

Mr. A. M. Toye,  
Bridge Engineer.  
Materials & Research Division,  
(Foundations Section)

October 12, 1961.

FOUNDATION INVESTIGATION REPORT  
By: H.Q. Golder & Assoc., Ltd.  
For: De Leuw, Cather & Co., Ltd.

Attention: Mr. F. I. Hewson.

Re: Proposed Queensway - Percy Overpass,  
Ottawa, Ontario --- District #9

Attached to this memo, we are forwarding to you a copy of the above-mentioned report submitted by the Consultant, H. Q. Golder and Associates. Six copies of this report were already sent by the Consultant directly to De Leuw, Cather and Company of Canada, who have initiated and authorized the investigation.

The recommendations contained in the report are self-explanatory and we believe, sufficient for your further design work. However, should there be any additional information that you might require, please contact our Office.

AGS/MdeF  
Attach.

cc: Messrs. A. M. Toye (2)  
Foundations Office ✓  
Gen. Files.

*AGS*  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGINEER

r. A. Stermac,  
Principal Foundation Engineer,  
Department of Highways,  
Room 107, Lab. Bldg.,  
Downsview, Ontario.

Bridge Division,  
January 4, 1962.

MEMORANDUM TO:

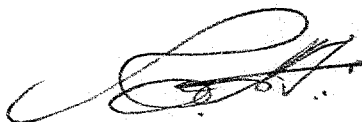
Mr. A. Gray,  
Grades Supervisor,  
Department of Highways,  
Road Design Section, Admin. Bldg.,  
Downsview, Ontario.

*Ken:*  
*Jan 10. 1962*  
*agf*

RE: W.P. 945-59,  
Percy St. Bridge #19,  
Hwy. O.Q., Dist. #9.

Attached please find one print of drawing D 4966-  
P1 and P2 of the above mentioned structure for your  
use.

Two additional prints are being mailed to the  
Principal Foundation Engineer for soils confirmation.



RF:go  
c.c. A. Stermac

R. Fitzgibbon,  
Bridge Design Expediter.

*NO COMMENT*

Materials and Research Division

February 8, 1962.

BA 1255  
De Leuw, Cather & Co. of Canada, Ltd.,  
Consulting Engineers,  
226 Sparks Street,  
Ottawa 4, Ontario.

Att'n: Mr. L. J. Marshall,  
Chief Bridge Engineer.

Re: Proposed Queensway Retaining Walls,  
Station 366+00 to Station 384+00,  
District #9 - W.P. 944-59 & 945-59.

*Perry H.B. #19*

Dear Sir:-

This is to acknowledge receipt of your letter addressed to Mr. F. I. Hewson, Consultant Liaison Engineer of the Department of Highways, in connection with the Foundation Reports by H. Q. Golder and Associates, for the above-mentioned proposed structure.

We would like to make certain comments regarding the recommendations contained in these reports:-

1. Earth Pressures:

We have recently discussed this matter with the consultants and were informed that they intend a value of  $K_0 = 0.5$  to be used only for retaining walls founded directly on the bedrock and dowelled in, whereas in other cases, a value of  $K_a = 0.3$  should be used. We agreed with the consultants on this matter.

2. Bulk Density:

We note that you have used a value of 125 p.c.f. for the unit weight of backfill material. The consultant has recommended a value of 135 p.c.f. Would you please let us know the reasons for this change.

cont'd. /2 ...

DE LEUW, CATHER & COMPANY  
OF CANADA LIMITED  
CONSULTING ENGINEERS  
TORONTO OTTAWA

D4966

226 SPARKS STREET  
OTTAWA 4, ONTARIO  
CENTRAL 3-4075

Our Ref. 1932-Q-3b

October 16th, 1961

Mr. F. I. Hewson,  
Consultant Liaison Engineer,  
Bridge Division,  
Department of Highways of Ontario,  
Parliament Buildings,  
Toronto, Ontario.

Dear Mr. Hewson:

Re: Bridge #19 at Percy Street  
Ottawa Queensway

Enclosed please find one copy of Soils Report No. 6104 for the above structure as prepared by H.Q. Golder and Associates Limited.

The report states that four copies have been sent direct to the Department of Highways of Ontario, presumably to your Foundations Office. The one copy is enclosed for your immediate reference and others are available should you require them.

Could you please give us your soils report number and drawing number assigned to the above structure.

Yours very truly,

DE LEUW, CATHER & CO. OF CANADA LIMITED

*B. B. Saunders*

*for*

Léon J. Marshall, P. Eng.,  
Chief Bridge Engineer

GSS:rm  
Encls.

De Leuw, Cather & Co. of Canada, Ltd.  
Att'n: Mr. L. J. Marshall

February 8, 1962.

3. Piled Foundation:

We are of the opinion that the design load of 45 tons as recommended by the consultant, is low for a 12 BP 53 steel "H" pile driven to bedrock or practical refusal. We suggest a design load of 60 tons per pile be used. It should be specified that the piles be driven to refusal on the bedrock or practical refusal in the till stratum. In the latter, pile driving should be controlled by means of the Hile Formula and in accordance with D.H.C. Standards DD 1218 and DD 1219.

We believe that the above covers all the items we have to comment upon. However, should there be any additional matters you would like to discuss with us, please do not hesitate to contact our Office.

MD/MceF

cc: Mr. F. I. Hewson ✓  
H. Q. Golder & Assoc.

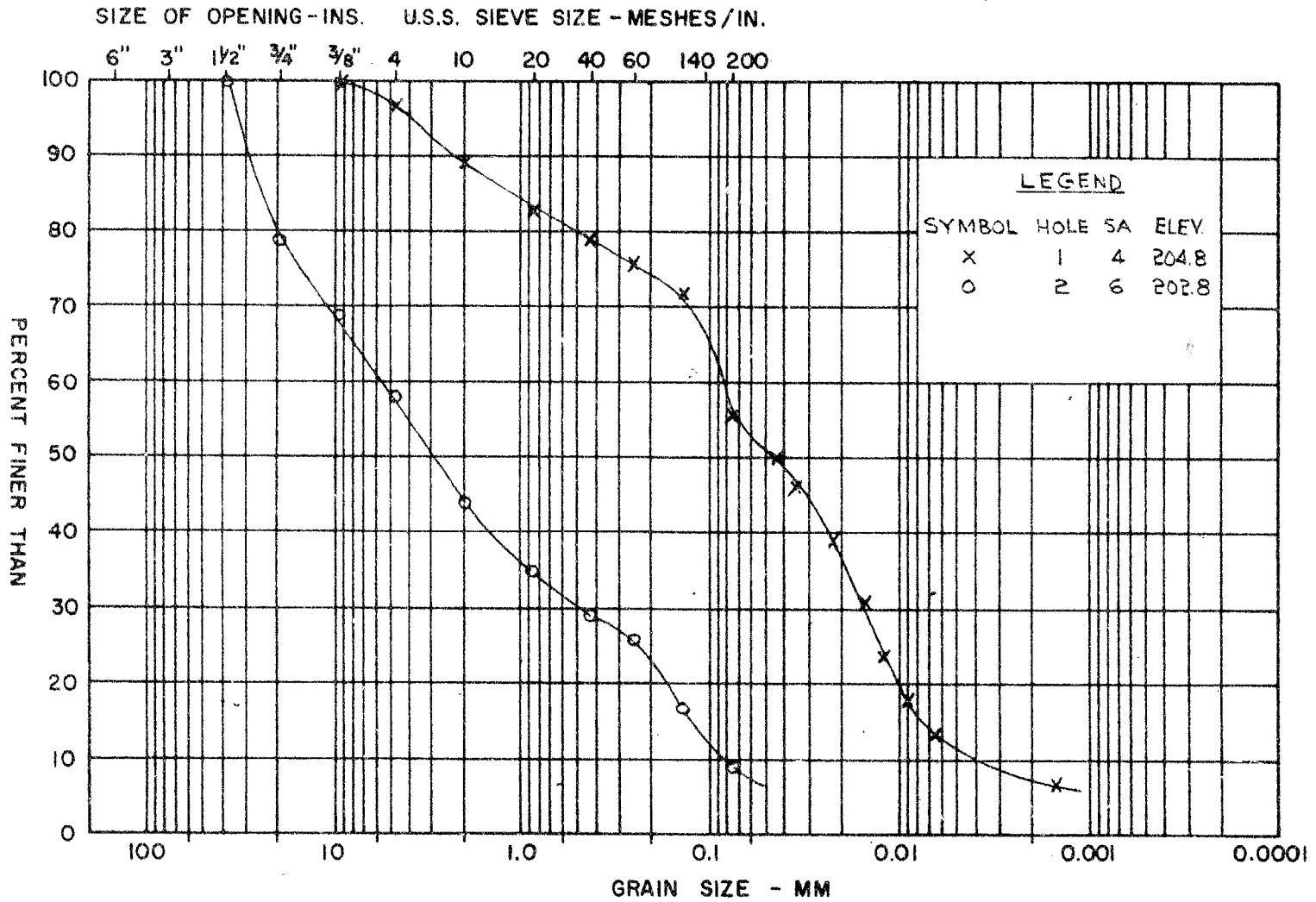
Foundations Office  
Gen. Files.

