

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 31 E - 84

W.P. No. 902A-58

CONT. No. _____

W. O. No. _____

STR. SITE No. 44 - 134

HWY. No. 69 LINE "H"

LOCATION BOYNE RIV. ,
PARRY SOUND

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. NONE

REMARKS: _____

HUNTING TECHNICAL AND EXPLORATION SERVICES LIMITED

RESOURCES AND DEVELOPMENT STUDIES

1450 O'CONNOR DRIVE
TORONTO 16, CANADA
PLYMOUTH 5-1141

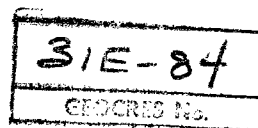
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NEW YORK
CARACAS
RIO DE JANEIRO
BUENOS AIRES

February 10th., 1959.

Mr. A. M. Toye,
Bridge Engineer,
Department of Highways,
Toronto, Ontario.



Attention: Mr. J. C. McAllister.

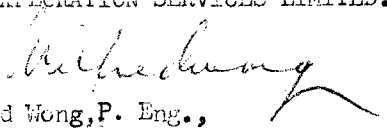
Re: W. P. 902A - 58, Boyne River.

Dear Sir:

Enclosed please find a copy of our correspondence to the Materials and Research Branch, Department of Highways, in connection with foundation investigation on the above site.

Yours very truly,

HUNTING TECHNICAL AND EXPLORATION SERVICES LIMITED.


Wilfred Wong, P. Eng.,
Engineering Division.

Wf/bd.
encl.

6061 1111 1111



ASSOCIATE OF THE WORLD-WIDE HUNTING GROUP

31E-84

GEOCRES No.

February 10th., 1959.

Materials and Research Branch,
Department of Highways,
Downsview, Ontario.

Re: Report on Foundation Investigation for the
Proposed Crossing of Highway No. 69, Revision
Line "H" at Boyne River, Parry Sound, Ontario.
WP. 902A-58.

Attention: Mr. L.G. Soderman.

Dear Sir:

With reference to our recent phone conversations on the above subject, we now have reviewed our calculations with respect to the allowable bearing capacity for spread footing foundation at EL. 670, and have found that a higher load of 2.0 tons/sq. ft. may be used for the design.

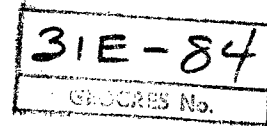
Several well-established formulae, i.e. Terzaghi and Peck, Peck-Hanson-Thornburn, Meyerhof and others, were used in the estimation of the allowable bearing capacity. These gave us a range of figures from a minimum of 1.4. tons/sq. ft. to a maximum of 2.6 tons/sq. ft.. Because the calculations were based on information from the only borehole, the minimum of 1.4. tons/sq. ft. was recommended to accommodate an extra measure of safety.

We trust you will find this satisfactory. Thank you again for bringing the matter to our attention.

Yours very truly,
HUNTING TECHNICAL AND EXPLORATION SERVICES LIMITED.

Wilfred Wong, P. Eng.,
Engineering Division.

W/bd.



REPORT ON FOUNDATION INVESTIGATION
FOR THE
PROPOSED CROSSING OF HIGHWAY NO. 69
REVISION LINE "H"
AT THE
BOYNE RIVER - PARRY SOUND, ONTARIO

for the

DEPARTMENT OF HIGHWAYS - ONTARIO

by the

Engineering Division
HUNTING TECHNICAL AND EXPLORATION SERVICES LIMITED
Toronto, Ontario

January, 1959.

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Section 1.1

PURPOSE OF REPORT

1.11 GENERAL

The purpose of this report is to present the results of a sub-surface soil investigation on the proposed site for the southerly extension of the existing double-lane concrete Boyne River Bridge, on Revision Line "H". Highway No. 69 near Parry Sound, and to offer recommendations regarding a safe foundation for the new structure.

Section 1.2

DISCUSSION OF PROCEDURES

1.21 LOCATION OF BOREHOLES

The field location of the site for this investigation was established by Department of Highways Surveyors. Hunting Technical and Exploration Services Limited engineers established the actual borehole locations by chaining to all boreholes from the centre line of the proposed Revision Line "H". Elevations for all boreholes were established by level from a reference point marked by Department of Highways Surveyors on the existing bridge. At the completion of the work each borehole was marked with a large stake denoting the hole number for future reference. The locations and elevations at top of the boreholes are shown on the plan in Appendix 1.71.

1.22 SUPERSURFACE DRILLING AND SAMPLING

At the discretion of the Soils Consultant, a primary program of 1 soil boring and 2 cone penetration tests was carried out in the vicinity of the proposed bridge site.

A skid-mounted, hydraulic head Junior Longyear diamond drilling rig was used on this project. All boring and sampling operations were completed by an experienced soil sampling crew under the supervision of engineering personnel experienced in soil sampling procedures.

All soil borings were performed by the standard washboring

procedure. By this method, drill casing was driven into the soil by a 350 lb. hammer to a depth determined by the boring supervisor. All the soil contained inside the casing during this operation was thoroughly washed out to the bottom of the casing and the resultant wash water was observed to determine stratum changes. Sampling tools were then lowered to the bottom of the hole. The sample was then taken and the sampling tools removed from the hole. Additional lengths of casing were added as required and the procedure repeated.

