#62-F-299 M

BLACK CREEK

BRIDGE

MAPLE LEAF DR.

NORTH YORK TWP.

H. Q. GOLDER & ASSOCIATES LTD.

CONSULTING CIVIL ENGINEERS

H. Q. GOLDER
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767-9201
763-4163

July 20, 1962

Ewbank, Tupper & Associates Limited,
Consulting Professional Engineers,
120 Eglinton Ave. East,
Toronto 12, Ontario.

Att: Mr. B. W. Bemrose, P.Eng.

RE: SITE INVESTIGATION,
PROPOSED BLACK CREEK BRIDGE,
MAPLE LEAF DRIVE,
NORTH YORK TOWNSHIP, ONTARIO.

Dear Sirs:

This letter reports the results of a site investigation carried out at the above site. The purpose of the investigation was to determine the subsoil conditions at the site and to provide information for the foundation design of the proposed bridge.

PROCEDURE

The field work was carried out on June 25 and 26, 1962. Two boreholes in BX size with adjacent dynamic penetration tests were put down to depths of 22 and 32 feet, respectively, using a skid-mounted machine drillrig. Following completion of each borehole a standpipe was installed to determine the groundwater level.

The locations of the boreholes are shown on the sketch plan in Figure 1. A section of the inferred soil stratigraphy is shown on Figure 2. A detailed log for each borehole is given on the Records of Boreholes.

The samples obtained in the investigation were brought to our laboratory for examination and testing. The results of the laboratory tests are plotted on the Records of Boreholes and on Figure 3 and 4.

The elevations given in this report are referred to Geodetic datum and were supplied by Ewbank, Tupper & Associates Limited.

SITE AND GEOLOGY

The site of the proposed bridge over the Black Creek is on Maple Leaf Drive about 500 feet east of Jane Street in North York Township, Ontario. The creek bottom at this location is 4 to 5 feet below the general flood plain level which extends some 50 to 100 feet on either side of the narrow creek channel.

From available geological information it is known that the overburden in this locality consists of a complex succession of glacial drift deposits separated by irregular interglacial beds of stratified sands, silts and clays. These deposits are sometimes overlain by sands deposited in glacial Lake Iroquois and in river channels which emptied into Lake Iroquois. Bedrock of the Dundas Formation consisting of interbedded shales and limestones underlies the overburden at a depth in excess of 100 feet.

SUMMARIZED SOIL CONDITIONS

The borings put down in this investigation, at the proposed bridge abutment locations, show that the Maple Leaf Drive roadway approaches to the existing bridge consist of fill from 7 to 9 feet thick. The fill is essentially comprised of brown silty sand with a trace to some gravel and contains cinders, brick fragments and a trace of organic matter. Based on the standard penetration tests which gave "N" values ranging from 2 to 11 blows per foot, together with the results of the dynamic penetration tests, the fill is very loose to loose and generally loose.

The fill in borehole 2, at the proposed west abutment location, is underlain by a thin layer of compact brown silty sand with a trace of gravel. The layer, which is about 1 foot thick, is a geologically recent flood plain deposit of the Black Creek. A grain size distribution curve obtained on a sample from this layer is shown on Figure 3.

A stratum of grey clayey silt underlies the roadway approach fill and flood plain deposit of sand at about elevations 389 and 388 in boreholes 1 and 2, respectively. It extends down to at least elevation 366, the maximum depth of exploration in borehole 1. The stratum which is glacial in origin is comprised mainly of silt with some clay and sand and a trace of fine to medium limestone and shale gravel interspersed throughout. The gravel content generally decreases and the clay content increases with depth, particularly in borehole 2.

The results of Atterberg limit tests carried out on samples of the clayey silt are plotted on the Records of Boreholes. In general the liquid limit is about 20 to 25 and the plastic limit 10 to 15 with the natural water content at about 15 percent. The total unit weight based on 6 determinations ranges from 133 to 143 pounds per cubic foot.

Five undrained triaxial compression tests were carried out on samples of the clayey silt and the results are given on the Records of Boreholes and on Figure 4. An undrained shear strength value ranging between about 1,000 and 2,000 pounds per square foot was obtained from these tests at a failure strain of about 20 percent. Based on the strength results together with the penetration test results, the clayey silt is very stiff becoming generally stiff with depth.

WATER CONDITIONS

An oberservation pipe was installed in each borehole to determine the groundwater level. Readings taken on July 3, 1962, one week following completion of the field work, showed that the groundwater level at the borehole locations was about one foot above creek level and at about elevation 392.

