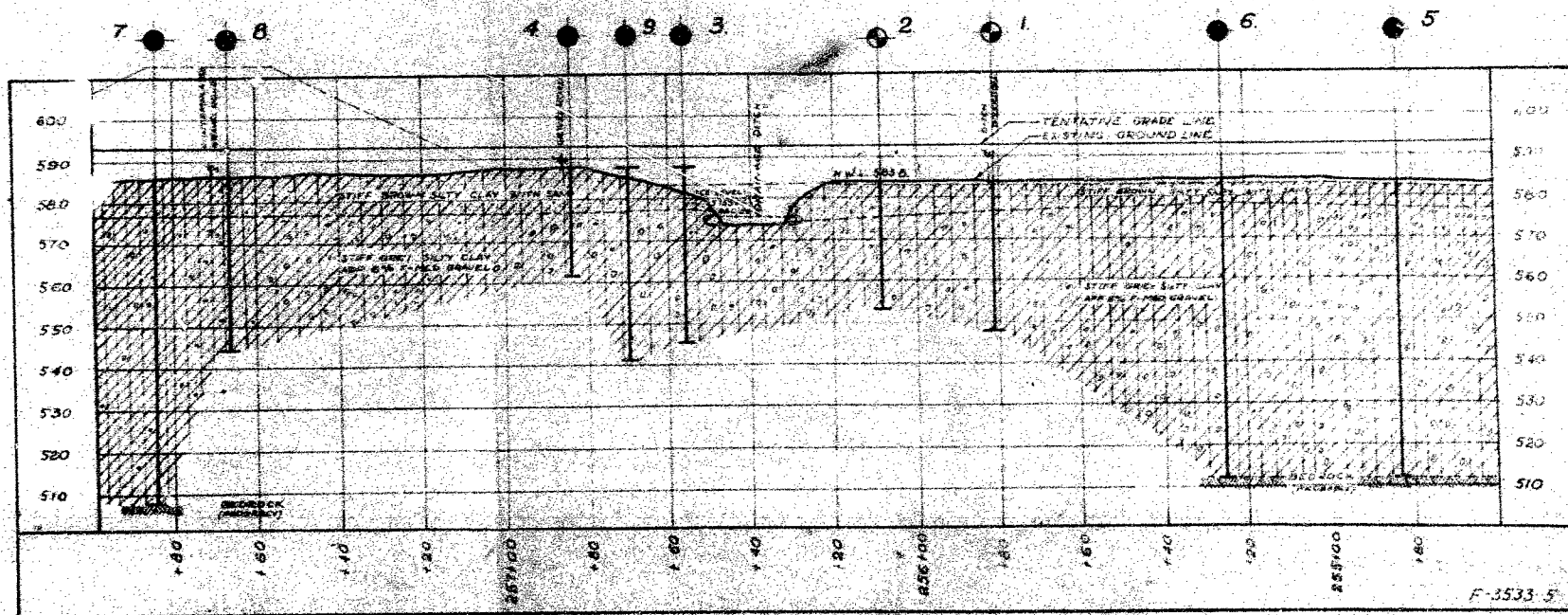
1000 2000 3000 4000 5000 6000

WATER CONTENT % X NAT. \rightarrow ATTERBERG LIMITS



LEGEND			
Bore Hole			●
Penetration Hole			○
Bore & Penetration Hole			⊙
HOLE NO.	ELEVATION	STATION	DISTANCE FROM
1	5850	25614	51.2
2	5871	25615	51.2
3	5876	25615	51.2
4	5876	25615	51.2
5	5871	25615	51.2
6	5850	25615	51.2
7	5800	25614	50.8
8	5800	25615	51.2
9	5870	25615	51.2

NOTE:
THE SEPARATION BETWEEN THE DITCH AND GRAVEL ROAD IS SHOWN AS A DASHED LINE. THE DISTANCE BETWEEN THE DITCH AND GRAVEL ROAD IS SHOWN AS A DASHED LINE. THE DISTANCE BETWEEN THE DITCH AND GRAVEL ROAD IS SHOWN AS A DASHED LINE.