Attempts were made to obtain samples in the cohesionless soils by means of a 2-inch O. D. standard split spoon sampler. The standard penetration test using a 140 lb. hammer falling 30 inches was recorded for each foot of sampler penetration. When necessary, recovery of samples for identification and correlation was obtained with a side slit sampler. All samples were visually examined and classified on the site, then placed in jars and forwarded to the engineering office.

Cone penetration tests were made as a quick means of probing to rock. The number of blows required by a 140 lb. hammer falling 30 inches for each foot of penetration was recorded.

Bedrock core samples were obtained by diamond drilling techniques and were visually examined and classified on site. Representative samples were chosen and forwarded to the engineering office.

Section 1.3

DISCUSSION OF SITE

1.31 GEOGRAPHIC LOCATION

The proposed bridge site is located on the King's Highway No. 69 at the proposed new crossing of the Boyne River on Revision Line "H", approximately four and one-half miles southeast of Parry Sound. The site is in the District of Parry Sound, Township of Foley on Lot 134, Concession B.

1.32 SITE GEOLOGY

Physiographically the site lies within a region of Precambrian rock which was covered by continental glaciation during the Pleistocene epoch. The soil at the site consists, in general, of a fluvial deposit of fine grey sand with silt underlain by coarse sand with gravel which is a glacio-fluvial deposit left by the retreating glacier. The underlying bedrock, encountered at approximately elevation 650, is a Precambrian granitic gneiss.

1.33 WATER CONDITION

At the time of this investigation, the water table in Borehole No. 1 and the water level in the river were both found to be at Elevation 678.2 approximately.

The material at the site is generally loose to medium dense

sandy soil. Therefore, in consideration of the required excavations for spread footings below water line, care should be taken to see that the free water surface is kept below the bottom of excavation at all times during construction otherwise liquefaction of the soil could occur with subsequent lowering of soil bearing value.

There is a difference in elevation of about 3 feet between the high and low water levels in the river. Because of the sandy nature of the river bed materials, we have anticipated that scouring effects may go down as deep as Elevation 658.0 under the proposed locations of the abutments. In mid-stream the effect may be greater. It should be realized that the extension to the existing structure is to be located on the upstream side of the river.

1.34 SOIL CONDITIONS

The material encountered at the site consisted generally of three structural types overlying the bedrock in the following order of their occurrence below ground surface.

1. Topsoil - decomposed organic material intermixed with some sand.
2. Loose to medium dense grey fine sand, some silt.
3. Medium dense brown coarse sand and gravel.

The approximate physical properties of each stratum are listed as follows:

1. Decomposed organic material intermixed with some sand:

This layer of topsoil exists about 1 foot to 4 feet in depth at

the site. This material is highly compressible and is considered to have no structural value. It should be removed before the construction of the abutment and the approaches to the bridge.

2. Loose to medium dense fine grey sand, some silt:

This material underlies the organic layer described in 1 above and is the predominant soil at the site in considerations of spread footing foundation for the bridge. The stratum appears homogeneous. The physical properties of the layer are listed below:

Thickness	-	15 feet
Top Elevation	-	674.7 feet
Bottom Elevation	-	658.7 feet
Penetration Resistance Average	-	14 blows/foot
Penetration Resistance Range	-	13 to 16 blows/foot

3. Medium dense brown coarse sand and gravel:

This layer of soil is located immediately above bedrock. The soil consists mainly of coarse sand and gravel intermixed with very small amount of silt. Some larger gravels or stones probably exist under the east bank because of the relatively higher number of blows by the cone penetration tests. The physical properties of the layer are listed below:

Thickness	-	6 feet
Top Elevation	-	658.7 feet
Bottom Elevation	-	652.7 feet
Penetration Resistance	-	30 blows/foot

1.35 BEDROCK CONDITIONS

Granitic gneiss bedrock was encountered at approximately Elevation 650 at the site. This is believed to be medium hard rock capable of providing a bearing load of about 30 tons/square foot.

Recovery of rock core from Borehole No. 1 was close to 100%. Although this indicates that the rock is quite solid in composition, slight defects due to weather^{ing} along the surface are possible.

Section 1.4

COMMENTS ON FOUNDATIONS OF STRUCTURE

1.41 GENERAL

Our understanding of the proposed bridge structure is that it will be a southerly extension to the existing concrete bridge with abutments in the vicinity of Chainages 355+98 and 356+25 with respect to the centre line of proposed Revision Line "H", Highway No. 69.

We have also assumed that the maximum height of back-fill at the approaches will be in the order of 20 feet and that the fill will be selected granular material contained and protected by wing-walls and retaining-walls where necessary.

The type of foundation most feasible for the proposed extension will be greatly influenced by the method of foundation support employed on the existing structure. If the existing culvert is on a spread footing, then any dynamic driving of piles or other vibratory action adjacent to it could be objectionable and could result in settlement of the underlying subsoil with possible damage to the existing rigid-framed structure. This will preclude the use of any other dynamically driven piling either for prevention of scour damage or for support of the structure. However, if the existing structure is on piles to bedrock, we do not anticipate any special foundation problem with the proposed extension.

1.42 SPREAD FOOTING FOUNDATION

Considering the use of a spread footing foundation placed at

Elevation 670, we have estimated the safe soil pressure to be in the order of 1.4 tons per square foot with a footing width of 8 feet and a surcharge of 8.5 feet. However, in our opinion, scouring may reach as far down as Elevation 658 so that spread footings placed at Elevation 670 would have to be protected against the scouring effects.