Due to the granular nature of the roadway approach fills the groundwater level may be expected to fluctuate with the creek level which at this location is dependent mainly on precipitation conditions in the locality.

DISCUSSION

General

It is understood that the existing Black Creek crossing on Maple Leaf Drive is to be replaced by a new bridge. The proposed bridge is to be a simply supported single span structure about 60 feet in length and 50 feet in width with the abutments at a 17° skew from the normal to the centre-line of Maple Leaf Drive. The bridge abutments are to be of reinforced concrete construction and the concrete deck of the bridge supported by steel beams. The roadway approaches to the proposed bridge are to be raised some 5 and 10 feet, on the west and east sides, respectively, above the existing road profile grade at about elevation 398.

Foundation Design

It is recommended that the abutments of the proposed bridge be founded on spread footings placed in the clayey silt stratum which underlies the site below about creek bed level. To provide adequate scour and frost protection the footings should be taken down at least 4 feet below the creek bed. Thus the foundation level will be no higher than about elevation 383.

The undrained shear strength of the clayey silt was determined by triaxial compression tests on samples obtained during the investigation. These tests gave a range in the undrained shear strength value from about 1,000 to 2,000 pounds per square foot. Reference to the stress-strain curves on Figure 4 for the triaxial tests shows that the ultimate strength values on the clayey silt were obtained at high failure strains. The high strains indicate sample disturbance and the difficulty in obtaining a relatively undisturbed sample of this material. Taking into account the effect of some sample disturbance on the strength results obtained and considering the standard penetration test results given on the Records of Boreholes, an allowable bearing value of up to 2 tons per square foot may be used in design of footings founded in the clayey silt. With this bearing pressure there should be no significant or detrimental settlement of the bridge abutment footings provided precautions are taken during construction to prevent softening of the clayey silt at foundation grade.

In the computation of sliding resistance between a rough concrete footing base and the clayey silt subsoil, a coefficient of friction of 0.3 may be used.

It is recommended that free draining granular backfill, compacted in 9 inch lifts, be placed behind the abutments of the structure. The granular backfill should extend horizontally from the back face of the abutment walls for a minimum distance of 4 feet.

In the design of the abutment walls it is recommended that an earth pressure coefficient, K, equal to 0.5 be used for the compacted granular backfill.

Construction Procedures

No major construction problems are envisaged for the bridge abutments to be founded in the relatively impervious clayey silt. However, to prevent entry of water into the foundation excavations through the pervious fill and sand deposit overlying the clayey silt, closed sheeting driven several feet below foundation level should be employed. The sheeting should be driven prior to excavation below creek bottom and should be constructed to sufficient height and above high water level to prevent flooding of the excavations during a flash runoff period. An alternate to driving of sheeting is to build an impervious earth cofferdam resting on the clayey silt, around the perimeter of the proposed excavations.

To prevent softening of the clayey silt due to entrance of surface water and construction operations, it is recommended that the base of the footing excavations, once foundation grade is reached, be immediately covered by a 4 inch thick mat of lean concrete.

Yours faithfully,

H. Q. GOLDER & ASSOCIATES LTD.

J. L. Seychuk, P. Eng.

JLS/me

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LIST OF STANDARD ABBREVIATIONS

The standard abbreviations commonly employed on each "Record of Borehole", on the figures, and in the text of the report are as follows:

SAMPLE TYPES

A.S. – Auger Sample
C.S. – Chunk Sample
D.O. – Drive Open
D.S. – Denison Type Sample
F.S. – Foil Sample
R.C. – Rock Core
S.T. – Slotted Tube
T.O. – Thin-walled, Open
T.P. – Thin-walled, Piston
W.S. – Wash Sample

PENETRATION RESISTANCES

Dynamic Penetration Resistance – The energy required to drive a 2 inch diameter, 60 degree cone attached to the end of the drilling rods into the ground: expressed in blows per foot, where each blow represents 4,200 inch-pounds of energy.

Standard Penetration Resistance, N – The number of blows by a 140 pound hammer dropped 30 inches required to drive a 2 inch drive open sampler one foot into the ground.

Sampler advanced by static weight – weight, hammer – Wh
Sampler advanced by pressure – pressure, hydraulic – Ph
Sampler advanced by pressure – pressure, manual – Pm

SOIL DESCRIPTION

The standard terminology for the descriptions of the relative density of cohesionless soils and the consistency of cohesive soils is as follows:

Relative Density	N, Blows/ft.	Consistency	c, lb/sq. ft.
Very Loose	0 to 4	Very Soft	Less than 250
Loose	4 to 10	Soft	250 to 500
Compact	10 to 30	Firm	500 to 1,000
Dense	30 to 50	Stiff	1,000 to 2,000
Very Dense	over 50	Very Stiff	2,000 to 4,000
		Hard	over 4,000

SOIL TESTS

C – Consolidation Test
H – Hydrometer Analysis
M – Sieve Analysis
MH – Combined Analysis, Sieve and Hydrometer
Q – Undrained Triaxial
Qc – Consolidated Undrained Triaxial
S – Drained Triaxial
U – Unconfined Compression
V – Field Vane Test

Note: Undrained triaxial tests in which pore pressures are measured are shown as Q' or Q'c.

