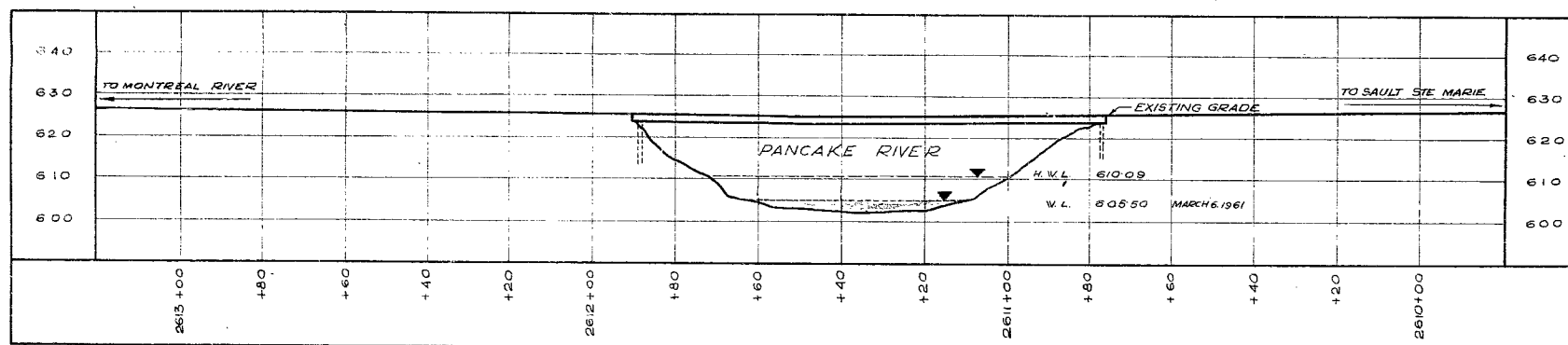
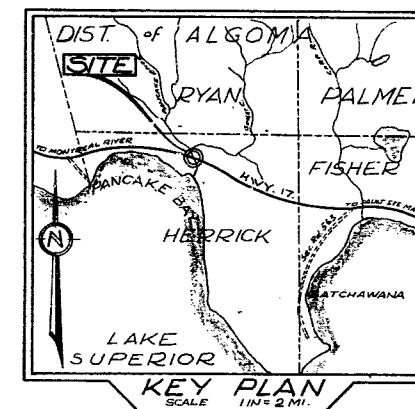
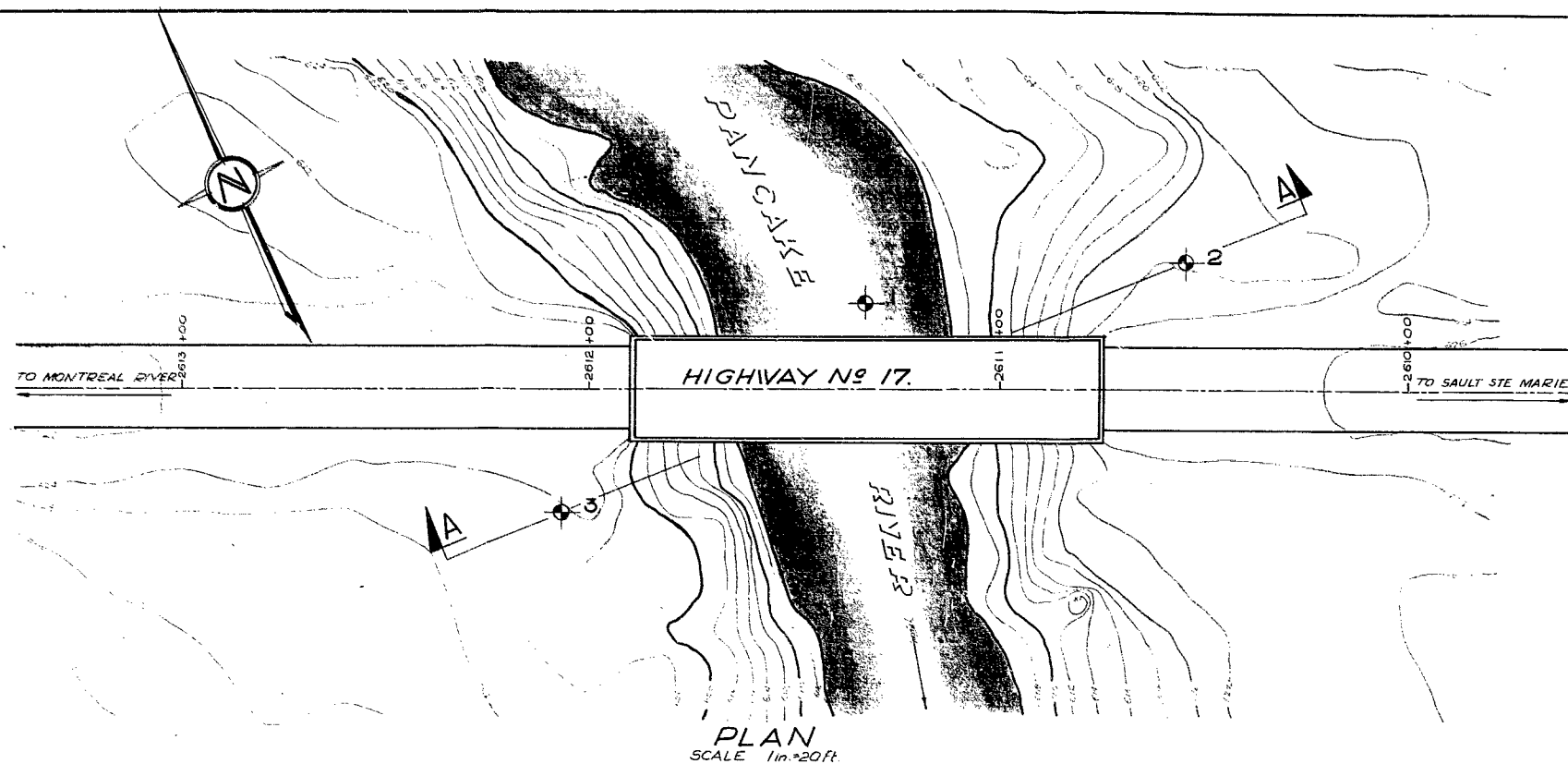
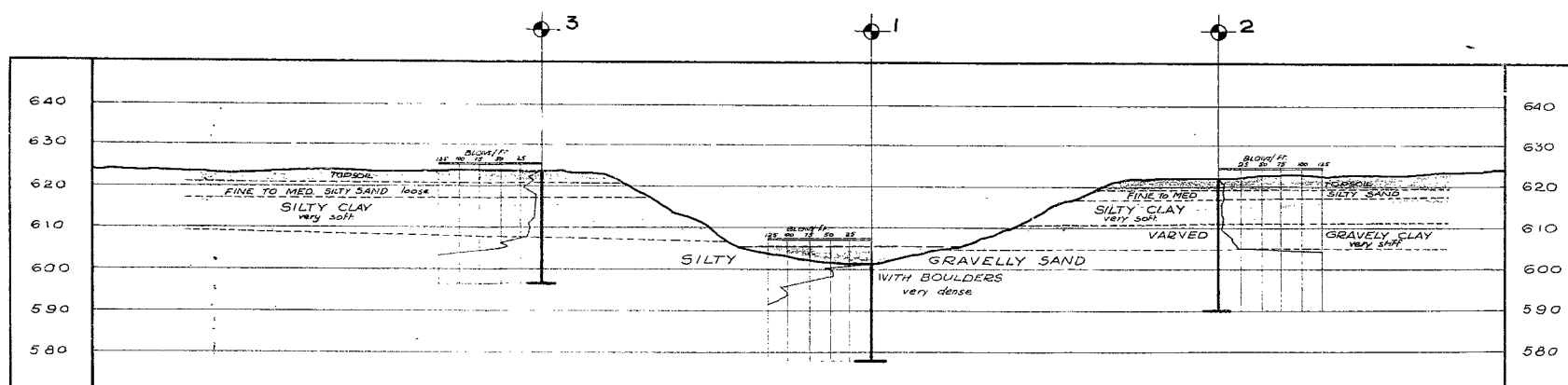


