



THURBER ENGINEERING LTD.

**FOUNDATION REPORT FOR DESKTOP STUDY
HIGHWAY 401 / COUNTY ROAD 41 INTERCHANGE (IC579)
INTERCHANGE AND MEDIAN IMPROVEMENTS
GREATER NAPANEE, ONTARIO
SITE NO. 17-053
G.W.P. 4459-04-00
Latitude: 44.264629
Longitude: -76.965248**

Geocres Number: 31C-274

Report to

AECOM

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August 7, 2018
File: 10035

H:\10000+\10035 Hwy 401 Napanee 4015-E-0003\Reports &
Memos\County Road 41\Desktop Study - County Road 41.doc

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**FOUNDATION REPORT FOR DESKTOP STUDY
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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents a summary of the factual subsurface information for the existing Highway 401 and County Road 41 interchange (IC579) improvements in the geographic Township of Richmond, in the Town of Greater Napanee, Ontario.

The purpose of this desktop study report is to summarize currently available subsurface information pertinent to the foundation aspects of the proposed structural rehabilitation works. The information includes a previous foundation report, preliminary design report, preliminary staging report, general arrangement and foundation layout drawings available from the Ministry of Transportation Ontario (MTO), geological maps, and a site reconnaissance visit. It also presents preliminary geotechnical recommendations for use in assessment of the existing foundations and for preliminary design at the site. It is noted that the proposed structural alternatives are not yet defined. Additional investigation and analysis may be required in any subsequent detail design phase of the project.

Thurber carried out this desktop study as a sub-consultant to AECOM under the MTO Consultant Assignment Number 4015-E-0003.

2 SITE DESCRIPTION

2.1 General

The Highway 401 and County Road 41 interchange (IC579) is located 2.1 km north of Napanee and 330 m west of the Sucker Creek crossing. At this location, the existing overpass consists of single-span rigid frame bridge which has total span length of about 17.1 m perpendicular to County Road 41, a width of about 35.2 m perpendicular to Highway 401 and is skewed at 7.4°. The structure was originally constructed in 1959.



The structure accommodates 4 traffic lanes (2 westbound and 2 eastbound lanes), 2 speed change lanes and a paved median on Highway 401 over 4 traffic lanes on County Road 41. Curved retaining walls are present at all four corners of the structure. Select photographs of the structure are included in Appendix B.

2.2 Geology

The project area is situated within the physiographic region known as the Napanee Plain. The Napanee Plain is characterized by a thin veneer of glacial till underlain at relatively shallow depths by limestone bedrock of the Bobcaygeon Formation. Thick glacial sediments are present in the deep river and stream valleys in the region.

2.3 Topography and Land Use

The Highway 401 corridor addressed in this project generally runs in an east to west orientation along relatively flat terrain. There are commercial and institutional developments in the vicinity of the interchange. These are concentrated to the south of Highway 401 with less intensive development to the north. To the south of the interchange, Sucker Creek runs in the general west to east direction and crosses County Road 41 approximately 250 m south of the existing structure. The Creek meanders to the north and crosses Highway 401 approximately 330 m east of the existing structure.

3 STUDY PRODECURES

The desktop study is based on geotechnical data gathered from available sources with no borehole drilling and sampling in this phase of the work.

Information on existing surface and subsurface conditions relevant to the foundations of the existing structures and embankments have been collected from the following sources:

- Review of an existing foundation investigation and design report for the structure available from the MTO GEOCREs system, and selected information from archived contract files.
- Review of contract drawings, a Preliminary Design Report and Preliminary Staging Report for the project site.
- Review of published geological information for the study area.
- Site reconnaissance visit by the Thurber project engineer to observe and document the existing structures, cuts, embankments and any visible geological/geotechnical features.

Imperial units in the original GEOCREs files have been converted to metric.

3.1 MTO GEOCRES Files

Existing foundation/geotechnical information relevant to the subject site has been obtained from the MTO GEOCRES library. The document used for the desktop study was provided under GEOCRES File 31C00-062 and is listed below and is included in Appendix A.

31C00-062: Foundation Report for the Proposed Structure at Hwy. 401 Line 'C' and Highway 41 Crossing, Lots 21 AND 22, Con. II, Township of Richmond, Approximately 1 Mile North of Napanee. W.P. 33-59. W.J. F-59-28. Prepared by the MTO Department of Highways Materials and Research Section, Dated June 22, 1959.

3.2 Contract Drawings

Contract drawings and quantity sheets were prepared by the MTO Eastern Region for the Highway 401 and County Road 41 Interchange in 2004.

