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DIST. 9 REGION EASTERN

W.P. No. 13-68-04

CONT. No. 73-192

W. O. No. 72-11109

STR. SITE No. 3-314

HWY. No. 417

LOCATION UNDERPASS AT 417 X-ING
1/2 CYRVILLE ROAD

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 0

REMARKS: 3 documents to be unfolded
before microfilmed

MEMORANDUM

3165-114

TO: Mr. T. C. Kingsland, (2)
Regional Structural Planning Eng.,
Eastern Region,
Kingston, Ontario.

FROM: Foundations Office,
Design Services Branch,
West Bldg., Downsview.

ATTENTION:

DATE: November 7, 1972.

OUR FILE REF.

IN REPLY TO

NOV - 8 1972

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

The Proposed Underpass Structure at the
Crossing of Hwy. #417
(E.B. and W.B. Lanes) and Realigned Cyrville Rd.
Twp. of Gloucester, Reg. Mun. of Ottawa-Carleton
District No. 9 (Ottawa)

W.O. 72-11109 -- W.P. 13-68-04
CONT 73-192 SITE 3-314

Cont 73-192

Attached we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above-mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

AGS/ao
Attach.

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATIONS ENGINEER.

cc: E. J. Orr
B. R. Davis
A. Rutka
S. J. Markiewicz
J. E. Callaghan
B. J. Giroux
E. R. Saint
G. A. Wrong
B. A. Singh

Foundations Files ✓
Documents

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FOUNDATION INVESTIGATION REPORT

For

The Proposed Underpass Structure at the

Crossing of Hwy. #417

(E.B. and W.B. Lanes) and Realigned Cyrville Rd.

Twp. of Gloucester, Reg. Mun. of Ottawa-Carleton

District No. 9 (Ottawa)

W.O. 72-11109 -- W.P. 13-68-04

1. INTRODUCTION:

The Foundations Office was requested to carry out a subsurface investigation at the aforementioned site as well as the site for a proposed culvert at the crossing of Cyrville Rd. and a major tributary of Green Creek. These sites, which are adjacent to one another are located in the Township of Gloucester, Regional Municipality of Ottawa-Carleton. The request was contained in a memo from Mr. T. C. Kingsland, Regional Structural Planning Engineer, Eastern Region, dated September 21, 1972. An investigation was subsequently carried out at the Hwy. 417 - Cyrville Rd. structure site to determine the subsoil, bedrock and groundwater conditions. The investigation at the culvert site has been delayed, however, due to complications arising from permission to enter private property.

This report contains the factual results obtained from the structure site investigation, together with recommendations pertaining to foundation design, as well as the stability and settlement considerations associated with the approaches. Recommendations pertaining to the placement of the culvert at the Cyrville Rd. - Green Creek tributary crossing will be presented in an addendum to this report once the necessary field work,

laboratory testing, draughting and report writing have been completed.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The area under investigation is located approximately 1,000 feet east of Star Top Rd. and some 150 feet south of the present Cyrville Rd. in the Township of Gloucester, Regional Municipality of Ottawa-Carleton. The terrain is flat to gently undulating in relief between about elevations 212 to 222. The land is primarily used for light commercial enterprises and housing.

A major tributary of Green Creek meanders across this area. The tributary's valley is approximately 30 feet wide and 10 feet deep; the depth of water being about 3 to 4 feet.

The present physical features of the region are of varied origin and are the result of erosion and deposition by various agencies. During a long period of time, previous to Pleistocene or Glacial time, the region was above sea level.* During this time, the major features of the bedrock topography were formed by processes of weathering and stream erosion. During Pleistocene time the region was invaded by one or more ice sheets advancing from the north. The pre-glacial land surface was modified by glacial erosion and by deposition, in places, of material eroded by the ice sheet. Near the close of Pleistocene time, when the ice sheet began to retire, the area was, in large part, below sea level so that as the ice retired or melted back, the sea entered and overspread the Ottawa Valley to a depth, in places, of several hundred feet. In this arm of the sea, known as the Champlain Sea, thick deposits of sand, silt and clay were laid down. As the ice

* Johnston, W.A., "Pleistocene and Recent Deposits in the Vicinity of Ottawa, with a Description of the Soils." Geological Surveys #84, Department of Mines.

sheet still further retired, uplift took place, the land gradually emerged from the sea. This area is now commonly called "The Ottawa Valley Clay Plain."** Here extensive sensitive marine clay deposits are interrupted by ridges of sand and/or bedrock. In the vicinity of the area under investigation one of these ridges exist. Here bedrock is overlain by shallow deposits of sand and silt underlain by glacial till. The bedrock is composed of grey shale of the Collingwood formation, Ordovician period.

3. FIELD AND LABORATORY WORK:

Six sampled boreholes, four of which were accompanied by a dynamic cone penetration test, as well as two additional cone tests, were put down at the site during the period of the field investigation, using a C.M.E. machine adapted for soil sampling purposes.

Samples of the overburden were obtained by using a 2-inch O.D. split-spoon sampler, which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. Bedrock was proven in three of the boreholes by obtaining BX size rock core samples. The groundwater level conditions across the site were obtained by recording the water levels in the open boreholes during the period of the investigation.

The soil, bedrock and groundwater conditions encountered at the boring locations are presented on the Record of Borehole sheets appended to this report. The locations and elevations of the boreholes and cone tests were provided by personnel from the Eastern Region Engineering Surveys Section. The elevations in this report are referenced to a Geodetic datum. The boring locations and elevations are shown on Drawing No. W.O. 72-11109A. An inferred stratigraphical profile along the centre-line of the

**Chapman, L.J. and Putnam, D.F., "Physiography of Southern Ontario," University of Toronto Press, 1967.

realigned Cyrville Rd. is also presented on the aforementioned drawing.

All the samples were subjected to a careful visual examination in the field, and subsequently in the laboratory. Following these examinations, laboratory testing was carried out on selected representative samples to determine the following physical properties of the overburden.

Natural Moisture Content

Atterberg Limits

Grain-Size Distribution

The results of this testing are plotted on the Record of Borehole sheets and summarized on Figures #1, 2 and 3, all of which are contained in Appendix I of this report.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The surficial deposit across the site is composed of a compact to very dense silty sand to sandy silt which varies from 6 to 8 feet in thickness. The granular deposit is underlain by a thin (2.5 to 3 feet thick) very stiff to hard glacial till, which in turn is followed by shale bedrock.

The boundaries of the various deposits, as determined at the boring locations, are plotted on the Record of Borelog sheets.. The stratigraphical profile shown on Drawing No. 72-11109A have been inferred from this data. The subsoil and bedrock conditions encountered from ground surface downward, are presented in the subsections to follow.

4.2) Silty Sand to Sandy Silt:

A thin topsoil cover (less than 1 foot) is underlain by a deposit composed of a brown to grey silty sand to sandy silt, with a trace of clay. The thickness of this deposit ranges from 6 to 8 feet. At B.H. #7 clayey silt seams, up to 2 inches thick, are present throughout. Grain-size distribution curves for representative samples obtained from the deposit are plotted on Figure #1.

The Standard Penetration Tests, carried out within the granular stratum, are plotted on the Record of Borehole sheets. This testing gave 'N' values which ranged from 12 to 66 blows/ft. Based on these values it is estimated that the relative density of the stratum varies from compact to very dense.

4.3) Glacial Till:

The granular deposit is underlain by a thin (2.5 to 3 feet thick) deposit of glacial till. The till is primarily cohesive in nature; i.e., composed of a matrix of clayey silt binding sand and gravel. In some isolated areas, however, the till is basically granular being composed of a heterogeneous mixture of silt, sand and gravel with a trace of clay. Fragments of shale are present throughout the till material. Grain-size distribution testing has been carried out on two samples obtained within the till using 2" I.D. sampling equipment. The results are plotted on Figure #2.

The Standard Penetration Testing, carried out within this material, gave 'N' values which ranged from 24 blows/ft. to 100 blows for 3 inches. Based on these results it is estimated that the major cohesive portions of the till has a consistency which ranges from very stiff to hard. It is inferred that the random granular zones within this deposit have a very dense relative density.

4.4) Shale Bedrock:

The glacial till is underlain by bedrock which was proven at three of the boring locations by obtaining between 4 and 6.5 feet of BX size rock core samples. The surface of the bedrock was found to vary between elevations 211 and 212, which corresponds to an average depth of about 11 feet below the existing ground surface.

The bedrock is composed of a grey calcareous shale of the Collingwood formation, Ordovician Period. The upper 1 to 2 feet of the shale is generally in a fractured and weathered condition. Below this upper weathered zone the shale is relatively sound as

evidenced by the high percentage of core recovered.

5. GROUNDWATER LEVEL CONDITIONS:

Groundwater level observations were carried out, during the period of the investigation, in the open boreholes. The observations are presented on the individual Record of Borelog sheets, as well as on Drawing No. 72-11109A. The results indicate that the groundwater level, in the overburden, varies between elevations 215.5 and 218, which corresponds to depths below ground surface of from 4.5 to 6 feet.

