

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 31E - 82

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

HWY. No. 11

LOCATION RAILWAY O'PASS AT
MAGNETAWAN Riv.

PROP. BLIRK'S FALLS By-Pass

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. NONE

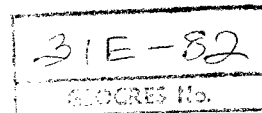
REMARKS: _____

31E-175 ?

BA 785

TROW, SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS
AND
SOIL MECHANICS CONSULTATION



W. A. TROW, M.A.S.C., M.E.I.C., P.ENG.
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DOWNSVIEW, ONT.
ST. 8-5921

Project: C108/J235

Sept. 2, 1958.

Mr. A. M. Toye,
Bridge Engineer,
Dept. of Highways of Ontario,
280 Davenport Road,
Toronto, Ont.

Attention: Mr. S. McCombie,
Bridge Planning Engineer.

Foundation Investigation
Railway Overpass at Magnetawan River Crossing
Proposed Burk's Falls By-Pass, Highway No.11.

Dear Sirs:

Enclosed herewith is our report on subsoil conditions existing at the above two structure locations. Field work, consisting of six borings at the river crossing and four borings at the overpass site, was carried out during the period July 7th to July 25th, 1958.

Details of subsoil types encountered at each structure location are contained in the body of the report. The field work was supervised by our Mr. D. Shields, P.Eng., who also prepared the attached detailed report.

For your convenience, the principal comments pertaining to soil types and foundation considerations are summarized as follows:

(1) Borings carried out at the proposed overpass site and river crossing locations have shown the subsoil to consist of sand and sandy gravel overlying igneous bedrock. Because of the granular nature of the subsoil, no embankment stability problems need be anticipated for typical embankment fill sections.

(2) Simple spread footings founded at a minimum depth of 4 feet below existing ground surface are recommended for the overpass structure. A permissible bearing pressure of $2\frac{1}{2}$ tons can be used at the recommended depth of 4 feet. No ground water will be encountered within this excavation depth.

(3) The north abutment of the proposed river crossing structure can be founded directly on bedrock at a depth below existing ground surface averaging 6 feet. Bedrock dips downwards toward the east at an approximate slope of 1-vertical to 4-horizontal; this will necessitate keying the footings to the bedrock. A bearing pressure of at least 25 tons/sq.ft. can be applied to the bedrock formation.

The south abutment of the proposed structure must be founded on bearing piles. Large displacement piles driven to the dense boulder layer overlying bedrock are recommended.

The proposed center pier can be either supported directly on the dense layer overlying bedrock, or supported on large diameter caissons. A detailed analysis of potential sliding of this pier should be carried out prior to finalizing the design of the foundation members.

(4) Flow velocities and water levels in the river are controlled by the overflow from the adjacent dam. Stream erosion does not appear to be noticeable along the existing river banks.

We are pleased to have been of service to you on this occasion and if we can be of further assistance in clarification of factual data or comments contained herein please contact us.

Yours very truly,

A handwritten signature in cursive script, reading "L. G. Soderman". The signature is written in dark ink and is positioned below the typed name.

LGS/lt
Encl.

Lawrence G. Soderman (P. Eng.)

DEPARTMENT OF HIGHWAYS OF ONTARIO
280 DAVENPORT ROAD,
TORONTO, ONTARIO.

FOUNDATION INVESTIGATIONS
RAILWAY OVERPASS MAGNETAWAN RIVER CROSSING
AND
PROPOSED BURK'S FALLS BY-PASS, HIGHWAY #11

C108/J235

Trow Soderman and Associates

Sept.2, 1958.

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FOUNDATION INVESTIGATION
FOR
TWO STRUCTURES ON THE PROPOSED HIGHWAY NO. 11 BYPASS
BURK'S FALLS, ONTARIO

This report covers the soil investigations carried out at the sites of the Canadian National Railways spur line overpass and the Magnetawan River crossing on the line of the proposed Burk's Falls Bypass by Provincial Highway No. 11. Also included are recommendations for the most suitable types of footing and allowable foundation loads for the proposed structures.

Description of Sites

(1) Overpass of the C.N.R. spur line: The area adjacent to the proposed crossing is relatively flat grassland, sloping gently down to the north. Approximately 80 feet to the south, the land is wooded and rises steeply. To the north the gentle slope continues to the river, a distance of some 500 feet, becoming wooded after 70 feet.

(2) Magnetawan River crossing: The river in this location is actually part of the reservoir area of a dam west of the present Highway No. 11. The water is slow moving and its level is fairly constant. To the south a relatively flat treed flood plane extends for a distance of 200 feet at an elevation approximately 3 feet higher than normal river level. To the north the treed bank is approximately 5 feet high, leading to a flat grass plateau some 50 feet wide. The ground then rapidly rises up a hillside.

Field Investigation

Field work consisted of four sampled borings at the railway overpass and six borings, (four sampled), at the river crossing. All borings were made using a standard diamond drill adapted to soil sampling. At the railroad crossing, boulders and very dense gravel conditions near the surface ruled out the use of conventional drive and wash piping procedure. The three inch pipe could not be driven. BX casing was drilled into the ground and samples obtained in the conventional manner. At the river crossing, it was found expedient to drill BX casing where bedrock was near ground surface. The casing could be drilled a short distance into the bedrock completely sealing off the upper sands. Elsewhere at this site, 3-inch pipe was driven and washed in the normal way.

Sampling was performed using a standard 2-inch outside diameter split spoon. The number of blows of a 140-lb. hammer dropping 30 inches required to drive the spoon from 6 inches to 18 inches penetration into the undisturbed soil ahead of the boring is recorded. This penetration resistance, or N value, of the soil is reported in the borehole logs. Sampling was usually carried out at 4 foot intervals in the holes that were sampled.

When bedrock was reached, a standard AX diamond core barrel was drilled in to the rock, resulting in continuous core of 1½-inch diameter.

Two-inch diameter cones were driven beside each boring. These cones were driven to refusal, the blows per foot of penetration are recorded in the logs.

