FIELD RECONNAISSANCE REPORT

REQUIRED BY FOUNDATION SECTION FOR PROPOSED C.N.R. O'HEAD AT HWY. 48 (APPROX. 0.9 MI. EAST OF PEFFERLAW)

PF-69 SEPT. 1968

W.P. NO. 98-70-02 HIGHWAY NO. 48 DISTRICT 6 SITE PLAN NO. E-4989 PROFILE NO. C-542-7

RIVER CROSSING ☐ GRADE SEPERATION ☐ R.R.X. ☐ OTHER (SPECIFY) _____

ALTERNATE SCHEME (IF ANY) _____

EXISTING SITE CONDITIONS

DESCRIPTION:

TOPOGRAPHY: HILLY ☐ ROLLING ☑ VALLEY ☐ GULLIED ☐ FLAT ☐

VEGETATION: TREES ☐ BRUSH ☑ GRASS ☐ SWAMP ☐ FARM CROPS ☐ CLEARED ☐

SNOW COVER: 0"-6" ☐ 6"-12" ☐ >12" ☐

ROCK OUTCROP (SPECIFY LOCATIONS) _____

UNDERGROUND UTILITIES:

	UTILITY COMPANY	TELEPHONE NO. FOR DEFINITE LOCATION
1		
2		
3		
4		
5		

EXISTING STRUCTURE(S): N/A

FOUNDATIONS: SPREAD FOUNDATIONS ☐ SIZE _____ ELEVATION(S) _____

PILES ☐ TYPE _____ LENGTH(S) _____

DESIGN LOAD _____ T.S.F _____ TONS/PILE

CONDITION OF STRUCTURE _____

APPROACHES: CUT ☐ FILL ☐ SIDE SLOPES _____

BERMS YES ☐ NO ☐

OTHER OBSERVATIONS (USE BACK OF SHEET TO DESCRIBE ANY FAILURES IN AREA, PAST PERFORMANCE OF EXISTING APPROACHES & STRUCTURE, ETC.)

ACCESSIBILITY

IS STRUCTURE LOCATED ON D.H.O. RIGHT OF WAY? YES ☐ NO ☐ IF NO, ALMOST WITHIN D.H.O AND C.N.R. R.O.W.

HAS PERMISSION BEEN OBTAINED TO ENTER PROPERTY? YES ☐ NO ☑ IF NO,

PROPERTY OWNER(S):

	NAME	ADDRESS	TELEPHONE NO.
1			
2			
3			
4			

WHO WILL OBTAIN NECESSARY PERMISSION? FOUNDATION SECTION

HAS SITE BEEN SURVEYED & STAKED? YES ☑ NO ☐ IF YES, DATE OF MOST RECENT SURVEY JAN. 1970

WILL CLEARING BE NECESSARY TO ENTER SITE AREA? YES ☐ NO ☑

IS SITE ACCESSIBLE TO WHEELED VEHICLES? YES ☑ NO ☐

IF RIVER CROSSING: N/A

WILL A RAFT BE NECESSARY? YES ☐ NO ☐ IF YES, GIVE MAX. DEPTH OF WATER _____ FT.

CURRENT: SWIFT ☐ MODERATE ☐ SLOW ☐

DRILLING OPERATIONS

NEAREST SOURCE OF WATER (GIVE HAULING DISTANCE, IF KNOWN) _____

ADDITIONAL INVESTIGATION REQUIRED FOR THE FOLLOWING PURPOSES:

ALTERNATE SCHEME: YES ☐ NO ☐ IF YES, SPECIFY _____

HYDROLOGIC REASONS: YES ☐ NO ☐ IF YES, SPECIFY (SCOUR, ETC.) _____

REMARKS

NEAREST AVAILABLE ACCOMODATION: PEFFERLAW

OTHER COMMENTS: _____

DATE SEP. 30TH 1970

~~REGIONAL~~ BRIDGE LOCATION ENGINEER M Bandeyko

DEPARTMENT OF HIGHWAYS ONTARIO

70-11092

MEMORANDUM Telephone: 248-3097

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

From: G.C.E. Burkhardt, Bridge Office, Central Building.

Attention:

Date: October 1st, 1970.

Our File Ref.

In reply to

Subject: Proposed C.N.R. O'Head at Hwy. 48, (Approx. 0.9 Mi. East of Pefferlaw Brook Bridge), W.P. 98-70-02, Site 37-952, District 6, Toronto.

Attached please find two prints of bridge site plan E-4989 for this structure and the relative field reconnaissance report.

Shown in different colours are two alternatives for footing locations at this crossing; the proposed grade is in accordance with Hwy. 48 F.P.R.