An exception to the aforementioned pattern occurs at B.H. #5 where the recorded groundwater level was at elevation 221 (2 feet below ground surface). Water was used while drilling the bedrock at this location; this operation might have caused this higher water level. The observations could conceivably have been made prior to the time necessary for the water level to reach its true equilibrium level.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

The design and construction of the rural portion of Hwy. #417, south-easterly of the Village of Ramsayville, in the Township of Gloucester, Regional Municipality of Ottawa-Carleton, to the Quebec border will be completed by 1974. The Ministry and the Regional Municipality have undertaken a study to determine the most appropriate alignment for the urban portion of Hwy. #417, specifically from Ramsayville northerly to the Ottawa Queensway located within the City of Ottawa. A preliminary Foundation Report, W.O. 70-11115, for various possible corridors of Hwy. #417, from Ramsayville northerly was submitted on March 23, 1971. The finalized alignment required interchanges at Hunt Club Rd., the Walkley Rd. Extension, Innes Rd. and the Ottawa Queensway. Structures will be required at the crossings of Baseline Rd., Canadian National Railway, Cyrville Rd. and Canadian Pacific Railway.

In addition, a number of creeks (Green, McEwen, Borthwick, etc.) will have to be crossed.

This discussion deals with the proposed underpass structure at the crossing of Hwy. #417 and realigned Cyrville Rd., in the Township of Gloucester, Regional Municipality of Ottawa-Carleton. Recommendations pertaining to the culvert required at the crossing of realigned Cyrville Rd. and a major tributary of Green Creek, will be submitted as an addendum to this report at a later date. Foundation reports for the other interchange, structure and creek crossings have been or will be presented in separate reports.

It is understood that the profile grade of Hwy. #417 (E.B. and W.B. Lanes), in the vicinity of the structure, will vary between elevations 215 and 218. This elevation range corresponds to depths of from 4 to 7 feet below existing ground surface. The proposed profile grade of Cyrville Rd. is to range from elevation 235.5 to 240. At these grades the associate approaches will have a maximum height of 16 and 21 feet in the transverse and longitudinal direction, respectively.

The surficial deposit across the site is a 6 to 8 feet thick compact to very dense silty sand to sandy silt, which is underlain by a 2.5 to 3 feet thick cohesive glacial till. This overburden sequence is underlain by grey shale bedrock, the upper 1 to 2 feet of which is in a weathered condition.

6.2) Hwy. #417 Cut Section:

In the vicinity of the structure Hwy. #417 will be located in a cut section which will extend 4 to 7 feet below the existing ground surface. The base of the cut will be located at or slightly below the groundwater level prevailing at the time of the investigation. Since the cut will be carried out within the relatively pervious silty sand deposit some groundwater seepage may occur within the excavation. Further, the base may boil due to the unbalanced hydrostatic pressure head. These conditions may make it necessary to depress the groundwater level along the cut section. Longitudinal drainage ditches on either side of the Hwy. #417 lanes

could be employed for this purpose. These ditches should extend at least 2 feet below the profile grade of the highway; provision should be made to channelize the water collecting in these ditches to the permanent drainage system in the area.

The cuts within the granular soil will be inherently stable provided i) standard 2:1 slopes are employed and ii) the slopes are protected against the erosional action of uncontrolled surface runoff by sodding or seeding and mulching them.

6.3) Structure Approaches - Stability and Settlement Considerations:

The maximum height of the approaches will be 21 feet in the forward or longitudinal direction (7 feet cut - 14 feet fill) and 16 feet in the transverse direction. Approaches of this height will be inherently stable provided i) the earth fill is properly compacted and ii) standard 2:1 slopes are employed.

The overburden deposits will settle due to the embankment loading (max. height of fill 16 feet). Since the overburden is relatively thin and competent this settlement should be of the order of 1/2 inch. Further, it will be elastic in nature; i.e., take place within 2 to 3 months following fill placement.

6.4) Structure Foundations:

6.4.1) Centre Pier (Refer to B.H. #4):

The centre pier can be founded on a spread footing. A minimum of 4 feet of earth cover should be provided to the underside of the footing for frost protection purposes. At the proposed grade of the E.B. and W.B. lanes of Hwy. #417 this would place the footing at elevation 213; i.e., within the competent glacial till deposit. A footing founded at this level could be designed using an allowable bearing value of 5.0 t.s.f.

In order to limit the dewatering requirements it would be advantageous to carry out the footing excavation only after the Hwy. #417 cut section has been completed. The footing excavation will extend through the granular deposit down into the basically cohesive glacial till. The granular material is water bearing,

therefore, some groundwater seepage can be expected into the excavation. This, however, could be handled using conventional techniques such as pumping from sumps.

The cohesive glacial till foundation subsoil will settle due to the applied footing pressure. Since the glacial till is thin and highly preconsolidated the settlement will be negligible, provided that it is not softened due to uncontrolled surface runoff or construction operations. In this regard it would be advantageous to pour a working mat of lean concrete as soon as the footing level is reached.

As an alternative the pier could be carried down to bear on a spread footing founded directly on the shale bedrock. If this scheme is adopted the upper fractured and weathered portion of the bedrock should be stripped so that the footing can bear directly on the sound rock. For estimating purposes it can be assumed that this would occur at about elevation 210; i.e., 3 feet lower than the previously mentioned founding level. A spread footing founded directly on sound bedrock could be designed using an allowable bearing value of 10.0 t.s.f. Any groundwater seepage occurring in the excavation could be handled in a manner similar to that discussed above.

6.4.2) Abutments:

The proposed abutments will be "perched" within the approach fills. The abutments may be supported on spread footings placed within the fills. The fill material, below the tops of the footings, should consist of well compacted granular 'A' material, and should extend for a horizontal distance of at least 10 feet from the footing edges in the plane of the footing tops. This portion of the fill should be constructed with side slopes no steeper than 2:1. The remainder of the fill should be completed to about profile grade for a distance of 50 feet behind the abutments before re-excavation for the abutment footings. An allowable bearing pressure of 2.5 t.s.f. may be used in design.

If the abutments are supported on spread footings, there will be differential settlement between the abutments and centre pier. Providing the fill, in the immediate vicinity of the abutment footings, is well compacted this settlement should not exceed 1 inch. This differential settlement could be reduced considerably if the fills were built to as high a height as possible and left in place for a period of time prior to constructing the abutments. If scheduling permits a period of 3 to 4 months would be ideal for this purpose.

As an alternative, the abutments may be supported on end-bearing piles driven to bedrock. For estimating purposes the pile tips can be assumed to be located between elevations 210 and 211. The piles could be designed for the ultimate capacity of the pile section chosen; e.g., 12BP74 steel H-piles could be designed for 95 tons/pile.

No rock or bouldery fill should be placed in areas where piles are to be driven.

7. MISCELLANEOUS:

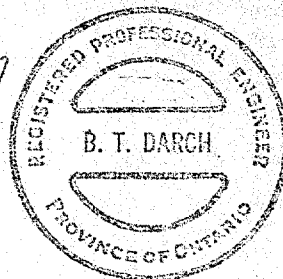
The field work, performed during the period of September 20 to 22, 1972, was carried out under the supervision of Mr. S. A. Ahmad, Project Foundations Engineer.

The equipment used was owned and operated by Master Soil Investigation Ltd., Toronto.

This report was written by Mr. B. T. Darch and reviewed by Mr. M. Devata, Supervising Foundations Engineer.

B. T. Darch,
B. T. Darch, P. Eng.

M. Devata
M. Devata, P. Eng.



APPENDIX I

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 1

FOUNDATIONS OFFICE

JOB 72-11109

LOCATION Co-ords. 16,506,449 N; 1,227 332 E.

ORIGINATED BY SAA

W.P. 13-58-04

BORING DATE Sept. 21, 1972

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger-BX Casing, BXL Rock Core

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	BLOWS / FOOT				WATER CONTENT					
						20	40	60	80	100	W _p	W	W _L		
222.2	Ground Level														
0.0	Silty sand with trace of clay & gravel. Grey		1	SS	13										4 64 21 11 217.2
214.2	Compact to Very Dense		2	SS	55										
8.0	Glacial Till, fragments of shale. Hard		3	SS	58										
211.2			4	SS	100										
11.0	Bedrock - Shale		5	BXL	80										
207.2	Sound Grey		6	BXL	100										
15.0	End of Borehole														

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATION OFFICE

RECORD OF BOREHOLE NO 2

JOB 72-11109

LOCATION Co-ords. 16,506,372 N; 1,227,342 E.

ORIGINATED BY SAA

W.P. 13-68-04

BORING DATE Sept. 21, 1972

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Dynamic Cone Test

CHECKED BY *SAA*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT					
222.4	Ground Surface									
0.0	Probably Silty Sand					220				
214.1										
8.3	End of Cone Test					210	100/4"			

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE № 3

JOB 72-11109

LOCATION Co-ords. 16,506,363 N; 1,227,495 E.

