

MEMORANDUM

To: Mr. A. M. Teye,
Bridge Engineer,
Bridge Division.

FROM: Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

attention: Mr. S. McCorbie

DATE: September 23, 1964

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Proposed Structure at C.N.R. Crossing
and Proposed Hwy. 122 (Line 5)
Lot 30 and 31, Con. II S.D.S., Twp. of
Toronto, County of Peel, District No. 6
W.J. 64-F-83 -- W.P. 233-64

It is proposed to construct a structure for either an overhead or a subway, at the junction of proposed Hwy. 122 and C.N.R. crossing, at the above-mentioned location. A foundation investigation at this site was requested by the Bridge Location Engineer in a memo dated August 28, 1964.

An investigation consisting of five sampled boreholes and five dynamic cone penetration tests adjacent to each borehole was undertaken on September 9, 1964, in order to determine the subsoil conditions and recommend the type of footings. Attached to this report is a drawing (64-F-83A) showing the locations of the boreholes, together with the inferred stratigraphy of the subsoil. Elevations of the boreholes were supplied by the D.H.O. survey crew.

cont'd. /2 ...

Subsoil conditions are uniform and favourable. A layer of clayey silt, some sand, gravel and organic material overlies shale bedrock. The thickness of this overburden is 4 ft. to 7 ft. Bedrock was investigated down to elevation 299. The respective properties of the individual layers are given on the borelogs appended to this report.

The proposed crossing will be either an overhead or a subway. In either case, spread footings are recommended. A safe load of 10 T.S.F. can be applied to footings founded on sound shale bedrock. It is recommended to remove all loose and weathered rock at footing elevations, before placing the footings. Adequate frost protection should be provided.

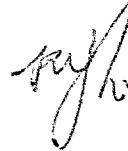
Ground water level was encountered between elevations 318 and 320, during the period of this investigation. No major dewatering problems are anticipated during the construction, due to the impermeability of the shale.

No slope stability problems are expected to occur for fill material, in case of an overhead construction. Standard 2:1 slopes should be adopted. All loose and compressible organic material should be removed before placing the fill.

The field investigation was carried out from September 9, 1964 to September 14, 1964, under the supervision of Mr. B. Ghadiali, Project Foundation Engineer, who also interpreted the findings and prepared this report.

cont'd. /3 ...

We trust that the above information will be sufficient for your future design work. However, if you have any questions you would like to discuss, please feel free to call on our Office.



A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

BMG/MdeF
Attach.

cc: Messrs. A. M. Towe (2)
H. A. Tregaskes
H. D. McMillan
G. K. Hunter (2)
C. Fraser
T. J. Kovich
A. Watt

Foundations Office
Gen. Files

APPENDIX I.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 64-F-83

LOCATION C.N.R. Crossing and Hwy. 122

ORIGINATED BY B.M.G.

W.P. 233-64

BORING DATE Sept. 9, 1964.

COMPILED BY

DATUM G.S.C.

BOREHOLE TYPE Washboring using BX Casing.

CHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	WATER CONTENT %			
322.7	Gr. Surface											
0.0	Road Fill											
1'-3"	Clayey silt, trace of fine sand, gravel & organics. Compact.		1	SS	14	320						
	D. brown.		2	SS	8							
314.7												
3'-0"	Carbonaceous Shale Bedrock		3	RC	-							
	Grey		4	RC	-	310						
305.0												
17'-9"	End of borehole.					300						

Refusal

W.L. at El. 318.0

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 64-P-83

LOCATION C.N.R. Crossing and Hwy. 122

ORIGINATED BY B.M.G.

W. P. 233-64

BORING DATE Sept. 10, 1964.

COMPILED BY

DATUM G.S.C.

BOREHOLE TYPE Washboring using BX Casing.

CHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _p WATER CONTENT ——— w	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.			
321.9	Gr. Surface.									
0'-6"	Clayey silt, trace of sand, organics and shale fragments. Soft to stiff. D. brown, black and grey.		1	SS	4	320				at El. 319.8
314.9			2	SS	12					
7'-0"	Carbonaceous Shale Bedrock		3	RC	-	310	Refusal			
	Grey		4	RC	-					
305.2										
16'-9"	End of borehole.					300				

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 64-F-83 LOCATION C.N.R. Crossing and Hwy. 122 ORIGINATED BY B.M.G.
W.P. 233-64 BORING DATE Sept. 14, 1964. COMPILED BY _____
DATUM G.S.C. BOREHOLE TYPE Washboring using BX Casing. CHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— W _L PLASTIC LIMIT ——— W _P WATER CONTENT ——— W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT 20 40 60 80 100					W _P W _L ----- WATER CONTENT %			
							SHEAR STRENGTH P.S.F.								
320.4	Gr. Surface					320									
0'-6"	Topsoil														
	Sand, gravel up to 2" Ø, clayey silt and organics.														
316.4	Brown and grey.		1	SS	5 for 6"										
4'-0"			2	RC	-										
			3	RC	-										
	Carbonaceous Shale Bedrock					310									
	Grey.		4	RC	-										
			5	RC	-										
298.7						300									
21'-8"	End of borehole.														

W.L.
at el. 320.2

Refusal

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 64-F-83 LOCATION C.N.R. Crossing and Hwy. 122 ORIGINATED BY B.M.G.
 W.P. 233-64 BORING DATE Sept. 14, 1964. COMPILED BY _____
 DATUM G.S.C. BOREHOLE TYPE Washboring using BX Casing. CHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— WL PLASTIC LIMIT ——— wp WATER CONTENT ——— w			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT 20 40 60 80 100					wP w WL — — — — — 10 20 30				
							SHEAR STRENGTH P.S.F.					WATER CONTENT %				
323.1	Gr. Surface															
	Topsoil															
1'-0"	Clayey silt, sand gravel up to 2" Ø & organics.		1	SS	6	320									Sa-41% Si-24% Gr-20% Cl-15%	
317.5	Loose. D. brown.															
5'-7"	Carbonaceous Shale bedrock		2	RC	-											
	Grey.		3	RC	-											
312.4																
10'-8"	End of borehole.					310										

50 Blows for 7"
Refusal

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 64-R-83

LOCATION C.N.R. Crossing & Hwy. 122

ORIGINATED BY B.M.G.