SOIL PROPERTIES

γ – Total Unit Weight
γ_d – Dry Unit Weight
γ_b – Submerged Unit Weight
L_L – Liquid Limit
P_L – Plastic Limit
W – Natural Water Content
G – Specific Gravity
e – Void Ratio
K – Coefficient of Permeability
c – Undrained Shear Strength (½ Compressive Strength)
S_t – Sensitivity
$\emptyset'$ – Effective Angle of Shearing Resistance
c' – Effective Cohesion Intercept
Cc – Compression Index
Cv – Coefficient of Consolidation

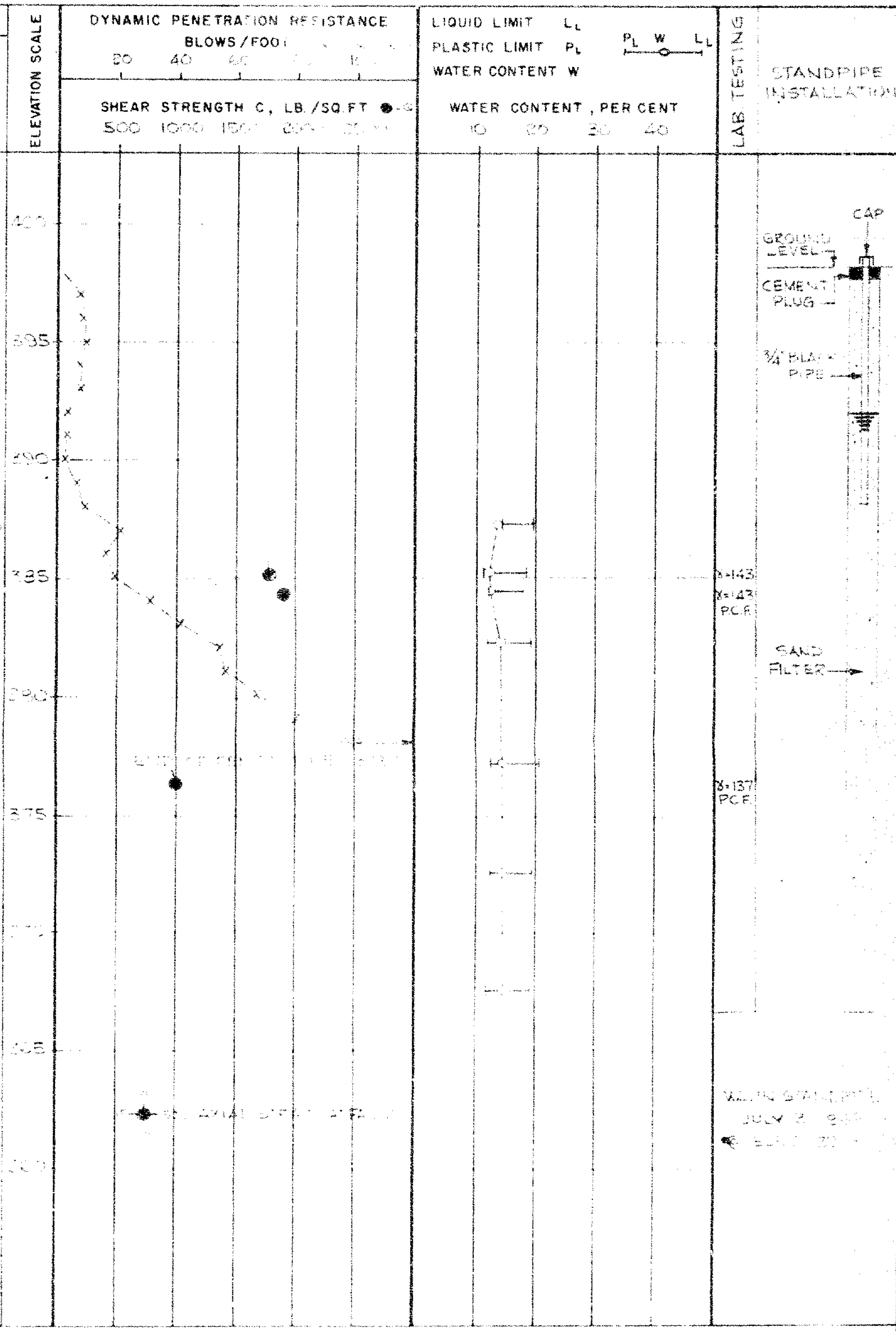
RECORD OF BOREHOLE 1

LOCATION SEE FIGURE 1 | BORING DATE JUNE 25, 196[illegible] | DATUM GEODETIC

BOREHOLE TYPE WASH BORING | BOREHOLE DIAMETER BX CASING

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES | PEN. TEST HAMMER WEIGHT 140 LB. DROP 30 INCHES

ELEVN. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FT
398.0	GROUND LEVEL				
0.0	VERY LOOSE TO LOOSE BROWN SILTY SAND TRACE OF GRAVEL, CINDERS, BRICK FRAGMENTS AND ORGANIC MAT. (FILL)		1	2" DO	11
			2	"	7
			3	"	2
389.3 / 8.7			4	"	[illegible]
	VERY STIFF TO STIFF GREY CLAYEY SILT, SOME SAND AND TRACE FINE GRAVEL		5	"	23
			6	2" [illegible]	[illegible]
			7	2"	[illegible]
			8	[illegible]	[illegible]
			9	[illegible]	
3[illegible] / 3[illegible]	END OF HOLE				



VERTICAL SCALE

1 INCH TO [illegible]

GOLDER & ASSOCIATES

DRAWN [illegible]

CHECKED [illegible]