Yours very truly,

A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.  
Per:

*M. Devata*  
M. Devata,  
SR. PROJECT FOUNDATION ENGR.

M.I.T. GRAIN SIZE SCALE

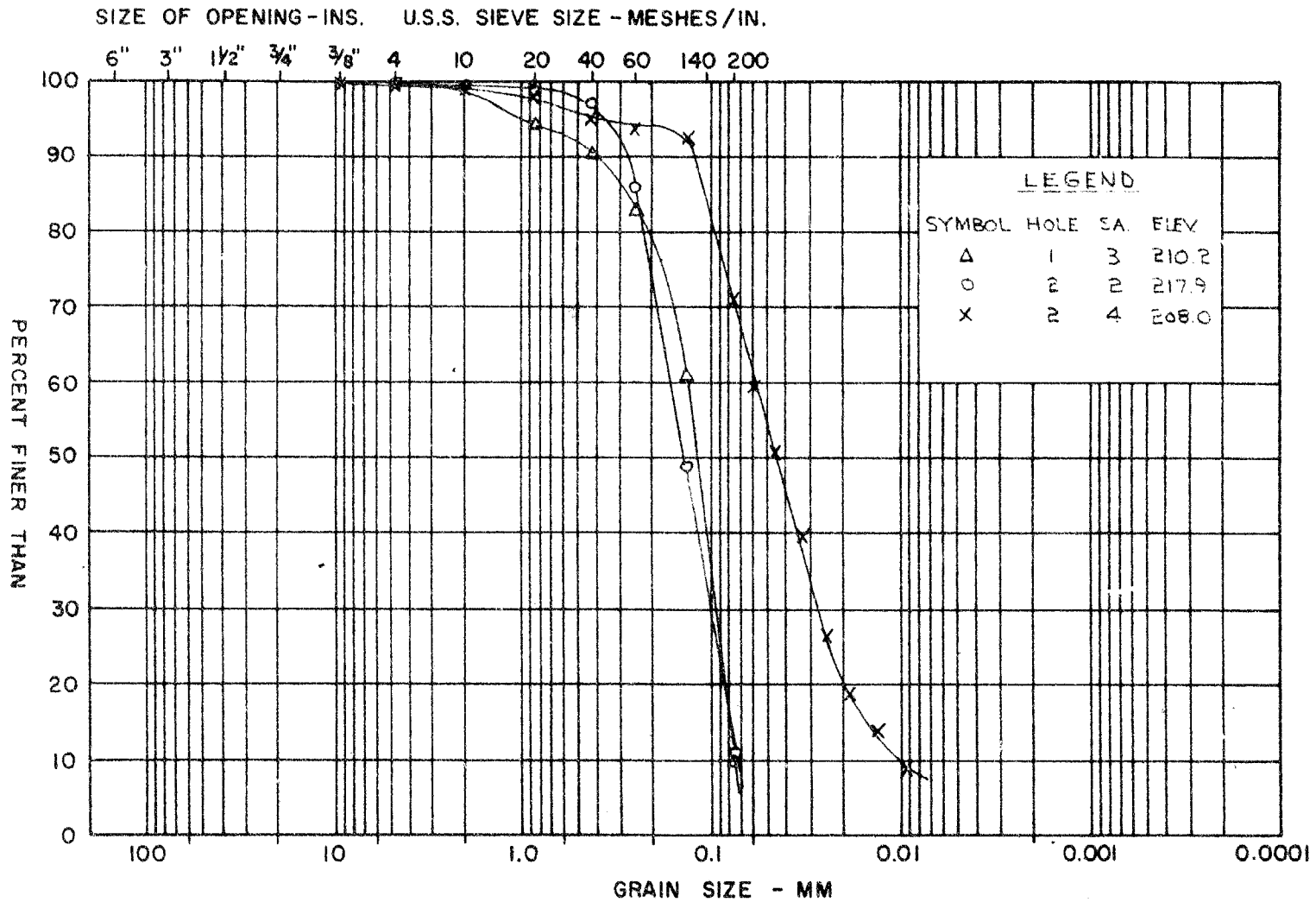


GOLDER & ASSOCIATES

GRAIN SIZE DISTRIBUTION

FIGURE 3

M.I.T. GRAIN SIZE SCALE

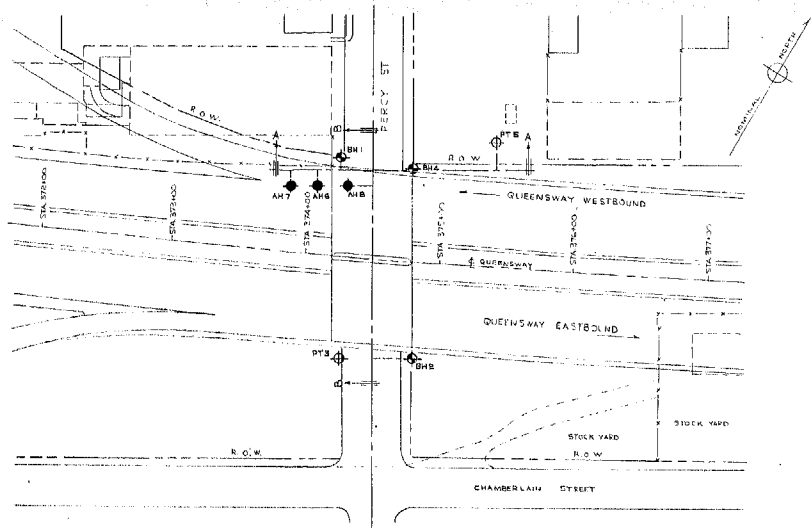


GOLDER & ASSOCIATES

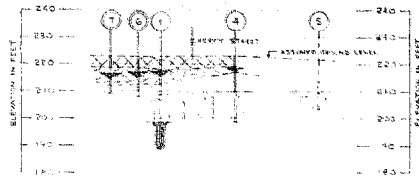
GRAIN SIZE DISTRIBUTION

FIGURE 2

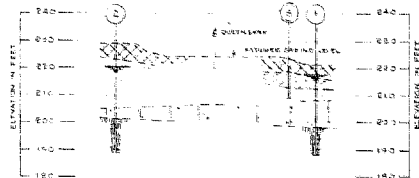
COBBLE SIZE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE		CLAY SIZE
	GRAVEL SIZE			SAND SIZE			FINE GRAINED		



PLAN  
SCALE: 1" TO 40' 0"



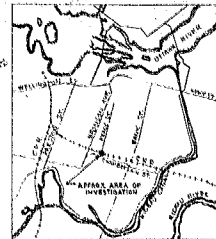
SECTION A-A  
SCALE: HORIZ. 1" TO 40' 0"  
VERT. 1" TO 20' 0"



SECTION B-B  
SCALE: HORIZ. 1" TO 40' 0"  
VERT. 1" TO 20' 0"

# LEGEND

- SURFACE IN PLAN (1) IN ELEVATION
- ADJUSTED IN PLAN (4) IN ELEVATION
- ⊕ PENETRATION TEST IN PLAN (5) IN ELEVATION
- WATER LEVEL IN BORINGS (BORINGS 1 AND 2 - APRIL 1961 BORINGS 3 AND 4 - APRIL 1962)



KEY PLAN  
SCALE: 1" TO 400' (APPROX)

# STRATIGRAPHY

- LOOSE DARK BROWN SANDY FILL
- SOFT DARK BROWN CLAY
- LOOSE TO COMPACT BROWN TO GREY SAND
- COMPACT TO DENSE GREY SILTY SAND WITH GRAVEL (TILL)
- DARK GREY LIMESTONE BEDROCK

REMARKS: BORING DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AS INDICATED BY THE BORING LOGS. THE BORING LOGS HAVE BEEN CHECKED BY THE ENGINEER AND FOUND TO BE CORRECT. THE BORING LOGS HAVE BEEN CHECKED BY THE ENGINEER AND FOUND TO BE CORRECT.