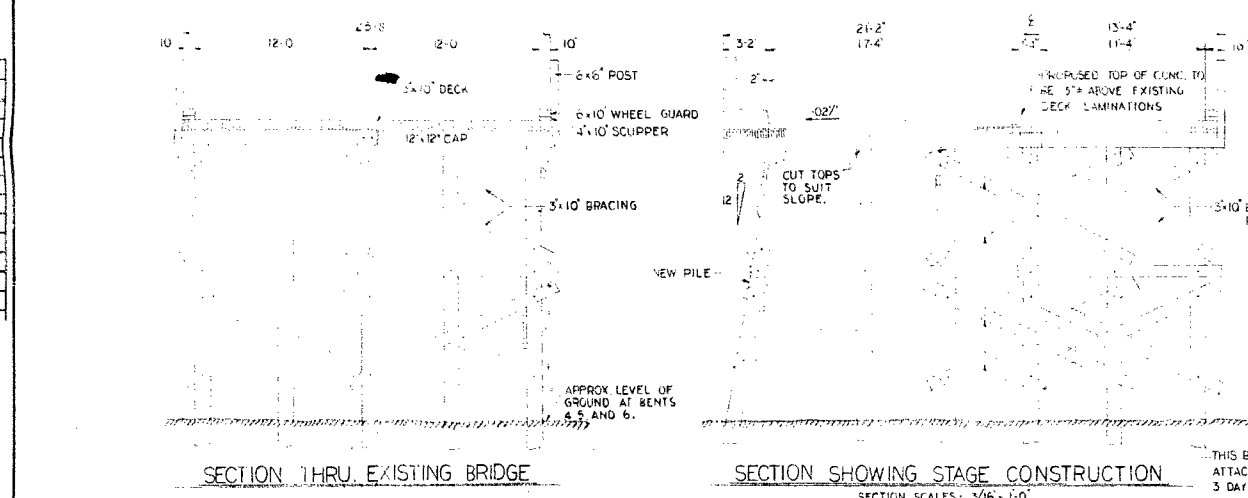
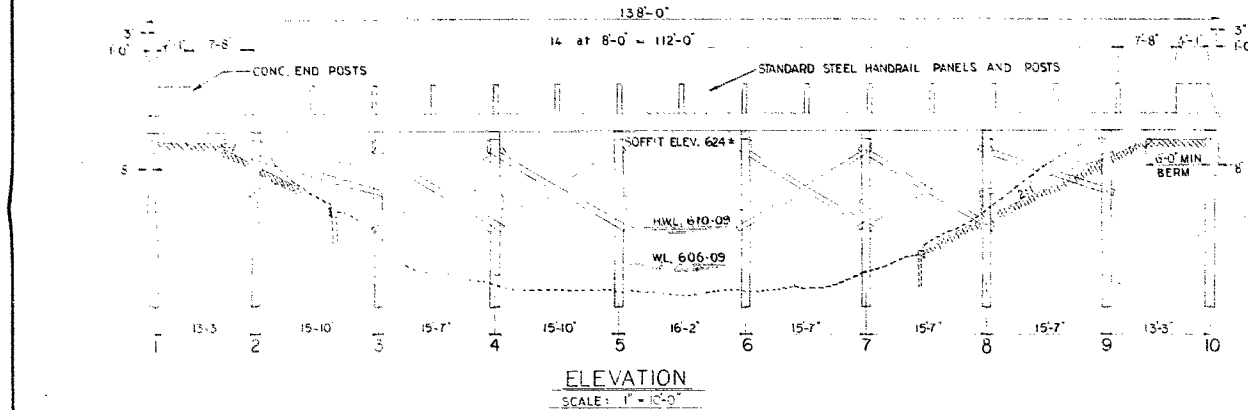
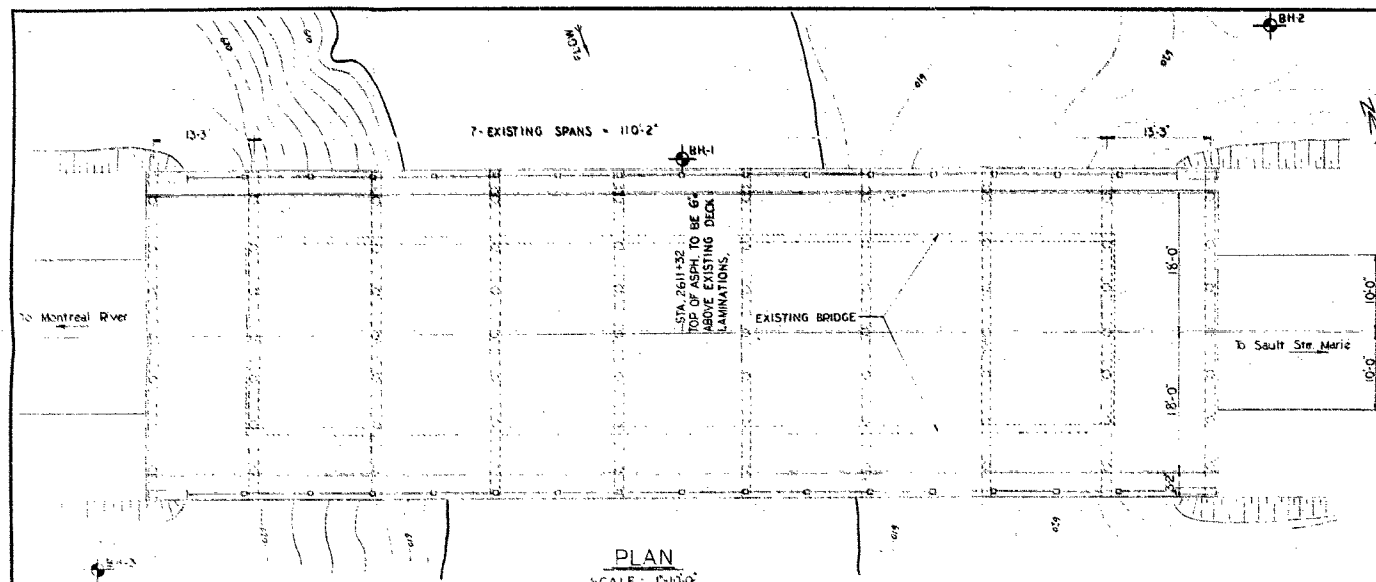
#61-F-13
W.P. #924-61
Hwy. #17
CROSSING
PANCAKE RIVER
56 MILES N.W. OF
SAULT STE.
MARIE



LEGEND			
BORE A-A PENETRATION HOLE			
HOLE	ELEVATION	STATION	DIST FROM E.
1	601.0	2611+35	21' RT.
2	621.75	2610+55	31' RT.
3	623.8	2612+08	30' LT.