PROJECT No. 6226

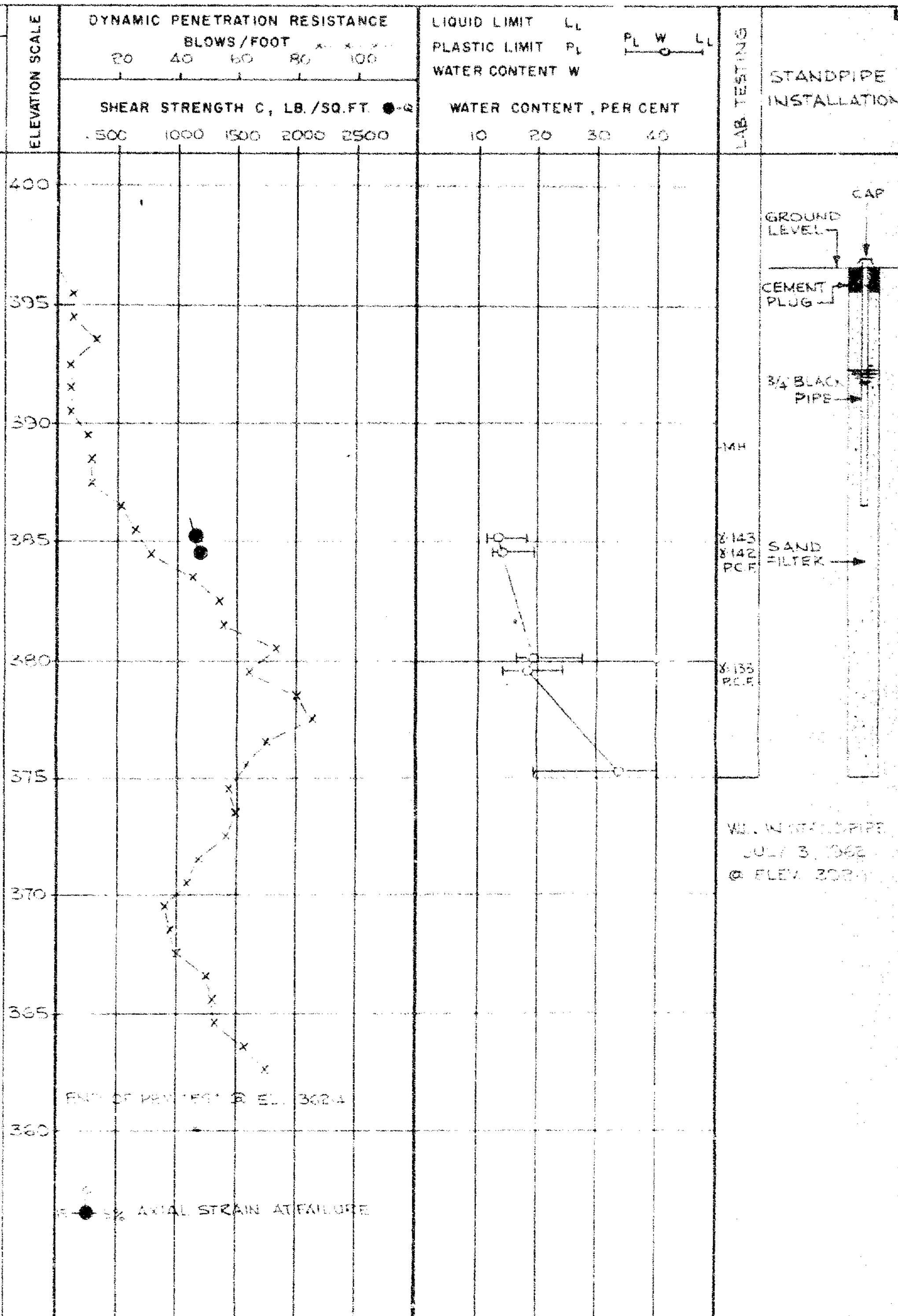
RECORD OF BOREHOLE 2

LOCATION SEE FIGURE 1 BORING DATE JUNE 26, 1962 DATUM GEODETIC

BOREHOLE TYPE WASH BORING BOREHOLE DIAMETER BX CASING

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT 140 LB. DROP 30 INCHES

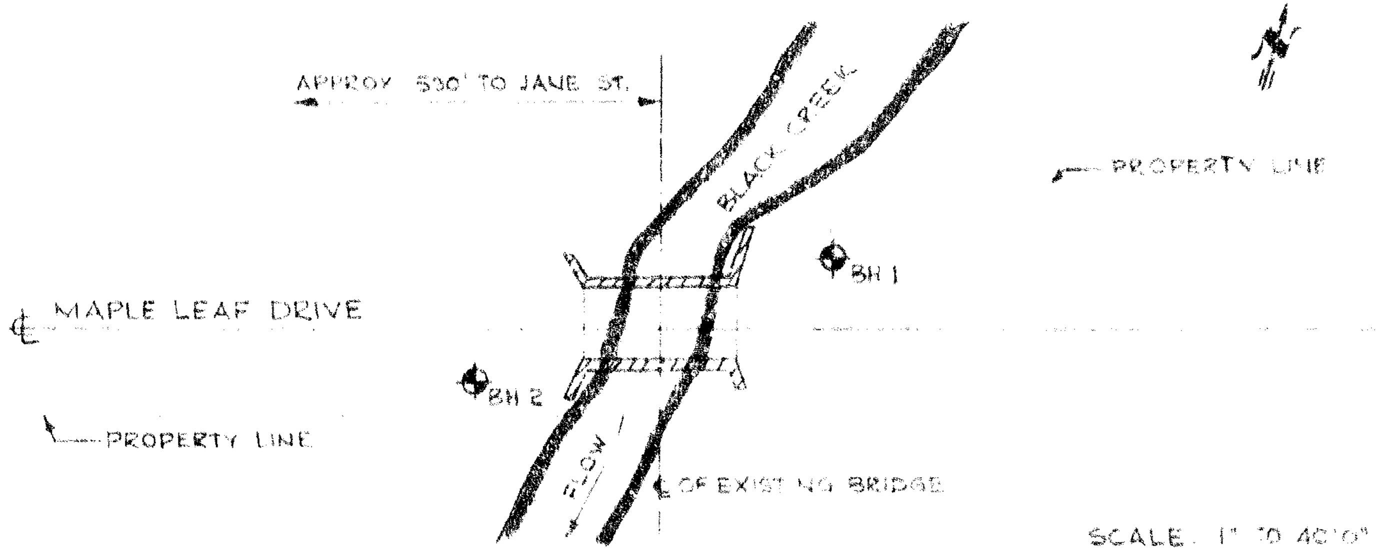
ELEVN. DEPTH	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	BLOWS / FT.
396.4	GROUND LEVEL			
0.0	VERY LOOSE TO LOOSE BROWN SILTY SAND WITH GRAVEL, TRACE OF CINDERS AND WOOD (FILL)	1	2" D.O.	8
		2	C.S.	—
		3	2" D.O.	3
389.4 7.0		4, 5	"	12
388.3 8.1	COMPACT BROWN SILTY SAND TRACE OF GRAVEL			
	STIFF GREY CLAYEY SILT SOME SAND AND TRACE FINE GRAVEL	6	2" D.O.	19
		7	"	10
374.9		8	2" D.O.	4
21.5	END OF HOLE			