3.3 Preliminary Design Report

A Preliminary Design Report was prepared by the MTO Eastern Region for the Highway 401 interchange at County Road 41 (W.P. 31-99-00) in April 2001. Appendix G in the Preliminary Design Report included General Arrangement Drawings for the structure prepared by Cole Sherman in January 2000.

3.4 Preliminary Staging Report

A Preliminary Staging Report for the structure rehabilitation of Highway 401 at County Road 41 and Sucker Creek Bridge was prepared by the Ainley Group in September 2011.

3.5 Geological Information

During the preparation of this report, reference was made to Chapman and Putnam, "The Physiography of Southern Ontario", Third Edition, Ontario Geological Survey, Special Volume 2, Ministry of Natural Resources, 1984.

3.6 Site Reconnaissance Visit

A site reconnaissance visit was carried out by Thurber's project engineer during the preparation of this report. The sites were visited and documented for visible geological/geotechnical features and for assessing structure, cut and embankment performance.

Based on the site observations, Highway 401 is constructed on an embankment that reaches approximately 6 m above the original ground surface. No bedrock exposures were noted at this site. There is no visible evidence of problems with the performance of the structure foundations. In particular, there is no evidence of settlement or sliding.

Similarly, the immediate approach embankments in all four quadrants appeared to be performing satisfactorily.

There is a box culvert running under Highway 401 just west of the structure to convey the County Road 41 drainage in a north to south direction.

4 DESCRIPTIONS OF SUBSURFACE CONDITIONS

A foundation investigation report was completed by the MTO Department of Highways Materials and Research Section in June 1959 (GEOCRE: 31C00-062) for the proposed overpass. The field investigation consisted of two sampled boreholes with adjacent dynamic cone penetration tests (DCPTs) at the north west and south east quadrants of the site and two separate DCPTs at the north east and south west quadrants of the site. The two boreholes were drilled and sampled through the overburden in conjunction with Standard Penetration Tests (SPTs) to depths of 2.2 to 3.0 m below the original ground surface (Elevations 94.1 to 93.3 m). Bedrock was confirmed below the soil sampling depth by coring in both of the boreholes to depths ranging from 4.4 to 4.5 m below the original ground surface (Elevations 92.6 to 91.9 m). The four dynamic cone penetration tests (DCPTs) were advanced to depths ranging from 2.2 to 3.1 m below the original ground surface (Elevations 94.1 to 93.2), where they encountered refusal on inferred bedrock.

The site was originally overlain by a layer of topsoil that ranged in thickness from 50 to 300 mm.

Clay was encountered below the topsoil in both of the sampled boreholes. The thickness of the clay ranged from 1.5 to 1.9 m, with the base of the layer lying at Elevations 94.1 to 93.3 m. In the south east quadrant of the site, the grey soil was described as gravelly sandy clay. In the north west of the site, the soil transitioned from brown to grey at a depth of 1.5 m and the description changed from sandy clay to silty clay. The report stated that the clay contained 20 to 30% sand and 21 to 35% silt. SPT 'N' values ranged from 10 to 39 blows per 0.3 m indicating a stiff to hard consistency. Three measured moisture contents ranged from 7.2 to 32.7%. One Atterberg Limit Test in the sandy clay yielded a plastic limit of 31.9% and a liquid limit of 59.7% (Plasticity Index of 27.8%) indicating that the clay is of high plasticity (CH).

Bedrock was encountered below the gravelly sandy clay at a depth of 2.2 m at the south east quadrant of the site (Elevation 93.3 m) and below the silty clay at a depth of 3.0 m at the north west quadrant of the site (Elevation 94.1 m). Two DCPTs were terminated upon refusal on probable bedrock at the north east and south west quadrants of the site at depths of 2.4 and 3.1 m below the ground surface, respectively (Elevations 93.9 and 93.2 m, respectively). The original investigation described the bedrock as "very sound" fine-grained dolomitic limestone with shaley partings.

Observed groundwater levels in the open boreholes upon completion of drilling varied between Elevations 96.2 and 95.5 m at the time of the investigation. These were short term observations

made prior to the formation of existing approach cuts for this structure, and therefore likely did not represent stabilized groundwater conditions.

5 EXISTING FOUNDATIONS

The foundation investigation report completed by the MTO Department of Highways Materials and Research Section in January 1959 (Reference 1) recommended that the structure should be supported by spread footings directly on bedrock (Elevations 93.9 to 93.3).

Based on the original construction drawings, the following founding elevations were selected:

- North retaining walls – 93.7
- North half of structure - 93.4
- South half of structure – 93.0
- South retaining walls – 93.0

At these elevations, the footings bear on the bedrock just below the bedrock surface and it is assumed that the design bearing pressure did not exceed 1,000 kPa.