If the existing structure is on a spread footing foundation, we would caution against the use of sheet piling for prevention of scour as the vibrations set by driving could cause settlement of the supporting soil and possible damage to the structure.

Prior to excavation for a spread footing foundation it will be necessary to lower the water table by a vacuum well point or other systems to below the proposed foundation level. If this is not done, the bottom of the excavation will become in a "quick" condition. This is recognizable by "boiling" sand accompanied by a general rising of the level of the bottom of the excavation. As a result, the material beneath the foundation will become loosened and its bearing capacity permanently destroyed.

1.43 PILE FOUNDATION

Depending on the nature of the foundations of the existing structure, pilings to bedrock could be the most satisfactory means of securing a safe foundation for the new structure. If the existing structure is on piles, depending on design requirements, cost and availability, there are several types of piles which could be satisfactorily used at this site. In general, the length of pile required to reach bedrock would be about 25 feet.

The following types of piles are presented for your consideration.

(a) Steel H-Piles:

Steel H-piles of section 12" x 12" driven to refusal into the rock should be able to provide an end bearing capacity of about 50 tons per pile although heavier sections may be used to obtain a higher bearing capacity. It is desirable that the piles be driven into the rock sufficiently to secure good seating. It may be also necessary to increase the cross sectional area of the point by welding or riveting on suitable angles and plates.

(b) Cast-in-place Concrete Piles:

Since bedrock occurs at more or less 26 feet below the shoreline of the river, cast-in-place concrete piles could be used to advantage if properly chosen. Cased concrete piles, cast-in-place with compressed bulb-section formed directly on rock are expected to provide at least 80 tons per pile.

(c) Wooden Piles:

Based on the information derived from Borehole No. 1, we have estimated that 10-inch wooden piles driven into the sandy-gravel stratum at approximately Elevation 656 will develop a permissible bearing capacity of about 15 tons per pile, allowing a factor of safety of two, however, this bearing load should be checked with standard or established driving formulae. Such piles should be spaced not less than 30 inches centre to centre.

Wooden piles may only be driven to surface of bedrock provided the pile tips are adequately reinforced, in order that proper seating on the rock could be secured. It is important that the driving energy for

these piles should by no means exceed the ultimate strength of the piles in direct compression , so that when piles are in contact with surface of bed-rock they will not be damaged by overdriving. Close supervision should be exercised during driving of the piles to rock.

If the existing structure is on spread footings , it is essential that piling procedures for the new structure do not disturb the soil beneath the existing structure. In this case , bored piles to rock may have to be used.

In all cases , prior to excavation for the pile cap , it will be necessary to lower the water table below the bottom of the cap otherwise the excavation will be in "quick" sand.

Section 1.5

RECOMMENDATIONS

1. We have determined the safe soil pressure for spread footings placed at Elevation 670 to be in the order of 1.4 tons/square foot. However, if this type of foundation is contemplated, provision will have to be made to prevent scour action beneath the footings.

2. Piles to bedrock will provide a satisfactory means of securing a safe foundation for the new structure.

Our comments under Section 1.43 outlined the possible use of several types of piles. In our opinion we consider steel H-piles would be of particular advantage on the site.

Steel H-piles of section 12" x 12" (or any other equivalent sections), driven to bedrock should provide a bearing load of about 50 tons per pile.

In the consideration of any type of pile foundation, however, it would be advisable to employ non-vibratory methods of placements of piles if the existing bridge structure was built on spread footing foundation.

3. A vacuum well-point or other system will be necessary to prevent "quick" conditions during excavation for either spread footings or pile caps.

4. We do not envisage any stability problems in connection with the 20-foot high approach fills provided that the top soil and other organic

materials have been removed.

The approach embankments may be constructed on a slope of 2 horizontal to 1 vertical.

5. Rip-rap or other appropriate material should be provided at the upstream toe of the embankment in order to protect against erosive action of the river.