ORIGINATED BY SAA

W.P. 13-63-04


BORING DATE Sept. 21, 1972

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Dynamic Cone Test

CHECKED BY OK

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L			BULK DENSITY γ	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	BLOWS / FOOT					PLASTIC LIMIT ——— w_p						
											WATER CONTENT ——— w						
											w_p ——— w ——— w_L						
SHEAR STRENGTH P.S.F.						+ FIELD VANE						WATER CONTENT %					
● QUICK TRIAXIAL						x LAB VANE											
222.4	Ground Level					ELEV. SCALE										P.C.F.	GR SA SI CL
0.0	Probably Silty Sand					220											
213.9	End of Cone Test					210	100/5"										

DESIGN SERVICES BRANCH

FOUNDATION OFFICE

RECORD OF BOREHOLE NO 4

JOB 72-11109

LOCATION Co-ords. 16,506,291 N; 1,227,514 E.

ORIGINATED BY SAA

W.P. 13-68-04

BORING DATE Sept. 21, 1972

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger-BX Casing, BXL Rock Core

 CHECKED BY *OK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE Blows / Foot 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
222.4	Ground Surface									
0.0	Silty sand to sandy silt, trace to some clay. Grey		1	SS	12	220				0 30 57 13 217.9
214.4	Compact to Very Dense		2	SS	66					
8.0	Glacial till with shale fragments		3	SS	100	210	100/2"			29 49 17 5
211.4	weathered		4	BXL	50%					
11.0	Bedrock Shale		5	BXL	80%					
204.9	Sound Grey		6	BXL	90%					
17.5	End of Borehole					200				

DESIGN SERVICES BRANCH

FOUNDATION OFFICE

RECORD OF BOREHOLE NO 5

JOB 72-11109

LOCATION Co-ords. 16,506,303 N; 1,227,670 E.

ORIGINATED BY SAA

W.P. 13-68-04

BORING DATE Sept. 21, 1972

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger-BX Casing, BXL Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT W_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	PLASTIC LIMIT W_P	WATER CONTENT W	WATER CONTENT %		
222.9	Ground Surface															
0.0	Silty sand to sandy silt, trace of clay.		1	SS	22	220										220.9
214.9	Compact		2	SS	15											22 68 10
8.0	Glacial Till, fragments of shale. Very Stiff		3	SS	24											21 47 23 9
211.9	weathered		4	SS	100	3"										
11.0	Shale Bedrock		5	BXL	60%	210										
206.9	Sound Grey		6	BXL	90%											
16.0	End of Borehole					200										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATION OFFICE

RECORD OF BOREHOLE NO 6

JOB 72-11109

LOCATION Co-ords. 16,506,241 N; 1,227,676 E.

ORIGINATED BY SAA

W.P. 13-68-04

BORING DATE Sept. 22, 1972

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger; Cone Test

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
220.6	Ground Level									
0.0	Silty sand with trace of clay		1	SS	12					
213.8	Compact to dense		2	SS	36					
6.8	Glacial Till, shale fragments. Hard		3	SS	100	3"				
210.4										
10.2	End of Borehole Probably Bedrock									

DESIGN SERVICES BRANCH

FOUNDATION OFFICE

RECORD OF BOREHOLE No 7

JOB 72-11109

LOCATION Co-ords. 16,506,466 N; 1,227,254 E.

ORIGINATED BY SAA

W.P. 13-68-Ch

BORING DATE Sept. 20/72

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY *JK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT —WL			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT					PLASTIC LIMIT —WP				
							20	40	60	80	100	WATER CONTENT —W				
												WP	W	WL		
SHEAR STRENGTH P.S.F.											WATER CONTENT %					
○ UNCONFINED + FIELD VANE																
● QUICK TRIAXIAL x LAB VANE																
						10 20 30					P.C.F. GR. SA. SI. CL.					
222.7	Ground Level					220									0 62 28 10	
0.0	Silty sand, trace of clay (occ. seams of clayey silt up to 2" thick) Compact to Dense		1	SS	22										216.7	
215.7			2	SS	41											
7.0	Glacial Till, fragments of shale. Hard		3	SS	100	210										
213.2																
9.5	End of Borehole															

DESIGN SERVICES BRANCH

FOUNDATION OFFICE

RECORD OF BOREHOLE NO 3

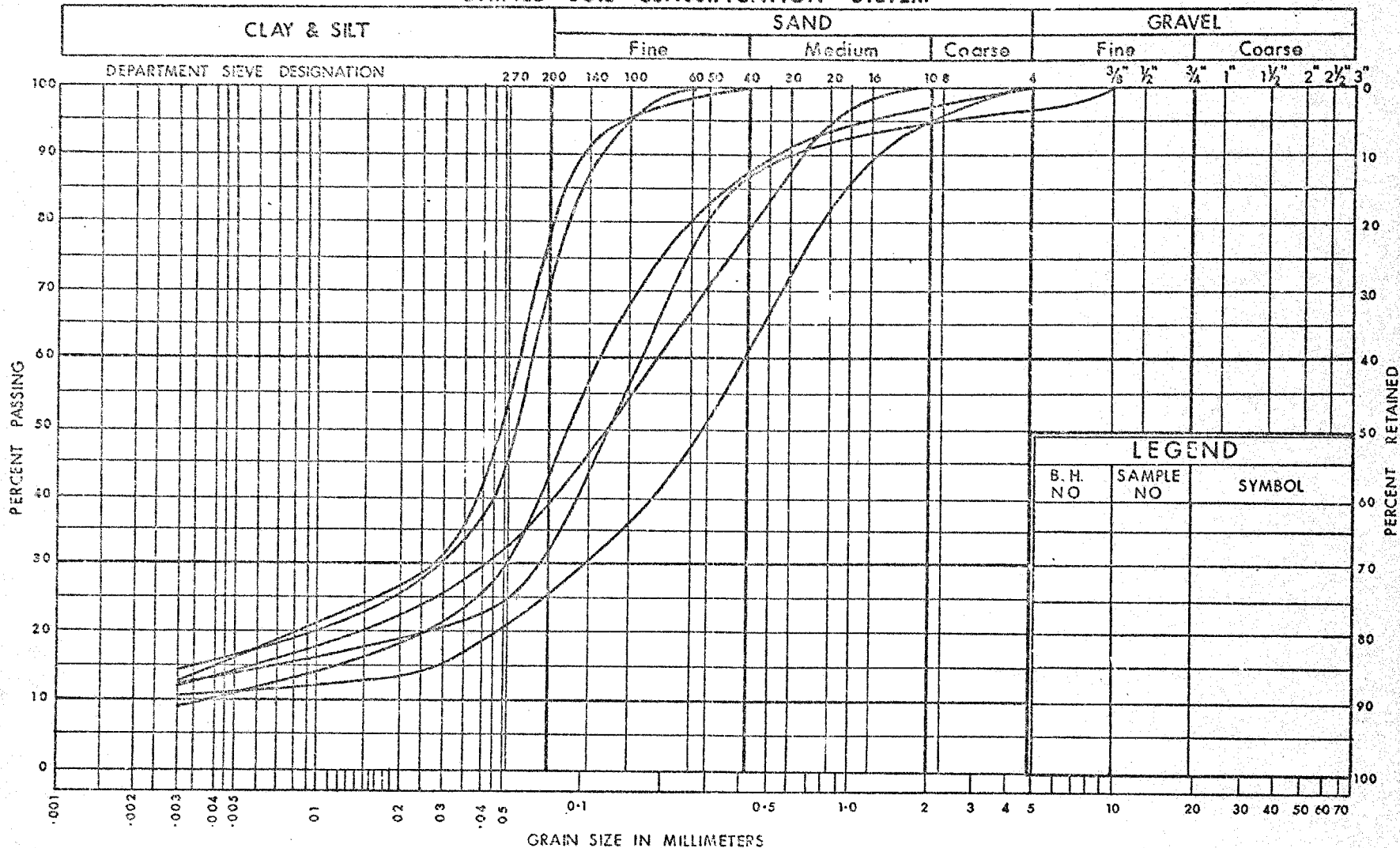
JOB 72-11109 LOCATION Co-ords. 16,506,261 N; 1,227,731 E.
 W.P. 13-68-04 BORING DATE Sept. 22, 1972
 DATUM Geodetic BOREHOLE TYPE Cont. Flight Auger

ORIGINATED BY SAA
 COMPILED BY SAA
 CHECKED BY *SK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w $w_p \quad w \quad w_L$ WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
221.9	Ground Level									
0.0	Silty sand, trace of clay.		1	SS	16	220				0 57 35 8
215.9	Compact									γ 215.9
6.0	Glacial Till, fragments of shale. Hard		2	SS	100.6"					
212.3			3	SS	100.3"					
9.3	End of Borehole Probable Bedrock					210				