Would you kindly arrange to have a foundation investigation carried out at this site.

M.D. Bendayan,
BRIDGE LOCATION ENGINEER,
for:
G.C.E. Burkhardt,
REG. BRIDGE PLANNING ENGINEER.

M.D.B/ced
Attach.
cc R. Fitzgibbon

cc: Foundations - Rm. 110, Lab. Bldg.

Hwy. 401 & Keele St.,
Downsview 464, Ont.

Tel. 248-3282
(Area Code 416)

Materials and Testing Office

October 15, 1970

Mr. A. E. Spears,
Area Engineer,
Canadian National Railways,
Capreol, Ontario.

Dear Sir:

As mentioned during our telephone conversation with your Mr. H. M. Hamilton on October 13, 1970, the Department of Highways intends to carry out a foundation investigation for the proposed overhead structure at the level crossing of the C.N.R. tracks and Hwy. #48 north of Pefferlaw. The investigation will consist of a number of boreholes, some of which will be located not closer than 25 ft. to the C.N.R. tracks.

If you feel that a C.N.R. Flagman is necessary to be present during the drilling operation, we will appreciate it if this Flagman will report at the site to our Field Engineer, Mr. W. Hendry around 8:30 - 9:00 A.M. on the 22nd (Thursday) of October, 1970. The boring operation near the C.N.R. will, hopefully, be over within approximately 3 to 4 days.

Attached please find a D.H.O. Local Purchase Order - No. N 182159, for the charges of the Flagman.

Your cooperation is much appreciated.

Yours very truly,

A. K. Barsvary,
SENIOR FOUNDATION ENGINEER
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

AKB/RdeF
Attach.

cc: Foundations Files
Gen. Files

cc: Foundations (Rm. 110 Lab Bldg.)

73-14

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

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

Attention: Mr. S. McCombie

Date: December 2, 1970

Our File Ref.

In reply to DEC - 4 1970

Subject:

31D-213

FOUNDATION INVESTIGATION REPORT
For
The Proposed C.N.R. Overhead
At Highway #48
(0.9 Mi. E. of Pefferlaw Brook Bridge)
District No. 6 (Toronto)
W.O. 70-11092 -- W.P. 98-70-02

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.

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

AGS/MdeF
Attach.
cc: Messrs. B. R. Davis
H. A. Tregaskes
D. W. Farren
G. K. Hunter (2)
H. Greenland
T. J. Kovich
G. C. E. Burkhardt (2)
B. J. Giroux
B. A. Singh

Foundations Files
Gen. Files

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FOUNDATION INVESTIGATION REPORT
For
The Proposed C.N.R. Overhead
At Highway #48
(0.9 Mi. E. of Pefferlaw Brook Bridge)
District No. 6 (Toronto)
W.O. 70-11092 -- W.P. 98-70-02

1. INTRODUCTION:

The Foundation Section was requested by Mr. G.C.E. Burkhardt, Regional Bridge Planning Engineer, Central Region, to carry out an investigation at the site of the proposed C.N.R. overhead at Hwy. #48. The request was submitted in a memo, dated October 1, 1970. Two alternative proposals are considered for this crossing: (a) a three-span structure, and (b) a rigid frame bridge with retaining walls.

The subsequent field and laboratory investigation were undertaken by this Section, the results of which are compiled in the following paragraphs.

2. DESCRIPTION OF THE SITE:

The site of the existing level crossing of the C.N.R. tracks and Hwy. #48 is generally flat, occupied by residential and agricultural developments. Immediately north of the crossing there is a small creek, flowing northward. High groundwater level is evidenced by the prevailing vegetation and wet, soggy areas. Geologically the site belongs to the "Lake Simcoe Basin" sub-region of the "Simcoe Lowlands" physiographic region. In Georgina Twp. the area is covered by sandy plains with low-lying swampy terrain. Pefferlaw Brook is one of the most important streams; however, it fails to provide adequate drainage. It is to be noted that the sand plain is interrupted by several areas of drumlinized till, which were islands in Lake Algonquin.

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3. FIELD AND LABORATORY INVESTIGATIONS:

The field investigation consisted of some 6 sampled boreholes and 12 dynamic cone penetration tests, placed at the locations of the proposed bridge and retaining wall-footings. The locations and elevations of the borings are marked on the accompanying Drawing #70-11092A. A conventional diamond drill adapted for soil sampling purposes was used to advance the holes by washboring techniques. Soil samples were taken at regular intervals by split-spoon and Shelby tube samplers. Standard penetration tests were performed and penetration 'N' values recorded when taken by split-spoon samples. Shelby tubes were pushed 18" into the 'undisturbed' soil manually, where the consistency of the materials permitted.