DRWG. NO.	DESCRIPTION
100-A-23	DELEW CATHY & COMPANY OF CANADA LIMITED - OTTAWA - QUEENSWAY, STA 372+00 TO STA 376+00, R.O.W. & UTILITIES.

DELEW CATHY & COMPANY OF CANADA LIMITED	OTTAWA, ONTARIO
PROPOSED QUEENSWAY PERCY OVERPASS	OTTAWA, ONTARIO
BORING PLAN AND SOIL STRATIGRAPHY	

GOLDER & ASSOCIATES CONSULTING CIVIL ENGINEERS	DATE: AUG. 20, 1961 SCALE: HORIZ. 1" TO 40' VERT. 1" TO 20'
MADE BY: J.A. [Signature]	APPROVED BY: [Signature]
FIGURE 1	



# RECORD OF BOREHOLES 6, 7, 8

LOCATION SEE FIGURE 1 BORING DATE SEPT. 16, 1961 DATUM GEODETIC  
 BOREHOLE TYPE POWER AUGER BORINGS BOREHOLE DIAMETER 5"  
 SAMPLER HAMMER WEIGHT — LB. DROP — INCHES PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT L <sub>L</sub> PLASTIC LIMIT P <sub>L</sub> WATER CONTENT W				REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH C, LB./SQ.FT.				WATER CONTENT, PER CENT				
223.0	GROUND LEVEL				230									
0.0	LOOSE BROWN SILTY SAND FILL													
218.9					220									W.L. @ EL. 217.0 SEPT. 17, 1961
4.1	SOFT DARK BROWN NON-FIBROUS PEAT													
212.5														
10.5	LOOSE BROWN TO GREY SILTY FINE SAND				210									
208.1														
15.0	END OF HOLE													
					200									
					130									
222.9	GROUND LEVEL													
0.0	LOOSE BROWN SILTY SAND FILL													
218.4					220									W.L. @ EL. 216.4 SEPT. 17, 1961
4.5	SOFT DARK BROWN NON-FIBROUS PEAT													
211.7														
11.2	LOOSE BROWN TO GREY SILTY FINE SAND				210									
208.2														
14.0	END OF HOLE													
					200									
					230									
222.0	GROUND LEVEL													
0.0	LOOSE BROWN SILTY SAND FILL													
218.0					220									
4.2	SOFT DARK BROWN NON-FIBROUS PEAT													
213.8														
10.5	LOOSE BROWN TO GREY SILTY FINE SAND				210									
208.0														
14.5	END OF HOLE													
					200									

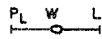
VERTICAL SCALE  
 1 INCH TO 10 FEET

GOLDER & ASSOCIATES

DRAWN J.A.  
 CHECKED *[Signature]*


## RECORD OF BOREHOLE 5

LOCATION SEE FIGURE 1 BORING DATE SEPT. 16, 1961 DATUM GEODETIC  
 BOREHOLE TYPE PENETRATION TEST BOREHOLE DIAMETER  
 SAMPLER HAMMER WEIGHT --- LB. DROP --- INCHES PEN. TEST HAMMER WEIGHT 140 LB. DROP 30 INCHES

SOIL PROFILE			SAMPLES			ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT					LIQUID LIMIT L <sub>L</sub> PLASTIC LIMIT P <sub>L</sub>  WATER CONTENT W		
ELEVATION DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FT.		SHEAR STRENGTH C, LB./SQ.FT.					WATER CONTENT, PER CENT		
							20	40	60	80	100			
221.5 0.0	GROUND LEVEL													
203.5 18.0	END OF PEN. TEST REFUSAL BOULDER OR BEDROCK													

VERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER &amp; ASSOCIATES

DRAWN J.A.  
CHECKED 

## RECORD OF BOREHOLE 4

LOCATION SEE FIGURE 1

BORING DATE SEPT. 16, 1961

DATUM

GEODETIC

BOREHOLE TYPE

POWER AUGER BORING

BOREHOLE DIAMETER

5"

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES

PEN. TEST HAMMER WEIGHT 140 LB. DROP 30 INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT					LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$			REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FT.	20	40	60	80	100	$P_L$ $W$ $L_L$			
							SHEAR STRENGTH $C$ , LB./SQ.FT.					WATER CONTENT, PER CENT			
222.4	GROUND LEVEL					230									
219.2	LOOSE TO COMPACT BROWN SAND FILL		1	D.O.	15	220								W.L. @ EL. 218.9 SEPT. 17, 1961 ↓	
216.8	SOFT DARK BROWN NON-FIBROUS PEAT		2	"	7										
210.1	LOOSE BROWN TO GREY SILTY FINE SAND		3	"	7										
206.6			4	A.S.	1										
203.3			5	D.O.	3										
200.7			6	"	35										
198.9	DENSE TO VERY DENSE GREY SILTY SAND WITH GRAVEL		7	"	34										
194.5			8	"	>100										
190.0	END OF HOLE REFUSAL BOULDER OR BEDROCK		9	A.S.	--										

END OF PEN. TEST @ EL. 200.7  
145 BLOWS FOR LAST 3 INCHES

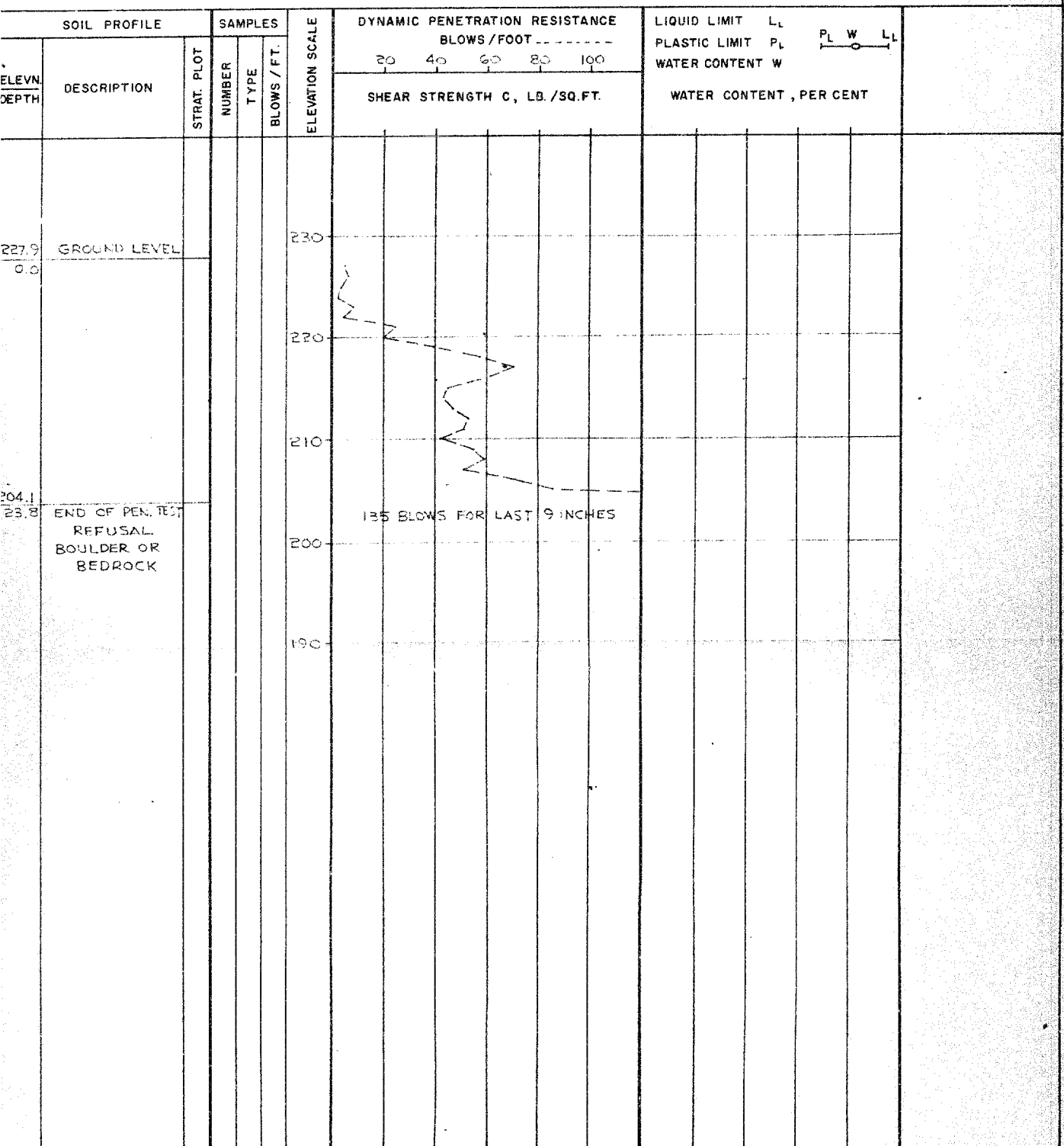
VERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER &amp; ASSOCIATES