Borehole records are presented as drawings Nos. 3 - 12; borehole locations are shown on drawings Nos. 1 and 2.

Soil Types Encountered

(1) Overpass Site

The subsoil type underlying the overpass area was found to be a fine to coarse grained granular material. The deposit extends from surface to a depth at least equal to 30 feet (i.e. elev. 936.0). In hole No. 4, which penetrated below this elevation, rock described as bedrock or large boulders was encountered.

The upper 4 feet of the sand and gravel deposit exists in a loose state. Immediately below this upper active zone, a layer of boulders and very dense sandy gravel was intersected. The thickness of this dense layer averaged 4 feet over the site. Below the layer, the sand and sandy gravel varied in density between dense and medium dense.

The heterogeneous nature of the sand and gravel encountered in the borings is indicative of a fluvial deposit. This origin is further substantiated by the site location being at the confluence of two rivers and in the slip off slope of one of the rivers.

Water table elevation was established at 5 feet below existing ground surface during the time of this investigation.

(2) River Crossing

The main soil type encountered was sand overlying a dipping bedrock surface. On the north side of the river, the sand stratum was of the order of 10 to 15 feet thick and varied from loose at the surface to very dense immediately above rock.

In the centre of the river which is approximately 14 feet deep, a 16 foot layer of sand and gravel with boulders at depth was encountered. This layer was very loose near the surface, becoming very dense at about mid-thickness. Bedrock underlies this sand stratum.

On the south bank of the river, two holes to 50 feet depth did not intersect bedrock, although a dense layer of boulders starting at 43 feet to 47 feet was encountered. A study of the trend of the rock surface encountered in other borings, (illustrated in Drawing No.2), indicates that bedrock lies not far below the depth of the borings. Sand varying from fine to medium in size with a small amount of gravel overlies the boulder stratum. This sand layer was loose to 12 feet, medium dense from 12 feet to 33 feet, then dense to the contact of the boulder layer.

Foundation Considerations

(1) Overpass Structure

Simple spread footings founded on the dense boulders, sand and gravel at 4 feet depth appears to be the most satisfactory means of abutment support at this location. Excavation will be in the dry and a bearing capacity of 5000 lbs./sq.ft., to limit settlement to one inch, can be used. If a higher bearing capacity is required, settlements will be proportional to load, but will not be excessive below a limit of 4 T/sq.ft. In any event, settlement will be immediate.

(2) Bridge Structure

Spread footings on rock appears to be the obvious choice for the north abutment of the proposed bridge. A timber crib or sheet piling enclosure to rock and underwater excavation would be most feasible. A bearing capacity of 25 T./sq.ft. is a reasonable value for this rock. The abutment should be either dowed or keyed into the sloping bedrock surface.

Spread footings or caissons founded on the dense sand-boulder stratum are two types of footings suitable for the centre pier if one is contemplated. The passive resistance of the sand on the sides of these massive units would counteract any tendency of the pier to slide along the rock surface. The small effective vertical area of piles would make them inadvisable as a foundation medium in the sand, or on top of bedrock. Piles drilled or driven into the rock would provide positive support. Bearing capacity of the dense stratum below elevation 935 feet is 4 T./sq.ft.

The south abutment will have to be carried on piles. Either 50 foot steel piles could be driven to refusal in the boulder stratum, or 35 foot wooden displacement piles driven to refusal in the dense sand, could be used. Steel piles would have a capacity dependent upon their size, probably of the order of 50 tons. The maximum allowable load per wooden pile would be of the order of 20 to 25 tons. The wooden piles could be capped below river level and would not have to be treated. The large depth of sand would provide adequate lateral support for the piled foundation.

Recommendations

(1) Simple spread footings founded at a minimum depth of 4 feet below existing ground elevation can be used to support the proposed overpass abutments. A safe allowable bearing pressure of $2\frac{1}{2}$ T/sq.ft. can be applied to the subsoil at the above recommended placement depth.

No ground water will be encountered in the shallow excavation for the footings placed at depths not greater than 5 feet.

(2) Support for the north abutment of the bridge over the Magnetawan river can best be obtained by founding directly upon the bedrock. This will necessitate sub-aqueous excavation which can be facilitated through the use of a sheet piling enclosure. Footings should be dowed or keyed into the sloping bedrock surface (approx. slope 1:4).

The south abutment can be supported on bearing piles. Timber piles, driven to design load "set" in the sand above bedrock (35 ft. below surface), or steel H piles, driven to refusal at the bedrock or boulder contact, could be used. Recent pull-out tests on H sections driven into boulder laden strata indicate severe distortion and bending of the pile sections. Because of the possibility of this effect at this site, large displacement timber or monotubes are recommended.

Support for the proposed centre pier can either be obtained through using short piling or founding the pier footing directly on the dense sandy gravel layer at elev. 935.0 feet. A bearing pressure of 4 T/sq.ft. can be used at this elevation.