After visual examinations and descriptions of the soil samples in the field and in the laboratory, representative samples were further tested to determine natural moisture contents, Atterberg limits, grain-size distributions, undrained shear strength and consolidation characteristics of the layers. Field and laboratory tests are delineated on the borelog sheets in the Appendix of this report.

4. SOIL CONDITIONS:

4.1) General:

The 25 - 27 ft. thick overburden was found to consist of three separate soil strata, namely, a granular silt to sandy silt, underlain by clayey silt to silty clay, and a heterogeneous glacial till.

Limestone bedrock was proved at three locations by diamond drilling. A description of the various deposits is as follows:

..... 3

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

4.2) Sandy Silt to Silt:

The surficial layer was identified to be granular sandy silt and silt with traces of clay. The overall thickness of the deposit is 15 ft. Standard penetration tests performed within this layer, resulted in 'N' values ranging from 9 blows per ft. to 59 blows per ft., corresponding to loose to very dense relative density. The average moisture content of the stratum is 19%, and it has no plasticity. Several laboratory grain-size analyses were carried out; the envelope of some of the representative curves are shown on Fig. #1.

4.3) Stratified Clayey Silt and Silty Clay:

Around el. 725 - 730 ft. a 5 - 6 ft. thick cohesive layer was observed, having a stratified structure at certain locations. The stratification was usually irregular with horizontal laminae of 1/16" to 2" in thickness. The clayey silt to silt portion of the stratum exhibited strong dilatancy with natural moisture contents between 19% and 26%. The plastic limits ranged from 12% to 16%, the liquid limits from 19% to 35%. The corresponding values of the silty clay portion were: natural moisture content 37 - 47%, plastic limits 21 - 23%, and liquid limits 45 - 47%.

The undrained shear strength of the material was determined by field vane tests, laboratory unconfined compression and quick triaxial tests. Field vane tests yielded shear strength values between 800 PSF and 2,200 PSF, and those of the laboratory tests between 400 PSF and 900 PSF. The discrepancy between the field and laboratory tests was likely caused by the silty nature of the deposit. During a field vane test, some pore pressure dissipation may take place within the silt seams, thus obtaining higher strength values. On the other hand, due to the dilatancy of the silts, laboratory samples might be somewhat disturbed, resulting in smaller strengths. For slope stability computations

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

4.3) Stratified Clayey Silt and Silty Clay: (cont'd.) ...

of the proposed approach embankments, an estimated average value of 700 PSF was used, with bulk densities of 125 PCF.

4.4) Sandy Silt with some Clay and Gravel (Glacial Till):

Underlying the stratified clayey silts, around el. 720 - 726 ft., a heterogeneous mixture of gravel, sand, silt and clay was found, the overall thickness of which was about 6 - 9 ft. The unsorted structure of the soils, together with the very hard consistency, indicated the glacial origin of this deposit. Penetration 'N' values were measured to vary between 56 blows per ft. to much above 100 blows per ft. The moisture contents were usually found to be lower than the plastic limits, averaging 8%, while the plastic limits ranged from 11% to 13% and the liquid limits from 15% to 20%. The heterogeneous nature of the deposit is well illustrated by the grain-size distributions. The percentage amount of gravel size particles ranged from 8% to 46%, sands from 30% to 38%, silts 18% - 44%, and clay particles 6% - 10%.

4.5) Bedrock:

Bedrock was proved in three boreholes by diamond drilling with an AXT size core barrel, for depths of approx. 5 - 10 ft. The bedrock surface was encountered at el. 717.3 - 718.0 ft. Between 40% and 100% rock core was recovered in the core barrels.

The bedrock samples were identified to be limestone of the Trenton formation with seams of shale. No visible signs of weathering were observed in the cores.

4.6) Groundwater:

Groundwater was observed in every borehole at some 1 - 2 ft. below ground surface. It is postulated that the noted water level was at or near the average high water table, and during dry seasons it might be a few feet lower.

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5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

Two alternative proposals are suggested for this overhead crossing, either a three-span structure, or a rigid frame bridge with retaining walls. The grade of Hwy. #48 at the crossing is planned to be at el. 774 ft., necessitating approach fills of approx. 28 ft. height.

The overburden was found to consist of deposits of fine sandy silts, stratified clayey silts, and heterogeneous glacial tills. Limestone bedrock was hit around el. 717 ft. - 718 ft.

