

MEMORANDUM

To: Mr. A. G. Stermac,
Principal Foundation Engineer,
Laboratory Building,
Downsview, Ontario.

FROM: Bridge Section,
Kingston, Ontario.

ATTENTION:

DATE: January 16, 1970.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 35-66-17, Site 27-213,
C.N.R. Overhead,
(0.6 Mi. East of County Road 7),
Highway 417, District 9 - Ottawa

70-F-7

We are sending to you herewith two prints of Bridge Site Plan E-4687-1 on which we have marked the proposed location of the above structure. Also enclosed are two copies of your Field Reconnaissance Report.

We would be pleased if you will make arrangements for the necessary foundation investigation and to have your report, the scheduled date for which is April 15, 1970.

T. C. Kingsland

T. C. Kingsland
Regional Bridge Planning Engineer

TCK/hl
Encls.

c.c. (with encl.)
Bridge Office Files Section

c.c. Mr. R. Forrest

Field Work Feb 16th 1970
Completion Date March 18th 1970
~~3-17-70~~

MEMORANDUM

316-48

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: March 25, 1970

OUR FILE REF.

IN REPLY TO

APR 3 1970

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For

Proposed Crossing at Hwy. 417
Eastbound and Westbound Lanes
And The Canadian National Railway
Twp. of Cambridge - Co. of Russell
District No. 9 (Ottawa)
W.J. 70-F-7 -- W.P. 35-66-17

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.

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

cc: Messrs. B. R. Davis
H. A. Tregaskes
D. W. Farren
S. J. Markiewicz
C. R. Robertson
T. C. Kingsland (2)
M. R. Ernesaks (2)
J. E. Crispier
B. A. Singh

Foundations Files
Gen. Files

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FOUNDATION INVESTIGATION REPORT
For
Proposed Crossing at Hwy. 417
Eastbound and Westbound Lanes
And the Canadian National Railway
Twp. of Cambridge - Co. of Russell
District No. 9 (Ottawa)
W.J. 70-F-7 -- W.P. 35-66-17

1. INTRODUCTION:

The Foundation Section was requested to carry out a subsurface investigation at the site of the above mentioned proposed crossing. The request was contained in a memo from the Bridge Section (Mr. T. C. Kingsland, Regional Bridge Planning Engineer), dated January 16, 1970. An investigation was subsequently carried out by this Section in order to determine the subsoil and groundwater conditions at the site. This report contains the results of this investigation, together with our recommendations pertaining to the foundations of the proposed structure and the stability of the approach embankments.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located about one mile southeast of Casselman and some 0.6 miles east of County Rd. #7. At this location, the two tracks of the C.N.R. are carried on an embankment which is about 5 to 6 ft. in height. Shallow drainage ditches are located on each side of the embankment. The surrounding terrain is generally flat-lying and cleared for agricultural purposes.

Physiographically, the site is located within the "Winchester Clay Plains" region. The predominant stratum throughout the "Winchester Clay Plains" is composed of a marine clay (Leda clay) deposited by the Champlain Sea. This clay stratum overlies a glacial till deposit which is followed by limestone bedrock.

3. FIELD AND LABORATORY WORK:

A total of twelve boreholes, each of which was accompanied by a dynamic cone penetration test, was carried out during the course of the field investigation by means of two standard diamond drill rigs adapted for soil sampling purposes.

Samples of the surficial clay and the underlying glacial till deposits were obtained in a 2-inch O.D. split-spoon sampler which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. The cohesive overburden was also sampled by means of 2-inch I.D. Shelby tubes, which were manually pushed into the soil. In addition, field vane tests were carried out to determine the undrained shear strength characteristics of the clay stratum, wherever possible. Bedrock was proven at all the borehole locations by obtaining AXT size rock core samples.

The locations and elevations of all the boreholes were surveyed by personnel from the Kingston Region Engineering Surveys Section, and are shown on Drawing 70-F-7A, together with the estimated stratigraphical profiles across the site. The elevations given in this report are referenced to a geodetic datum.

All the samples were subjected to a careful visual examination in the field and subsequently in the laboratory. Following this inspection, laboratory tests were carried out on certain samples to determine the physical properties of the various soil types, namely:

- Natural Moisture Contents
- Atterberg Limits
- Bulk Densities
- Grain-Size Distributions
- Undrained Shear Strengths

3. FIELD AND LABORATORY WORK: (cont'd.) ...

The results of the laboratory tests are plotted on the Record of Borelog sheets and are summarized on Figures 1 to 5 inclusive, all contained in the Appendix to this report.

4. SUBSOIL CONDITIONS:

4.1) General:

Beneath a thin surficial cover of topsoil is a stratum of clay of 4 to 10 ft. in thickness followed by a 1 to 11 ft. thick glacial till deposit consisting of a heterogeneous mixture of clayey silt, sand and gravel with occasional non-cohesive zones. Boulders up to 12 inches in size are randomly present within the glacial till deposit. Directly underlying the glacial till stratum is sound limestone bedrock which is encountered across the site at depths of 13 to 23 ft. below the ground surface. The various soil types encountered at this site are described in further detail below:

4.2) Clay:

Underlying a thin cover of topsoil on either side of the railway embankment is a deposit of clay ranging in thickness between 4 and 10 ft. The upper 2 to 3 ft. of the clay stratum is in a desiccated condition and exhibits brown mottling. Alternate layers of brown and grey clay are present below a depth of 6 ft. in this stratum. Occasional silt seams up to 2 inches in thickness are randomly located throughout. The results of laboratory tests carried out on representative samples from this deposit are tabulated on the following page.

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

4.2) Clay: (cont'd.) ...

	<u>Range</u>	<u>(Avg.)</u>
Natural Moisture Content (W) - %	39 - 61	49
Liquid Limit (W_L) - %	56 - 71	64
Plastic Limit (W_p) - %	25 - 32	30
Bulk Density (γ) - PCF	100 - 113	-
Undrained Shear Strength (C_u) - PSF	<u>Range</u>	<u>Sensitivity</u>
- Field Vanes	550 - 1600	12 - 22
- Lab. Vanes	1300 - 3000	4 - 13
- Lab. Tests	560 - 860	-
Standard Penetration Resistance	4 - 12	(Avg. 7)
'N' Values - Blows/ft.		

The Atterberg limit tests are plotted on the Plasticity Chart, Figure 1, in the Appendix. These indicate that the deposit is mainly an inorganic soil of high plasticity (CH). The consistency of the overall deposit, as determined from the undrained shear strength testing, ranges from firm to stiff, being locally very stiff near the surface of the deposit.

4.3) Heterogeneous Mixture of Clayey Silt, Sand and Gravel - (Glacial Till):

A deposit consisting of a heterogeneous mixture of clayey silt, sand and gravel (glacial till), was encountered immediately below the clay stratum, between elevations 201 and 208. This deposit was found to vary randomly in thickness between 1 and 11 ft. across the site.

The glacial till is essentially cohesive; however, at some locations, non-cohesive zones were encountered at random.

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

4.3) Heterogeneous Mixture of Clayey Silt, Sand and Gravel -
(Glacial Till): (cont'd.) ...

Occasional boulders up to 12 inches in size are also present within the glacial till deposit.

Laboratory tests on representative samples indicate an average moisture content for the overall deposit of about 8 per cent. The Atterberg limits and a grain-size distribution envelope for this deposit are shown respectively, on Figures 2 and 3 in the Appendix.

The Standard Penetration Resistance 'N' values in this deposit generally increased with depth and ranged from 11 to 177 blows/ft. These 'N' values indicate that the cohesive glacial till is of stiff to hard consistency, whereas the non-cohesive zones are dense to very dense.

4.4) Bedrock:

Bedrock was encountered across the site at depths of 13 to 23 feet below the ground surface and was proven at all the borehole locations by obtaining a minimum of 10 ft. of AXT size rock core. The surface of the bedrock was found to vary from elevation 189 (at B.H. 9) to elevation 206 (at B.H. 7).

Examination of the rock cores indicates that the bedrock is composed of a slightly fossiliferous and crystalline limestone containing occasional thin shale seams of 2 to 4 inches in thickness. Core recoveries were generally in excess of 90 per cent indicating that the bedrock is sound. During the core drilling operations at the location of B.H.'s 4, 5, 6 and 10, a loss of drill water was noticed after the rock had been cored for about 2 ft. This loss of water during drilling may be due to open joints within the bedrock.

5. GROUNDWATER CONDITIONS:

Water level observations were carried out in the open boreholes during the period of the investigation and indicate that the water level across the site is situated approximately 5 ft. below the ground surface - i.e., at about elevations 207 - 208.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct two parallel structures to carry the East- and Westbound lanes of Hwy. 417 over the C.N.R. tracks, about 1 mile southeast of Casselman. Present proposals call for three-span (77'-62'-77') structures having deck widths of about 48 ft. each. The profile grade of Hwy. 417 at the crossing location will be at about elevation 245; thus, fills up to 32 ft. in height will be required at the approaches to the structures.

The investigation has revealed the presence of a surficial clay stratum, some 4 to 10 ft. in thickness, followed by a glacial till deposit of 1 to 11 ft. thickness which, in turn, is underlain by sound limestone bedrock at depths of 13 to 23 ft. below the ground surface - i.e., elevations 189 to 206.

6.2) Structure Foundations:

Alternative schemes for the support of pier and abutment footings are discussed in detail in the following sections:

6.2.1) Pier Footings -

(a) Spread Footings -
- - - - -

The proposed piers may be founded on spread footings located on the surface of, or within, the glacial till deposit and designed for a safe allowable bearing pressure of 3.0 TSF. A minimum soil cover of 5 ft. should be provided to the underside of the footing for frost protection. Since the glacial till is

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

6.2) Structure Foundations: (cont'd.) ...

6.2.1) Pier Footings - (cont'd.) ...

(a) Spread Footings - (cont'd.) ...
- - - - -

relatively incompressible, settlement of such footings should be negligible.

During construction of the pier footings, adequate measures will be required to protect the existing railway embankment in this area. To reach founding level, the pier excavations will extend below the prevailing ground water. In view of the presence of permeable, non-cohesive zones within the glacial till deposit, dewatering may be a problem.

(b) Caissons -
- - - - -

As an alternative, the proposed piers may be supported on caissons bearing on the sound limestone bedrock. Caissons 30 inches in diameter and supported on the bedrock may be designed for a safe load of up to 250 tons/caisson. The investigation has revealed that the bedrock elevation varies considerably within a confined area surrounding the location of Borehole No. 9. In view of this, the Foundation Section will carry out additional borings in order to establish the bedrock elevations more precisely at each caisson location.

Due to the presence of occasional permeable zones in the glacial till deposit, it may be necessary to provide temporary caisson liners during construction of the piers.

6.2.2) Abutment Footings:

The proposed abutments may be perched within the approach fills. Such abutments may be supported in either of the following manners:

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

6.2) Structure Foundations: (cont'd.) ...

6.2.2) Abutment Footings: (cont'd.) ...

(a) Caissons -
- - - - -

The abutments may be supported on caissons taken down to the bedrock surface. The same design criteria, as discussed earlier for pier footings, may be used for the design of caissons at the abutment locations.

(b) Piles -
- - -

The abutments may, alternatively, be supported on end-bearing steel H-piles driven to the surface of the bedrock. The design load will depend on the pile section chosen; e.g., 12 BP 7 $\frac{1}{2}$ piles may be designed for 90 tons/pile. Care should be taken to ensure that no bouldery or rock fill is placed in the areas through which the piles will be driven. The pile caps should be provided with a 5-ft. soil cover for frost protection.

