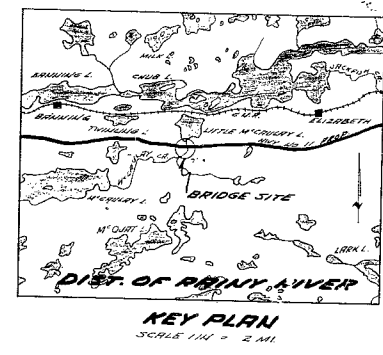
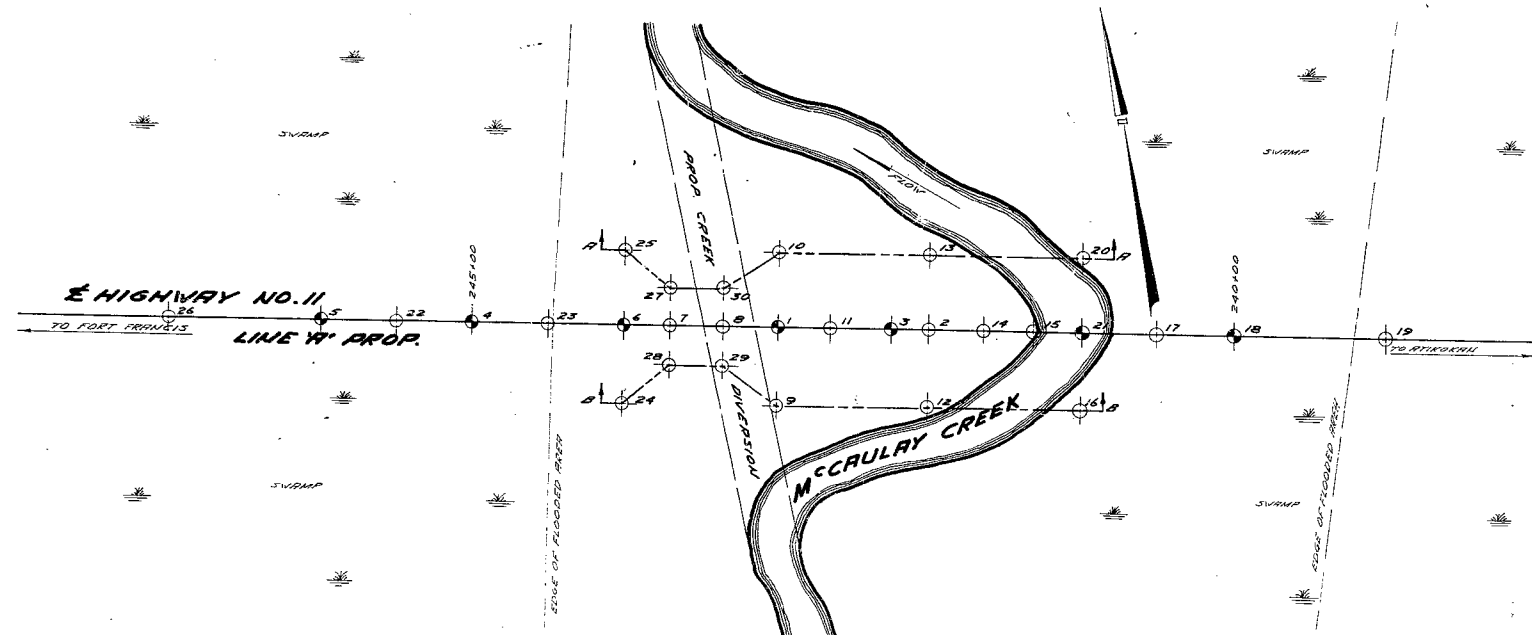


#60-F-17  
WP # 82-60  
Hwy # 11  
FORMERLY  
Hwy # 120 &  
McCAULAY CREEK



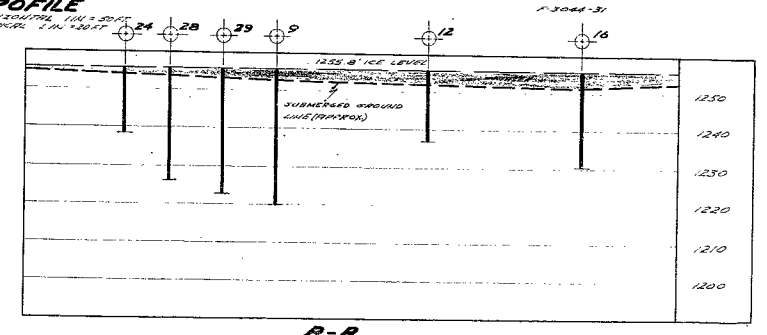
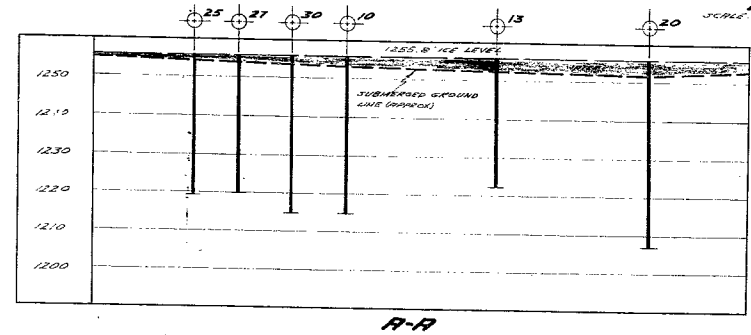
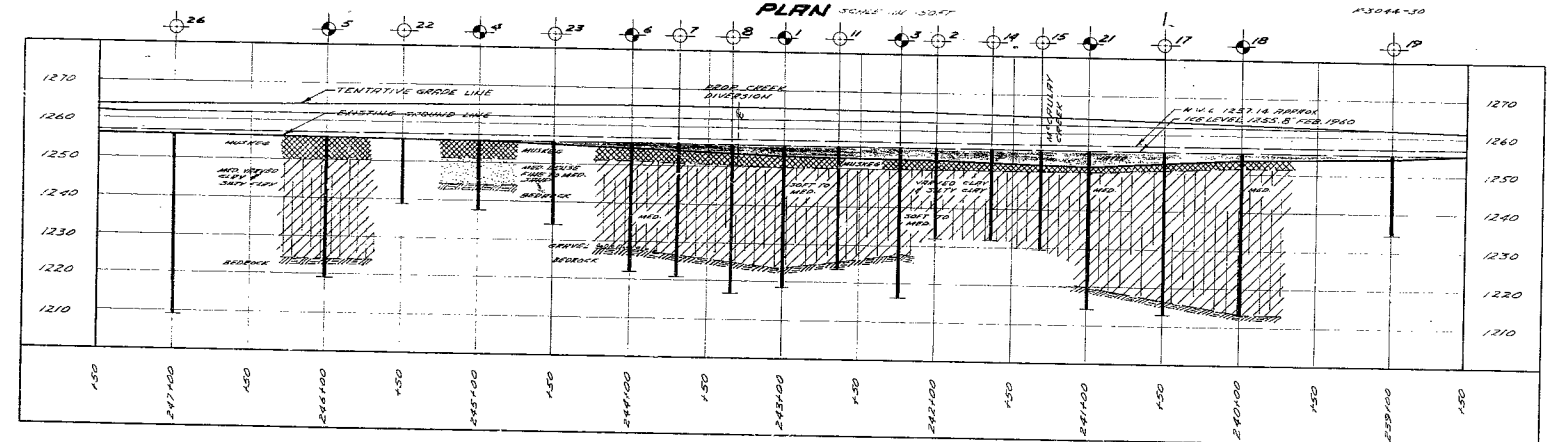
**LEGEND**

ADJUSTMENT HOLE  
BORE HOLE ADJUSTMENT HOLE

NO.	ELEVATION	STATION	DISTANCE FROM H.S.
1	1255.8	248+00	E
2	1255.8	248+00	E
3	1255.8	248+05	E
4	1255.8	248+00	E
5	1255.2	248+00	E
6	1255.8	248+00	E
7	1255.8	248+10	E
8	1255.8	248+15	E
9	1255.8	248+00	20' LT
10	1255.8	248+00	30' RT
11	1255.8	248+05	E
12	1255.8	248+00	30' LT
13	1255.8	248+00	30' RT
14	1255.8	248+15	E
15	1255.8	248+30	E
16	1255.8	248+30	E
17	1255.8	248+30	30' LT
18	1255.8	248+30	E
19	1255.8	248+30	E
20	1255.8	248+30	30' RT
21	1255.8	248+00	E
22	1257.0	248+50	E
23	1255.0	248+50	E
24	1255.8	248+00	30' LT
25	1255.8	248+00	30' RT
26	1257.0	248+00	E
27	1255.8	248+10	25' RT
28	1255.8	248+10	25' LT
29	1255.8	248+35	25' LT
30	1255.8	248+35	25' 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.



UNCLASSIFIED AREA

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH SECTION

**MCCAULAY CREEK  
PROPOSED CROSSING**

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY #1	DISTRICT 20	TOWNSHIP RAINY RIVER
TOWNSHIP UN-SURVEYED TERRITORY	CON	
LOCATION RT BRUNING (12 1/2 MI. W. OF RAINY RIVER)		
DRAWN BY T. A. FELLERS	CHECKED BY J. J. F.	W.P. 82-60
DATE 24 APR 1960	APPROVED BY J. J. F.	W.P. 82-60
SCALE 1/4\"/>		

60-F-17A

Mr. E. E. Rye,  
Chief Engineer,  
Materials & Research Section.

June 8, 1966.

U.S. FOUNDATION DIVISION

62-60 -- 60-5-17.

Attention: Mr. E. E. Rye.

Re: Hwy. 11 & Redoubt Creek Diversion  
Crossing at Sanning (approx. 12 1/2 miles  
west of Atkasook), Dist. 20, Kenai, Alaska.

Attached hereto, we are forwarding to you the  
soil investigation report for the above mentioned location.

The summary and recommendations contained in  
this report are self-explanatory, and we trust they will  
prove sufficient for your future design work.

Should you require any further assistance in  
connection with this project, please feel free to call on  
our office.

Very truly,  
Sincerely,

W. E. Rye,  
Chief Engineer.

cc: Mr. E. E. Rye (1)  
Mr. E. E. Rye (1)  
Mr. E. E. Rye (1)  
Mr. E. E. Rye (1)  
Mr. E. E. Rye (1)  
Mr. E. E. Rye (1)  
Mr. E. E. Rye (1)  
Mr. E. E. Rye (1)

cc:

W. E. Rye,  
Chief Engineer.

Foundations Office  
Mr. E. E. Rye.

## FOUNDATION INVESTIGATION

For

Hwy. No. 11 & McCaulay Creek Diversion  
Creek Crossing at Banning - (approx.  
12½ Miles West of Atikokan), Dist. 20.  
W.P. 82-60      --      W.J. 60-F-17.

---

### INTRODUCTION:

Presented herein, are the results of a subsoil investigation carried out at a structure location approximately 12½ miles West of Atikokan, where proposed Hwy. No. 11, Line 'A', crosses the McCaulay Creek Diversion in the County of Rainy River.

This report contains the detailed field and laboratory findings as well as recommendations for the foundation of the structure and embankment construction. The locations of the boreholes and their subsoil profile are shown in the accompanying Drawing No. 60-F-17 A. The borehole logs, summary of field and laboratory tests and plots of shear strengths, moisture contents, as well as Atterberg limits vs. depths, are included in this report under Appendix I.

### DESCRIPTION OF THE SITE:

The site and its surrounding areas are in swamps. The topography is, in general, level. McCaulay Creek meanders at the site and the area has been reported to be flooded in Spring thaw periods. The High Water Level has been observed to be at approx. Elev. 1257.1'. At the time of the investigation, the site was covered with ice and snow. The ice level was at approx. Elev. 1255.8'. At this site, a 2' to 5' thick layer of muskeg was found to be existing immediately underneath the ground surface. The muskeg was underlain by a soft varved clay layer which extended to bedrock.

FIELD & LABORATORY WORK:

Field work, consisting of 7 sampled boreholes with accompanying cone tests and 23 separate cone tests, was carried out during the period of the 29th of February and the 16th of March. In addition, in-situ vane tests were carried out in each of the sampled boreholes. A standard diamond drill, adapted for soil sampling, was used. Boreholes were advanced by the conventional wash boring procedures and samples were recovered at depths required.

In the cohesive material, samples were obtained by means of 2" I.D. thin-walled Shelby tube samplers. In the granular material, samples were recovered by means of a 2" O.D. split-barrelled spoon sampler. The dimensions of this spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test. Bedrock was proven by drilling into it for at least 5 ft. Immediately upon recovery, samples were visually examined and identified at the site, wax-sealed or placed in moisture-proof containers for transport to our laboratory. Rock core samples were kept in core-boxes and examined to determine their quality and soundness in the field as well as in the laboratory.

Upon receipt in the laboratory, samples were visually examined and identified. Triaxial shear as well as routine index tests were carried out on selected representative samples.

Results of our field and laboratory tests are presented in the borehole logs and summarized in Table No. 1. In addition, a plot of shear strengths vs. depths, as well as a plot of moisture contents and Atterberg limits vs. depths, have been presented and are included under Appendix I.

cont'd. /3 ...

### SUBSOIL CONDITIONS:

The site is underlain by a 2' - 5' thick layer of muskeg, followed by a stratum of soft to medium varved clay of thicknesses ranging from 23 ft. in Boring 3, to 39 ft. in Boring 18. Underneath the varved clay stratum, bedrock was encountered. Bedrock was contacted at elevations ranging from 1213.1' in Boring 18, to 1244.3' in Boring 4. In Boring 4, however, no varved clay was encountered but, instead, a layer of medium dense sand was found to be existing between the muskeg and the bedrock.

In general, the soil types encountered are as follows:-

#### 1. Soft to Medium Varved Clay & Silty Clay:

This stratum of varved clay was encountered immediately underneath the muskeg layer in each of the sampled boreholes with the exception of Boring 4. The material is composed of alternate thin layers of clay, silty clay and silt. Its colour is grey and reddish brown. Moisture content and Atterberg limit tests have been carried out separately on the clay as well as the silt phases of the material. These results are shown in a plot included in this report under Appendix I.

In-situ vane and laboratory triaxial shear tests carried out, show that the varved clay is soft to medium in consistency. Shear strengths as low as 400 p.s.f. were measured. A plot of shear strengths vs. depths, has been presented and is included in this report under Appendix I.

#### 2. Bedrock:

Immediately underneath the varved clay stratum, bedrock was encountered. Bedrock is composed of grey gneiss of Precambrian age. The gneiss is in a sound condition with no sign of weathering or fracture. Bedrock was proven by drilling into it for at least 5 ft. in each of the sampled boreholes. The elevation of bedrock contact varies from 1213.1' in Boring 18, to 1244.3' in Boring 4. The accompanying Drawing No. 60-F-17A, shows the elevation of bedrock contact or cone refusal at each of the locations of the boreholes.

cont'd. /4 ...

### EMBANKMENT STABILITY:

We have carried out embankment stability analyses based on an average shear strength of 400 p.s.f. for the upper 15 ft. of the varved clay stratum. Assuming that all the muskeg is to be removed and replaced by granular backfill material, the safe height of embankment construction above the top of the varved clay stratum, has been calculated to be 12 ft. (a safety factor of 1.3 has been considered desirable). Where the grade is such that the height of fill exceeds 12 ft., counterbalancing berms will be necessary in order to ensure stability of the embankments. Drawing No. 60-F-17 B, included in this report under Appendix I, shows the length of berms required for various heights of fill in excess of 12 ft. The embankments should be constructed of granular material up to approx. Elev. 1257' (H.W.L.) and above this elevation, either well-graded granular or well-compacted cohesive material can be used. Rip-rap protection should be provided for the embankments up to H.W.L.

### FOUNDATION CONSIDERATIONS:

The soft to medium varved clay cannot provide adequate spread footing type of foundation support for the proposed structure. A pile-supported foundation is necessary. Wood piles driven to refusal at the contact of the bedrock, will be feasible. Treated wood piles can carry allowable loads of 20 - 25 tons per pile.

It is understood that a timber trestle structure is being contemplated. The length of structure required will depend on the final profile grade. The tentative grade line, as shown in Drawing No. 60-F-17 A, indicates that the length of structure required will be over 600 ft. if the fill height above the top of the varved clay stratum is limited to 12 ft.

The length of structure required can be shortened if berms are provided for fill heights in excess of 12 ft. above the top of the varved clay stratum.

cont'd. /5 ...

FOUNDATION CONSIDERATIONS: (cont'd.) ...

The other alternative to reduce the length of structure required, if the fill height above the top of the varved clay stratum is limited to 12 ft., would be to lower the profile grade such that the length of structure to be constructed will be economical. The tentative grade line as shown in Drawing No. 60-F-17 A, indicates that the profile grade is 8 ft. above the H.W.L. at the creek diversion. It appears that if the grade is lowered to 5 ft. above the H.W.L., the length of structure required will be greatly reduced and no berms are required for embankments at this grade.

There has been some doubt as to whether the source of granular material is available in the area or not. It appears that an economical study should be made to determine whether an extended structure is more economical than a shorter structure with approaches. In either case, consideration should be given to lowering the profile grade since the length of structure and/or the quantities of fill material involved will be reduced.