W.P. 233-64

BORING DATE Sept. 15, 1964.

COMPILED BY _____

DATUM G.S.C.

BOREHOLE TYPE Washboring using BX Casing.

CHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F.	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W WP — W — WL WATER CONTENT % 10 20 30	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					
324.3	Gr. Surface									
	Topsoil									
1'-0"	Clay, silt, trace of sand and organics. Stiff to v. stiff.		1	SS	15	320				
	Brown.									
317.6										
6'-8"	Carbonaceous Shale Bedrock		2	RC	-					
	Grey.									
			3	RC	-					
306.8										
17'-6"	End of borehole.									

70 Blows for 7" Refusal

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
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_t	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
$\bar{\sigma}$	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

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Eng.,
Room 107, Lab. Bldg.

FROM: Bridge Division,
Downsview, Ontario.

DATE: August 28, 1964.

OUR FILE REF.

IN REPLY TO


64-F-83

SUBJECT: C.N.R. Structure,
W.P. 233-64, Site # 25-224,
Hwy. # 122, District #6,
($\frac{1}{2}$ Mile North of Hwy. # 2.)

Please find enclosed marked print # E-4259-1 laying out the probable location of the above mentioned structure. On inspection of the drawing you will see that two proposals are submitted, an overhead and a subway, coloured differently. The final design will be settled shortly.

Would you please arrange to have a soil investigation of the area of sufficient magnitude to enable us design either one of the structures.

JR/jf



J. Robertson,
for J. B. Curtis,
Regional Bridge Location Engineer.

C.N.R.

MR

P.A. WEBBER

365-3582

Mr. John Curtis,
Bridge Location Engineer,
Bridge Office.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

October 22, 1964.

Stability of Approach Embankment

Proposed Structure at C.N.R. Crossing
and Proposed Hwy. 122 (Line 5)
Lot 30 and 31, Con. II S.D.S., Twp. of
Toronto, County of Peel, District No. 6
W.J. 64-F-83 -- W.P. 233-64

This is to confirm our verbal discussion on the stability condition of approach fills of the above project. The subsoil condition is favourable and does not present any problem provided the organic material be removed as stated in the report. The stability of the fill itself depends on the height of the fill, the material used for the fill and the compaction achieved. All these data are not presently known.

The 2:1 slope quoted in the report is of course a good practice followed by the Department, to provide for general conditions and surface sloughing. For a moderately high embankment constructed of well compacted material, there is no reason why a steeper slope say, $1\frac{1}{2}:1$ cannot be used.

RYL/PB


A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

27

3

7.

John Curtis

Aug 182 CNR Subway.

65-F-36

Cut in shale bedrock

64-F-83

W.L. 10' above

H = 14'

5' into shale.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division.

From: Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

Attention: Mr. S. McCombie

Date: February 28, 1967

Our File Ref.

In Reply To:

MAR - 8 1967

SUBJECT:

FOUNDATION INVESTIGATION REPORT
On the Site of Bridge #29, Hwy. #401
and Richview Expressway under
Renforth Drive, District #6 (Toronto)
Contract #6 (Red)

W.J. 66-F-104

--

W.P. 399-65

Attached, we are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above structure 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/MdeF
Attach.

A. G. Stermac
A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
G. K. Hunter (2)
F. Allen
W. S. Melinyshyn
T. J. Kovich
B. A. Singh
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-

FOUNDATION INVESTIGATION REPORT

On the Site of Bridge #29, Hwy. #401
and Richview Expressway under
Renforth Drive, District #6 (Toronto)
Contract #6 (Red)

W.J. 66-F-104 -- W.P. 399-64

1. INTRODUCTION:

In a memo, dated November 24, 1966, the Regional Bridge Location Engineer, Mr. W. S. Melinyshyn, requested a foundation investigation at the site of the proposed crossing of Hwy. #401 and Richview Expressway under Renforth Drive. The structure, numbered Bridge #29, is part of the proposed Hwy. #401, Hwy. #27 and Richview Expressway interchange, and is covered by Contract #6 (Red).

Accordingly, Dominion Soil Investigation Ltd. was retained by our Section to carry out a field investigation and subsequent laboratory testing, in order to determine the existing soil conditions.

Presented in this report are the results of this investigation, together with the evaluation of the soil properties and recommendations pertaining to the foundations.

2. DESCRIPTION OF THE SITE:

The site of the proposed bridge is occupied by the existing Hwy. #401 and an abandoned old road (Indian Lane) in the north-south direction. The immediate vicinity is generally flat, residential area and farmland. The site under investigation belongs to the physiographic region known as the "South Slope". The terrain at this portion of the region consists of ground moraines with irregular knolls and hollows.

3. FIELD AND LABORATORY INVESTIGATION PROCEDURE:

Some eight boreholes and adjacent to the holes, eight dynamic cone penetration, tests were carried out during the course of the field investigation.

The borings were performed by means of a Pennsylvania continuous flight auger. 2-inch O.D. split-spoon samplers were used to recover soil samples. The number of hammer blows required to advance the sampler one foot into the soil was recorded as Standard Penetration 'N' values. A driving energy of 350 ft.-lb./blow was utilized to lower the sampler.