(c) Spread Footings -
- - - - -

Since the compressible clay stratum at the approach locations is some 4 to 10 ft. thick, consideration should be given to subexcavate the entire clay stratum for a minimum distance of 50 ft. behind the abutment locations within the plan limits of the approach embankments. The material for backfill should preferably be of a granular type in order to achieve greater compaction and hence reduce the settlements within the fill. In such a case, it would be feasible to support the abutments on spread footings within the approach fills. The fill material below the tops of the footings, should consist of well compacted G.B.C. Class 'A' material, and should extend to a horizontal distance of at least 10 ft. from the

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

6.2) Structure Foundations: (cont'd.) ...

6.2.2) Abutment Footings: (cont'd.) ...

(c) Spread Footings - (cont'd.) ...
- - - - -

footing edges in the plane of the footing tops. This portion of the fill should be constructed with side slopes no steeper than 2:1. The remainder of the fill should be completed to about profile grade for a distance of 50 ft. behind the abutments before re-excavation for the abutment footings. An allowable bearing pressure of 2.0 TSP may be used in design.

6.3) Approach Embankments:

The approach embankments will be about 32 ft. high. No stability problems are anticipated for such fills constructed with standard 2:1 slopes.

It is estimated that the total settlement due to the consolidation of the clay stratum at the approach locations will be in the order of 4 to 8 inches. Of this total amount, at least 50 per cent should be realized within about 12 months after completion of fills to grade. Settlements will be negligible if the clay deposit is subexcavated from beneath the approach fill locations, as discussed elsewhere in this report.

7. MISCELLANEOUS:

The field work was carried out during the period February 13 - 25, 1970, by Mr. Harold R. Stankaitis, Technician.

This report was prepared by Mr. C. Mirza, Project Foundation Engineer, and reviewed by Mr. M. Devata, Supervising Foundation Engineer, who was in charge of the entire project.

March, 1970

APPENDIX I

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 70-F-7 LOCATION Sta. 465 + 09 E Prop. Hwy. 417 EBL o/s 30' Lt. ORIGINATED BY HRS
 W.P. 35-66-17 BORING DATE February 6 & 25, 1970 COMPILED BY CM
 DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing; Cone CHECKED BY JK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	T. PE	BLOWS / FOOT		BLOWS / FOOT					SHEAR STRENGTH P.S.F.					WATER CONTENT %
							20	40	60	80	100	○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL			
213.5	Ground Level																
0.0	Topsoil	177															
1.0	Silty clay to clay																
206.5	Grey - Brown:																
7.0	Glacial Till																
	Brown to Grey Brown																
196.4																	
17.1	Limestone Bedrock		1	AXT 90%													
	Sound		2	AXT 100%													
186.1																	
27.4	End of Borehole																

Elevation (ft)	Resistance (blows/foot)	Sample
213.5	210	1
206.5	190	1
196.4	200	2
186.1	180	2

208.2

208.2

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 70-F-7

LOCATION Sta. 465 + 62 @ Prop. Hwy. 417 EBL o/s 18' Rt.

ORIGINATED BY HRS

W.P. 35-66-17

BORING DATE February 17 - 18, 1970

COMPILED BY CM

DATUM Geodetic

BOREHOLE TYPE Washboring-BX & BX Casing; Cone

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					SHEAR STRENGTH P.S.F.					WATER CONTENT % 25 50 75
							20	40	60	80	100	○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					
213.4	Ground Level																
0.0	Topsoil	222															
1.0	Clay with trace of sand. Stiff - Firm		1	SS	12	210											
205.4	Mottled Brown - Grey		2	SS	4												
8.0	Het. mix. of clayey silt sand & gravel (Glacial Till)		3	SS	59												
	Hard		4	SS	50	200											
196.4	occ. non-cohesive zones. Very dense. Grey		5	SS	125/5"												
17.0	Limestone Bedrock		6	AXT	97%												
186.0	Sound		7	AXT	98%	190											
27.4	End of Borehole					180											

208.2

6 38 44 12

FOUNDATION SECTION

ORIGINATED BY HRS

COMPILED BY CM

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB	70-F-7	LOCATION	Sta. 466 + 55 @ Prop. Hwy. 417 EBL o/s 42' Lt.	ORIGINATED BY	HRS
W.P.	35-66-17	BORING DATE	February 24, 1970	COMPILED BY	CM
DATUM	Geodetic	BOREHOLE	Washboring-BX Casing; Cone	CHECKED BY	62

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION	RESISTANCE	LIQUID LIMIT ——— w_L	PLASTIC LIMIT ——— w_p	WATER CONTENT ——— w	BULK DENSITY γ P.C.F.	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT							SHEAR STRENGTH P.S.F.	WATER CONTENT %
							20	40	60	80	100				
							20 40 60 80 100					w_p ——— w ——— w_L			
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE								
212.8	Ground Level														
0.0	Topsoil														
1.2	Clay with trace sand & silt seams.		1	SS	7	210									
206.8	Firm. Grey		2	SS	126										
6.0	Het. mix. of clayey silt, sand & gravel (Glacial Till)		3	SS	30										
198.8	Hard. Grey-Brown.		4	SS	67	200									
14.0	Limestone Bedrock		5	AXT	90%										
	Sound		6	AXT	97%	190									
188.0															
24.8	End of Borehole														

OH

208.3

19 34 37 10

Loss of drill water @ elev. 198+

FOUNDATION SECTION

ORIGINATED BY **HRS**

COMPILED BY CM

CHECKED BY

[illegible]

FOUNDATION SECTION

ORIGINATED BY HRS

COMPILED BY CM

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION BLOWS / FOOT	RESISTANCE	LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT		20 40 60 80 100		w_p ——— w ——— w_L		
							SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE 500 1000 1500 2000 2500		WATER CONTENT % 25 50 75		
213.5	Ground Level										
0.0	Topsoil	???									
1.0	Clay with trace sand & occ. silt seams. Very stiff to firm Brown & Grey		1	TW	PM						
			2	TW	PM						
203.0											
10.5	Glacial Till										
200.7											
12.0	Limestone Bedrock		3	AXT	90%						
	Sound		4	AXT	100%						
190.2											
23.3	End of Borehole										

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 70-F-7 LOCATION Sta. 465 + 03 @ Prop. Hwy. 417 WBL o/s 30' Rt. ORIGINATED BY HRS
 W.P. 35-66-17 BORING DATE 9 February 16 & 25, 1970 COMPILED BY CM
 DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing; Cone CHECKED BY 11

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION BLOWS / FOOT 20 40 60 80 100	RESISTANCE	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						
213.1	Ground Level										
0.0	Topsoil										
1.0	Clay										
203.1	Grey & Brown										
10.0	Glacial Till with boulders up to 12" in size.										
198.6			1	AXT	45%						
14.5	Limestone Bedrock Sound		2	AXT	96%						
191.5											
21.6	End of Borehole										

207.6

FOUNDATION SECTION

ORIGINATED BY HRS

COMPILED BY CM

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION	RESISTANCE	LIQUID LIMIT ——— w_L	PLASTIC LIMIT ——— w_p	WATER CONTENT ——— w	BULK DENSITY γ P.C.F.	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100			SHEAR STRENGTH P.S.F.	WATER CONTENT % 25 50 75
														w_p ——— w ——— w_L	
											\circ UNCONFINED + FIELD VANE \bullet QUICK TRIAXIAL x LAB. VANE				
											500 1000 1500 2000 2500				
212.9	Ground Level														
0.0	Topsoil	222													
1.0	Clay with trace sand & occ. silt seams. Firm to stiff		1	SS	5	210									
			2	TW	PM										
203.9	Grey & Brown		3	WS	-										
			4	SS	190/6"										
			5	WS	-										
9.0	Het. mix. of clayey silt? sand & gravel (Glacial Till) Hard occ. non-cohesive zones Compact to very dense		7	SS	75	200									
			8	SS	177										
			10	SS	11										
			11	SS	20										
189.8	Grey.														
23.1	Limestone Bedrock		12	AXT	91%										
	Sound		13	AXT	97%										
179.1						180									
33.8	End of Borehole					170									

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 10

FOUNDATION SECTION

JOB 70-F-7

LOCATION Sta. 466 + 03 @ Prop. Hwy. 417 WBL o/s 28' Lt.

ORIGINATED BY HRS

W.P. 35-66-17

BORING DATE V February 23, 1970

COMPILED BY CM

DATUM Geodetic

BOREHOLE TYPE Washboring-NX & BX Casing; Cone

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE				
212.8	Ground Level															
0.0	Topsoil	222														
1.0	Clay with trace sand.															
207.8	Firm. Brown-Grey.		1	SS	8	210										
5.0	Het. mix. clayey silt, sand & grav. (Glac. fill)		2	SS	19											
203.3	Hard. Brown-Grey		3	SS	100.6"											
9.5	Limestone Bedrock		4	AXT	91%	200										
	Sound		5	AXT	95%											
192.5																
20.3	End of Borehole															

207.0
 56 35 (4)
 Loss of drill water at el. 202 ±

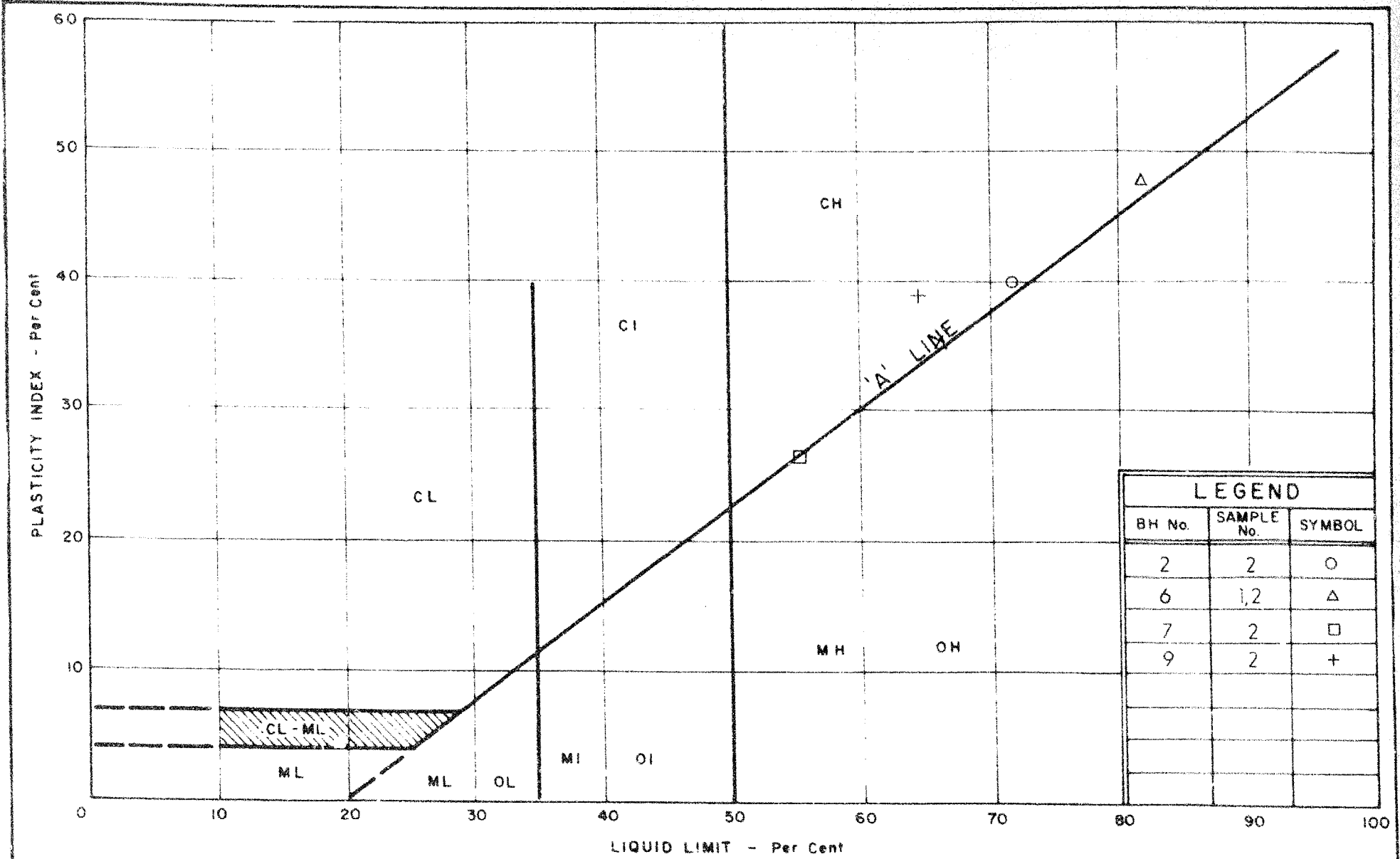
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 12

