

#62-F-207

W.P.#85-59-02

HWY.#401 &

AVENUE RD.

Toronto Regional Road Design Office,
DOWNSVIEW, February 4, 1964.

MEMORANDUM FOR:

Mr. B. Davis,
Bridge Design Engineer,
Bridge Office,
Administration Building.

Re: W.P. 252-61-3, 252-61-4, Highway 401,
Bayview Avenue to Victoria Park Avenue,
W.P. 85-59-2, Spadina Interchange.

Don. Soil '62

On January 29, 1964 a meeting was held in your office re. deck drainage on Don Valley Parkway structures along with other matters. Minutes of meeting are being prepared by FENCO but have not been received in this office.

Method of deck drainage at Don Valley was generally approved. FENCO was asked to investigate the possibility of revisions at several locations. This will be discussed at our regular meeting on Tuesday, February 4, 1964.

Structure approach pavement in the Leslie Street area was discussed and it was agreed that the stability of fills in the area, with the proposed trestle structure, are now such that we will proceed with concrete pavement throughout. It was previously recommended that a flexible pavement be used.

Continued /2

Mr. B. Davis - Re: W.P. 252-61-3, 252-61-4.

We also assured you at this meeting that a report is being prepared for deck drainage at the Spadina Interchange. This will be ready for your review shortly.

W.C. Friedmann
PROJECT DESIGN ENGINEER

For:

G.K. Hunter
SENIOR PROJECT DESIGN ENGINEER

WCF/GB

c.c. D.W. Farren
C. Fraser
A. Stermac ✓
P. Andersen - FENCO
J. Curtis

Mr. A. M. Toye,
Bridge Engineer,
Bridge Division.

Attn: Mr. S. McCombie.

Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.
December 20, 1962.

Re: Avenue Road - Hwy. #401, Interchange Leg "A"
Retaining Wall. WP85-59-2. District #6, Toronto.
Foundation Report by Dominion Soil Investigation
Ltd. Ref. 2-11-2.

Attached we are sending the above-mentioned foundation report, which contains factual data only concerning subsoil conditions.

The subsoil consists of a dense to very dense heterogeneous mixture of clayey silt and sand of glacial origin. Generally conditions are favourable for spread footing type foundations and bearing capacities up to 4000 p.s.f. may be used below about elevation 487.0, with little or no settlement.

If you have any queries in connection with this matter please contact this office.

KCS/tt
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
G. K. Hunter
C. Fraser
T. J. Kovich
J. Roy
J. E. Gruspier
E. R. Saint
F. Norman
A. Watt

Foundations Office
Gen. Files

K. G. Selby
K. G. Selby,
SENIOR FOUNDATION ENGR.
For:

A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

ONTARIO DEPARTMENT OF HIGHWAYS
MATERIALS AND RESEARCH DIVISION
PARLIAMENT BUILDINGS
TORONTO - ONTARIO

AVENUE ROAD - HIGHWAY NO. 401
INTERCHANGE - LEG "A"
RETAINING WALL
(W.P. 85-59-2)

S U B S O I L C O N D I T I O N S

Submitted by

DOMINION SOIL INVESTIGATION LIMITED
77 Crockford Boulevard
SCARBOROUGH - ONTARIO

OUR REFERENCE NO. 2-11-2

DECEMBER 1 9 6 2

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GEOTECHNICAL DATA SHEETS	Encls. #3 & #4

I N T R O D U C T I O N

Verbal authorization was received from Mr. Kenneth Selby, Senior Foundation Engineer of the Ontario Department of Highways, Materials and Research Division to conduct a subsoil investigation at the site of a proposed retaining wall on the south-east side of the Avenue Road - Highway #401 interchange, Leg. "A", in Toronto, Ontario.

The number and location of the boreholes were determined by the Client and marked on a drawing provided to us.

The purpose of the investigation was to reveal the subsurface conditions.