Section 1.6

PERSONNEL

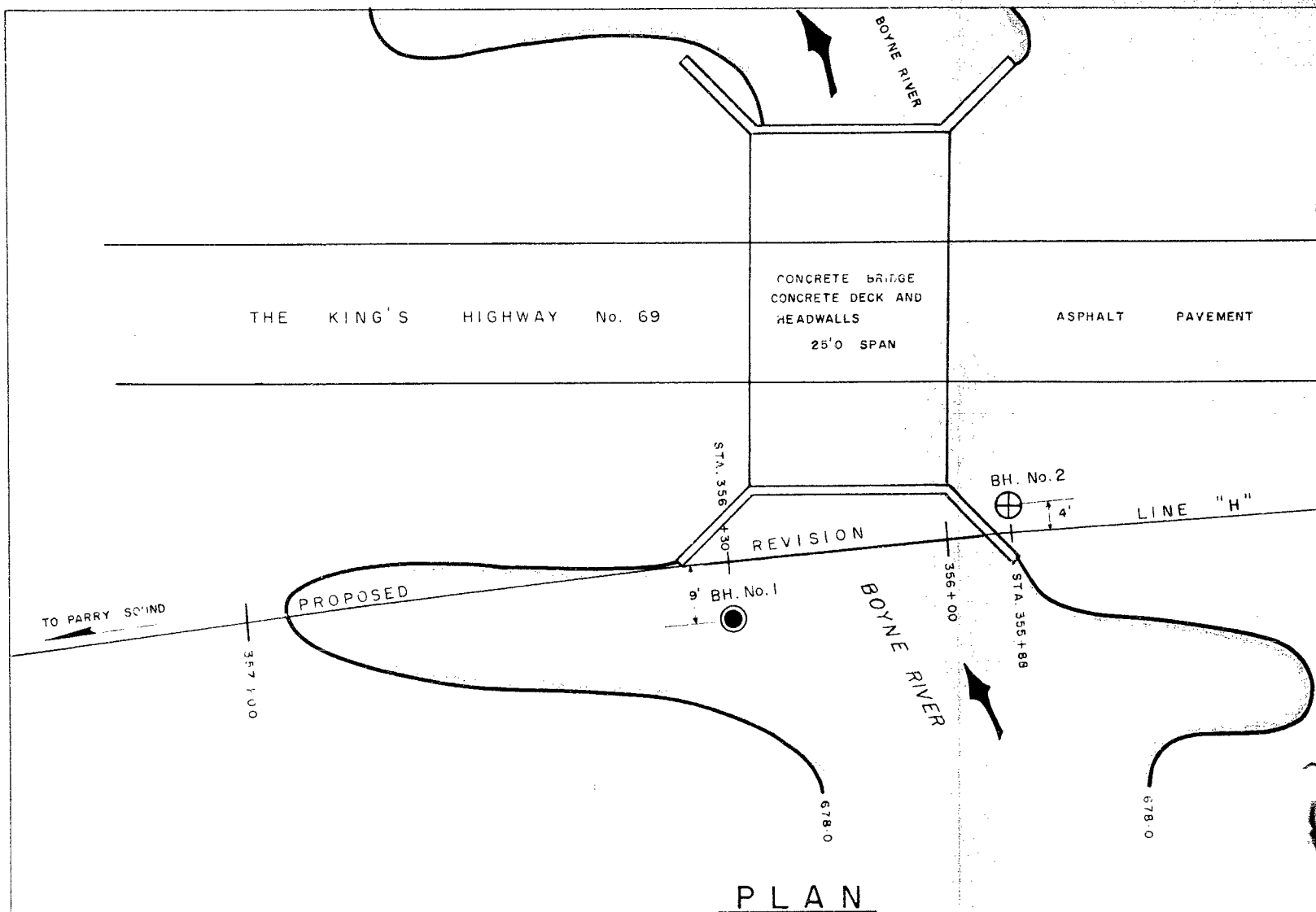
The field work for this project and the writing of this report were performed by Mr. W. W. F. Wong, P. Eng. , assisted by Mr. A. B. MacArthur, B.A. Sc.

Mr. J. Kilgour, P. Eng. , reviewed the report and the interpreted results.