DRAWN J.A.  
CHECKED J.D.

## RECORD OF BOREHOLE 3

LOCATION SEE FIGURE 1 BORING DATE SEPT. 15, 1961 DATUM GEODETIC  
 BOREHOLE TYPE PENETRATION TEST BOREHOLE DIAMETER —  
 SAMPLER HAMMER WEIGHT — LB. DROP — INCHES PEN. TEST HAMMER WEIGHT 140 LB. DROP 30 INCHES





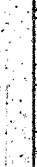


VERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER &amp; ASSOCIATES

DRAWN J.A.  
CHECKED J.R.

## RECORD OF BOREHOLE 2

LOCATION SEE FIGURE 1 BORING DATE MARCH 30-APRIL 4, 1961 DATUM GEODETIC  
 BOREHOLE TYPE POWER AUGER & DIAMOND DRILL BOREHOLE DIAMETER BX CASING  
 SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $L_L$ PLASTIC LIMIT $P_L$ WATER CONTENT $W$				REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH $C$ , LB./SQ.FT.					WATER CONTENT, PER CENT				
229.0	GROUND LEVEL				230										W.L. @ EL 220.6 APRIL 7, 1961
0.0	LOOSE DARK BROWN SAND FILL		1	2" D.O.	228										
223.0			2	"	220										
6.0	COMPACT BROWN TO GREY SAND TO SILTY FINE SAND		3	"	215										M
			4	"	210										MH
205.0			5	A.S.											
24.0	DENSE GREY SILTY SAND WITH GRAVEL		6	2" D.O.	205										LM
201.2			7	B.X. R.C.	200										NO WATER LOSS DURING DRILLING OF BEDROCK
27.8	SOUND DARK GREY LIMESTONE BEDROCK		8	"											
			9	"	190										
189.1	END OF HOLE				180										
39.9															

VERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER &amp; ASSOCIATES

DRAWN J.A.  
CHECKED JRR

# RECORD OF BOREHOLE 1

LOCATION SEE FIGURE 1 BORING DATE MARCH 29-APRIL 3, 1961 DATUM GEODETIC  
 BOREHOLE TYPE POWER AUGER & DIAMOND DRILL BOREHOLE DIAMETER 8x CASING  
 SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT					LIQUID LIMIT L <sub>L</sub> PLASTIC LIMIT P <sub>L</sub> WATER CONTENT W					REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH C, LB./SQ.FT.					WATER CONTENT, PER CENT					
																W.L. IN PIEZOMETER @ EL. 217.6 APRIL 7, 1961 PIEZOMETER TIP @ EL. 199.5
220.9	GROUND LEVEL															
0.0	LOOSE DARK BROWN CLAYEY GRAVEL FILL															W.L. ▼
216.9																
4.0	VERY SOFT DARK BROWN			A.S.	—											
211.9	NON-FIBROUS PEAT			"	—											
9.0	LOOSE BROWN FINE SAND WITH SOME ORGANIC MATTER		3	2" T.O.	P.M.	210										M
207.9																
13.0	COMPACT TO DENSE GREY SILT AND SAND TRACE OF CLAY AND GRAVEL		4	2" D.O.	2E	200										MH
197.9																
23.0	SOUND DARK GREY LIMESTONE BEDROCK		6	BX. R.C.	—											NO WATER LOSS DURING DRILLING OF BEDROCK
187.9																
33.0	END OF HOLE		7	"	—	190										

VERTICAL SCALE  
1 INCH TO 10 FEET

GOLDER & ASSOCIATES

DRAWN J.A.  
CHECKED J.A.

**H. Q. GOLDER & ASSOCIATES LTD.**

**CONSULTING CIVIL ENGINEERS**

H. Q. GOLDER  
V. MILLIGAN

2446A BLOOR ST. W.  
TORONTO 9  
RO. 7-9201

REPORT  
TO  
DELEUW, CATHER & COMPANY OF CANADA, LIMITED  
ON  
SITE INVESTIGATION

PROPOSED QUEENSWAY-PERCY OVERPASS

BRIDGE NO. 19

OTTAWA

ONTARIO

WP 945-59

Distribution:

- 6 copies - DeLeuw, Cather & Company of Canada, Limited,  
Ottawa, Ontario.
- 4 copies - Department of Highways, Ontario.  
Toronto, Ontario.
- 2 copies - H. Q. Golder & Associates Ltd.,  
Toronto, Ontario.

September, 1961.

6104

## ABSTRACT

The results of an investigation carried out at the site of the proposed Queensway limited access highway and Percy Street overpass structure in Ottawa, Ontario, are reported.

It was found from the borings put down that the site is underlain by about 25 feet of essentially granular material overlying sound limestone bedrock. Bedrock is covered by 4 to 10 feet of compact to dense sandy glacial till which in turn is covered by 4 to 18 feet of loose to compact sand. The sand in the north-west portion of the site is covered by a 2 to 7 foot thick layer of soft peat. A surface layer of loose sandy fill, about 4 feet thick, covers the site.

To ensure stability of the approach fills to the structure it is recommended that the peat layer which underlies a portion of the site be excavated and replaced by granular material. The lateral extent of the peat across the site should be completely determined by a shallow auger boring program prior to approval of final design.

Due to the presence of the very soft peat under one portion of the site together with the loose condition of the upper granular strata, a pile supported foundation for the proposed structure has been recommended. Considering 12BP53 lb. steel H piles driven to practical refusal in the lower portion of the till or to bedrock, a design load of 45 tons per pile may be used.



## TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
PROCEDURE	1
SITE TOPOGRAPHY AND GEOLOGY	2
SOIL CONDITIONS	3
Fill	3
Peat	4
Sand	4
Silty Sand with Gravel	5
Bedrock	6
WATER CONDITIONS	7
DICSUSSION	8
General	8
Foundation Design	8
Approach Embankments	9
ABBREVIATIONS	11
RECORDS OF BOREHOLES	In Order
FIGURE 1 - Boring Plan and Soil Stratigraphy	Following
FIGURES 2 & 3 - Laboratory Test Results	Page 11.

## INTRODUCTION

H. Q. Golder & Associates Ltd. has been retained by DeLeuw, Cather & Company of Canada Ltd., Consulting Engineers, to carry out a site investigation for a proposed overpass at the intersection of the Ottawa Queensway limited access highway and Percy Street in the City of Ottawa, Ontario. The purpose of the investigation was to determine the soil conditions at the site and to provide information for the foundation design of the proposed bridge structure.

## PROCEDURE

The field work for the investigation was carried out during the period March 29th, to April 7th, 1961. Two sampled boreholes were put down to depths of 33 and 40 feet below ground surface, respectively. The boreholes were put down through the overburden using a continuous flight power auger. For proving bedrock at each location a skid-mounted machine drillrig was used. After completion of borehole 1, a piezometer was installed for ground water level observation.

Following this phase of the field investigation it was decided, after a study of the boring results, that further field work was required to obtain more information on the soil conditions, particularly in the northern portion of the site. Consequently on September 15th and 16th, 1961, a borehole with an adjacent dynamic penetration test and 2 further dynamic penetration tests were put down through the overburden using mobile

power auger equipment. Three shallow auger borings, to determine the lateral extent of the peat layer, were also put down adjacent to the railway tracks in the north-west portion of the site near the location of borehole 1.