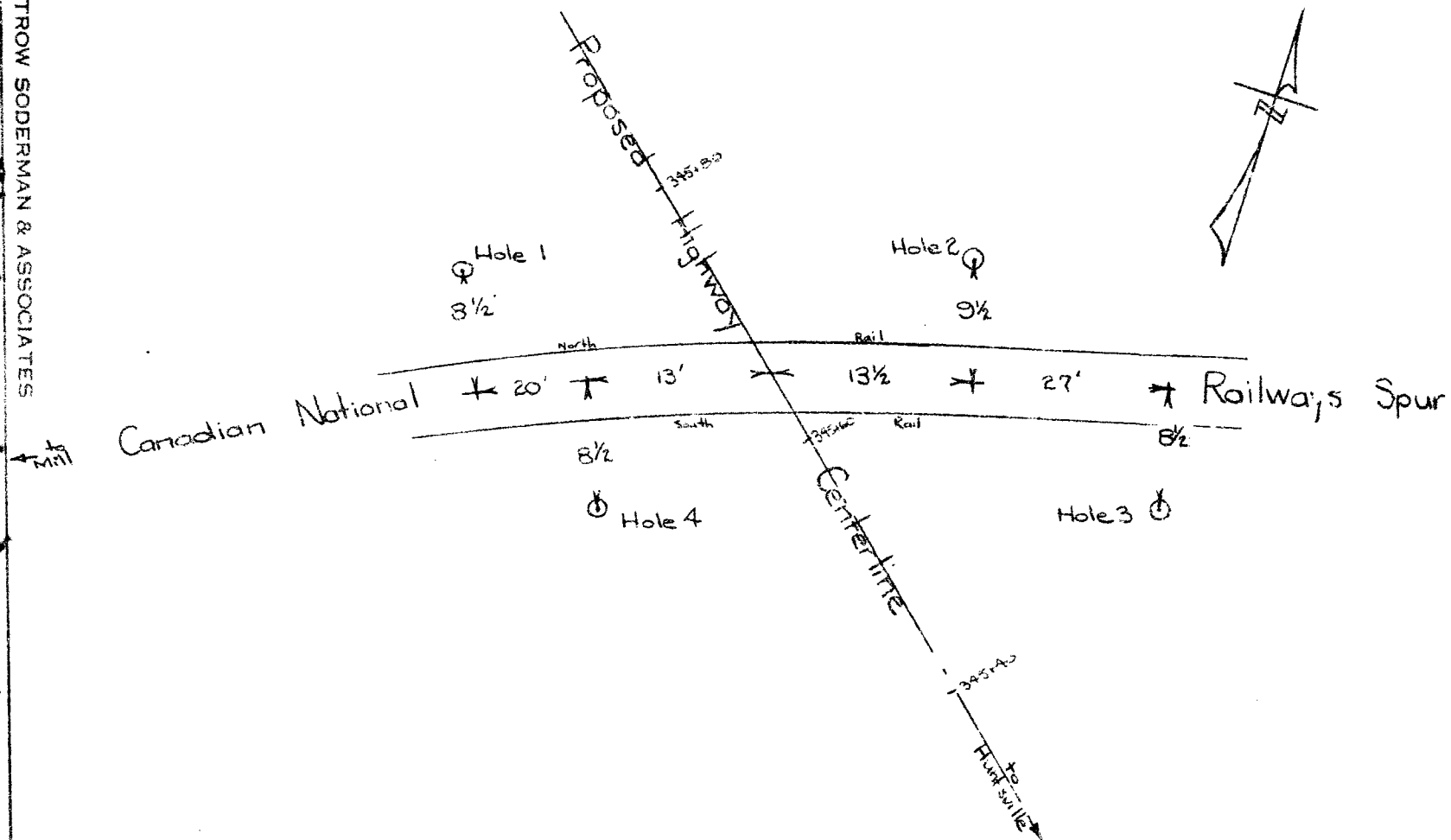
On completion of preliminary design of foundation members, the resistance to sliding along the bedrock contact should be checked analytically.

(3) The soil types in the area of the overpass and river crossing are predominantly sands and sandy gravels. No embankment problems need be anticipated with typical fill sections placed on these subsoil types.