FOUNDATION SECTION

JOB 70-F-7 LOCATION Sta. 467 + 19 @ Prop. Hwy. 417 WBL o/s 30' Rt. ORIGINATED BY HEA HRS
W.P. 35-66-17 BORING DATE February 18-19, 1970 COMPILED BY CM
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing; Cone CHECKED BY LP

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	SHEAR STRENGTH P.S.F.					WATER CONTENT % w_p — w — w_L 25 50 75				
							20 40 60 80 100									
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE									
213.3	Ground Level															
0.0	Topsoil															
1.0	Clay with trace sand.															
208.3	Firm. Grey-Brown		1	SS	7	210										
5.0	Het. mix. of clayey silt, sand & grav. (Glac. Till)		2	SS	20											
	Very stiff to hard. non-cohesive zones		3	SS	39											
199.5	Very dense		4	SS	163/9"	200										
13.8	Limestone Bedrock		5	AXT	96%											
	Sound		6	AXT	96%											
189.1						190										
24.2	End of Borehole					180										



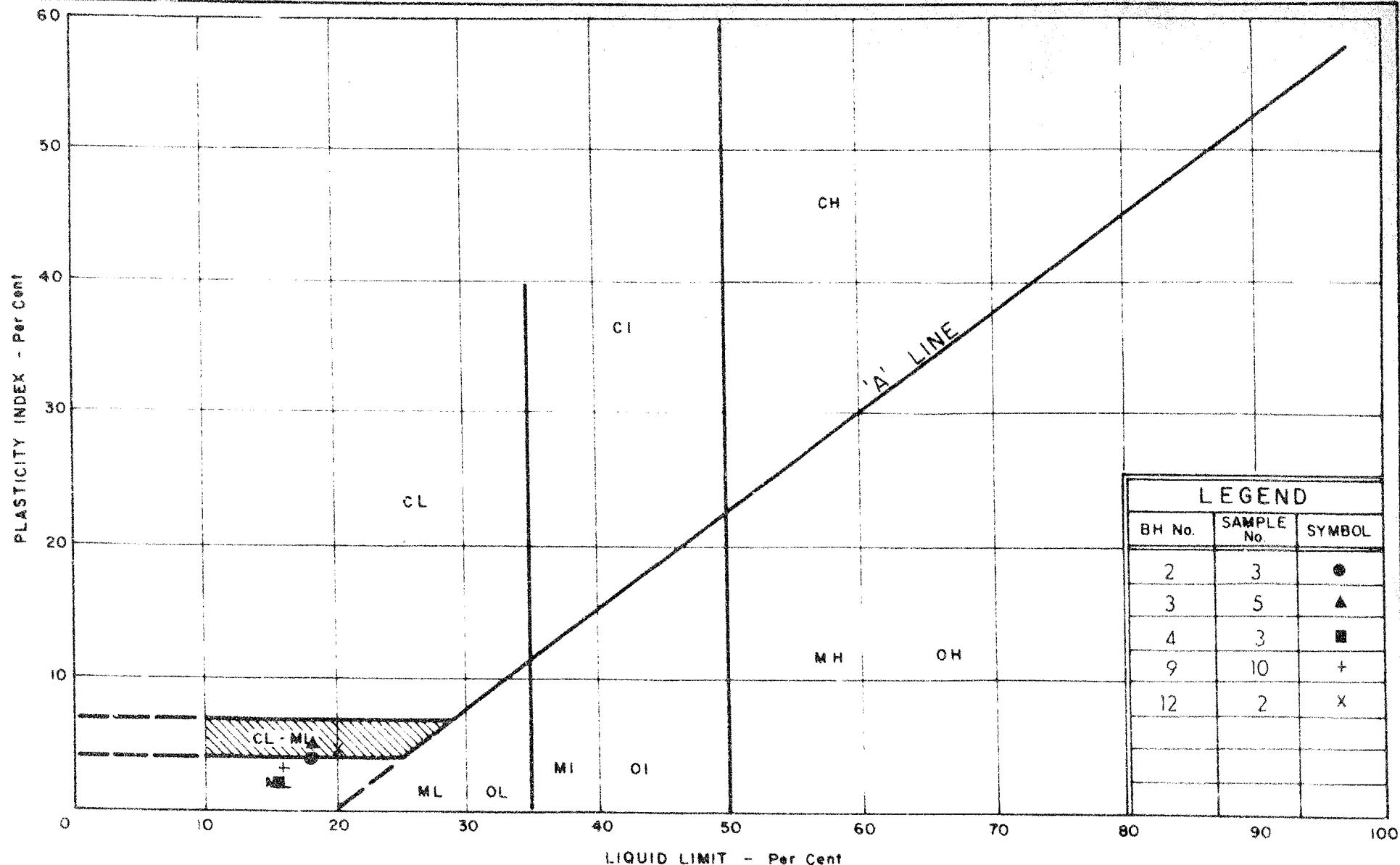
LEGEND		
BH No.	SAMPLE No.	SYMBOL
2	2	○
6	1,2	△
7	2	□
9	2	+