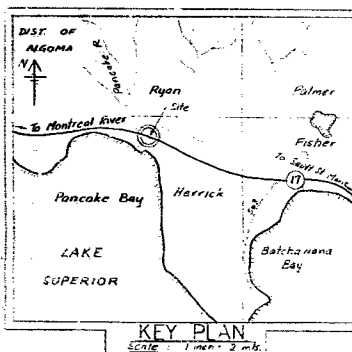
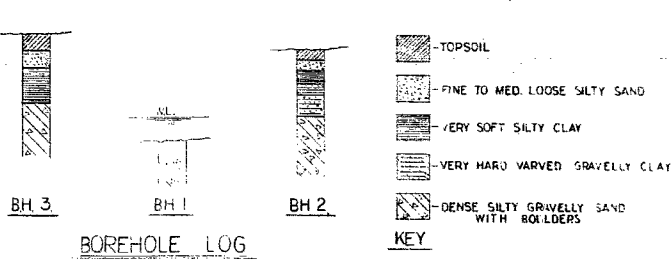
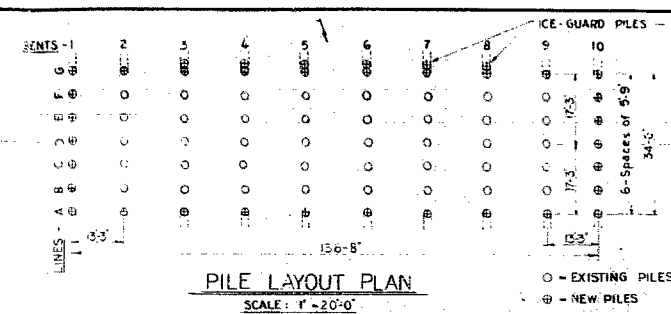
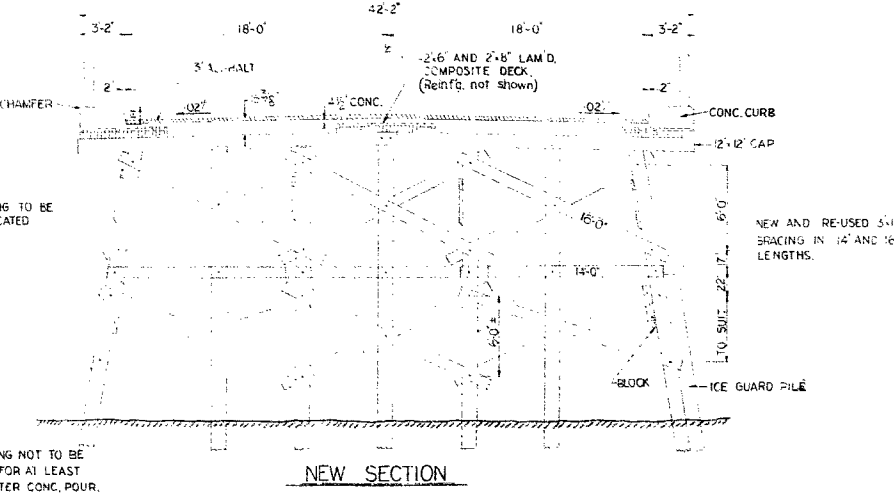


DEPARTMENT OF HIGHWAYS - ONTARIO		
MATERIALS & RESEARCH SECTION		
PANCAKE RIVER AND HIGHWAY NO. 17		
ORIGINATED BY KULMATICAS	DISTRICT NO. 18	DATE 10 APR 1961
DRAWN BY [Signature]	W.P. NO. 924-61	JOB NO. 61-F-13
CHECKED BY [Signature]	SCALE 1 in. = 20 feet	DRAWING NO.
APPROVED BY [Signature]		61-F-13A



NOTES - STAGE CONSTRUCTION

1. DRIVE NEW OUTSIDE PILES - BENTS 2 TO 9.
2. DRIVE NEW ABUTMENT PILES - DOWNSTREAM SIDE ONLY.
3. REMOVE DOWNSTREAM HALF OF EXISTING SUPERSTRUCTURE, INCLUDING PILE CAP, AND PROVIDE TEMP'Y BARRIERS.
4. CONSTRUCT DOWNSTREAM HALF OF NEW SUPERSTRUCTURE, PLACE NEW BRACING, POUR CONC. DECK AND CURB.
NOTE: AT THIS STAGE, TRAVELLED PART OF STRUCTURE IS NOT TO BE CONNECTED BY BRACING TO NEW PORTION FOR AT LEAST 3 DAYS AFTER DECK CONC. HAS BEEN POURED.
5. DRIVE REMAINDER OF ABUTMENT PILES.
6. REMOVE UPSTREAM HALF OF EXISTING SUPERSTRUCTURE.
7. COMPLETE NEW BRACING.
8. CONSTRUCT UPSTREAM HALF OF NEW SUPERSTRUCTURE.



REVISIONS			
NO.	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO			
BRIDGE DIVISION			
PANCAKE RIVER BRIDGE			
KING'S HIGHWAY No. 17 TCH		DIST. No. 15	
CO. DIST. OF ALGOMA			
TWP. HERRICK and RYAN		40P SEC. 3 OF 40N SEC. G	
PRELIMINARY			
APPROVED	BRIDGE ENGINEER	SITE No.	W.R. No. 924-61
DESIGN	ADP'D	CHECK	J.W.R.
DRAWING	H.S.B.	CHECK	J.W.R.
DATE	FEB '62	LOADING	H20-S16
DRAWING No.			D-5018-P

23-63-45

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Section,
(Foundations Office)

April 6, 1961.

D.H.O. FOUNDATION INVESTIGATION
REPORT -
W.J. 61-F-13 --(W.F. 924-61.)

Attention: Mr. M. McCumbie.

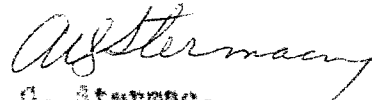
For: Panceake River and the King's Hwy. No. 17 Crossing
(Approx. 56 miles North-West of Sault Ste. Marie)
Twp. of Herrick and Ryan, District of Algoma.
District No. 18.

Attached hereto, we are forwarding to you the
Soil Investigation Report for the above mentioned location.

We believe the contents of this report will
provide you with the factual data and recommendations nec-
essary for your future design work.

Should you require further assistance with respect
to this project, please do not hesitate to call on our Office.

L. G. Soderman,
PRINCIPAL FOUNDATION ENGR.
Per:



(A. G. Sternac,
SUPERVISING FOUNDATION ENGR.)

AGS/10aeV
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
G. E. Hunter
D. P. Collins
E. R. Saint
A. Watt

Foundations Office
Gen. Files. ✓

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 3. FIELD AND LABORATORY WORK.
 4. SUBSOIL CONDITIONS.
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 - 4.2) Loose Silty Sand.
 - 4.3) Very Soft Clay.
 - 4.4) Very Dense Gravelly Silty Sand
with Boulders.
 5. GROUND WATER CONDITIONS.
 6. EXISTING STRUCTURE.
 7. DISCUSSION AND RECOMMENDATIONS.
 8. SUMMARY.
 9. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION

For

Pancake River and the King's Hwy. No. 17 Crossing
(Approx. 56 miles North-West of Sault Ste. Marie)
Twp. of Herrick and Ryan, District of Algoma,
District No. 18.

W.J. 61-F-13

--

W.P. 924-61

1. INTRODUCTION:

It is intended to replace or just widen and repair the existing wooden bridge which carries the King's Highway No. 17 over the Pancake River. The site of the bridge is located approx. 56 miles North-West of the Town of Sault Ste. Marie between the Townships of Herrick and Ryan, District of Algoma. At this location the chainage of the King's Highway No. 17 is 2611 + 35.

In order to determine the soil properties and decide on the type of foundation, an investigation was carried out by this Section. Results and discussion of the field and laboratory investigations, as well as conclusions and recommendations for the future design work, are contained in the following paragraphs of this report.

2. DESCRIPTION OF SITE AND GEOLOGY:

The area in which the structure is located, is flat. As can be seen from the enclosed Plan (Key Plan), it is located on the shore of Lake Superior.

The river bed is located in a depression approx. 20 feet deep.

cont'd. /2 ...

3. FIELD AND LABORATORY WORK:

In order to obtain sufficient information on the types and properties of the subsoil, three sampled boreholes, supplemented by the same number of dynamic cone penetration holes, were carried out at this particular site.

Samples were taken at depth intervals of 5 feet. Samples recovered in the split spoon were used for determining the liquid and plastic limits, moisture contents, and grain-size curves.

