

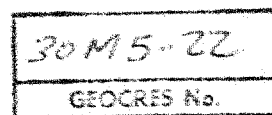


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January, 1970



SOIL CONDITIONS AND FOUNDATIONS  
PROPOSED GRADE SEPARATION  
SYDENHAM ROAD AND C.N.R.  
HAMILTON-WENTWORTH  
SUBURBAN ROADS COMMISSION

70-F-208C

Our Ref. No. 8-1-14

Prepared for:

Hamilton-Wentworth  
Suburban Roads Commission  
County Hall  
Hamilton, Ontario

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## 1.0 INTRODUCTION

The Hamilton-Wentworth Suburban Roads Commission proposes to realign Road No. 5 (Sydenham Road) where it crosses the C.N.R. Railway near to the Town of Dundas, Ontario. This will involve the construction of a multi-span bridge to effect a grade separation between the road and the railway. The results of exploratory borings put down at the locations of the proposed piers and abutments of the bridge are presented in this report together with recommendations for the design and construction of foundations.

Several separate investigations have been performed in connection with the whole road reconstruction project and the results of all borings which are in the immediate vicinity of the bridge project have been incorporated in this particular report.

## 2.0 SUMMARIZED SOIL CONDITIONS

The bridge will be constructed part-way up the slope of the Niagara Escarpment just outside the Town of Dundas. The escarpment is composed of sedimentary bed-rock covered by a slope of talus. This talus consists of a heterogeneous, unsorted and unstratified formation of rock debris in sizes ranging from clay to boulders. The relative density is variable but generally high.

At the bridge location the underlying bedrock is the Queenston formation which is a hard, brick-red

argillite shale. Unconfined compression tests performed on samples cored from the shale gave strengths ranging between 4,620 and 7,920 pounds per square inch. The surface of the shale follows that of the overlying ground surface and is generally encountered at depths of between 40 and 60 feet at the bridge site. This can be seen from the following table where the average elevations of sound bedrock underlying the abutment and pier locations are given.

<u>Location</u>	<u>Approx. Station</u>	<u>Average Elevation of Sound Bedrock</u>
S. Abutment	8 + 04	417
Pier #1	8 + 69	419
Pier #2	9 + 56	405 to 421
Pier #3	10 + 45	416 to 426
Pier #4	10 + 81	426
Pier #5	11 + 77	437
N. Abutment	12 + 65	436

The shale is relatively permeable as it was observed that generally the wash-water used in the boring operations did not return to the surface. Free-standing water levels were not observed in the boreholes put down at the bridge location, thus it is concluded that ground water level is below the depth explored.



### 3.0 FOUNDATIONS

The proposed bridge is to be a six-span simply-supported structure with two abutments and 5 intermediate piers.

It is understood that the maximum total load on a pier will be about 1,650 kips.

The use of normal shallow spread footings founded in the talus is not recommended because the slopes are in borderline equilibrium and the imposition of additional exterior loads is likely to result in excessive movements or even complete failure. Therefore the foundations for the bridge should be supported on the underlying bedrock.

The use of driven piles is not recommended for the following reasons. The vibrations due to driving may initiate sliding of the talus slopes; furthermore the sloping surface of the bedrock and the presence of boulders would make driving difficult and the piles are likely to be deflected from their intended positions.

It is considered therefore that the use of caissons is the most satisfactory method of constructing the foundations with a minimum of disturbance to the slopes and to ensure that sound bearing in the bedrock is achieved. Installation of the caissons could be effected largely by augering, although percussion drilling might be required on occasion to penetrate boulders and harder seams in the bedrock. Although ground water seepage is anticipated to be slight the use of a temporary casing through the over-

S

burden is recommended. In order to facilitate the removal of boulders and the cleaning and inspection of the bottom of the caissons the minimum shaft size recommended is 30 inches diameter. The shafts should be extended for the full diameter into the sound bedrock to provide a socket of sufficient depth to develop the structural capacity of the caisson. This is to ensure that bearing is achieved in sound, confined rock; to provide anchorage against slipping and to increase the carrying capacity of the caissons by end-bearing and shaft adhesion acting together. For design purposes the following bearing values are recommended.

- 1) End bearing - 100 kips per square foot (700 P.S.I.)
- 2) Shaft adhesion - 13 kips per square foot (90 p.s.i.)

Based on the above design values the required socket depth for a 30" diameter caisson carrying 825 kips (assuming two caissons per pier) is about 4 feet and it is recommended that this minimum depth of embedment be adopted throughout for all caissons. No allowance is made for shaft adhesion in the overburden because of its compressibility compared with that of the rock.

For practical reasons caissons with a minimum diameter of 30 inches and a penetration of at least 4 feet into sound shale have been recommended. Since these are capable of bearing half of the maximum total load on a pier the use of two caissons per pier and abutment is

indicated. The structural design of the caisson shaft itself may be based on the assumption that it will act as a short column below ground level since the soil will provide adequate lateral restraint against buckling. In order to carry the necessary compressive stresses the concrete may be reinforced, although the use of a plain section is to be preferred for economy of construction. For the same reason a single diameter of caisson is preferable throughout and therefore the structural capacity of the shaft should be adjusted by using concrete of various strengths as far as possible.