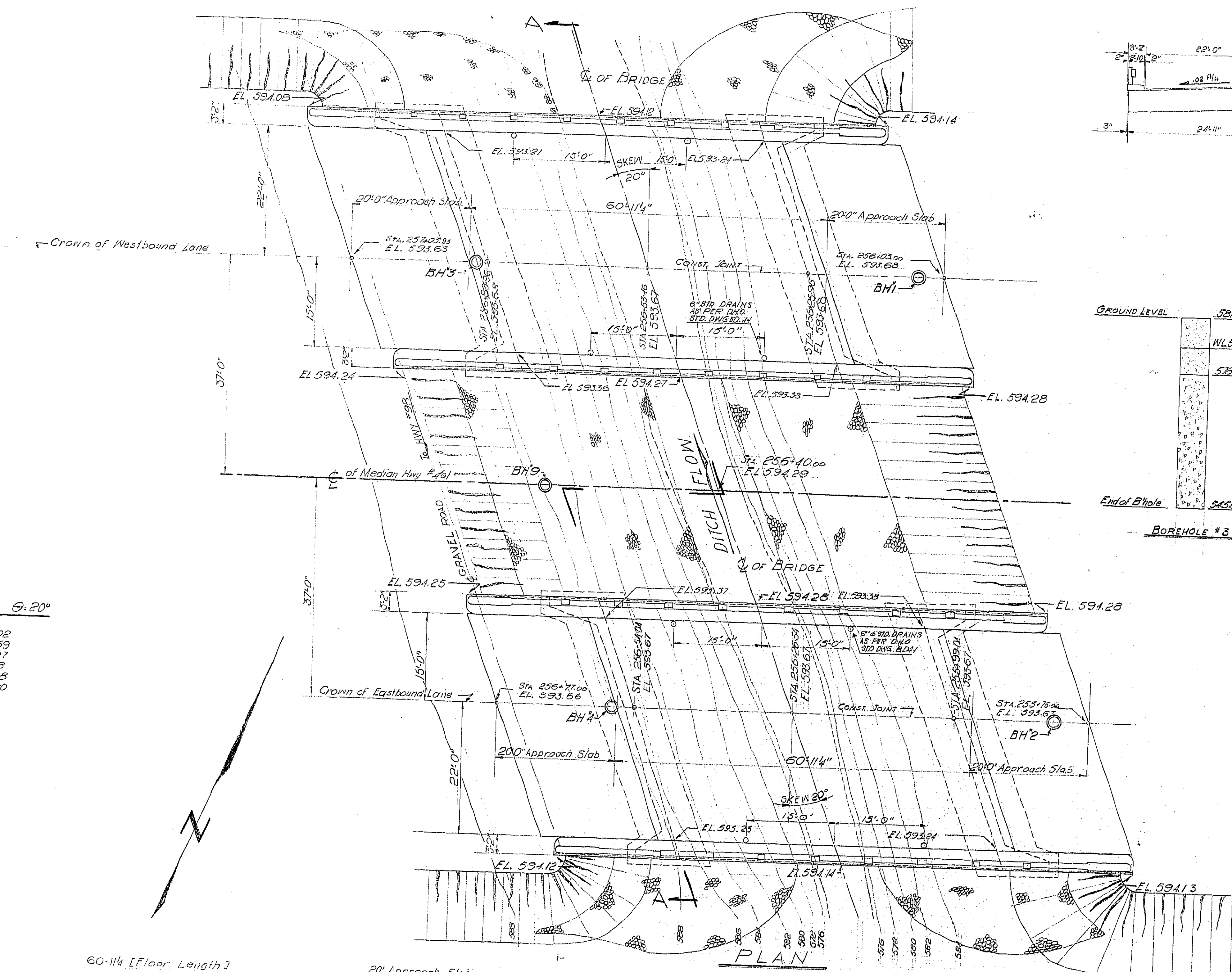


DEPARTMENT OF HIGHWAYS - ONTARIO			
MAINTAINED & RECONSTRUCTED			
DITCH & GRAVEL ROAD PROPOSED CROSSING			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
HWY. 401	DISTRICT 1	COUNTY KENT	
LOCATION RALEIGH	CON. 12-13	CON. 11	
LOCATION R.R. 6 N.E. OF CHATHAM			
DESIGNED BY: B. J. J. J.	CHECKED BY: J. J. J.	DATE: JULY 30, 1969	
APPROVED BY: J. J. J.	DATE: JULY 30, 1969	DRAWN BY: J. J. J.	
F-59-61A			