SUMMARY OF RECOMMENDATIONS:

1. Subsoil conditions are such that the safe height of embankment construction above the top of the varved clay stratum is limited to 12 ft. Where the profile grade is such that the height of fill above the top of the varved clay stratum exceeds 12 ft., counterbalancing berms will be necessary. Drawing No. 60-F-17 B, included in this report under appendix I, shows the length of berms required for various heights of embankment fill. All the muskeg should be stripped prior to the placing of the fill material. The embankments should be constructed of granular fill material up to the H.W.L., and above the H.W.L., either well-graded granular or well-compacted cohesive material should be used. Rip-rap protection should be provided for the embankments up to H.W.L.



SUMMARY OF RECOMMENDATIONS: (cont'd.) ...

2. A pile-supported foundation is necessary. Wood piles driven to refusal at the contact of the bedrock, will be feasible. An allowable bearing capacity of 20 - 25 tons per pile can be used for design if treated wood piles are used.
3. A timber trestle structure appears to be most feasible and economical. The length of structure required will depend on the final profile grade if the fill height above the top of the varved clay stratum is limited to 12 ft. The length of structure required can be shortened if counterbalancing berms are used.
4. It is our recommendation that the tentative grade line, as shown in Drawing No. 60-F-17 A, be lowered to 5 ft. instead of 8 ft. above the H.W.L. since the length of structure and/or the quantities of fill material involved will be reduced.
5. Economics appears to be the decisive factor, in order to determine whether a longer structure or a shorter structure with long approaches, should be used.

*AKGh*

REPORT PREPARED BY: A. E. Loh,  
PROJECT FOUNDATIONS ENGR.

*Attorney*

REPORT APPROVED BY: A. Sternac,  
FOUNDATIONS OFFICE ENGR.

APPENDIX I.

## SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-17

W.P. 82-60

[illegible]

# SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-17

W.P. 82-60

SOLE NO	SAMP NO	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENETN RESIST BLOWS FT	MOIST CONT %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH PSI	UNIT WEIGHT PCF	REMARKS
3	S1	8'-9.5'	Soft to medium grey and reddish brown varved clay and silty clay	P	28.6	21.4	28.5	-	-	
	Vane	13.5'	" " " "	-	-	-	-	480	-	Sens: 4.0
	Vane	16.5'	" " " "	-	-	-	-	360	-	" : 2.3
	T2	20'-22'	" " " "	P	77.8 35.2	24.8 20.5	75.6 39.5	500	106.0	clay phase silt phase
	Vane	23.5'	" " " "	-	-	-	-	660	-	Sens: 5.1
	RC 3	28'-39'	Bedrock-dark grey hard gneiss	-	-	-	-	-	-	100% Recovery
4	S1	6.5'-8'	Medium dense grey fine to medium sand	11	-	-	-	-	-	
	RC 2	11.5'-17.8'	Bedrock-dark grey hard gneiss	-	-	-	-	-	-	100% Recovery

# SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-17

W.P. 82-60

HOLE NO	SAMPLE NO	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENETR RESIST. BLOWS FT	MOIST CONT %	PLASTIC LIMIT	LIQUID LIMIT %	SHEAR STRENGTH (PSF)	UNIT WEIGHT (PCF)	REMARKS
5	S1	6.5'-8'	Medium grey and reddish brown varved clay and silty clay	9	37.6	22.6	36.6	-	-	
	T2	14.5'-16'	" " " "	P	76.3 29.1	34.5	96.1	1100	101.0	
	Vane	17.5'	" " " "	-	-	-	-	1040	-	Sens: 8.7
	S3	19.5'-21'	" " " "	P	28.4	-	-	-	-	
	Vane	22.5'	" " " "	-	-	-	-	960	-	Sens: 5.7
	RC 4	31.3'-36.3'	Bedrock-dark grey hard gneiss	-	-	-	-	-	-	
6	T1	8'-9.8'	Soft to med. grey and reddish brown varved clay and silty clay.	7	33.9 55.6	28.8	65.2	879 379	113.0 108.5	
	Vane	14.5'	Med. grey and reddish brown varved clay and silty clay.	-	-	-	-	1400	-	Sens: 7.8
	T2	16'-18'	" " " "	P	32.2 69.6	29.6	80.7	1060	114.0	
	Vane	19.5'	" " " "	-	-	-	-	1080	-	Sens: 6.8
	Vane	22.5'	" " " "	-	-	-	-	840	-	" : 7.6
	RC 3	28.3'-33.3'	Bedrock-dark grey hard gneiss	-	-	-	-	-	-	

# SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-17

W.P. 82-60

SOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENETN RESIST BLOWS/FT	MOIST CONT %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH (PSF)	UNIT WEIGHT (PCF)	REMARKS
B	H:	7 - 17	Cones only							
18	Vane	11.5'	Stiff grey varved clay and silty clay.	-	-	-	-	2000	-	Sens: -
	Vane	16.5'	Med. grey and reddish brown varved clay and silty clay.		-	-	-	1320	-	" : 5.5
	T1	20'-21.5'	Soft grey and reddish brown varved clay and silty clay.	P	74.0	26.2	87.0	375	95.0	
	Vane	26.5'	Med. grey and reddish brown varved clay and silty clay.	-	-	-	-	640	-	Sens: 5.3
	S2A	30'-32'	" " " "	( 6	29.6	-	-	-	-	
	B		" " " "	(	-	-	-	-	-	
	T3	35'-36.5'	" " " "	P	75.9 31.2	-	-	770	112.0	Clay phase Silt phase
	Vane	38'	" " " "	-	-	-	-	920	-	Sens: 5.8
	Vane	41.5'	" " " "	-	-	-	-	800	-	" : 6.2

# SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-17

W.P. 82-60

HOLE NO	SAMP NO	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENETIN RESIST BLOWS FT	MOIST CONT %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH PSI	UNIT WEIGHT PCF	REMARKS
19 20										Cones only
21	Vane T1	11.5' 15'-16.5'	Med. grey and reddish brown varved clay and silty clay.	- P	- 51.4	- 33.6	- 71.3	1280 423	- 100.0	Sens: 5.6
	Vane	18'	"	-	-	-	-	800	-	Sens: 5.6
	Vane	21.5'	"	-	-	-	-	680	-	" : 4.5
	Vane	26.5'	"	-	-	-	-	540	-	" : 4.5
	T2	30'-31.5'	"	P	52.7	-	-	698	106.0	
	Vane	33'	"	-	-	-	-	500	-	Sens: 6.2
	RC 3	31.3'-41.3'	Dark grey gneiss	-	-	-	-	-	-	
BH	22	- 30	Cones only							
			S denotes split spoon sample T " Shelby tube " RC " rock core "							

## OFFICE REPORT ON SOIL EXPLORATION

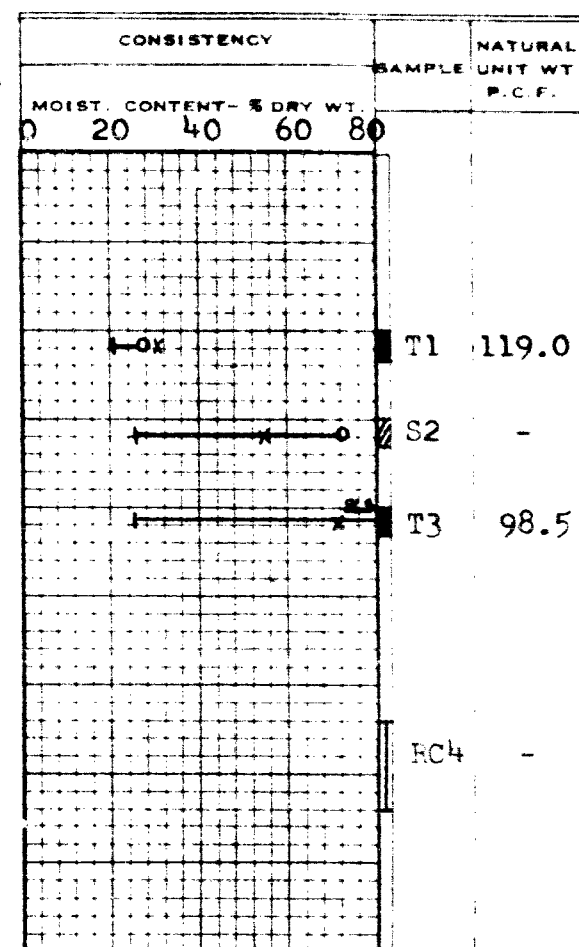
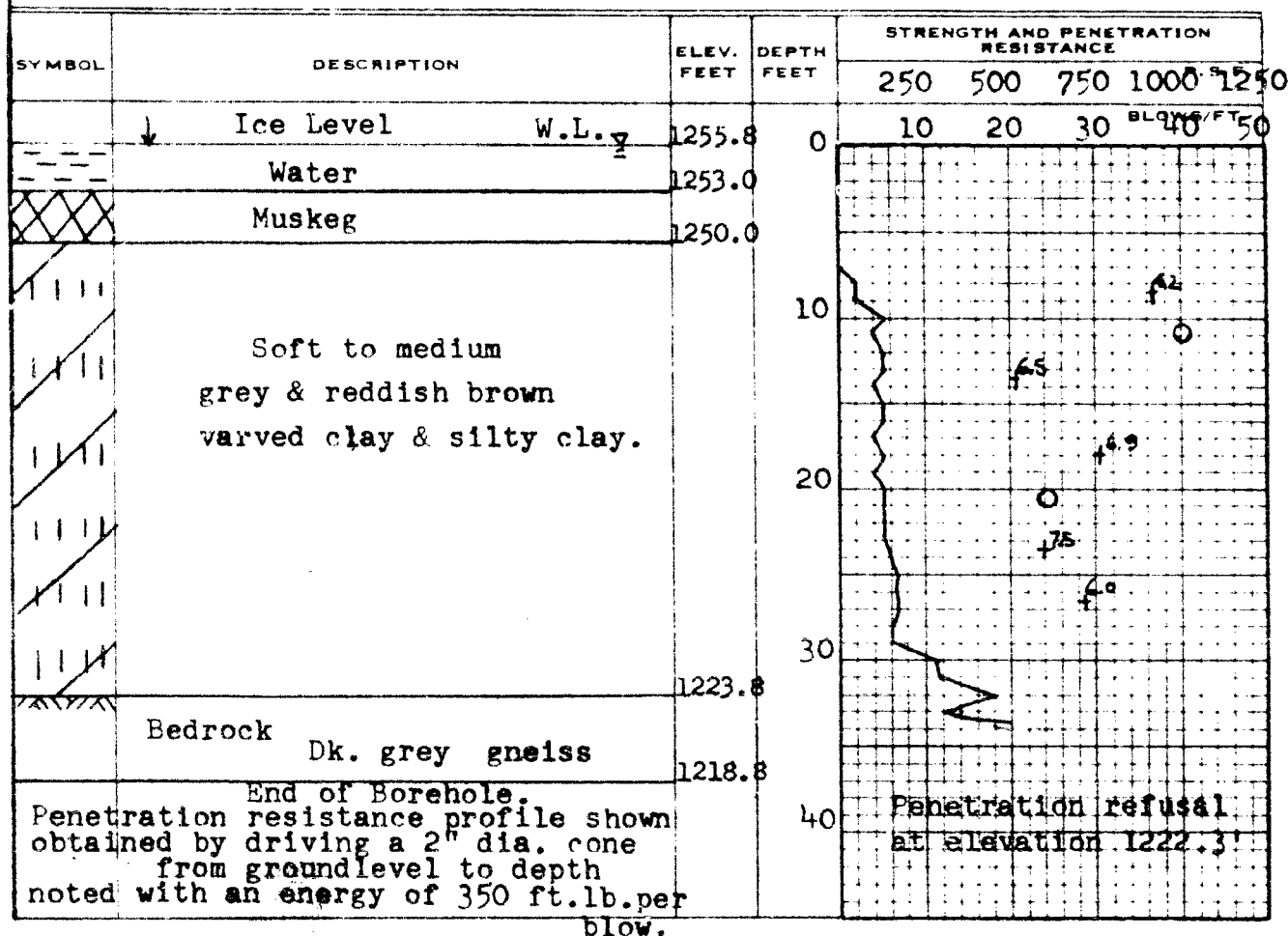
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 1  
 JOB 60-F-17 STATION 243+00 €  
 DATUM 1255.8' COMPILED BY B.K.  
 BORING DATE Feb. 29/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

## LEGEND

1/2 UNCONFINED COMPRESSION ( $Q_u$ )  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT





DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 2

JOB 60-E-17 STATION 242+00 C

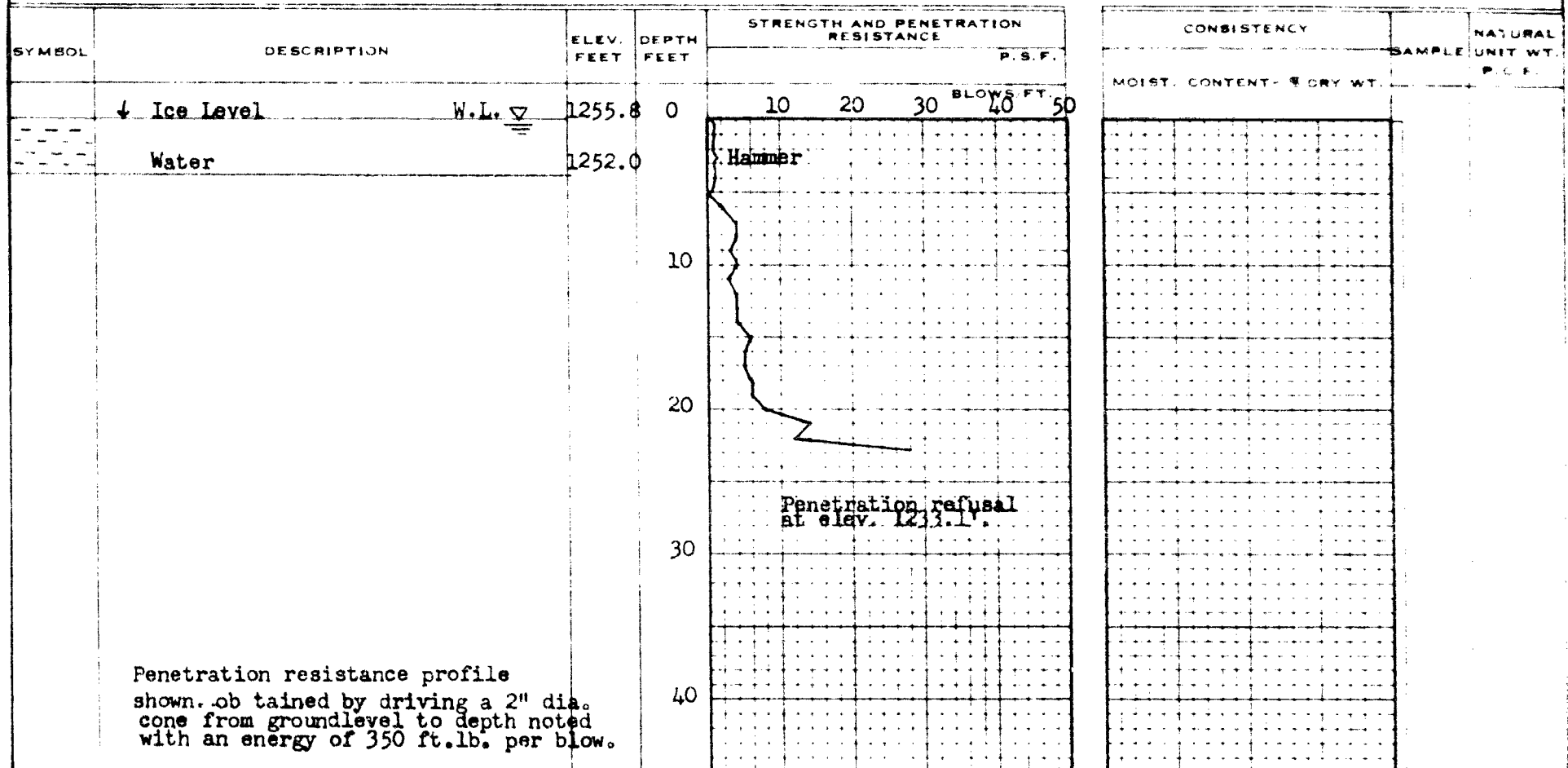
DATUM 1255.8' \_\_\_\_\_ COMPILED BY B.K. \_\_\_\_\_

BORING DATE Feb. 29/60 CHECKED BY A.L.