The locations and elevations of the boreholes, together with the estimated soil profile projected to the centre-line of the proposed bridge, are shown on Drawing #66-F-104A.

Soil specimens were visually examined and identified immediately after recovery and again, upon arriving in the laboratory. Laboratory tests of natural moisture content, Atterberg limits and grain-size analyses were performed on representative samples.

The results of the field and laboratory tests are plotted on the attached geotechnical data sheets and on the grain-size distribution forms.

4. SOIL CONDITIONS:

4.1) Overburden:

The subsoils within the area investigated, consist of layers of fine sand and silt, gravelly sand and clayey silt, underlain by shale bedrock.

The upper stratum in each borehole, within a depth of 5 - 15 ft., was identified to be brown to grey fine sand and silt. The uppermost portion of this layer contains a fair percent of clay particles. The relative density of this material increases with depth, being loose to compact within the higher elevations and very dense below. Some stratification of the deposit was observed in the samples.

cont'd. /3 ...

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

4.1) Overburden: (cont'd.) ...

Underlying the fine sand and silt, a much coarser deposit of gravelly sand with some silt and traces of clay was found. This material is believed to belong to the glacial tills; hence, its heterogeneous nature and very dense relative density. The penetration 'N' values were found to range from approx. 50 to above 100 blows/ft. Samples tested within the layer indicated a gravel content of 21 - 40% by weight.

Underlying the gravelly sand at el. 502 - 504 ft., a clayey silt with some sand and gravel (glacial till) was revealed in the borings. The consistency of the layer is hard, corresponding to penetration 'N' values of 93 to much above 100 blows/ft. The soil samples exhibited low plasticity, the values of plastic limits ranging from 19% to 22% and those of liquid limits from 28% to 38%. The moisture contents of the specimens fell below the plastic limits (average $W = 12\%$), confirming that the soil is overconsolidated.

4.2) Bedrock:

Grey shale bedrock underlies the glacial overburden around el. 490 - 497 ft. The upper 10 - 20 ft. of the bedrock was observed to be very soft, broken textured and weathered. The sound portion of the bedrock was found in one boring only (B.H. #2) at el. 478.4 ft., below which elevation the drilling yielded 75% recovery in the diamond core barrel.

4.3) Groundwater:

The groundwater level was established in the boreholes between el. 515 - 522 ft., during the time of the field investigation, corresponding to depths of 6 - 10 ft. below existing ground surface.

cont'd. /4 ...

5. DISCUSSION AND RECOMMENDATIONS:

Bridge #29 is proposed to be multiple span structure, to carry Renforth Drive over Hwy. #27, Richview Expressway and three ramps.

The exact design grades of the proposed crossing are not yet known. According to the information received from the Regional Bridge Location Section, however, the design grade of Hwy. #401 may be assumed to be around el. 513 ft. and that of Renforth Drive, around el. 533 ft.

The subsoil appears to possess sufficient strength to support the bridge on spread footings at shallow depths. Footings should be placed approx. four ft. below finished grade of Hwy. #401. A safe design load of four t.s.f. may be utilized on the footings.

It was pointed out that the proposed grades are not final, and they may be subject to modifications. In the case of selecting higher design grades, the footings may also be raised. The highest elevations above which the bases of the footings should not be placed, are listed as follows:

Footings of the north abutment	should not be higher than el. 524 ft.
" " " south "	" " " " " el. 526 ft.
" -s " " northern two piers	" " " " " el. 518 ft.
" -s " " rest of the piers	" " " " " el. 521 - 522 ft.

At or below the listed elevations, a safe bearing capacity of four t.s.f. may also be assumed.

Dewatering problems may be encountered in the footing excavations below the groundwater table, since the granular sand and silt deposit is susceptible to conditions of unbalanced hydrostatic head. A dewatering scheme, therefore, will likely be necessary.

No instability is foreseen for approach fills or cuts with slopes of 2 horizontal to 1 vertical.

cont'd. /5 ...

6. SUMMARY:

A foundation investigation at the site of Bridge #29, Hwy. #401 and Richview Expressway under Renforth Drive, is reported.

The hard and very dense glacial till subsoil exhibits sufficient strength for spread footing type foundations. The highest elevations above which the footings should not be placed are given under Section No. 5. Safe design loads of 4 t.s.f. are recommended on the footings.

A dewatering scheme for the footing excavations will likely be required.

7. MISCELLANEOUS:

The field work performed during the period January 16 - February 14, 1967, together with the laboratory testing, were undertaken by Dominion Soil Investigation Ltd., who also owned the equipment. This report was prepared by Mr. A. K. Barsvary, Senior Foundation Engineer, D.H.O., and reviewed by Mr. K. G. Selby, Supervising Foundation Engineer, D.H.O.

February 1967

APPENDIX I.

GEOTECHNICAL DATA SHEET FOR BOREHOLE . . .

OUR REFERENCE NO. 7-1-14
Your Ref. No. W.P. 201-62-2

CLIENT: D. H.O.

PROJECT: HWY. 27 RICHVIEW EXPR. WAY & RENFORTH DR. INTERCHANGE

LOCATION: 867,415 N ; 975,740 E.

DATUM ELEVATION: G.S.C.

METHOD OF BORING: AUGERING

DIAMETER OF BOREHOLE: 4"

DATE: FEB. 13, 1967

ENCLOSURE NO.