I. DESCRIPTION OF SITE AND GEOLOGY

The present four-lane highway does not meet the requirements of the modern traffic; therefore, its widening was decided upon. In view of the fact that the land is very expensive on this residential area, retaining walls will support the earth in cuts rather than to build a slope which would require more space. The present wall under which the substrata were explored will be located south of leg "A" of the Avenue Road-Highway #401 interchange.

Regarding the scarce number of the boreholes in relation to the size of the project, extrapolation of the findings is permissible only if the geological history of the site is known.

Research established the fact that practically the whole of Canada was covered with ice varying in thickness up to several thousand feet. (Ontario was overlain by the so-called Labrador Ice Shield). The glaciers advanced and retreated four times during the Pleistocene Epoch - that is roughly during the last million years. The latest cold period - which lasted about one hundred thousand years and ended probably seven thousand years ago - is generally referred to as the "Wisconsin Glacial Stage". Most of the deposits into which the foundations of structures and buildings are placed, originate from this time.

The moving glaciers picked up the loose and unconsolidated material and abraded the bedrock whenever encountered; it is estimated that glaciation removed on the average probably as much as 100 feet from the top of the Precambrian rock now known as the Canadian Shield. The material transported by glaciers may consist of 99% boulders or 99% clay, or any combination of these and/or intermediate sizes. Being deposited directly from the ice, all factions are thoroughly mixed together and the resulting unstratified, nonsorted and densely packed mixture is called a "till".

II. FIELD AND LABORATORY WORK

Field work and analysis of the findings were carried out during the period November 19th to 23rd, 1962 and comprised two boreholes at the locations shown on Enclosure #1. The positions of the test holes were set out on the site with the assistance of a drawing provided to us. The location of the centre line of the retaining wall was confirmed by a surveying crew of D.H.O. All elevations are geodetic.

The boreholes were of 6 in. diameter. They were advanced to the required sampling depths by a mounted, continuous flight power auger.

Standard penetration tests were made at frequent intervals using a 2 in. outside diameter split spoon driven into the bottom of the clean borehole over a depth of three times six = eighteen inches and applying a constant driving energy: 140 lb. hammer dropping 18 inches. (These tests provided disturbed samples from the substrata indicating their relative density and consistency.) The blows to advance the sampler six inches were counted and thus three values obtained. The first one is discarded because the soil in the vicinity of the bottom of the borehole may have been disturbed by the borings. The second and third values are added and thus the blows required for one foot penetration (=Standard Penetration Resistance) is obtained and recorded on the data sheet. In some cases when the subsoil was so hard that the heavy pounding involved the danger of breaking the sampler, the penetration resistances were computed by extrapolation from a shorter advancement. These values are also indicated on the data sheets together with the details of which they were derived.

The stratification of the subsoil in terms of depth from surface and elevation, the position and type of samples and the results of the penetration tests are recorded on geotechnical data sheets comprising Enclosures #3 to #4 inclusive.

The samples were shipped to our laboratory where they were thoroughly examined and classified. The results of this analysis together with the findings obtained and observations made in the field comprise the basis on which the geotechnical properties of the substrata are being evaluated.

III. SUBSURFACE CONDITIONS

Hard, glacial tills were encountered below a shallow layer of topsoil (sodding). The material is brown in the upper strata due to oxydisation, turning into grey at greater depths.

Three types of tills were found:

- (1) Sandy, silty clay: cohesive, impermeable and very hard.
- (2) Silt and sandy silt, in a damp condition. This is probably the aquifer stratum. It is densely packed.
- (3) Hard, clayey silt till begins at about elevation 574. This is a concrete-hard, fine grained material.

The ground water conditions were checked continuously for several days after the completion of the boreholes. The water level in Borehole #2 reached its final position the following day while in Borehole #1, it took more than two days to obtain the state of moisture equilibrium. The final positions are indicated on the geotechnical data sheets.

DOMINION SOIL INVESTIGATION LIMITED

L. S. Rolko

L. S. Rolko, P.Eng.,
Senior Soils Engineer.




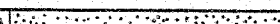


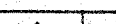

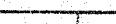

LSR/oed

Encls.