The design values for the caissons have been chosen to provide an adequate factor of safety against failure of the rock and to keep the settlement within a tolerable limit of one inch. In order to ensure that these relatively high bearing values are realized in the actual construction it is recommended that each caisson be inspected prior to concreting. In addition to checking the condition of the rock within the shaft and at the base the inspection should check the caissons for plumb and location; and the concrete for quality. The elevations given in this report for the sound rock may be used to determine the caisson lengths for estimating purposes. Some slight variations during the construction may be necessary as a result of the inspections.

#### 4.0 CONCLUSIONS AND RECOMMENDATIONS

1. The soil conditions consist of about 50 feet of talus overlying shale bedrock of the Queenston formation.
2. The recommended foundation treatment for the bridge structure is to support the piers and abutments on caissons taken into the sound shale.
3. The elevations at which sound shale was encountered in the borings are given in this report and these may be used for estimating purposes. Some slight variation in the depths of the caissons may be necessary as a result of inspection during construction.
4. For practical reasons the recommended minimum diameter of caisson is 30 inches and the minimum depth of embedment in sand shale is 4 feet.
5. Recommended design values for end-bearing and shaft adhesion in sound shale are 100 K.S.F. and 13 K.S.F. respectively.
6. For economy of construction the structural design of the embedded portions of the caissons should provide for unreinforced sections as far as possible. This could be achieved by the use of high-strength concrete where necessary.
7. Provision should be made for detailed inspection of the caissons as discussed.

APPENDIX5.0 PROCEDURE

The purpose of the investigation work reported herein was to provide information on the subsurface conditions at the specific locations of the bridge foundations now that these have been finalized. In the past several separate investigations have been performed for various aspects of the road reconstruction project and these resulted in exploratory boreholes being put down in close proximity to the bridge foundations. The results of these early borings are reported herein together with others which were put down recently to complete the information at the specific pier locations. This latter work, involving boreholes 101 to 109 inclusive, was performed between September 3rd and September 11th and between December 3rd and December 23rd, 1969.

All borings were performed with a skid-mounted machine drill rig. Casing was driven into the ground and the soil removed by washing. Because of the presence of hard ground and of boulders the use of rotary drilling both with and without diamond bits was frequently necessary to permit advancement of the casing. In overburden soil samples were recovered using a standard 2 inch o.d. split-spoon sampler. This was driven into the ground by means of a 140 pound hammer falling freely for a distance of 30 inches. The number of blows required to drive the sampler 12 inches into undisturbed soil is recorded as

the Standard Penetration Resistance or "N" value in blows per foot. The results of this test are used to estimate the relative density of the soil strata from empirical relationships. In the present case the test results may be too high because of the presence of gravel and boulders in the subsoil. The boreholes were advanced in bedrock by diamond core-drilling, generally in Bx size.

The boreholes were located with reference to the proposed centre-line of the road as staked-out by the Commission. All levels were referred to the bench mark established on the north abutment of the existing bridge as shown on the site plan. This bench mark has a given elevation of 472.43 above Geodetic datum.

#### 6.0 SOIL CONDITIONS

Details of the soil conditions encountered in the borings are presented on the logs of Enclosures 1 to 21. The sections on the Drawing enclosed show the inferred subsurface profiles underlying each abutment and pier location. In the following paragraphs the properties of the strata relevant to foundation design and construction are described.

Fill: Over part of the bridge site on the south side of the C.N.R. a test fill had been placed and some of the borings (Nos. 101; 103; 105; 106 and 107) revealed the presence of fill to various depths below the ground surface. Between the time of this investigation and the construction of the bridge some of the fill will be

removed and the final cross-sections are indicated approximately on the accompanying Drawing. The fill was derived from material excavated from cuts made at the north end of the road reconstruction and it consists therefore, of a heterogeneous assortment of rock fragments (limestone, sandstone and shale) intermixed with soil and decomposed shale.

Talus: The overburden at the site is complex and includes soil of all types and origin. Since there is no readily establishable sequence of strata the overburden has been described for convenience herein in accordance with its constituent, namely talus. Talus is the accumulation on the slope of the products of weathering of the rocks forming the escarpment. Because of its mode of deposition it is unconsolidated, heterogeneous and unstratified. Generally the talus may be described as coarse angular rock fragments of gravel to boulder size embedded in a silty clay matrix. Pockets or layers of sand and clay till are present. The presence of numerous boulders throughout the overburden is to be noted.

Shale bedrock: The bridge location is underlain by shale bedrock of the Queenston formation. The surface of the rock, as interpolated between the individual borings, is roughly parallel to the ground surface at this particular site, being at a depth of about 40 feet generally.