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART
CLAY

WP. No. 35 - 66 - 17
JOB No. 70 - F - 7
FIG. No. 1



DEPARTMENT OF HIGHWAYS
 MATERIALS and
 TESTING
 DIVISION

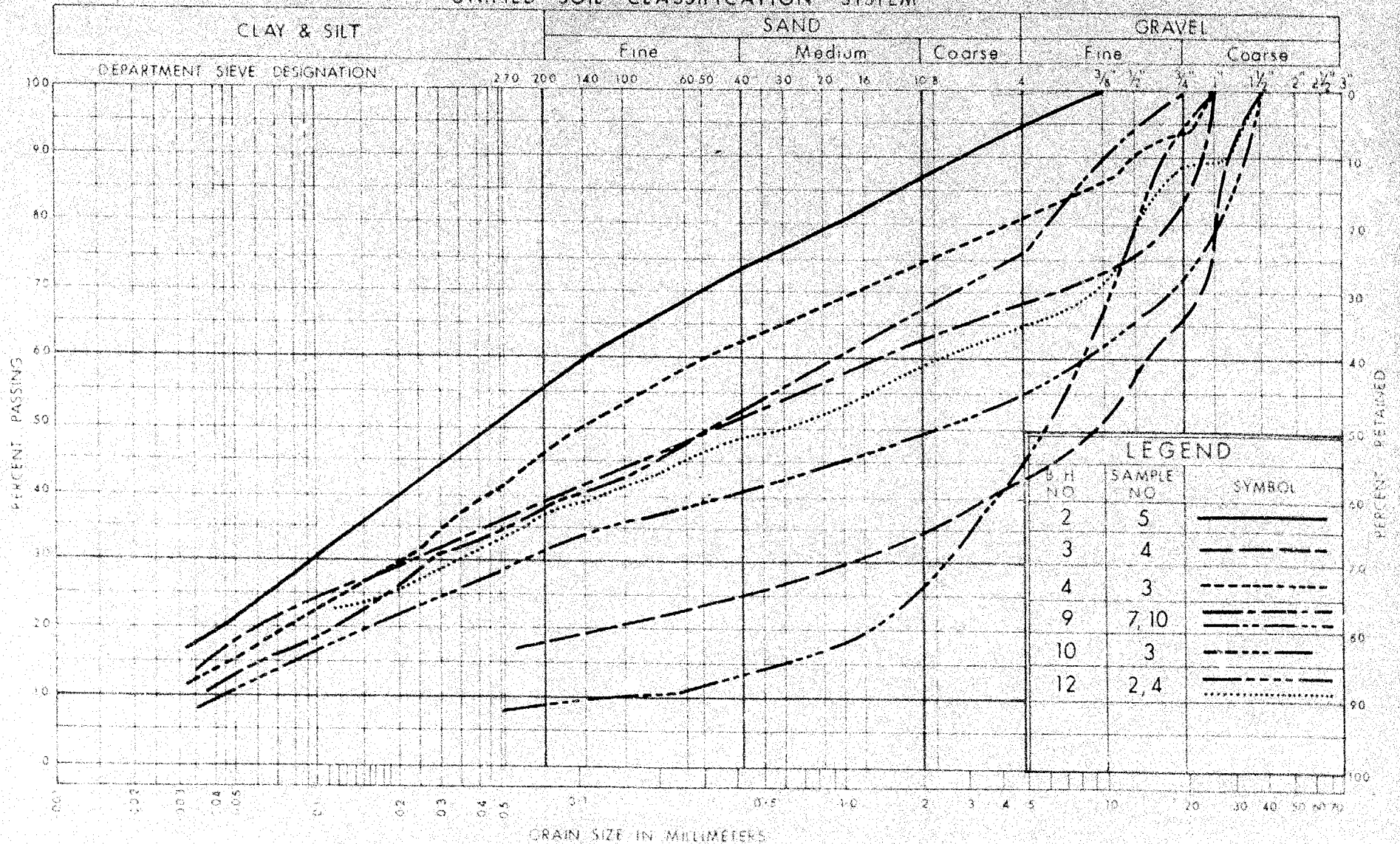
PLASTICITY CHART GLACIAL TILL

W.P. No. 35 - 66 - 17

JOB No. 70 - F - 7

FIG. No. 2

UNIFIED SOIL CLASSIFICATION SYSTEM



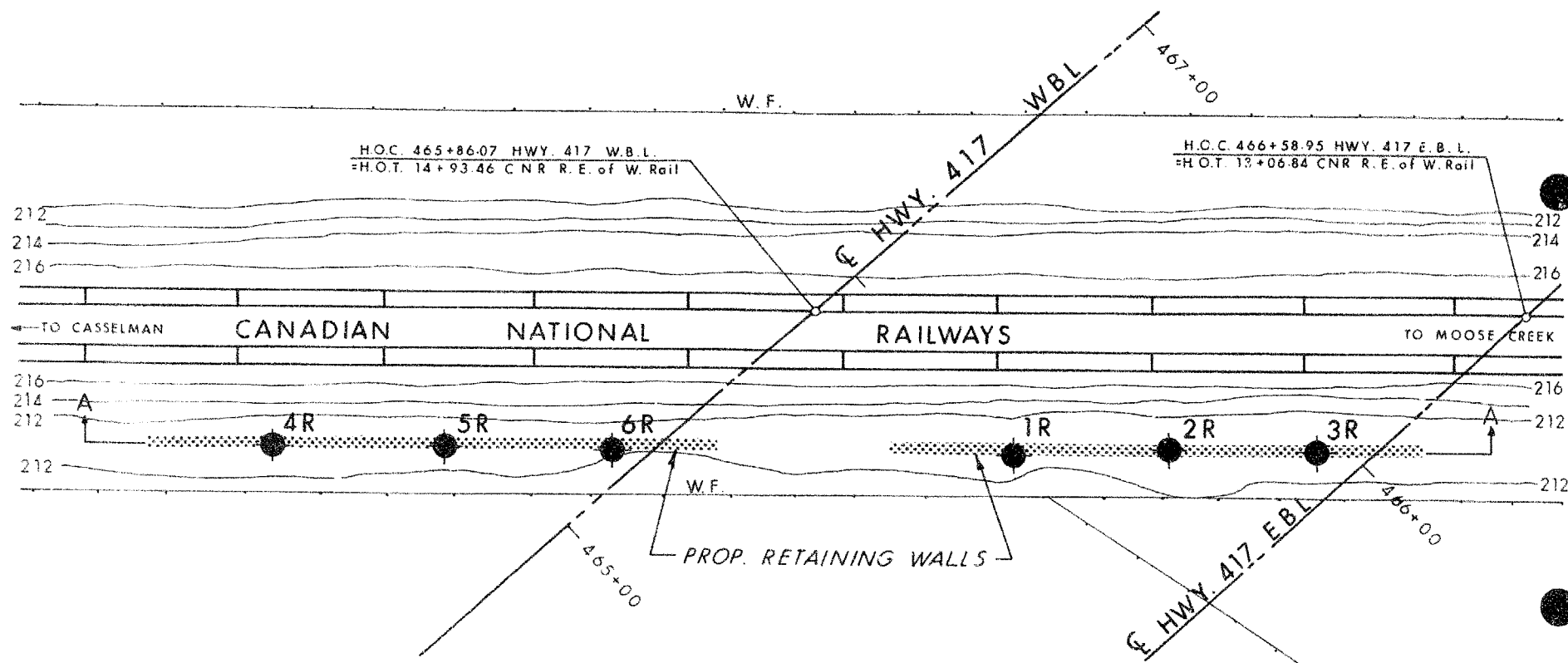
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION GLACIAL TILL

WP No. 35-66-17

JOB No. 70-F-7

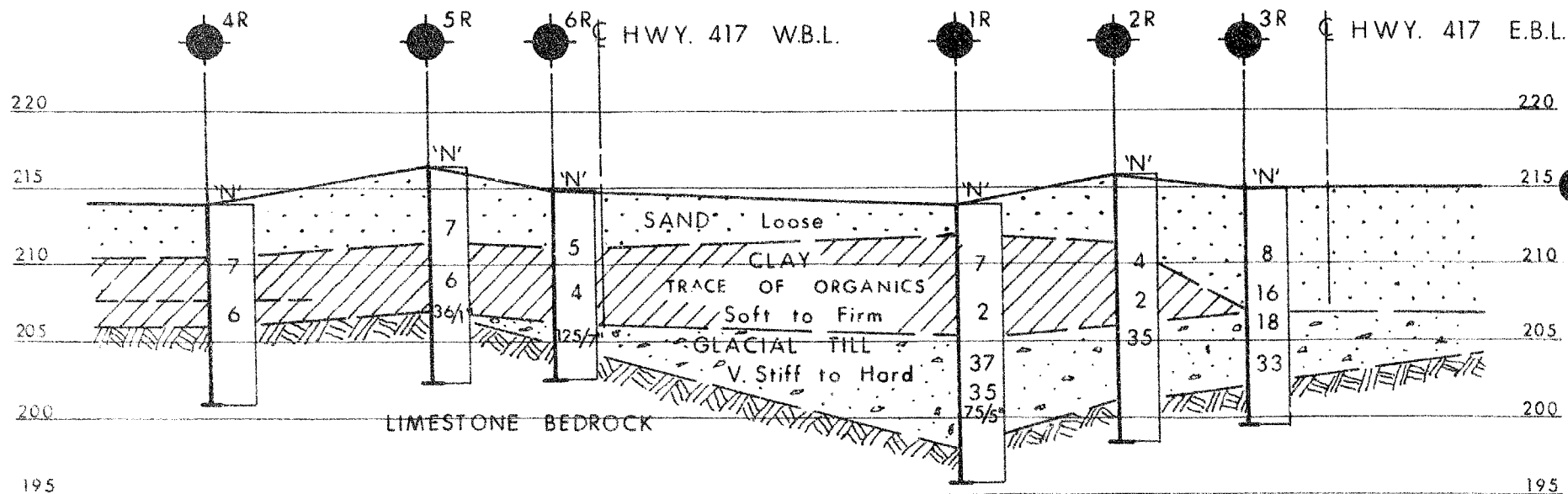
FIG. No. 3



PLAN
SCALE 1"=40'-0"

B.H. NO.	ELEV.	STA.	OFFSET
1R	214.0	465+33	64' LT. EBL
2R	215.9	465+64	38' LT. EBL
3R	215.0	465+93	11' LT. EBL
4R	213.9	464+54	68' LT. WBL
5R	216.4	464+89	38' LT. WBL
6R	215.0	465+22	8' LT. WBL

FIGURE 1



SECTION A-A

SCALE : Horiz.- 1" = 40'
Vert. - 1" = 10'

FIGURE 2

W.O. 70-11007

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

Q _u	UNCONFINED COMPRESSION	L V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F V	FIELD VANE
Q _{cu}	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q _d	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_r	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

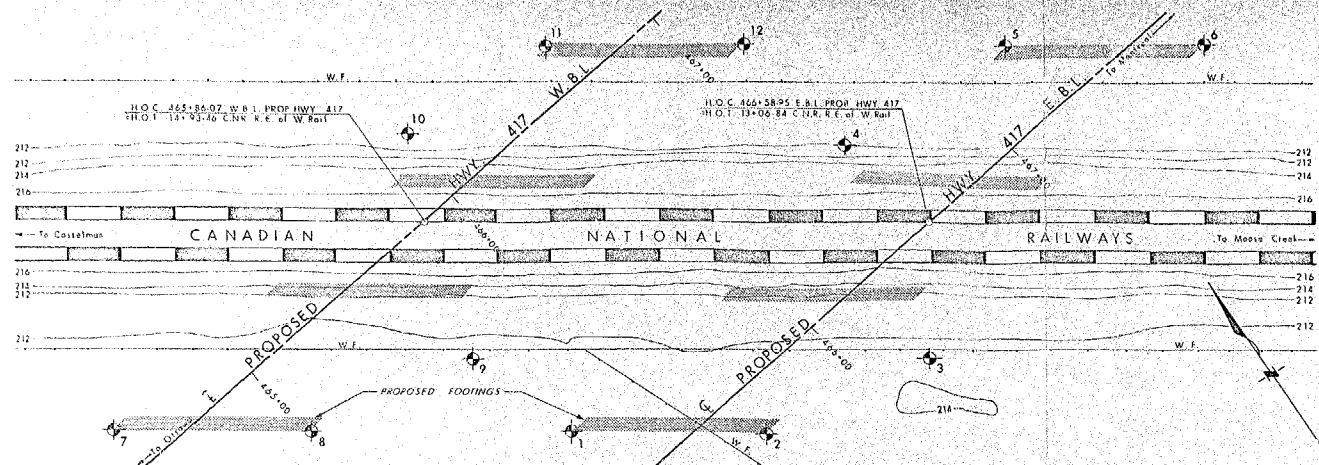
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

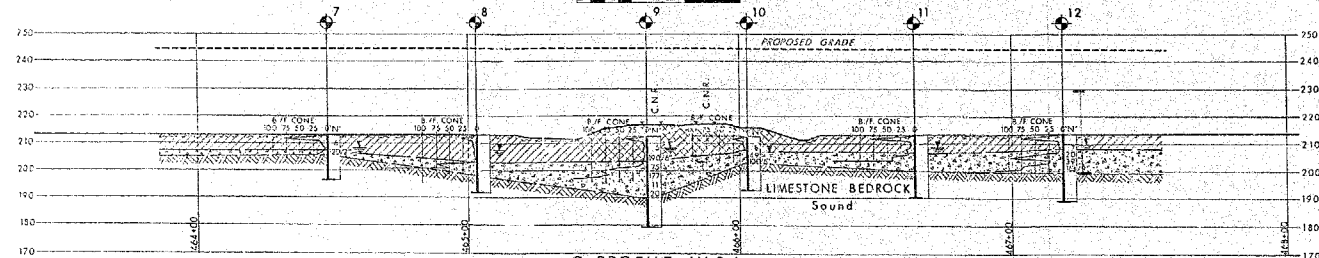
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

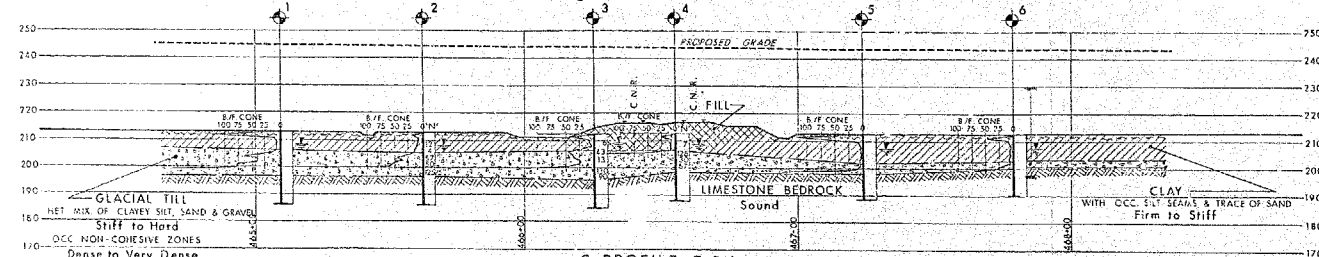
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



PLAN
SCALE
20 10 0 20 40 FT.

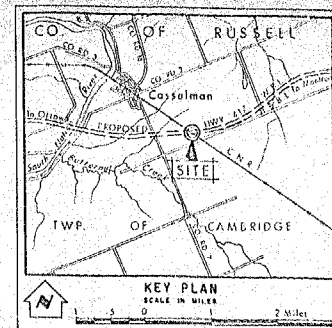


§ PROFILE W.B.L.



§ PROFILE E.B.L.

SCALE
20 10 0 20 40 FT.



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation, Feb. 1970
- Estimated Water Levels

NO.	ELEVATION	STATION	OFFSET
1	213.5	465+09	30' LT. E.B.L.
2	213.4	465+62	18' RT. E.B.L.
3	212.4	466+25	37' RT. E.B.L.
4	212.8	466+55	42' LT. E.B.L.
5	213.3	467+24	30' LT. E.B.L.
6	212.5	467+79	18' RT. E.B.L.
7	213.4	468+48	10' LT. W.B.L.
8	213.1	468+03	30' RT. W.B.L.
9	212.9	468+66	50' RT. W.B.L.
10	212.8	469+03	24' LT. W.B.L.
11	212.3	469+64	18' LT. W.B.L.
12	213.3	467+19	30' RT. W.B.L.