The bearing capacities given in working stress analysis are analogous to the SLS reaction given in Limit State Design.

6 FUTURE ANALYSIS OF EXISTING FOUNDATIONS

Based on the subsurface stratigraphy provided in the foundation investigation report and using present day accepted methods of foundation analysis, the following values may be used in assessing the structure:

Footing	Assumed Founding Elevation (m)	SLS (kPa)	Factored ULS (kPa)
North half	93.4 (wall 93.7)	*	1,000
South half	93.0	*	1,000

* The bedrock may be considered to be an unyielding stratum and the SLS condition will not govern foundation design.

It is recommended that evaluation of the footings on bedrock be based on a factored ULS resistance of 1,000 kPa because the founding elevations are very close to the bedrock surface and within a depth where weathering effects may be more pronounced.

6.1 Structure Rehabilitation

In general, if the load demands of the rehabilitated structure can be met by the geotechnical resistances shown above, no further foundation analysis is required. However, if the factored ULS resistance or SLS reaction given above are exceeded as a result of the rehabilitation, supplementary site investigation and analysis will be required.

6.2 Structure Widening

For widening of the structure, it is recommended that the new construction be supported on spread footings bearing on bedrock. If the new footings will be founded on the bedrock surface, as in the existing case, they may be designed on the basis of a factored ULS geotechnical resistance of 1,000 kN and the SLS condition may be assumed not to govern. Higher bearing resistances, typically in the order of 2,000 kPa could be used for footings founded on proven sound bedrock.

6.3 Embankment Widening

If embankment widening is considered, then for preliminary design purposes the widening may be considered to be stable at side slopes of 2H:1V. The shallow depth to bedrock also will restrict settlement under the widening. New construction must be keyed into the existing embankment slope in accordance with OPSD 208.010.

7 FUTURE WORK

Supplementary geotechnical investigation and analysis may be required in the following situations:

- Widening of the structure, to further define the bedrock surface.
- Construction activities, including rehabilitation, that will require roadway protection to be designed.

8 MISCELLANEOUS

Ms. Deanna Pizycki, E.I.T. and Mr. Alastair Gorman, P.Eng. prepared the Desktop Foundation Investigation Report. Dr. P.K. Chatterji, P.Eng. a Designated Principal Contact for MTO Foundations projects, reviewed the report.

THURBER ENGINEERING LTD.



Deanna Pizycki
Geotechnical Engineer-in-Training

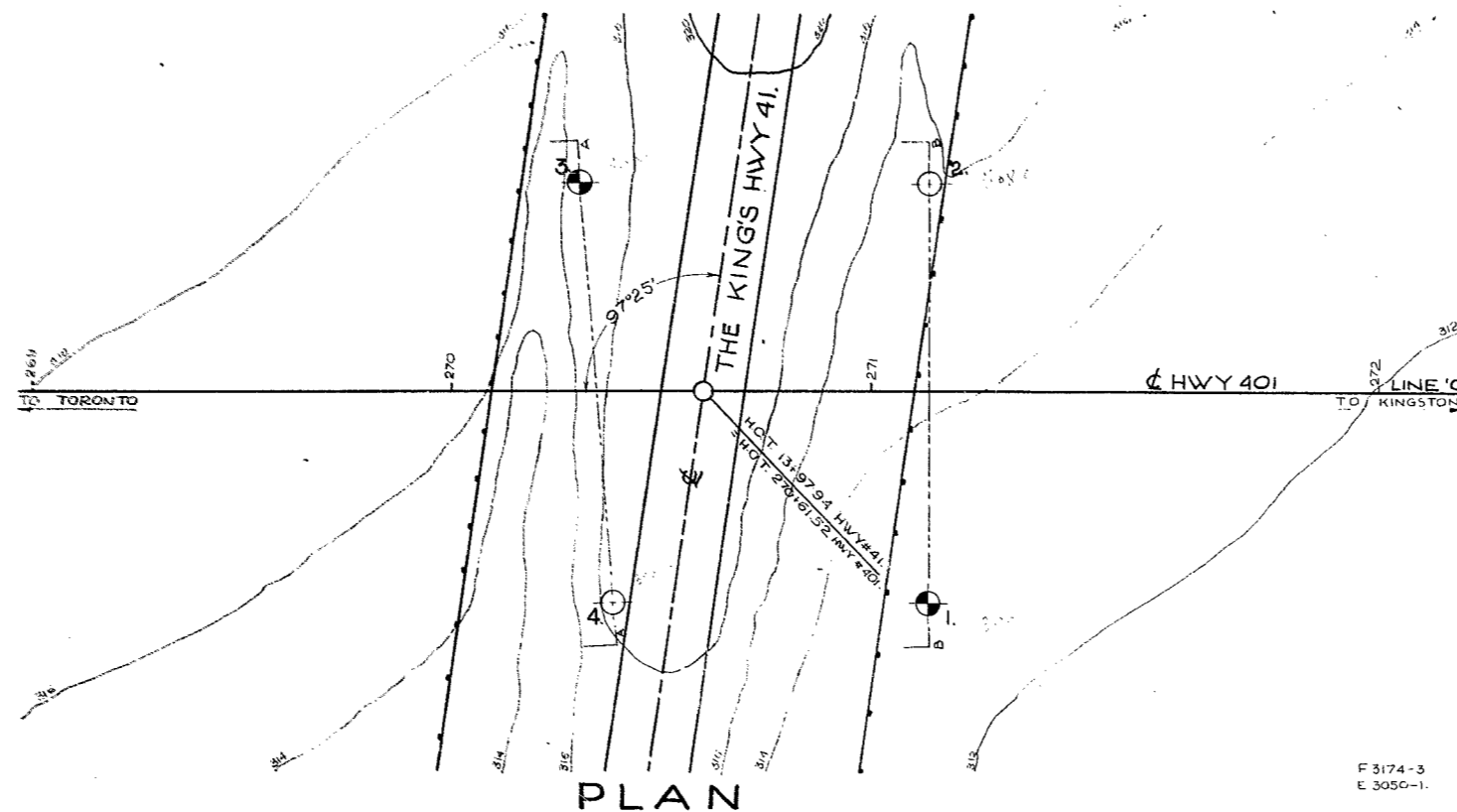
Alastair Gorman, P.Eng.
Senior Associate / Senior Geotechnical Engineer