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT

SAND

GRAVEL

Fine

Medium

Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION

270 290

140

0

50

30

20

10

 $8 \frac{1}{2}$

34

 $1\frac{1}{2}$

2nd 2nd

3

PERCENT PASSING

PERCENT RETAINED

LEGEND

B. H.
NO

SAMPLE NO

SYMBOL

GRAIN SIZE IN MILLIMETERS

DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS



DESIGN SERVICES
BRANCH

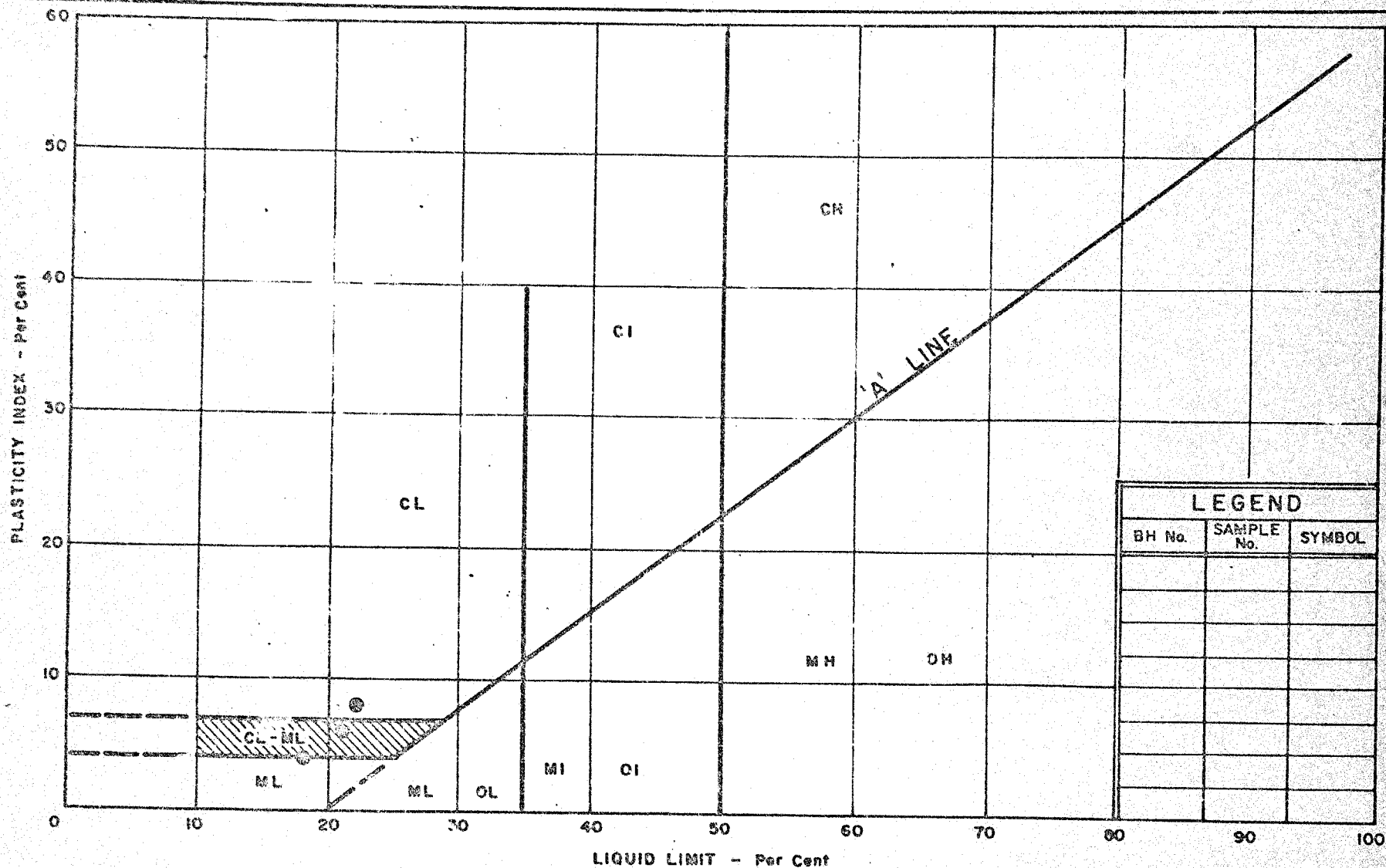
GRAIN SIZE DISTRIBUTION

GLACIAL TILL

W.P. No. 13-68-04

JOB No. 72-11109

FIG. 2



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART GLACIAL TILL

WP. No. 13-68-04

JOB No. 72-11109

FIG. 3

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_i	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

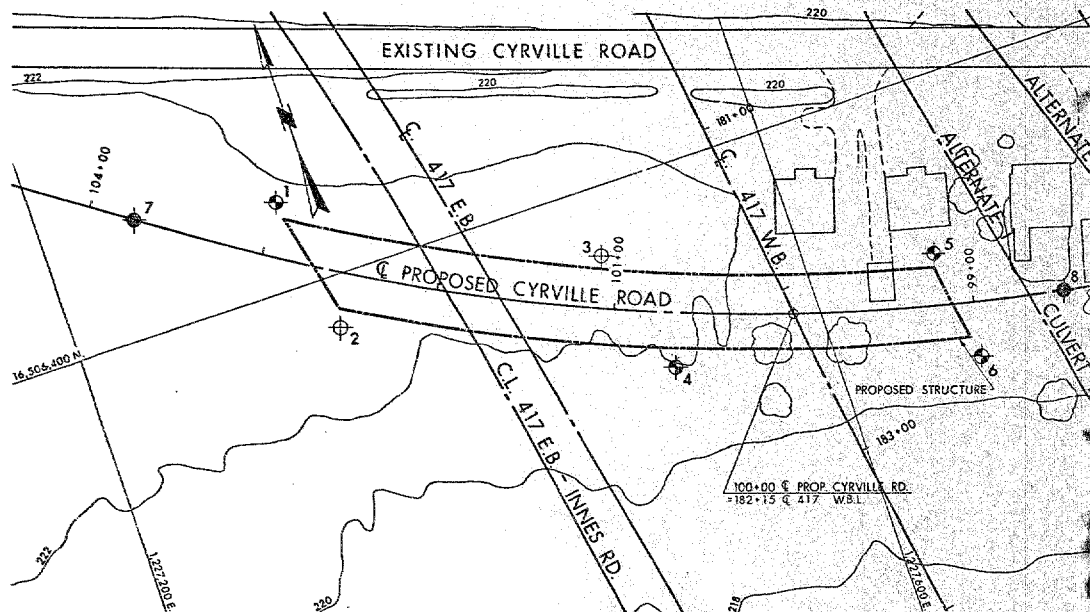
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

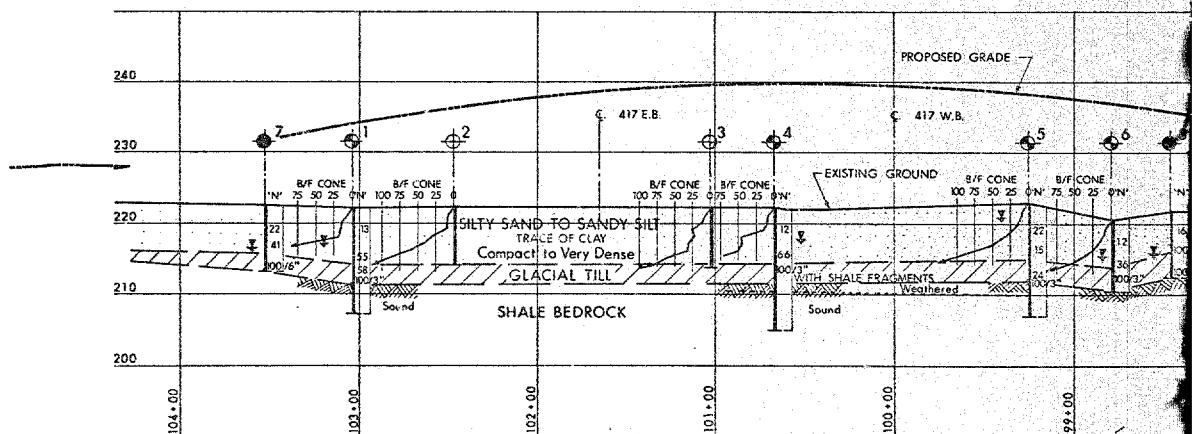
SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