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.

REV.	BY	DATE	DESCRIPTION

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

CANADIAN NATIONAL RAILWAYS

KING'S HIGHWAY NO. 417 DIST. NO. 9
CO. RUSSELL
TWP. CAMBRIDGE LOT 7 & 8 CON. VII

BORE HOLE LOCATIONS & SOIL STRATA

SUBMITT. C.N. CHECKED	W.P. NO. 33-06-03	M.B.T. DRAWING NO.
DRAWN C.E. CHECKED	JOB NO. 70-F-7	70-F-7A
DATE: March 18, 1970	SITE NO.	OFFICE DRAWING NO.
APPROVED: [Signature]	PROJECT NO.	

Department of Highways Ontario

Copy for the information of
Mr. A. Stermac

~~Mr. T.C. Kingland,~~
Reg. Bridge Planning Engineer,
Kingston Regional Office,
Kingston, Ontario

Bridge Office,
Downsview

June 23, 1970

Canadian National Railways Overhead - E.B.L.
0.6 Mi. East of County Rd. 7
W.P. 35-66-17, Site 27-213
Highway 417, District No. 9

70-F-7

Attached herewith are prints of the Preliminary Bridge Plan
Drawing D-6839-P for the above-mentioned structure.

The estimated cost of the proposed structure is \$135,000.
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 (2)
J. Anderson

Abutment piles are to be driven to bedrock

On Swata
July 8th 1970

Department of Highways Ontario
Copy for the information of
Foundation Office

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

C.S. Grebski,
Bridge Office

January 15, 1971

Canadian National Railways Overhead - E.B.L.
W.P. 35-66-17, Site No. 27-213
Highway 417, District No. 9

70-F-7

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

no comments

BTD

Jan 29/71

HL
12 Feb 71

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: File,

FROM: C. S. Poon,
Project Foundations Engineer,
Foundations Office.

ATTENTION:

DATE: January 5, 1973.

OUR FILE REF.


IN REPLY TO

SUBJECT:

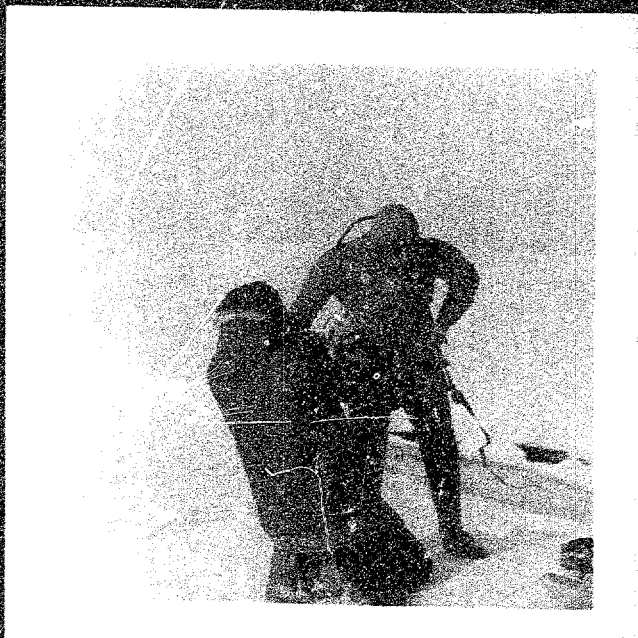
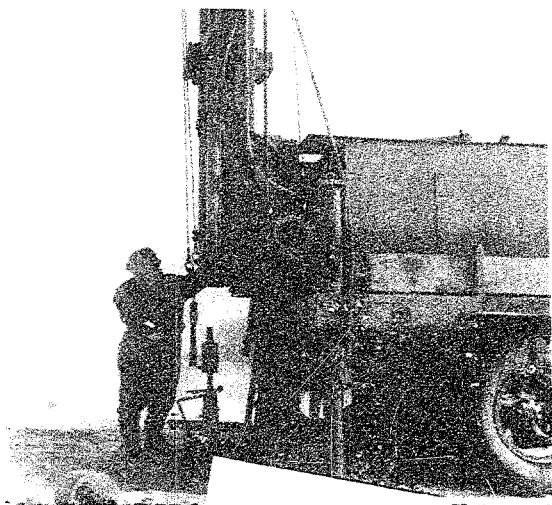
*Bedrock Elevation at West Pier
Hwy. 417 W.B.L. and C.N.R.
Twp. of Cambridge, County of Russell
District No. 9 (Ottawa)
W.O. 70-11007 W.P. 35-66-05*

This Office was advised by J. Cruickshank, Construction Engineer, District No. 9, on January 4, 1973, that the bedrock at the west pier location of Hwy. 417 W.B.L. structure was found to be at elevations 205 to 207. The founding level of the pier is, however, at elev. 203. It is our opinion that the founding level may be raised to 205. This was discussed with Messrs. K. Bassi and W. Hashizume and agreed upon.

CSP/ck



C. S. Poon,
Project Foundations Engineer.





Design Services Branch,
1251 Wilson Avenue,
Downsview, Ontario.
M3M 1J9

February 8, 1973.

Telephone: 249-3282.

F. E. Johnston Drilling Co. Ltd.,
P.O. Box 4134,
Postal Station 'E',
Ottawa, Ontario.

Dear Sirs:

This letter confirms our request of February 8, 1973,
for the supply of a diamond drill together with all necessary
equipment, as specified under the terms of our Contract Agreement,
at Casselman, Ontario, on February 3, 1973.

Mobilization will be from Casselman, Ontario.

Our project number is W.O. 70-11007. ✓

Yours truly,

MD/ao

cc: W. W. Fry
(Attn: Mrs. M. Andrews)

Foundations Files
Documents

For:

M. Davata
M. Davata,
Supervising Foundations Eng.,
A. G. Sternac,
Principal Foundations Eng.

T E L E T Y P E

To: Mr. J. A. Cruickshank,
Construction Engineer,
District #9, Ottawa.

Re: Canadian National Railways Overhead N.B.L. Structure,
Hwy. 417, District #9 (Ottawa, W.P. 35-66-17
W.O. 70-11007, Cont. 72-173

This Office completed the borings at the east pier location of the above-mentioned structure. Our recommendations are as follows for the base of the foundations:

South End	Elevation 204.0
North End	Elevation 200.0

The excavation so formed should be brought up to the design elevation with mass concrete. A representative from this Office will be available to inspect the footings if required.

MD/ao

M. Devata,
SUPERVISING FOUNDATIONS ENGINEER.

cc: W. Hashizume
Construction Branch



ONTARIO

DEPARTMENT OF HIGHWAYS

OVER

NOTIFICATION OF INTENT TO CLAIM

CHIEF HIGHWAY ENGINEER,
DEPARTMENT OF HIGHWAYS ONTARIO.

Date February 19, 1973

Against Contract No. 72-173

District Ottawa

Location Casselman

Contractor C. A. Pitts Engineering

Construction Ltd. - Sub-Contract to Bennett Paving

In accordance with Paragraph 2, Sub-section 104-1 of Section 104 "Control of the Work" of the "General Conditions of the Contract" D.H.O. Form 100, I/We declare my/our intention to file a claim against the above contract due to the following (Give complete details, attaching separate sheet if necessary.)

The contract drawings for the two Canadian National Railway Overhead Bridges showed definite elevations for the four pier footings and the requirement for shoring of the two western piers.

During actual construction, the rock was found to be at a higher elevation than shown in the drawings for both piers of the W. B. L. and additional handwork was necessary to meet M. T. C. requirements. A large boulder was encountered in the west footing of the E. B. L. and a week was lost trying to break it out before it was accepted. OK

Rock could not be found in the east footing of the E. B. L. by probing with a backhoe and, therefore, a drill was brought in by the M. T. C. to determine rock elevation. As a result, it is expected that the footing elevation will be a minimum of six (6) feet below design grade and will require extensive shoring where originally token shoring was anticipated and will cause severe delay in our construction program.

Although the additional work has been paid on a force account basis, our overhead costs, additional equipment, additional materials and overall loss of schedule are not fully compensated for under this arrangement. Upon completion of the work and finalization of cost records, we would be prepared to discuss the claim further with M. T. C. officials.

NOTICE CLAIM CONTINUED

NOTE: Contractor must give this notice to the Chief Highway Engineer and District Engineer within 7 days of his date of commencement on the work out of which this claim arises - Refer - Section 104-I General Conditions of the Contract D.H.O. Form #100 Revised January, 1962

Signed


Contractor or Authorized Representative

TO BE MADE IN QUADRUPLICATE BY THE CONTRACTOR
ONE COPY SENT TO DISTRICT ENGINEER - TWO COPIES SENT TO CHIEF HIGHWAY ENGINEER

(1) CHIEF HIGHWAY ENGINEER'S COPY NO. 1

MEMORANDUM

TO: Mr. J.W. MacDougall,
Claims Engineer,
Downsview, Ontario.

FROM: #9, Ottawa

ATTENTION:

DATE: March 2, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Re: Contract 72-173

Bennett Paving & Materials Ltd.

Attached for your information is a "Notification of Intent to Claim" which has been submitted by C.A. Pitts who are doing the structures for Bennett Paving on the above contract.

This Intent to Claim was discussed briefly at the last monthly site meeting when the Ministry were advised that Pitts intended to submit this form. After the work has been completed the Contractor will assess what additional costs, if any, has resulted in the pier footings due to the rock not being as shown on the drawings. Records are being maintained by our field office to permit the Ministry to either concur or reject the Contractor's claim should same be submitted at a later date.

A detailed report will be prepared and submitted to your office by our Project Supervisor on C.A. Pitts Intent to Claim dated February 1973 by March 16, 1973.

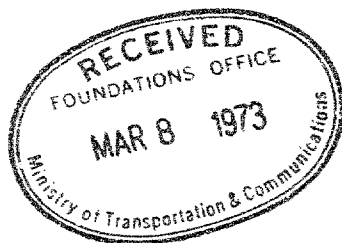
Should additional information be required prior to our submission I would suggest W.T. Hashizume in the Bridge Office will be able to provide information as he has been very involved with all the structure work to-date on this contract.

R. Wert

R. Wert,
District Engineering Office Supvr.

Att'd.
RW/ea

c.c. Mr. F.G. Allen, Director of Construction Branch
Mr. W.T. Hashizume, Regional Construction Engineer, Structures
Mr. W. McShane, Project Supervisor



Mr. L. R. Sadie,
Executive Director,
Operations Division

J. W. MacDougall,
Claims Engineer

March 5, 1973.

Re: Contract 72-173,
Prime Contractor - Bennett Paving & Materials Ltd.,
Sub-Contractor - C. A. Pitts Engineering Construction Ltd.

Attached herewith please find a Notification of Intent to Claim dated February 19, 1973, which was sent directly by the sub-contractor to the District. Also attached is a copy of the District Report dated March 2, 1973, both of these are self-explanatory.

J. W. MacDougall,
Claims Engineer

Attach. (2)

c.c. Messrs. J. B. Wilkes,
E. J. Orr,
C. R. Wilmet, ✓
P. D. Billings,
A. F. Leach,
D. M. Hopper,
J. E. Callaghan,

70-F-7

Mr. J.A. Cruikshank,
Construction Engineer,
District 9, Ottawa.