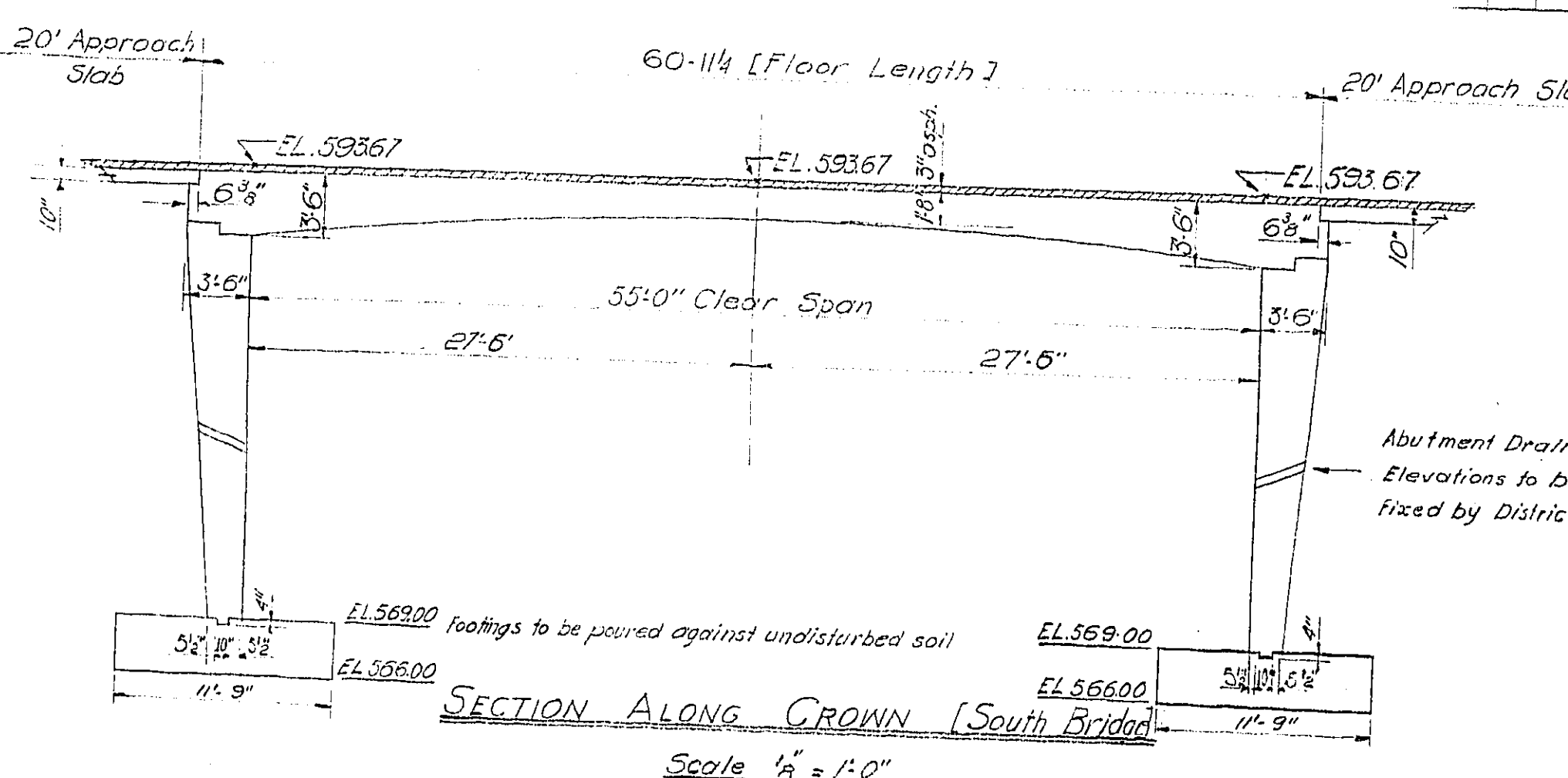
SKIRM ANGLE 0.20°

Sta. 54202
Cos 93.953
Tan 36.937
Cot 2.14748
Sec. 1.06418
Cosec. 2.92380

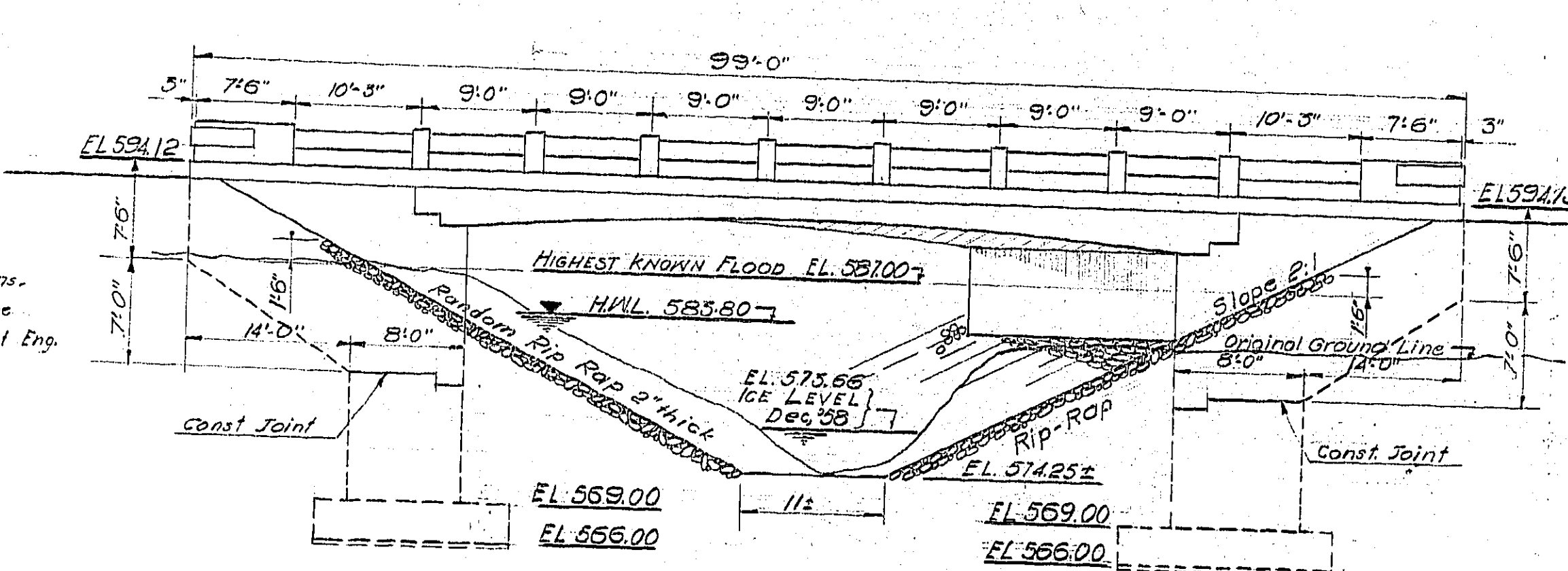
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2	FOR	10/1/59
3	FOR	10/1/59
