#59-F-89

PROPOSED PARK RD. NORTH BRIDGE BRANTFORD

cc: Foundations Office.

file 28-2.

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Section.

March 7, 1960.
Re: Proposed Park Road North Bridge, City of Brantford.

Attention: Mr. Ken. Kleinsteiber.

Enclosed herewith are the borehole logs and summary of test results of two additional borings carried out at the above noted structure location. The location plan and subsoil profile are also attached.

Our recommendations pertinent to the foundation design of this structure have been forwarded to you in our previous memo of September 9, 1959.

L. G. Soderman,
PRINCIPAL SOILS & FOUNDATIONS ENGINEER

Per: M. K. Peaker

K. Peaker,
FOUNDATION FIELD SUPERVISING ENGINEER.

KP/MdeF

cc: Foundations Office
Gen. Files.

SUMMARY OF FIELD & LABORATORY TESTS

JOB F 59-89
W.P. None

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
C	C1	0'-3'	Med. gr. silty sand & sandy silt	-	14.9	-	-	-	-	
	S2	3'-4.5'	"	8	-	-	-	-	-	No Recovery
	S3	3'-4.5'		-	21.6	-	-	-	-	
	T4	6'-7'	Med. dense gr. silty sand & sandy silt	17	18.6	-	-	1578	131.6	
	T5	9'-10.5'	"	20	16.5	-	-	3400	131.8	
	T6	12'-13.5'	Dense gr. clay silt with clay interbeds	18	-	-	-	-	-	
	S7	15'-16.5'	"	18	-	-	-	-	-	
	T8	20'-21.5'	"	15	-	-	-	-	-	
	S9	25'-26.5'	"	32	-	-	-	-	-	
D	S1	3'-4.5'	Dense gr. silty sand & sandy silt	47	-	-	-	-	-	
	S2	6'-7.5'	"	36	17.1	-	-	-	-	
	S3	9'-10.5'	"	32	17.3	-	-	-	-	
	S4	14.3'-15.8	Dense gr. clay silt with clay interbeds	16	-	-	-	-	-	
	T5	19'-20.5'	Med. reddish br. clay silt with clay interbeds	10	28.7	-	-	1005	129.6	
	T6	24'-25.5'	"	12	-	-	-	-	-	

Borings A & B carried out by Universal Geotechnique

c Denotes casing sample

T denotes thin walled shelby tube

S denotes split spoon sample

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. None BORE HOLE NO. C

JOB F 59-89 STATION See drawing

DATUM 725.0' COMPILED BY B.K.

BORING DATE Sept. 3/59 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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	groundlevel	725.0	0
	W.L. ▽ 723.5		
	Medium dense grey silty sand and sandy silt.		
		713.0	10
	Dense grey clay silt with clay interbeds.		20
		698.5	30
	End of borehole		
	Penetration resistance profile shown; obtained by driving a 2" dia cone from ground surface to depth indicated with an energy of 350 lb.ft per blow.		40

STRENGTH AND PENETRATION RESISTANCE
P.S.F. 1000 2000 3000 4000
BLOWS/FT. 25 50 75 100

Penetration ends at Elev. 700.0'

CONSISTENCY
MOIST. CONTENT - % DRY WT. 10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
C 1	-
S 2	No. Rec'y
S3	-
T 4	131.6
T 5	131.8
T 6	-
S 7	-
T 8	-
S 9	-

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. None — BORE HOLE NO. D

Hwy. No. F 59-89 — STATION See drawing

DATUM 725.0' — COMPILED BY R.K.

BORING DATE Sept. 4/59 — 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 (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +
NATURAL MOISTURE AND LIQUIDITY INDEX X
LIQUID LIMIT →
PLASTIC LIMIT ⊢

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Groundlevel	725.0	0
	W.L. ▽	723.5	
	Dense grey silty sand and sandy silt		
		710.7	
	Med. grey clay silt with clay interbeds changed to reddish in color below Elev. 706.0'		
		699.5	
	End of borehole		

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

STRENGTH AND PENETRATION RESISTANCE — P.S.F. 1000 2000 3000 4000 — BLOWS/FT. 25 50 75 100

0 10 20 30 40

Penetration ends at Elev. 716.4'