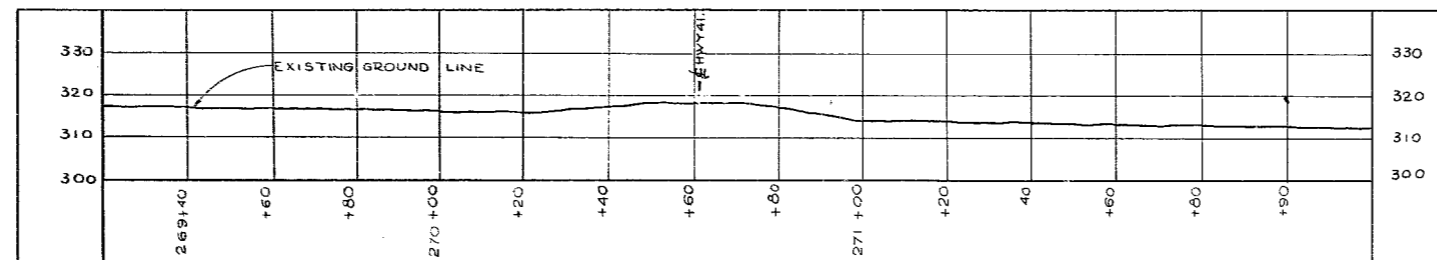
P.K. Chatterji, Ph.D., P.Eng.
Review Principal, Designated MTO Contact

Appendix A
Geocres Files

59-F-28
W.P. # 28-59
Hwy. # 401 ;
Hwy. # 41
CROSSING
CON. # 2
1 MILE N. OF
NAPANEE

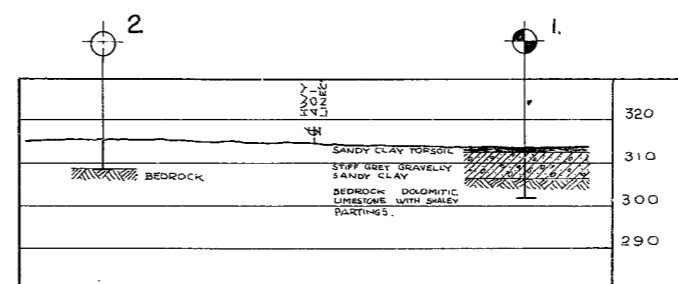
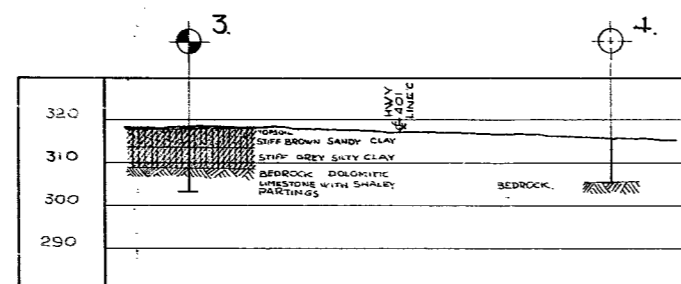


LEGEND			
BORE & PENETRATION HOLE			
PENETRATION HOLE			
HOLE NO.	ELEVATION	STATION	DISTANCE FROM C
1.	313.4	271+14	50 RT.
2.	315.8	271+14	50 LT.
3.	318.7	270+30	50 LT.
4.	315.9	270+38	50 RT.