5.2) Footings:

On account of the firm to stiff clayey silt to silty clay layer, it is believed that spread footings for the proposed structure will not be economical. It is recommended, therefore, that the bridge be supported on end-bearing piles driven to bedrock. In the case of adopting the rigid frame structure, the retaining walls should also be founded on piles. Steel H-piles appear to be the most practical, piles being driven to refusal on bedrock around el. 717 - 718 ft. Design loads, equal to the full structural strength of the particular H-section used, may be employed on the piles, provided they are supported on bedrock.

In constructing the three-span structure, the pile caps for the abutments may be formed within the approach fills, in which case, care should be taken not to place bouldery material at the locations of the abutments. Pile caps should have a minimum cover of four ft. for frost protection. It is surmised that the pile cap excavations for the piers of the three-span structure, and for the abutments and retaining walls of the rigid frame bridge will extend below the groundwater level. The sandy silt material is susceptible to conditions of unbalanced hydrostatic head, hence a dewatering scheme will be necessary in order to prevent the excavation bottoms from 'boiling'. Since only some

..... 6

5. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

5.2) Footings: (cont'd.) ...

2 - 3 ft. hydrostatic head is anticipated at the base of the excavations, dewatering may be attempted by pumping from shallow sumps outside the area of the pile caps, along the perimeter of the excavations.

For the retaining walls, no frictional resistance and no adhesion should be considered to act along the base slab, since the walls are supported on piles.

5.3) Approach Embankments:

The maximum height of the approach embankments will be roughly 28 ft. Stability analyses, in terms of total stresses, were carried out by means of an electronic computer, in order to ascertain the stable height of these fills. The results of the calculations showed that embankments up to the height of 28 ft. will be stable, provided they are built with slopes of 2 horizontal to 1 vertical.

Some long-term consolidation settlements will take place under the proposed fills due to the compressibility of the clayey silt stratum. Based upon calculations, using laboratory consolidation curves, it is predicted that settlements will range from 3" to 8" under the middle of the 28-ft. high fills.

6. MISCELLANEOUS:

The field work, carried out during the period October 19 - 27, 1970, was supervised by Mr. R. A. Hendry, Student Technician.

Equipment used was owned and operated by Johnston Drilling Company, Toronto.

This report was written by Mr. A. K. Barsvary, Senior Foundation Engineer, and reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

December, 1970.

APPENDIX I

FORM 08-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 704 + 69 24.5' Lt. ℄ ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 19, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
744.3	Ground Level					
0.0	Fine sandy silt, traces of clay. Compact Brown & Grey		1	SS	19	
			2	SS	29	
			3	SS	32	
729.3			4	SS	18	
15.0	Stratified Clayey silt & silt. Firm		5	TW	PM	
723.3			6	TW	PM	
21.0	Sandy silt with clay & gravel (Glacial Till) Hard		7	SS	74	
717.3			8	SS	100/4"	
27.0	Limestone Bedrock		9	RC	86%	
707.3			10	RC	83%	
37.0	End of Borehole					

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
1000 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
	0 15 76 9
127	0 7 83 10
128	0 2 (98)
	23 34 35 8

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 704 + 36 34' Rt. ℄ ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 20, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
744.2	Ground Level					
0.0	Silt with traces of sand & clay. Compact Brown		1	TW	PM	740
			2	SS	17	
			3	SS	14	
729.2						730
15.0	Silt to clayey silt Soft to Firm		4	SS	5	
723.2			5	SS	1	
21.0	Sandy silt with traces of gravel & clay (Glacial Till) Hard		6	TW	PM	
727.5			7	SS	131	720
			8	SS	50/2"	
26.7	End of Borehole Probable Bedrock					

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
1000 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
	0 3 89 8
141 143	
	8 38 44 10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 704 + 18 32' Lt. ℄ ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 27, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test only CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w w_P w w_L WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE				
743.4	Ground Level									GR, SA, SI, CL
0.0						740				
						730				
719.7						720				
23.7	End of Cone Test									

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 703 + 92 34' Rt. of ℄ ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 26, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test Only CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100; SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE				
742.9	Ground Level									
0.0						740				
						730				
720.2										
22.7	End of Cone Test					720				GR, SA, SI, CL

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 703 + 60 32' Lt. ℄ ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 27, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test Only CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100 / SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w / WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
743.0	Ground Level									
0.0						740				
						730				
717.9						720				
25.1	End of Cone Test									

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 6

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 703 + 34 34' Rt. Ø ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 27, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
742.5	Ground Level					
0.0	Fine sandy silt with some clay. Compact Brown & Grey		1	SS	16	740
			2	SS	17	
727.5						730
15.0	Silty clay, pockets of clayey silt. Firm.		3	SS	4	
724.5						
18.0	Clayey silt, traces of sand & gravel (Glac.Till) Hard		4	TW	PM	
718.0			5	SS	50/0"	720
24.5	Limestone Bedrock		6	RC	40%	
713.0						
29.5	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE — 1000 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % — 10 20 30