The locations of all the boreholes together with a section of the inferred soil stratigraphy are shown on Figure 1. Detailed logs of each boring are given on the Records of Boreholes.

The samples obtained during the investigation were dispatched to our laboratory for examination and testing. Representative samples of those remaining after testing will be stored until April 15th, 1962, at which time you will be notified regarding their disposal.

The results of the laboratory testing are shown on the Records of Boreholes and on the figures.

All elevations given in this report were determined by reference to a Geodetic bench mark adjacent to the site.

#### SITE TOPOGRAPHY AND GEOLOGY

The Percy Street overpass is located within the centre town section of the Ottawa Queensway. The proposed Queensway centreline in this locality follows an existing railroad consisting of several tracks. Percy Street, which extends to the north and south of the railway does not cross the railway at this time. The ground surface across the tracks is essentially flat. To the

south of the tracks the ground surface rises steeply for several feet and is then practically flat. The tracks on the north side rest on fill, which brings the ground surface at this point several feet above the level of Percy Street to the north.

Geological information indicates that bedrock in the immediate vicinity and to the west of the site is a Trenton limestone of the Ottawa Formation, Cobourg Series and to the east of the site is a black shale of the Billings Formation. The bedrock is covered by a layer of glacial till deposited by the Labradorean Glacier during the Wisconsin stage of glaciation. Immediately following retreat of the ice, the area was inundated by the Champlain Sea by way of the Gulf of St. Lawrence. During this period sand, silt and clays were deposited over the glacial till. In certain localized areas more recent deposits of sand and peat cover the Champlain soils.

#### SOIL CONDITIONS

The following main soil strata were encountered by the borings put down at the site.

##### Fill

A layer of dark brown fill was encountered at ground surface in all the borings. The thickness of the fill varies from about 4 feet at borehole 1 to about 6 feet at borehole 2 and is generally about 4 feet in thickness. At borehole 1 the fill is comprised of a heterogeneous mixture of gravel with clay. In the remainder of the borings the fill is

essentially comprised of sand in all grain sizes, with a trace of silt throughout and some clay towards the base of the layer in borehole 2. Pieces of partially decayed wood were encountered throughout the fill layer.

Based on standard penetration resistance or "N" values of 8 and 15 blows per foot obtained at the base of the fill in boreholes 2 and 4 together with the resistance to boring penetration and the results of the dynamic penetration tests, the relative density of the fill is estimated to range from very loose to compact and to be generally loose.

#### Peat

Beneath the fill in the northern portion of the site, a layer of dark brown peat, ranging from 2 feet in thickness at borehole 4 to about 7 feet in thickness at auger holes 6, 7 and 8, was encountered. The complete lateral extent of the peat could not be determined in this investigation because it was not possible to work on the railway tracks. The peat contains no root fibres or distinguishable foliage remains and is essentially non-fibrous and in a decomposed state.

Based on resistance to auger penetration and examination of the samples obtained, the peat is very soft and highly compressible.

#### Sand

Underlying the surface layer of sandy fill in borehole 2 and the peat in the remainder of the boreholes, a

stratum of sand was encountered. The sand where it was completely penetrated by the borings, ranges from about 4 feet in thickness at borehole 1 to about 18 feet in thickness at borehole 2. The colour of the stratum is brown in about the upper 5 feet indicating oxidation. Below this depth the stratum is generally grey in colour. The upper portion of the stratum is essentially comprised of fine sand with about 15 percent by weight of medium to coarse sand and a trace of silt and subangular gravel up to about  $3/8$  inch size. The stratum in the upper few feet contains some decomposed organic matter. With depth the silt content of the stratum increases and below about 15 to 20 feet from ground surface the stratum is essentially a sandy silt with a trace of fine gravel. The stratum throughout does not exhibit any pronounced stratification.

Three grain size distribution curves obtained from samples of the stratum are shown on Figure 2.

Five standard penetration resistance values ranging from 3 to 23 blows per foot together with one value of manual push near the surface of the stratum were obtained. Based on these values together with the results of the dynamic penetration tests the relative density of the stratum ranges from very loose to compact.

#### Silty Sand with Gravel

Beneath the fine sand where it was completely penetrated in boreholes 1, 2 and 4, a stratum of grey silty sand

with gravel was encountered. The thickness of the stratum varies from about 10 feet in boreholes 1 and 4 to about 4 feet in borehole 2. The stratum, which is typical of the basal till stratum overlying bedrock in the Ottawa area, consists of a well graded composite of silt, sand and sub-angular gravel up to at least  $1\frac{1}{2}$  inches in size. Cobble sizes are generally present within the stratum. The general predominance of sand sizes allows classification as a sandy till sensibly non-plastic.

Two grain size distribution curves on samples from the stratum are shown on Figure 3.

Standard penetration resistance values ranging from 22 to 49 blows per foot with one value greater than 100 blows per foot were obtained in the till stratum. These values together with the results of the dynamic penetration tests indicate that the relative density of the stratum is compact to very dense and generally dense.

#### Bedrock

Underlying the sandy till, bedrock was encountered at depths of about 23 and 28 feet below ground surface in boreholes 1 and 2 respectively. The bedrock was core drilled in BX size in both boreholes for depths of about 10 feet. Examination of the rock core obtained showed the rock formation to be a sound dark grey limestone with no evidence of weathering or fragmentation below a depth of about 12 inches from surface. Core recovery was about 85 percent in the upper 12 inches and

100 percent elsewhere. No water loss was observed during the drilling process (water loss would indicate fissuring or open jointing).

#### WATER CONDITIONS

Water level observations were made during the initial drilling and sampling program in the open boreholes and in a porous tube piezometer installed in borehole 1 after completion of the boring. The observations confirm that no artesian pressures existed in the overburden or bedrock during the period of the investigation and that the ground water level was at about elevation 218 (3 feet below ground surface) in borehole 1 and at about elevation 221 (8 feet below ground surface) in borehole 2 during the beginning of April, 1961.

Readings taken on September 17th, 1961, after completion of borehole 4 and auger holes 6 and 7 during the second phase of the field investigation showed the ground water level to be between about elevations 217 and 219 or about 4 to 6 feet below ground surface.

Because of the shallow granular overburden which overlies a relatively impermeable bedrock formation at the site, the ground water table can be expected to fluctuate with both seasonal and diurnal precipitation conditions.



## DISCUSSION

### General

It is understood that it is proposed to construct a single span overpass structure to carry the proposed Ottawa Queensway over Percy Street in the City of Ottawa. No structural details are available at this time but it is assumed that a rigid frame reinforced concrete structure will be the adopted design. The overpass structure is to have a width of about 60 feet and a length parallel to Percy Street of about 125 feet. The Queensway roadway approach fill at the structure location is to be about 20 feet above existing ground surface.

### Foundation Design

The loose relative density and variable nature of the upper portion of the overburden at the site together with the proximity of the ground water to ground surface does not permit an economical shallow spread footing design for the proposed structure. It is recommended that the structure be supported on steel H piles driven to practical refusal which will be met in the lower portion of the dense sandy till immediately overlying bedrock or at the bedrock surface. Considering a 12 BP 53 lb. section driven to practical refusal, an allowable load of 45 tons per pile may be used for design.

For adequate frost protection at least 6 feet of earth cover should be provided above the underside of the concrete pile cap footings.

A layer of soft and highly compressible peat extending

**GOLDER & ASSOCIATES**

to a depth of as much as 11 feet below ground surface was encountered beneath the fill in the northern portion of the site. To prevent settlement and lateral movements, this deposit should be excavated in the area of the abutments and approach fills and the excavation backfilled with free draining granular material. The excavation and backfilling can be carried out in the wet (below the ground water level), thus eliminating dewatering. Backfilling of the excavation should be completed to the elevation of the underside of the abutment footing. The foundation piles can then be driven through the granular backfill. The driving of the piles after backfilling will compact and thus increase the relative density of the granular backfill material. Should the ground water level during construction be above the underside of the footing elevation, normal sump pumping methods could serve to lower the water table in the excavation to facilitate forming and pouring the footing concrete.