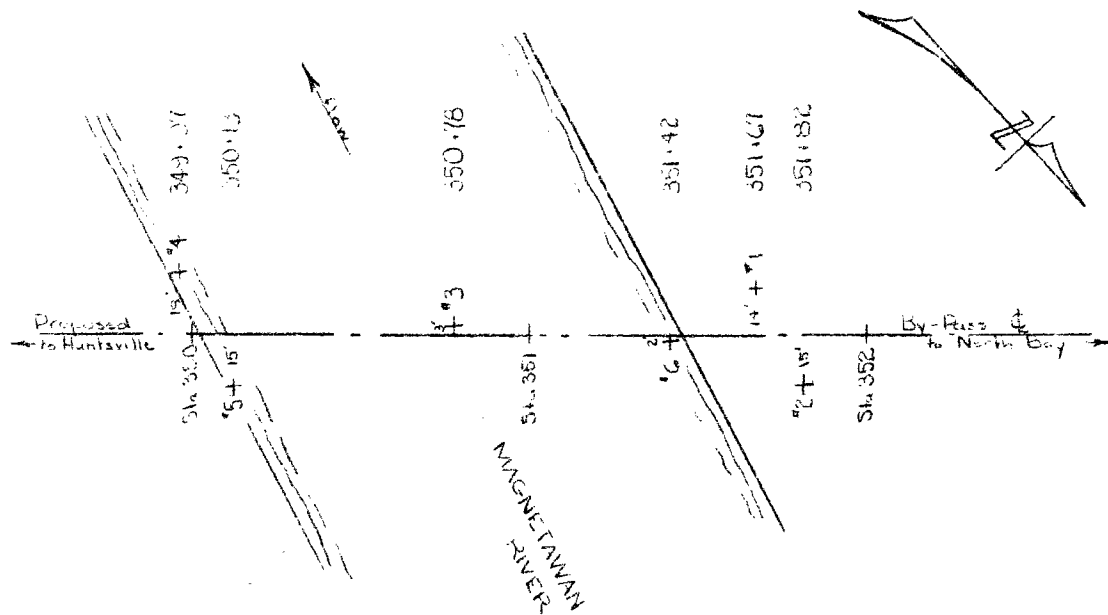
DHS/lt
Sept. 2, 1958.
C108/J235

D. H. Shields / mka
Donald H. Shields (P. Eng.)

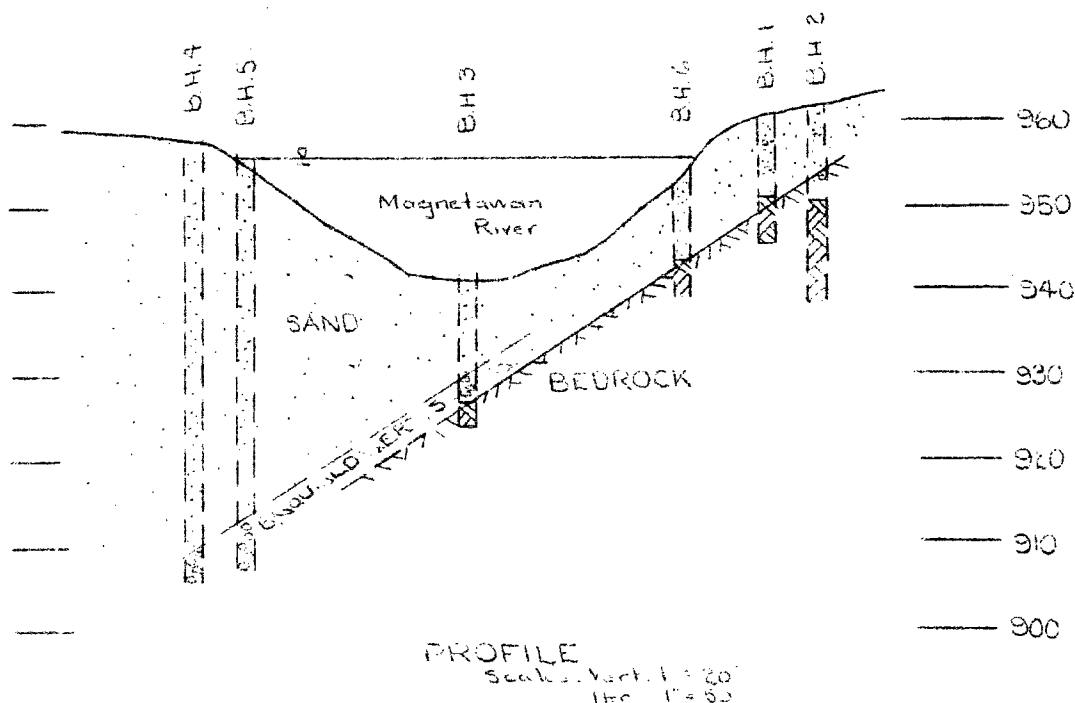




Borehole Location Plan for
Proposed Railway Overpass on Burk's Falls By-Pass
Scale 1" = 10'



PLAN
Scale: 1" = 50'



PROFILE
Scale: Vert. 1" = 20'
Htz. 1" = 50'

Borehole Location Plan & Projected Soils Profile

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT Railway Overpass

LOCATION Birk's Falls, Ontario.

HOLE LOCATION See Drawing No.1

HOLE ELEVATION AND DATUM 967.5

BOREHOLE NO. 1

FIELD SUPERVISOR D. S.

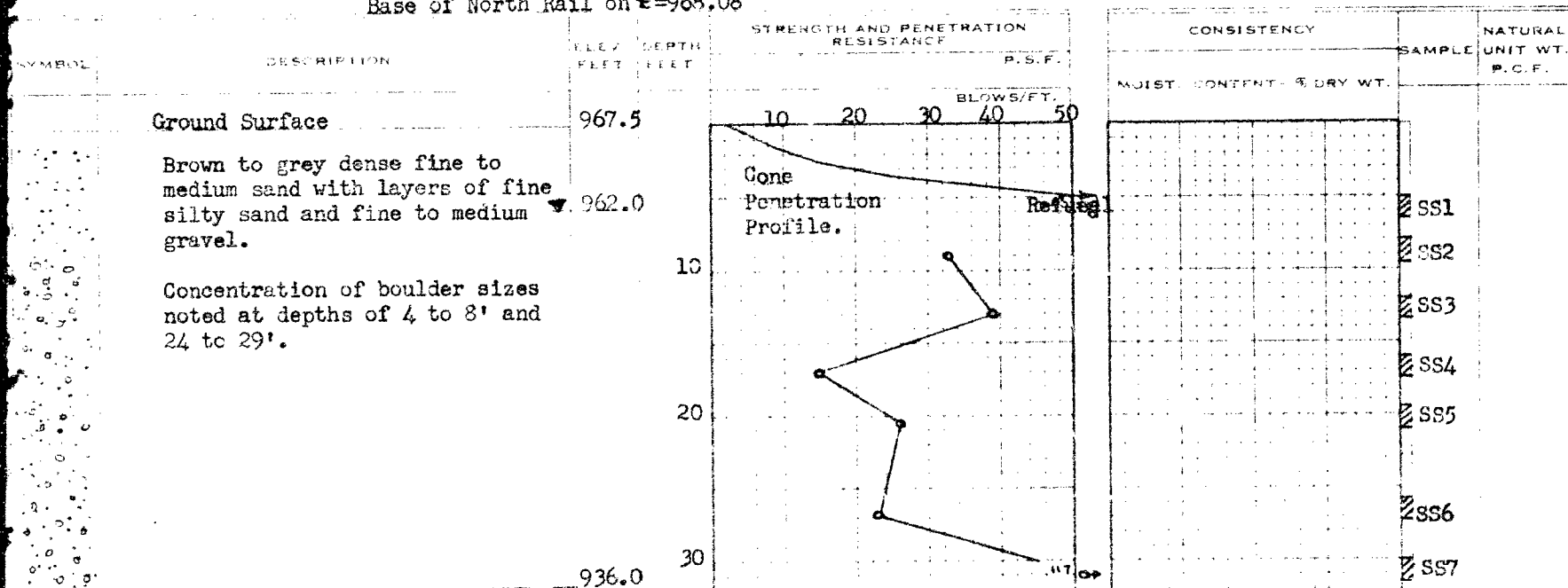
DRILLER F.B.

PREP. D.S.

Base of North Rail on 4 = 968.08

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 SHELBY
 1.2 UNCONFINED COMPRESSION [Qu]
 VANE TEST [C] AND SENSITIVITY [S]
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



Notes: (1) Hole dry and caved at 4'2" after 6 days.

(2) Hole advanced by drilling with BX shoe bit to depth of 31 1/2'.

(3) Water Table elevation based upon observation in borehole left open for 6 days.