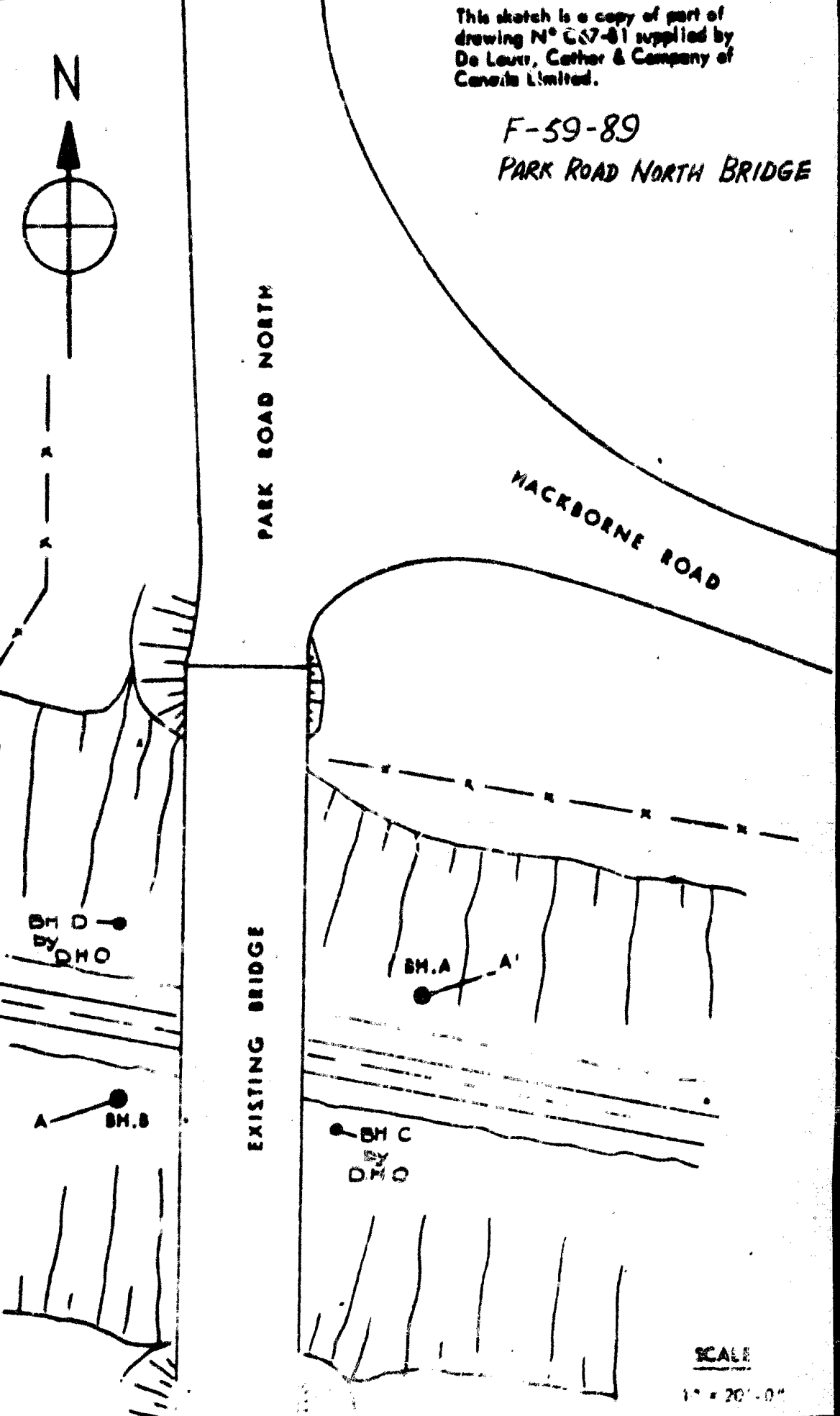
CONSISTENCY — MOIST. CONTENT - % DRY WT. 10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
S 1	-
S 2	-
S 3	-
S 4	-
T 5	129.6
T 6	-

This sketch is a copy of part of drawing N° C57-81 supplied by De Leuw, Cather & Company of Canada Limited.

F-59-89

PARK ROAD NORTH BRIDGE



Bore hole C

Ground level	N	725.0
Wk ▽		723.5
Medium dense grey silty sand and sandy silt.	8	
	17	
	20	
	18	713.0
Dense grey clay silt with clay interbeds.	18	
	15	
	32	698.5

Bore hole D

by Dept of Highways

Ground level	N	725.0
Wk ▽		723.5
Dense grey silty sand and sandy silt.	47	
	36	
	32	
	16	710.7
Medium grey clay silt with clay interbeds changed to reddish in color below Elev. 706.0'	10	
	12	699.5

Bore hole A.

by Geotechnique.