#### Approach Embankments

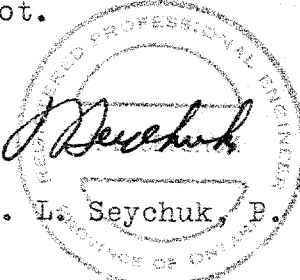
The Queensway approach fills to the proposed structure are in the order of 20 feet above existing ground surface. Prior to construction of the embankments sub-excavation of all organic strata such as the peat encountered in the northwest portion of the site should be carried out. This is necessary to ensure stability of fills of the order of 20 feet in height using standard 2 horizontal to 1 vertical side slopes. If the embankments were constructed over the peat unacceptable

differential settlements if not complete failure would probably take place.

The lateral extent of the peat deposit encountered at the site has not been completely determined in this investigation. It is recommended that prior to finalizing the design at this overpass location, additional shallow auger borings be put down to define the extent of the peat.

In the construction of the approach embankments to the overpass structure, it is recommended that at least 6 feet, in horizontal extent, of non-frost susceptible and free draining granular material be placed behind the structure abutment walls.

It is further recommended that in the design of the rigid structure abutment walls, a coefficient of earth pressure at rest,  $K_0 = 0.5$  be used for granular approach embankments. With full effective drainage provided by the free draining granular material behind the abutment walls and with heavy compaction of the embankment fill, the unit weight of the fill material for computing earth pressures on the walls should be taken as at least 135 pounds per cubic foot.

  
J. L. Seychuk, P. Eng.

JLS/jb  
6104  
September, 1961.

  
V. Milligan, P. Eng.

**GOLDER & ASSOCIATES**

## LIST OF STANDARD ABBREVIATIONS

The standard abbreviations commonly employed on each "Record of Borehole", on the figures, and in the text of the report are as follows:

### SAMPLE TYPES

A.S. - Auger Sample	R.C. - Rock Core
C.S. - Chunk Sample	S.T. - Slotted Tube
D.O. - Drive Open	T.O. - Thin-walled, Open
D.S. - Denison Type Sample	T.P. - Thin-walled, Piston
F.S. - Foil Sample	W.S. - Wash Sample

### PENETRATION RESISTANCES

Dynamic Penetration Resistance - The energy required to drive a 2 inch diameter, 60 degree cone attached to the end of the drilling rods into the ground: expressed in blows per foot, where each blow represents 4,200 inch-pounds of energy.

Standard Penetration Resistance, N - The number of blows by a 140 pound hammer dropped 30 inches required to drive a 2 inch drive open sampler one foot into the ground.

Sampler advanced by static weight - weight, hammer - Wh  
Sampler advanced by pressure - pressure, hydraulic - Ph  
Sampler advanced by pressure - pressure, manual - Pm

### SOIL DESCRIPTION

The standard terminology for the descriptions of the relative density of cohesionless soils and the consistency of cohesive soils is as follows:

<u>Relative Density</u>	<u>N, Blows/ft.</u>	<u>Consistency</u>	<u>c, lb/sq. ft.</u>
Very Loose	0 to 4	Very Soft	Less than 250
Loose	4 to 10	Soft	250 to 500
Compact	10 to 30	Firm	500 to 1,000
Dense	30 to 50	Stiff	1,000 to 2,000
Very Dense	over 50	Very Stiff	2,000 to 4,000
		Hard	over 4,000

### SOIL TESTS

C - Consolidation Test	Q - Undrained Triaxial
H - Hydrometer Analysis	Qc - Consolidated Undrained Triaxial
M - Sieve Analysis	S - Drained Triaxial
MH - Combined Analysis, Sieve and Hydrometer	U - Unconfined Compression
	V - Field Vane Test

Note: Undrained triaxial tests in which pore pressures are measured are shown as Q' or Q'c.

### SOIL PROPERTIES

$\gamma$ - Total Unit Weight	K - Coefficient of Permeability
$\gamma_d$ - Dry Unit Weight	c - Undrained Shear Strength ( $\frac{1}{2}$ Compressive Strength)
$\gamma_b$ - Submerged Unit Weight	St - Sensitivity
L <sub>L</sub> - Liquid Limit	$\phi'$ - Effective Angle of Shearing Resistance
P <sub>L</sub> - Plastic Limit	c' - Effective Cohesion Intercept
W - Natural Water Content	Cc - Compression Index
G - Specific Gravity	Cv - Coefficient of Consolidation
e - Void Ratio	