The rock is a brick-red argillite shale. It breaks readily along horizontal bedding planes and contains frequent open joints within the depth explored in this investigation. The surface of the rock is considerably fractured by weathering and, in places, the shale has decomposed into a hard red clay-like material which could be sampled with a split-spoon sampler. The sound rock is a harder material which required diamond-drilling to effect penetration. Representative specimens of the rock core recovered were subjected to unconfined compression tests which gave values of compressive strength ranging between 4,620 and 7,920 pounds per square inch; the average value being 6,350 pounds per square inch. In considering these test results it must be borne in mind that inevitably only the hardest pieces of rock would be available for testing, the rest being too disturbed by the coring operation. Furthermore the testing could take little account of the weakness along the bedding planes since these are normal to the direction of loading.

#### 7.0 WATER CONDITIONS

All of the boreholes were dry when drilling was completed. During the drilling it was observed that the wash-water did not return to the surface when the holes were advanced in the bedrock although generally there was full return in the overburden. Thus it is concluded that the shale bedrock, at least within the upper 10 feet,



is relatively permeable and that the normal ground water level is below the depth explored in this investigation. This is confirmed by piezometer readings made in the original borings.



DOMINION SOIL INVESTIGATION LIMITED

A handwritten signature in dark ink, appearing to read "K. H. King".

K. H. King, P. Eng.

KHK/ns

Encl:



E N C L O S U R E S

## 4

Exhibition 2011

### TRAINING DATA

1950

DATE APRIL 15, 1964

2004-06-10 10:52

[illegible]

DOMINION SEC INVESTIGATION LIMITED

NAME : \_\_\_\_\_

# LOG OF BOREHOLE 5

Dr. Reference No. D-1-1-12

Enclosure No. 2

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: GYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNDAS, ONTARIO  
BATHY ELEVATION: GEODETIC

DRILLING DATA  
Method: WASHBORING  
Diameter: 8X 1 7/8"  
Date: APRIL 17, 1964

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE (Blows / Foot)					WATER CONTENT %			REMARKS	
ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	DATE	30	40	50	60	70	PLASTIC LIMIT	NATURAL		LIQUID LIMIT
								PROPOSED SHEAR STRENGTH (lb/sq ft)					FIELD WRE TEST			
457.9	0	GROUND SURFACE														
		12" TOPSOIL			1	SS	19	0								
					2	SS	23									
					3	SS	26									
					4	SS	15									
					5	SS	8									
					6	SS	27									
					7	SS	8									
					8	SS	26									
					9	SS	26									
					10	SS	26									
					11	SS	35									
					12	SS	20									
					13	SS	35									
					14	SS	28									
					15	SS	30									
					16	SS	53									
427.9	30				17	R.C.	50									
		Boulders			18	R.C.	60									
422.9	45.0				19	R.C.	80									
		SHALE BEDROCK			20	R.C.	85									
					21	R.C.	55									
407.9	60	END OF BOREHOLE														



## LOG OF BOREHOLE 6

Our Reference No. A-1-14

ENCLOSURE # 3

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNDAS, ONTARIO.  
DATUM ELEVATION: GEODETIC.

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x (2 1/2")  
Date: APRIL 21-24, 1964

[illegible]

VERTICAL SCALE: 1 inch = 10 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE 2 A CHECKED



# LOG OF BOREHOLE 7

Dist. Reference No. 9-1-14

Enclosure No. 4

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: GUNDAS, ONTARIO  
DATUM ELEVATION: GEODETIC

## DRILLING DATA

Method: WASHBORING  
Diameter: 8" (203 mm)  
Date: APRIL 23-24, 1964

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE Blows / Foot					WATER CONTENT %			REMARKS
ELEVATION Feet	DEPTH Feet	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	W D T Z	20	40	60	80	100	PLASTIC LIMIT	NATURAL	LIQUID LIMIT	
							UNDRAINED SHEAR STRENGTH + FIELD VANE TEST					OR COMPRESSION TEST			
485.3	0	GROUND SURFACE													
		12" TOPSOIL			1	CS									
					2	SS 12	0								
	0				3	SS 31		0							
		<b>TALUS</b> Gravel, some Sand Cobbles & Soil Fines			4	SS 37		0							
	20				5	SS 66			0						
					6	SS 82				0					
	30				7	SS 184									
					8	SS 49		0							
					9	R.C. 47%									
		<b>Boulders</b>			10	SS 38		0							
	40				11	R.C. 47%									
					12	SS 51		0							
					13	R.C. 42%									
438.3	48.3				14	SS 102					0				
	50	<b>SHALE BEDROCK.</b>			15	R.C. 20%									
					16	R.C. 49%									
					17	R.C. 49%									
425.3	60	<b>END OF BOREHOLE</b>			18	R.C. 42%									
	70														

VERTICAL SCALE: 1 inch to 10 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A. CHECKED:



## LOG OF BOREHOLE ..... 8

File Reference No. 8-1-14

Enclosure No 5

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNGAS, ONTARIO  
ESTIM. ELEVATION: GEODETIC