2" DIA SPLIT TUBE -----  
2" SHELBY TUBE -----  
2" SPLIT TUBE -----  
2" DIA. CONE -----  
2" SHELBY -----  
CASING -----

### LEGEND

1/2 UNCONFINED COMPRESSION (Qu)	---	0
VANE TEST (C) AND SENSITIVITY (S)	---	+ 5
NATURAL MOISTURE AND		
LIQUIDITY INDEX	---	X
LIQUID LIMIT	---	
PLASTIC LIMIT	---	



# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 3

JOB 60-F-17 STATION 242+25.6

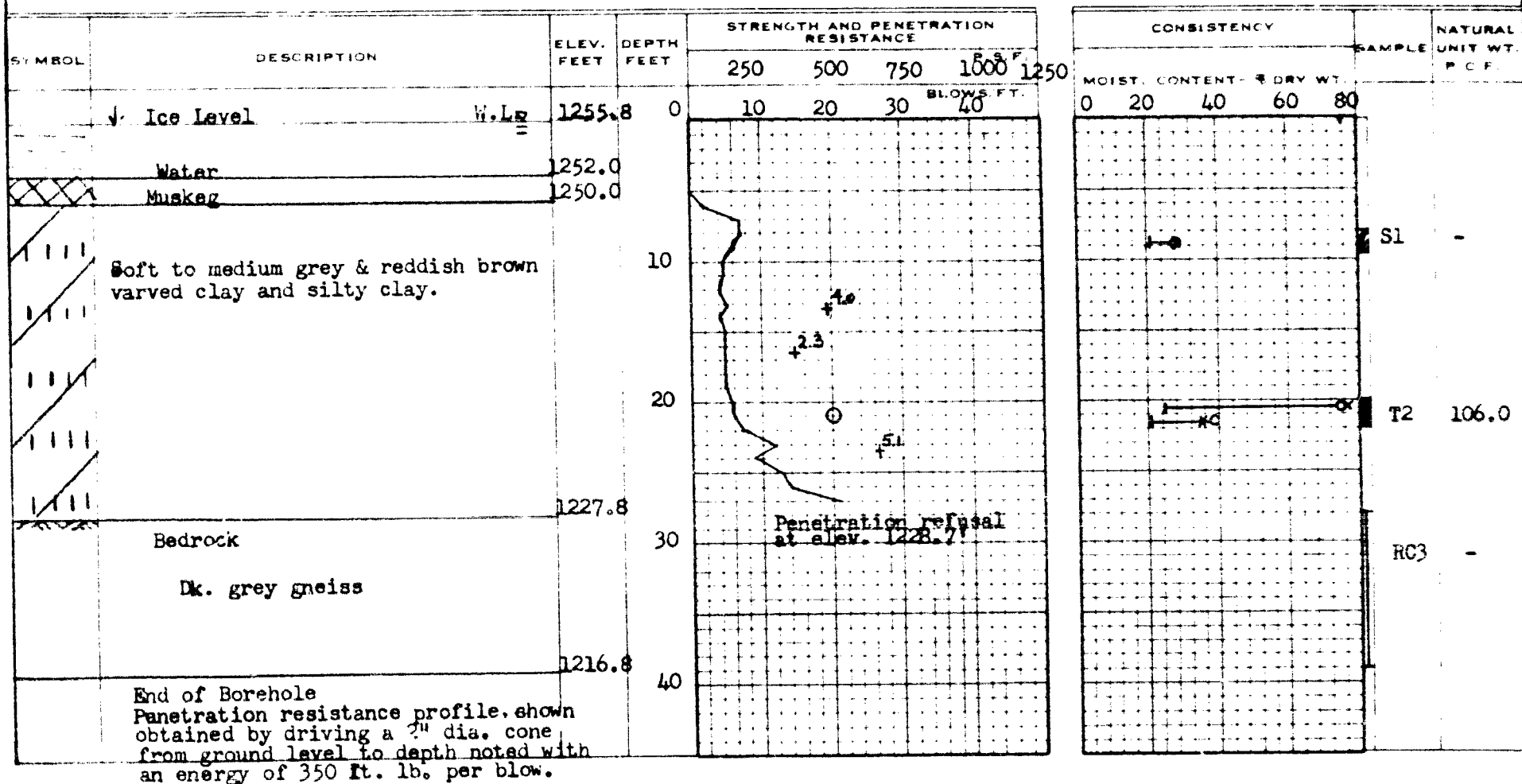
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BORING DATE Feb. 29/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

## LEGEND

1/2 UNCONFINED COMPRESSION ( $Q_u$ )  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND  
 LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 4

JOB 60-F-17 STATION 245400 E



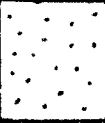

DATUM 1255.81 \_\_\_\_\_ COMPILED BY B.K. \_\_\_\_\_

BORING DATE Mar. 3/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA CONE  
2" SHELBY  
CASING

## LEGEND

1/2 UNCONFINED COMPRESSION (Qu) — O  
VANE TEST (C) AND SENSITIVITY (S) — +  
NATURAL MOISTURE AND LIQUIDITY INDEX — LI  
LIQUID LIMIT — X  
PLASTIC LIMIT —

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F.	
	↓ Ground Level W.L. 	1255.8	0	BLOWS FT 10 20 30 40 50	
	Muskeg	1251.0			
	Medium dense grey, fine to medium sand	1244.3	10		
	Bedrock Dk. grey gneiss	1238.0		Penetration refusal at elev. 1244.5	
	End of borehole.		20		
			30		
			40		

Penetration resistance profile..shown  
obtained by driving a 2" dia. cone from  
ground level to depth noted with an penetrometer

[illegible]

## OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 5

JOB 60-F-17 STATION 246+00.8

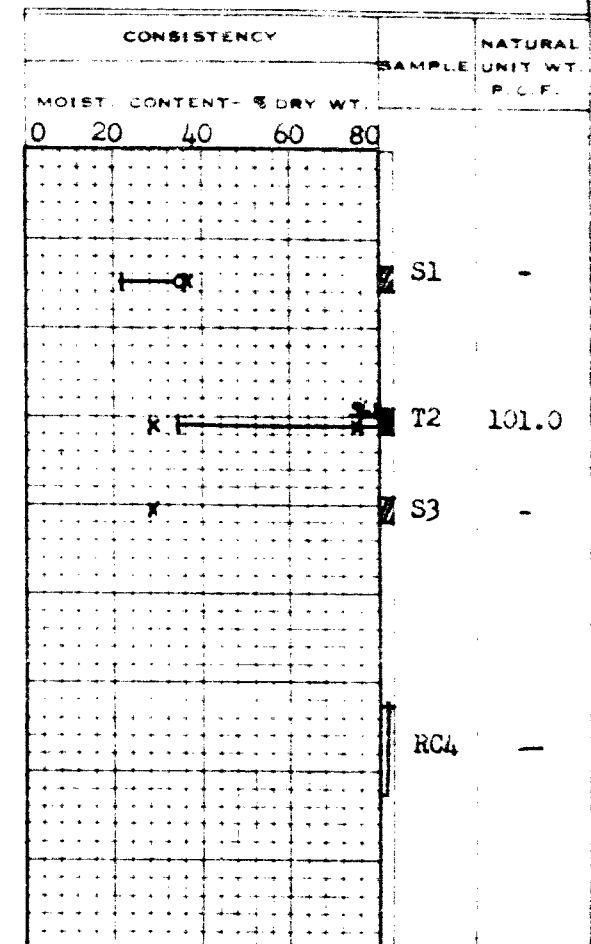
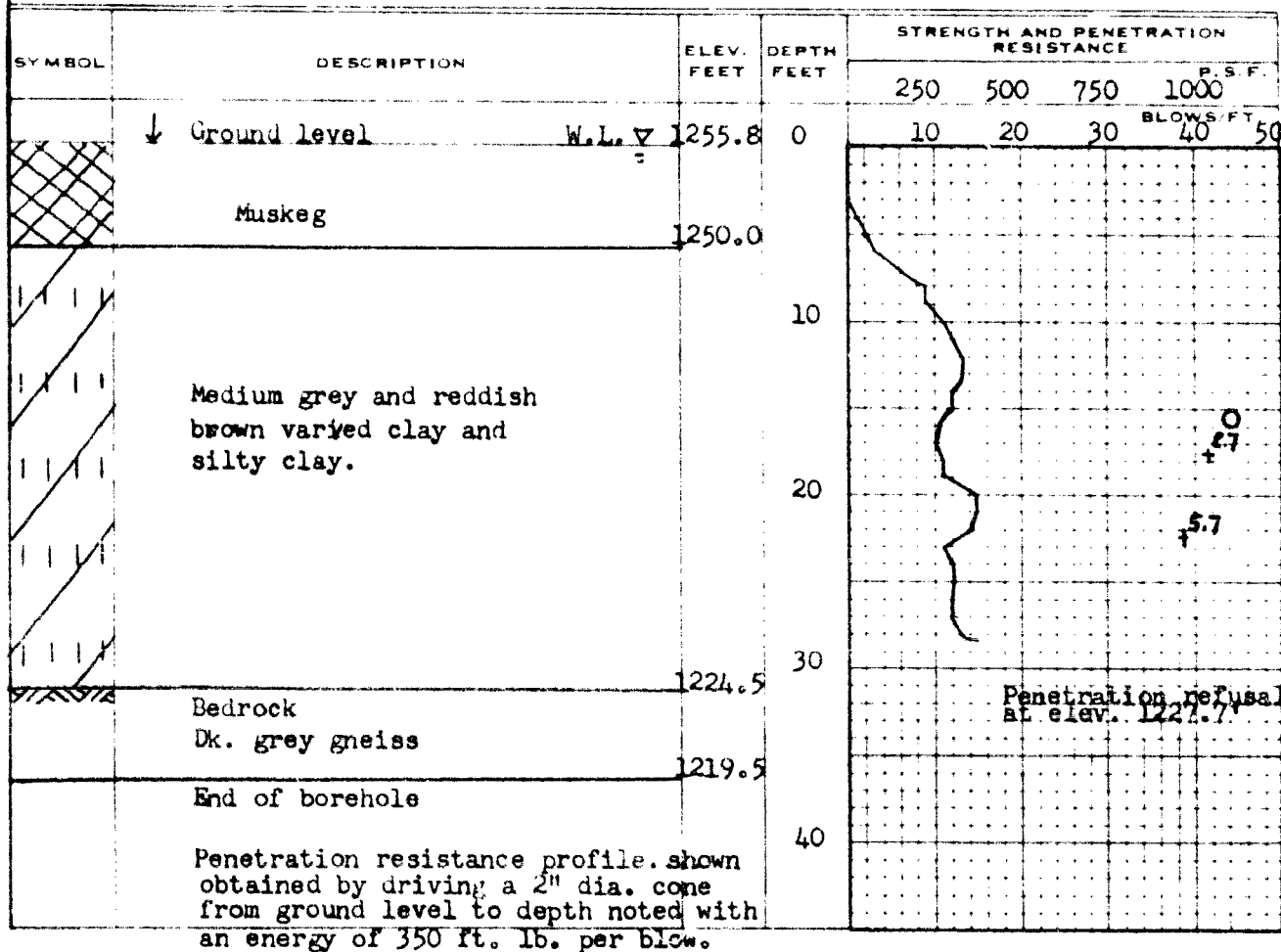
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BORING DATE Mar. 4/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

## LEGEND

1/2 UNCONFINED COMPRESSION ( $Q_u$ ) — O  
 VANE TEST (C) AND SENSITIVITY (S) — +  
 NATURAL MOISTURE AND LIQUIDITY INDEX — LI  
 LIQUID LIMIT — X  
 PLASTIC LIMIT —



# DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 6

JOB 60-F-17 STATION 244+00.6

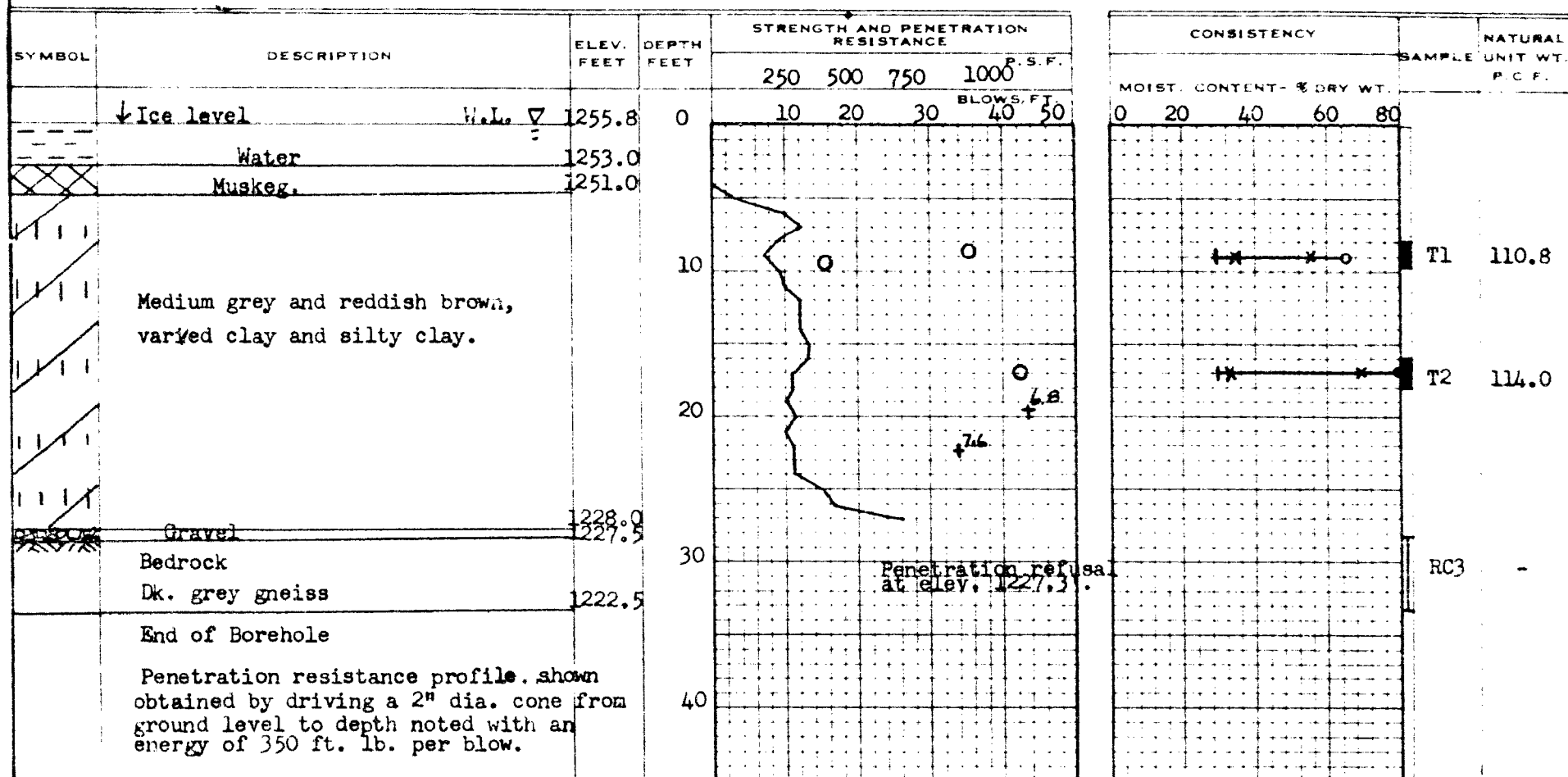
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BORING DATE Mar. 5/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

## LEGEND

1/2 UNCONFINED COMPRESSION ( $Q_u$ )  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT



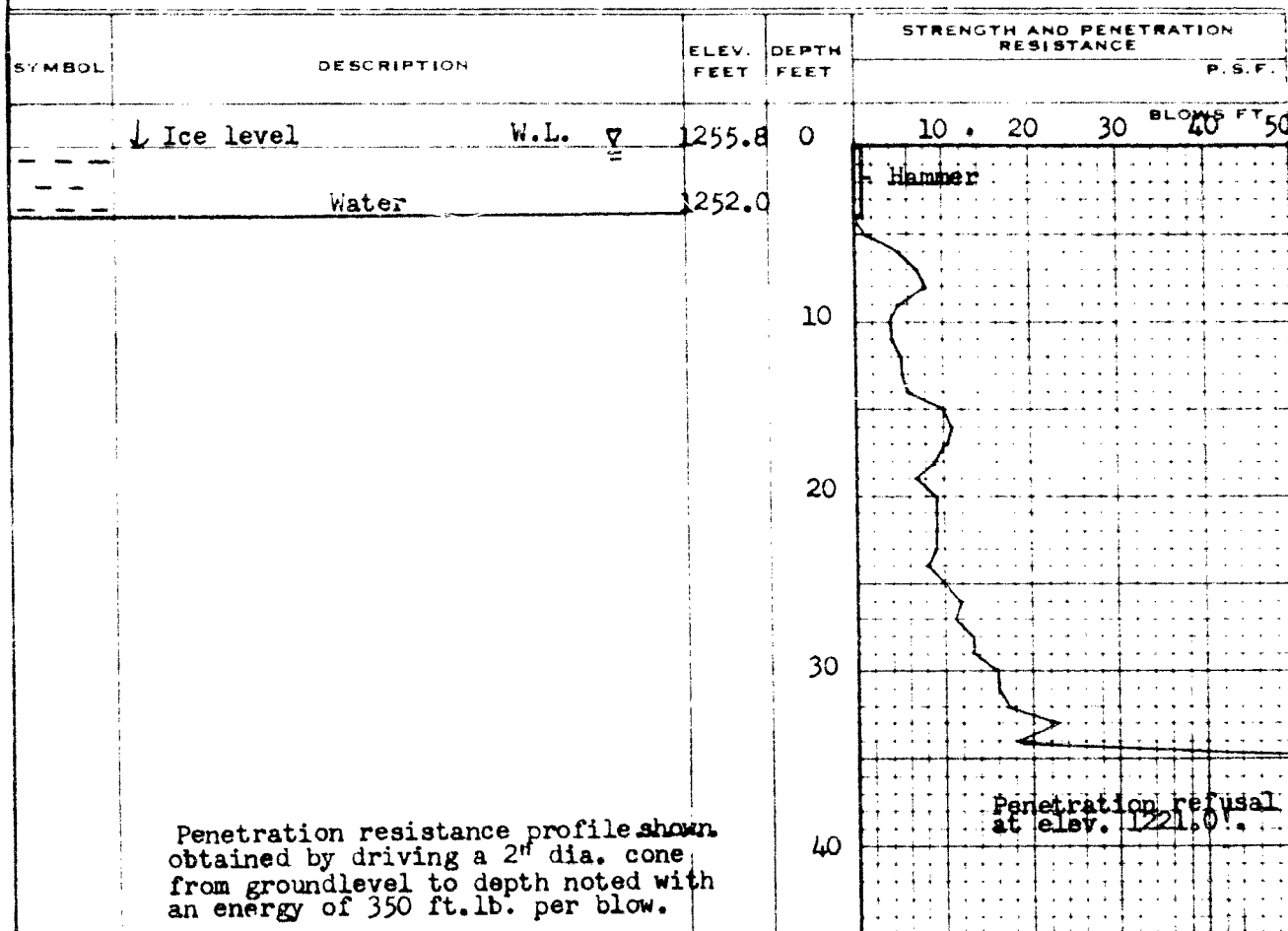
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 7  
JOB 60-F-17 STATION 24370 G  
DATUM 1255.8' COMPILED BY B.K.  
BORING DATE Mar. 7/60 CHECKED BY A.L.