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot				CONSISTENCY water content %		REMARKS
				NUMBER	TYPE	N Advancement of Sampler	2.0	4.0	8.0	16.0	PL	W	
528.3	0	GROUND SURFACE											
525	5	Very Dense CLAYEY above El. 525 ft.		1	S.S.	59							
520	10	Brown to Grey SILT with some fine sand and a trace of clay.		2	S.S.	89							
516.3	12.0			3	S.S.	139							
515	15	Very Dense Grey GRAVELLY SAND with some silt		4	S.S.	78/6							
510	20			5	S.S.	94							
505	23.0			6	S.S.	70/3							
500	30	Hard, Grey CLAYEY SILT with some sand and a trace of gravel and embedded shale fragments.		7	S.S.	100/25							
495	35			8	S.S.	100/2							
490	38.0			9	S.S.	90/2							
485	45	Grey, Soft WEATHERED SHALE		10	S.S.	100/2							
480	50	END OF BOREHOLE		11	S.S.	80/0							
475													

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: D. A. M. CHD

972

GEOTECHNICAL DATA SHEET FOR BOREHOLE ...2...

OUR REFERENCE NO. 7-1-14
Your Ref. No. W.P. 201-62-2

CLIENT: D. H. O.

PROJECT: HWY. 27, RICHVIEW EXPR. WAY & RENFORTH DR. INTERCHANGE

METHOD OF BORING AUGERING & CORING

DIAMETER OF BOREHOLE 4"

ENCLOSURE NO.

LOCATION: 867, 322 N; 975, 712 E.

DATE: FEB. 10, 1967

DATUM ELEVATION: G. S. C.

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %			REMARKS
				NUMBER	TYPE	N Advancement of Sampler	2,0	4,0	6,0	8,0	100	PL	W	LI	
523.4	0	GROUND SURFACE													
520	5	Very Dense Brown SILT with some fine sand and a trace of clay. (stratified)		1	S.S.	78									
				2	S.S.	61/6"									
516.4	7.0	Very Dense Multicoloured GRAVELLY SAND with some silt													Gr. 32 % ; Ss. 45 % Si, Cl. 23 %
515	10			3	S.S.	100/6"									
510	15			4	S.S.	76									
505	18.4	Hard, Grey CLAYEY SILT with some sand embedded gravel and random oriented shale fragments. (GLACIAL TILL)		5	S.S.	133/11"									Gr. 21 % ; Ss. 47 % Si, Cl. 32 %
500	25			6	S.S.	100/3 1/2"									
495	28.5	Grey, Soft WEATHERED SHALE		7	S.S.	100/11"									
490	35			8	S.S.	100/11 1/2"									
485	40			9	S.S.	100/11"									
480	45			10	S.S.	100/11"									
478.4		SOUND SHALE BEDROCK		11	R.C.	75 %									
475	49.0	END OF BOREHOLE													
470															

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: D. A. M. CHD.

GEOTECHNICAL DATA SHEET FOR BOREHOLE . 3 . . .

OUR REFERENCE NO. 7-1-14
Your Ref. No. W.P. 201-62-2

CLIENT: D. H. O.
PROJECT: HWY. 27, RICHVIEW EXPR. WAY & RENFORTH DR. INTERCHANGE
LOCATION: 867, 240 N.; 975, 800 E.
DATUM ELEVATION: G. S. C.

METHOD OF BORING: AUGERING
DIAMETER OF BOREHOLE: 4"
DATE: FEB. 9, 1967.

ENCLOSURE NO.

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %		REMARKS	
				NUMBER	TYPE	No. of Advancement of Sampler	20	40	60	80	100	PL	W		LI
522.2	0	GROUND SURFACE													
520		Dense, Brown FINE SAND and SILT with a trace of clay.		1	SS	53									<div style="text-align: center;"> <p>W.L. El. 515' Feb. 10, 1967</p> </div>
517.7	4.5	Very Dense Brown GRAVELLY SAND with some silt.		2	SS	50/3"									
515															
513.2	9.0	Dense, Grey FINE SANDY SILT with a trace of clay (stratified)		3	SS	45									
510	12.0														
	15	Very Dense Grey GRAVELLY SAND with some silt and a trace of clay		4	SS	67									
505															
503.2	19.0	Hard, Grey CLAYEY SILT with some embedded gravel and random oriented shale fragments (GLACIAL TILL)		5	SS	93									
500															
498.2	26.0			6	SS	100/3"									
495															
	30	Grey, Soft WEATHERED SHALE		7	SS	100/1/2"									
490															
	35			8	SS	100/2"									
485															
	40			9	SS	100/1/2"									
480															
477.2	45	END OF BOREHOLE		10	SS	100/NP									
475															
	50														

VERTICAL SCALE 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE V. G. H. CHD.

GEOTECHNICAL DATA SHEET FOR BOREHOLE . . . 4 . . .

OUR REFERENCE NO. 7-1-14
Your Ref. No. W.P. 201-62-2

CLIENT: D. H. O.

PROJECT: HWY. 27, RICHVIEW EXPR. WAY & RENFORTH DR. INTERCHANGE

LOCATION: 8 67, 140 N; 975, 790 E

DATUM: ELEVATION: G. S. C.

METHOD OF BORING: AUGERING

DIAMETER OF BOREHOLE: 4"

DATE: FEB. 8, 1967.

ENCLOSURE NO.