### DRILLING DATA

Method: WASHBORING  
Diameter: 8x (2 1/2")  
Date: APRIL 30 - MAY 2, 1964

SUBSURFACE PROFILE				PENETRATION RESISTANCE					WATER CONTENT %			REMARKS					
ELEVATION Feet	DEPTH Feet	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	SAMPLES		Blows / Foot					PLASTIC LIMIT	NATURAL	LIQUID LIMIT		
						SI	T-1	20	40	60	80					100	
						UNGRAINED SHEAR STRENGTH (lb./sq. ft.) + FIELD VANE TEST					* COMPRESSION TEST						
GROUND SURFACE																	
461		TALUS Gravel, some Sand Cobbles & Soil Fines		W.L.P. ELEV. 454.1' JUNE, 30, 1964	1	SS	19										
					2	SS	74										
470					3	SS	27										
					4	SS	41										
460					5	SS	20%										
					6	SS	60%										
					8	RC	58%										
					9	SS	40%										
					10	RC	70%										
450					11	SS	65										
					12	SS	64										
440					13	SS	43										
372	44				SHALE BEDROCK			14	SS	100%							
		15	RC	87%													
430		16	RC	80%													
END OF BOREHOLE																	
420																	
70																	

VERTICAL SCALE (each 10 feet)

DOMINION SOIL INVESTIGATION LIMITED

MADE IN A CHECKED.

# LOG OF BOREHOLE 22

Dr. Reference No. S-1-14

SYDENHAM RD. 5

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNDAS, ONTARIO  
DATUM ELEVATION: GEOIDETIC

DRILLING DATA  
Method: WASHBORING  
Diameter: 8x 12 1/2"  
Date: MAY 6, 1964

SUBSURFACE PROFILE			SAMPLES		PENETRATION RESISTANCE (Blows/foot)					WATER CONTENT %			REMARKS
DEPTH FEET	DESCRIPTION	STANDARD GROUND WATER NUMBER	TYPE	NO.	20	40	60	80	100	PLASTIC LIMIT	NATURAL	LIQUID LIMIT	
					UNDRAINED SHEAR STRENGTH					FIELD VANE TEST			

395.1	GROUND SURFACE												
	12" TOPSOIL												
	TALUS Gravel, some Sand Cobbles & Soil-Fines		NO-	R.C.									
		3	SS	18		0							
		4	SS	34		0							
		5	SS	35		0							
		6	SS	38		0							
		7	SS	39		0							
		8	SS	100		0							
		9	SS	120									
		10	SS	125									
		11	SS	Refuse									
43.0	END OF BOREHOLE PROBABLY ON SHALE												

VERTICAL SCALE: 1 inch = 10 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: J. A. CHECKED:



# LOG OF BOREHOLE 23

Our Reference No. B-1-14

Enclosure No. 7

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNDAS, ONTARIO  
DATUM ELEVATION: GEODETTIC

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x (2 3/8")  
Date: APRIL 30, 1984

SUBSURFACE PROFILE				SAMPLES		PENETRATION RESISTANCE Blows / Foot					WATER CONTENT %			REMARKS			
ELEVATION FT	DEPTH FT	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	W % L	N	Blows / Foot	20	40	60	80	100		PLASTIC LIMIT	NATURAL	LIQUID LIMIT
									UNDRAINED SHEAR STRENGTH						100,000 LB/FT <sup>2</sup>		
									FIELD VANE TEST						4th COMPRESSION TEST		
														W <sub>p</sub>	W	W <sub>L</sub>	

413.8	0	GROUND SURFACE																	
		<div>TALUS Gravel, some Sand Cobbles &amp; Soil Fines</div>		<div>BOREHOLE DRY JUNE 30, 1964</div>	1	SS	13	0											
					2	SS	17	0											
10					3	SS	14	0											
					4	SS	61	0											
20					5	SS	150												
					6	SS	110												
30					7	R.C.													
					8	SS	Reveal												
380-0.33	33.8				9	R.C.													
					10	R.C.	100 %												
	40				11	R.C.	60 %												
					12	R.C.	100 %												
363.8	50	END OF BOREHOLE																	
	60																		
	70																		

VERTICAL SCALE: 1 inch to 10 feet

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MADE: Z. A. CHECKED:



# LOG OF BOREHOLE 104

QUT REFERENCE NO. B-1-13




Enclosure No. 16

CLIENT: HAMILTON SUBURBAN ROAD COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNDAS, ONTARIO  
DATUM ELEVATION: GEODETIC

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x (2 1/4")  
Date: SEPT. 12-15, 1969

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE					WATER CONTENT %			REMARKS		
ELEVATION ft.	DEPTH ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	ft.	Blows / Foot					PLASTIC LIMIT	NATURAL		LIQUID LIMIT	
								20	40	60	80	100					
								UNDRAINED SHEAR STRENGTH									lb./sq. ft.
								+ FIELD VANE TEST					φ COMPRESSION TEST				
<div><div>W<sub>p</sub></div><div>W<sub>n</sub></div><div>W<sub>L</sub></div></div>																	

463.6	0	GROUND SURFACE																
	10	TALUS Gravel, Some Sand, Cobbles & Soil Fines  Compact to Very Dense		BOREHOLE DRY UPON COMPLETION	1	SS	23	0										
	2				SS	21	0											
	3				SS	26	0											
	4				SS	16	0											
	5				SS	44	0											
	6				SS	18	0											
	7				SS	55	0											
	8				SS	86	0											
421.6	42.0	Boulders			9	SS	100/3	0										
399.6	64.0																	
418.3	45.3	SHALE BEDROCK			10	BxT RC	80 %											
408.3	55.3	END OF BOREHOLE			11	BxT RC	90 %											
	60																	
	70																	
	80																	

Cave-In

@ EL. 453.6'

NOTE

During coring the pressure on the drill bit was steady and there was full return of wash water.

