

MEMORANDUM

W.P. 353-64

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

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

Attention: Mr. S. McCombie

DATE: March 13, 1968

OUR FILE REF.

IN REPLY TO

MAR 15 1968

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Proposed New Structure
Over Ebenezer Creek on Hwy. #7
0.9 Miles West of Hwy. #50
District No. 6 (Toronto)
W.J. 67-F-117 -- W.P. 353-64

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 feel free to contact our Office.

AGS/MdeF
Attach.

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

Foundations Files
Gen. Files ✓

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

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FOUNDATION INVESTIGATION REPORT
For

Proposed New Structure
Over Ebenezer Creek on Hwy. #7
0.9 Miles West of Hwy. #50
District No. 6 (Toronto)
W.J. 67-F-117 -- W.P. 353-64

1. INTRODUCTION:

A request for a foundation investigation at the site of the proposed new crossing of Hwy. #7 and Ebenezer Creek was received in a memo dated November 29, 1967, from Mr. W. S. Melinyshyn, Regional Bridge Location Engineer.

A field investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the location of the proposed structure. Presented in this report are the results of our field and subsequent laboratory investigations, together with recommendations which pertain to the future structure foundations and approach embankments.

2. DESCRIPTION OF SITE:

This site is located on Hwy. #7, 0.9 miles west of Hwy. #50 near Woodbridge, Ontario. The surrounding area is farmland, partly cultivated, and the topography is flat to gently rolling. The new line, Line 'N', is located some 100 ft. south of existing Hwy. #7.

Physiographically, the site is located in the region referred to as the 'Peel Plain'.

3. FIELD INVESTIGATION PROCEDURE:

Two sampled boreholes and six dynamic cone penetration tests were carried out during the course of the field work. Boring was achieved by means of a conventional diamond drill,

3. FIELD INVESTIGATION PROCEDURE: (cont'd.) ...

adapted for soil sampling purposes. Samples were recovered using a 2-inch O.D. split-spoon sampler driven according to the requirements for the Standard Penetration Test.

Samples were visually inspected in the field before being sent to the laboratory. A field log of soil types and groundwater conditions was recorded during field operations.

The boreholes were located in the field by personnel from Toronto District Construction staff. The locations and elevations of all borings are shown on the attached Drawing 67-F-117A.

4. LABORATORY TESTS:

All samples were subjected in the laboratory to a careful visual inspection and classified according to soil type. Tests were then carried out on selected samples, primarily for classification purposes, to determine the following physical properties:

Liquid Limit
Plastic Limit
Natural Moisture Content
Grain-Size Distribution

The results of these tests are plotted on the Record of Borelog sheets contained in the Appendix of the report.

5. SOIL TYPES AND SOIL CONDITIONS:

5.1) General:

Subsoil at this site consists of about 4 feet of firm to stiff clayey silt with sand, gravel and traces of organics followed by 6 to 13 feet of very dense sandy silt with gravel and traces of clay (glacial till), followed by shale and limestone bedrock. The boundaries between the different deposits are shown

cont'd. /3 ...

5. SOIL TYPES AND SOIL CONDITIONS: (cont'd.) ...

5.1) General: (cont'd.) ...

on the attached borelog sheets, together with a description of each soil type. The estimated stratigraphical profiles shown on Drawing 67-F-117A, is based upon this information. A description of each soil type follows:

5.2) Clayey Silt:

This deposit consists of clayey silt with sand, gravel and traces of organics, and is the surface soil deposit. 'N' values obtained from Standard Penetration Tests averaged 9 blows per foot, indicating a firm to stiff consistency. The natural moisture content ranges from 15% to 20%. The liquid and plastic limit ranges are 25% to 28% and 16% to 20%. The estimated undrained shear strength is in the order of 500 to 1000 p.s.f. The average thickness of the deposit is about 4 feet.