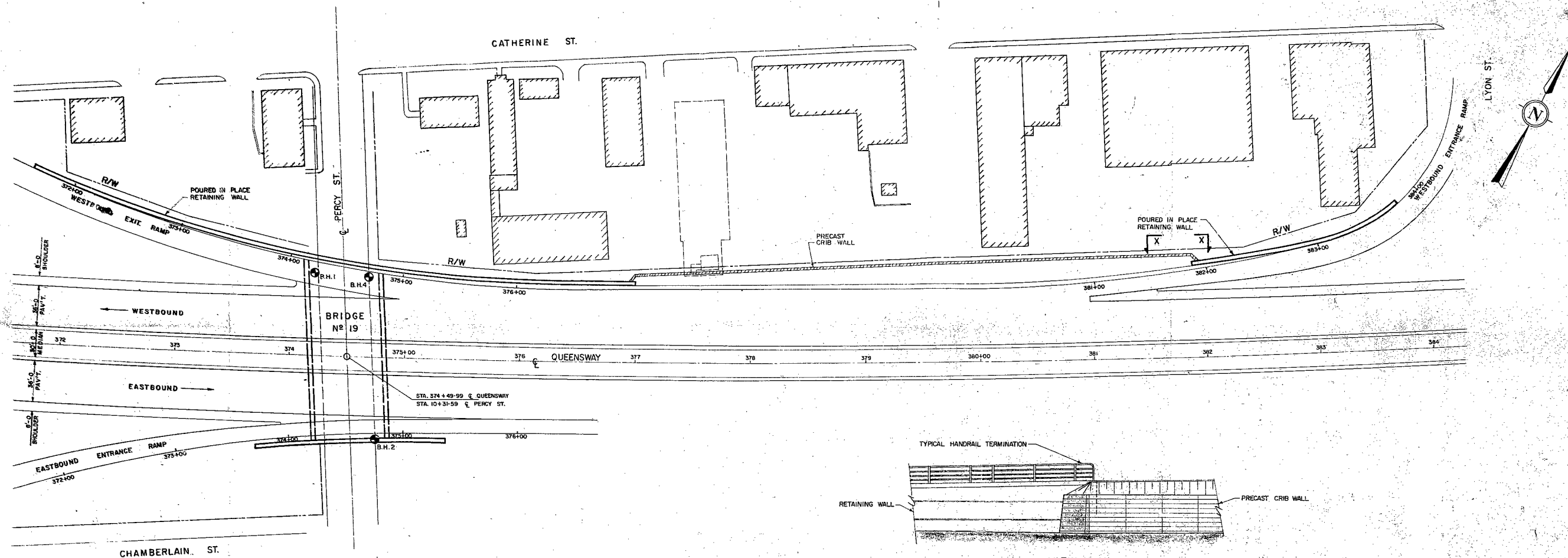
#61-F-219C

W.P. # 945-59

QUEENSWAY-

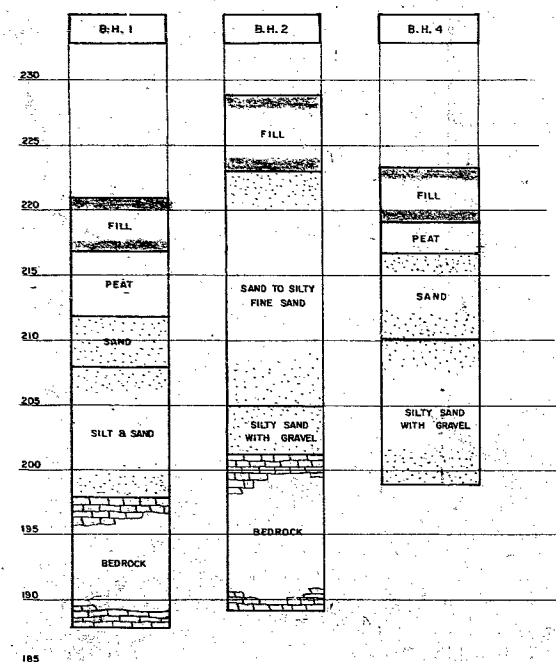
PERCY OVERPASS

OTTAWA

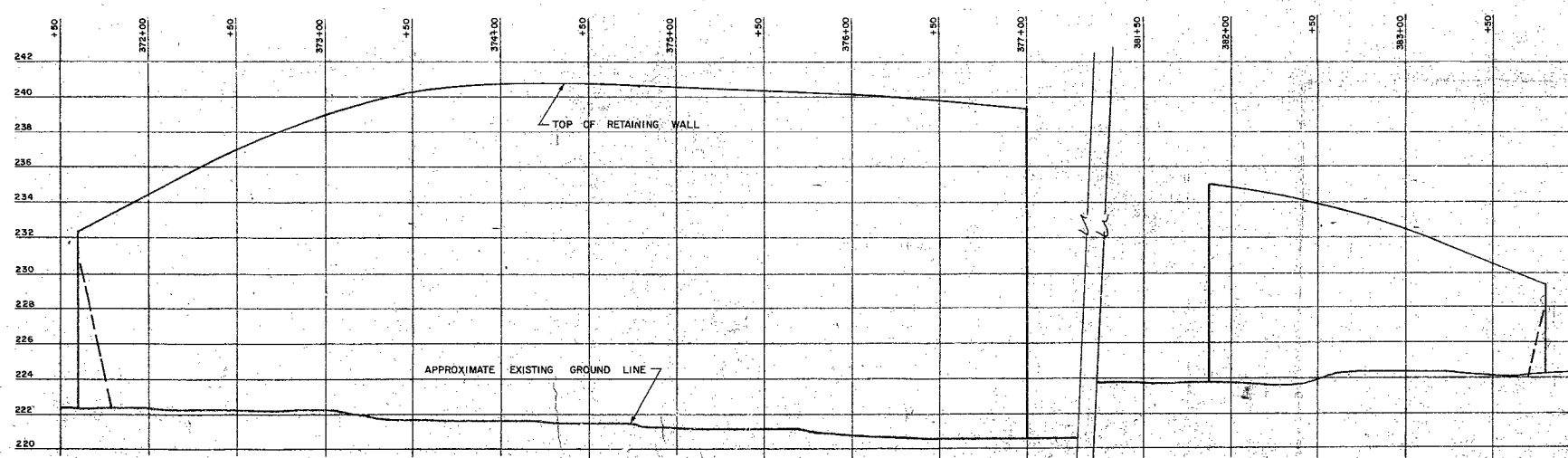


SITE PLAN  
SCALE: 1" = 40'

VIEW X-X  
SCALE: 1" = 10'-0"



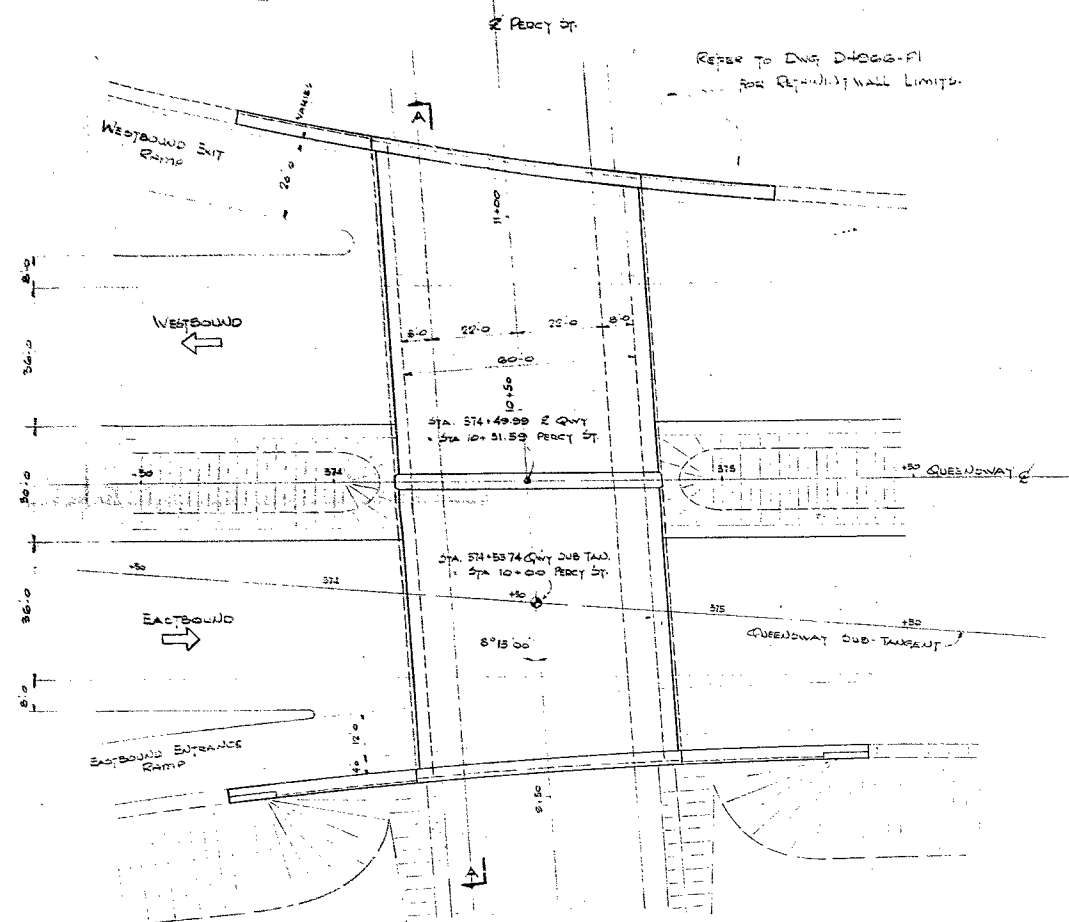
BOREHOLE LOG  
(FOR INFORMATION PURPOSES ONLY;  
NOT GUARANTEED.)



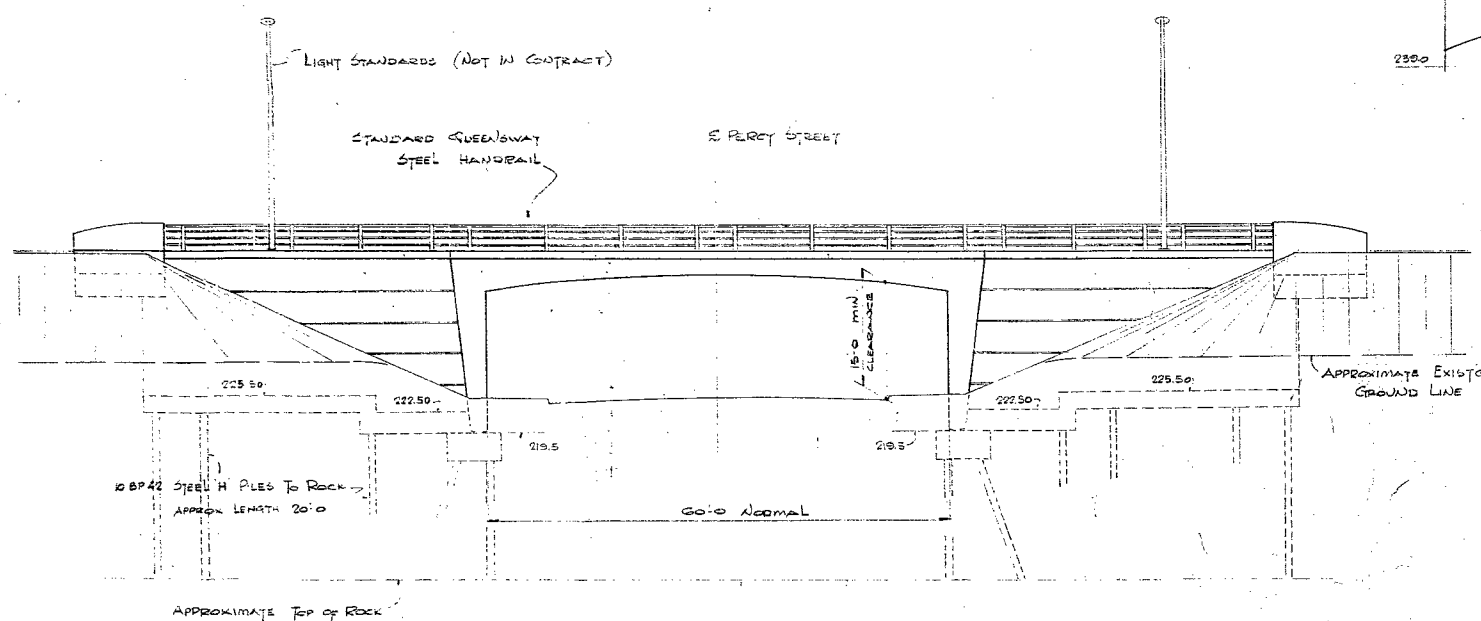
NORTH RETAINING WALL PROFILE

SCALE: VERT. 1" = 4'-0"  
HORIZ. 1" = 40'-0"