Ground level	N	725.8
Dense sands and silts. ▽	60	722.3
	48	
	24	716.3
Stratified silts and clays.	11	
	15	
	20	
	16	
	21	
	14	
	50	690.8
Dense sands and silts.	55	

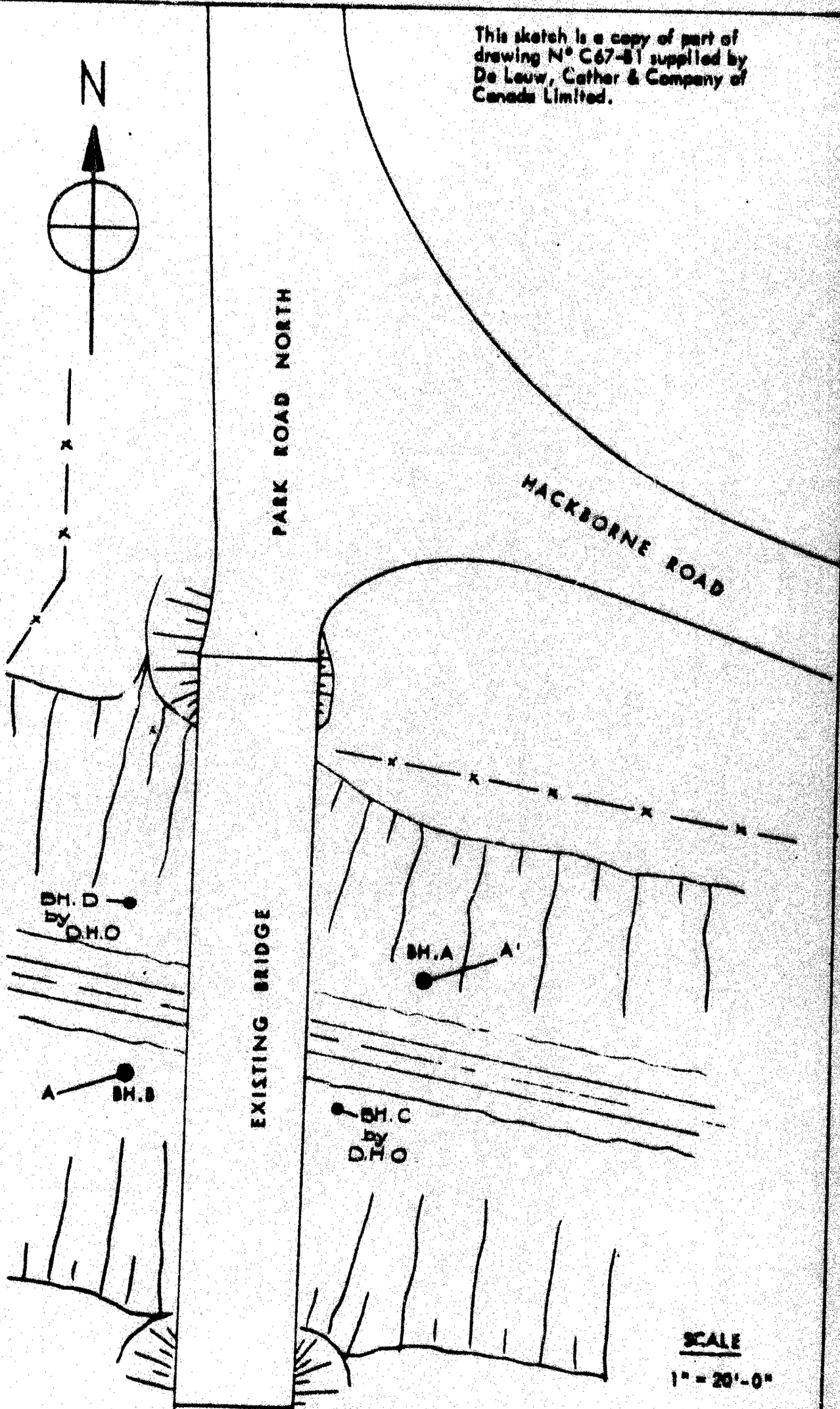
Bore hole B.