- 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.



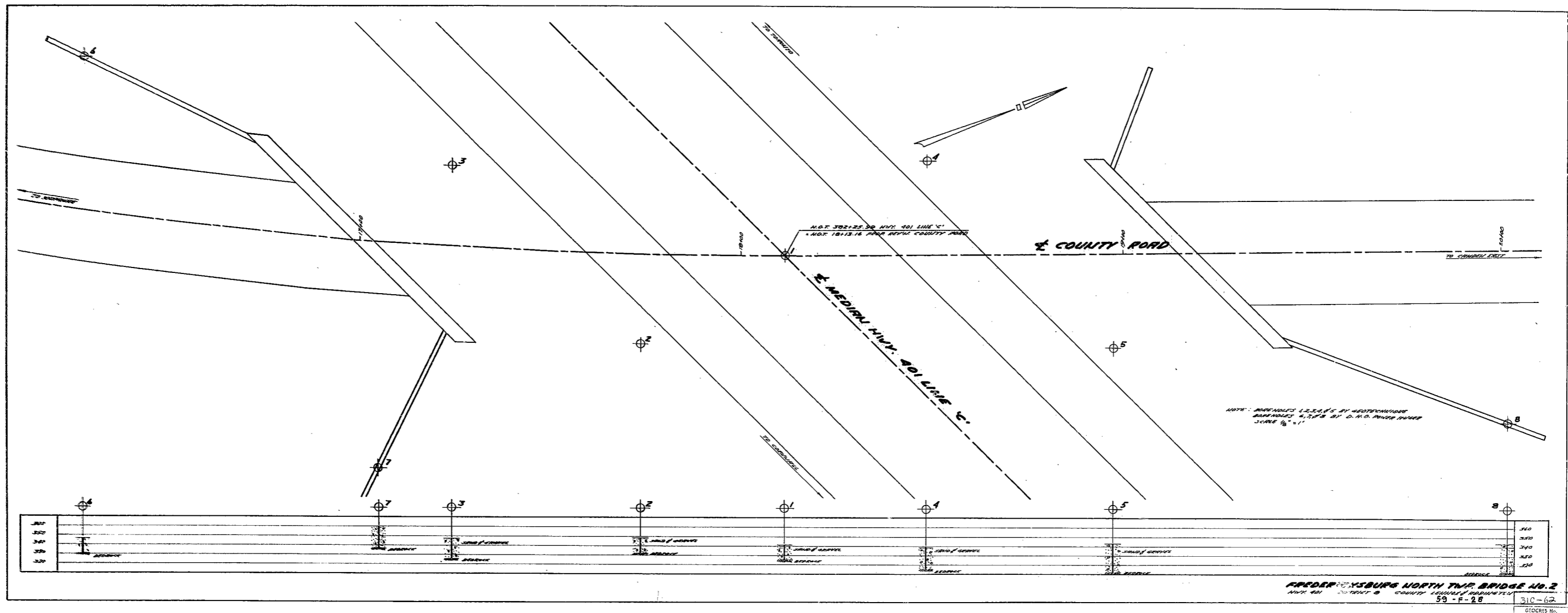
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION

HIGHWAY 41 PROPOSED CROSSING

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY. 401 LINE 'C' DISTRICT 8 COUNTY, LENNOX AND ADDINGTON
TOWNSHIP RICHMOND 101 21 22 CON II
LOCATION 1 mile NORTH OF NAPANEE

DRAWN BY T. SZEGVARY CHECKED BY W.P. 28-59
DATE 1. JUNE 1959 APPROVED BY DRAWING NO.
SCALE 1" = 20' F 59-28A



Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Section.

June 22, 1959.

Re: FOUNDATION REPORT -
W.P. 28-59 - W.J. F-59-28.

Attention: Mr. S. McCombie.

Hwy. 401 Line 'C' & Hwy. 41 Crossing,
Lots 21 & 22, Con. II, Twp. of Richmond,
Approximately 1 Mile North of Napanee.