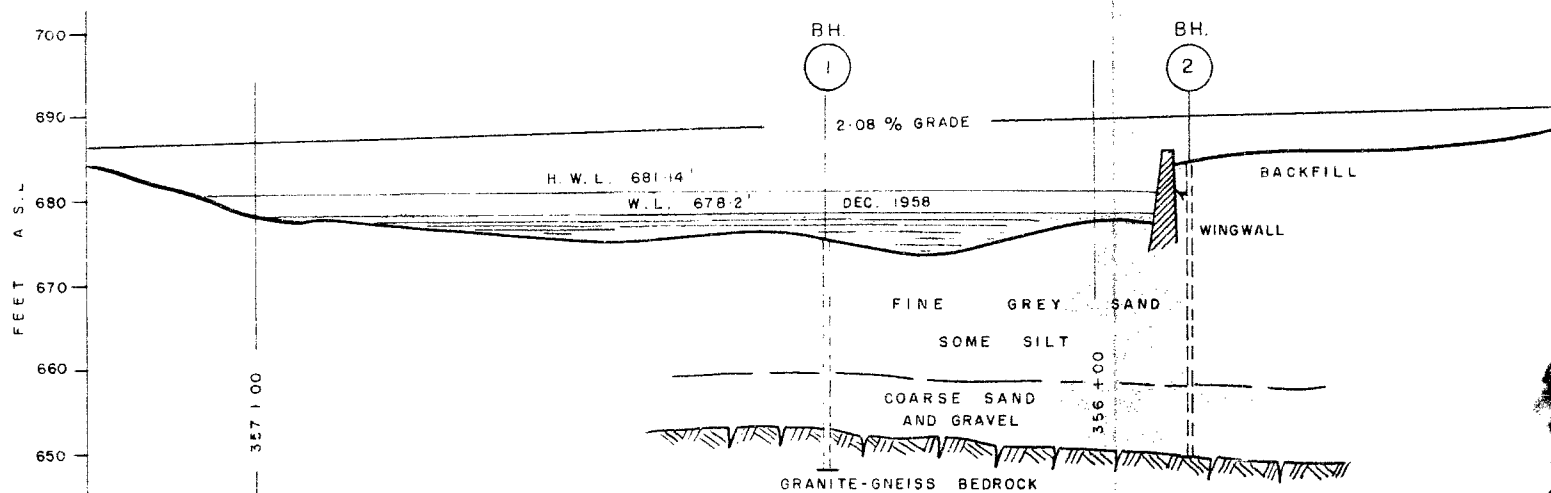
Section 1.7

APPENDICES

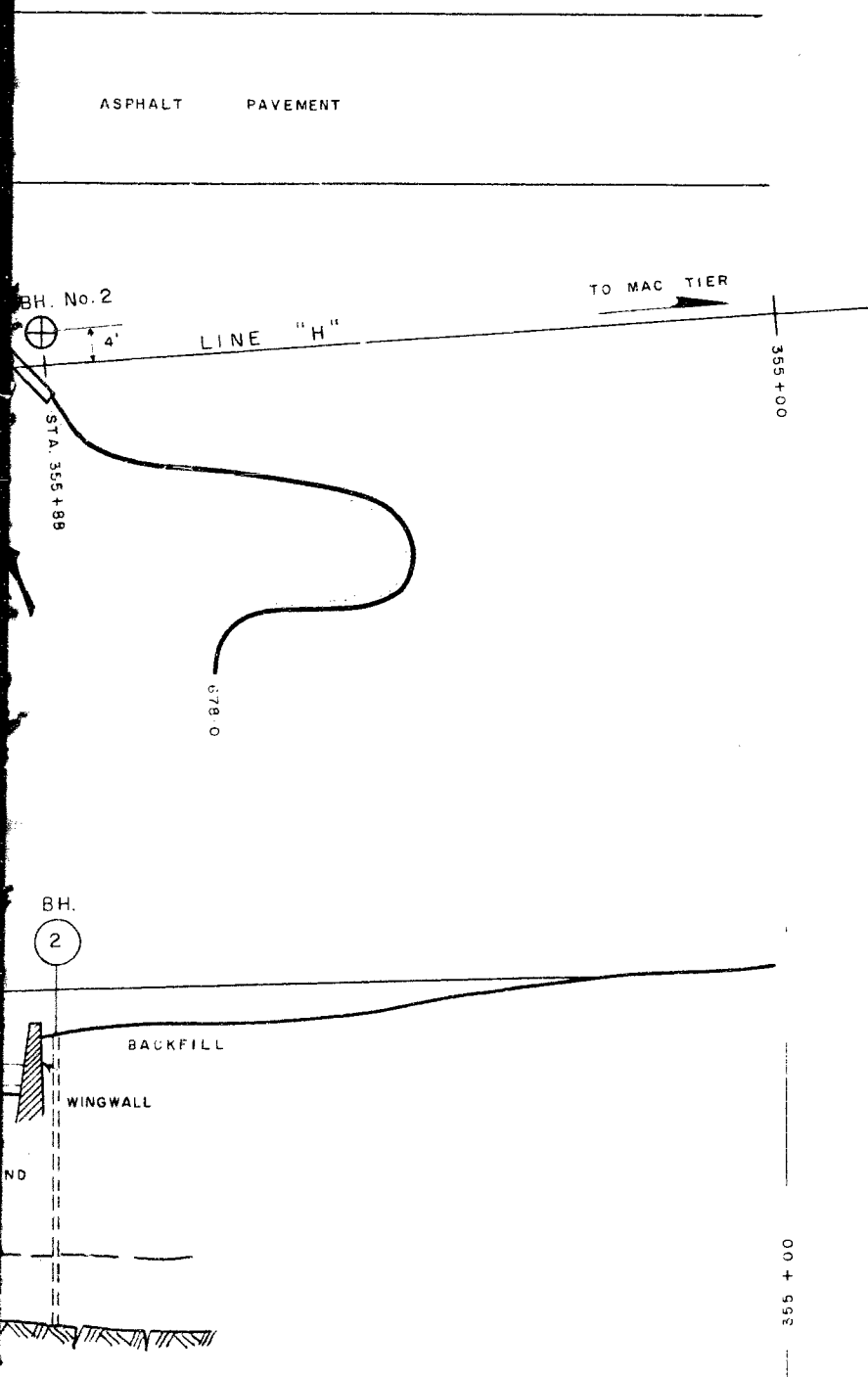
1.71 General Plan of Site and Subsurface Sections



PLAN



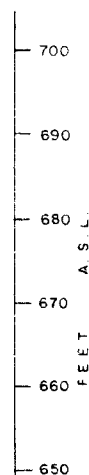
PROBABLE SOIL PROFILE ALONG CENTRE LINE OF HIGHWAY No. 69.



LEGEND

- - BOREHOLE &
- ⊕ - CONE PENETRA

31

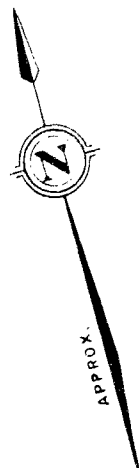


HUNTING TECHNICAL & EXPLORATION TORONTO	
DEPARTMENT OF HIGHWAYS -	
LOCATION OF BOREHOLE AND SUBSURFACE SOIL PROFILE FOR PROPOSED CROSSING AT AND THE KING'S HIGHWAY No 69, REVISION	
BRIDGE SITE	
SCALE - 1 in. = 20 ft.	Drawn by - C. I. B.
REFERENCE - Plan E 354	

OF HIGHWAY No. 69, REVISION LINE "H"

TO MAC TIER

355+00



LEGEND

● - BOREHOLE & CONE PENETRATION HOLE

⊕ - CONE PENETRATION HOLE ONLY

3 84
GEOCRE No.