Ground level	N	725.3
Dense sands and silts ▽		722.3
	80	
	23	
	16	715.8
Stratified silts and clays.	33	
	12	
	16	
	11	
	33	
	20	691.3
Dense sands and silts.	40	
	60+	685.3

F-59-89

PARK ROAD NORTH BRIDGE

This sketch is a copy of part of drawing N° C67-81 supplied by De Leuw, Cather & Company of Canada Limited.



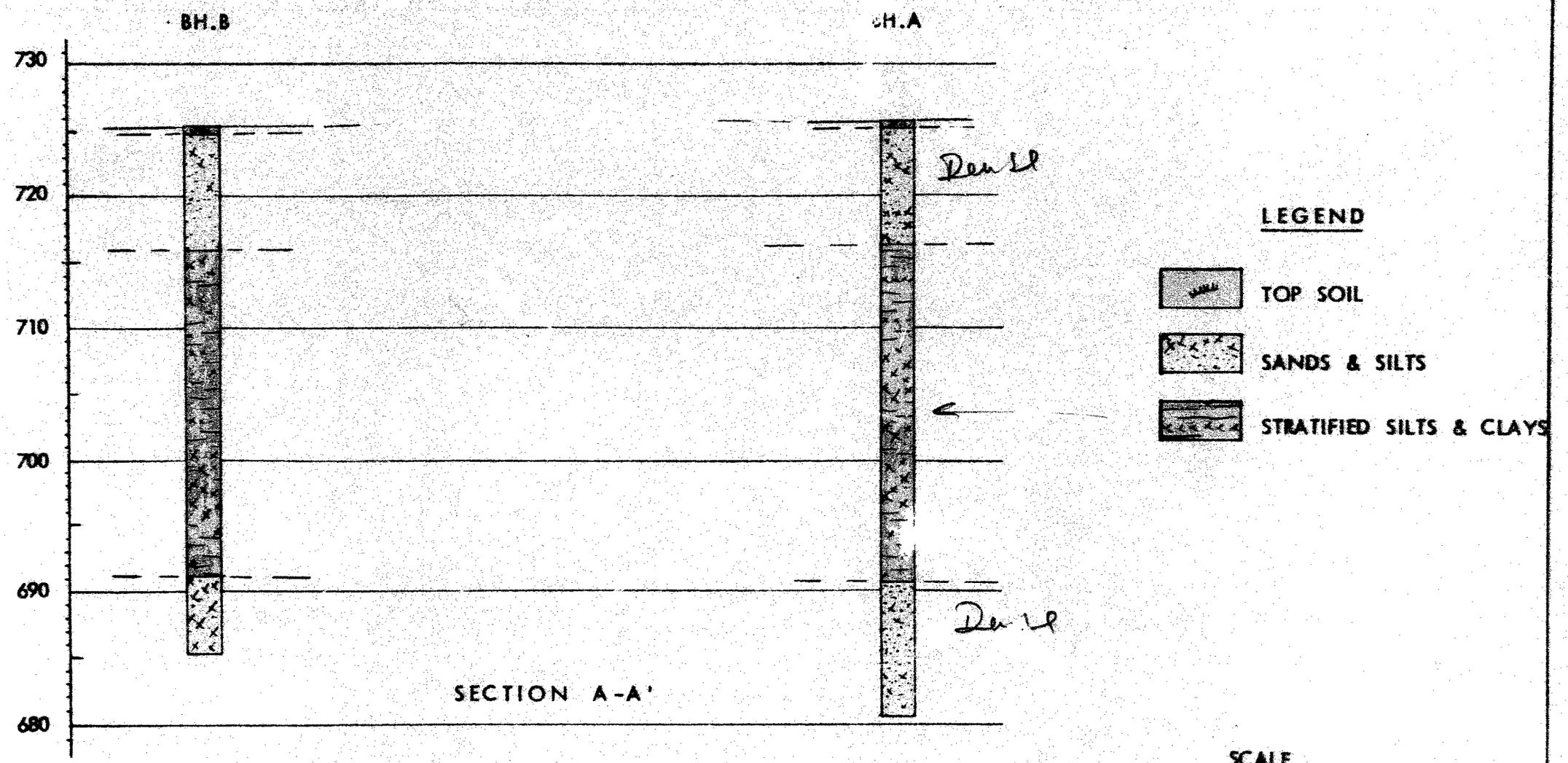
SCALE
1" = 20'-0"

PROJECT Proposed Park Road North Bridge, Brantford.
TITLE Borehole Location Plan
DWG. No. 2 ORDER No. T.357/79