4	FOR	10/1/59
5	FOR	10/1/59
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7	FOR	10/1/59
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9	FOR	10/1/59
10	FOR	10/1/59



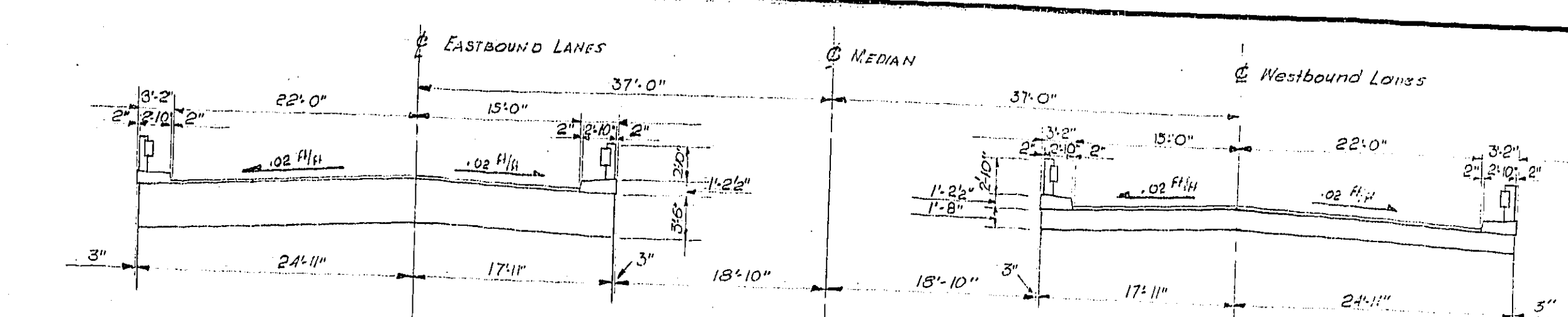
PLAN
Scale 1"=100'