Mr. W.T. Hashizume.

March 7, 1973.

Contract 72-173, W.P. 35-66-24,
CNR Overhead WBL, Site 27-213,
Highway 417, District 9.

This will confirm verbal recommendations given to Mr. W. McShane of your field office on January 25, 1973, regarding the east pier footing of the above bridge.

During excavation for the above footing, bedrock was encountered at an elevation much higher than the bottom of footing elevation of 204.9 as shown in the attached sketch.

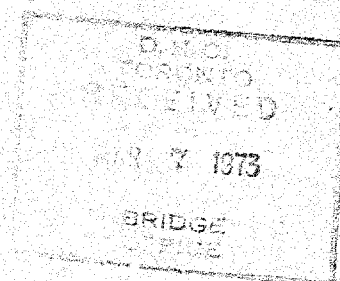
It was therefore decided that the excavation will be cleaned out and the cavity filled with mass concrete (3000 p.s.i.) to elev. 207. This will establish the bottom of the east pier at elev. 207 and the top of footing at 210.00.

The foregoing will require cutting to suit the column reinforcing and spirals.

WTH/JC

W.T. Hashizume
W.T. Hashizume,
Regional Construction Engineer,
Structures

c.c. B.R. Davis ✓



Mr. A. G. Stermac,
Principal Foundations Engineer,
Design Services Branch,
West Bldg., Downsview.

Mr. M. Devata,
Supervising Foundations Engineer.

March 19, 1973.

*Complications Arising During the
Construction of Piers, Twin Overhead
Structures at the Crossing of the
C.N.R. and Hwy. #417 (E.B.L. and W.B.L.)
Twp. of Cambridge - County of Russell,
Site 27-13, Contract No. 72-173
District No. 9 (Ottawa)
W.O. 70-11007 - W.P. 35-66-17 (E.B.L.)
35-66-24 (W.B.L.)*

1. Introduction:

C. A. Pitts Engineering Construction Ltd., the sub-contractor to Bennett Paving, have submitted an intent to claim on the work they have performed to install the four piers associated with these two structures (form dated February 19, 1973). The problems arising during construction at each location will be discussed in the sections to follow.

2. Structure at the Crossing of Hwy. 417 (W.B.L.) and the C.N.R. (W.P. 35-66-24):

i) East Pier Footing:

The proposed founding elevation of this footing was elevation 204. Over the major portion of this footing, however, bedrock was encountered at a higher elevation (as high as elevation 207). The treatment at this footing consisted of excavating down to bedrock over the footing area and bringing the low areas back up to elevation 207 with mass concrete. This treatment was described by W. T. Hashizume, Regional Construction Engineer (memo dated March 7, 1973).

The end result was that the footing was placed 3 feet higher than shown on the contract drawing (D6850-1). The pier columns, therefore, had to be shortened and the reinforcing cut.

The mass concrete required was paid for on force account. There appears to be no reason why an additional claim need be considered at this location. District personnel know the quantity of mass concrete required.

ii) West Pier Footing:

The proposed founding elevation of this footing was elevation 203. Over the major portion of this footing, however, bedrock was encountered at a higher elevation. The treatment was exactly the same as described for the East Pier footing.

The end result was that the footing was placed about 3 feet higher than shown on the contract drawing. The pier columns, therefore, had to be shortened and the reinforcing cut.

The mass concrete required was paid for on force account. There appears to be no reason why an additional claim need be considered at this location. District personnel know the quantity of mass concrete required.

5. Structure at the Crossing of Hwy. 417 (E.B.L.) and the C.F.R. (M.P. 35-66-17):

i) West Pier Footing:

The proposed founding elevation of this footing was elevation 203. At this level the footing was to be located in a competent glacial till deposit. Two bedrock peaks were encountered within the footing area; these extended well above elevation 203.

The bedrock knobs were removed down to elevation 203. This was accomplished using manually operated jackhammers. The footing was then poured at elevation 203 as recommended (Drawing No. D-6839-1).

ii) East Pier Footing:

The proposed founding level of the east pier footing was at elevation 204. During the time of construction, the contractor indicated to the district personnel that neither the hard glacial till nor the limestone bedrock was encountered at the proposed founding elevation. As a result of this, this Office carried out additional borings to determine the precise elevation of the glacial till surface and the bedrock. These borings revealed that the glacial till was found to vary from elevation 205 at the south end of the footing to elevation 200 at the north end. The bedrock within the footing area ranged from elevation 197.6 to elevation 198.5.

Since the subsoil conditions are so variable within the footing length, it was recommended that the overburden should be excavated to the proposed founding elevation or to the competent glacial till stratum. It was agreed that the low area (the northern portion of this footing) be brought up to the proposed founding elevation with mass concrete. According to the present information, this method of construction was adapted by the district and the mass concrete required was paid for on force account.

It is possible that additional shoring work may be necessary since the excavation for the foundation will have to be carried out deeper than anticipated.

4. Conclusions:

It should be noted that bedrock elevations vary considerably over the entire site.

In view of this, some adjustments in the footing founding elevations will be necessary during construction irrespective of the number of borings put down at this site.

MD/ao


M. Devata,
SUPERVISING FOUNDATIONS ENGINEER.

Design Services Branch,
1201 Wilson Avenue,
Downsview, Ontario.
M3M 1J5

Telephone: 248-3282.

July 9, 1973.

St. E. Johnston Drilling Co. Ltd.,
P.O. Box 4134,
Postal Station "E",
Ottawa, Ontario.
K1S 5B2

Dear Sirs:

This letter confirms our request of July 6, 1973,
for the supply of a diamond drill together with all
necessary equipment, as specified under the terms of
our Contract Agreement, at Casselman, Ontario, on July 9, 1973.

Mobilization will be from Ottawa.

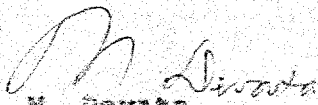
Our Project Number is W.O. 76-P-7 (76-11007).

Yours truly,

MD/so

C.C. W. W. Fry
(Attn: Mrs. M. Porter)

Foundations Files
Documents


M. Devata,
Supervising Foundations Eng.,
For: A. C. Sternac,
Principal Foundations Eng.

Mr. J.A. Cruickshank,
District Construction Engineer,
Ottawa.

70-E-5
ML
Mr. A.E. McKim.

July 16, 1973.

Contract 72-173, C.N.R. Overhead E.B.L. & W.B.L.,
Site 27-213, Highway 417, District 9.

We have investigated the use of rock fill to protect the railway ditch in place of the gabion walls sent to you earlier. The rock fill may be used subject to the following criteria:

- 1) Excavate to the bottom of the soft clay layer. In general this will be to elevation 206 +. Bottom of excavation to be not higher than 210 or 1 foot below the ditch. The railway side of the excavation may be sloped at 1/2 to 1 and the other side made as steep as possible. The bottom of the excavation to be 10 ft. wide.
- 2) The above excavation is to be carried out in 10' strips adjacent to the structure and in 15' strips elsewhere, and backfilled with rock fill immediately. The rockfill is to be sloped 1:1 on the front and brought up to where this slope intersects the 1 3/4:1 slope of the fill. We estimate this to be elevation 222 ±.

A sketch of the above criteria is attached for your information.


The water table is presently around elevation 211, which is the bottom of the ditch elevation. We foresee no problems with water in the rock fill below this elevation but perhaps this should be checked with the C.N.R. to make sure they are satisfied.

continued...../2

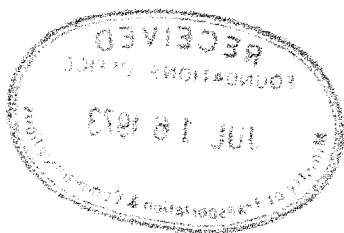
I understand you propose to do this work by force account and am in agreement with this.

We are returning the cross sections you sent to us earlier, on which we have sketched in blue the proposed rock fill.

AEM/JC


A.E. McKim,
Asst. Construction Engineer.
Structures.

c.c. W. McFarlane
M. Davata ✓
T. Kingsland
G. Martens
E.R. Davis



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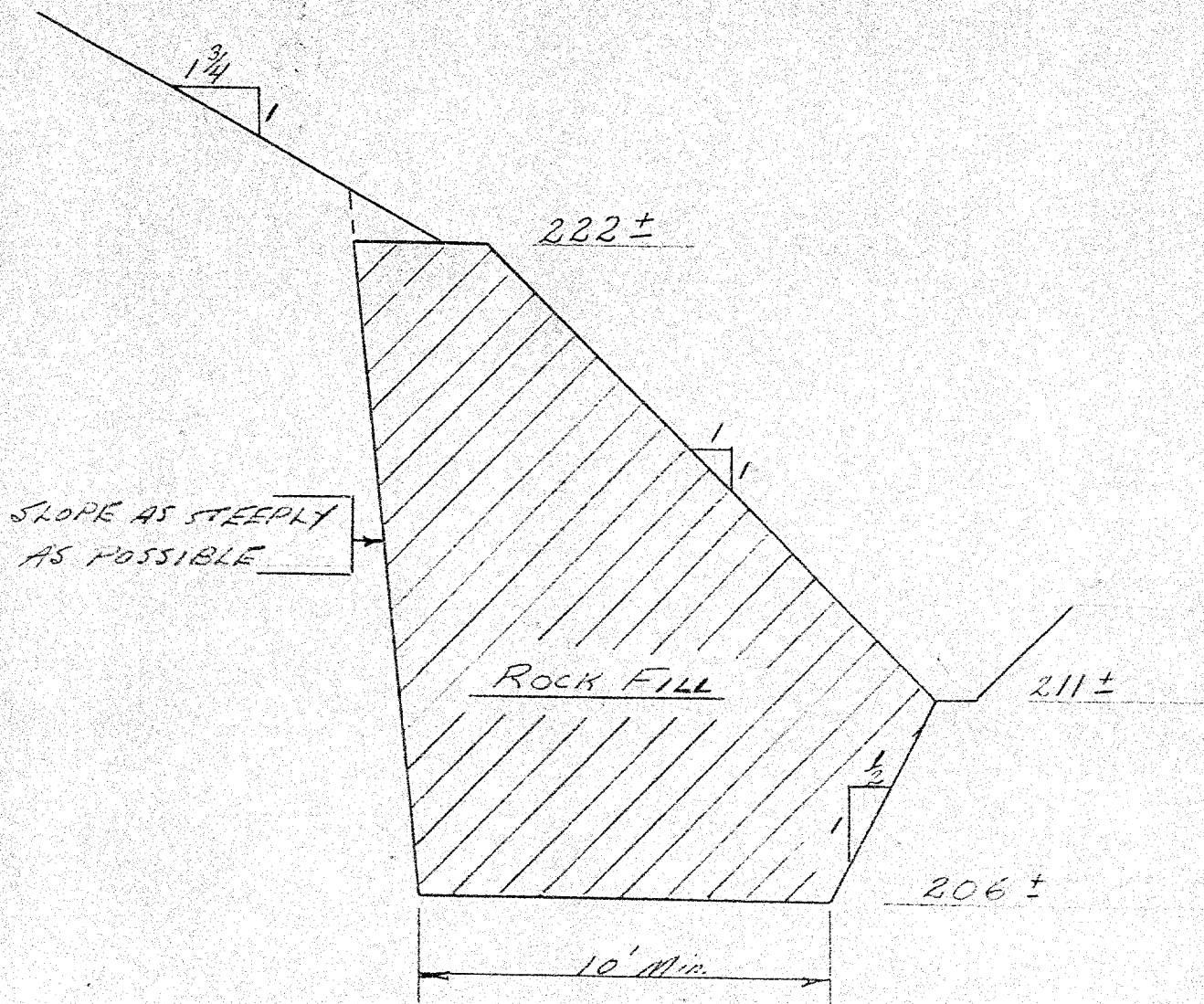


A.E. McKim
Asst. Construction Engineer.
Structures.