Boreholes No. 1, 2 & 3 were terminated in the underlying very dense, gravelly, silty sand with boulders stratum at a depth of 22.5 ft., 31.5 ft., and 26.5 ft., respectively, below the existing ground level.

The elevations as well as the locations (chainages) of the boreholes, are given on Drawing No. 61-F-13A, attached to this report (Appendix I).

Under Appendix I, Borehole Logs with penetration results, are also given.

Laboratory testing was confined to the determination of liquid limits, plastic limits, moisture contents, and grain-size distribution curves.

The plasticity chart and the grain-size distribution curves are given under Appendix I.

4. SUBSOIL CONDITIONS:

4.1) General:

The stratigraphy of the soil at the site was found to be quite uniform. Apart from the topsoil cover and a 4 ft. thick

cont'd. /3 ...

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

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

layer of stiff, gravelly varved clay in B.H. #2. Three main types of soil were encountered and they are:

4.2) Loose Silty Sand:

This material forms the top layer on the site and extends to about 4 - 6 feet below ground level. This material has no structural value and will not be discussed any further.

4.3) Very Soft Clay:

Underlying the loose silty sand is a layer approx. 8 - 10 ft. thick, of very soft, reddish clay. This layer is of med. to high plasticity.

The liquid limit for this material varies from 34.8 to 65.8, and the plastic limit from 15.9 to 19.1.

The moisture content varies with the plasticity of the layer, being higher in more plastic portions. The liquidity index is around one.

4.4) Very Dense Gravelly Silty Sand with Boulders:

This material was encountered below the very soft clay. The average 'N' value for this material is more than 120 blows/foot.

The sand percentage in this layer is around 45%, gravel forms around 18%, and the rest, 37%, is silt and clay.

The average value of moisture content in this layer is about 9.0%.

A relatively thin layer (approx. 4 ft.) of stiff varved clay with some gravel, was encountered between the soft clay and the very dense gravelly sand. Cone penetration resistance increased

cont'd. /4 ...

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

4.4) Very Dense Gravelly Silty Sand with Boulders: (cont'd.) ... quite rapidly in this layer indicating a stiff and dense condition. This layer was encountered in B.H. #2, only.

5. GROUND WATER CONDITIONS:

No ground water was encountered during the investigation.

6. EXISTING STRUCTURE:

The existing wooden bridge that carries the King's Hwy. No. 17 over the Pancake River, is erected on 40 wooden piles 10 to 12 inches in butt diameter. The piles are arranged in 8 rows at 5 piles to a row. The existing bridge is in a relatively bad shape. From the information gathered at the site, it seems that the piles are 30 feet long, but that only 6 feet are in the ground (tip elevation 595.0). The horizontal and vertical bracing is inadequate and therefore, the heavy traffic over the bridge causes considerable vibrations which, in turn, lead to the destruction of the asphalt deck.

Considerable scour action and damage has been observed on the river banks. At the site of the bridge, timber cribs are the present scour protection structures.

The Pancake River carries a large amount of driftwood.

7. DISCUSSION AND RECOMMENDATIONS:

As described in detail in the earlier paragraph, the stratification of the soil is basically uniform. Below the 2 - 3 ft. thick topsoil cover there is a 4 - 6 ft. layer of loose silty sand underlain by a 8 - 10 ft. thick layer of very soft clay which is,

cont'd. /5 ...

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

in turn, underlain by a stratum of very dense gravelly well-graded silty sand with boulders. On the eastern bank (B.H. #2) there is a layer, approx. 4 ft. thick, of stiff varved gravelly clay between the very soft clay and the very dense gravelly and silty sand. The first two layers are of such properties that spread footings have to be discarded. However, if for some reason, the spread footing design is desirable, it can be achieved, but the bottom footing elevation would have to be at elev. 608.0 for the West abutment, and at elev. 606.0 for the East abutment. Since this would require relatively deep excavations, it is recommended that the structure be founded on piles driven down into the dense gravelly sand stratum. It should be attempted to drive the piles some 5 - 6 feet into this stratum. Because of the presence of boulders, some piles would probably have to be stopped earlier, but this would have no detrimental effect on the bearing capacity of the piles because the boulders, themselves, are in the very dense stratum. Timber piles, Class 'B', 12" butt and 8" tip, with a safe load of 20 T/pile, are recommended.

Because of the great amount of driftwood carried by the river, a one-span structure is recommended. If the span would be too long, a two-span structure with a pier in the middle of the river is the second best solution. The soil in the middle of the river is very dense from the surface (elev. 601.0) and definitely capable of supporting spread footings with 3.0 T/sq.ft. safe bearing pressure. At this location, the depth of the footings would be governed by scour protection requirements. However, because of the presence of

cont'd. /6 ...

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

of boulders, it is doubtful whether a sheet pile protection wall could effectively be driven into the ground to the desired depth. We do not have enough hydraulic and hydrological information at our disposal to recommend scour protection measures and would advise that the Hydrology Section be contacted.

In case that only the existing bridge will be repaired and enlarged, it is recommended that the additional piles be driven into the underlying dense gravelly sand stratum as recommended for the new structure, and that additional bracing be provided to stiffen the whole structure.

8. SUMMARY:

The soil stratification at the investigated site is, in general, uniform. The upper layers, as described in detail in the previous paragraphs, are incompetent to support spread footings. Therefore, timber, Class 'B' piles, driven 5 - 6 feet into the dense gravelly sand layer, are recommended. A safe bearing load of 20 tons per pile is suggested.

Because of the large amount of driftwood carried by the river, a single-span structure is recommended. In the report, alternative recommendations are given if the above proposal could not be carried out.

Scour damage was observed at the site and therefore, attention is drawn to the necessity of scour protection measures.

cont'd. /7 ...

9. MISCELLANEOUS:

The field work was carried out during the period of March 6 to March 10, 1961, by the Longyear skid-mounted core drills, adapted for soil sampling, under the supervision of Mr. W. Kulmatickas, Project Engineer, Foundation Sub-section.

April 1961.

REPORT PREPARED BY:

W. Kulmatickas
.....
W. Kulmatickas,
PROJECT FOUNDATION ENGINEER.

REPORT APPROVED BY:

A. G. Stermac
.....
A. G. Stermac,
SUPERVISING FOUNDATION ENGINEER.

APPENDIX I

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-13

W.P. 924-61

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	S1	5'-6.5'	Very dense gravelly sand with boulders.	158-9"	-	-	-	-	-	
	S2	10'-11.5'	Very dense silty gravelly sand with boulders.	81	8.3	-	-	-	-	
	S3	18'-19.5'	Very dense silty gravelly sand with boulders.	71	-	-	-	-	-	
2	S1	5'-6.5'	Very soft silty clay.	2	66.4	16.9	65.8	-	-	
	S2	10'-11.5'	Very stiff gravelly varved clay.	30	45.4	15.9	34.8	-	-	
	S3	15'-16.5'	Very dense gravelly silty sand - boulders.	87	7.6	-	-	-	-	
	S4	20'-21.5'	Very dense gravelly silty sand - boulders.	132	7.5	-	-	-	-	
	S5	25'-26.5'	Very dense gravelly silty sand - boulders.	76	10.3	-	-	-	-	
	S6	30'-31.5'	Very dense gravelly silty sand - boulders.	97	8.5	-	-	-	-	

JOB 61-F-13

W.P. 924-61

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
3	S1	5'-6.5'	Very soft silty clay.	3	64.8	19.1	64.2	-	-	
	S2	10'-11.5'	Very soft silty clay.	3	32.8	-	-	-	-	
	S3	15'-16.5'	Dense gravelly silty sand.	44	10.5	-	-	-	-	
	S4	20'-21.5'	Very dense gravelly silty sand - boulders.	56	10.1	-	-	-	-	
	S5	25'-26.5'	Very dense gravelly silty sand - boulders.	94	10.3	-	-	-	-	
			S denotes split spoon sample							