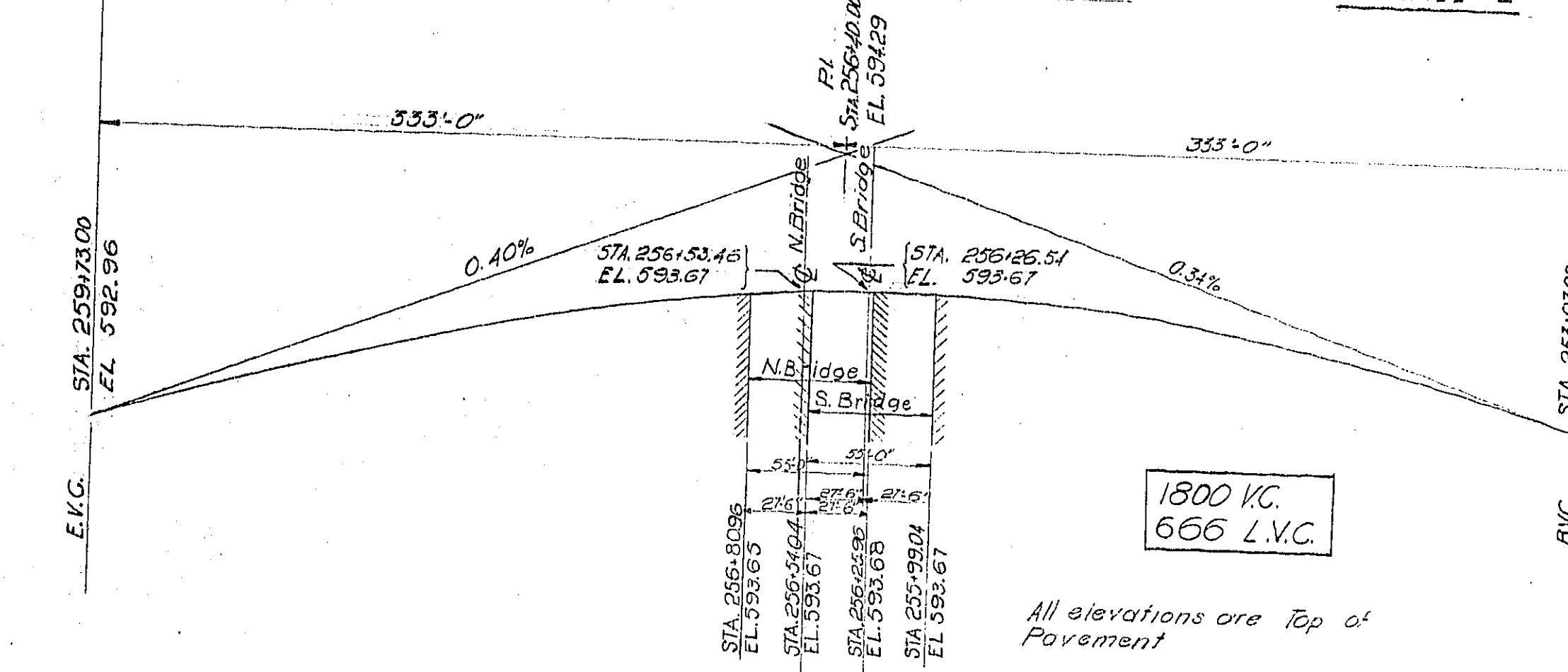
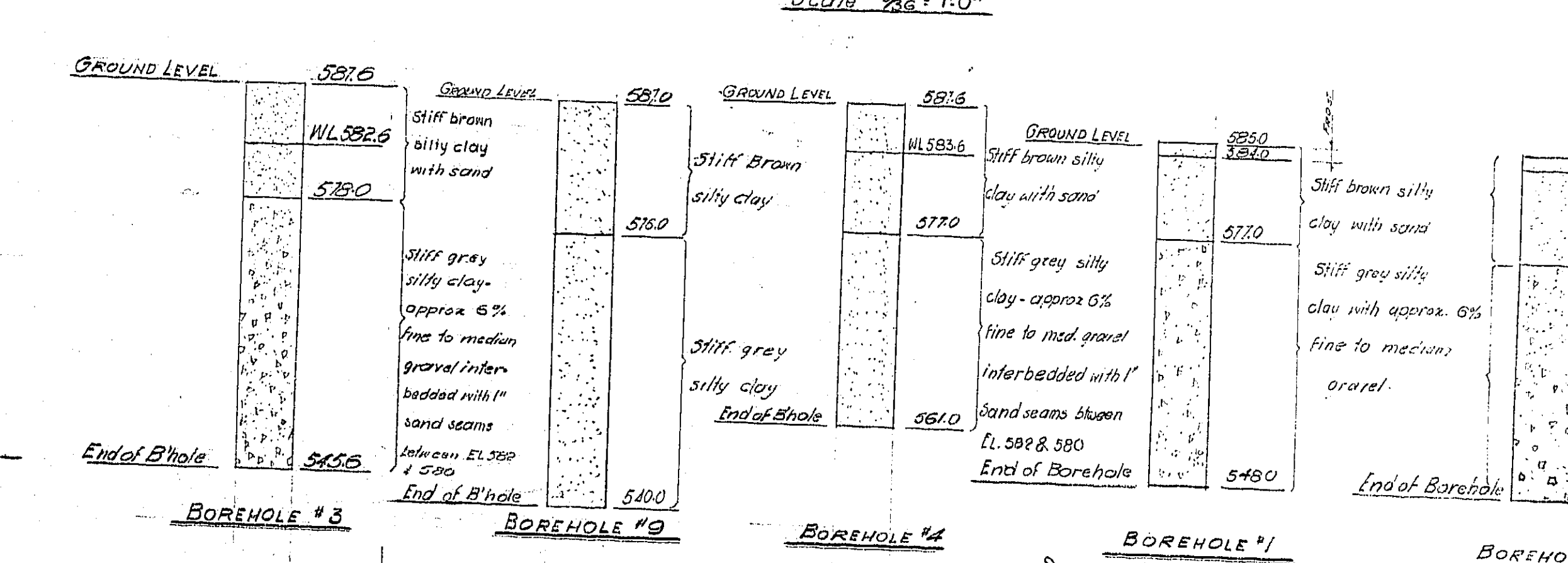
SECTION ALONG CROWN (South Bridge)
Scale 1/2"=1'0"