AEW/JC

C.C. W. McFarlane
M. Dwyer
T. Kingsland
G. Martens
B.R. Davis





PROPOSED ROCK FILL TOE

SCALE: 1/4 IN. = 1 FT.

CONTRACT 72-173 W.P. 35-66-17 1/2-24
CNR O'HEAD EBL 1/2 WBL SITE #27-213
HWY 47 DISTRICT 9
16 JULY 1973 A.E.M.

Mr. W. M. McFarlane,
Regional Structural Design Engineer,
Structural Office,
West Building,
Downsview, Ontario.

Foundations Office,
Design Services Branch,
West Building.

July 20, 1973.

*Toe Wall for the Forward Slopes of Approach
Embankments of C.N.R. Overhead Structures W.B.L.
& E.B.L., Hwy. No. 417, District #9,
Site 27-213 & 27-213A, W.O. 70-F-7 - W.P. 35-66-17*

Our office was requested to investigate the possibility of construction of a toe wall in order to accommodate the drainage ditch between the forward slopes of the approaches and the C.N.R. tracks at the W.B.L. and E.B.L. structure crossing.

The request was contained in a memo from your office dated July 5, 1973. A foundation investigation was carried out at the above-mentioned site to determine the subsoil conditions at the proposed toe wall locations.

A total of six boreholes was carried out during the course of the field investigation by means of a standard diamond drill rig adopted for soil sampling purposes. The borehole locations and their elevations are shown on the accompanying drawing sketch.

The borings reveal similar subsoil conditions to those encountered in the foundation investigation for the E.B.L. and W.B.L. structures (W.O. 70-F-7). The subsoil consists of an approximately 2 to 6 ft. thick stratum of fine sand (fill material), underlain by a deposit of clay ranging in thickness between 1 to 6 ft. The average moisture content for this deposit is 49 percent. The consistency of the overall deposit ranges from firm to very soft with depth. Immediately below the clay stratum is a glacial till deposit consisting of a heterogeneous mixture of clayey silt, sand and gravel. This deposit was found to vary randomly in thickness between 1 (B.H. #6R) to 7 ft. (B.H. #1R). The average moisture content for the overall deposit is about 8 percent. This cohesive glacial till stratum can be described as having a consistency ranging from very stiff to hard with depth. Directly underlying the glacial till stratum is sound limestone bedrock. It can be found between elevation 198.0 and 206.8.

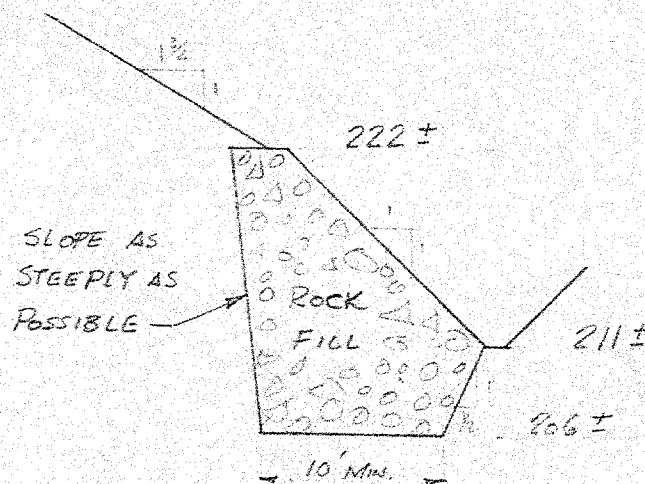
Groundwater observations were carried out during the period of the investigation and indicate that the water level across the site is situated approximately at elevation 206±.

Since C.N.R. desires a minimum distance between the drainage ditch and the existing tracks, it may be necessary to steepen the forward slopes of the approaches. The existing approach embankment are constructed with 1-3/4:1. Steeping these forward slopes to 1-1/2:1, may endanger the stability of the approaches.

As a result of this, it was agreed by personnel from the Structural Office and the Foundations Office that the most desirable scheme is one that consists of a rock-filled toe wall.

Recommendations pertaining to the construction of the rock-filled toe wall are as follows:

- 1) Excavate down to the lower boundary of the soft clay layer (approximate elevation 206±). In any case the bottom of the excavation should be at least 1 foot below the ditch invert elevation. The excavation may be sloped at 1/2 horizontal to 1 vertical on the railway side and the other side may be as steep as possible.
- 2) In order to ensure stability of the approach embankments during construction the above-mentioned excavation should be carried out in 10 ft. strips adjacent to the structure and in 15 ft. strips elsewhere and backfilled immediately with rock fill material to the finished grade. The rock fill should be sloped at 1:1 on the front and brought up to where it intersects the earth slope. This point should be at elevation 222± (see figure below).



PROPOSED ROCK FILL TOE

We believe that the foregoing recommendations will be adequate for the construction for the proposed rock filled toe walk. This memo together with the enclosed sketches should be included to our foundation report (W.O. 70-F-7) submitted on April 3, 1970.

If further information is required please feel free to contact this Office.



J. Bangs,
Project Foundations Engineer,
M. Devata,
Supervising Foundations Engineer.

JB/ao

For:

c.c. C. S. Grebski
T. C. Kingsland
G. Martens
J. A. Cruickshank
J. M. Crannie

Foundations Files
Documents

OVER

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO
Form OB-MT-285
(REVISED NOV. 1971)

DESIGN SERVICES BRANCH

FOUNDATION OFFICE

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 72-173 STRUCTURE C.N.R. - W.B.L.
CONTRACTOR C.A. PITTS LTD. DESIGN LOAD OF PILE 70 T/PILE ^(DRIVEN TO REFUSAL)
HAMMER DETAILS: TYPE DALMAC D-12 WEIGHT 1.38 HEIGHT OF FALL OR ENERGY _____
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP .25

PILE DETAILS: 12 BP 53PILE NO. 3 LOCATION EAST ABUTMENT FOOTING DATE DRIVEN JAN. 17/73

TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.
	1	1		26	26		51			76	
	2	3		27	31		52			77	
	3	3		28	29		53			78	
	4	5		29	16		54			79	
	5	6		30			55			80	
	6	13		31			56			81	
	7	18		32			57			82	
	8	20		33			58			83	
	9	23		34			59			84	
	10	30		35			60			85	
	11	33		36			61			86	
	12	38		37			62			87	
	13	40		38			63			88	
	14	44		39			64			89	
	15	45		40			65			90	
	16	40		41			66			91	
	17	36		42			67			92	
	18	35		43			68			93	
	19	34		44			69			94	
	20	32		45			70			95	
	21	27		46			71			96	
	22	24		47			72			97	
	23	24		48			73			98	
	24	24		49			74			99	
	25	29		50			75			100	

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER 'NCH						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE <u>29' 9"</u>	FINAL CUT OFF ELEVATION <u>229.50</u>					

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
DESIGN SERVICES BRANCH
DEPARTMENT OF
TRANSPORTATION AND
COMMUNICATIONS
DOWNSVIEW, ONTARIO

SIGNED

NAME (PRINT)

DATE JAN. 17/73

ATTACH SKETCH OF PILE NUMBERING SYSTEM

229.50
29.40

199.70

TIP

Notes:-

In general this form should be completed for every tenth pile in a group, but at least one is required for every pier and abutment.

Piles driven vertically should be selected where possible.

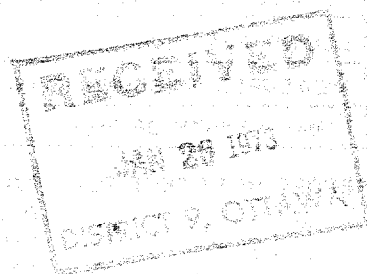
Pile Details must include type, dimensions and weight per foot, details of shoe, and slope of batter: e.g. 12 $\frac{1}{2}$ " O.D. steel tube x 0.251" @ 33 lbs. per ft. Vertical. 12 $\frac{1}{2}$ " x $\frac{1}{2}$ " steel plate shoe.

Details for the final six inches of penetration must be completed for all piles except in the case of an end bearing pile driven to bedrock. Final length of pile, and final cut off elevation must always be given.

The total length being driven is the full length of the pile and remains unchanged until a length is cut off or spliced on.

The penetration in blows per foot must be recorded for every foot of penetration of the pile.

Measured rebounds recorded on this form must be the average for each individual inch for the final six inches of penetration.



BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 72-173 STRUCTURE C.N.R. - E.B.L. (EAST ABUT.)

CONTRACTOR C.A. PITS LTD DESIGN LOAD OF PILE 70 T/PILE

HAMMER DETAILS: TYPE DALMEG D-12 WEIGHT 1.38 HEIGHT OF FALL OR ENERGY

TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP .25

PILE DETAILS 12 BP 53

PILE NO. 9 LOCATION EAST ABUTMENT FOOTING DATE DRIVEN JAN. 15/73

TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS/FT.
	1	1		26	18		51			76	
	2	3		27	17		52			77	
	3	11		28	30		53			78	
	4	12		29	39		54			79	
	5	13		30	38		55			80	
	6	16		31	70		56			81	
	7	22		32	52		57			82	
	8	23		33			58			83	
	9	23		34			59			84	
	10	24		35			60			85	
	11	27		36			61			86	
	12	25		37			62			87	
	13	27		38			63			88	
	14	28		39			64			89	
	15	29		40			65			90	
	16	31		41			66			91	
	17	23		42			67			92	
	18	18		43			68			93	
	19	16		44			69			94	
	20	15		45			70			95	
	21	13		46			71			96	
	22	12		47			72			97	
	23	12		48			73			98	
	24	13		49			74			99	
	25	22		50			75			100	

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER INCH						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE <u>33' 0"</u>	FINAL CUT OFF ELEVATION <u>229.50</u>					

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
 DESIGN SERVICES BRANCH
 DEPARTMENT OF
 TRANSPORTATION AND
 COMMUNICATIONS
 DOWNSVIEW, ONTARIO

SIGNED Dale Turner
 NAME (PRINT) DALE TURNER
 DATE JAN. 17/73
 ATTACH SKETCH OF PILE NUMBERING SYSTEM

TIP
 229.5
 33
 196.5

1

16

DATE DRIVEN JAN / 73 WEIGHT OF ANVIL 0.25 T
HAMMER TYPE D-12 WEIGHT 1.38 T ENERGY 22,500 FT LBS.