VERTICAL SCALE 1 INCH TO 5 FEET

GOLDER & ASSOCIATES

DRAWN A.T.
CHECKED

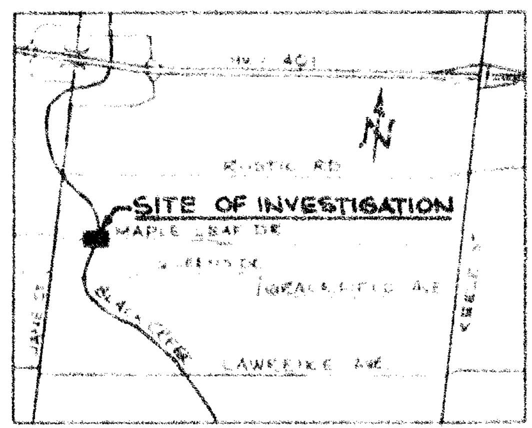


LEGEND

BOREHOLE IN PLAN

NOTE: FOR SOIL STRATIGRAPHY REFER TO FIGURE 2

REFERENCE: DWG NO A 3162 - SK1, EWBANK, TUPPER AND ASSOC. LTD. PLAN SHOWING SITE



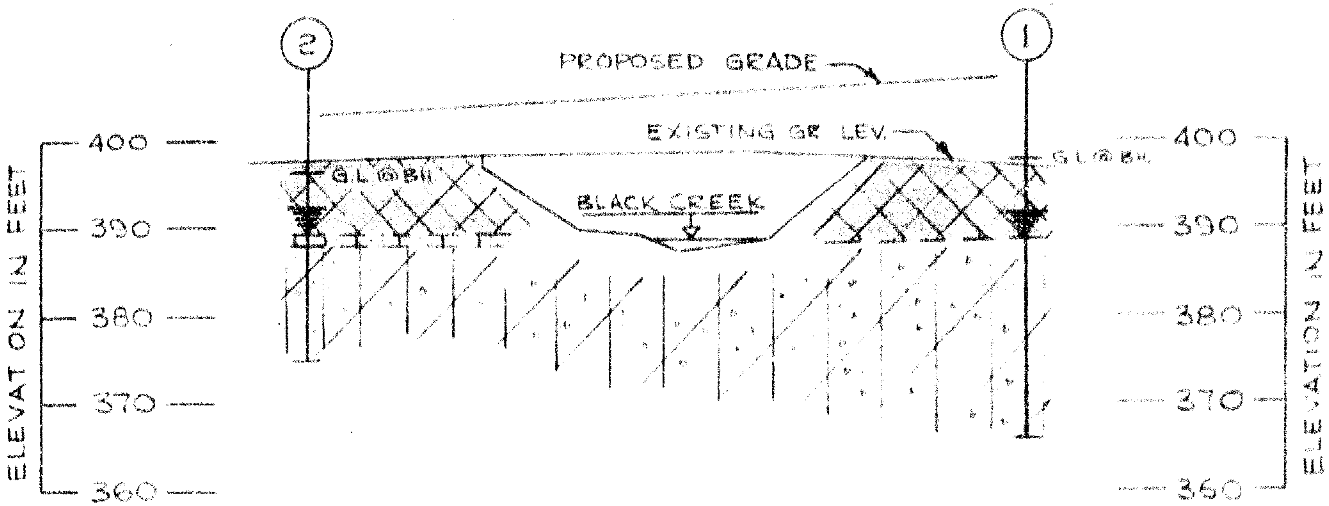
KEY PLAN

SCALE 1" TO 3100' APPROX

GOLDER & ASSOCIATES

EWBANK, TUPPER & ASSOCIATES LTD.
TORONTO ONTARIO
PROPOSED BLACK CREEK BRIDGE
MAPLE LEAF DRIVE NORTH YORK TWP
BORING PLAN

FIGURE 1



SCHEMATIC SECTION ALONG ℄ - MAPLE LEAF DRIVE

SCALE : 1" TO 20'0"

LEGEND

(1) BOREHOLE IN ELEVATION

WL. IN BOREHOLE JULY 3, 1962

NOTE: FOR LOCATION OF BOREHOLES REFER FIGURE 1

REFERENCE : DWG. NO. A 3162 - SK 2, EWBANK TUPPER AND ASSOC. LTD. PROFILE ALONG CENTRELINE SITE.