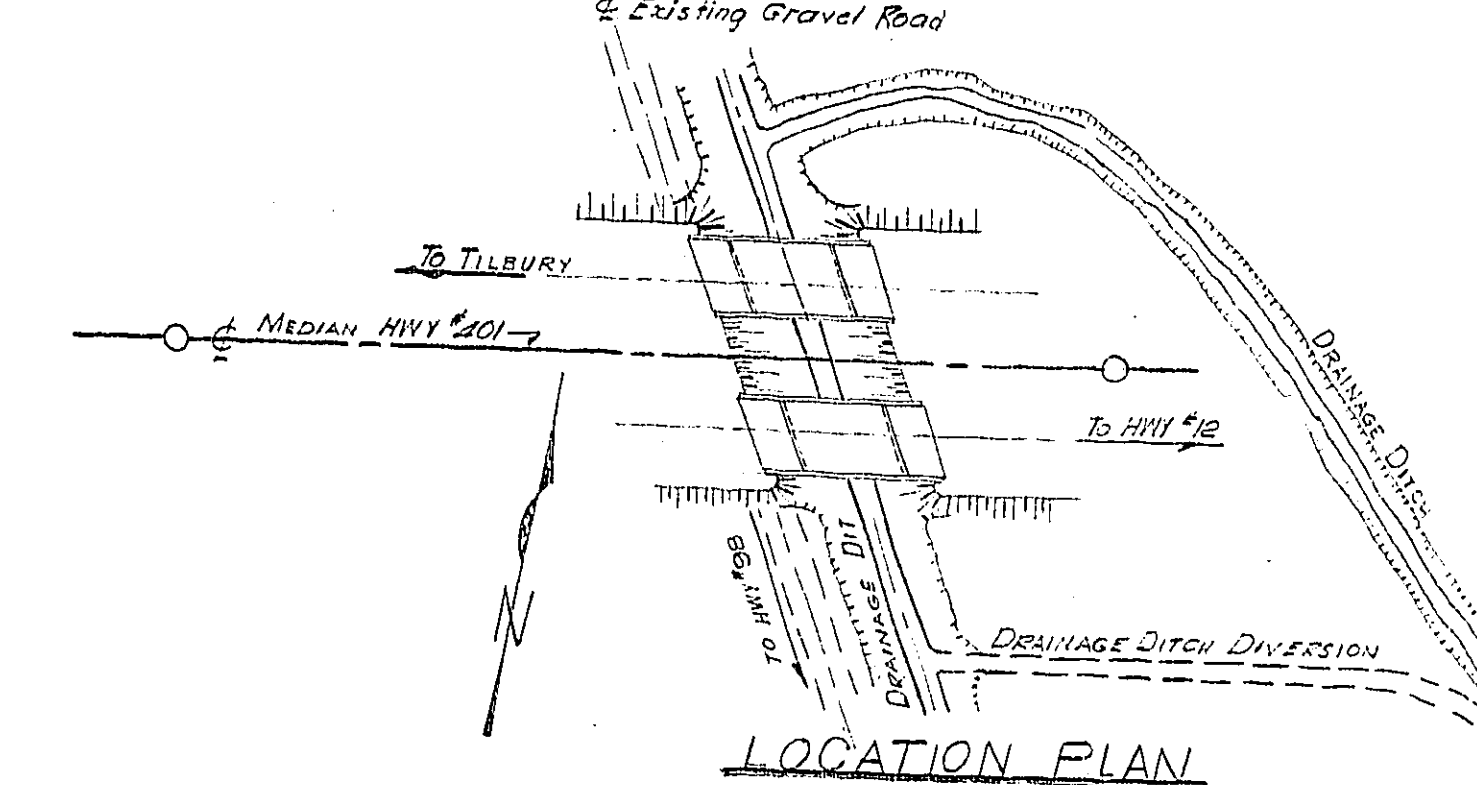
ELEVATION OF SOUTH BRIDGE
Scale 1/4"=1'0"