5.3) Sandy Silt:

This material underlies the clayey silt deposit and consists of a heterogeneous mixture of gravel, sand, silt, and clay in a very dense state. The deposit is believed to be glacial till. The Standard Penetration Tests carried out during sampling operations, gave results ranging from 36 to 145 blows per foot. Natural moisture content test results averaged about 10%. Mechanical analyses indicated the following average grain-size distribution: Gravel 12%, silt 28%, sand 48%, clay 12%. The thickness of the deposit ranges from about 6 to thirteen feet.

5.4) Bedrock:

The bedrock at this site consists of shale and limestone bands. The rock is in a generally sound condition from the surface down.

5.5) Groundwater:

Water levels in the borings were found to closely correspond with the level of the existing creek (el. 579.55).

cont'd. /4 ...

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct a new bridge at this site. The centre-line, Line 'N', will be located some 100 feet south of the existing Hwy. #7 centre-line, and the new grade will be such that 25-ft. high approach embankments will be required.

Subsoil conditions at this site are such that adequate support can be provided for spread footing type foundations. Bearing in mind that a minimum cover of 4.0 ft. is necessary for frost protection, and that hydrological requirements may dictate the final footing elevations, a safe pressure of 4.0 tons per square ft. may be assumed at or below el. 577.0. If excavations are carried out below the groundwater level, it will be necessary to provide a dewatering scheme to prevent the excavation bases from 'boiling'. The sandy silt subsoil is very susceptible to conditions of unbalanced hydrostatic heads and will probably 'boil' under such conditions.

If perched abutments are decided upon, they may be supported on steel H-piles driven to rock. The maximum allowable load for the particular steel section adopted should be assumed in this case. In the case of piled foundations, and spread footings constructed with the above comments in mind, differential settlements are anticipated to be of a negligible order.

No stability problems are anticipated for the proposed embankments constructed with 2:1 slopes and according to D.H.O. Standards.

7. SUMMARY:

A foundation investigation at the site of the proposed new crossing of Hwy. #7, Line 'N' and Ebenezer Creek, is reported.

Subsoil at the site consists of about 4 feet of firm to stiff clayey silt followed by about 6 to 13 feet of very dense sandy silt (glacial till), followed by shale and limestone bedrock.

cont'd. /5 ...

7. SUMMARY: (cont'd.) ...

It is recommended to found the new bridge on spread footings utilizing an efficient dewatering scheme to prevent 'boiling'. If perched abutments are contemplated, these may be supported on end-bearing piles driven to rock.

No stability problems are anticipated for the 25-ft. high approach embankments.

8. MISCELLANEOUS:

The field work for this project was carried out during the period December 14 - 18, 1967, under the supervision of Mr. S. Nassif, Project Foundation Engineer, who also prepared this report. Equipment used was owned and operated by Dominion Soil Investigation Ltd.

This report was reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

March, 1968.

APPENDIX I

FOUNDATION SECTION

ORIGINATED BY SN

COMPILED BY _____ SN _____

BOREHOLE TYPE

CHECKED BY

[illegible]

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO.5

FOUNDATION SECTION

LOCATION Sta. 52 + 49 Ø

BORING DATE Dec. 15, 1967

ORIGINATED BY SN

BOREHOLE TYPE Dynamic Cone Test

COMPILED BY _____ SN

CHECKED BY AK

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 67-F-117 LOCATION Sta. 52 + 53 o/s 32' Rt. ORIGINATED BY SN
W.P. 353-64 BORING DATE Dec. 15, 1967 COMPILED BY SN
DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test CHECKED BY SP

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	WATER CONTENT % WP — W — WL			
583.6	Ground Level															
0.0																
578.3																
5.3	End of Cone Test															

580

570

580.5

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 67-F-117LOCATION Sta. 52 + 15 o/s 35' Lt.ORIGINATED BY SNW.P. 353-64BORING DATE Dec. 15, 1967COMPILED BY SNDATUM GeodeticBOREHOLE TYPE Dynamic Cone TestCHECKED BY HL