Enclosed herewith is our report on the subsoil conditions existing at the above noted site. The field work which consisted of two sampled borings and two dynamic cone penetration tests, shows that the shallow overburden layer of stiff clay overlies sound limestone bedrock at this structure location.

It is recommended that spread footings for this structure be founded directly on the limestone bedrock which has been noted at elevations 306' to 308'. This will involve excavations to a depth of 7' - 10' below existing ground surface. An allowable footing pressure of at least 10 tons/sq. ft. can be applied to the bedrock. Ground water conditions are such that excavations will be sensibly dry. No problems need be anticipated with respect to embankment loadings, for either an overpass or underpass structure.

If any questions arise with respect to the contents of this report, please contact our office.

L. G. Soderman

LGS/MdeF
Encl.

L. G. Soderman,
PRINCIPAL FOUNDATIONS & SOILS ENGINEER.

cc: Messrs. A. M. Toye
H. A. Tregaskes
D. G. Ramsay
S. Markiewicz
L. E. Walker
J. E. Gruspier
Dr. P. Karrow
Foundation Section
Gen. Files.

FOUNDATION REPORT

on

Hwy. 401 Line 'C' & Hwy. 41 Crossing,
Lots 21 & 22, Con. II, Twp. of Richmond,
Approximately 1 Mile North of Napanee.

Plan No: F-3174-3

Profile No: F-3174-2

Chainage: Sta. 270+61.52.

Distribution:

Mr. A. M. Toye, Bridge Engineer.	(2)
Mr. H. A. Tregaskes, Construction Engineer.	(1)
Mr. D. G. Ramsay, Design Engineer.	(1)
Mr. S. Markiewicz, Project Design Engineer.	(1)
Mr. L. E. Walker, District Engineer, Kingston, Ontario.	(1)
Mr. J. E. Gruspier, Regional Soils Engineer, Kingston, Ontario.	(1)
Dr. P. Karrow, Department of Mines.	(1)
Foundation Section.	(1)
Gen. Files.	(1)

W.P. 28-59.

W.J. F-59-28.

INTRODUCTION:

Presented in this report are the results of a subsoil investigation carried out at a structure location approximately one mile north of Napanee, where proposed Hwy. 401 Line 'C' crosses existing Hwy. 41 in Lots 21 & 22, Con. II, Twp. of Richmond (Station 270+61.52, Profile No. F-3174-2). This report contains the field and laboratory findings and recommendations for the foundation of the structure.

The field work commenced on April 16, 1959 and was completed on April 17, 1959.

DESCRIPTION OF THE SITE & GEOLOGY:

The topography of the site and its surrounding areas is generally level to undulating. The areas on both sides of existing Hwy. 41 are presently uncultivated and in pasture. Limestone rock outcrops are visible in the vicinity of the crossing site. At the time of the investigation, the area was covered with water resulting from spring thaw and rain.

Physiographically, the site is located on the Napanee Plain, a flat to undulating plain of limestone, from which the glaciers stripped most of its overburden. At this site, a surface layer of stiff clay overlies the limestone bedrock.

DESCRIPTION OF FIELD & LABORATORY WORK:

Field work consisted of 2 sampled boreholes with dynamic cone penetration test adjacent to each hole and 2 separate dynamic cone penetration tests. The exploration programme was carried out by a standard diamond drill adapted for soil sampling.

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

Conventional wash boring procedures were followed. Samples were recovered at depths required by means of 2" I.D. thin-walled shelby tube samplers or a 2" O.D. split spoon sampler. The dimensions of this spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration test. Rock samples were obtained by rotary drilling using an AXT corebit and retained in a 5-ft. double-tube core-barrel.

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-59-28A.

SUBSOIL CONDITIONS:

The site is underlain by limestone bedrock covered by a shallow overburden of stiff clay.

In each of the sampled boreholes, the topsoil was found to be underlain by a 7' to 10' layer of stiff clay extending from Elevations 312.4' to 306.2' in Boring 1, and 318.7' to 308.7' in Boring 3. The stiff clay was underlain by limestone bedrock. Bedrock was drilled and cored to Elev. 301.4' in Boring 1, and Elev. 303.7' in Boring 3 to determine its quality and soundness.

cont'd. /3 ...

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

In the order of stratigraphic succession, the following soil types are defined:-

1. Stiff Clay -

This layer of stiff clay was encountered immediately below the topsoil in both Borings 1 & 3. Its thickness ranges from approximately 7 ft. in Boring 1, to 10 ft. in Boring 3. Its colour is predominantly grey except that in Boring 3, the upper 5 ft. has been subjected to oxidation resulting in its present brownish colour. The stiff clay contains 20% to 30% sand and 21% to 35% silt. The average unit weight and moisture content were found to be 130 p.c.f. and 30%, respectively. Laboratory test results show its shear strength ranges from 1100 p.s.f. to 5600 p.s.f. It is of medium plasticity.