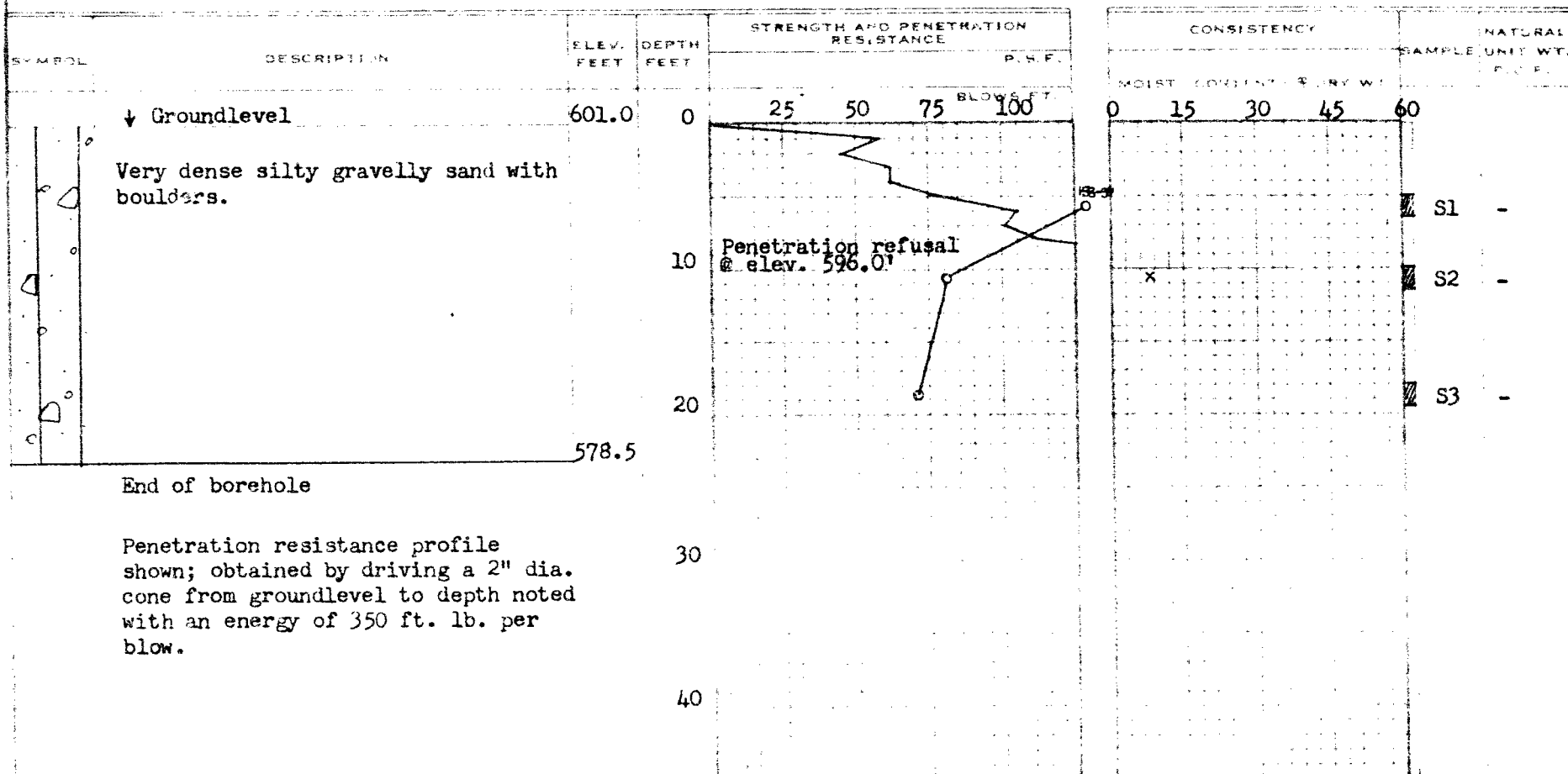
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 924-61 BORE HOLE NO. 1
JOB 61-F-13 STATION 2611/35 (21' Rt.)
DATUM 601.0 COMPILED BY B.K.
BORING DATE Mar. 6/61 CHECKED BY W.W.K.

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. 924-61

BORE HOLE NO. 2

JOB 61-F-13

STATION 2610+55 (31' R.L.)

DATUM 621.75

EMPLOYED BY B.K.

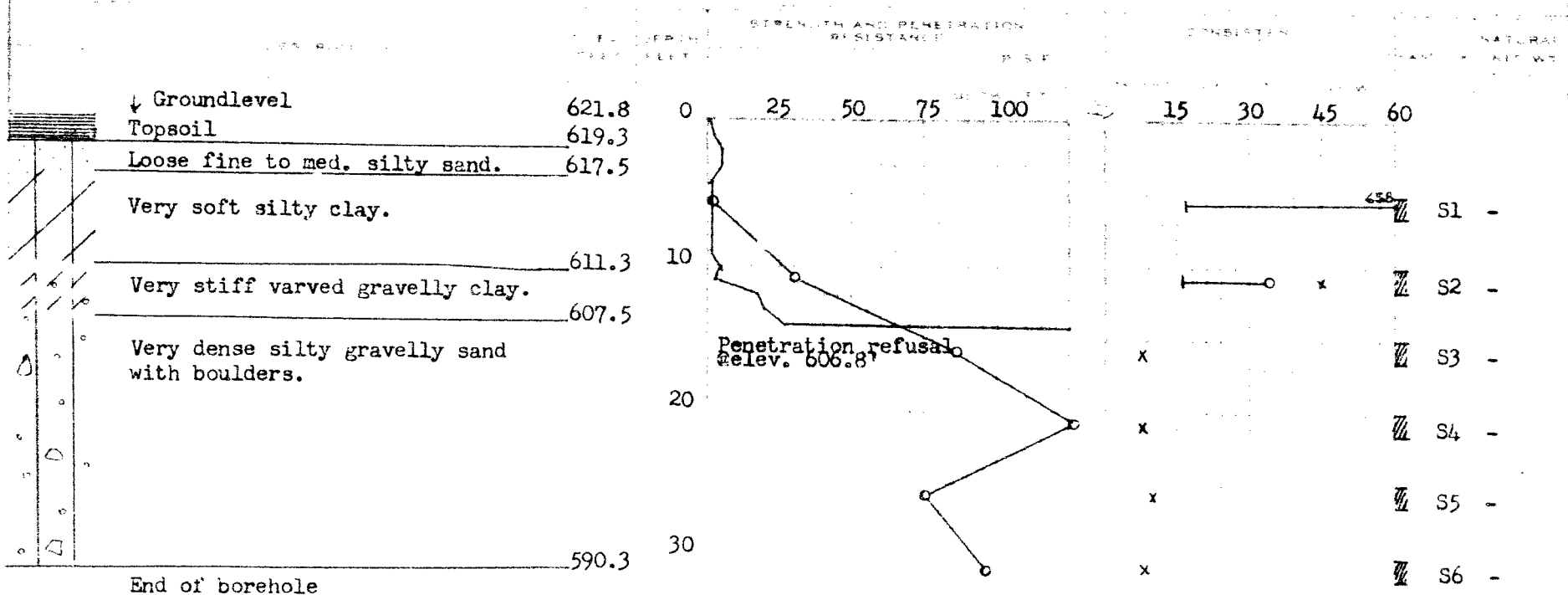
BORING DATE Mar. 7/61

CHECKED BY W.W.K.