BULK DENSITY γ P.C.F. — 116

REMARKS — GR. SA. SI. CL.
0 19 70 11

FORM Gs-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 703 + 09 29' Lt. ℄ ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 21, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY

SOIL PROFILE ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
742.6	Ground Level					
0.0	Fine sandy silt with some clay Loose to Dense Brown & Grey		1	SS	9	740
			2	SS	17	
			3	SS	25	
			4	SS	30	730
725.1			5	SS	40	
17.5	Clayey silt.		6	TW	PM	
720.6	Stiff. Grey					
22.0	Sandy gravel with silt & clay(Glac.Till)		7	SS	100/4"	720
717.4						
25.2	Limestone Bedrock		8	RC	80%	
			9	RC	100%	710
707.4						
35.2	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
1000 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.

REMARKS GR. SA. SI. CL.
0 10 80 10
0 10 79 11
46 30 18 6

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 702 + 86 33' Rt. ℄ ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 27, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test Only CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE	w_P w w_L WATER CONTENT %	P.C.F.	GR. SA. SI. CL.
741.9	Ground Level									
0.0						740				
						730				
718.1						720				
23.8	End of Cone Test									

FORM CS-MT-120 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 9

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 704 + 44 97' Lt. of ℄ ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 22, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
741.6	Ground Level					
0.0	Fine sandy silt to silt, some clay. Very Dense to Compact Brown & Grey		1	SS	59	740
			2	SS	28	
			3	SS	12	730
726.1						
15.5	Silt to clayey silt, traces of sand & gravel (Till) Firm to Hard		4	SS	4	
			5	TW	PM	
			6	SS	65	720
717.4	Bedrock		7	SS	100/6"	
24.2	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE — 1000 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % — 10 20 30

BULK DENSITY γ P.C.F.

REMARKS — GR. SA. SI. CL.

0 5 79 19
9 33 41 17

FORM CS-MT-128 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 10

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 703 + 66 98' Rt. Ø ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 23, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100; SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE 1000 2000	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
742.4	Ground Level									
0.0	Sandy silt to silt. Compact Brown & Grey		1	SS	15	740				
			2	SS	10					
730.4										
12.0	Stratified clayey silt & silty clay.		3	TW	PM	730			126	0 16 74 10
725.4	Soft to Firm		4	TW	PM				117	
17.0	Sandy silt with gravel traces of clay (Till) Hard		5	SS	56				111	21 30 40 9
			6	SS	96	720				
717.9	Bedrock		7	SS	60/4"					
24.5	End of Borehole									

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 11

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 703 + 86 80' Lt. ℄ ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 27, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Dynamic Cone Penetration Test CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 / SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w / WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
742.6	Ground Level									
0.0						740				
						730				
719.6										
23.0	End of Cone Test					720				