700
690
680
670
660
650
FEET A S L

CO + 592

HUNTING TECHNICAL & EXPLORATION SERVICES LTD.
TORONTO

DEPARTMENT OF HIGHWAYS - ONTARIO

LOCATION OF BOREHOLES
AND
SUBSURFACE SOIL PROFILES
FOR
PROPOSED CROSSING AT BOYNE RIVER
AND

THE KING'S HIGHWAY No 69, REVISION LINE "H"

BRIDGE SITE

SCALE - 1 in. = 20 ft.

Drawn by - C. I. B.

Date - Dec. 1958

REFERENCE - Plan E 3549-1

VISION LINE "H"

1.72 Office Logs of Boreholes

JOB # 8742/58 LOCATION Bayne River East

CLIENT Department of Highways - Ontario

COORDINATES STN. 356 + 30.0, Offset 9' Lt. of d

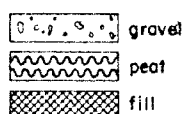
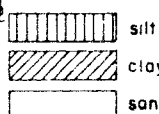
ELEV. (surface) 678.7 (collar) Datum D.H.O.

BOREHOLE NUMBER 1

DATE (started) Dec. 22/58 (finished) Dec. 23/58

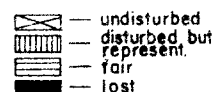
RIG No. TYPE Longyear Jr. A

HUNTING TECHNICAL AND EXPLORATION SERVICES



x — standard penetr. 2 s.s.
 Δ — vane shear
 o — pocket penetrometer
 ⊗ — Cone Penetr.

SAMPLE CONDITION



W.
 SS
 ST
 T.W.P.
 D.B.

BORING LOG					FIELD TESTS									
SCALE	DEPTH	ELEV.	WATER	LOG	DESCRIPTION	SHEAR STRENGTH (TONS PER SQUARE FOOT)		SAMPLES						ATTERBERG
FT.	FT.	FT.	OBSERVATION			1/2	1 1/2	No.	COND.	DEPTH	TYPE	RECOVERY	PENETRATION	LIMITS
						STANDARD PENETRATION TEST (BLOWS PER FOOT AT STANDARD ENERGY)				FROM	TO	LENGTH REC.	RESISTANCE	wp x — o w
						20	40			Ft.	Ft.	DIST. DRIV.	(BLOWS PER FOOT)	NATURAL WATER CONTENT
0	0.0	678.7			Ground Surface									
	0.5	678.2			Loose Brown Sand Intermixed with Decomposed Vegetation									
5	4.0	674.7			Loose to Medium Dense,			1		5.0	7.0	W.S.		
10					Fine Grey Sand Some Silt (Silty Sand)			2		9.0	10.5	S.S.	14/18	16
15								3		15.0	16.5	S.S.		16
20	20.0	658.7			Coarse Sand And Gravel			4		20.0	21.5	S.S.		30
25	26.0	652.7			(BX casing bouncing on rock)			5		24.5	26.0	W.S.		
30	31.0	647.7			Granite-Gneiss Bedrock (End of Boring)			6		26.0	31.0	D.B.	60/60	

End of Cone Penetration
 Hole Bouncing on
 Rock at 26.0'

BOREHOLE No. 1

C — consolidation test
M — mechanical analysis
T — triaxial shear
rK — permeability
U — unconfined compression

LABORATORY TESTS

ATTERBERG
 LIMITS $w_p \times - - 0 w_l$
 ● ——— NATURAL
 WATER CONTENT

REMARKS

No.	COND.	DEPTH		TYPE	RECOVERY		PENETRATION RESISTANCE (GILGUS PER FOOT)
		FROM	TO		LENGTH REC.	DIST. DRIV.	
BOARD ENERGY)		Ft.	Ft.				
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End of Cone Penetration
Hole. Bouncing on
Rock at 26.0'

Borehole and Cone Penetration Hole are about 4 feet apart of each other.

JOB No. H742/58 LOCATION: Boyne River East

CLIENT Department of Highways - Ontario

COORDINATES STN. 355+88.0, Offset 4' Rt. of C

ELEV. (surface) 687.7 (collar) Datum D.H.O.

BOREHOLE NUMBER 2

DATE (started) Dec. 23/58 (finished) Dec. 23/58

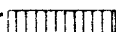
RIG No. TYPE Longyear Jr. A

HUNTING TECHNICAL

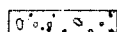
AND

EXPLORATION

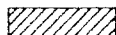
SERVICES



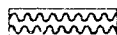
silt



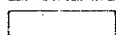
gravel



clay



peat



sand



fill

x — standard penetr. 2 s.s.

Δ — vane shear

○ — pocket penetrometer

● — Cone Penetr.