STRATIGRAPHY

VERY LOOSE TO LOOSE BROWN SILTY **SAND**, TRACE TO SOME GRAVEL, CINDERS, BRICK FRAGMENTS AND [illegible] **(FILL)**

COMPACT BROWN **SILTY SAND**, TRACE OF GRAVEL

VERY STIFF TO STIFF GREY **CLAYEY SILT** SOME SAND AND TRACE FINE GRAVEL

EWBANK, TUPPER & ASSOCIATES LTD.
TORONTO ONTARIO.
PROPOSED BLACK CREEK BRIDGE
MAPLE LEAF DRIVE NORTH YORK TWP.
SOIL STRATIGRAPHY

FIGURE 2

GOLDER & ASSOCIATES

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Stermac
Principal Foundation Eng.
Materials & Research
LAB. BLDG

From: G. C. E. Burkhardt

Date: July 25 1962

Our File Ref. B A 1466

In reply to

Subject: Township of North York
Bridge over Black Creek
Maple Leaf Drive

We are enclosing herewith one (1) copy of the Foundation Report, by Golder and Associates, for your comments.

The structure is a single 55 foot span structure with simply supported steel beams and concrete deck, supported by concrete abutments. The concrete spread footings are founded at Elev. 382.5.

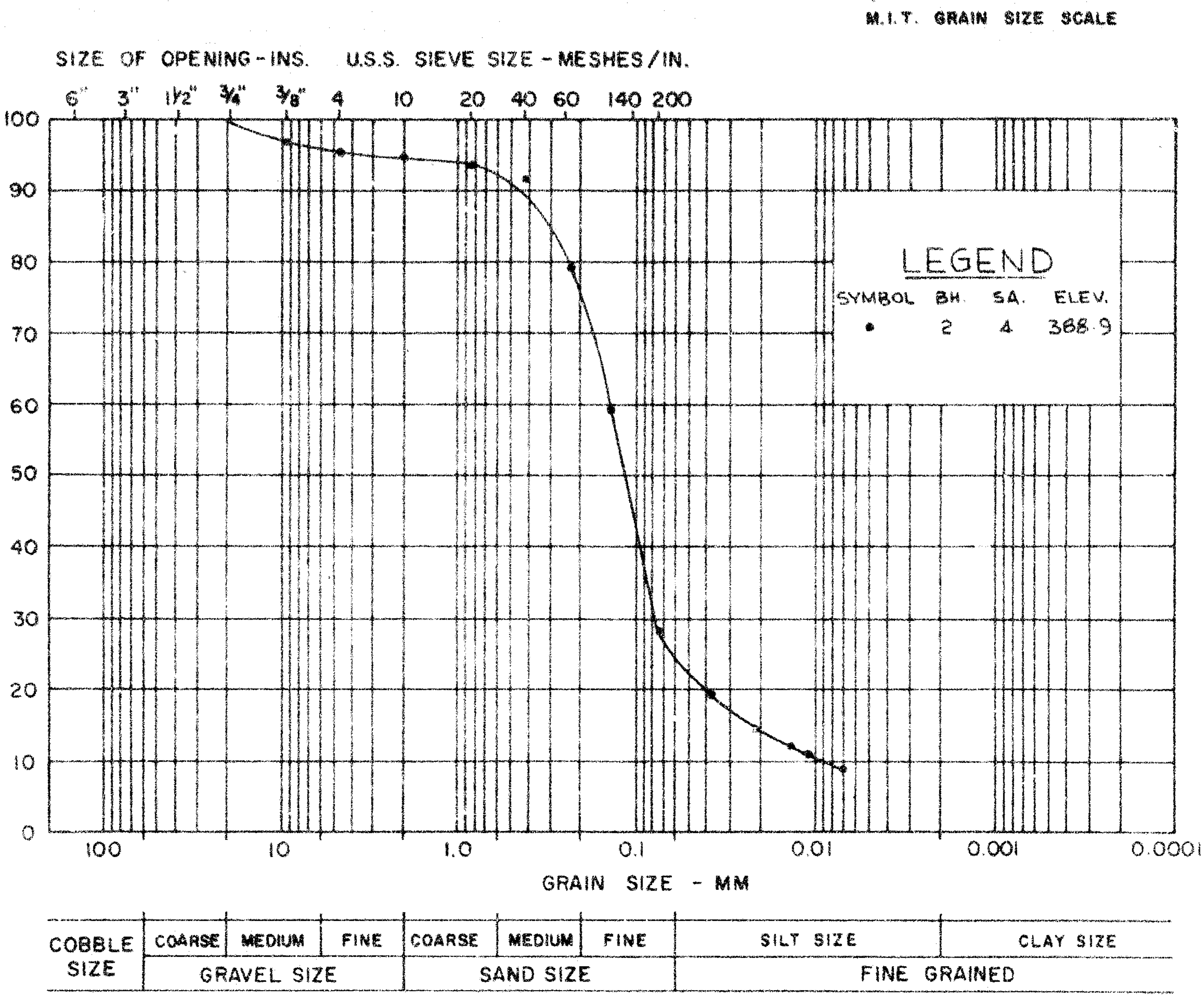
We would like to approve the preliminary design as soon as possible and would appreciate it very much if we could have your comments at your earliest convenience.