2" DIA. SPLIT TUBE
2" ENERGY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELTER
CASING

LEGEND

2" CONFINED COMPRESSION (QU)
VANE TEST (C) AND PENETRATION
NATURAL MOISTURE AND
LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT



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

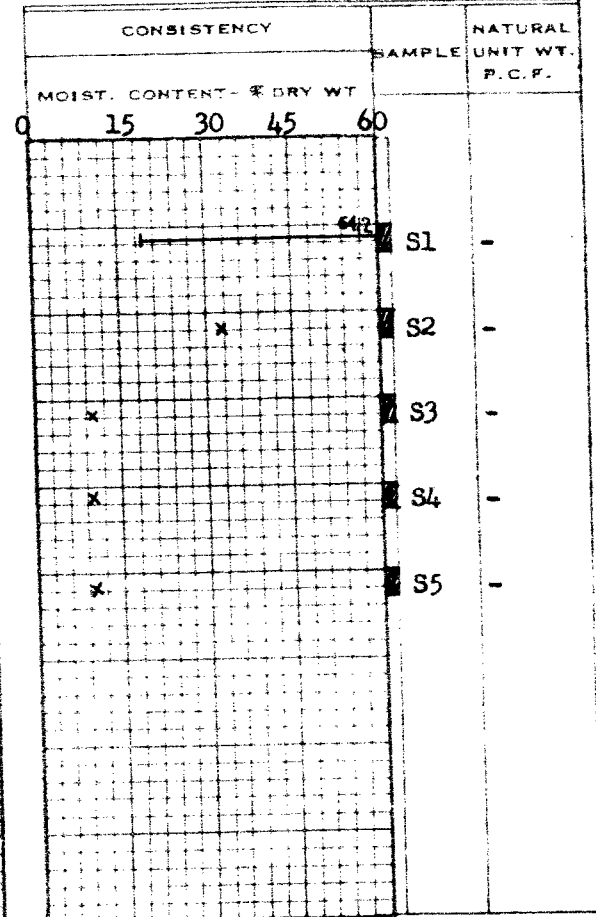
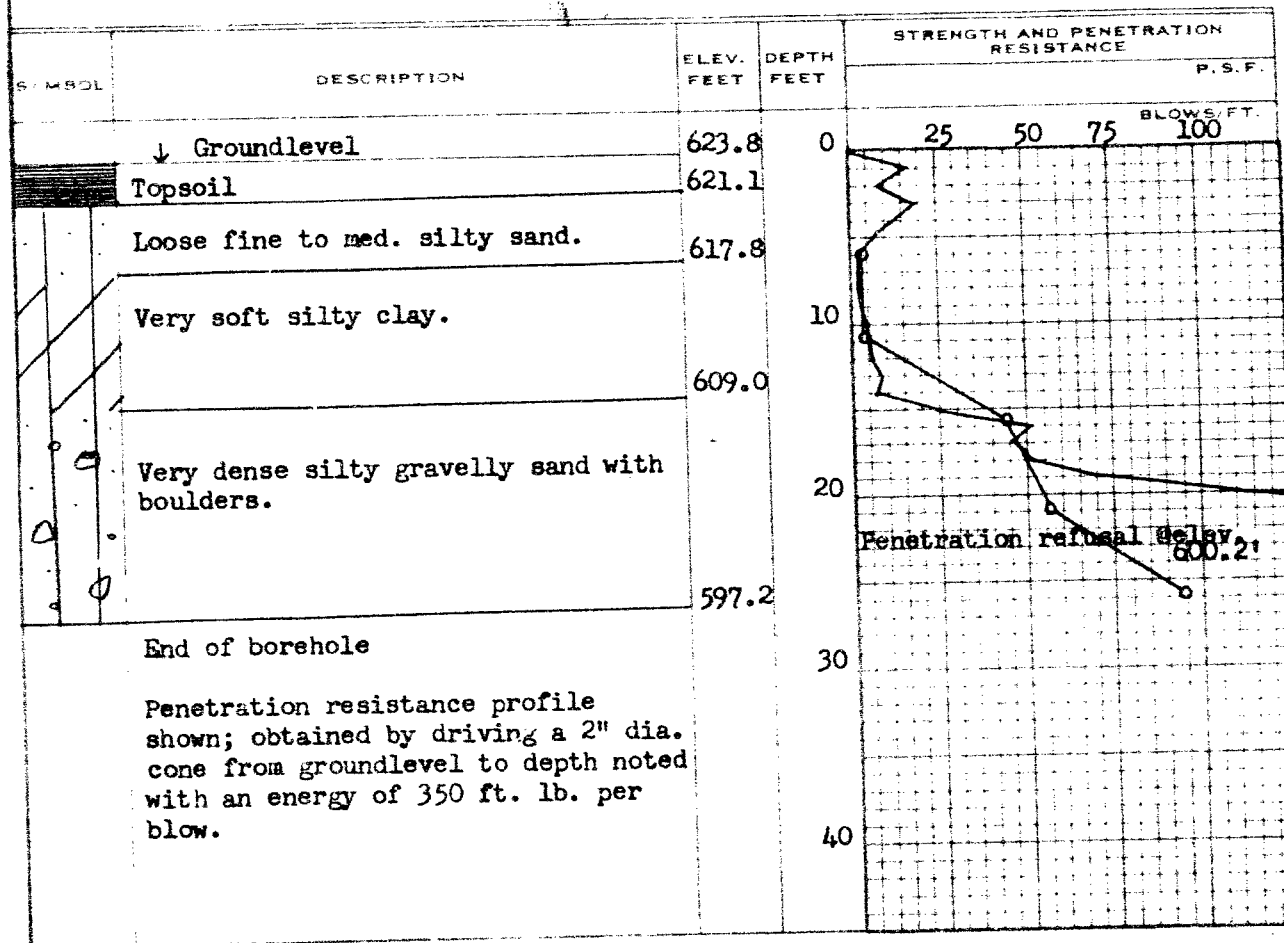
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 924-61 BORE HOLE NO. 3
 JOB 61-F-13 STATION 2612+08 (30' Lt.)
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 BORING DATE Mar. 8/61 CHECKED BY W.W.K.

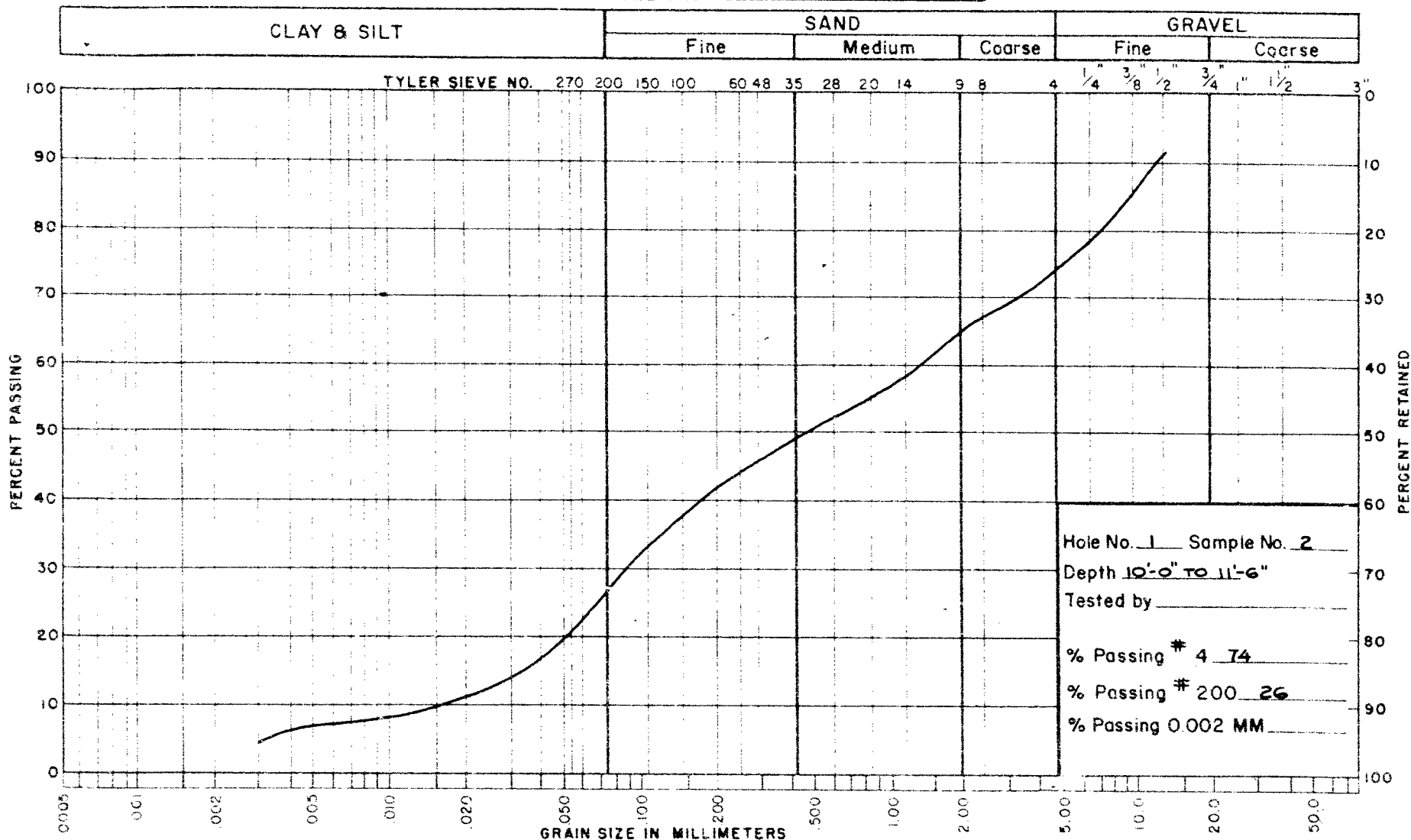
2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 2" SHELBY
 CASING