Cave-in  
@ EL. 453.6

NOTE:  
During coring the pressure on the drill bit was steady and there was full return of wash water.

VERTICAL SCALE: 1 inch to 10 feet

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MADE: Z.A.

CHECKED:



## LOG OF BOREHOLE 105

1948-1949

Page 17

06047 HAMILTON SUBURBAN ROADS COMMISSION  
06048 EVESHAM ROAD RECONSTRUCTION  
06049 DUNDAS, ONTARIO  
06050 ELEVATION: GEODETH

0811443 2-76

Method: WASHBORO  
Diameter: 8x (2 1/2")  
Date: SEPT 9-11, 1969

SUBSURFACE PROFILE			SAMPLES		PENETRATION RESISTANCE					WATER CONTENT			REMARKS
DEPTH	DESCRIPTION	SYMBOL	GROUPS	NUMBER	10	20	30	40	PLASTIC LIMIT	NATURAL	LIQUID LIMIT		
462.6	GROUND SURFACE												
	ROCK FILL	Boulder		1	50	8	0						
				2	30	27	0						
				3	50	12	0						
462.6	TALUS			4	20	17	0						
	Gravel, some Boulder			5	30	33	0						
	Sand, Cobbles & Soil Fines	Boulder		6	30	40	0						
	Compact to Very Dense	Boulder		7	30	45	0						
				8	BxT 15 RC %								
				9	BxT 135 RC %								
	Boulders			10	BxT 58 RC %								
				11	BxT 100 RC %								
				12	BxT 35.7 RC %								
				13	SS 59								
				14	BxT 16.5 RC %								
405.6 57.0	WEATHERED			15	SS 100/17								
401.8 60.0	SHALE BEDROCK.			16	BxT 28 RC %								
				17	SS 100								
				18	BxT 48 RC %								
392.1 70.5	END OF BOREHOLE			19	BxT 100 RC %								

WEEKLY SPARE 1946-10-14

DOMINION SOIL INVESTIGATION LIMITED

1000

# LOG OF BOREHOLE 106

Our Reference No. 8-1-14

Enclosure 18

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNDAS, ONTARIO  
DATUM ELEVATION: GEODETIC

DRILLING DATA  
Method: WASHBORING  
Diameter: Bx 12 1/8"  
Date: DEC. 3, 1969

SUBSURFACE PROFILE				SAMPLES		PENETRATION RESISTANCE (Blows / Foot)					WATER CONTENT %			REMARKS			
ELEVATION FT.	DEPTH FT.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	IN	20	40	60	80	100	PLASTIC LIMIT		NATURAL	LIQUID LIMIT	
								UNDRAINED SHEAR STRENGTH									COMPRESSION TEST
								+ RILEY VANE TEST									
462.0	0	GROUND SURFACE															
		ROCK FILL															
455.0	7.0				1	95	100%										
	10				2	95	22	0									
	20	TALUS Gravel, coarse sand, cobbles & pea fines  compact in very dense			3	95	15	0									
						Bx RC											
	30				4	95	91	0									
					5	95	75%										
	40				6	95	80										
421.0	41.0				7	95	50										
		SHALE BEDROCK			8	Bxt RC	40%										
					9	Bxt RC	60%										
					10	Bxt RC	65%										
					11	Bxt RC	100%										
402.0	50	END OF BOREHOLE															
	60																

NOTE:  
During logging the  
pressure on the  
slide bit was steady  
and there was  
full return of  
wash water.

NOTE:  
During boring the  
structure on the  
site was steady  
and there was  
full return of  
wash water.



# LOG OF BOREHOLE 107

Our Reference No. B-1-14

Enclosure 19

CLIENT HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT SYDENHAM ROAD RECONSTRUCTION  
LOCATION DUNDAS, ONTARIO  
DATUM ELEVATION: GEODETIC

## DRILLING DATA

Method: WASHBORING  
Diameter: 8" (2 3/8")  
Date: DEC. 10-12, 1969

SUBSURFACE PROFILE			SAMPLES		PENETRATION RESISTANCE Blows / Foot					WATER CONTENT %			REMARKS															
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	IN Blows / Foot	20	40	60	80	100		PLASTIC LIMIT	NATURAL	LIQUID LIMIT												
								UNOAINED SHEAR STRENGTH						150/100 Ft.														
								+ FIELD VANE TEST						* COMPRESSION TEST														
476.4	0	GROUND SURFACE																										
		FILL																										
469.4	7.0																											
10	1															SS	19	0										
20	2															SS	22	0										
30	3															SS	28	0										
40	4															SS	86											
50	5															BxT (R.C)												
56.2	6															SS	50	0										
60	7															SS	148/8											
70	8															SS	51	0										
73.0	9															SS	100/4											
	10															BxT (R.C)	40 %											
	11															BxT (R.C)	40 %											
	12															BxT (R.C)	75 %											
	13															BxT (R.C)	88 %											
	14	BxT (R.C)	88 %																									
		WEATHERED SOUND																										
		SHALE BEDROCK																										
403.4	73.0	END OF BOREHOLE																										