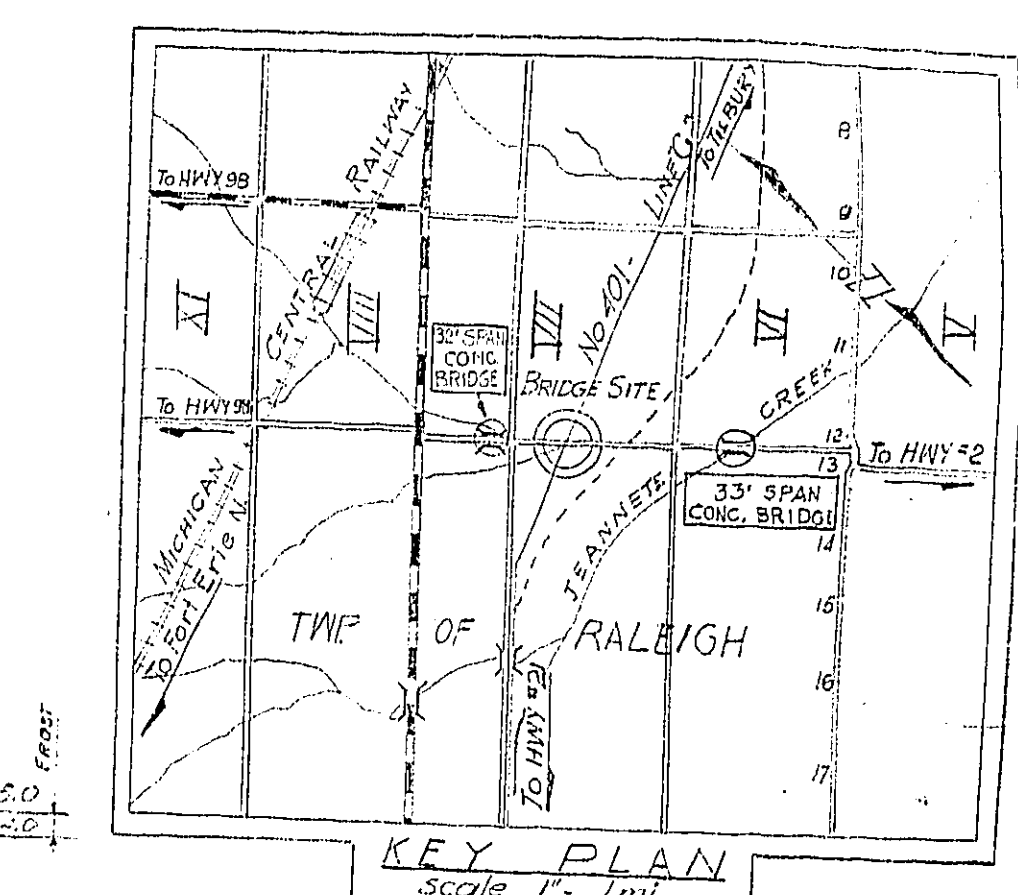
SECTION A-A
Scale 3/4"=1'0"