LEGEND

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



UNIFIED SOIL CLASSIFICATION SYSTEM



NOTES _____

DEPARTMENT OF HIGHWAYS - ONTARIO
 MATERIALS & RESEARCH SECTION
GRAIN SIZE DISTRIBUTION

Job No. G-F-13 W.P. No. 924-61
 Location PANCAKE RIVER

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT

SAND

GRAVEL

Fine

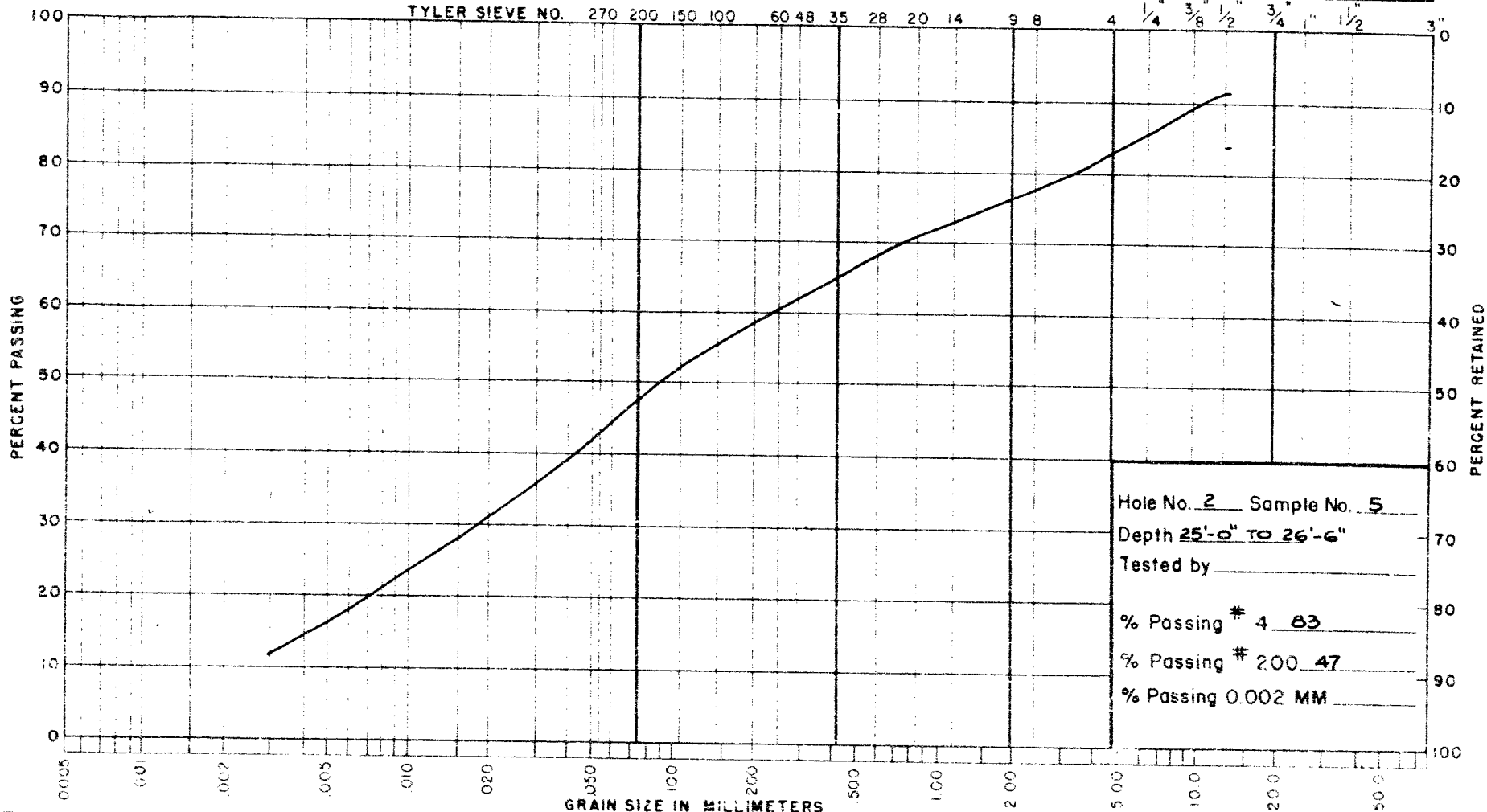
Medium

Coarse

Fine

Coarse

TYLER SIEVE NO. 270 200 150 100 60 48 35 28 20 14 9 8 4 1/4 3/8 1/2 3/4 1 1 1/2 3"



Hole No. 2 Sample No. 5

Depth 25'-0" TO 26'-6"