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE					CONSISTENCY				REMARKS			
				NUMBER	TYPE	N ₆₀ or Adjusted Value of S _N	blows per foot					water content %							
							20 40 60 80 100					PL W LI							
							SHEAR STRENGTH					lbs. sq. ft.				1.0 2.0 3.0 4.0			
526.0	0	GROUND SURFACE																	
		Compact to Dense Brown FINE SANDY SILT with some clay. (stratified)		1	SS	28										NON PLASTIC			
520	5			2	SS	57										Sa. 25 % ; Si. 59 % Cl. 16 %			
519.0	7.0															W. L. E! 519.5' Feb. 9, 1967			
		Very Dense Brown to Multicoloured GRAVELLY SAND with some silt and a trace of clay.		3	SS	121													
515	10																		
				4	SS	102										Gr. 28 % ; Sa. 50 % Si. Cl. 22 %			
510	15																		
				5	SS	100/3"													
505	21.0																		
		Hard, Grey CLAYEY SILT with some sand, embedded fine gravel, random oriented shale fragments and occasional zones of weathered shale.		6	SS	100/4"													
500	25																		
				7	SS	117										Gr. 7 % ; Sa. 28 % Si. 48 % ; Cl. 17 %			
495	30	(GLACIAL TILL)																	
494.0	32.0																		
		Grey, Soft WEATHERED SHALES		8	SS	100/1/2"													
490	35																		
				9	SS	100/2"													
485	40																		
481.2	45	END OF BOREHOLE																	
480																			
	50																		

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: V. G. H. CHD

GEOTECHNICAL DATA SHEET FOR BOREHOLE 5

OUR REFERENCE NO. 7-1-14
Your Ref. No. W. P. 201-62-2

CLIENT: D. H. O.
PROJECT: HWY. 27, RICHVIEW EXPR. WAY & RENFORTH DR. INTERCHANGE
LOCATION: 8 67, 080 N.; 9 75, 865 E.
DATUM ELEVATION: G. S. C.

METHOD OF BORING: AUGERING
DIAMETER OF BOREHOLE: 4"
DATE: FEB. 6-7, 1967.

ENCLOSURE NO.

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot				CONSISTENCY water content %		REMARKS
				NUMBER	TYPE	ft. or Advancement of Sampler	20	40	60	80	100	PL	
527.3	0	GROUND SURFACE											
525		Compact, Brown CLAYEY SILT with some sand and organic matter. (FILL)		1	SS	18							
522.8	4.5	Very Dense Brown FINE SAND and SILT. (stratified)		2	SS	88							
520	10												
516.3	11.0	Very Dense Multicoloured GRAVELLY SAND with some silt.		3	SS	53							
515	15	SILT SEAM and a trace of clay		4	SS	62							
510	20			5	SS	70							
505	23.0	Hard, Grey CLAYEY SILT with some sand, embedded gravel and shale fragments (GLACIAL TILL)		6	SS	141							
504.3													
500													
497.3	30	Grey, Soft WEATHERED SHALE		7	SS	70/6"							
495													
490	35			8	SS	100/3"							
487.8	39.5	END OF BOREHOLE											
485	40												
	45												

W.L. El. 521.8
Feb. 8, 1967

GEOTECHNICAL DATA SHEET FOR BOREHOLE . . . 6 . . .

OUR REFERENCE NO. 7-1-14
Your Ref. No. W.P. 201-62-2

CLIENT: D. H. O.

PROJECT: HWY. 27, RICHVIEW EXPR. WAY & RENFORTH DR INTERCHANGE

LOCATION: 867,000 N; 975,852 E.

DATUM ELEVATION: G. S. C.

METHOD OF BORING: AUGERING

DIAMETER OF BOREHOLE: 4"

DATE: JAN. 26-27, 1967.

ENCLOSURE NO.

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot		CONSISTENCY water content %		REMARKS	
				NUMBER	TYPE	Advance- ment of Sampler	20	40	60	80		100
GROUND SURFACE												
528.5	0	Dense to Very Dense CLAYEY above El. 523 ft.	c	1	SS	34	3	15	45	85	55	O H
525	5	Brown SILT with some fine sand and a trace of clay. (stratified)		2	SS	37						
520	10	Very Dense Brown to Multicoloured GRAVEL and SAND with some silt and a trace of clay.	c	3	SS	62	7-11	15	45	85	55	So. 11% ; Si. 80% Cl. 9%
515	13.5			4	SS	70/6"						
510	20	Hard, Grey CLAYEY SILT with some sand, fine gravel and random oriented shale fragments. occasional zones of weathered shale (GLACIAL TILL)	c	5	SS	100/6"	20	15	45	85	55	Gr. 40% ; Sa. 45% Si. Cl. 15%
505	25			6	SS	110						
502.2	26.3	Grey, Soft WEATHERED SHALE	c	7	SS	80/4"	30	15	45	85	55	O
500	30			8	SS	80/3"						
495	35	Grey, Soft WEATHERED SHALE	c	9	SS	100/3 1/2"	40	15	45	85	55	O
490	38.5			10	SS	100/1 1/2"						
485	45	END OF BOREHOLE	c	11	SS	100/2 1/2"	30	15	45	85	55	O
480	50											
478.3	50.2											
475												

7

W. F. 201-62-2
CLIENT: D. H. O.

PROJECT: HWY. 27 RICHVIEW

PROJECT: HWY 7 ETL HIGHWAY EXIT RAMP & RAMP GRADUALLY INCREASED

METHOD OF BORING AUGERING

DIAMETER OF BOREHOLE

DATE: JAN. 30 - 31, 1967

ENCLOSURE NO

LOCATION 866, 952 N.; 975, 915 E.

DATUM ELEVATION: G. S. C.

W.L. E1 521.7
FEB 8, 1967

DOMINION SOIL INVESTIGATION LIMITED

MADE: V. G. H. CHO

GEOTECHNICAL DATA SHEET FOR BOREHOLE . . . 8 . . .

OUR REFERENCE NO. 7-1-14
Your Ref. No. W. P. 201-62-2

CLIENT: D. H. O.

PROJECT: HWY. 27 RICHVIEW EXPR. WAY & RENFORTH DR. INTERCHANGE

METHOD OF BORING: AUGERING

DIAMETER OF BOREHOLE: 4"

ENCLOSURE NO.

LOCATION: 866, 870 N.; 975, 885 E.

DATE: FEB. 6-7, 1967.