2" DIA SPLIT TUBE \_\_\_\_\_  
2" SHELBY TUBE \_\_\_\_\_  
2" SPLIT TUBE \_\_\_\_\_  
2" DIA CONE \_\_\_\_\_  
2" SHELBY \_\_\_\_\_  
CASING \_\_\_\_\_

## LEGEND

1/2 UNCONFINED COMPRESSION ( $Q_u$ ) --- 0  
VANE TEST (C) AND SENSITIVITY (S) --- +  
NATURAL MOISTURE AND  
LIQUIDITY INDEX --- X  
LIQUID LIMIT ---  
PLASTIC LIMIT ---

[illegible]

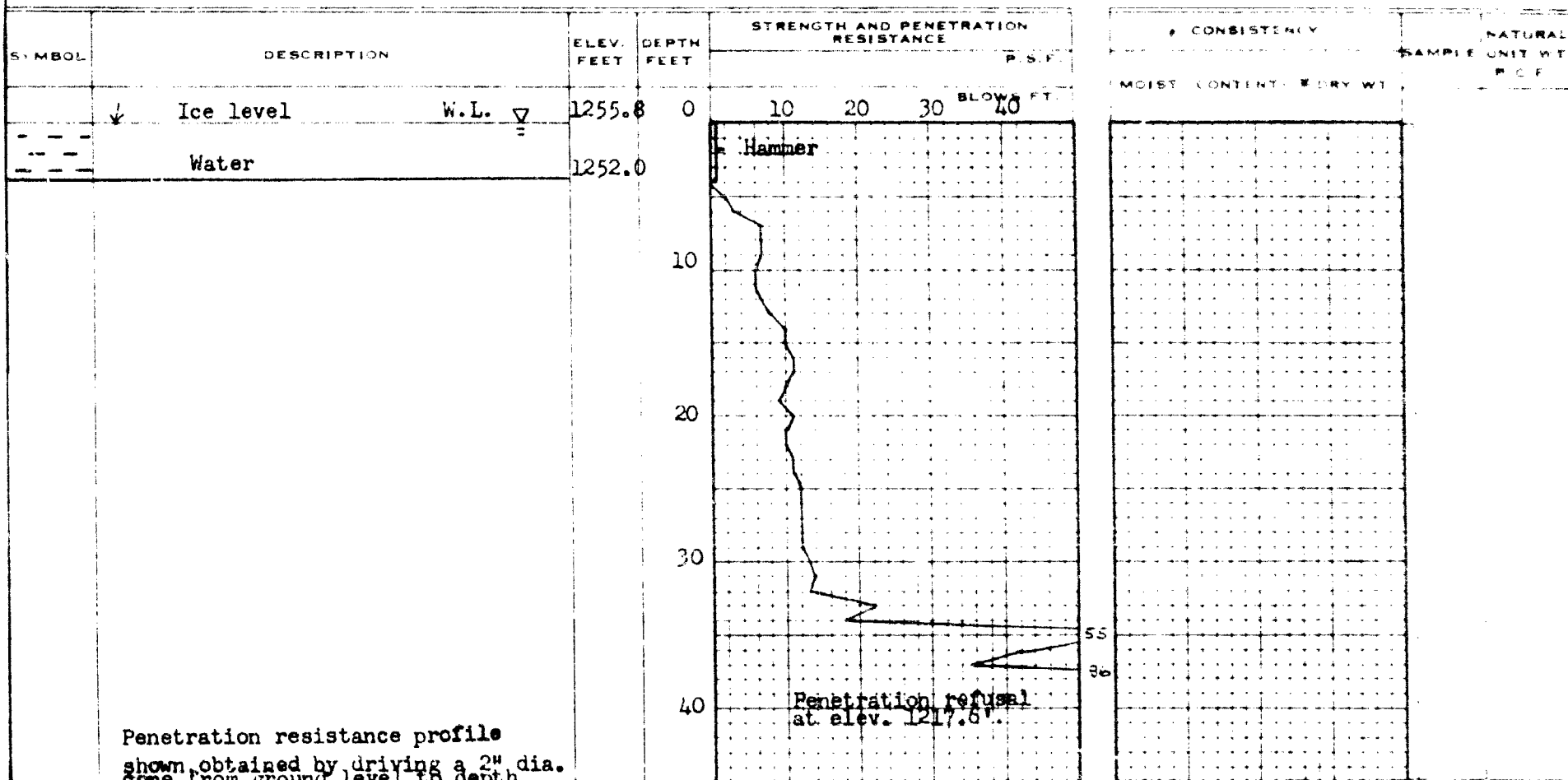
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 8  
 JOB 60-F-17 STATION 243+35 E  
 DATUM 1255.8' COMPILED BY B.K.  
 BORING DATE Mar. 7-1960 CHECKED BY A.L.

2" DIA SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

## LEGEND

1/2 UNCONFINED COMPRESSION ( $Q_u$ )  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND  
 LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 9

JOB 60-F-17 STATION 243+00 (50' Lt.)

DATUM 1255.8' COMPILED BY B.K.

BORING DATE Mar. 7/60. CHECKED BY A.L.

2" DIA SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

### LEGEND

1/2 UNCONFINED COMPRESSION (Qu)	0
VANE TEST (C) AND SENSITIVITY (S)	+6
NATURAL MOISTURE AND	
LIQUIDITY INDEX	X
LIQUID LIMIT	
PLASTIC LIMIT	

SYMBOL	DESCRIPTION	ELEV FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F. BLOWS FT	
	↓ Ice level	W.L. 1255.8	0	10	20
---	Water	1252.0			
			10		
			20		
			30		
			40		
Penetration resistance profile shown obtained by driving a 2" dia. cone from ground level to depth noted, with an energy of 350 ft. lb. per blow.				Penetration refusal at elev. 1220.0'.	

[illegible]



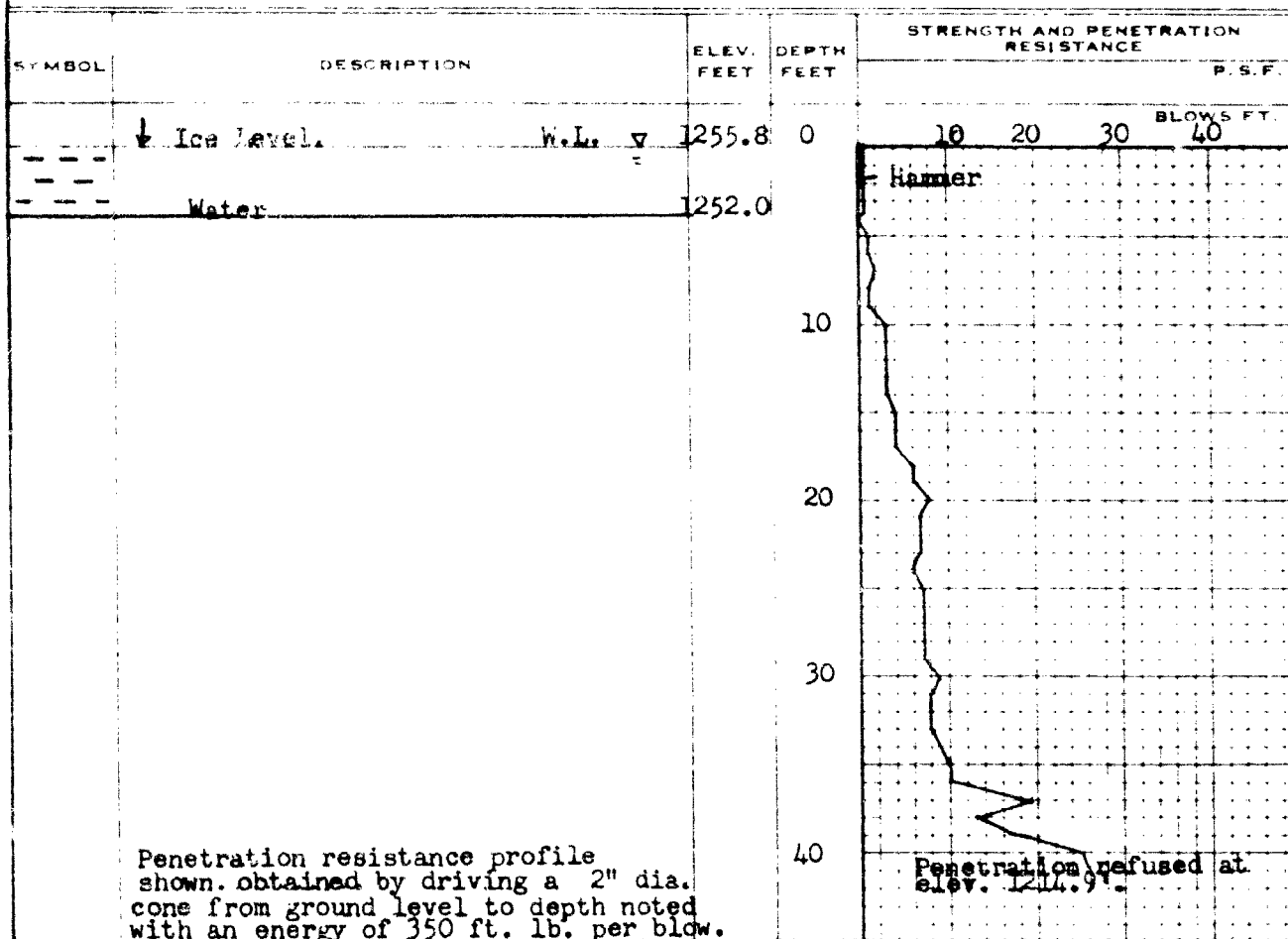
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 10  
JOB 60-F-17 STATION 243+00 (50' Rt.)  
DATUM 1255.8' COMPILED BY B.K.  
BORING DATE Mar. 7/60 CHECKED BY A.L.

2" DIA SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

### LEGEND

1/2 UNCONFINED COMPRESSION (Qu)	---	0
VANE TEST (C) AND SENSITIVITY (S)	---	+
NATURAL MOISTURE AND		
LIQUIDITY INDEX	---	x
LIQUID LIMIT	---	
PLASTIC LIMIT	---	

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 11

JOB 60-F-17 STATION 24265 C

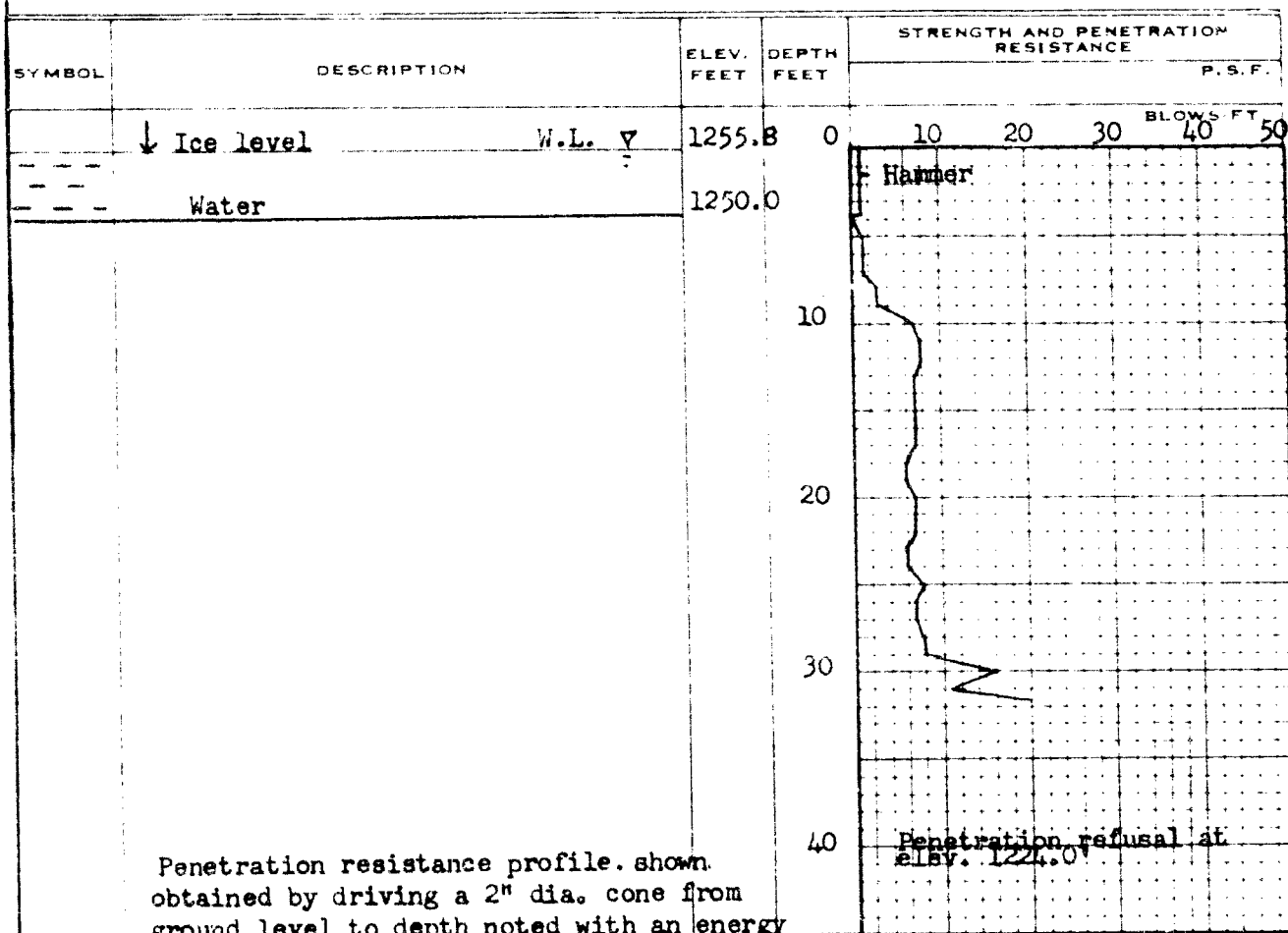
DATUM 1255.8' COMPILED BY B.K.

BORING DATE March 9-1960 CHECKED BY A.J.

2" DIA. SPLIT TUBE \_\_\_\_\_  
2" SHELBY TUBE \_\_\_\_\_  
2" SPLIT TUBE \_\_\_\_\_  
2" DIA. CONE \_\_\_\_\_  
2" SHELBY \_\_\_\_\_  
CASING \_\_\_\_\_

### LEGEND

1/2 UNCONFINED COMPRESSION (QU)	---	O
VANE TEST (C) AND SENSITIVITY (S)	---	+ <sup>L</sup>
NATURAL MOISTURE AND		
LIQUIDITY INDEX	---	X
LIQUID LIMIT	---	
PLASTIC LIMIT	---	

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 12

JOB 60-E-17 STATION 242.00 (50' Lt.)