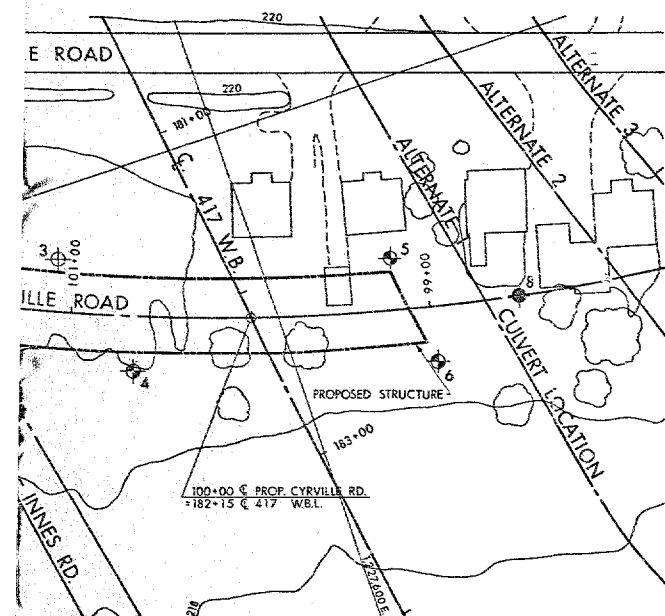
PLAN

HORIZ. 40 20 0 40 80 FT.
SCALE



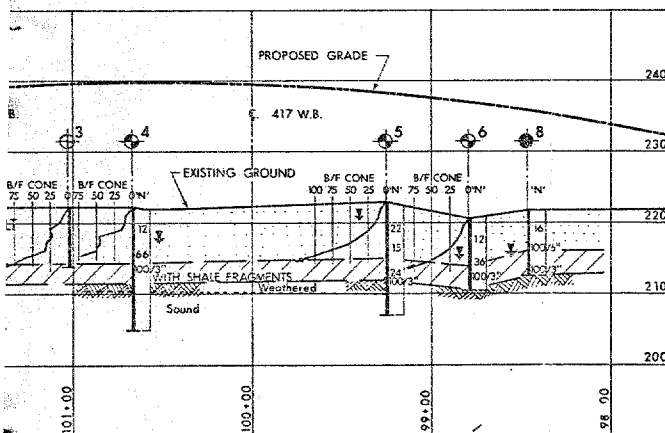
PROFILE C PROPOSED CYRVILLE ROAD

HORIZ. 40 20 0 40 80 FT.
VERT. 10 5 0 10 20 FT.
SCALE



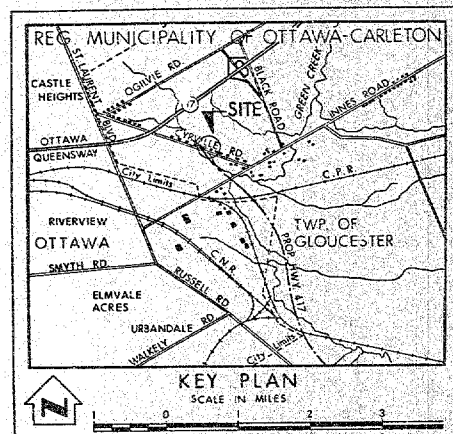
PLAN

SCALE 0 40 80 FT.



PROPOSED CYRVILLE ROAD

SCALE 0 40 80 FT.
0 10 20 FT.



LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation, SEPT. 1972

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	222.2	16,506,449	1,227,332
2	222.4	16,506,372	1,227,342
3	222.4	16,506,363	1,227,495
4	222.4	16,506,291	1,227,514
5	222.9	16,506,303	1,227,670
6	220.6	16,506,241	1,227,676
7	222.7	16,506,466	1,227,254
8	221.9	16,506,261	1,227,731

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION
28/12/72	JIG		BOREHOLE LOCATIONS REVISED

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

CYRVILLE ROAD

HIGHWAY NO. 417 DIST. NO. 9
CO. REG. MUNICIPALITY OF OTTAWA—CARLETON
TWP. GLOUCESTER LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD. 3 A	CHECKED <input checked="" type="checkbox"/>	W.P. NO. 13-68-04	DRAWING NO.
DRAWN J.I.G.	CHECKED <input checked="" type="checkbox"/>	WO NO. 72-11109	72-11109 A
DATE OCT. 25, 1972		SITE NO.	BRIDGE DRAWING NO.
APPROVED <i>[Signature]</i>		CONF. NO.	
PRINCIPAL FOUNDATION ENGINEER			



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. M. Devata,
Sup. Foundation Engineer.

FROM: Ken W. Ingham

ATTENTION:

DATE: January 2, 1972

OUR FILE REF.

IN REPLY TO

SUBJECT: Foundation Investigation 72-11109; Ottawa
Queensway, Cyrville Road and Highway 417
Interchange

The area is underlain by the Carlsbad formation, a dark grey shale somewhat calcareous with more or less fossil debris and thin vertical but irregular calcite veins throughout. Thin bedding is prominent; there are, however, medium bedded and also platy bedded sections. The shale parts readily parallel to the bedding planes imparting a general platy character to weathered or fractured zones.

Subordinate to the shale but nonetheless conspicuous are: layers of limey shale, shaley limestone and limestone. The limestone is for the most part silty, however, beds of pure light grey limestone are occasionally present. In general, the shaley beds range from 0.1 to 0.9 ft. in thickness and the bands of limestone from 0.1 to 0.5 ft.

The shales where exposed in outcrop are generally flat-lying or have a shallow dip to the south. Structures are uncommon and thus the steep dip of the bedding planes, of approximately 55° , is quite unusual. The Ottawa area is known to be traversed by several major and minor faults and the only reasonable explanation of the phenomenon is that the layers represent a down drag feature in the vicinity of one of the minor faults. This may also explain the fracturing and poor core recovery in the upper sections of holes 11 and 12. Due to the severe fragmentation the bedrock elevation can only be fixed with any degree of accuracy at the top of the relatively unfractured core.

A brief description of the rock encountered in each hole is given below together with the appropriate bedrock elevation.

/continued...

Hole No. 11

Bedrock at 198.4

4.0 - 23.0

Badly fragmented dark grey calcareous shale with minor silty limestone; some pebble sized gravel.

23.0 - 24.9

Dark grey shale; generally medium bedded, dip 50° to 60° .

Hole No. 12

Bedrock at 211.2

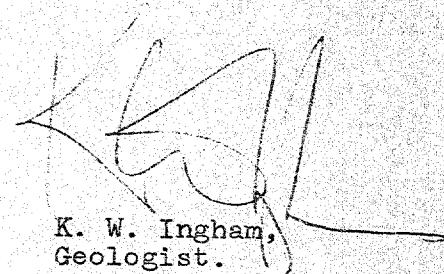
8.0 - 9.0

Badly fragmented dark grey shale.

9.0 - 14.0

Dark grey shale; generally medium bedded, occasional thin bands of shaley and silty limestone, dip 50° to 60° , frequent thin calcite seams parallel to the bedding.

KWI:mv



K. W. Ingham,
Geologist.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundation Engineer,
Downsview, Ontario.

FROM: Structural Planning Office,
Kingston, Ontario.

ATTENTION: Mr. M. Devata

DATE: September 21, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 13-68 & W.P. 10-69 - Highway 417-Ottawa Queensway to
Ramsayville
- Entry into Property for Foundation Investigations -

Referring to your telephone call on Tuesday, September 19, 1972, I regret that circumstances have arisen again in which property access has been denied to one of your site engineers and a drilling crew, particularly since the engineer, drilling rig and crew had been sent especially from Toronto to carry out the foundation investigation at the Highway 417/Mather Drain crossing.

The facts are as follows:

The occupier of the property, Mr. John Willem, a tenant of the N.C.C., had expressed his agreement to our Regional Property Section for entry to be made onto his property. This agreement was obtained before I wrote to you on August 28 requesting a foundation investigation at this site, and was mentioned in my letter. Unfortunately, Mr. Willem's attitude changed during the last few days when damage was caused to a harvesting machine allegedly by some stakes left in one of his fields by an M.T.C. agency. The damage was estimated by him at \$600. His claim is currently being investigated by Property Section and will be settled as soon as possible.

It was fortunate in this instance that a line for the Cyrville Road Underpass had been agreed with the Consultants on Tuesday, and by sending plans from this office to Ottawa by hand on Tuesday evening we were able to ensure that work proceeded at this alternative site.

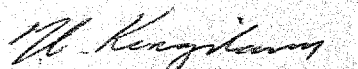
A meeting was held here yesterday between all interested Sections and Property Section in order to discuss internal procedures relating to property entry and the settlement of claims. It is of course not possible to prevent incidents in which the owner or tenant changes his mind about allowing entry on his property. However, it is hoped that in future cases the effect of such incidents can be minimized by closer liaison procedures.

Property Section are currently endeavouring to obtain access to all remaining structure sites to be investigated, i.e. -

W.P. 13-68-08 - E.B. O'Pass of O.Q.W. - Site 3-303


W.P. 10-69-13 - Green Creek under Walkley Road
immediately south of Hwy. 417 - Site 3-312

W.P. 10-69-16 - Proposed crossing at McEwen Creek
(Mather Drain Award) - Site -



T. C. Kingsland
Regional Structural Planning Engineer

TCK/hl



c.c. P. D. Billings
A. E. Lodge
E. R. Saint
R. Forrest
D. Barr
C. S. Grebski - Att. K. Bassi

MEMORANDUM

TO: Mr. A. E. Lodge,
Regional Services Manager,
Kingston, Ontario.

FROM: Structural Planning Office,
Kingston, Ontario.