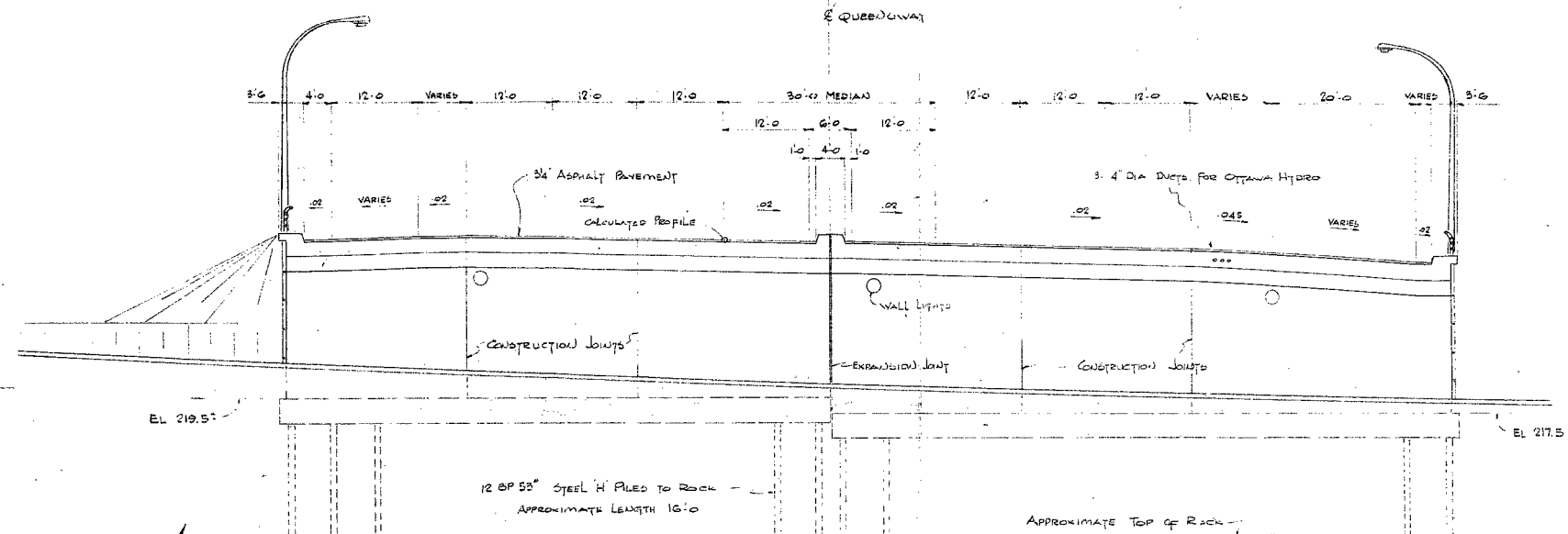
No.		Revisions		By		Date	
DEPARTMENT OF HIGHWAYS OF ONTARIO							
OTTAWA QUEENSWAY LIMITED-ACCESS HIGHWAY OTTAWA CANADA							
BRIDGE No. 19 AT PERCY ST. SITE PLAN							
DE LEUW, CATHER & CO. OF CANADA LIMITED Consulting Engineers				DEPT. OF HIGHWAYS OF ONTARIO Director of Planning & Design			
Designed by: G.S.S.		Date: Nov. 1961		DWG. No. D4966-PI		Sheet	
Drawn by: A.S.Y.		Scale: AS SHOWN		Checked by: G.S.S.		DEC 18 1961	
CONTRACT NUMBERS		WORKS PROJECT No. 945-59		DISTRICT No. 9			



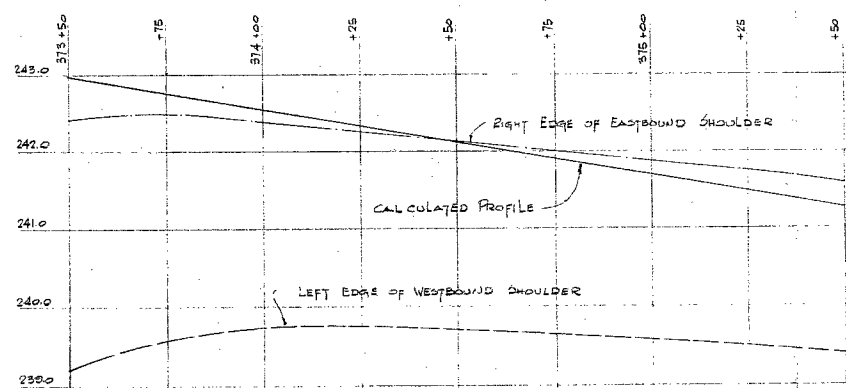
BRIDGE PLAN  
SCALE: 1" = 20'



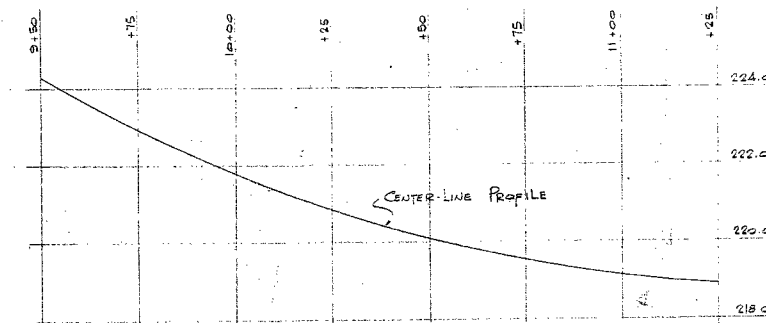
ELEVATION - SOUTH SIDE  
SCALE: 1" = 10'



SECTION A-A  
SCALE: 1" = 10'



QUEENSWAY PROFILE  
SCALE: VERT. 1" = 1.0', HORIZ. 1" = 20.0'



PERCY STREET PROFILE  
SCALE: VERT. 1" = 2.0', HORIZ. 1" = 20.0'

NOTES:  
DESIGN SPECIFICATIONS: A.A.S.H.O. SPECIFICATIONS FOR HIGHWAY BRIDGES.  
LIVE LOAD: H20-S16  
CONCRETE STRENGTH: 3000 PSI THROUGHOUT  
REFER TO BIDDING FOR COMPLETE SOILS REPORT AND RECOMMENDATIONS FOR REMOVAL OF PEAT.  
SUPERSTRUCTURE: R.C. RIGID FRAME.  
FOUNDATIONS: BEARING PILES TO ROCK.  
PROVISION FOR TRAFFIC ON PERCY STREET NOT REQUIRED DURING CONSTRUCTION.

1. REVISIONS TO APPROVAL		PT. 1/12/66
No.	Revisions	By Date
DEPARTMENT OF HIGHWAYS OF ONTARIO		
OTTAWA QUEENSWAY LIMITED ACCESS HIGHWAY		
OTTAWA CANADA		
BRIDGE NO 19 AT PERCY ST. PRELIMINARY PLAN.		
DE LEUW CATHIER & CO. OF CANADA LIMITED Consulting Engineers		DEPT. OF HIGHWAYS OF ONTARIO Director of Planning & Design
Designed by: S.S.S.	Date: NOV. 1961	DWG. No. D4966-P2
Drawn by: P.T.	Scale: AS SHOWN	Sheet DEC 13 1961
Checked by: L.J.M.		

CONTRACT NUMBERS	WORKS PROJECT No. 545-59	DISTRICT No. 9
------------------	--------------------------	----------------