DATUM ELEVATION: G. S. C.

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot				CONSISTENCY water content %				REMARKS
				NUMBER	TYPE	Size or Admixture of Samples	20	40	60	80	100	PL	W	LI	
531.7	0	GROUND SURFACE													
530		Loose some CLAY to above El. 528 ft.		1	SS	8									
525	5	Dense Brown SILT with some fine sand and a trace of clay (stratified)		2	SS	42									So. 10 % ; Si. 93 % Cl. 7 %
520	10			3	SS	77									W. L. El. 520.7 Feb. 8, 1967
516.5	15.2			4	SS	94									
515		Very Dense Multicoloured GRAVELLY SAND with some silt and a trace of clay.		5	SS	100/4 1/2									Gr. 30 % ; Sa. 50 % Si, Cl. 20 %
510	20			6	SS	100/4 1/2									
505	25			7	SS	100/3									
504.7	27.0	Hard, Grey CLAYEY SILT with some fine gravel and random oriented Shale Fragments. (GLACIAL TILL)		8	SS	100/3									
495	35			9	SS	100/2									
493.7	39.0			10	SS	100/1 1/2									
490	40	Grey, Soft WEATHERED SHALE		11	SS	60/NP									
485	45			12	SS	60/NP									
480	50														
55		END OF BOREHOLE													

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

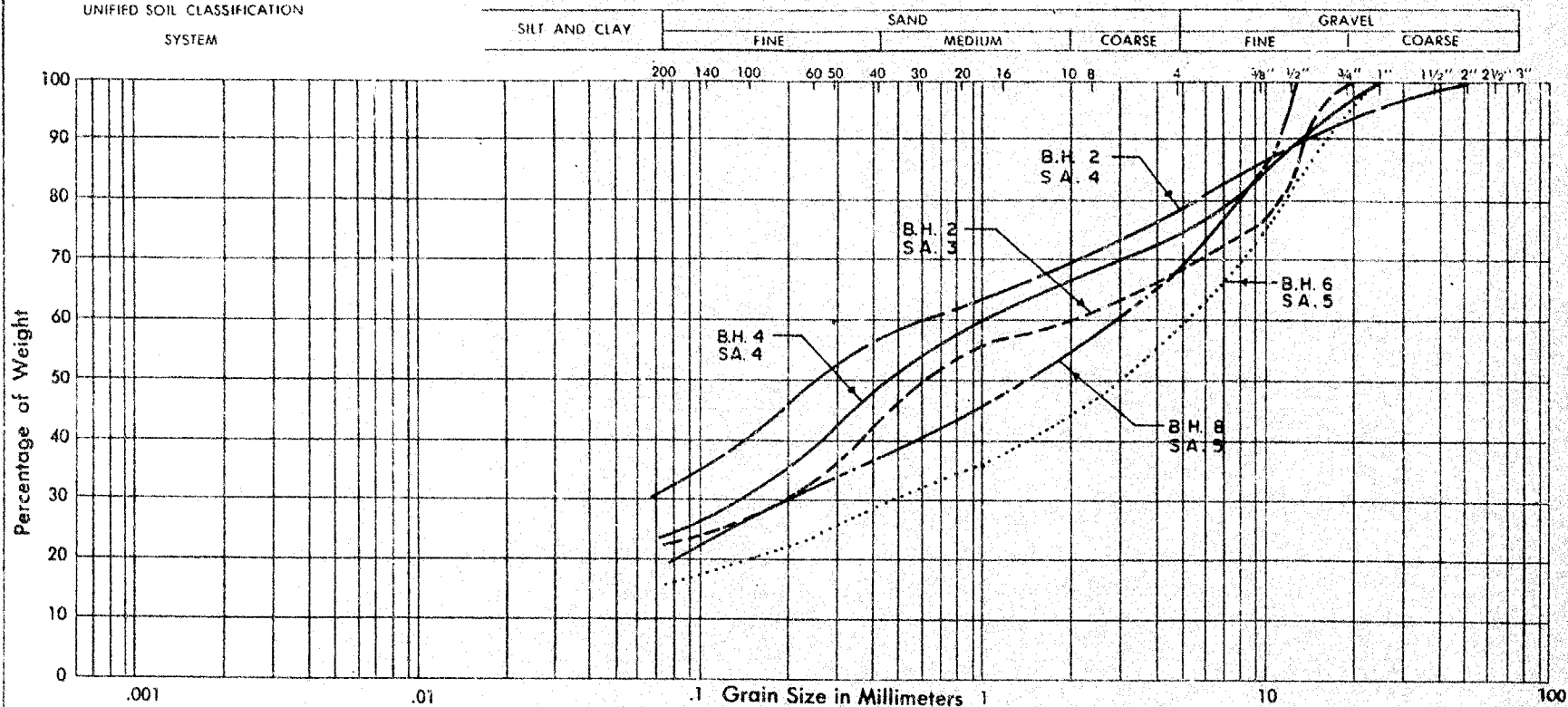
MADE: V. G. H. CHD

DOMINION SOIL INVESTIGATION LIMITED

GRAIN SIZE DISTRIBUTION

OUR REFERENCE NO. 7-1-14
Your Ref. W.P. 201-62-2

UNIFIED SOIL CLASSIFICATION
SYSTEM



PROJECT: HWY. 27, RICHVIEW EXPR.WAY 8
RENFORTH DR. INTERCHANGE
LOCATION: BRIDGE No. 29
BOREHOLE NO.: 2, 2, 4, 6, 8
SAMPLE NO.: 3, 4, 4, 5, 5
DEPTH OF SAMPLE: _____
ELEVATION OF SAMPLE: _____