ATTENTION:

DATE: September 21, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 13-68 & W.P. 10-69 - Highway 417 - Ottawa Queensway to
Ramsayville
- Entry into Property for Foundation Investigations -

As agreed at our meeting in your office on Wednesday, September 20, I list below the structure sites where entry difficulties are being experienced by Foundations Section who wish to carry out foundation investigations:

W.P. 13-68-08	E.B. Overpass of O.Q.W. - Site 3-303
W.P. 10-69-13	Green Creek under Walkley Road immediately south of Highway 417 - Site 3-312
W.P. 10-69-16	Proposed crossing at McEwen Creek (Mather Drain Award) under Highway 417 ERI, & WBL

Enclosed herewith are copies of 100' to 1" Plans of each of the structure locations showing in each case the area in which bore holes are required.

When property clearances at the above locations have been obtained for the purposes of foundation investigations, I shall be glad if you will notify the Principal Foundation Engineer, Mr. A. G. Stermac, Foundations Office, West Building, Downsview, with a copy to me. From the date of notifying Mr. Stermac and myself that entry may be made into a particular property, I shall be glad if any further change in status with regard to entry permission can also be notified to Mr. Stermac, with copies of correspondence to this office.

T. C. Kingsland

T. C. Kingsland
Regional Structural Planning Engineer

TCK/hl
encls.

c.c. P. D. Billings
A. G. Stermac - Att. M. Devata
C. S. Grebski - Att. K. Bassi
E. R. Saint
R. Forrest
D. Barr

72-11109

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundation Engineer,
Downsview, Ontario.

FROM: Structural Planning Office,
Kingston, Ontario.

ATTENTION: Mr. M. Devata

DATE: September 21, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 13-68-04, Site 3-314,
Cyrville Road Underpass,
(1.5 miles east of Ottawa Queensway),
Highway 417, District 9 - Ottawa

Please find enclosed a copy of De Leuw, Cather's 100' = 1" plan showing the alignment chosen for the above-noted structure. This is a copy of the plan handed to Mr. S. Ahmad in Ottawa on Tuesday, September 19, by Mr. A. Van Dalen. I shall be glad if you will consider this letter as our formal request for a foundation investigation for this structure.

The line has not yet been run by Engineering Surveys but they are cooperating on the site with Mr. Ahmad by relating bore hole locations to suitable reference points which can be tied in later to the run line.

Entry to the properties involved has been cleared by our Regional Property Section. No entry problem should arise at this location.


T. C. Kingsland
Regional Structural Planning Engineer

TCK/hl
encl.

c.c. P. D. Billings
A. E. Lodge
A. G. Boucher
R. Forrest
D. Barr
C. S. Grebski - Att. K. Bassi

Design Services Branch,
1201 Wilson Avenue,
Downsview 464, Ontario.

November 1, 1972.

Telephone: 248-3282.

Master Soil Investigation,
104 Kenhar Drive,
Woodbridge, Ontario.

Dear Sirs:

This letter confirms our request of September 12, 1972, for the supply of C.M.E. drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Ottawa, Ontario, on September 19, 1972.

Mobilization will be from Ottawa, Ontario.

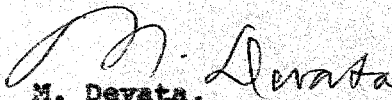
Our Project Number is W.O. 72-11109.

Yours truly,

MD/ao

cc: W. W. Fry
(Attn: Mrs. M. Andrews)

Foundations Files ✓
Documents


M. Devata,
Supervising Foundations Eng.,
For: A. G. Stermac,
Principal Foundations Eng.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. T. C. Kingsland (2)
Regional Structural Plann. Engr.,
Eastern Region,
Kingston, Ontario.

FROM: Foundations Office,
Design Services Branch,
West Bldg., Downsview.

ATTENTION:

DATE: January 3, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Foundation Investigation 72-11109; Ottawa
Queensway, Cyrville Road and Highway 417
Interchange

We are herewith enclosing a copy of the report prepared by Mr. K. W. Ingham, Geologists. Please include this along with a Foundation Report W.O. 72-11109, W.P. 13-68-04.

MD/ck
Encl.

M. Devata
M. Devata,
Supervising Foundations Engr.

c.c. E. J. Orr
B. R. Davis
A. Rutka
S. J. Markiewicz
J. E. Callaghan
B. J. Giroux
E. R. Saint
G. A. Wrong
B. A. Singh

Foundations Files ✓
Documents

MEMORANDUM

TO: Mr. T. C. Kingsland,
Regional Structural Planning Eng.,
Eastern Region,
Kingston, Ontario.

FROM: Foundations Office,
Design Services Branch,
West Bldg., Downsview.

ATTENTION:

DATE: January 9, 1973.

OUR FILE REF.

IN REPLY TO JAN 10 1973

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

The Proposed Underpass Structure at the
Crossing of Hwy. #417
(E.B. and W.B. Lanes) and Realigned Cyrville Rd.
Twp. of Gloucester, Reg. Mun. of Ottawa-Carleton
District No. 9 (Ottawa)
W.O. 72-11109 -- W.P. 13-68-04

Attached we are forwarding to you our addendum report of the foundation investigation for the proposed culvert at the crossing of realigned Cyrville Rd. and Green Creek Tributary Scheme D (Alternates 1, 2 & 3) at the above-mentioned site. We believe that the factual data and recommendations contained therein will prove adequate for your design requirements.

We are also herewith enclosing revised borehole log sheets (B.H. #1 to #8 inclusive) and a revised Drawing #72-11109A along with the addendum report. Please destroy the original borehole log sheets and drawing from our foundation report W.O. 72-11109 and insert the revised ones in its place.

Should additional information be required, please do not hesitate to contact our Office.

AGS, ao
Attach.

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATIONS ENGINEER.

cc: E. J. Orr
B. R. Davis
A. Rutka
A. J. Percy
J. E. Callaghan
B. J. Giroux
E. R. Saint
G. A. Wrong
B. A. Singh
M. M. Dillon - Ottawa

Foundations Files ✓
Documents

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-

ADDENDUM REPORT
FOUNDATION INVESTIGATION
For

The Proposed Culvert at the Crossing of Realigned
Cyrville Rd. and Green Creek Tributary
Scheme D (Alternates 1, 2 and 3)
Twp. of Gloucester, Reg. Mun. of Ottawa-Carleton
District No. 9 (Ottawa)
W.O. 72-11109 -- W.P. 13-68-4

1. INTRODUCTION:

A subsurface investigation was carried out for the underpass structure at the crossing of Hwy. #417 and realigned Cyrville Rd. The results of this investigation, together with recommendations pertaining to foundation design were presented in our report W.O. 72-11109, dated November 7, 1972. In addition to the aforementioned an investigation was requested for the proposed culvert at the crossing of realigned Cyrville Rd. and a major tributary of Green Creek. This latter investigation was delayed because of complications arising from permission to enter private property. Recently, however, permission has been obtained and the investigation at the possible culvert sites has been carried out.

This report, which is an addendum to the original report, contains all the factual data obtained in the vicinity of three alternate alignments for the tributary of Green Creek. Also included are recommendations pertaining to the installation of and bedding requirements for the culvert.

2. FIELD WORK:

Seven sampled boreholes, four of which were accompanied

by a dynamic cone penetration test, were put down in the area encompassing the three alternate alignments for the creek tributary. The borings were advanced by means of a C.M.E. machine adapted for soil sampling purposes.

Samples of the overburden were obtained by using a 2 inch O.D. split-spoon sampler, which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. Bedrock was proven in three of the borings by obtaining BX size rock core samples.

The soil, bedrock and groundwater conditions encountered at the boring locations are presented on the Record of Borehole sheets appended to this report. The boring locations and elevations are shown on Drawing No. W.O. 72-11109B. Inferred stratigraphical sections along the possible alignments are also presented on this drawing.

3. SUBSOIL AND BEDROCK CONDITIONS:

The surficial deposit across the area under investigation consists of 1 foot of topsoil, underlain by 4 to 7 feet of loose to dense ('N' values 5 to 40 blows/ft.) silty sand to sand with a trace of gravel. At Borehole #12, the topsoil and granular deposit are absent; here, however, 4 feet of granular fill was placed in order to form the existing Cyrville Rd. roadway section. This fill has been subjected to a moderate degree of compaction.

A deposit of very stiff to hard ('N' values 24 blows/ft. to greater than 100 blows/ft.) glacial till, varying from 3 to 7.5 feet in thickness, is present beneath the surficial deposits. The till is primarily cohesive in nature being composed of a clayey silt binding sand and gravel. In some isolated areas, however, the till is basically granular being composed of a heterogeneous mixture of silt, sand and gravel with a trace of clay. Fragments of shale are present throughout the till material.

The glacial till is underlain by bedrock which was proven at three of the boring locations by obtaining between 5 and 12.5 feet of BX size rock core samples. The surface of the

bedrock was found to vary between elevations 209 and 212, which corresponds to depths of from 7.5 to 11 feet below existing ground surface.

The bedrock is composed of a grey calcareous shale of the Collingwood formation, Ordovician Period. The upper 1 to 2 feet of the shale is generally in a fractured and weathered condition. Below this upper weathered zone the shale is sound as evidenced by the high percentage of core recovered. An exception to this pattern occurs at B.H. #11; here the zone of weathering extends to a depth of 10.5 feet below the surface of the bedrock. It is inferred that such extensive zones of weathering are quite isolated.