Enclosures

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE.

SOIL COMPONENTS AND GROUND WATER CONDITIONS.

												
BOULDER	COBBLE	GRAVEL		SAND			SILT	CLAY	ORGANICS	BEDROCK	GROUND WATER LEVEL	DEPTH OF CAVE-IN
		COARSE	FINE	COARSE	MEDIUM	FINE						
Ø	> 8"	3"	3/4"	4.76mm	2.0	0.42	0.074	0.002	>	NO SIZE LIMIT		
U.S. Standard Sieve Size :				No.4	No.10	No.40	No.200					

SAMPLE TYPES.

AS Auger sample
CS Sample from casing
ChS Chunk sample

RC Rock core
% Recovery
SS Split spoon sample

TP Piston, thin walled tube sample
TW Open, thin walled tube sample
WS Wash sample

SAMPLER ADVANCED BY static weight : w
" pressure : p
" tapping : t

OBSERVATIONS
MADE WHILE
CORING

Steady pressure
No pressure
Intermittent pressure

Washwater returns
Washwater lost

PENETRATION RESISTANCES.

DYNAMIC PENETRATION RESISTANCE : to drive a 2" Ø, 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

STANDARD PENETRATION RESISTANCE, -N- : to drive a 2" outside dia, split spoon sampler 1 foot into the ground, expressed in blows per foot.

EXTRAPOLATED -N- VALUE

The energy for the penetration resistances is supplied by a 140 lb. hammer falling 30 inches

SYMBOL :



322

SOIL PROPERTIES.

W % Water content
LL % Liquid limit
PL % Plastic limit
PI % Plasticity index
LI Liquidity index

γ Natural bulk density (unit weight)
e Void ratio
RD Relative density
C_v Coeff. of consolidation
m_v Coeff. of volume compressibility

k Coeff. of permeability
C Shear strength
φ Angle of int. friction
C' Cohesion
φ' Angle of int. friction

in terms of total stress
in terms of effective stress

UNDRAINED SHEAR STRENGTH.

- DERIVED FROM -

TRIAXIAL COMPRESSION TEST



UNCONFINED TEST



LABORATORY VANE TEST



FIELD



POCKET PENETROMETER TEST



Strain at failure is represented by direction of stem

20%
15% + 5%
10%

St : sensitivity = $\frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$

SOIL DESCRIPTION.

COHESIONLESS SOILS :