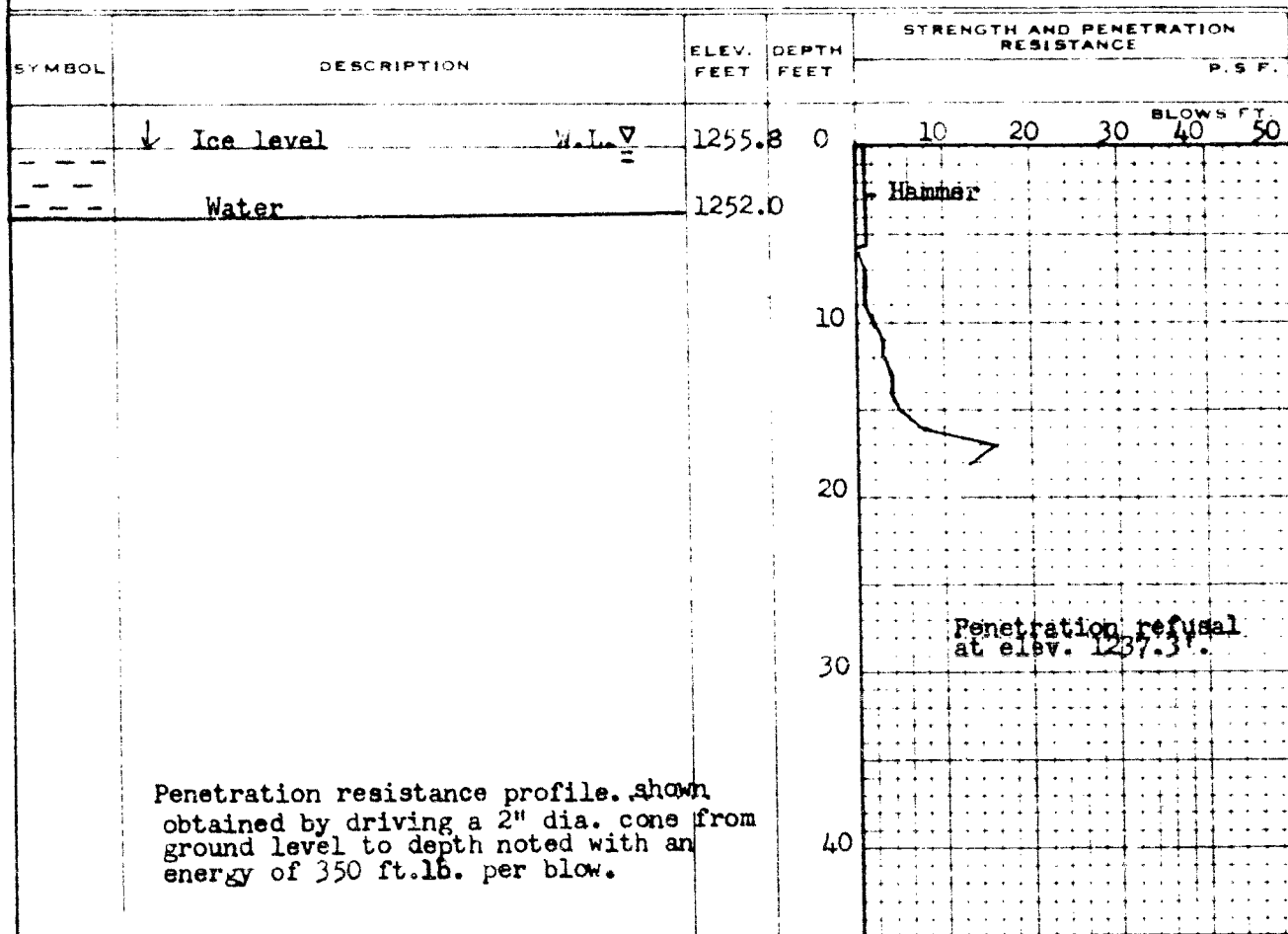
DATUM 1255.8' \_\_\_\_\_ COMPILED BY B.K. \_\_\_\_\_

BORING DATE Mar. 9/60. CHECKED BY A.L.

2" DIA SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

### LEGEND

1/2 UNCONFINED COMPRESSION (Qu) — 0  
VANE TEST (C) AND SENSITIVITY (S) — +  
NATURAL MOISTURE AND LIQUIDITY INDEX — L  
LIQUID LIMIT — X  
PLASTIC LIMIT —

[illegible]

W.P. 82-60 BORE HOLE NO. 13  
JOB 60-E-17 STATION 242400 (50' Rt.)  
DATUM 1255.8' COMPILED BY B.K.  
BORING DATE Mar. 9, 60 CHECKED BY A.L.

2" DIA SPLIT TUBE \_\_\_\_\_  
2" SHELBY TUBE \_\_\_\_\_  
2" SPLIT TUBE \_\_\_\_\_  
2" DIA. CONE \_\_\_\_\_  
2" SHELBY \_\_\_\_\_  
CASING \_\_\_\_\_

1/2 UNCONFINED COMPRESSION (Qu)	---	0
VANE TEST (C) AND SENSITIVITY (S)	---	+*
NATURAL MOISTURE AND		
LIQUIDITY INDEX	---	X
LIQUID LIMIT	---	
PLASTIC LIMIT	---	

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F.	
	↓ Ice level	1255.8	0	10 20 30 40	
	W.L. 7				
	Water	1252.0		Hammer	
			10		
			20		
			30		
			40	Penetration refusal at elev. 1222.5.	

Penetration resistance profile shown obtained by driving a 2" dia. cone from ground level to depth noted with

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 14

JOB 60-F-17 STATION 24165 E

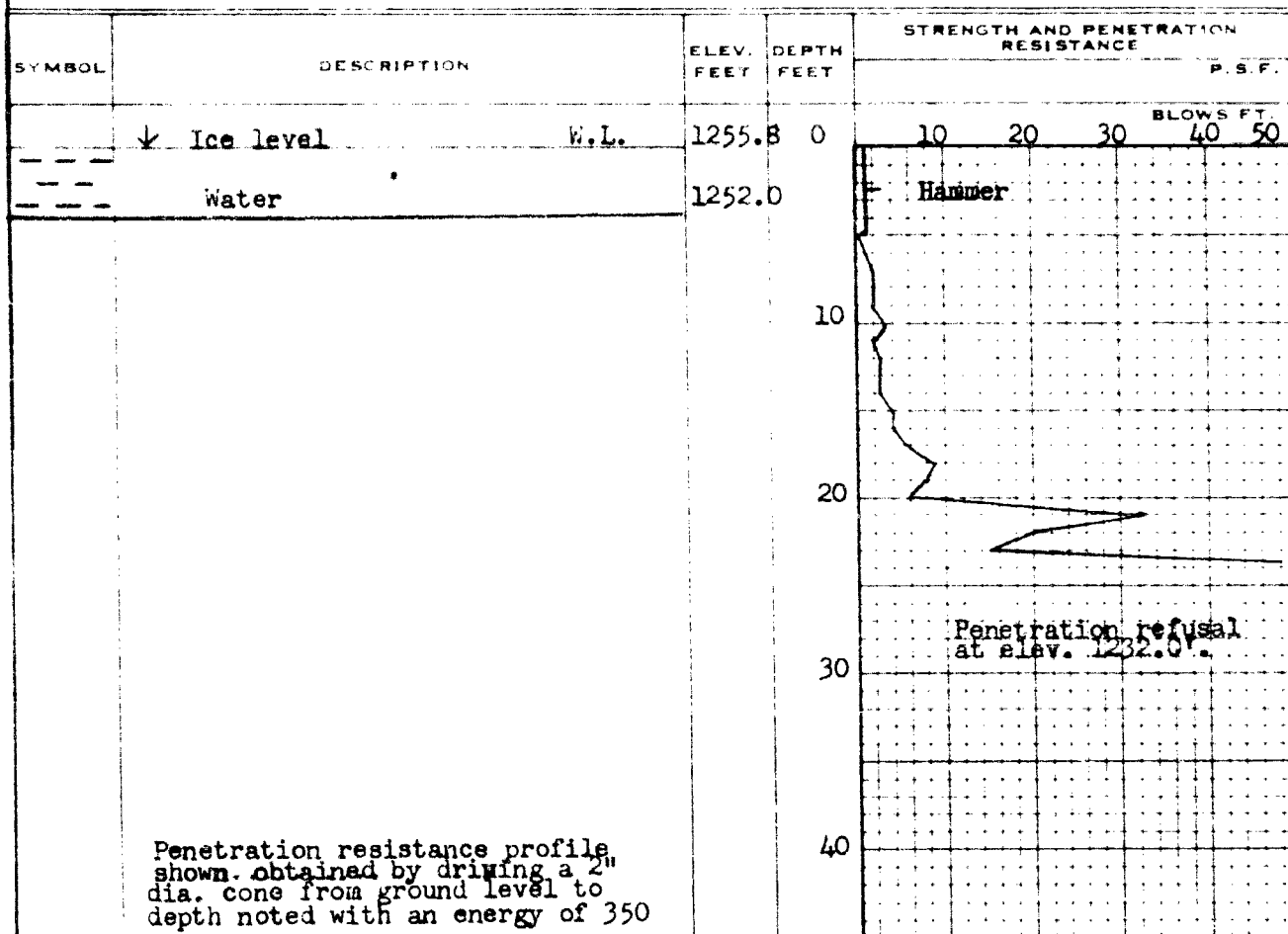
DATUM 1255.8' COMPILED BY B.K.

BORING DATE March 9/60 CHECKED BY A.J.

2" DIA. SPLIT TUBE \_\_\_\_\_  
2" SHELBY TUBE \_\_\_\_\_  
2" SPLIT TUBE \_\_\_\_\_  
2" DIA. CONE \_\_\_\_\_  
2" SHELBY \_\_\_\_\_  
CASING \_\_\_\_\_

### LEGEND

1/2 UNCONFINED COMPRESSION {Qu}	---	0
VANE TEST (C) AND SENSITIVITY (S)	---	+
NATURAL MOISTURE AND		
LIQUIDITY INDEX	---	x
LIQUID LIMIT	---	
PLASTIC LIMIT	---	



Penetration resistance profile shown, obtained by driving a 2" dia. cone from ground level to depth noted with an energy of 350 ft.lb. per blow.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 15

JOB 60-F-17 STATION 241.30 E

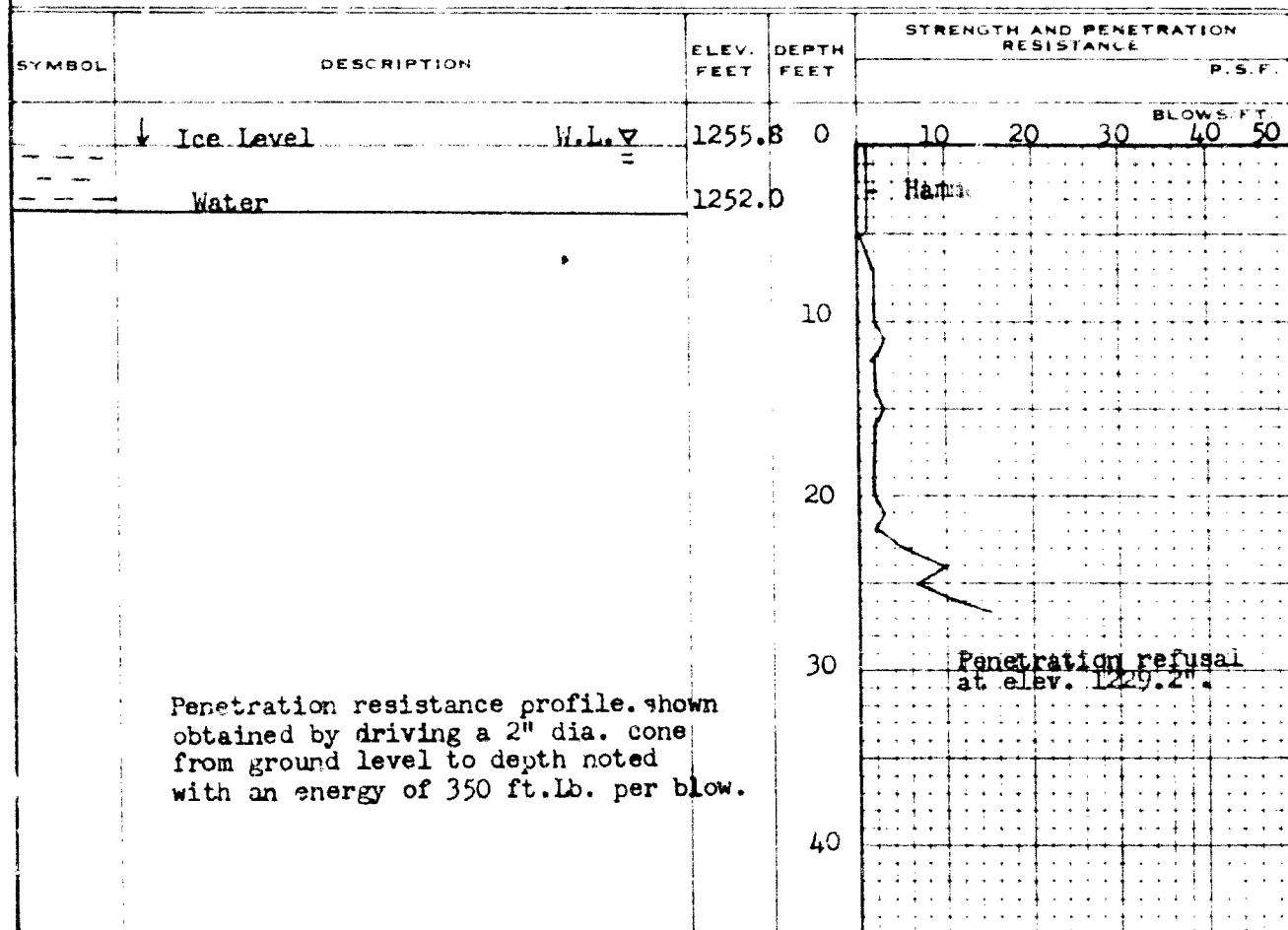
DATUM 1255.8' COMPILED BY B.K.

BORING DATE Mar. 10/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE \_\_\_\_\_  
2" SHELBY TUBE \_\_\_\_\_  
2" SPLIT TUBE \_\_\_\_\_  
2" DIA. CONE \_\_\_\_\_  
2" SHELBY \_\_\_\_\_  
CASING \_\_\_\_\_

## LEGEND

1/2 UNCONFINED COMPRESSION (QU) --- O  
VANE TEST (C) AND SENSITIVITY (S) --- + S  
NATURAL MOISTURE AND LIQUIDITY INDEX --- LI  
LIQUID LIMIT --- X  
PLASTIC LIMIT ---

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. B2-60 BORE HOLE NO. 26

JOB 60-F-17 STATION 241+00 (50' Lt.)

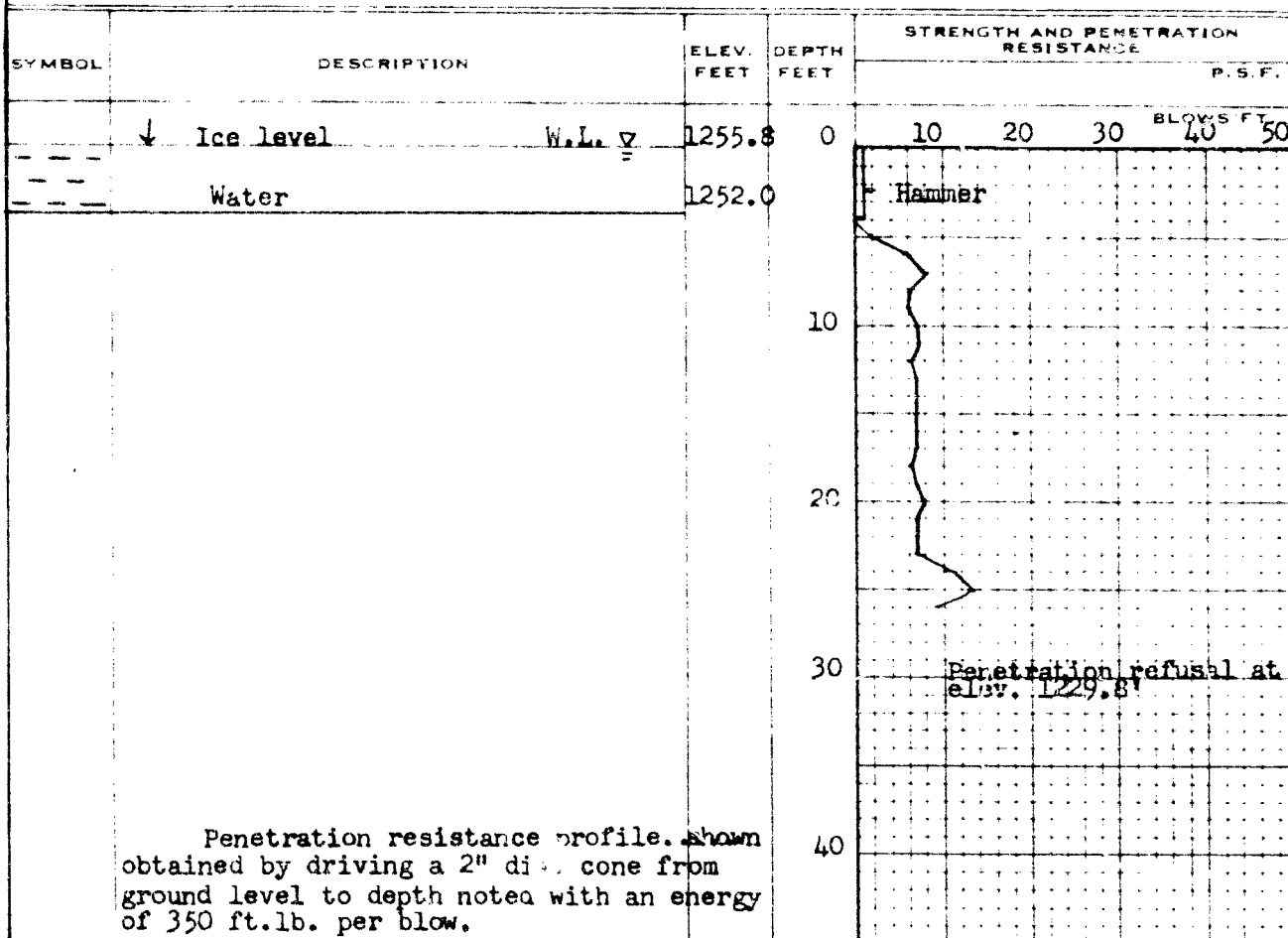
DATUM 1255.81 \_\_\_\_\_ COMPILED BY B.K. \_\_\_\_\_