4. GROUNDWATER LEVEL CONDITIONS:

Groundwater level observations were carried out, during the period of the investigation, in the open boreholes. The observations are presented on the individual Record of Borelog sheets, as well as on Drawing No. 72-11109B. The results indicate that the groundwater level, in the overburden, varies between elevations 215.5 and 218, which corresponds to depths below ground surface of from 3.5 to 6 feet.

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

An investigation for the proposed underpass structure at the crossing of Hwy. #417 (E.B. and W.B. Lanes) and realigned Cyrville Rd., in the Township of Gloucester, Regional Municipality of Ottawa-Carleton, has been carried out. The factual data obtained, as well as recommendations pertaining to foundation design, have been submitted in report No. W.O. 72-11109, dated November 7, 1972.

This report, which is an addendum to the aforementioned report, is concerned with the proposed culvert required at the

crossing of realigned Cyrville Rd. and a major tributary of Green Creek. The culvert will be located immediately north of the underpass structure. Three alternate alignment designated No.'s 1, 2 and 3, are being considered. The location of each is shown on Drawing No. W.O. 72-11109B.

The surficial deposit across the site is composed of a loose to dense silty sand to sand with a trace of gravel. This deposit is underlain by a 3 to 7.5 feet thick competent glacial till. The till is followed by a weathered to sound shale bedrock the surface of which varies between elevations 209 and 212.

It is understood that the culvert is to have a 20 foot span and a length of 200 feet. Two possible culvert types are being considered; namely,

- i) a concrete culvert, or
- ii) a structural steel pipe arch culvert.

The invert of the tributary is to be located at about elevation 208, which is some 12 to 14 feet below the existing ground surface. At this grade the invert will be located in the upper portion of the shale bedrock. The Cyrville Rd. grade, in the vicinity of the proposed culvert, may vary anywhere from elevation 232 to 237, depending on which alignment is finally selected. The fill will extend to a maximum height of 16 feet above existing ground surface (maximum 29 feet above the channel invert).

All of the alternate alignments for the Green Creek tributary are equally feasible. Similarly, both the proposed structure schemes are practical from a foundation point of view. Specific recommendations relating to each will be discussed in separate subsections.

5.2) Open Channel Section:

The invert of the open channel section is to be at elevation 208, which is some 12 to 14 feet below the existing ground surface. The channel excavation will extend through the surficial granular deposit, the basal glacial till sheet down into the shale bedrock. No major stability problems are anticipated, provided standard 2:1 slopes are employed.

The excavation will extend some 7 to 10 feet below the prevailing groundwater level. Groundwater seepage can be expected to occur in the excavation. The seepage, during the construction period, could be handled using conventional techniques such as pumping from sumps.

The granular and till portions of the cut slopes may have to be protected against the erosional effects of uncontrolled surface runoff.

5.3) Cyrville Rd. Approach Fill - Stability and Settlement Considerations:

Discussed in detail in subsection 6.3) of Report No. W.O. 72-11109.

5.4) Culvert Foundations:

5.4.1) Concrete Culvert:

A rigid frame culvert (either open footing or box type) can be found on shallow foundations located in the upper portion of the weathered to sound shale bedrock. Such foundations could be designed using an allowable bearing value of up to 10.0 t.s.f. in design.

The foundation excavation will extend up to 10 feet below the prevailing groundwater level across the site. Seepage will occur in the excavation; this could be controlled, however, by employing conventional techniques such as pumping from sumps.

Providing the shale is not softened by uncontrolled surface water runoff or construction activities the settlement of the culvert sections will be negligible. In this regard it would be advantageous to protect the shale foundation by pouring a working pad of lean concrete over the shale, as soon as the foundation level is reached.

Since the culvert will be designed as a rigid frame then a coefficient of earth pressure at rest (K_0) of 0.5 should be assumed for the granular material placed behind the wall, when designing the walls. The design should incorporate the full effect of the surcharge located above the walls.

In order to relieve the buildup of excess hydrostatic pressure behind the walls, suitable drainage measures should be provided. Weep holes, located at the base of the walls, could be employed for this purpose; these holes should be spaced not more than 10 feet apart.

5.4.2) Structural Steel Pipe Arch Culvert:

As an alternative the tributary could be carried beneath realigned Cyrville Rd. within a 200 foot long multi-plate pipe arch culvert.

No major complications are envisaged with regard to the placement and performance of the culvert. The bedding and backfilling for the culvert should be carried out using current M.T.C. specifications; namely ,

- i) bedding - Standard No. DD-808-B (Type 5), and
- ii) backfill - Standard No. DD-813-A.

The excavation will extend up to 10 feet below the prevailing groundwater level across the site. Seepage will occur in the excavation; this could be controlled, however, by employing conventional techniques such as pumping from sumps.

6. MISCELLANEOUS.


The field work for this project was carried out on October 31 and November 1, 1972, under the supervision of Mr. J. Cortabarría, Student Technician, who also wrote this report.

The drilling equipment was owned and operated by Master Soil Investigation Ltd., Toronto.

The entire project was under the general supervision of Mr. M. Devata, Supervising Foundations Engineer, who also reviewed this report.



J. Cortabarría



M. Devata, P. Eng.

JC/ao
Dec. 22, 1972.



APPENDIX I

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 9

JOB 72-11109

LOCATION Co-ords. 16,506,346 N; 1,227 774 E.

ORIGINATED BY SAA

W.P. 13-68-04

BORING DATE September 22, 1972

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY 2

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT _____			LIQUID LIMIT _____ w_L PLASTIC LIMIT _____ w_p WATER CONTENT _____ w w_p — w — w_L WATER CONTENT % _____			BULK DENSITY γ P.C.F. GR. SA. SI. CL.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
221.1	Ground Level													
0.0	Silty sand, trace of gravel. Brown		1	SS	5		220							
213.1	Loose to Dense		2	SS	40								216.0	
212.7	Glacial Till. Hard		3	SS	100								WL in open RH	
8.5	End of Borehole Probable Bedrock					210								

P.C.F. GR.SA.SI.CL

216.0

WL in open RH

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 9

JOB 72-11109

LOCATION Co-ords. 16,506,346 N; 1,227,774 E.

ORIGINATED BY SAA

W.P. 13-68-04

BORING DATE September 22, 1972

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT W_L		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT		PLASTIC LIMIT W_p	WATER CONTENT W		
221.1	Ground Level						SHEAR STRENGTH P.S.F.		WATER CONTENT %			
							O UNCONFINED + FIELD VANE		W_p — W — W_L			
							● QUICK TRIAXIAL x LAB VANE		WATER CONTENT %			
0.0	Silty sand, trace of gravel. Brown		1	SS	5	220						
213.1	Loose to Dense		2	SS	10							
212.8	Clayey silt, brown		3	SS	10							
8.5	End of Borehole Probable Bedrock					210						

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 10

JOB 72-11109

LOCATION Co-ords. 16,506,686 N; 1,227,754 E.

ORIGINATED BY JC

W.P. 13-68-04

BORING DATE Nov. 1, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Flight Auger and Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L		
222.0	Ground Level															
1.0	Topsoil		1	SS	14	220										
	Silty sand to sand with a trace of gravel.		2	SS	12											
213.8	Compact to Dense		3	SS	15											
8.2	Glacial Till Hard		4	SS	65	210										
211.0	End of Borehole Probably Bedrock															

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 11

JOB 72-11109

LOCATION Co-ords. 16,506,172 N; 1,227,855 E.

ORIGINATED BY JC

W.P. 13-68-04

BORING DATE Nov. 1, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Flight Auger, EXL Rock Core and Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100	LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
221.4	Ground Level									
1.0	Silty sand to sand with a trace of gravel. Compact		1	SS	12	220				
216.4			2	SS	125					
5.0	Clayey silt with sand & gravel (Glac. Till) (shale fragments throughout)		3	SS	100					
203.9	Hard		4	SS	100	210				
12.5	Shale Bedrock (Fractured and weathered)		5	EXL RC	20%					
198.4			6	EXL RC	60%	200				
196.5	Sound		7	EXL	95%					
24.9	End of Borehole					190				

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 12

JOB 72-11109

LOCATION Co-ords. 16,506,345 N; 1,227,842 E.