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT Railway Overpass
 LOCATION Birk's Falls, Ontario.
 HOLE LOCATION See Drawing No.1.
 HOLE ELEVATION AND DATUM 967.4

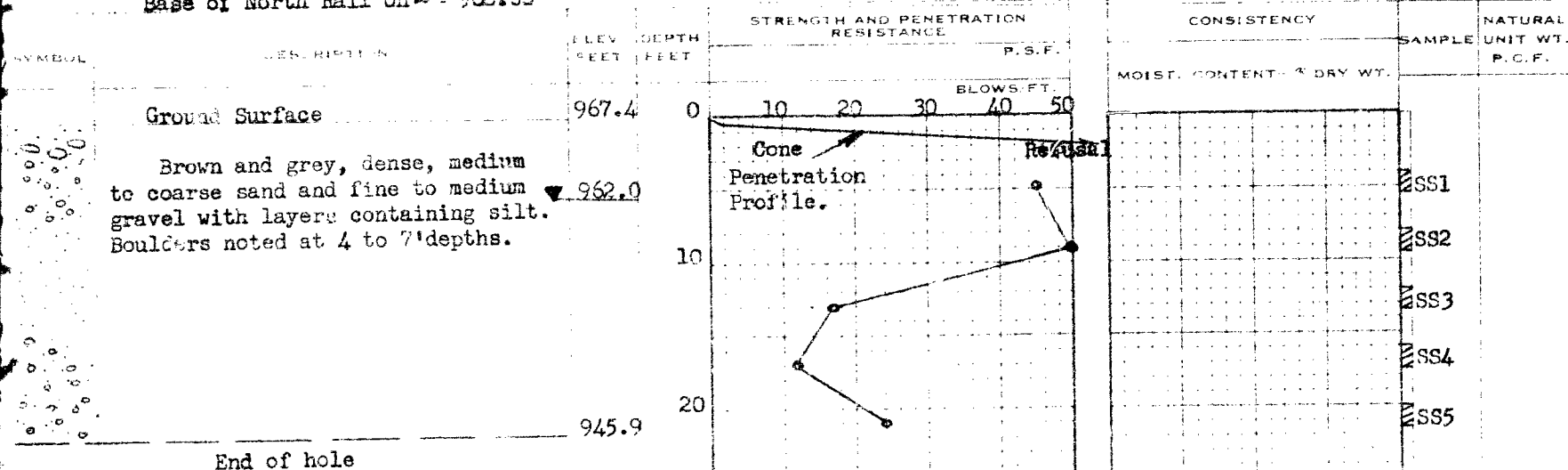
Base of North Rail on \pm = 968.03

BORE HOLE NO. 2
 FIELD SUPERVISOR D. S.
 DRILLER F. B.
 PREP D. S.

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION [QU]
 VANE TEST [C] AND SENSITIVITY [S]
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT

①
 +
 X
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Notes:

- (1) After 6 days hole caved and dry to 4'3".
- (2) Hole advanced by drilling BX shoe bit to depth of 21½'.
- (3) Water table elevation based on open hole observations after 6 days.

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT Railway Overpass

LOCATION Birk's Falls, Ontario.

HOLE LOCATION See Drawing No.1.

HOLE ELEVATION AND DATUM 967.6

Base of North Rail on $\phi = 968.08$

BOREHOLE NO. 3

FIELD SUPERVISOR D. S.

DRILLER F. B.

PREP. D. S.

LEGEND

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2' SPLIT TUBE

2" DIA. CONE

CASING

2 11 **SHELBY**

1.2 UNCONFINED COMPRESSION (Q_u)

VANE TEST [C] AND SENSITIVITY [S]

NATURAL MOISTURE AND

LIQUIDITY INDEX

LIQUID LIMIT

PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE		CONSISTENCY	SAMPLE	NATURAL UNIT WT P.C.F.
				P.S.F.	BLOWS/FT.			
	Ground Surface	967.6	0					
	Brown to grey medium to coarse sand with layers containing gravel sizes. High silt content to 10 feet depth.	962.0						
			10					
			20					
	End of Hole	945.6						

Notes:

- (1) Water level recorded after 5 days.
- (2) Hole advanced by drilling with a BX shoe bit to 22 ft.

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT Railway Overpass

LOCATION Birk's Falls, Ontario.

HOLE LOCATION See Drawing No.1.

HOLE ELEVATION AND DATUM 967.4

Base of North Rail on \pm = 968.08

BOREHOLE NO. 4

FIELD SUPERVISOR D.S.

DRILLER F.B.

PREP. D.S.

LEGEND

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

2" DIA. CONE

CASING

2" SHELBY

1/2 UNCONFINED COMPRESSION [Qu]