COEFFICIENT OF UNIFORMITY
COEFFICIENT OF CURVATURE

Classification of Sample and Group Symbol:

GRAVELLY SAND with some SILT

PLASTIC PROPERTIES:

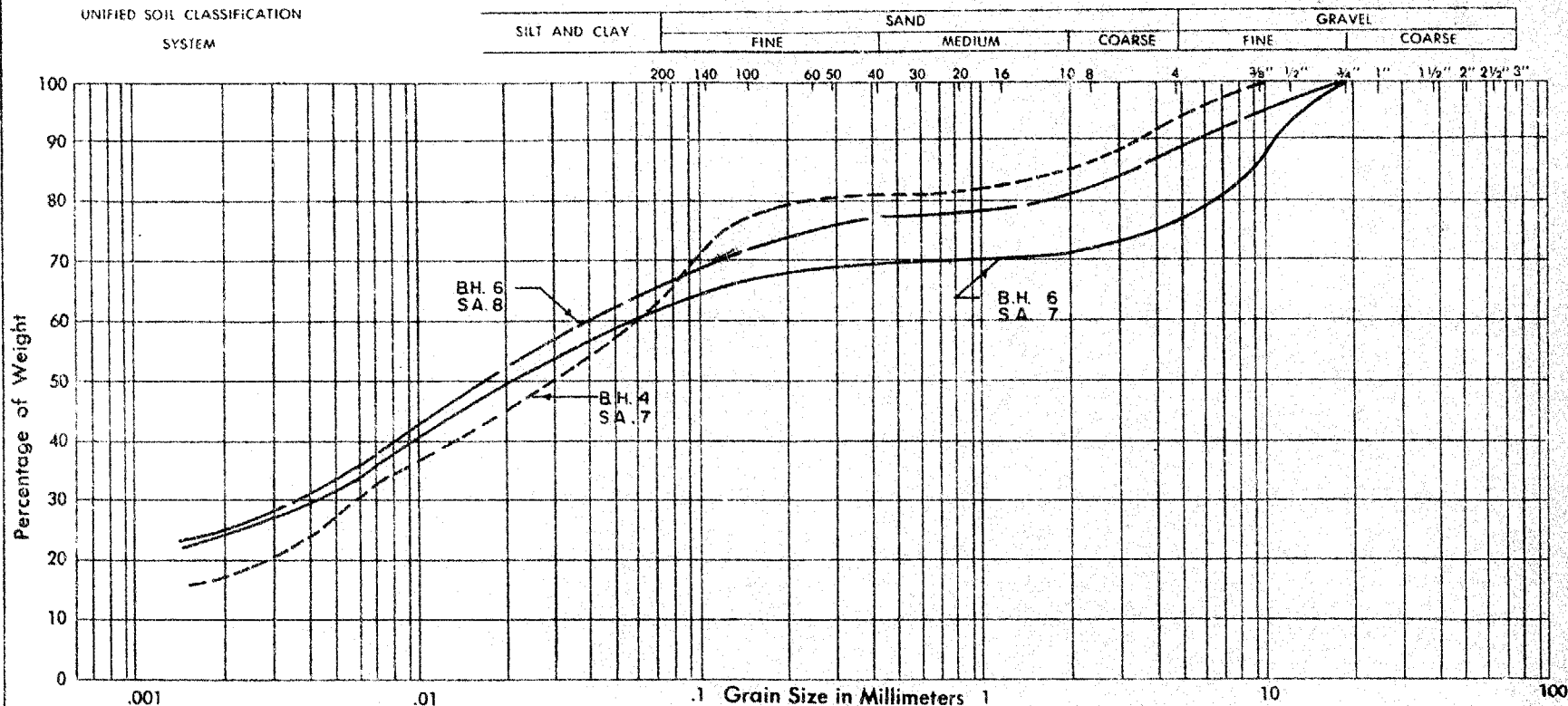
LIQUID LIMITED % =
PLASTIC LIMIT % = Non
PLASTICITY INDEX % = Plastic
MOISTURE CONTENT % =
ACTIVITY % =

Enclosure No.

DOMINION SOIL INVESTIGATION LIMITED

GRAIN SIZE DISTRIBUTION

OUR REFERENCE NO. 7 - 1 - 14
Your Ref. W.P. 201-62-2



PROJECT: HWY. 27, RICHVIEW EXPR. WAY & RENFORTH DR. INTERCHANGE

LOCATION: BRIDGE No 29

BOREHOLE NO.: 4 6 6

SAMPLE NO.: 7 7 8

DEPTH OF SAMPLE: —

ELEVATION OF SAMPLE: —

COEFFICIENT OF UNIFORMITY

COEFFICIENT OF CURVATURE

PLASTIC PROPERTIES:

LIQUID LIMITED % = 29 - 31

PLASTIC LIMIT % = 19 - 21

PLASTICITY INDEX % = 10

MOISTURE CONTENT % = 10 - 12

ACTIVITY —

Classification of Sample and Group Symbol:

CLAYEY SILT with some SAND and a
trace to some GRAVEL

Enclosure No.