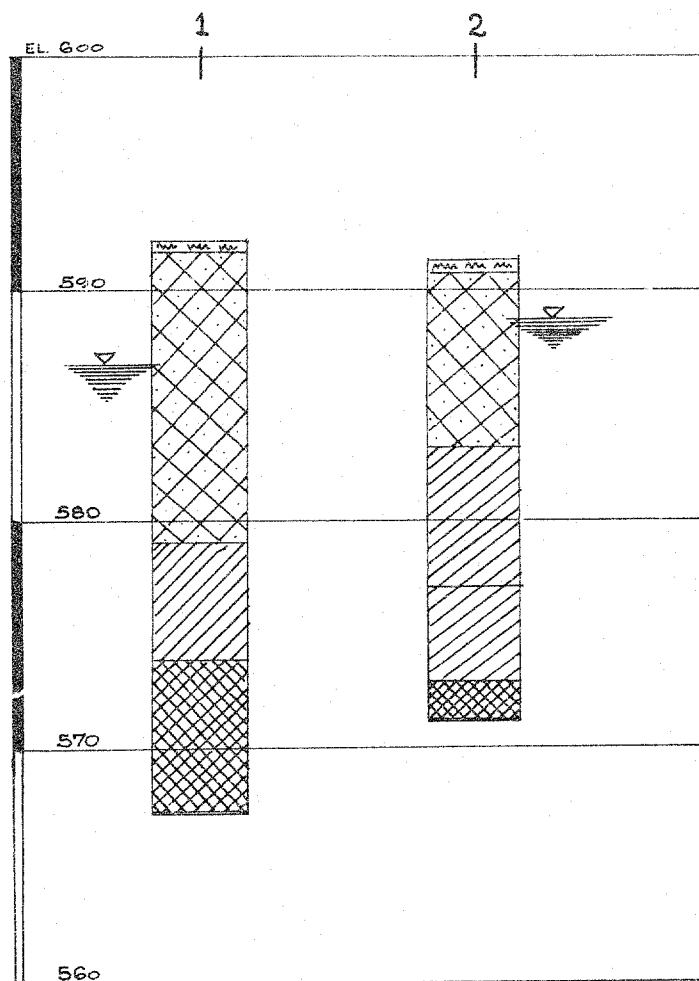
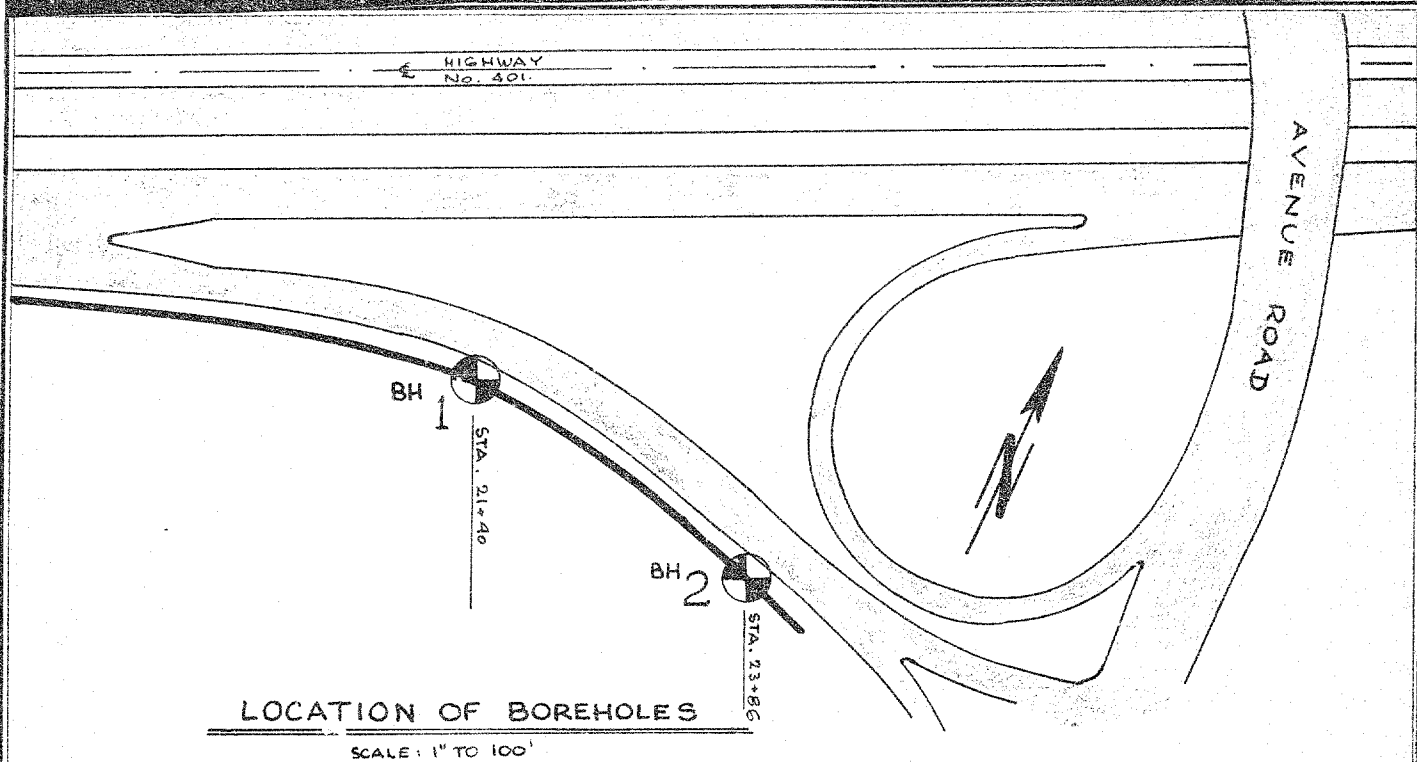
RD :