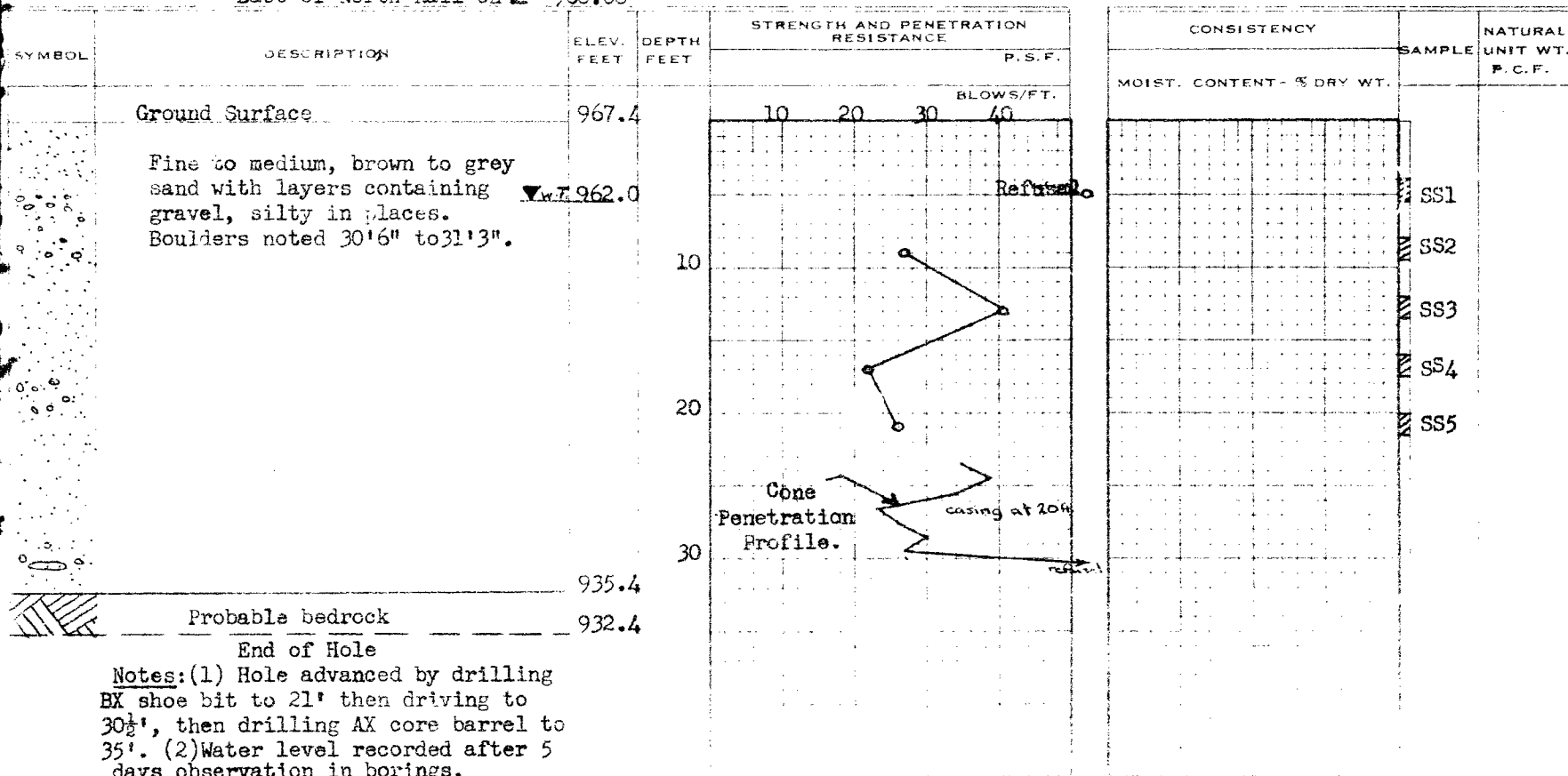
VANE TEST [C] AND SENSITIVITY [S]

NATURAL MOISTURE AND

LIQUIDITY INDEX

LIQUID LIMIT

PLASTIC LIMIT



TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT River Crossing

LOCATION Birk's Falls By-Pass (Proposed)

HOLE LOCATION See Drawing No.1.

HOLE ELEVATION AND DATUM 961.0

Sta. 352 + 00 on E = 964.1

BOREHOLE NO. 1

FIELD SUPERVISOR D. S.

DRILLER F.B.

PREP. D. S.

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION [Qu]
 VANE TEST [C] AND SENSITIVITY [S]
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT

SYMBOL

DESCRIPTION

ELEV.
FEETDEPTH
FEETSTRENGTH AND PENETRATION
RESISTANCE

P.S.F.

BLOWS/FT.

CONSISTENCY

SAMPLE

NATURAL

UNIT WT.

P.C.F.

MOIST. CONTENT - % DRY WT.

	3" of grass topsoil	961.0	0
	Sand with gravel sizes- brown to grey fine to medium sand, layers contain silt.	951.0	10
	Bedrock - biotite granite	945.5	20
	End of Hole		

Cone
Penetration
Profile.

Notes:

- (1) Water level = 2'10" after 9 days.
- (2) Hole advanced by drilling BX shoe bit to 12'.
- (3) Rock cored using AX diamond bit.

70

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT River Crossing

LOCATION Proposed Birk's Falls By-Pass

HOLE LOCATION See Drawing No.1.

HOLE ELEVATION AND DATUM 961.6

Sta. 352 + 00 on 4 = 964.1

BOREHOLE NO. 2

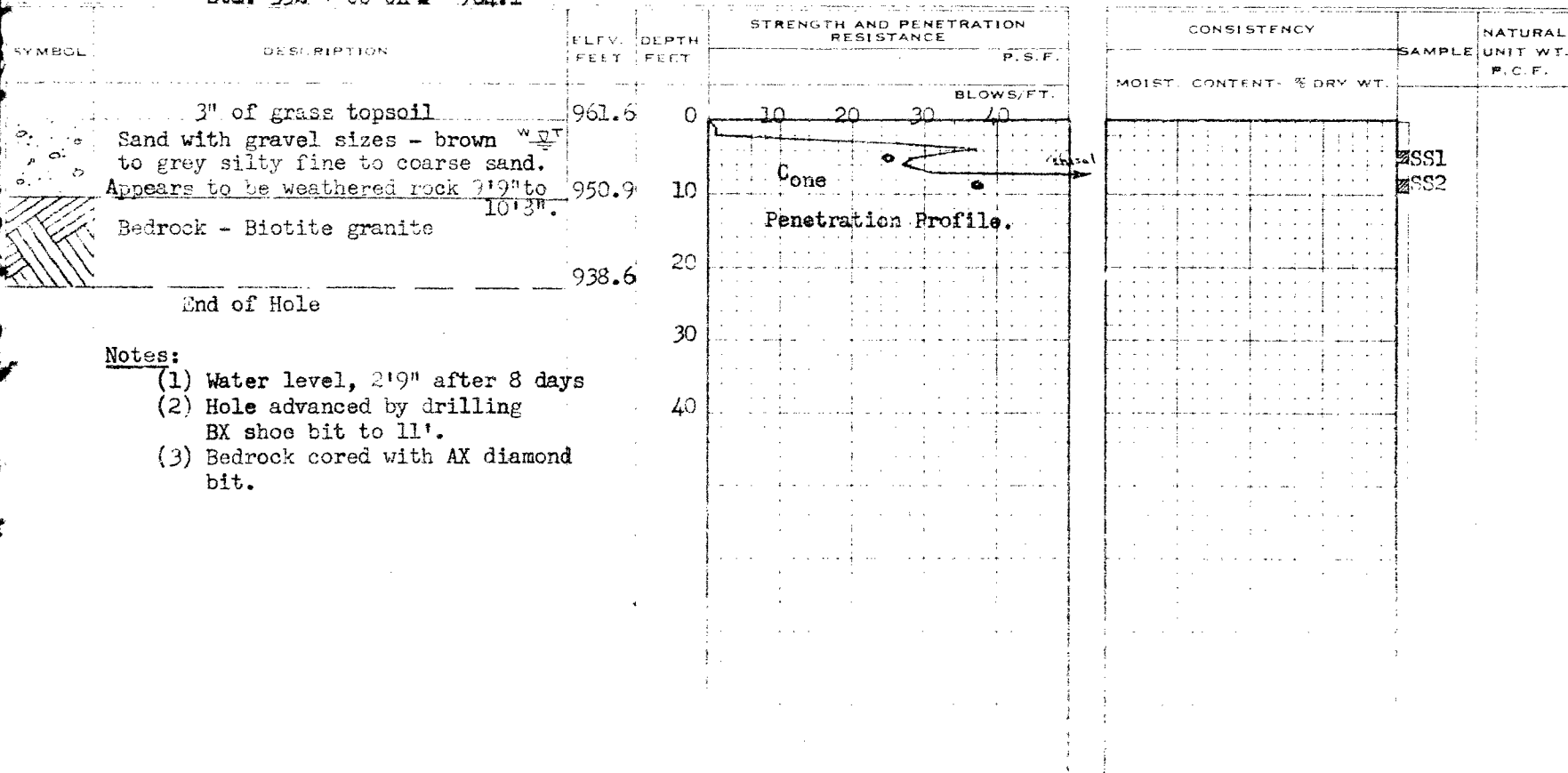
FIELD SUPERVISOR D. S.