SAMPLE CONDITION



— undisturbed



— disturbed but present



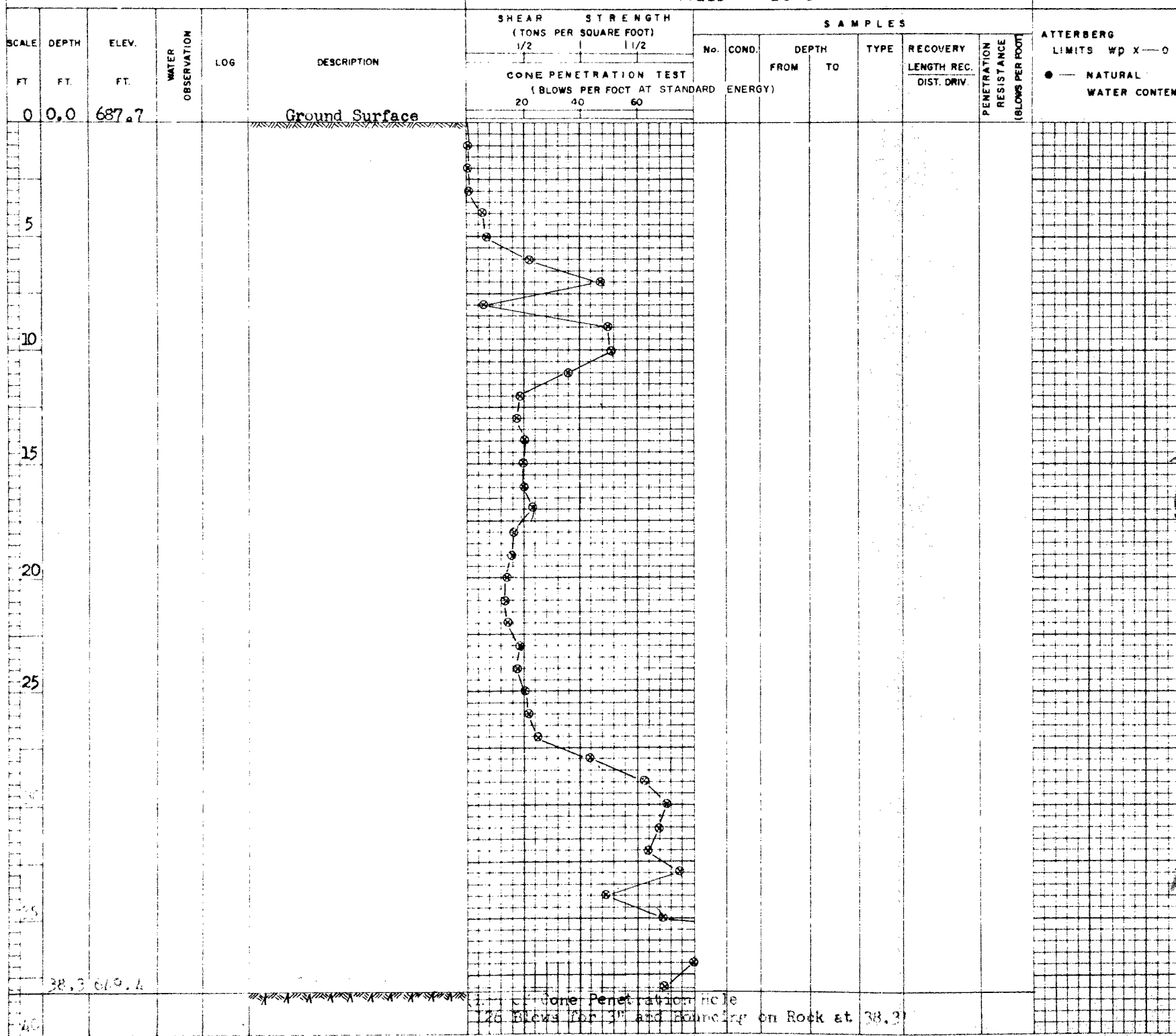
— fair

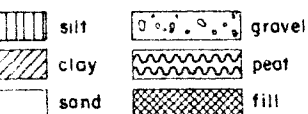


— lost

BORING LOG

FIELD TESTS





x — standard penetr. 2 s.s.
 △ — vane shear
 ○ — pocket penetrometer
 ● — Cone Penetr.

SAMPLE CONDITION
 — undisturbed
 — disturbed but represent.
 — fair
 — lost

SS — split spoon
 ST — shelby tube
 T.W.P. — thin walled piston
 D.B. — diamond bit

C — consolidation test
 M — mechanical analysis
 T — triaxial shear
 K — permeability
 U — unconfined compression

FIELD TESTS

LABORATORY TESTS

SHEAR STRENGTH
 (TONS PER SQUARE FOOT)
 1/2 1 1/2

SAMPLES

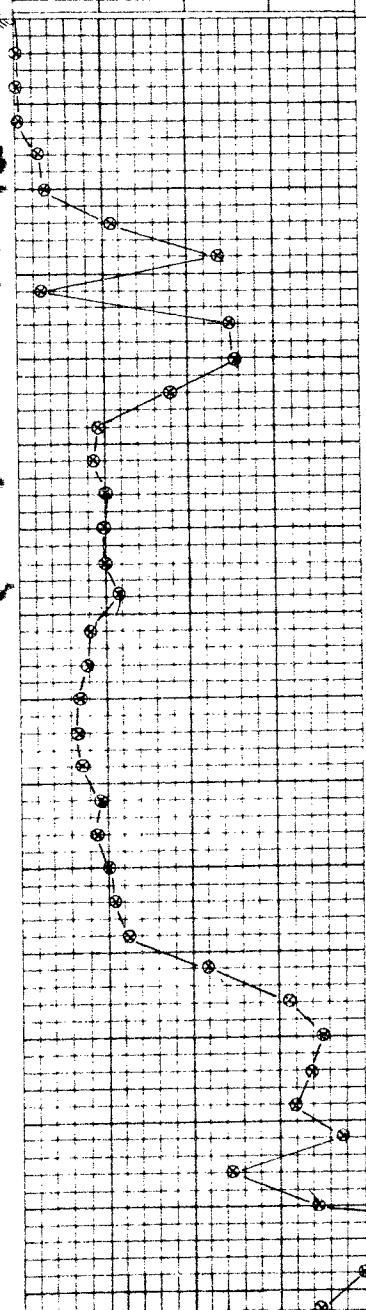
CONE PENETRATION TEST
 (BLOWS PER FOOT AT STANDARD ENERGY)
 20 40 60