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 ——— WL WATER CONTENT %	BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT						
581.2	Ground Level					580					580.5
0.0											
577.3											
3.9	End of Cone Test					5'0					

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 67-F-117LOCATION Sta. 52 + 04 ØORIGINATED BY SNW.P. 353-64BORING DATE Dec. 15, 1967COMPILED BY SNDATUM GeodeticBOREHOLE TYPE Dynamic Cone TestCHECKED BY SR

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	20	40	60	80	100	PLASTIC LIMIT — w_p	WATER CONTENT — w		
581.9	Ground Level															
0.0						580										
576.9																
5.0	End of Cone Test															
						570										

 580.5

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 67-F-117

LOCATION Sta. 51 + 80 o/s 29¹ Rt. (Hwy. 7 West of Hwy. 50)

FOUNDATION SECTION

W. P. 353-64

BORING DATE Dec. 14, 15, 1967

ORIGINATED BY SN

DATUM Geodetic

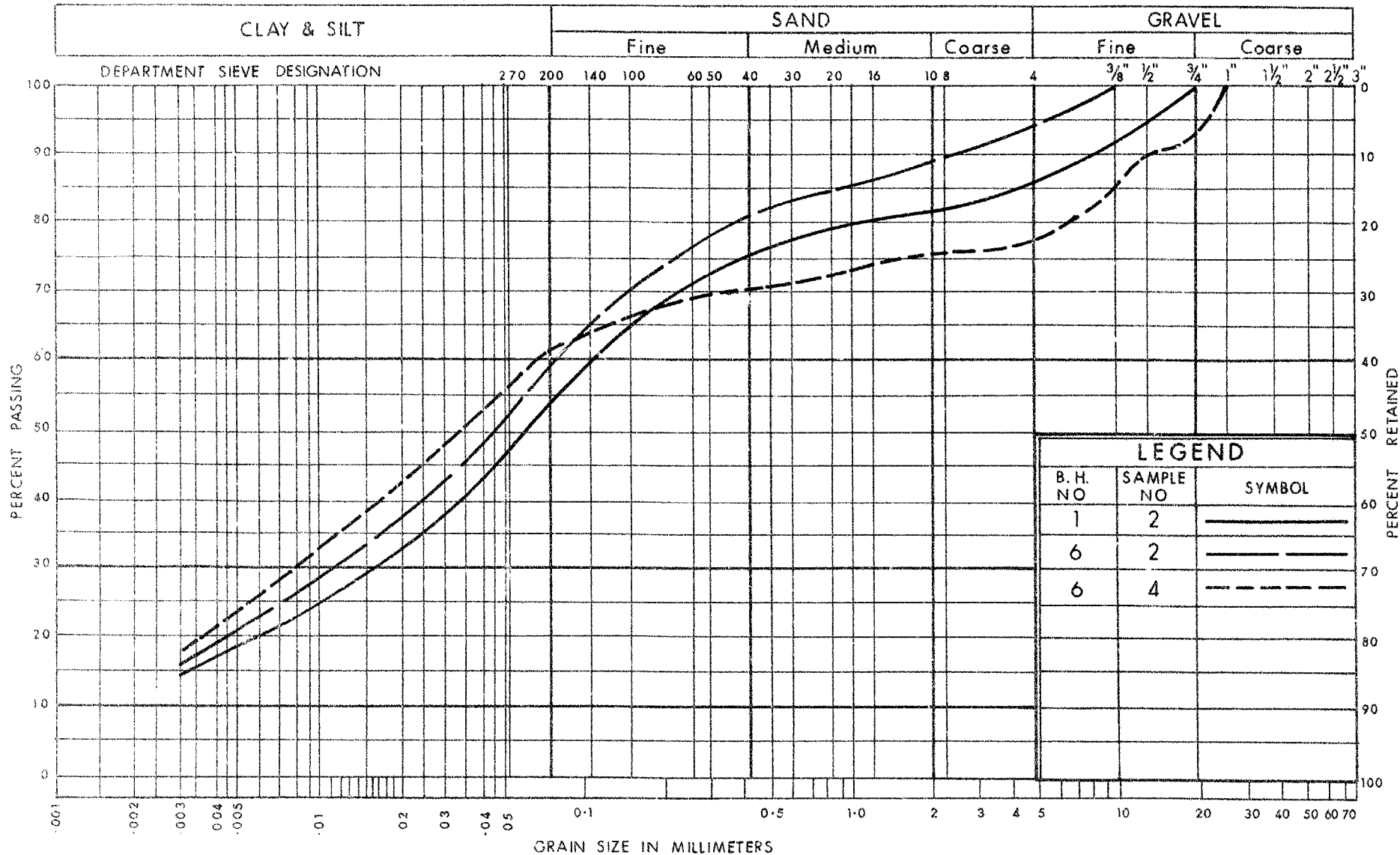
BOREHOLE TYPE BX Casing and Wash

COMPILED BY _____ SN

CHECKED BY

[illegible]

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION

W.P. No. 353-64
JOB No. 67-F-117

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

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

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

DESCRIPTION OF SOIL

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

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

TYPE OF SAMPLE

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

SOIL TESTS

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

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