2. Bedrock -

Underneath the stiff clay layer, bedrock was encountered at Elev. 306.2' in Boring 1, and Elev. 308.7' in Boring 3. It was proven by core drilling down to Elev. 301.4' in Boring 1, and Elev. 308.7' in Boring 3. Bedrock is composed of fine-grained dolomitic limestone with shaley partings of the Black River Series. The limestone is in a very sound condition with no sign of fracture or weathering. The allowable bearing capacity of the limestone is estimated to be at least 10 t.s.f.

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

cont'd. /4 ...

WATER CONDITIONS:

Observations and measurements carried out during boring and sampling operations indicate that the ground water table is at approximately Elev. 313' to Elev. 315'. In view of the fact that no water-bearing sand seams of any significance, or artesian water conditions were encountered during the exploration programme, seepage inflow during footing excavations will be local and of minor quantities, only.

FOUNDATION CONSIDERATIONS:

Reference to the borehole logs shows that subsoil conditions at the site consist simply of a shallow overburden of 7' to 10' overlying limestone bedrock. The limestone is of good quality and soundness; henceforth, the proposed structure can safely be supported on spread footings placed directly on top of the bedrock surface, which commences at approximately Elev. 306' to Elev. 308'. An allowable bearing value of at least 10 t.s.f. can be used for spread footing design.

No excessive seepage problems with respect to footing excavations are anticipated.

No approach fill stability problems are anticipated, either for an overpass or underpass structure.

CONCLUSIONS & RECOMMENDATIONS:

- (1) The site is underlain by limestone bedrock of the Black River series, covered by a shallow overburden of stiff clay.

cont'd. /5 ...

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

- (2) The proposed structure can be supported on spread footings placed directly on top of the bedrock surface, which commences at approximately Elev. 306' to 308'. An allowable bearing value of at least 10 t.s.f. can be used.
- (3) No ground water problems with respect to footing excavations are anticipated.
- (4) No approach fill stability problems are anticipated, either for an overpass or underpass structure.

AKLH

A. K. Loh,
FOUNDATIONS ENGINEER.

APPENDIX I.

JOB # - 59 - 28

W.P. 28-59.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 28-59. BORE HOLE NO. 1
JOB F 59-28. STATION 271/14 (50' Rt.)
DATUM Geodetic COMPILED BY B.K.
BORING DATE April 16/59 CHECKED BY A.L.

LEGEND

SS 1/2 UNCONFINED COMPRESSION (Qu) O
TW VANE TEST (C) AND SENSITIVITY (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
	Ground Level. W.L. ∇	313.4					
	Sandy Clay Topsoil	312.4			50		100
	Stiff grey gravelly sandy clay.		5				
	Bedrock.	306.2					
	Dolomitic Limestone with Shaley Partings.		10				
	End of Borehole.	301.4					
			15				
			20				

CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.		
	TW1	151.5
	RC	

Borehole No. 1.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 28-59. BORE HOLE NO. 2.
JOB F 59-28 STATION 271/14 (50' Lt.)
DATUM Geodetic. COMPILED BY B.K.
BORING DATE April 17/59 CHECKED BY A.L.

LEGEND

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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				2000 P.S.F.	4000 P.S.F.	6000 P.S.F.	8000 P.S.F.
↓	Ground Level.	315.8		50	100		
///	Bedrock.	308.2					

[illegible]

Borehole No. 2

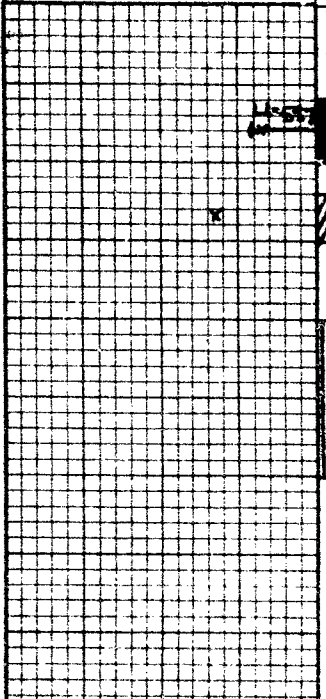
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 28-59. BORE HOLE NO. 3.
 JOB F 59-28. STATION 270+38 (50' Lt.)
 DATUM Geodetic. COMPILED BY B.K.
 BORING DATE April 17/59 CHECKED BY A.L.