BORING DATE Mar. 10/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE \_\_\_\_\_  
2" SHELBY TUBE \_\_\_\_\_  
2" SPLIT TUBE \_\_\_\_\_  
2" DIA. CONE \_\_\_\_\_  
2" SHELBY \_\_\_\_\_  
CASING \_\_\_\_\_

### LEGEND

1/2 UNCONFINED COMPRESSION (Qu) _____	Q
VANE TEST (C) AND SENSITIVITY (S) _____	+S
NATURAL MOISTURE AND	
LIQUIDITY INDEX _____	X
LIQUID LIMIT _____	
PLASTIC LIMIT _____	

[illegible]

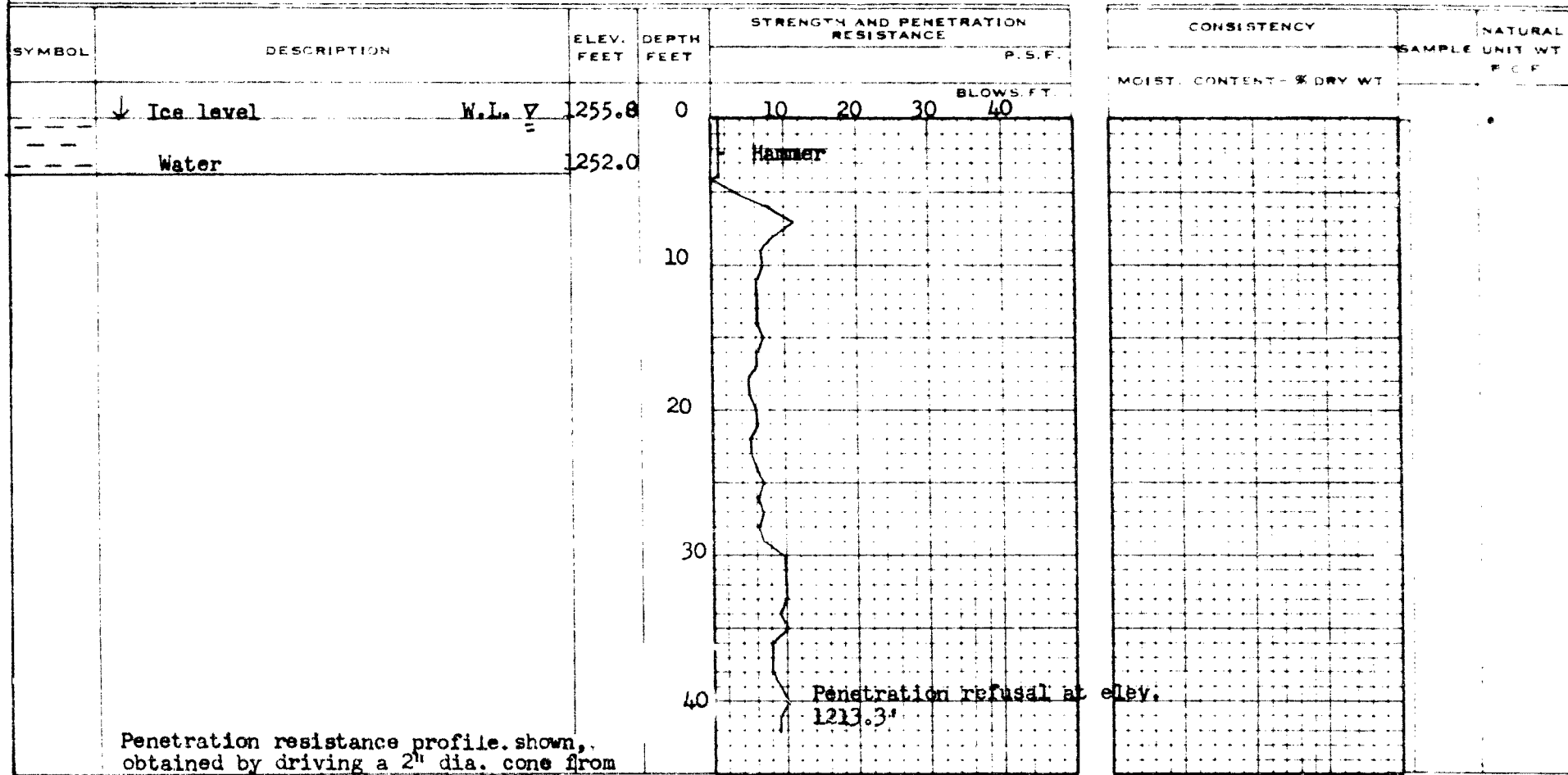
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 17  
JOB 60-F-17 STATION 240+50 E  
DATUM 1255.8' COMPILED BY B.K.  
BORING DATE March 10/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASINGS

## LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O  
VANE TEST (C) AND SENSITIVITY (S) +  
NATURAL MOISTURE AND LIQUIDITY INDEX LI  
LIQUID LIMIT X  
PLASTIC LIMIT





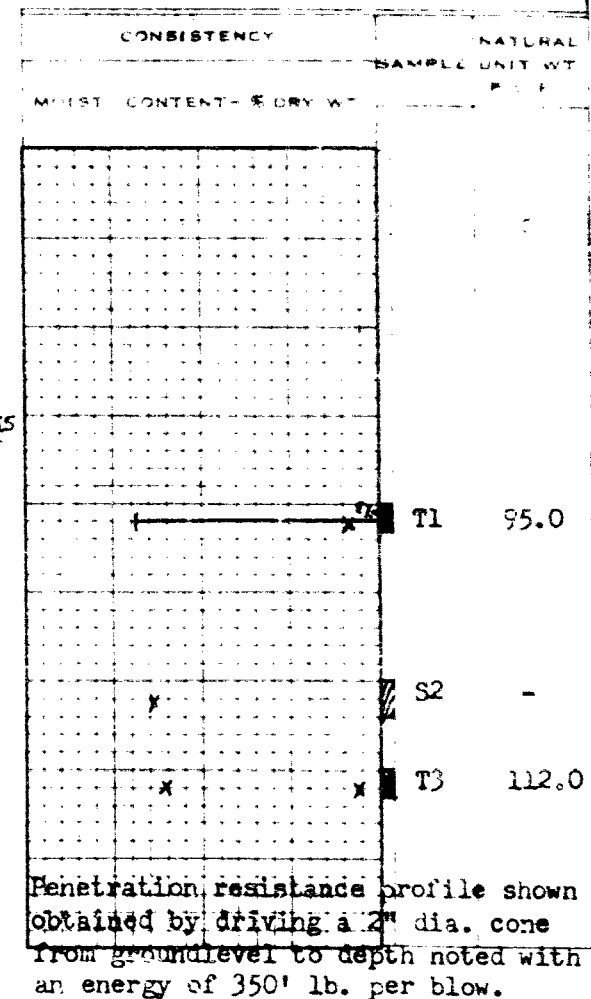
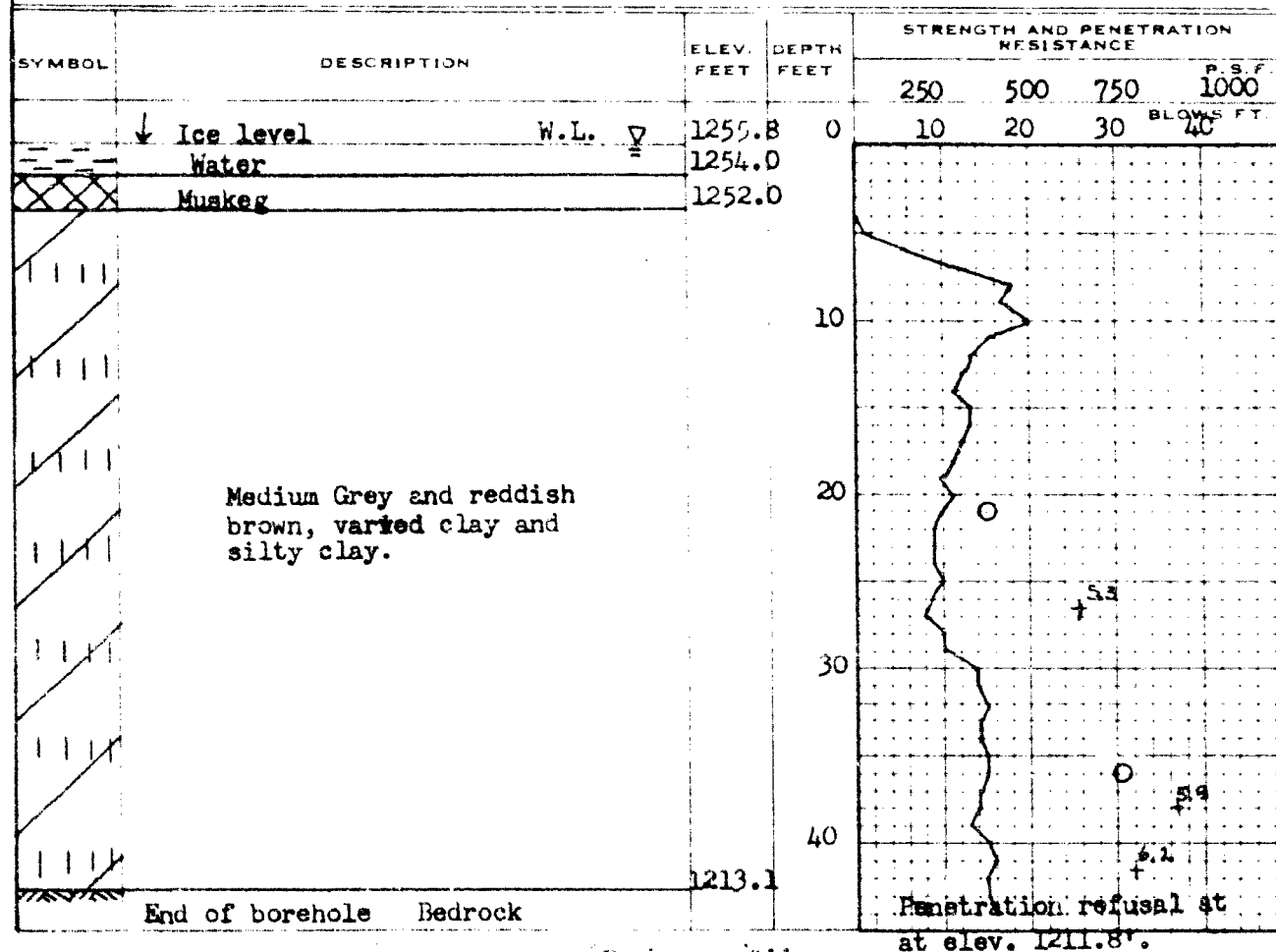
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 18  
 JOB 60-F-17 STATION 240+00  
 DATUM 1255.8' COMPILED BY B.K.  
 BORING DATE March 10/60 CHECKED BY A.L.

2" DIA SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA CONE  
 2" SHELBY  
 CASING

## LEGEND

1/2 UNCONFINED COMPRESSION (QU)  $\bigcirc$   
 VANE TEST (C) AND SENSITIVITY (S)  $+$   
 NATURAL MOISTURE AND  
 LIQUIDITY INDEX  $\lambda$   
 LIQUID LIMIT  $\sim$   
 PLASTIC LIMIT  $\sim$



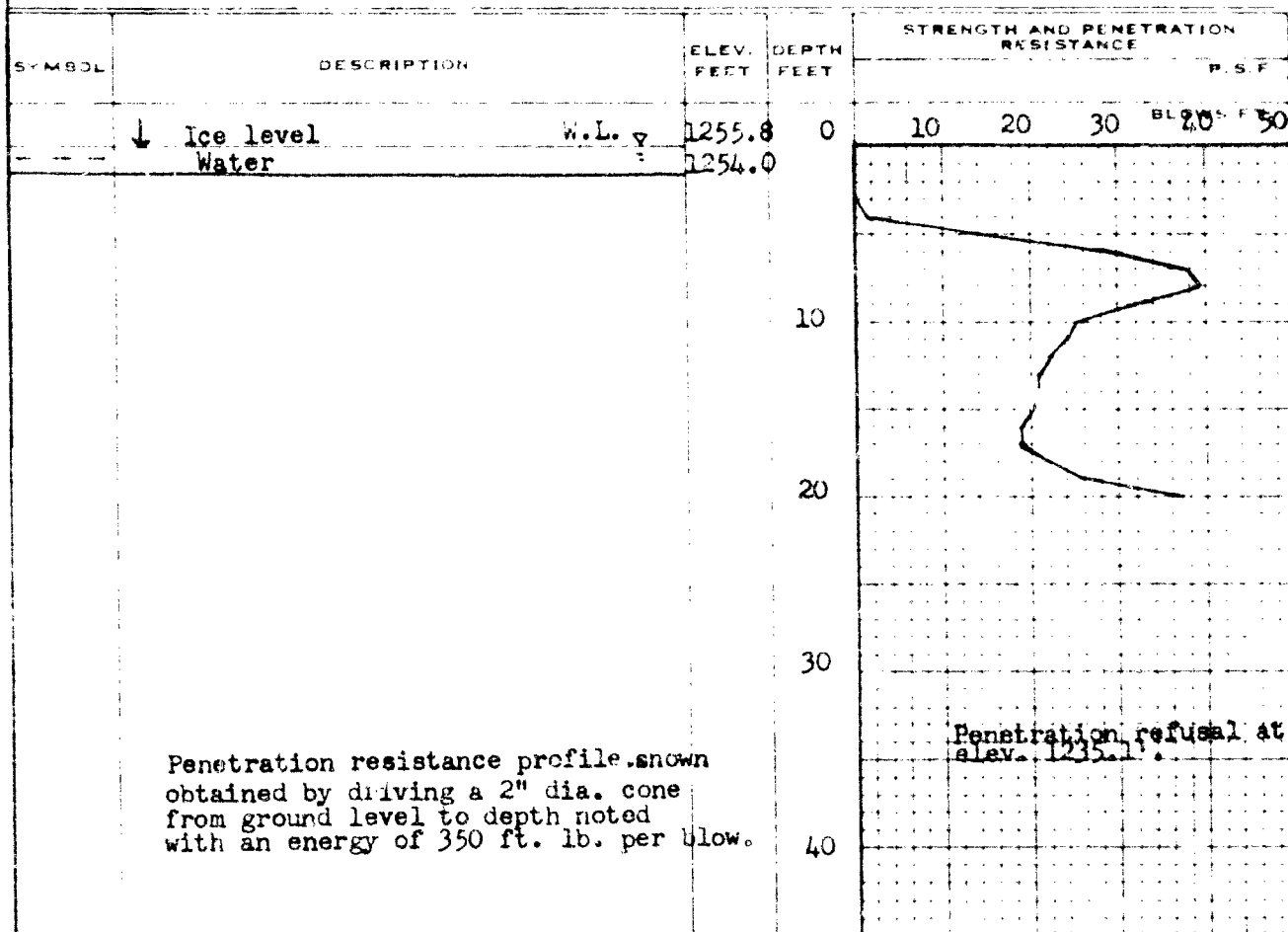
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 19  
JOB 60-F-17 STATION 239+00 E  
DATUM 1255.8' COMPILED BY B.K.  
BORING DATE Mar. 10/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

### LEGEND

1/2 UNCONFINED COMPRESSION (Qu)	---	0
VANE TEST (C) AND SENSITIVITY (S)	---	+ 6
NATURAL MOISTURE AND		
LIQUIDITY INDEX	---	X
LIQUID LIMIT	---	
PLASTIC LIMIT	---	

[illegible]