# LOG OF BOREHOLE 108

Our Reference No. 6-1-14

Enclosure No. 20

CLIENT HAMILTON SUBURBAN ROADS COMMISSION.  
PROJECT SYDENHAM ROAD RECONSTRUCTION.  
LOCATION DUNDAS, ONTARIO.  
DATUM ELEVATION: GEODETIC.

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x (2 3/8")  
Date: DEC. 18-23, 1969

SUBSURFACE PROFILE			SAMPLES			PENETRATION RESISTANCE					WATER CONTENT %			REMARKS	
DEPTH FT.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	N Blows / Foot	Blows / Foot					PLASTIC LIMIT	NATURAL		LIQUID LIMIT
							20	40	60	80	100				
							UNDRAINED SHEAR STRENGTH + FIELD VANE TEST								
w <sub>p</sub> — w — w <sub>L</sub>															

483.9	0	GROUND SURFACE													
10				1	SS	7	0								
20				2	CS										
				3	BxT (R.C.)	40 %									
30				4	SS	69									
				5	BxT (R.C.)	20 %									
				6	SS	75/2									
40				7	SS	39									
50				8	BxT (R.C.)	60 %									
60				9	BxT (R.C.)	90 %									
420.9	63.0			10	BxT (R.C.)	90 %									
		END OF BOREHOLE													

### TALUS

Gravel, some Sand  
Cobbles & Soil Fines

### SHALE BEDROCK

VERTICAL SCALE 1 inch to 10 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A. CHECKED:

## LOG OF BOREHOLE 109

Our Reference No. 8-1-14

ENCLOSURE W 21

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: BUNDAS, ONTARIO  
DATUM ELEVATION: GEODETIC

### CHILLING DATA

Method: WASHING  
Diameter: 2x (2 3/4")  
Date: DEC. 15 - 18, 1969

[illegible]

VERTICAL SCALE 1 inch 10 100 1000

DOMINION SOIL INVESTIGATION LIMITED

NAME: A. CHEN



# LOG OF BOREHOLE 27

Our Reference No. 8-1-14

Enclosure No. 8

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNDAS, ONTARIO  
DATUM ELEVATION: GEODETIC

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x (2 3/8")  
Date: FEB. 22, 1968

SUBSURFACE PROFILE				SAMPLES		PENETRATION RESISTANCE      Blows / Foot					WATER CONTENT %			REMARKS			
ELEVATION ft.	DEPTH ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	N	Blows / Foot	UNDRAINED SHEAR STRENGTH						PLASTIC LIMIT W <sub>p</sub>	NATURAL W	LIQUID LIMIT W <sub>L</sub>
									+ FIELD VANE TEST      • COMPRESSION TEST								
									20	40	60	80	100				

464.7	0	GROUND SURFACE			1	SS	50										
					2	SS	17										
					3	SS	18										
					4	SS	22										
					5	SS	26										
					6	SS	68										
					7	SS	51										
					8	SS	35										
					9	SS	50										
					10	SS	18										
					11	SS	32										
					12	SS	77										
					13	SS	22										
					14	SS	51										
					15	SS	100/5										
					16	BK											
					17	SS	86										
					18	SS	44										
					19	SS	21										
					20	SS	9										
					21	SS	43										
					22	SS	62										
					23	SS	45										
					24	SS	100/3										
					25	SS	46										
					26	SS	85										
					27	SS	71										
					28	SS	100/5										
					29	SS	100/5										
					30	SS	100/5										
422.2	42.5				31	SS	100/5										
					32	BK	42										
						(R.C.)	%										
					33	BK	100										
						(R.C.)	%										
412.4	52.3				34	BK	100										
						(R.C.)	%										



# LOG OF BOREHOLE 28

Our Reference No. H-1-14

Enclosure No. 9

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
 PROJECT: SYDENHAM ROAD RECONSTRUCTION  
 LOCATION: DUNDAS, ONTARIO  
 DATUM ELEVATION: GEODETIC