DRILLER F. B.

PREP. D. S.

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION [Qu]
 VANE TEST [C] AND SENSITIVITY [S]
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



Notes:

- (1) Water level, 2'9" after 8 days
- (2) Hole advanced by drilling BX shoe bit to 11'.
- (3) Bedrock cored with AX diamond bit.

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT River Crossing

LOCATION Proposed Birk's Falls By-Pass

HOLE LOCATION See Drawing No.1.

HOLE ELEVATION AND DATUM 956.8

Sta. 352 + 00 on Δ = 964.1

BOREHOLE NO. 3

FIELD SUPERVISOR D. S.

DRILLER F. B.

PREP. D. S.

LEGEND

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

2" DIA. CONE

CASING

211 SHELBY

1/2 UNCONFINED COMPRESSION (QU)

VANE TEST [C] AND SENSITIVITY [S]

NATURAL MOISTURE AND

LIQUIDITY INDEX

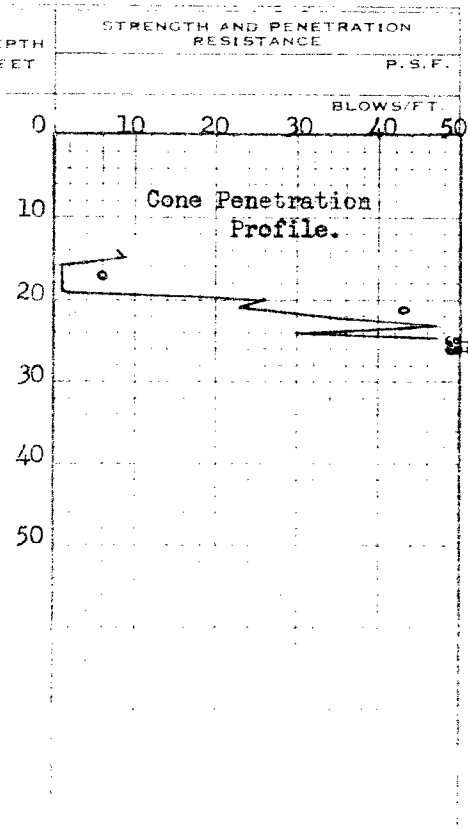
LIQUID LIMIT

PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET
	Raft Deck	956.8
	Water	956.0
	Sand and gravel- sand is well graded Many small boulders after 20 feet. Boulders 27' - 27'10" 28'4" - 29'	943.3
	Bedrock- Biotite granite	927.0
	End of Hole.	923.8

Notes:

- (1) BX casing washed and drilled to 30'.
- (2) Bedrock cored with AX diamond bit.

[illegible]

TPOW SODERMAN AND ASSOCIATES

SOIL INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT River Crossing

LOCATION Proposed Birk's Falls By-Pass.

HOLE LOCATION See Drawing No.1.

HOLE ELEVATION AND DATUM 956.9

Sta. 350 + 00 on Δ = 957.8

BOREHOLE NO. 4

FIELD SUPERVISOR D. S.

DRILLER F. B.

PREP D. S.

LEGEND

2" DIA. SPLIT TUBE

2' SHELBY TUBE

2. SPLIT TUBE

D.A. CONE

CASING

211 SHELBY

1/2 UNCONFINED COMPRESSION [QU]

VANE TEST [C] AND SENSITIVITY [S]

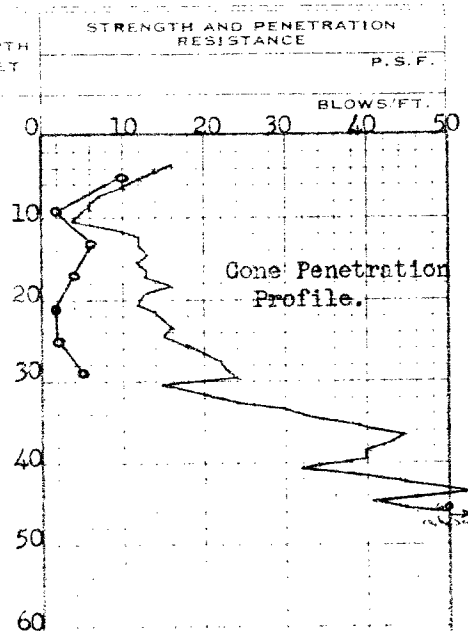
NATURAL MOISTURE AND

LIQUIDITY INDEX

LIQUID LIMIT

PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET
	RAFT DECK	956.9
	Water	958.0
	sand- fine to medium grey silty sand clean after 10 feet pieces of wood 3 to 13 feet pieces of gravel after 16ft.	955.1
		909.8
	Sand and Boulders-about equal in volume.	905.5
	End of hole	