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

cc: Foundations Files (Rm. 110)

Hwy. 401 & Keele St.,
Downsview, Ontario.

Tel. 248-3282
(Area Code 416)

Materials and Testing Division

January 17, 1968

Dominion Soil Investigation Ltd.,
77 Creekford Blvd.,
Scarborough, Ontario.

Dear Sirs:

This is to confirm our request of December 4, 1967,
for the supply of a diamond drill, together with all necessary
equipment, as specified under the terms of our Contract
Agreement, at Hwy. 7 and 50 junction, on December 5, 1967.

This project bears Job Number 67-P-116 & 117 & 120.

Yours truly,

KGS/MdeP

K. G. Selby,
Supervising Foundation Engineer
For: A. G. Stermac,
Principal Foundation Engineer

cc: Mr. H. Konings

Foundation Files
Gen. Files

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

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

Bridge Division,
Downsview, Ontario

July 5, 1968

Ebenezer Creek
0.9 Mi. West of Hwy. 50
W.P. 353-64, Site 24-210
Highway 7, District No. 6

67-F-117

Attached herewith are prints of the Preliminary Bridge Plan
Drawing B-6441-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$44,000.
This cost includes tender, materials, engineering and sundry
construction.

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

CSB:rd

C.S. Grabekl,
Bridge Design Engineer

Attach.

c.c. B. McComb
A. Stermac (2)
J. Anderson

NO COMMENTS.

JULY 30/1968

A.H.B.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

FROM: Bridge Division,
Downsview, Ontario

ATTENTION:

DATE: October 7, 1968

OUR FILE REF:

IN REPLY TO

SUBJECT: Ebenezer Creek
0.9 Miles West of Hwy. 50
W.P. 353-64, Site 24-210
Highway 7, District No. 6