## DRILLING DATA

Method: WASHBORING  
 Diameter: 8 1/8"  
 Date: MARCH 1-4, 1968

SUBSURFACE PROFILE				SAMPLES		PENETRATION RESISTANCE Blows / Foot					WATER CONTENT %			REMARKS							
ELEVATION ft.	DEPTH ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	N Blows / Foot	20	40	60	80	100	PLASTIC LIMIT		NATURAL	LIQUID LIMIT					
								UNDRAINED SHEAR STRENGTH					COMPRESSION TEST								
								+ FIELD VANE TEST													
467.7	0	GROUND SURFACE																			
		TALUS Gravel, some Sand Cobbles & Soil Fines			1	SS	63														
					2	SS	11														
					3	SS	16														
					4	SS	39														
					5	SS	27														
					6	SS	25														
					7	SS	24														
					8	SS	20														
					9	SS	47														
					10	SS	24														
					11	SS	53														
					12	SS	85														
					13	SS	44														
					14	SS	109														
			15	SS	59																
			16	SS	74																
			17	SS	25																
			18	SS	27																
			19	SS	24																
			20	SS	100/34																
			21	SS	37																
			22	SS	50																
			23	SS	23																
			24	SS	42																
			25	SS	18																
			26	SS	122																
438.2	38.5	SHALE BEDROCK			27	R.C.	80 7%														
					28	R.C.	60 7%														
					29	R.C.	62 7%														
418.7	48.0			END OF BOREHOLE																	

# LOG OF BOREHOLE 29

Our Reference No. B-1-14

Enclosure No. 10

CLIENT HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT RYDENHAM ROAD RECONSTRUCTION  
LOCATION DUNDAS, ONTARIO  
DATUM ELEVATION GEODETIC

## DRILLING DATA

Method WASHBORING  
Diameter 8x 12 1/2"  
Date MARCH 18-20, 1968

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE Blows / Foot					WATER CONTENT %			REMARKS							
ELEVATION ft.	DEPTH ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	1	2	3	4	5	6	7									
														UNDRAINED SHEAR STRENGTH					PLASTIC LIMIT NATURAL LIQUID LIMIT			
														FIELD VANE TEST					W <sub>p</sub> W W <sub>L</sub>			
														100/100 FT.								
														W <sub>p</sub> W W <sub>L</sub>								
479.8	0	GROUND SURFACE			1	SS	7	0														
					2	SS	33		0													
					3	SS	73			0												
					4	SS	41		0													
					5	SS	32		0													
					6	SS	39		0													
					7	SS	19		0													
					8	SS	35		0													
					9	SS	23		0													
					10	SS	20		0													
					11	SS	34		0													
					12	SS	16		0													
					13	SS	60			0												
					14	SS	23		0													
					15	SS	46			0												
					16	SS	38			0												
					17	SS	45			0												
					18	SS	48			0												
					19	SS	37			0												
					20	SS	77				0											
					21	SS	47				0											
					22	SS	100/11															
					23	SS	47				0											
					24	SS	49				0											
					25	SS	96															
439.3	40.5	SHALE BEDROCK			26	SS	60/45															
					27	R.C.	80/60															
430.3	49.5	END OF BOREHOLE			28	R.C.	90/70															

VERTICAL SCALE: 1 inch = 10 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A. CHECKED:



## LOG OF BOREHOLE...30

Our Reference No. 6-1-14

Enclosure # 1)

CLIENT HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT SYDENHAM ROAD RECONSTRUCTION  
LOCATION DUNDAS, ONTARIO  
DATUM ELEVATION GEOIDETIC

### DRILLING DATA

Method WASHBORNE  
Diameter Bx 12 3/4"  
Date MARCH 12, 13, 14 & 15, 1968

[illegible]

# LOG OF BOREHOLE 31

Our Reference No. B-1-14

Enclosure No. 12

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNDAS, ONTARIO  
DATUM ELEVATION: GEODETTIC

## DRILLING DATA

Method: WASHBORING  
Diameter: 8" (203 mm)  
Date: MARCH 13-15, 1968

SUBSURFACE PROFILE				SAMPLES		PENETRATION RESISTANCE Blows / Foot					WATER CONTENT %			REMARKS					
ELEVATION Feet	DEPTH Feet	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	N°	Blows / Foot	UNDRAINED SHEAR STRENGTH						PLASTIC LIMIT	NATURAL	LIQUID LIMIT		
									+ FIELD VANE TEST									COMPRESSION TEST	
																		20	40
														C <sub>u</sub> W      C <sub>L</sub>					
464.8	0	GROUND SURFACE																	
		6" TOPSOIL																	
	10			1	SS	4		0											
				2	SS	11		0											
				3	SS	15		0											
	20			4	SS	41		0											
		TALUS		5	SS	31		0											
		Gravel, some Sand		6	SS	23		0											
		Cobbles & Soil Fines		7	SS	100/6													
	40			8	R.C.	23 %													
		Boulders		9	R.C.	10 %													
				10	SS	100/9													
448.8	49.0			11	R.C.	90 %													
	50	SHALE		12	R.C.	100 %													
		BEDROCK.																	
407.3	57.5	END OF BOREHOLE																	
	60																		
	70																		



# LOG OF BOREHOLE 101

Our Reference No. 8-1-14

Enclosure No. 13

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNDAS, ONTARIO  
DATUM ELEVATION: GEODETIC

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x 12 3/8"  
Date: SEPT. 3-8, 1969