VERTICAL CURVE DETAIL
Scale Vertical 1"=5'
Horizontal 1"=60'0"



LOCATION PLAN
Scale 1"=100'



KEY PLAN
Scale 1/4"=1'0"

GENERAL NOTES
NOTE TO DISTRICT ENGINEER
Concrete work on this structure must not be commenced until monuments to its control points have been established and checked by the District Engineer.
NOTE TO CONTRACTOR
Structure to be built in accordance with Form No. 9 and the Special Provisions; extra copies of which may be obtained from the District Engineer.
All construction joints must be approved by the Bridge Engineer.
CONCRETE MIX
Minimum Strength at 28 days 3,000 psi. Working Slab 3,000 psi. Structure, 3,000 psi. Footings, 3,000 psi.
An approved admixture supplied by the Department will be added to all concrete as specified by the Engineer.
Max. size aggregate 3".
BORING DATA
The complete soil investigation report, BA 940 may be examined at the Bridge Office, Downsview, Ont.
The Department does not guarantee the accuracy of this report or its abridged version shown on this drawing.
CLEAR COVER
Footings, Surfaces in contact with water and/or ground, 3".
Deck 2".
Handrails 1 1/2".
CURB 2".
CONSTRUCTION NOTES
1. All exposed edges to be chamfered 1" unless stated otherwise.
2. Formwork supporting wing walls to be left in position until after placing of concrete, and shall be removed only on the Engineer's approval.
3. Backfill behind both abutments to be placed simultaneously.
4. Deck Drains to be cut out 3" below Deck.

- LIST OF DRAWINGS**
1. D 4375-1 GENERAL PLAN, ELEVATIONS & SECTIONS
 2. D 4375-2 FRAME & HANDRAIL DETAILS & REINFORCEMENT
 3. D 4375-3 FOOTING, PLAN & REINFORCEMENT
 4. D 4375-4 WING WALLS & APPROACH SLABS
 5. D 4375-5 REINFORCING STEEL SCHEDULE
 6. D 4375-6 REINFORCING STEEL SCHEDULE

W/P 12-59
DEPARTMENT OF HIGHWAYS-ONTARIO
BRIDGE OFFICE-TORONTO

RALEIGH TWP BRIDGE # 9

THE KING'S HIGHWAY No. 401
CO. KENT
TWP. RALEIGH
LOT 12 & 13
CON. VII

GENERAL PLAN, ELEVATIONS & SECTIONS

APPROVED
BRIDGE ENGINEER
DESIGN ENGINEER

DESIGN
CHECK
CONTRACT NUMBER
LOADING
DATE

DESIGN
CHECK
CONTRACT NUMBER
LOADING
DATE

61292 Twp #103-227-1-A



APPENDIX B

Site Photographs



Photograph 1: Looking east at the Government Drain Bridge No. 3 EBL structure. The adjacent slopes of the abutments are heavily vegetated. No erosion of the slope face was observed. Scouring effects of the slope toes were not observed. (October 20, 2013)



Photograph 2: Looking at the east abutment of the structure. Front slope partially covered with rip-rap. Slight erosion of the slope face or scouring of the toe of the exposed earth was observed on the front slope. Adjacent slopes of the abutment were vegetated. Weep holes in the abutment wall were open and wet. (October 20, 2013)



Photograph 3: Looking at the west abutment of the structure. Erosion/scouring effects were observed on the front slope and toe. Rock protection of the earth surface was minimum and scattered. Adjacent slopes of the abutment were vegetated. Weep holes in the abutment wall were open and wet. (October 20, 2013)