No. COND. DEPTH TYPE RECOVERY
 FROM TO LENGTH REC.
 DIST. DRIV

PENETRATION
 RESISTANCE
 (BLOWS PER FOOT)

ATTERBERG
 LIMITS wp x — o wl
 ● — NATURAL
 WATER CONTENT

REMARKS



Cone Penetration Hole
 26 Blows For 3" and Bouncing on Rock at 38.3'

1.73 Photos of Site



General view of site looking east across proposed centre line.



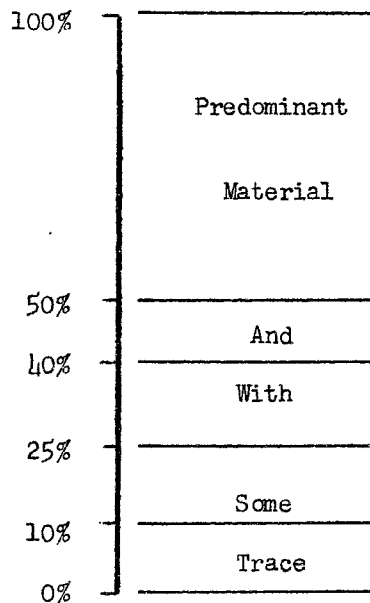
General view of site looking east along proposed centre line.

HUNTING TECHNICAL & EXPLORATION SERVICES

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SOIL TYPES

The following system was used in classifying the various soils by name:



Example:

Medium dense grey silt with fine sand
(Penet. resist.) (colour) (pred. type) (25%-40%) (other type)
or relative density

Unless believed to have a significant effect on the soil characteristics the minor soil types (i.e. traces) present are disregarded in the name used on the boring log and cross-sections. The complete classification is given with the gradation analysis.

In all cases the strength characteristics (e.g. penetration resistance) is quoted first, followed by the colour and finally the descriptive name based on the mechanical analysis.

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

Soils encountered in sub surface exploration for engineering purposes are composed of organic or inorganic materials, water, air and dissolved salts. The water and air are generally considered to be uniform so that identification is primarily in the nature of organic or inorganic (mineral grains) and dissolved salts.

In the field a soil is generally identified in terms of grain size characteristics, color and mineral content -- properties of the mineral grains. Occasionally, the origin of a soil is included in the identification.

The systems used to describe soils in terms of engineering properties are called classification systems. In the system described below, the soils are first identified and then classified in terms of strength characteristics which are of prime importance in utilizing the soil boring data in designing a safe and economical foundation.

Penetration measured by dropping 140 lb. hammer 30" on 2" O.D. split spoon sampler.

Identification (Soil Type)	Classification	Classification Criteria	
		Unconfined Compressive Strength	
Clay	Soft	Less than 0.50 Tons/Sq. Ft.	
	Medium	0.50 to 1.00 Tons/Sq. Ft.	
	Stiff	1.00 to 2.00 Tons/Sq. Ft.	
	Very Stiff	2.00 to 4.00 Tons/Sq. Ft.	
	Hard	Greater than 4.00 Tons/Sq. Ft.	
Silt	Loose	Density	
	Medium Dense	Less than 80 lbs./Cu. Ft.	
	Dense	80 to 95 lbs./Cu. Ft.	
Sand		Greater than 95 lbs./Cu. Ft.	
		Relative Density	Penetration Resist.
	Loose	0 - 30%	0 - 10 Blows/Ft.
	Medium Dense	30 - 60%	10 - 30 Blows/Ft.
	Dense	60 - 90%	30 - 50 Blows/Ft.
Very Dense	90 -100%	Over 50 Blows/Ft.	
Gravel	Loose	Penetration Resist.	
	Dense	Less than 30 Blows	
Hardpan		Over 30 Blows/Ft.	
		Cemented or partially cemented sandy gravels, sands, gravels with or without some clay and silt and having unconfined compression strength greater than 5 tons/sq. ft.	
Fill	Organic	Very Loose	0 - 4 Blows/Ft.
		Loose	4 - 10 Blows/Ft.
		Medium	10 - 30 Blows/Ft.
	Inorganic	Dense	30 - 50 Blows/Ft.
		Very Dense	Over 50 Blows/Ft.
			Unconfined Compressive Strength
Peat	Very Soft	Less than 0.30 Tons/Sq. Ft.	
	Soft	0.30 to 0.60 Tons/Sq. Ft.	
	Stiff	Greater than 0.60 Tons/Sq. Ft.	
Organic Silt (Muck)	Loose	Density	
	Medium Dense	Less than 30 lbs./Cu. Ft.	
		Greater than 80 lbs./Cu. Ft.	