67-F-117

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.c. Foundation Section


C.S. Grebski,
Bridge Design Engineer

9. OCT. 68

NO COMMENTS

A. K. B.



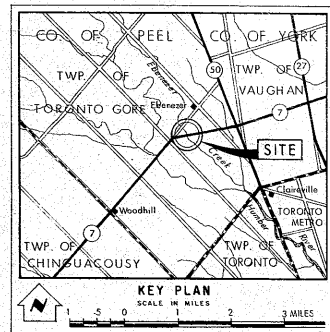
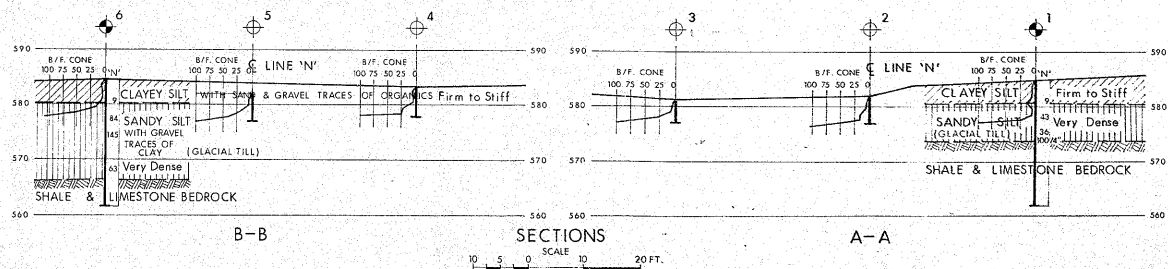
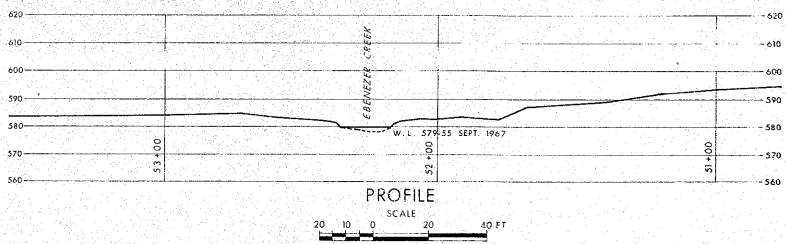
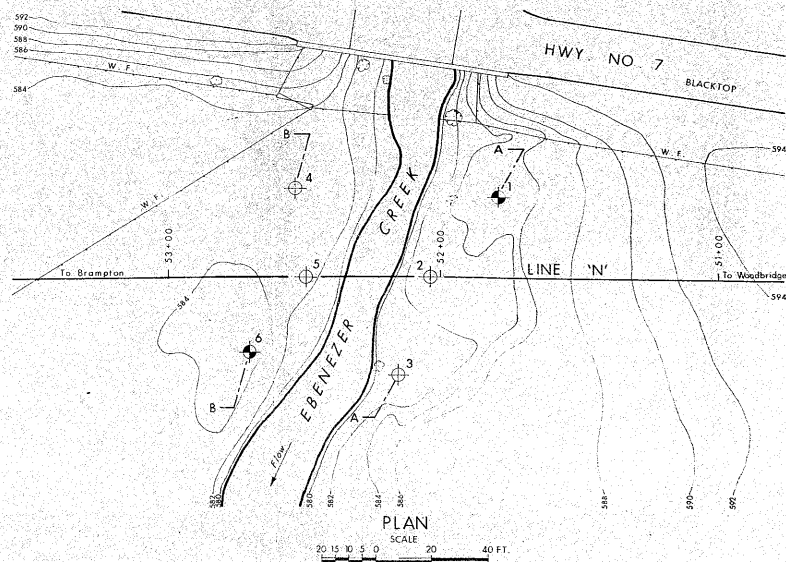
#67-F-117

W.P. #353-64

HWY #7

EBENEZER

CREEK



LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation		

NO.	ELEVATION	STATION	OFFSET:
1	585.0	51+80	29' RT.
2	581.9	52+04	6
3	581.2	52+15	35' LT.
4	583.6	52+53	32' RT.
5	582.0	52+49	6
6	584.5	52+70	27' LT.

NOTE -
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION - FOUNDATION SECTION

EBENEZER CREEK
0.5 MI. WEST OF HWY. 50
KING'S HIGHWAY NO. 7 LINE 'N' DIST. NO. 6
CO. PEEL
TWP. TORONTO GORE LOT 5 CON. IX

BORE HOLE LOCATIONS & SOIL STRATA

SUBMITT. S.N. CHECKED	W.P. NO. 353-04	M.B.T. DRAWING NO.
DRAWN G.P. CHECKED	JOB NO. 67-F-117	67-F-117A
DATE 19 JAN. 1968	SITE NO. 24-210	BRIDGE DRAWING NO.
APPROVED <i>[Signature]</i>	CONT. NO.	D-6441-2