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

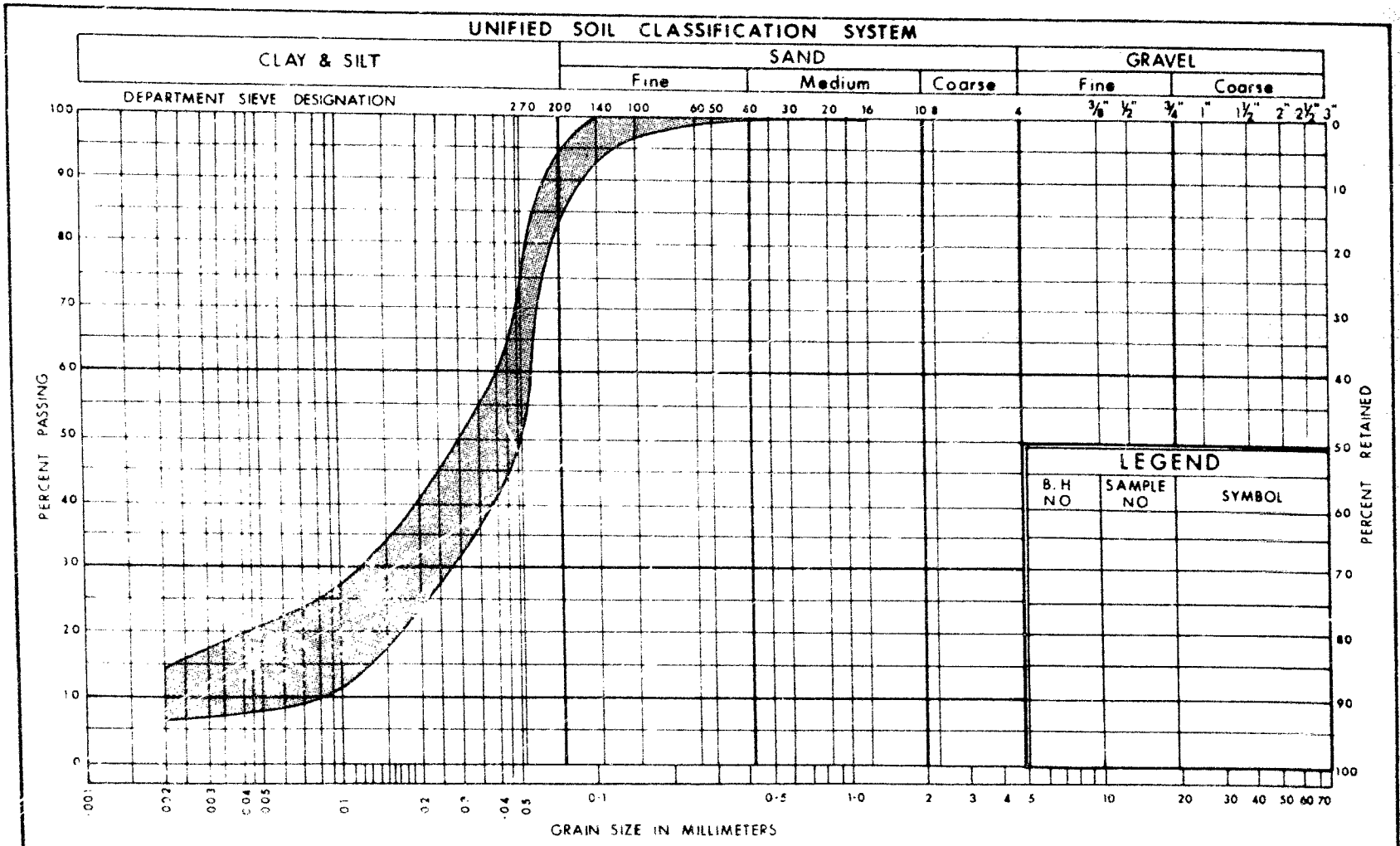
RECORD OF BOREHOLE No. 12

FOUNDATION SECTION

JOB 70-11092 LOCATION Sta. 703 + 14 100' Rt. ℄ ORIGINATED BY RAH
W.P. 98-70-02 BORING DATE Oct. 26, 1970 COMPILED BY AKB
DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test Only CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w w_P w w_L WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE				
741.3	Ground Level									
0.0						740				
						730				
721.6										
19.7	End of Cone Test					720				GR, SA, SI, CL

FORM OB MT - 17
REV. APR 1965



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

GRAIN SIZE DISTRIBUTION

SANDY SILT TO SILT.

W.P No. 98 - 70 - 02

JOB No. 70 - 11092

FIG. NO. 1

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 :-

CONSISTENCY	'N' BLOWS / FT.	c LB. / SQ. FT.
VERY SOFT	0 - 2	0 - 250
SOFT	2 - 4	250 - 500
FIRM	4 - 8	500 - 1000
STIFF	8 - 15	1000 - 2000
VERY STIFF	15 - 30	2000 - 4000
HARD	> 30	> 4000

DENSENESS	'N' BLOWS / FT.
VERY LOOSE	0 - 4
LOOSE	4 - 10
COMPACT	10 - 30
DENSE	30 - 50
VERY DENSE	> 50

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
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
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
σ'	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 (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

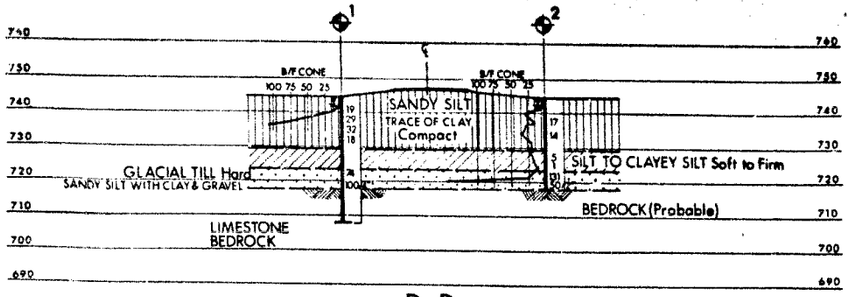
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