Tested by _____

% Passing # 4 83

% Passing # 200 47

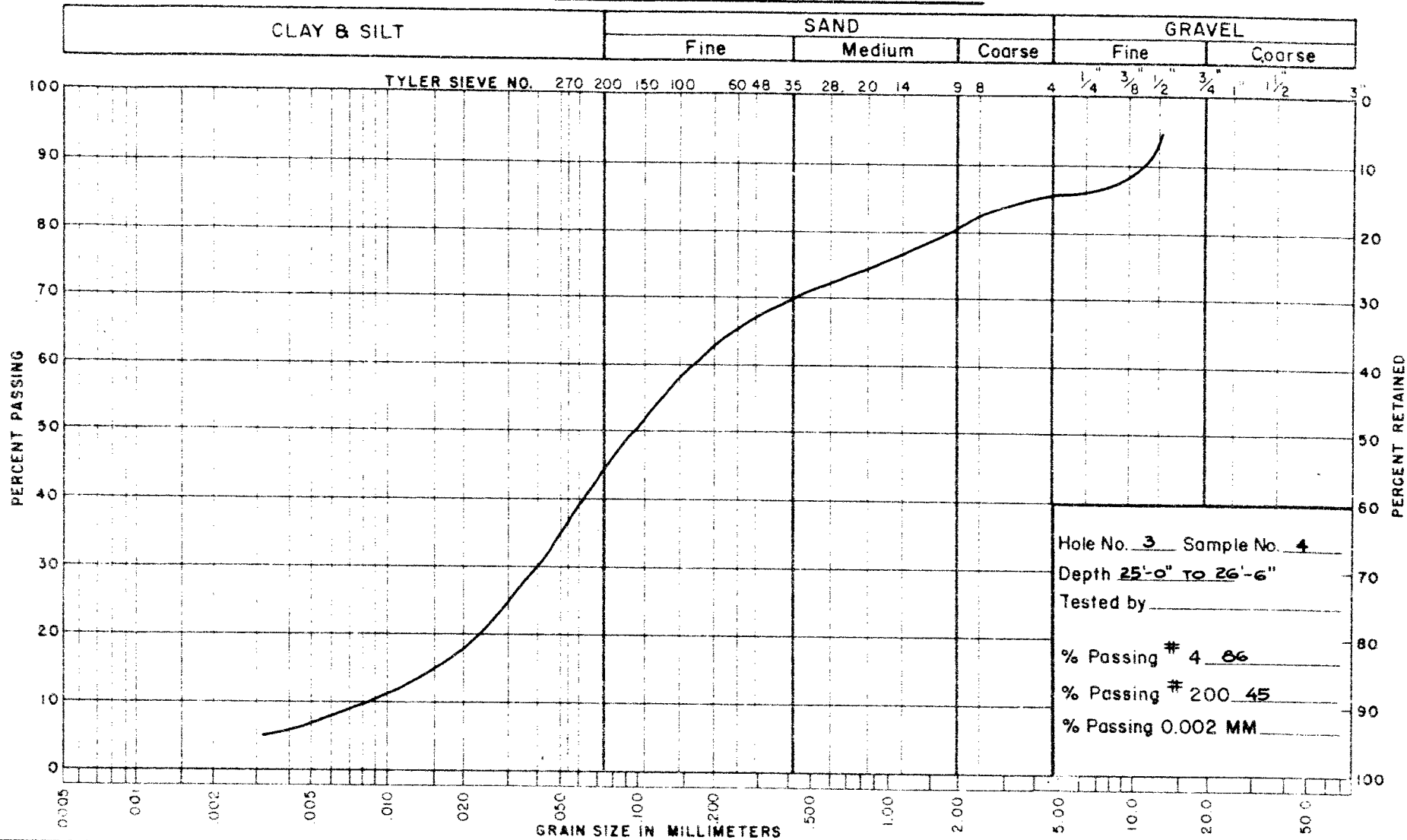
% Passing 0.002 MM _____

NOTES _____

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION
GRAIN SIZE DISTRIBUTION

Job No. 61-F-13 W.P. No. 924-G1
Location PANCAKE RIVER

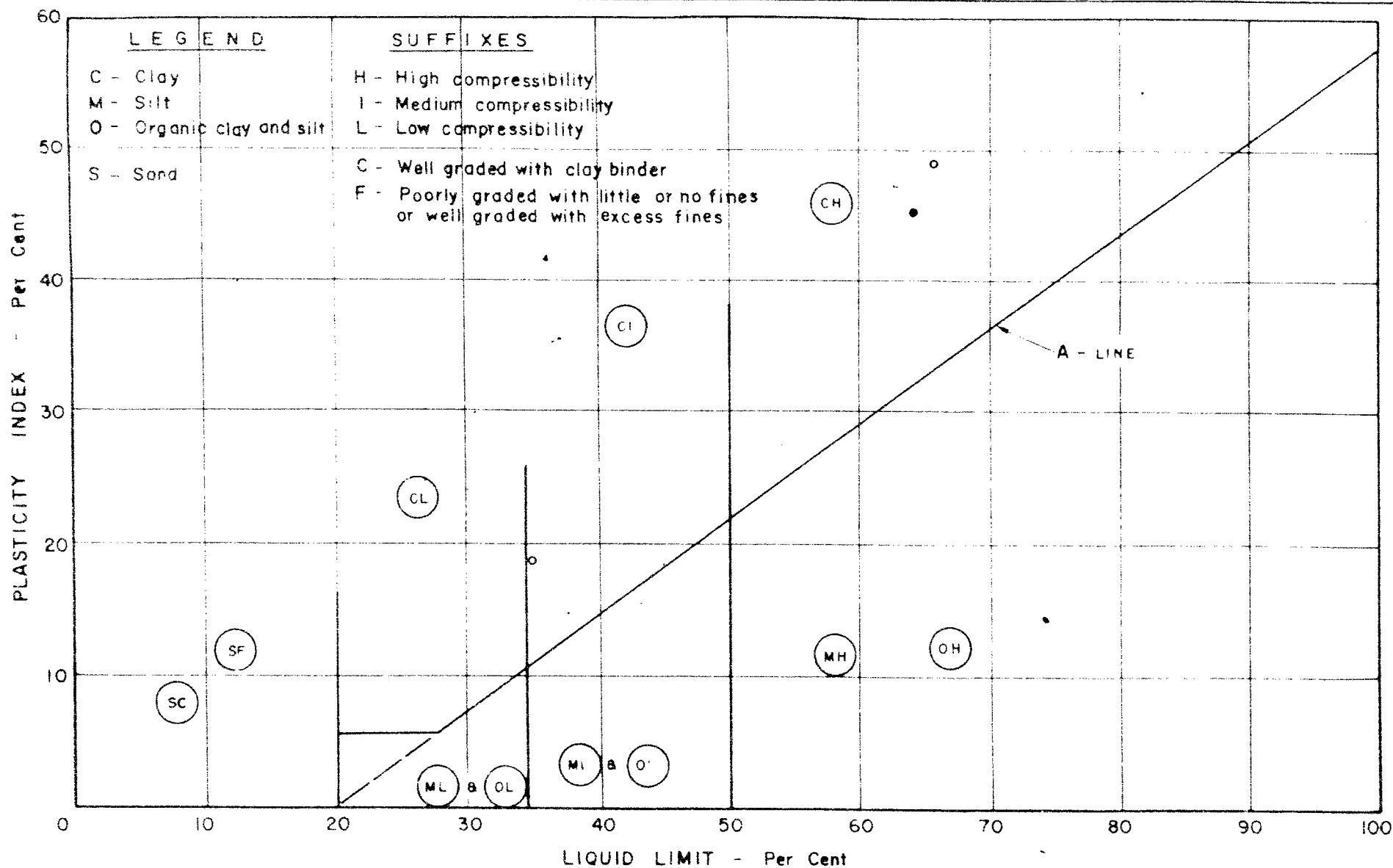
UNIFIED SOIL CLASSIFICATION SYSTEM



NOTES

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION
GRAIN SIZE DISTRIBUTION

Job No. 61-F-13 W.P. No. 924-61
Location PANGAKE RIVER



NOTES

- - BOREHOLE #2
- - BOREHOLE #3

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION
PLASTICITY CHART

Job No. 61-F-13 W.P. No. 924-61

Location PANCAKE RIVER



ONTARIO
DEPARTMENT OF HIGHWAYS

Ken

Bridge Division,

Memo to Mr. A.G. Stermac Date February 9, 1962,
Principal Foundation Engineer
Room 107, Lab. Bldg., Downsview Subject W.P. 924-61 Hwy #17 T.C.H.
From J. C. McAllister, Pancake River Bridge Dist. #18

ATTN: Mr. K. Selby

Attached please find one print of plan D 5018
- P for the above structure.

It is the opinion of the Bridge Office that
the existing structure is in good condition and it has been
decided to widen and lengthen the structure as shown.

J. C. McAllister

J. C. McAllister,
for S. McCombie,
Bridge Planning Engineer.

JCMcA/z

Ken:

*The Bridge Office states its opinion and
I am all right with it. Since they don't
care for our, we don't give it.
I think there is no problem anyway.*

Feb. 12, 1962,

as

File