[illegible]

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 316-48

DIST. 9 REGION Eastern

W.P. No. 35-66-17 (EAL) 35-66-24 (WBL)

CONT. No. 72-173

W. O. No. 70-F-7

STR. SITE No. 27-213

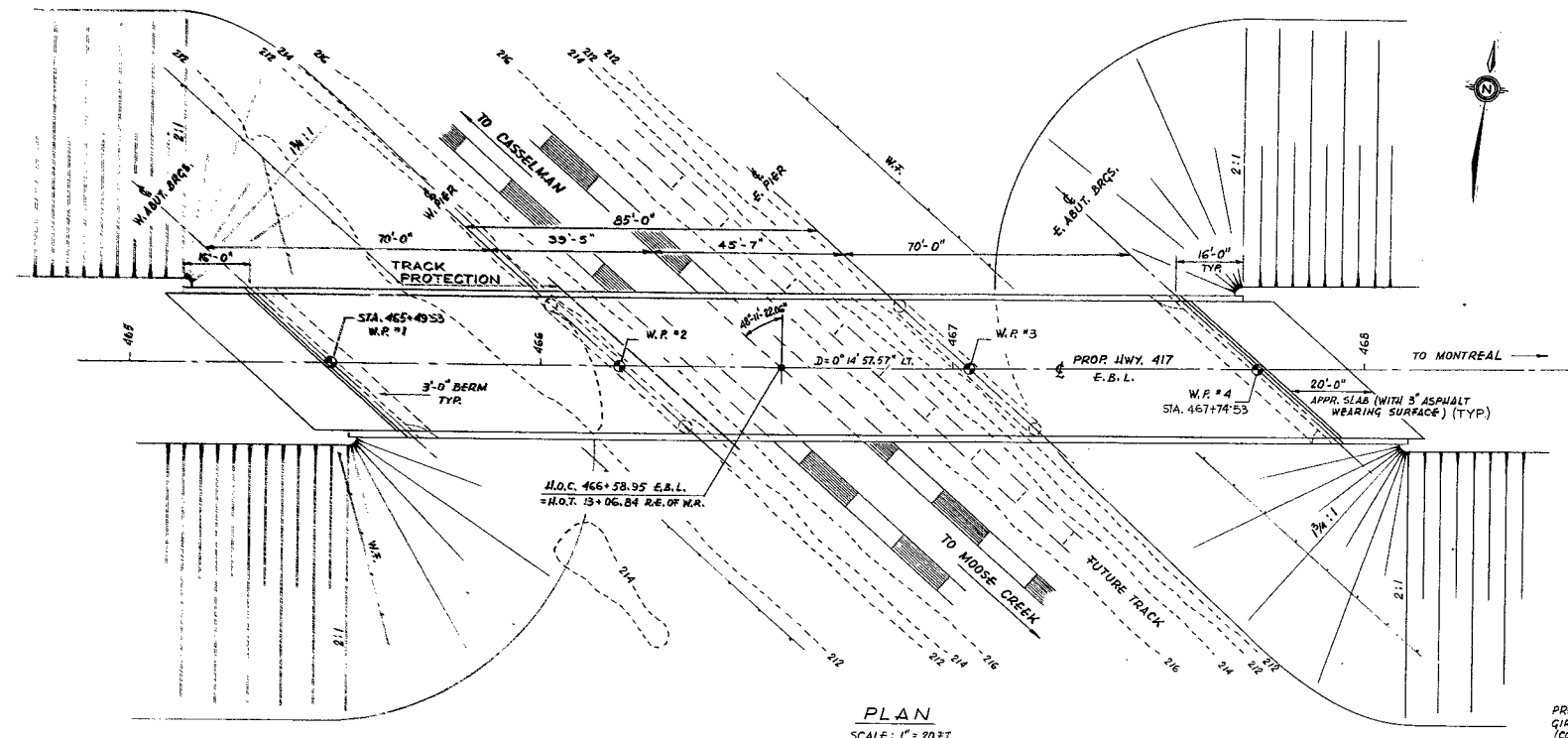
HWY. No. 417

LOCATION CNR (1.0 MI. S.E. of
CASSELMAN) STR. NO. 82B O'HEAD

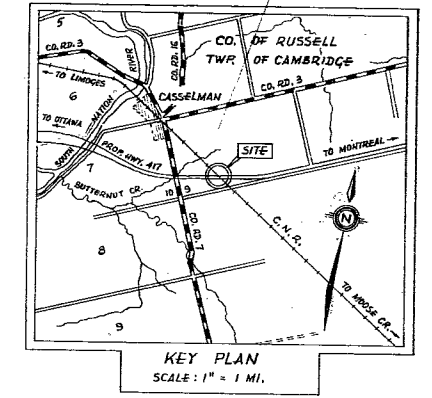
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. \$2

REMARKS: 1 DOCUMENT TO BE UNFOLDED

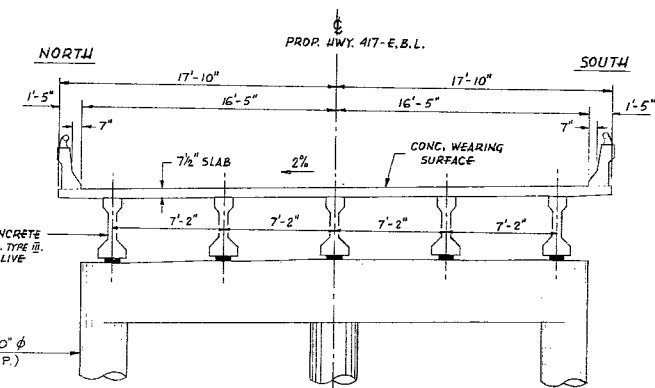
BEFORE MICROFILM



SKW DATA - 48°-11'-22.06"
 SIN — 0.7453534
 COS — 0.6666696
 TAN — 1.1180252
 SEC — 1.4999935

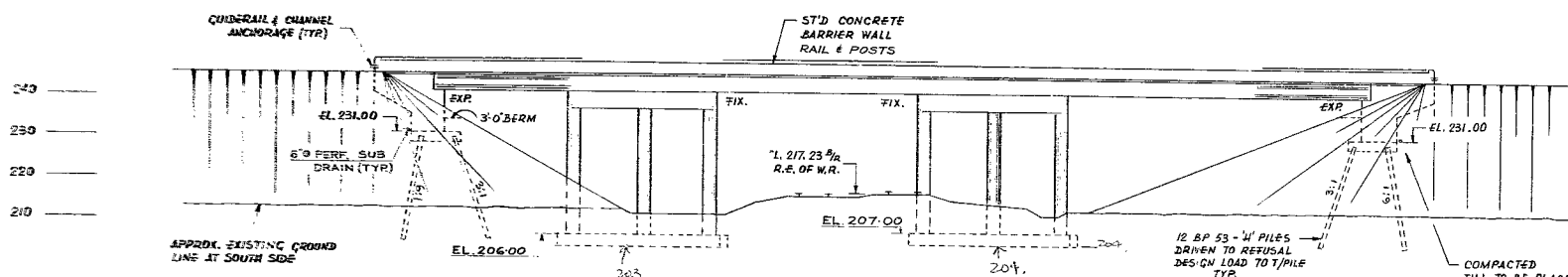


B.M. ELEV. 216.83
 GEODETIC DATUM
 TOP OF BOLT ON N.E. CORNER OF CONC. BASE OF
 RAILWAY SIGNAL LIGHT #464, 232.0' RT. OF 469+12 (MED.)



GENERAL NOTES:
 CLASS OF CONCRETE: DECK, BARRIER WALL
 AND PIERS 5000 P.S.I.
 APPROACH SLABS, PIER FOOTINGS, ABUTMENTS AND
 ABUTMENT FIGS. 3000 P.S.I.
 CLEAR COVER TO REINF. STEEL
 FOOTINGS, ABUTMENT AND PIERS 3", CURBS 2",
 PARAPET WALLS 1 1/2", DECK - TOP 1 1/2",
 APPROACH SLABS 3".

- LIST OF DRAWINGS:
- D6839-1 GENERAL PLAN
 - 2 BORE HOLE LOCATIONS & SOIL STRATA
 - 3 FOOTINGS - DIMENSIONS AND REINFORCING
 - 4 ABUTMENTS - DO DO DO
 - 5 PIERS - DO DO DO
 - 6 PRESTRESSED GIRDERS & BEARINGS
 - 7 DECK DETAILS
 - 8 CONCRETE BARRIER WALL
 - 9 DET. OF 9" HIGH STEEL PARAPET RAILING
 - 10 20' APPROACH SLAB FOR BARRIER WALL
 - 11 STANDARD DETAILS
 - 12 STANDARD DETAILS
 - 13 RAILWAY TRACK PROTECTION

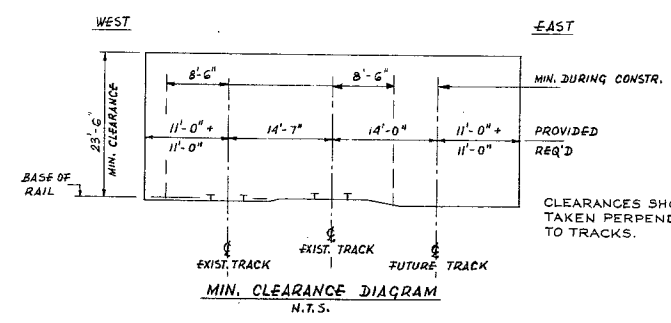
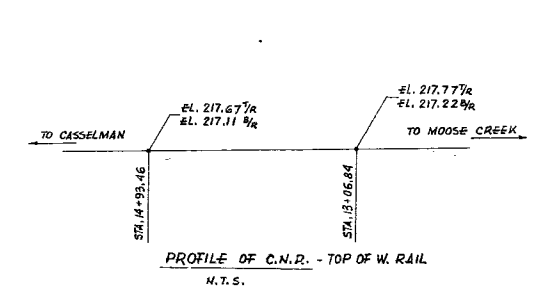
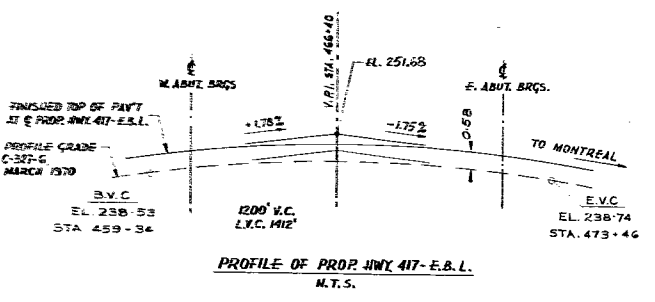


NOTES:
 • W.R. DENOTES WORKING POINT.
 • T.C. DENOTES TOP OF CONCRETE WEARING SURFACE.
 • T.R. DENOTES TOP OF RAIL.
 • B.R. DENOTES BASE OF RAIL.

HWY. #47 - E.B. LANE
 CURVE DATA
 R1. 492+25.86
 S.C. 460+29.87
 E.C. 525+23.35
 Δ = 45° 32' 39"
 R = 22,980.34'
 T = 3,135.59'
 L = 6,233.48'
 D = 0° 14' 57.57"

SOUTH ELEVATION
SCALE: 1" = 20 FT.

12' x 9' wide



REVISIONS	
DATE	DESCRIPTION
DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION	
70-P-7	
CANADIAN NATIONAL RAILWAYS OVERHEAD-E.B.L. 0.6 MI. EAST OF COUNTY RD. 7	
KING'S HIGHWAY No. 417	DIST. No. 9
CO. RUSSELL	CON. VII
TWP. CAMBRIDGE	LOT 7 & 8
GENERAL PLAN	
APPROVED	SITE No. 27-213 W.P. No. 35-66-17
DESIGN J. de	CHECK 1962
DRAWING R.K.	CHECK R.S.R.
DATE DEC. 1970	LOADING #5 20-44
CONTRACT No.	
DRAWING No. D-6839-1	