GCEB/m

G. C. E. Burkhardt
G. C. E. Burkhardt
for K. L. Kleinsteiber
Municipal Bridge Liaison Engineer

GRAIN SIZE DISTRIBUTION

SILTY SAND



GOLDER & ASSOCIATES

FIGURE 3

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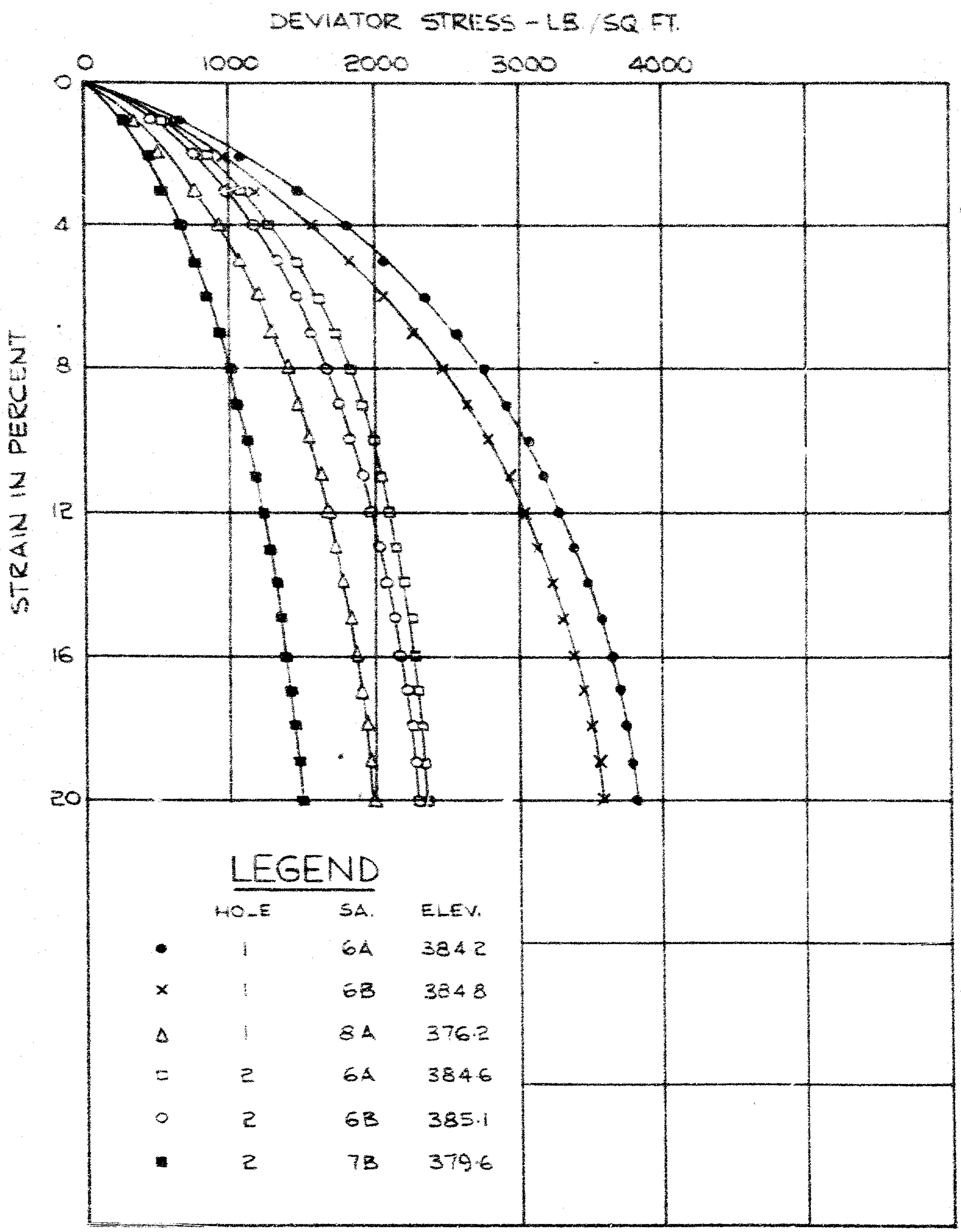
UNDRAINED TRIAXIAL COMPRESSION TESTS
STRESS – STRAIN CURVES
CLAYEY SILT

FIGURE 4



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