Very loose 0 - 15 %
Loose 15 - 35 %
Compact 35 - 65 %
Dense 65 - 85 %
Very dense 85 - 100 %

COHESIVE SOILS :

C lbs/sq.ft.

Very soft less than 250
Soft 250 - 500
Firm 500 - 1000
Stiff 1000 - 2000
Very stiff 2000 - 4000
Hard over 4000



LEGEND:

- TOPSOIL
- SANDY SILTY CLAY TILL
- SILT AND SANDY SILT
- HARD CLAYEY SILT TILL

SUBSURFACE PROFILE

SCALE: 1" TO 6'

GEOTECHNICAL DATA SHEET FOR BOREHOLE 1

OUR REFERENCE NO. 2-II-2

CLIENT: ONTARIO DEPARTMENT OF HIGHWAYS
 PROJECT: AVENUE ROAD - HWY 401 - RETAINING WALL
 LOCATION: SEE ENCL. 2.
 DATUM ELEVATION: 592.2

METHOD OF BORING: AUGERING
 DIAMETER OF BOREHOLE: 6"
 DATE: NOVEMBER 19, 1962.

ENCLOSURE NO. 3

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot		CONSISTENCY water content %		REMARKS
				NUMBER	TYPE	Advancement ft./sample	0	20	40	60	
592.2	0	TOPSOIL	~								
590											
587	5	DAMP HARD SANDY CLAYEY SILT TILL	X	1	SS	40					HAMMER BOUNCING
585											
	10	<i>-- brown gray</i>	X	2	SS	75					
580											
	15	GREY DAMP VERY DENSE SILT <i>slightly cemented</i>	/	3	SS	450					
575											
	20	GREY HARD CLAYEY SILT TILL	X	4	SS	150					
570											
	25			5	SS	110					
565											
	30										

DETAILS OF
EXTRAPOLATED
PENETRATION
RESISTANCES:

SA #	BLOWS
1	15/6" 25/6"
2	20/6" 30/6" 15/2"
3	75/2"
4	30/6" 65/5"
5	36/6" 50/6" 20/2"

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: MB

CH'D: *Rosen*

GEOTECHNICAL DATA SHEET FOR BOREHOLE 2

OUR REFERENCE NO. 2-11-2

CLIENT: ONTARIO DEPARTMENT OF HIGHWAYS
 PROJECT: AVENUE RD - HWY 401 RETAINING WALL
 LOCATION: SEE ENCL. 2.
 DATUM ELEVATION: 591.2

METHOD OF BORING: AUGERING
 DIAMETER OF BOREHOLE: 6"
 DATE: NOVEMBER 19, 1962.

ENCLOSURE NO. 4

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot						CONSISTENCY water content %			REMARKS
				NUMBER	TYPE	4-1/2 in. or less diameter of sampler	0	20	40	60	80	100	PL	W	LI	
591.2	0	TOPSOIL	MSB													
590		BROWN DAMP HARD SANDY CLAYEY SILT TILL	MSB	1	SS	61										
585	5															
580	10	BROWN DAMP VERY DENSE SANDY SILT slightly cemented	MSB	2	SS	146										
575	15	GREY DAMP VERY DENSE SANDY SILT	MSB	3	SS	150										
570	20	GREY HARD CLAYEY SILT	MSB	4	SS	130										
565	25															

DETAILS OF
EXTRAPOLATED
PENETRATION
RESISTANCES:

SA²: BLOWS:

2 27/6"
73/6"
3 75/6"
4 35/6"
65/6"