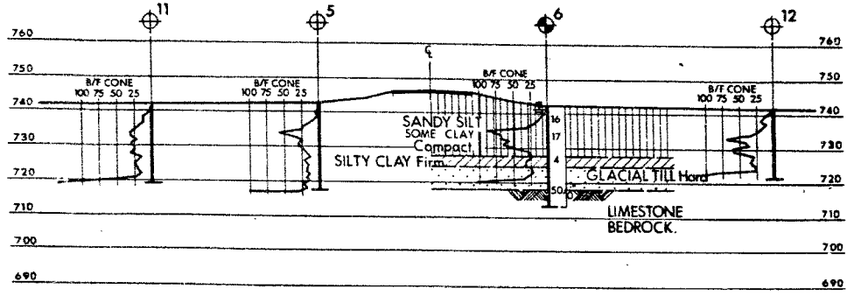
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY. DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

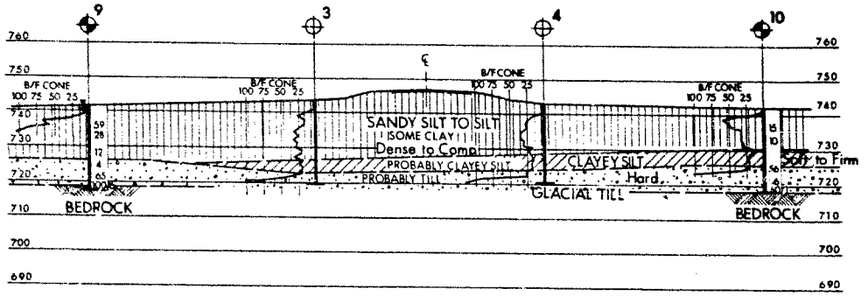
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