SUBSURFACE PROFILE				SAMPLES		PENETRATION RESISTANCE Blows / Foot					WATER CONTENT %			REMARKS				
ELEVATION FT.	DEPTH FT.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	TEST	27	40	60	80	100	PLASTIC LIMIT		NATURAL	LIQUID LIMIT		
								UNDRAINED SHEAR STRENGTH 100/100 LB.										
								* FIELD VANE TEST * COMPRESSION TEST										
466.2	0	GROUND SURFACE																
463.7	2.5	ROCK FILL																
					1	SS	28	0										
					2	SS	27	0										
					3	SS	32	0										
		TALUS					100											
		Gravel, fine Sand, Cobbles & Soil Fines			4	SS	50	0										
		Compact to Very Dense			5	SS	29	0										
435.2	30.0	BOULDERS			6	SS	100/75											
431.2	35.0				7	B&T RC	37-51 %											
					8	SS	77											
		TALUS			9	SS	45	0										
					10	B	27											
					11	SS	46	0										
415.7	52.0				12	SS	100/77											
		SHALE BEDROCK			13	B&T RC	77 %											
					14	B&T RC	50 %											
					15	B&T RC	100 %											
401.2	65.0	END OF BOREHOLE																

BOREHOLE DRY UPON COMPLETION

NOTE  
During coring the  
pressure on the  
drill bit was eased  
and there was  
full return of  
wash water

## NOTE

During coring the pressure on the drill bit was increased and there was full return of wash water.

VERTICAL SCALE 1 inch to 10 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A. CHECKED:



# LOG OF BOREHOLE 102

Draw Reference NY 8-1-14

Enclosure No. 14

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNDAS, ONTARIO  
BASIC ELEVATION: GEODETIC

DRILLING DATA  
Method: WASHBORING  
Diameter: 8x (2 1/2")  
Date: DEC. 5, 1969

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE Blows / Foot					WATER CONTENT %			REMARKS						
ELEVATION Fe	DEPTH Fe	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	Feet / Foot	20	40	60	80	100	PLASTIC LIMIT	NATURAL		LIQUID LIMIT					
								UNDRAINED SHEAR STRENGTH					# COMPRESSION TEST					W <sub>p</sub>	W	W <sub>L</sub>	
								+ FIELD VANE TEST													
470.3	0	GROUND SURFACE																			
	10	TALUS Gravel, Some Sand, Cobbles & Soil Fines  Compact to Very Dense		BOREHOLE DRY UPON COMPLETION	1	SS	19		0												
					2	SS	11		0												
					3	SS	19		0												
	20				4	SS	23		0												
					5	SS	100/3														
	50				6	SS	46		0												
					7	SS	56		0												
	60				8	SS	31		0												
					9	SS	51		0												
	49.6 50.2					10	SS	130													
49.3 53.0		WEATHERED			11	BxT RC.	45 %														
		SHALE BEDROCK			12	BxT RC.															
					13	BxT RC.	85 %														
405.1 65.0																					
		END OF BOREHOLE																			

NOTE  
During casing the  
pressure on the  
drill bit was steady  
and there was  
full return of  
wash water

NOTE:  
During coring the  
pressure on the  
drill bit was steady  
and there was  
no return of  
wash water.

VERTICAL SCALE: 1 inch = 10 feet

COMMISSION SOIL INVESTIGATION LIMITED

MADE: Z.A. CHECKED:



# LOG OF BOREHOLE 103

Our Reference No. B-1-14

Form 675 NY 15

CLIENT: HAMILTON SUBURBAN ROADS COMMISSION  
PROJECT: SYDENHAM ROAD RECONSTRUCTION  
LOCATION: DUNCAS, ONTARIO  
DATUM ELEVATION: GEODETIC

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x (2 3/8")  
Date: SEPT. 8-9, 1969

SUBSURFACE PROFILE		SAMPLES			PENETRATION RESISTANCE Blows / Foot					WATER CONTENT %			REMARKS			
ELEVATION ft.	DEPTH ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	IN Blows / Foot	20	40	60	80	100		PLASTIC LIMIT	NATURAL	LIQUID LIMIT
								UNDRAINED SHEAR STRENGTH (lb/sq ft)						* FIELD VANE TEST		
462.8	0	GROUND SURFACE														
		<b>ROCK FILL</b>			1	SS	14	0								
					2	SS	19	0								
					3	SS	10	0								
					4	SS	21									
					5	SS	8	0								
					6	SS	26	0								
					7	SS	34	0								
					8	SS	29	0								
					9	SS	35	0								
					10	SS	100 N.P.									
					11	B&T RC	37 %									
					12	B&T RC	100 %									
		BOREHOLE DRY UPON COMPLETION														
		<b>TALUS</b> Gravel, Some Sand Cobbles & Soil Fines  Compact to Very Dense														
		<b>Boulders</b>														
		<b>SHALE BEDROCK</b>														
		END OF BOREHOLE														

NOTE  
During coring the pressure on the drill bit was steady and there was full return of wash water.

NOTE  
During coring the pressure on the drill bit was always full return of wash water.

VERTICAL SCALE: 1 inch to 10 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A.

CHECKED:

W.O. 70-F-208C

SYDENHAM

ROAD & C.N.R.

30M5-22