ORIGINATED BY JC

W.P. 13-68-04

BORING DATE Oct. 31, 1972

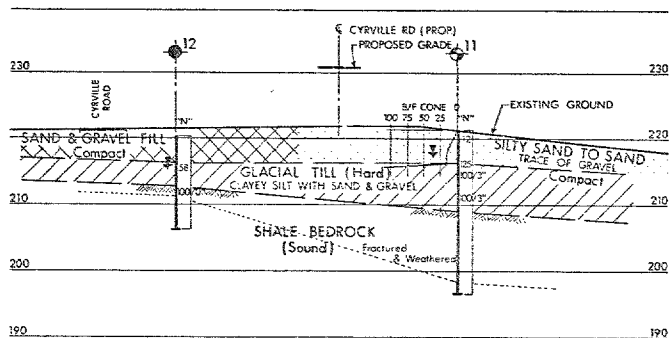
COMPILED BY JC

DATUM Geodetic

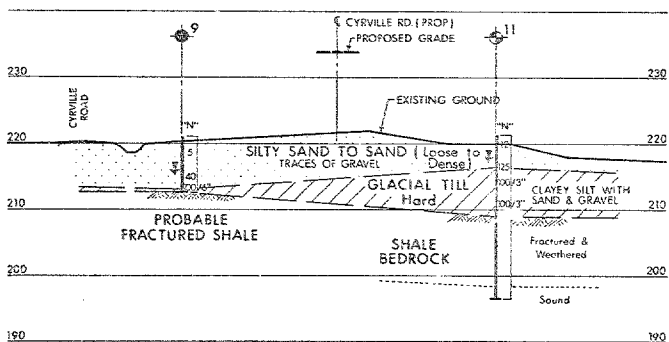
BOREHOLE TYPE Flight Auger and BXL Rock Core

CHECKED BY

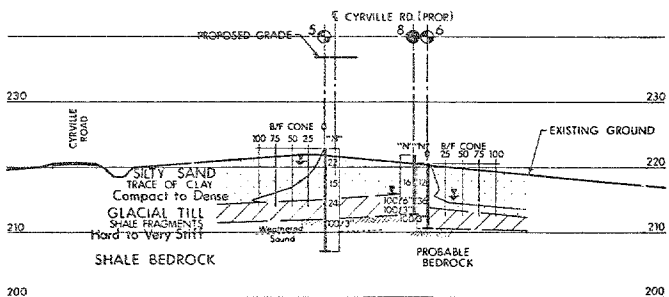
SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	SHEAR STRENGTH P.S.F.		w_p — w — w_L WATER CONTENT %		
220.2	Ground Level						<input type="radio"/> UNCONFINED + FIELD VANE <input checked="" type="radio"/> QUICK TRIAXIAL x LAB. VANE			P.C.F.	GR.SA.SI.C
0.0	Granular Road Fill (sand and gravel)					220					
216.2	Compact Clayey silt with sand & gravel (Glac. Till)		1	SS	58						216.0
212.7	Hard										WL in open BH
211.2	Weathered		2	SS	100	210					
9.0	Shale Bedrock		3	RC	88%						
206.2	Numerous fissures throughout.		4	RC	81%						
14.0	End of Borehole										
						200					



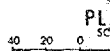
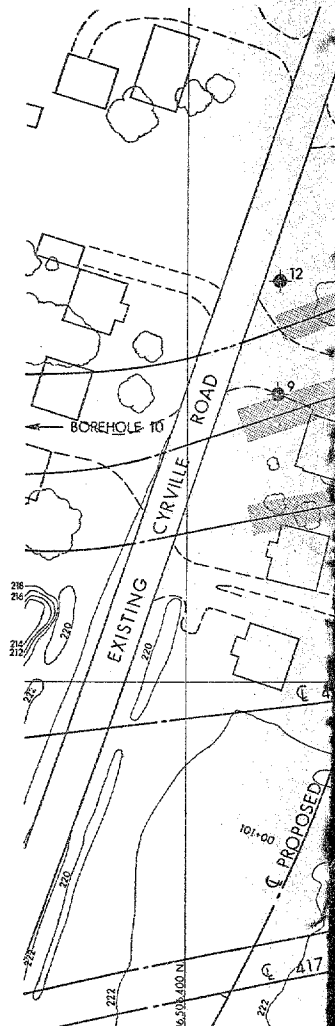
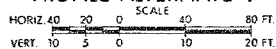
PROFILE ALTERNATE 3

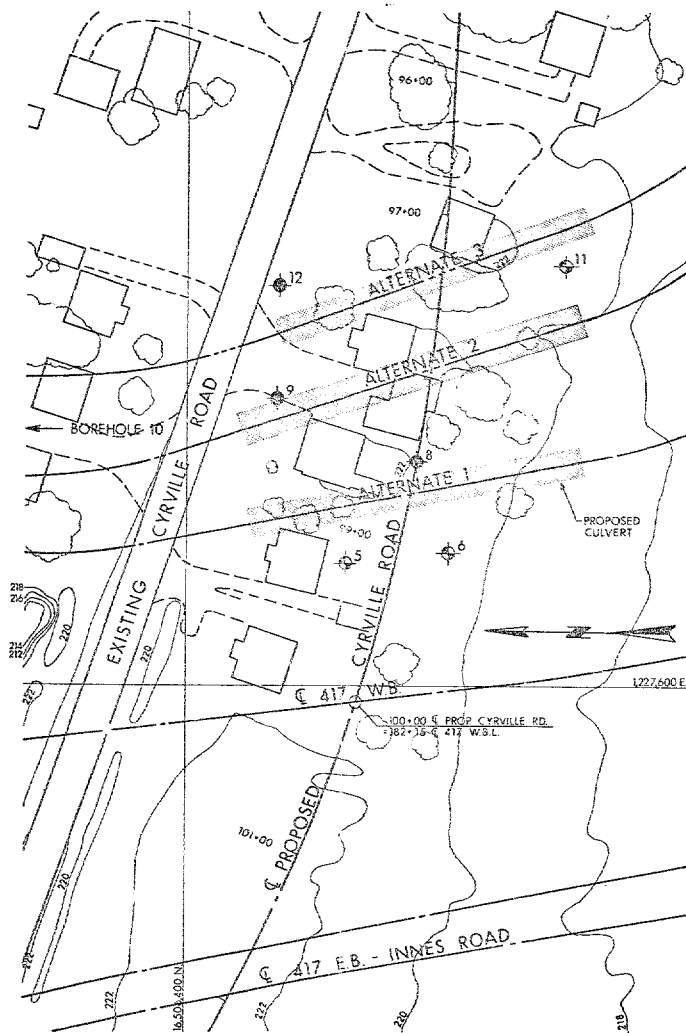


PROFILE ALTERNATE 2



PROFILE ALTERNATE 1





SEE DWG. 72-11109A



KEY PLAN
SCALE IN METERS

LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation. Sept. & Oct. 1972.

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
5	222.9	16,505,303	1,227,670
6	220.6	504,241	227,676
8	221.9	506,261	227,731
9	221.1	506,346	227,774
10	222.0	506,686	227,754
11	221.4	506,172	227,855
12	220.2	506,345	227,842

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

CYRVILLE ROAD PROPOSED CULVERT (ALTERNATES I, II & III)

HIGHWAY NO. 417 (SCHEME D) DIST. NO. 9
CO. REG. MUNICIPALITY OF OTTAWA - CARLETON
TWP. GLOUCESTER LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBVD J.C. CHECKED	WP NO 13-68-04	DRAWING NO
DRAWN J.L.G. CHECKED	WO NO 72-11109	72-11109B
DATE DEC. 28, 1972	SITE NO	BRIDGE DRAWING NO
APPROVED <i>[Signature]</i>	CONT. NO	

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. T. C. Kingsland,
Reg. Structural Planning Eng.
355 Counter Street,
Postal Bag 4000,
Kingston, Ontario.

FROM: Structural Office,
West Building,
Downsview, Ontario.

ATTENTION:

DATE: July 30, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Cyrville Road Underpass,
W.P. 13-68-04, Site 3-314,
Hwy. 417, District 9.

72-11-109

Attached herewith are prints of the Preliminary Bridge Plan Drawing D 3-314-F1 the above mentioned structure.

The estimated cost of the proposed structure is \$350,000.00 which includes tender, materials, engineering, and sundry construction.

Any comments or revisions you may have should be submitted within four weeks.

WL/CSG/js
Attach. 1

c.c. B. R. Davis
W. D. Birch
A. E. McKim
W. McFarlane
M. Stoyanoff
A. Stermac
J. Anderson
R. Forrest

Walter Lin

W. Lin
For

C. S. Grebski
Structural Design Engineer

No comments

P. Parry

AUG 8/73

MINISTRY OF TRANSPORT AND COMMUNICATIONS, ONTARIO

Copy for the information of

Mr. A. Stermac
Principal Foundation Engineer
Room 107, West Bldg.

C.S. Grebski
Structural Design Engineer
Structural Office
West Bldg.
October 10, 1973

Cyrville Road Underpass
W.P. 13-68-04, Site 3-314
Hwy. 417, District #9

72-11-109

Attached herewith we are submitting the final bridge
drawings which show the foundation design for this structure.

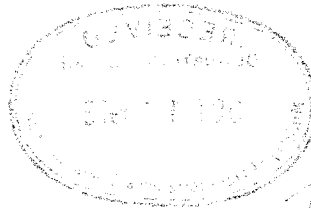
Kindly give us your comments at your earliest convenience.

CSG:AMP

C.S. Grebski
Structural Design Engineer

Attached

cc



*Aug. 72-11/09A
finalized & sent to
Structure Office 5 Nov. 73
J.K.*

no comments

*G. Poon Oct 16/73
M.L.*