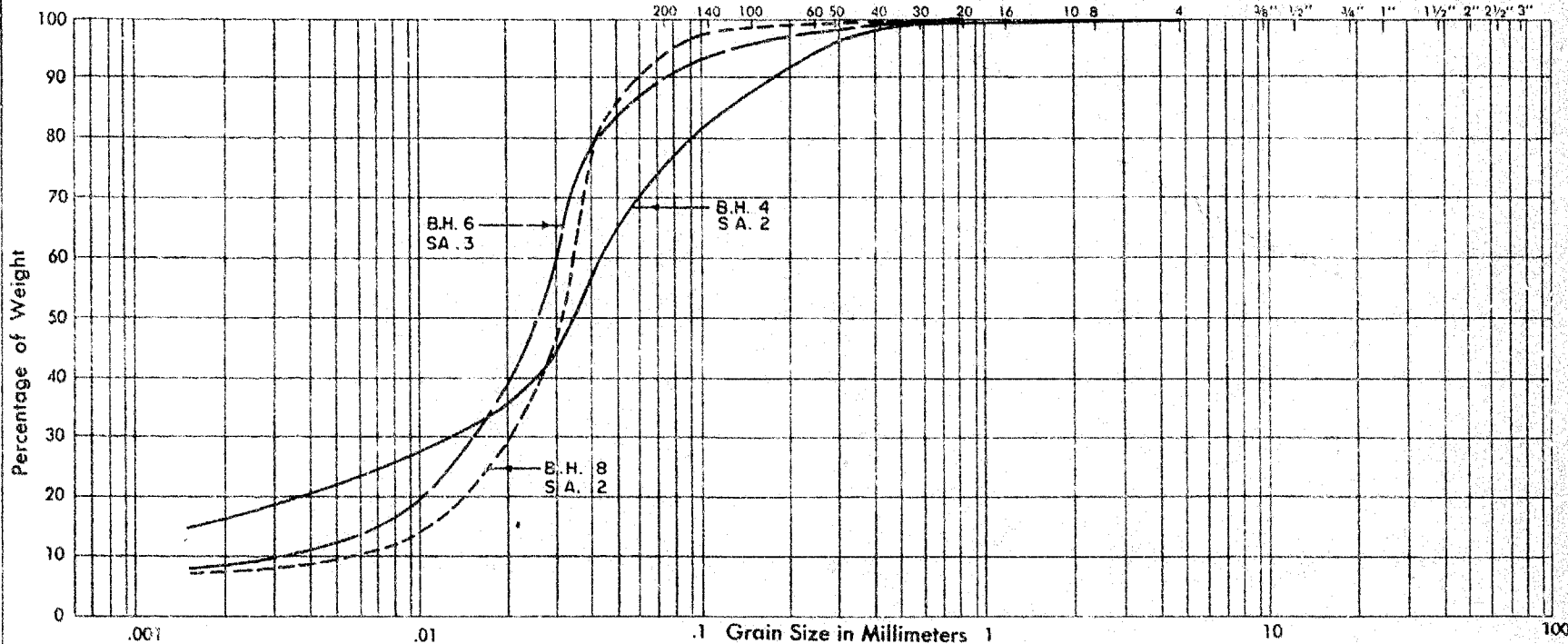
DOMINION SOIL INVESTIGATION LIMITED

GRAIN SIZE DISTRIBUTION

OUR REFERENCE NO. 7-1-14
Your Ref. W.P. 201-62-2

UNIFIED SOIL CLASSIFICATION
SYSTEM

SILT AND CLAY	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE



HWY. 27, RICHVIEW EXPR. WAY &
PROJECT: RENFORTH DR. INTERCHANGE

LOCATION: BRIDGE No. 29

BOREHOLE NO.: 4, 6, 8

SAMPLE NO.: 2, 3, 2

DEPTH OF SAMPLE: —

ELEVATION OF SAMPLE: —

COEFFICIENT OF UNIFORMITY

COEFFICIENT OF CURVATURE

PLASTIC PROPERTIES:

LIQUID LIMIT	%	=
PLASTIC LIMIT	%	=
PLASTICITY INDEX	%	= Non Plastic
MOISTURE CONTENT	%	=
ACTIVITY	%	=

Classification of Sample and Group Symbol:

SILT with some FINE SAND and a trace of
some CLAY

Enclosure No.

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 COPE
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
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_t	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
$\bar{\sigma}$	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

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac, Principal Foundation Engineer,
Room 107, Lab. Building

Mr. W. Malinyshyn,
Reg. Bridge Location Engineer,
Central Region,
Administration Building

Bridge Division,
Downsview, Ontario

July 6, 1967

Bridge No. 29
Renforth Dr. over Hwy. 401
and Richview Expressway
W.P. 399-65, Site No. 37-822
Hwys. 401 & 27, District 6

Attached herewith are prints of the Preliminary Bridge
Plan Drawing D-6242-F1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$680,000.
This cost includes tender, materials, engineering and sundry
construction.

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

CSG:rd

C.S. Grebski,
Bridge Design Engineer

Attach.

c.c. S. McCombie
A. Stermac
R. Forrest
E. Cross

af

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

July 17, 1967

-- Bridge No. 29 --
Renforth Drive over Hwy. #401 & Richview Exp'y.
W.P. 399-65 -- Site No. 37-82
Hwy's. #401 & #27, District No. 6 (Toronto).

66F104

We have reviewed Preliminary Plan D-6242-P1 for
the above mentioned structure.

We have no comments.

H. G. Selby

KGS/WdeP

H. G. Selby,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. S. McCombie
W. S. Melnyshyn

Foundations Files ✓
Gen. Files

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Building

FROM: Bridge Division,
Downsview, Ontario

ATTENTION:

DATE: July 25, 1968

OUR FILE REF:

IN REPLY TO

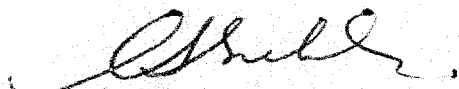
SUBJECT: Bridge No. 29
Renforth Drive over Hwy. #401
and Richview Expressway
W.P. 399-65, Site 37-822
Hwys. 401 & 27, District 6

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:rd

Attach.


C.S. Grebski,
Bridge Design Engineer

66-F-104

NO COMMENTS.

JULY 29, 1968

A.K.B.



64-F-83

W.P. # 233-64

Hwy. # 122

CROSSING

C.N.R.