CONSISTENCY		SAMPLE	NATURAL
MOIST. CONTENT- % DRY WT.			UNIT WT P.C.F.
		SS1	
		SS2	
		SS3	
		SS4	
		SS5	
		SS6	
		SS7	

PROJECT NO.

DRAWING NO. 11

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT River Crossing

LOCATION Proposed Birk's Falls By-Pass

HOLE LOCATION See Drawing No.1.

HOLE ELEVATION AND DATUM 356.9

Sta. 352 + 00 on Δ = 964.1

BOREHOLE NO. 5

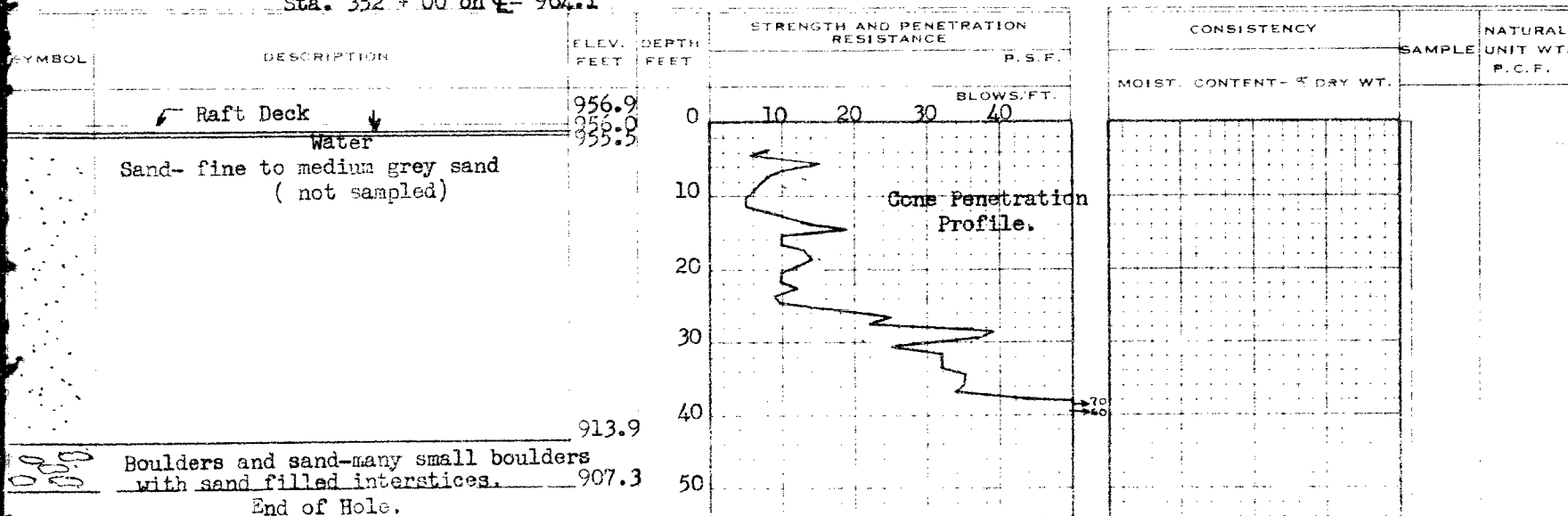
FIELD SUPERVISOR D. S.

DRILLER F. B.

PREP. D. S.

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1-2 UNCONFINED COMPRESSION [Qu]
 VANE TEST [C] AND SENSITIVITY [S]
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



Notes:

Refusal to 3" pipe at 43'.

PROJECT NO.

DRAWING NO.. 12

TROW SODERMAN AND ASSOCIATES

WATER INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

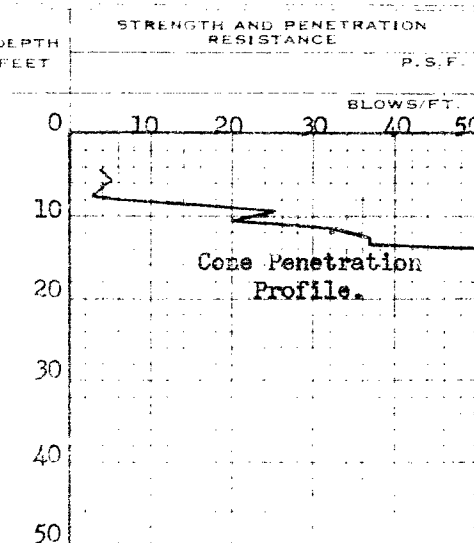
PROJECT River Crossing
LOCATION Proposed Birk's Falls By-Pass
HOLE LOCATION See Drawing No.1.
HOLE ELEVATION AND DATUM 356.9
Sta. 352 + 00 on ~~4~~ = 964.11

BOREHOLE NO. 6
FIELD SUPERVISOR D. S.
DRILLER F. B.
PREP. D. S.

LEGEND

- 2 " DIA. SPLIT TUBE
2 " SHELBY TUBE
2 " SPLIT TUBE
2 " DIA. CONE
CASING
4 " SHELBY
102 UNCONFINED COMPRESSION [Qu]
VANE TEST [C] AND SENSITIVITY [S]
NATURAL MOISTURE AND
LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	DEPTH FEET
	Raft Deck	856.9
	Water	934.9
	Sand (not sampled)	
		943.6
	Bedrock- Biotite granite	939.2
	End of Hole.	

[illegible]