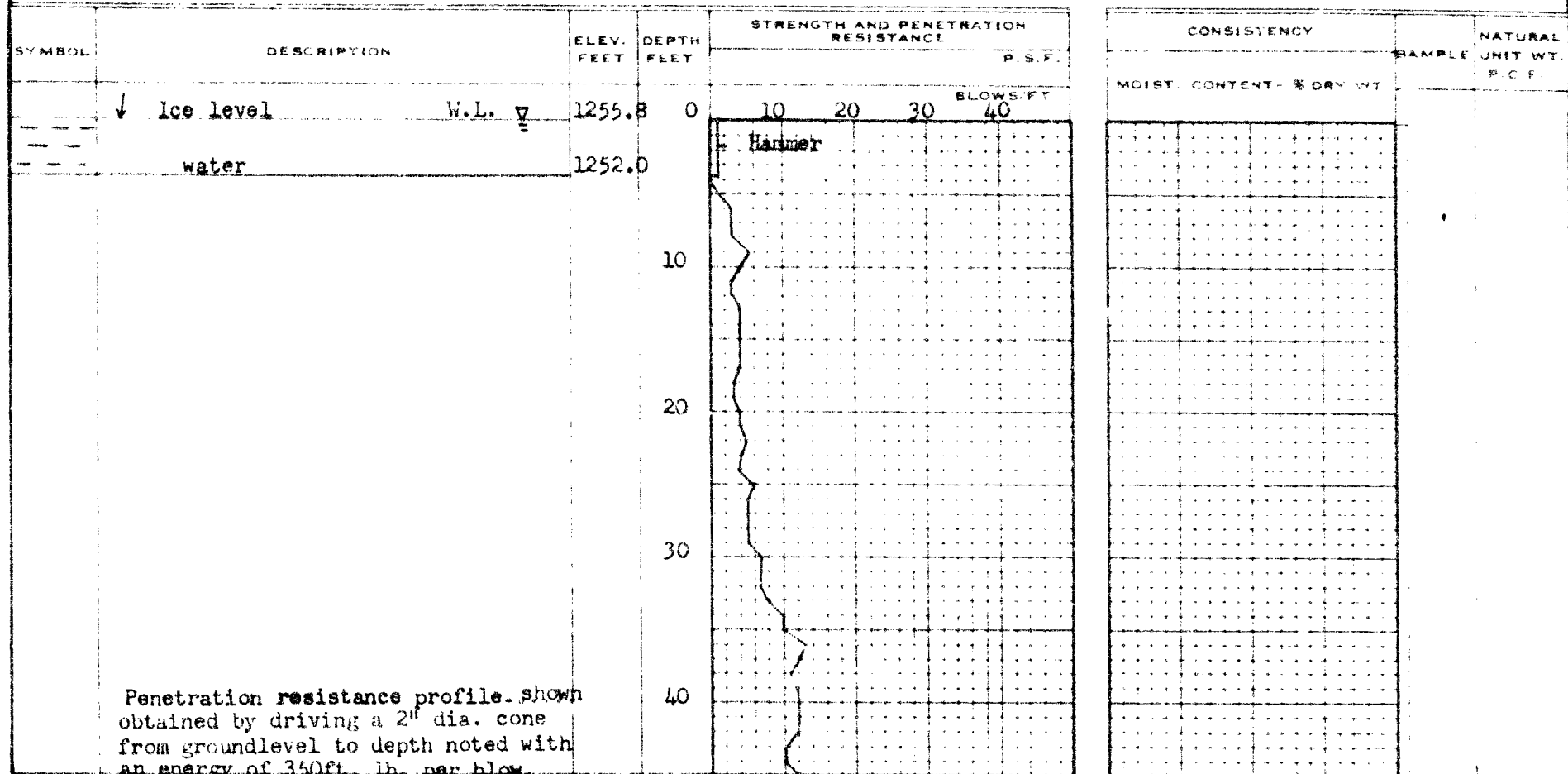
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 20  
JOB 60-F-17 STATION 241+00 (50' R.L.)  
DATUM 1255.8' COMPILED BY B.K.  
BORING DATE March 10/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

## LEGEND

1/2 UNCONFINED COMPRESSION ( $Q_u$ )  
VANE TEST (C) AND SENSITIVITY (S)  
NATURAL MOISTURE AND LIQUIDITY INDEX  
LIQUID LIMIT  
PLASTIC LIMIT



Penetration refusal at elev. 1207.0'

# DEPARTMENT OF HIGHWAYS - ONTARIO

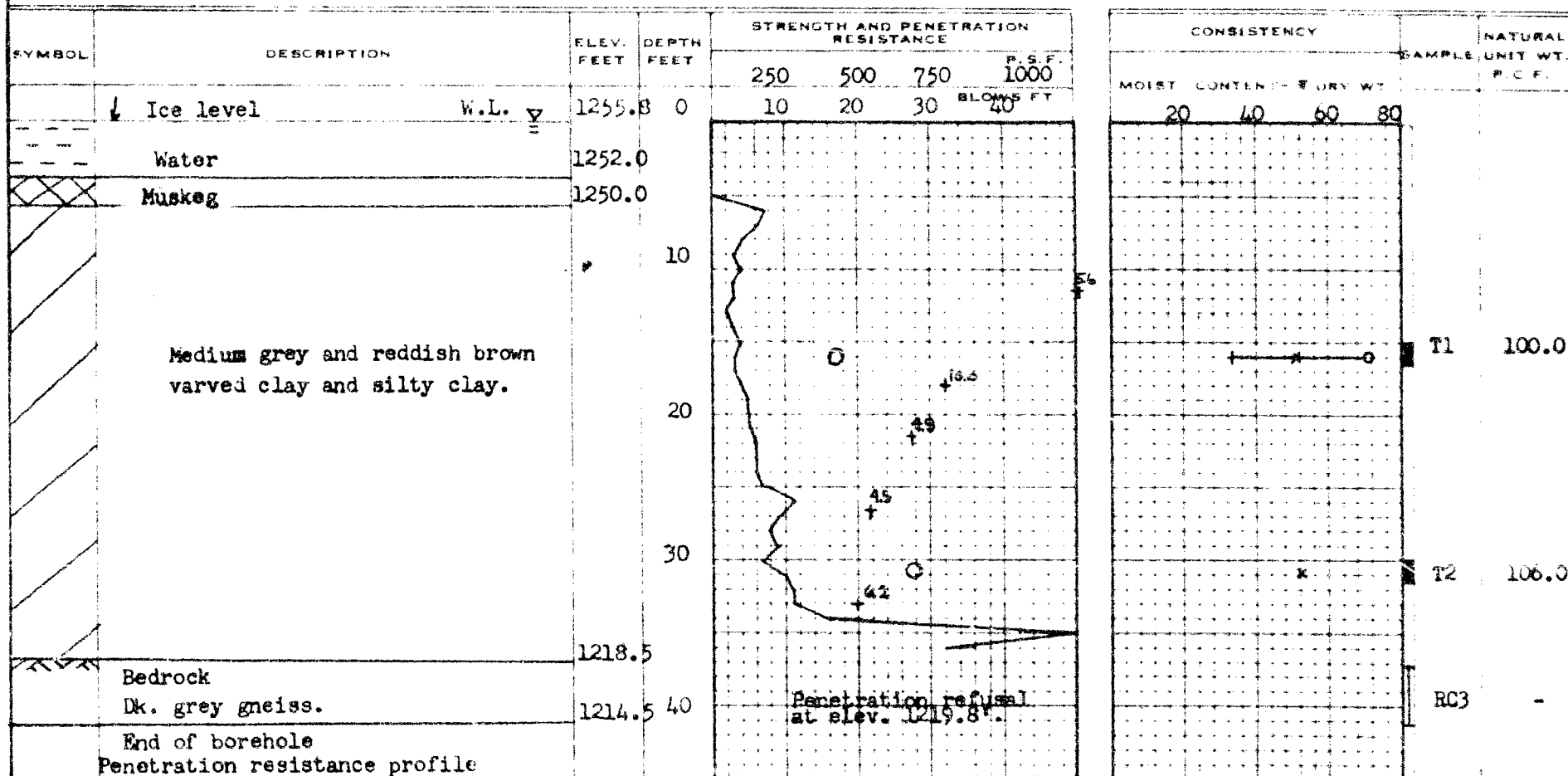
## MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 21  
 JOB 60-F-17 STATION 241+00.6  
 DATUM 1255.8 COMPILED BY B.K.  
 BORING DATE Mar. 11/60. CHECKED BY A.L.

2" DIA SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

### LEGEND

1/2 UNCONFINED COMPRESSION ( $Q_u$ )  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT



Penetration refusal  
 at elev. 1219.8'

T1 100.0

T2 106.0

RC3 -

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 22

JOB 60-F-17 STATION 245750 E

DATUM 1257.0 \_\_\_\_\_ COMPILED BY B.K. \_\_\_\_\_

BORING DATE Mar. 15/60 CHECKED BY A. L.

2" DIA. SPLIT TUBE \_\_\_\_\_  
2" SHELBY TUBE \_\_\_\_\_  
2" SPLIT TUBE \_\_\_\_\_  
2" DIA. CONE \_\_\_\_\_  
2" SHELBY \_\_\_\_\_  
CASING \_\_\_\_\_

### LEGEND

1/2 UNCONFINED COMPRESSION (Qu)	---	0
VANE TEST (C) AND SENSITIVITY (S)	---	+ 5
NATURAL MOISTURE AND		
LIQUIDITY INDEX	---	X
LIQUID LIMIT	---	0
PLASTIC LIMIT	---	0

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE		CONSISTENCY	NATURAL SAMPLE UNIT WT P.C.F.	
				P.S.F.				
				BLOWS, FT.		MOIST. CONTENT % DRY WT		
	↓ Groundlevel	129.4	0	10	20	30	40	
				Hammer				
			10					
			20					
				Penetration refusal at elev. 129.4'				
			30					
			40					

Penetration resistance profile shown obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350' lb. per blow.

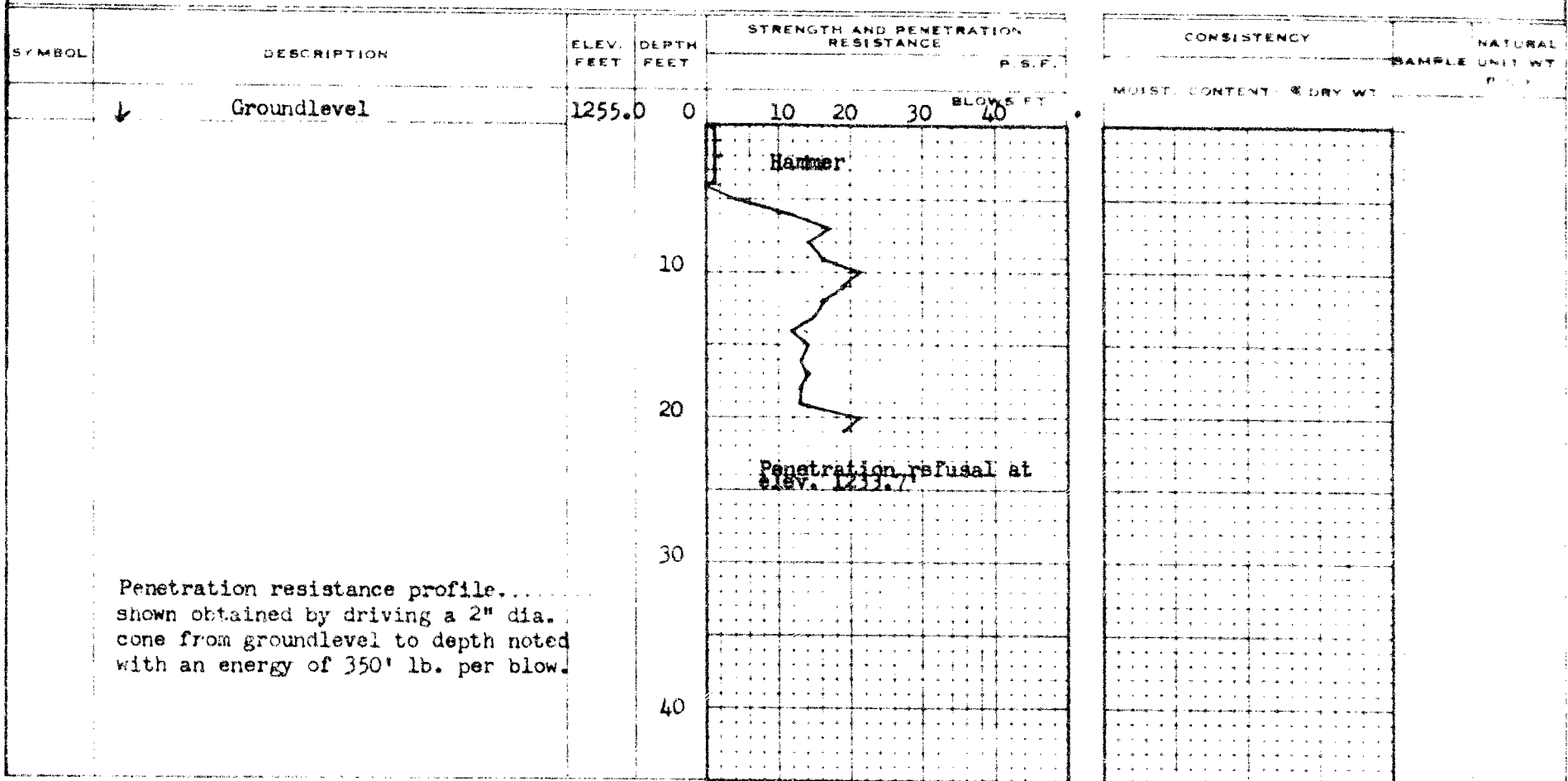
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 23  
 JOB 60-F-17 STATION 244+50 G  
 DATUM 1255.0' COMPILED BY B.L.  
 BORING DATE Mar. 15/60 CHECKED BY A.L.

2" DIA SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA CONE  
 2" SHELBY  
 CASING

## LEGEND

1/2 UNCONFINED COMPRESSION (QU) O  
 VANE TEST (C) AND SENSITIVITY (S) +S  
 NATURAL MOISTURE AND LIQUIDITY INDEX L  
 LIQUID LIMIT X  
 PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 24

JOB 60-F-17 STATION 24450 S

DATUM 1255.8' COMPILED BY B.K.

BORING DATE Mar. 15/60. CHECKED BY A. L.

2" DIA SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA CONE  
2" SHELBY  
CASING

## LEGEND

1/2 UNCONFINED COMPRESSION (QU) \_\_\_\_\_ 0  
VANE TEST (C) AND SENSITIVITY (S) \_\_\_\_\_ +  
NATURAL MOISTURE AND LIQUIDITY INDEX \_\_\_\_\_ LI  
LIQUID LIMIT \_\_\_\_\_  
PLASTIC LIMIT \_\_\_\_\_

[illegible]

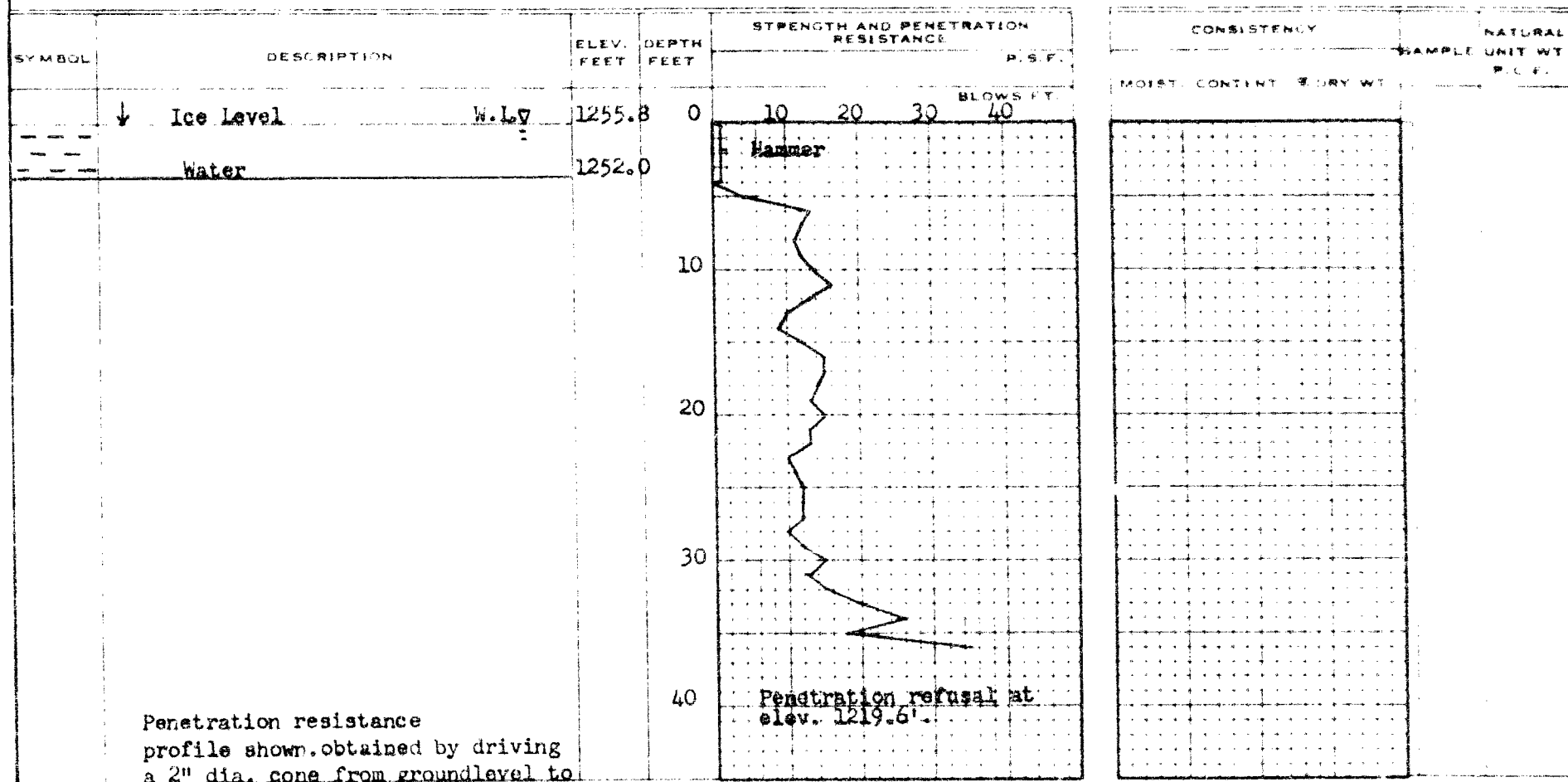
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 25  
 JOB 60-F-17 STATION 244+00 (50' Rt.)  
 DATUM 1255.8' COMPILED BY B.K.  
 BORING DATE Mar. 15/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

## LEGEND

1/2 UNCONFINED COMPRESSION ( $Q_u$ )  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND  
 LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT





## OFFICE REPORT ON SOIL EXPLORATION

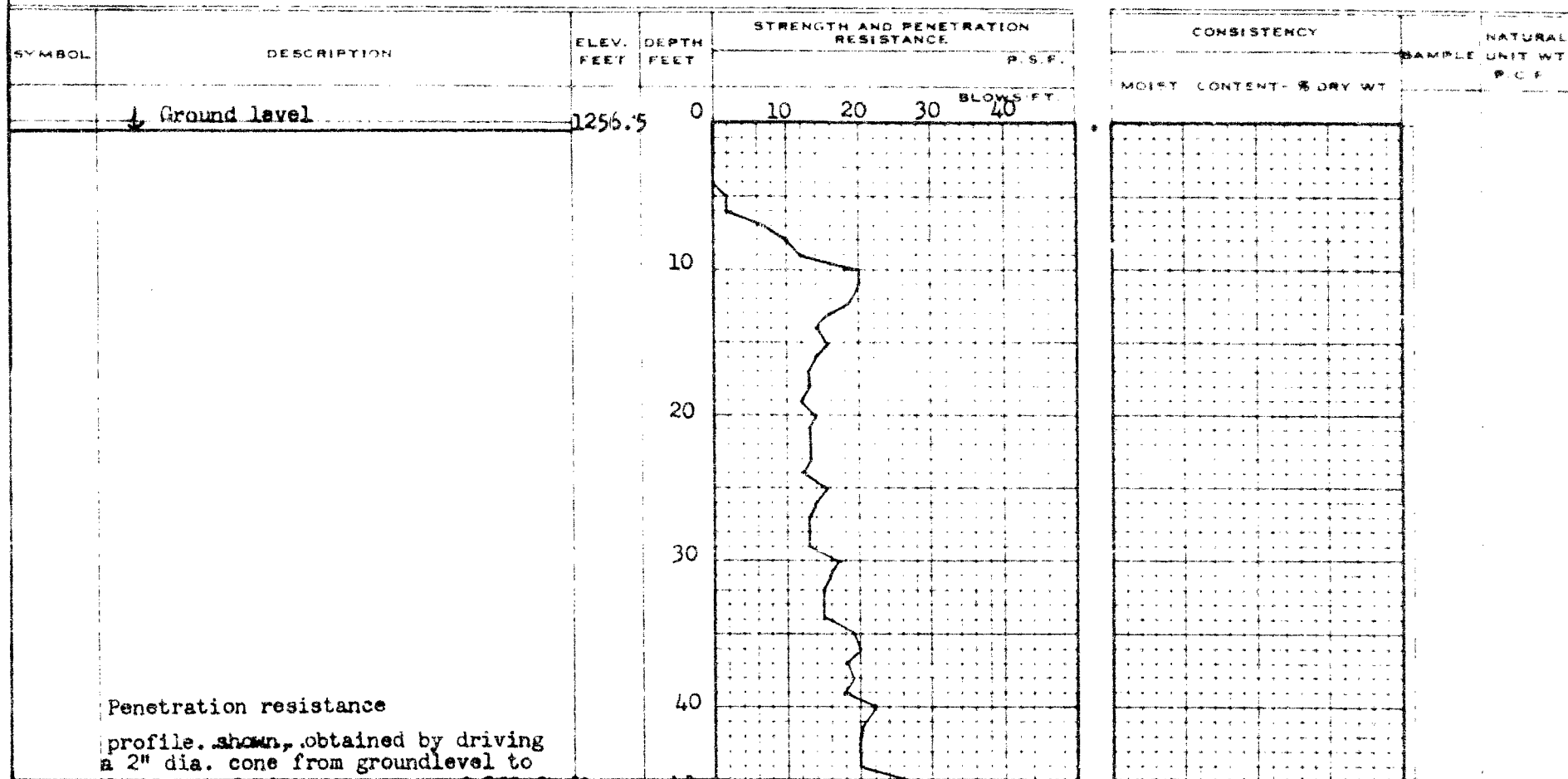
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 26  
 JOB 60-F-17 STATION 247+00  
 DATUM 1257.01 COMPILED BY B.K.  
 BORING DATE Mar. 15/60. CHECKED BY A.L.

## LEGEND

2" DIA SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

1/2 UNCONFINED COMPRESSION ( $Q_u$ )  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT



Penetration refusal at elev. 1210.0'.

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60	BORE HOLE NO. 27
JOB 60-F-17	STATION 243770 (25' Ht.)
DATUM 1255.8'	COMPILED BY B.K.
BORING DATE Mar. 15/60	CHECKED BY A.L.

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

### LEGEND

1/2 UNCONFINED COMPRESSION (QU)	0
VANE TEST (C) AND SENSITIVITY (S)	+6
NATURAL MOISTURE AND	
LIQUIDITY INDEX	11
LIQUID LIMIT	X
PLASTIC LIMIT	

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				U.S.F.	
	↓ Ice level	1255.8	0	BLOWS FT	
	Water	1252.0		Penetration refusal at elev. 1220.2'	

[illegible]

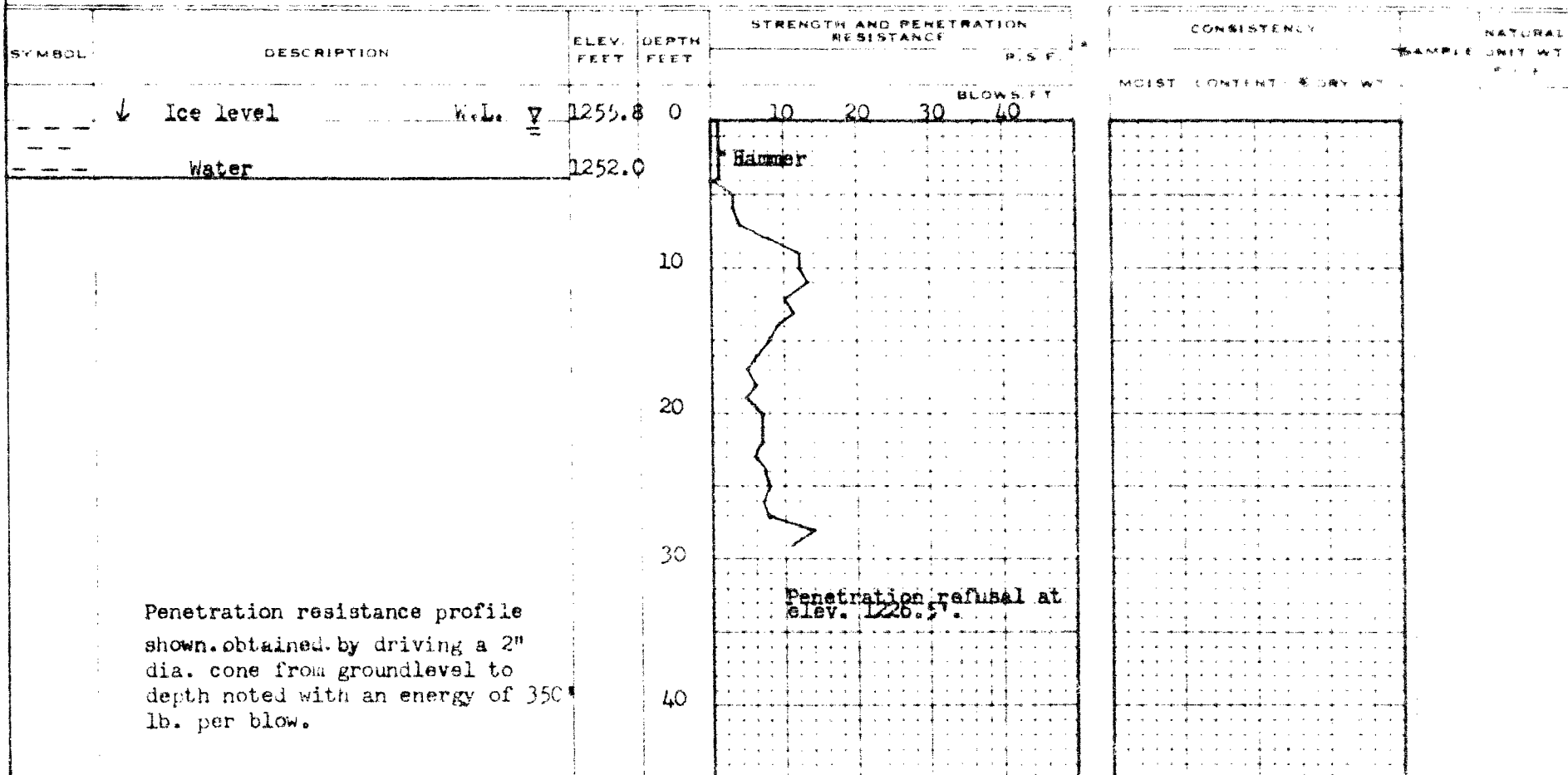
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 28  
 JOB 60-F-17 STATION 2434 (25' Lt.)  
 DATUM 1255.8' COMPILED BY B.K.  
 BORING DATE Mar. 16/60 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

## LEGEND

1/2 UNCONFINED COMPRESSION (QU) O  
 VANE TEST (C) AND SENSITIVITY (S) +  
 NATURAL MOISTURE AND LI  
 LIQUIDITY INDEX X  
 LIQUID LIMIT O  
 PLASTIC LIMIT



# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 29

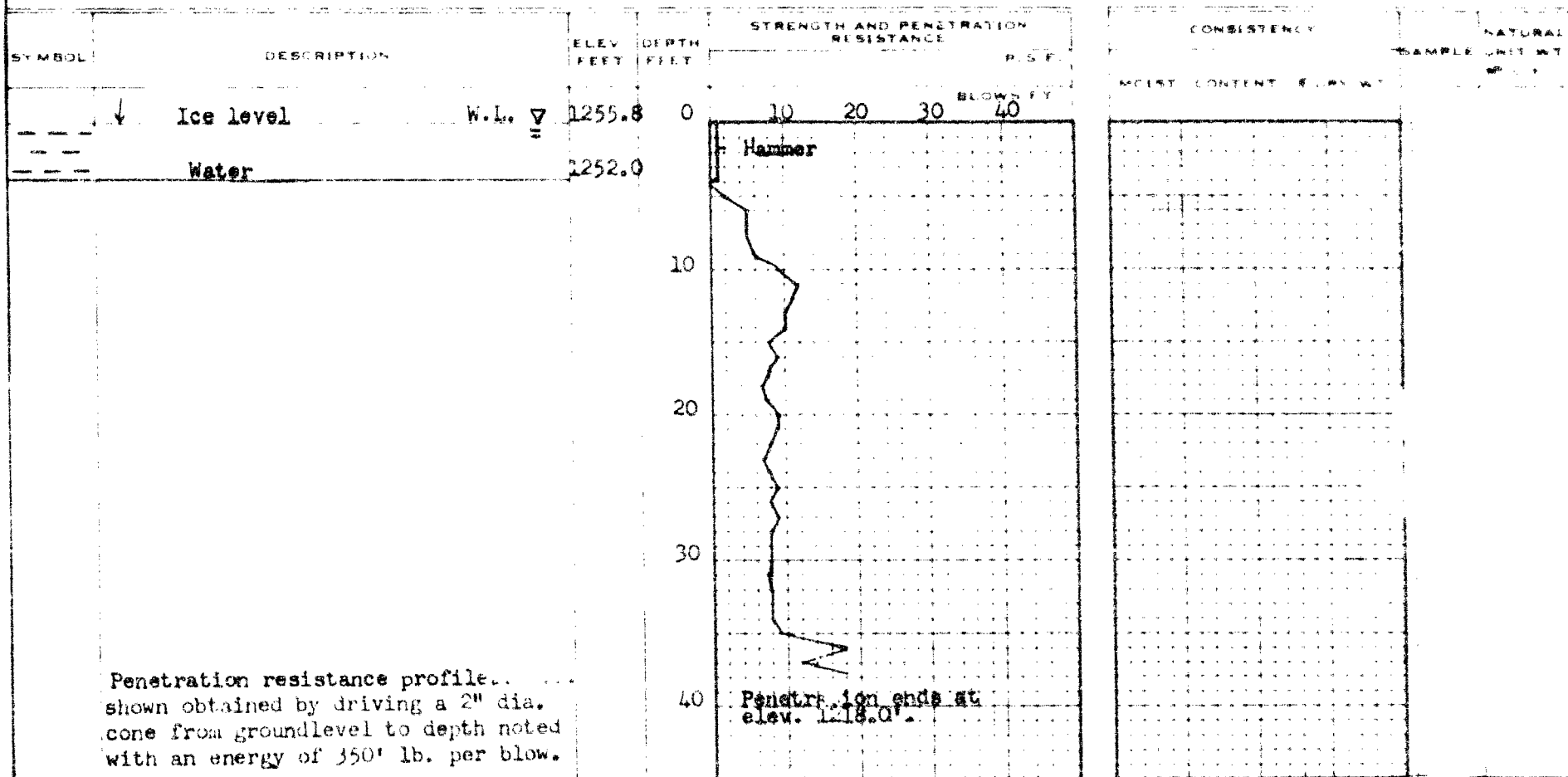
JOB 60-F-17 STATION 243+35. (25' LL.)

DATUM 1255.8' COMPILED BY B.K.

BORING DATE Mar. 16/60 CHECKED BY A.L.

 2" DIA. SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

## LEGEND

 1/2 UNCONFINED COMPRESSION (QU)  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND  
 LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT


## OFFICE REPORT ON SOIL EXPLORATION

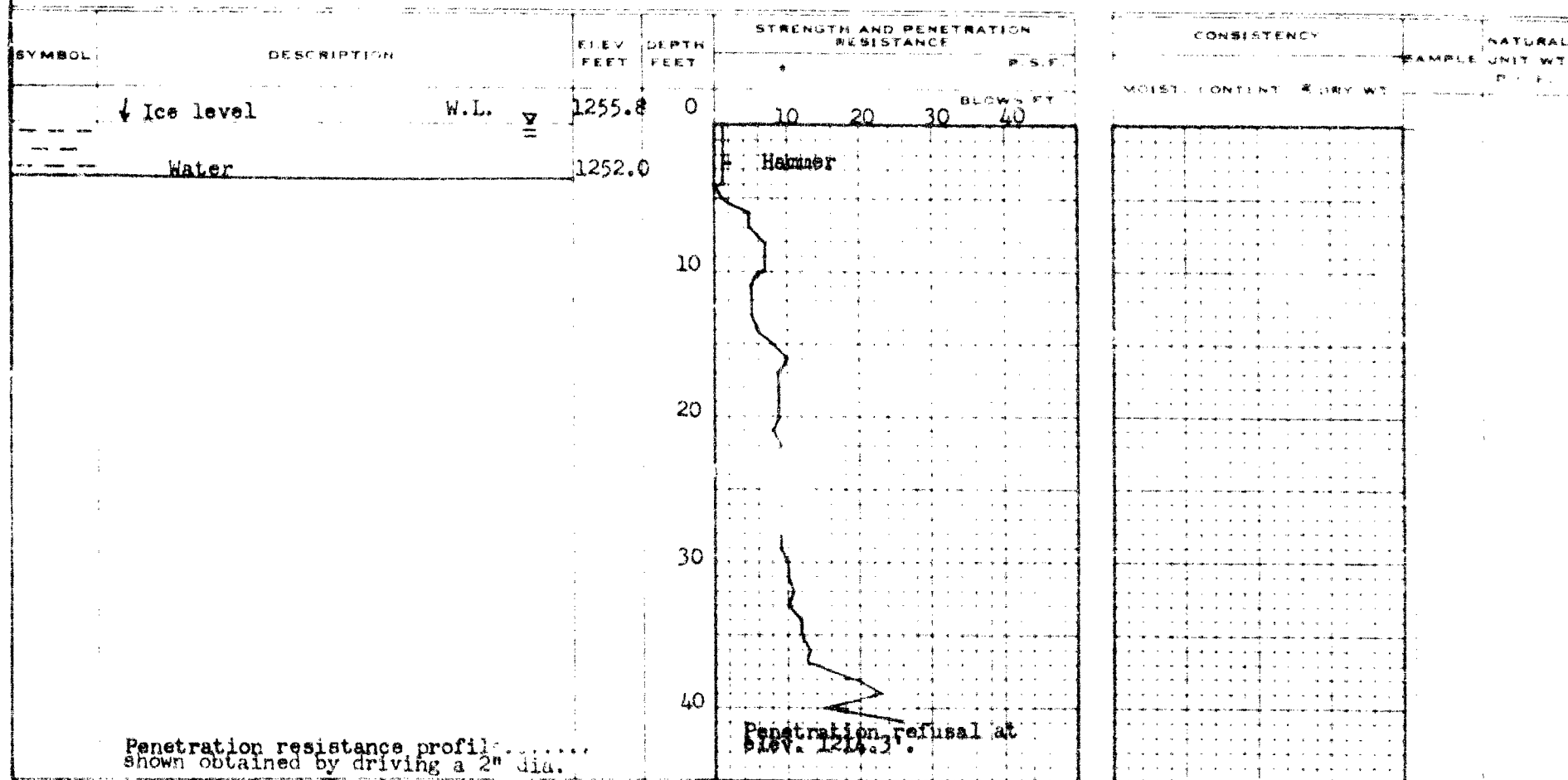
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-60 BORE HOLE NO. 30  
 JOB 60-P-17 STATION 243+35 (25' Rt.)  
 DATUM 1255.8' COMPILED BY B.K.  
 BORING DATE Mar. 16/60 CHECKED BY A.L.

2" DIA SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA CONE  
 2" SHELBY  
 CASING

## LEGEND

1/2 UNCONFINED COMPRESSION ( $Q_u$ )  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT



## SHEAR STRENGTH IN P.S.F.