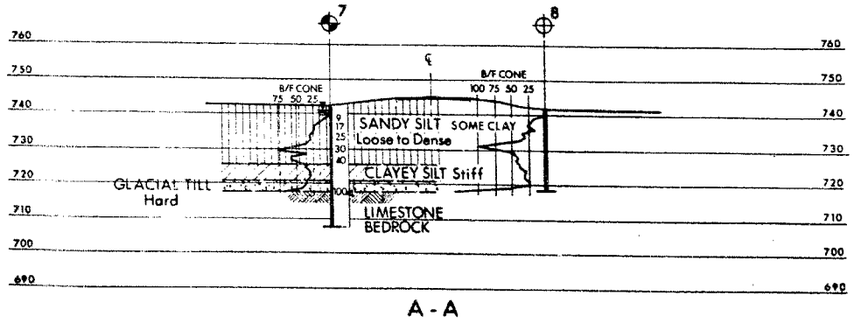
D - D



B - B



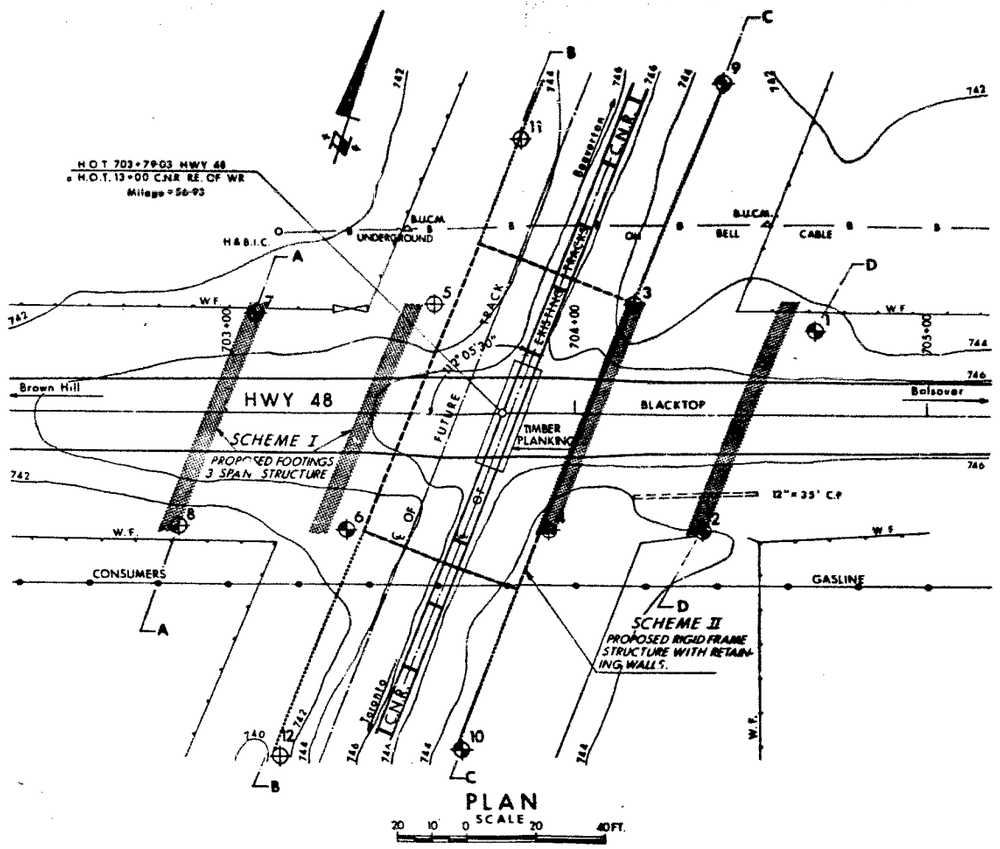
C - C



A - A

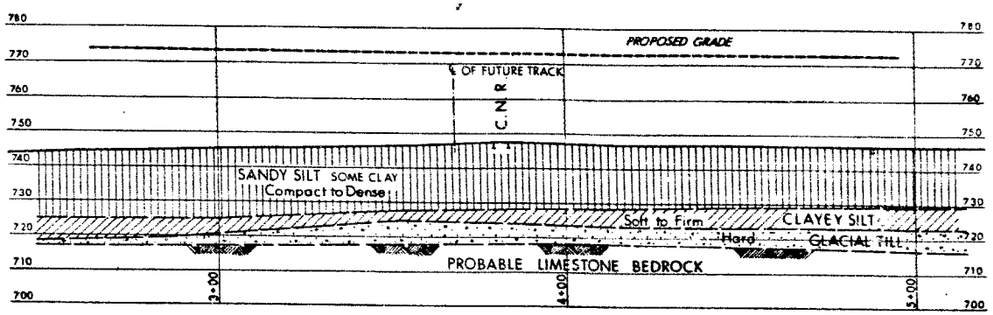
SECTIONS

20 10 0 20 40FT.



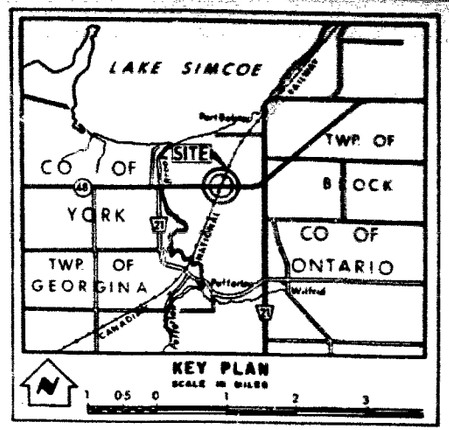
PLAN

20 10 0 SCALE 20 40FT.



PROFILE

20 10 0 SCALE 20 40FT.



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation, OCT. 1970
- No water level established at bore hole No. 10

NO.	ELEVATION	STATION	OFFSET
1	744·3	704+69	24·5'LT
2	744·2	704+36	34'RT.
3	743·4	704+18	32'LT
4	742·9	703+92	34'RT
5	743·0	703+60	32'LT.
6	742·5	703+34	34'RT.
7	742·6	703+09	29'LT
8	741·9	702+86	33'RT.
9	741·6	704+44	97'LT
10	742·4	703+66	98'RT
11	742·6	703+86	80'LT
12	741·3	703+14	100'RT

- 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.

REVISIONS		
DATE	BY	DESCRIPTION

PRINT RECORD		
NO	FOR	DATE

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

CANADIAN NATIONAL RAILWAY

KING'S HIGHWAY NO. 48 DIST. NO. 6
CO. YORK
TWP. GEORGINA LOT 23,24 CON. 6 & 7

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D R.H.	CHECKED	W.P. NO. 98-70-01&02	M.&T. DRAWING NO.
DRAWN G.G.	CHECKED	JOB NO. 70-11092A	70-11092A
DATE 26, NOV 1970		SITE NO.	BRIDGE DRAWING NO.
APPROVED		CONT. NO.	

REF NO E - 4989-1

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

~~Mr. C. Burkhardt,~~

Reg. Bridge Planning Engineer,
Central Region,
Central Building

C.S. Grebski,
Bridge Office

January 11, 1971

C.N.R. Overhead at Hwy. 48
W.P. 98-70-02, Site No. 37-952
Highway 48, District No. 6

70-11092

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6942-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is $108,000. This cost includes tender, materials, engineering and sundry construction.

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

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

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

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

TO: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Bldg.

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: February 26, 1971

OUR FILE REF.

IN REPLY TO

SUBJECT: C.N.R. Overhead at Hwy. 48
W.P. 98-70-02, Site No. 37-952
Highway 48, District No. 6

70-11-092

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.

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office

MARCH 3, 71

NO COMMENTS

A. A. S.

April 71