LEGEND

2" DIA. SPLIT TUBE ----- SS
 2" SHELBY TUBE ----- TW
 2" SPLIT TUBE ----- O
 2" DIA. CONE ----- LI
 2" SHELBY ----- X
 CASING -----
 1/2 UNCONFINED COMPRESSION (Q_u) ----- O
 VANE TEST (C) AND SENSITIVITY (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.	318.7		50			
	TOP SOIL	2"		100			
	Stiff Brown Sandy Clay.	315.7					
		313.7	5				
	Stiff Grey Silty Clay.						
		308.7	10				
	Bedrock.						
	Dolomitic Limestone with Shaley Partings.	303.7	15				
	End of Borehole.		20				

CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT- % DRY WT.			
		TW 1	118.0
		SS 2	123.5
		RC	

Borehole No. 3.

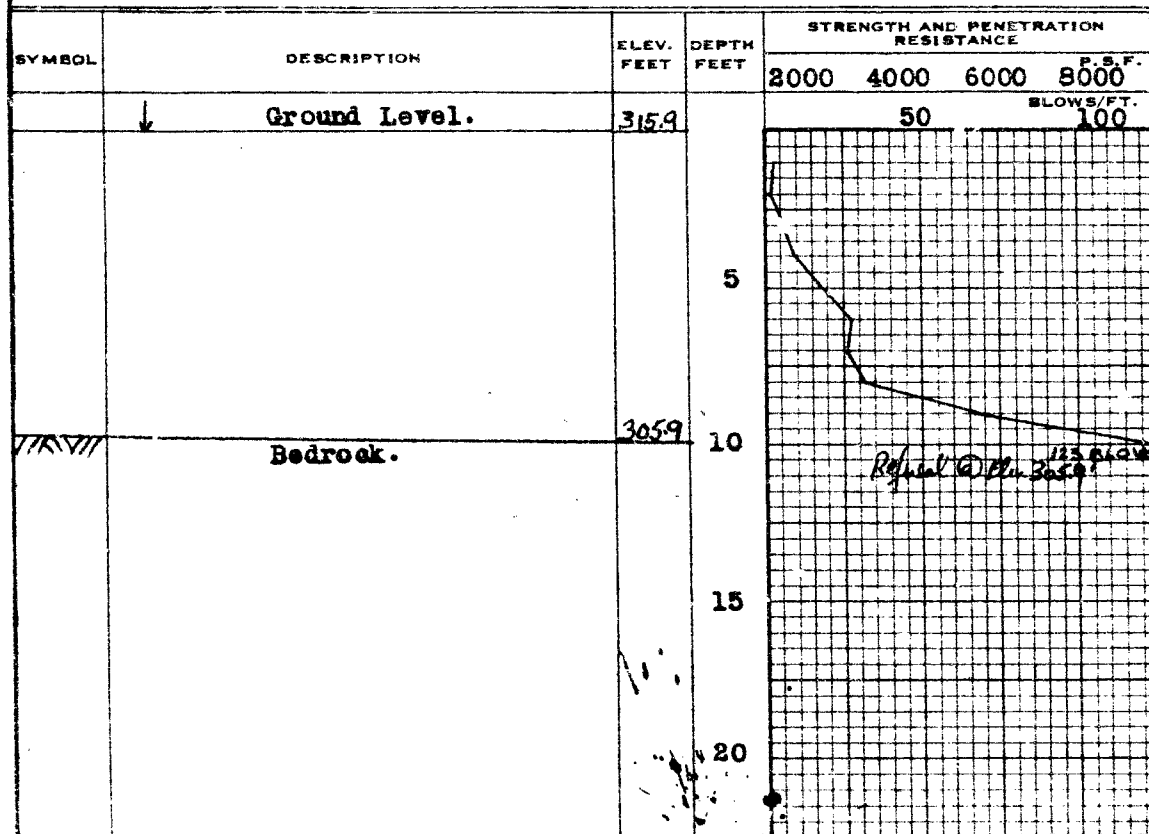
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 28-59. BORE HOLE NO. 2.
JOB F 59-28 STATION 270+38 (50' Rt.)
DATUM Geodetic COMPILED BY B.K.
BORING DATE April 17/59 CHECKED BY A.L.

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

LEGEND

SS	1/2 UNCONFINED COMPRESSION (Qu)	0
1W	VANE TEST (G) AND SENSITIVITY (S)	+*
	NATURAL MOISTURE AND	LI
	LIQUIDITY INDEX	X
	LIQUID LIMIT	
	PLASTIC LIMIT	

[illegible]

Appendix B
Site Photographs



County Road 41 Looking South



County Road 41 Looking North



Highway 401 Looking West Over County Road 41 Structure