UNIVERSAL GEOTECHNIQUE LIMITED

PROJECT Proposed Park Road North Bridge, Brantford.
TITLE Borehole Section
DRG. NO. 3 ORDER NO. T.357/59

UNIVERSAL GEOTECHNIQUE LIMITED



SCALE

1" = 10'-0"

UNIVERSAL **GEOTECHNIQUE** LIMITED

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT Proposed Park Road North Bridge, Brantford, Ontario. ORDER NO. T.357/59

CLIENT City of Brantford (De Leuw, Cather & Company of Canada Limited, Consulting Engineers)

BOREHOLE NO. BH.A DIAMETER 2-1/2" CASING 2-1/2"

BOREHOLE LOCATION See Sketch INCLINATION Vertical BEARING —

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Brown loam with organic matter.	725.8			Zero 0'-3"			
Dense greyish brown fine silty SAND.			• 1	Free Water		60	Damp. Low dry strength.
Dense grey brown silty SAND. Traces of bedding.			• 2			45	Wet. Low dry strength.
Firm grey brown silty SAND.			• 3			24	do
Firm greyish brown silty to very silty CLAY with bands of clayey silt.			4	9'-6"		11	Moist. Clay: High dry strength. Silt: Medium dry strength.
do Contains layer of silty sand.			• 5			15	do
Firm grey brown SILT with interbeds of very silty clay.			• 6	14'-9"		20	Wet. Clay: High dry strength. Silt: Medium dry strength.
Firm reddish grey SILTS interbedded with firm grey brown CLAYS.			• 7			16	Moist
do Silt layers thicker and more pronounced.			• 8			21	Moist. Silt: Medium dry strength.
Firm greyish brown very silty CLAY with layers of silt.			• 9			14	Moist. Clay: High dry strength.
Dense brown fine silty SAND.			• 10	35'-0"		50	Wet Low dry strength.
do			• 11			55	do
do			• 12	45'-0"		53	do
				End of Borehole			

SCALE : 1" = 5'-0" • DISTURBED SAMPLE ▮ UNDISTURBED SAMPLE

FORM 6-1A 500 UNITED STATIONERY CO.

UNIVERSAL **GEOTECHNIQUE** LIMITED

SOIL MECHANICS LABORATORY

BOREHOLE LOG

PROJECT Proposed Park Road North Bridge, Brantford, Ontario. ORDER NO. T.357/59

CLIENT City of Brantford (De Leuw, Cather & Company of Canada Limited, Consulting Engineers)

BOREHOLE NO. BH.B DIAMETER 2-1/2" CASING 2-1/2"

BOREHOLE LOCATION See Sketch INCLINATION Vertical BEARING ———

DESCRIPTION OF STRATA	ELEVATION	LEGEND	SAMPLE	DEPTH	THICKNESS	N	REMARKS
Brown loam with organic matter. Brown silty SAND with some organic matter.	725.3			Zero 0'-4"			
				Free Water			
Dense brown fine somewhat silty SAND.			1			80	Wet. Low dry strength.
Firm do			2			23	do
Firm brown fine SAND.			3			16	do
Firm brownish grey slightly sandy SILT with layers of silty clay.			4	9'-6"		33	Wet. Clay: High dry strength. Silt: Medium dry strength.
Soft to firm greyish brown sandy very silty CLAY with layers of sandy silt and silty sand.			5			12	Moist. Clay: High dry strength.
Firm brownish grey SILT grading into very silty CLAY.			6			15	Wet. Clay: High dry strength. Silt: Medium dry strength.
Firm brownish grey silty CLAY with thin layers of silt.			7			11	Moist. High dry strength.
				24'-3"			
Firm brownish grey somewhat clayey SILT.			8			33	Moist. Medium to high dry strength.
Stiff to very stiff brownish grey very silty CLAY.			9			20	Moist. High dry strength.
				34'-0"			
Dense greyish brown somewhat sandy SILT.			10			40	Moist. Medium dry strength.
do			11	40'-0"		60	do
				End of Borehole			

SCALE : 1" = 5'-0" • DISTURBED SAMPLE ▮ UNDISTURBED SAMPLE

FORM 6-1A 800 UNITED STATIONERY LTD.

PROJECT Park Road North Bridge, Brantford.
TITLE Table N° 1
DWG. NO. ORDER No. L-357/59

UNIVERSAL GEOTECHNIQUE LIMITED

TABLE N° 1

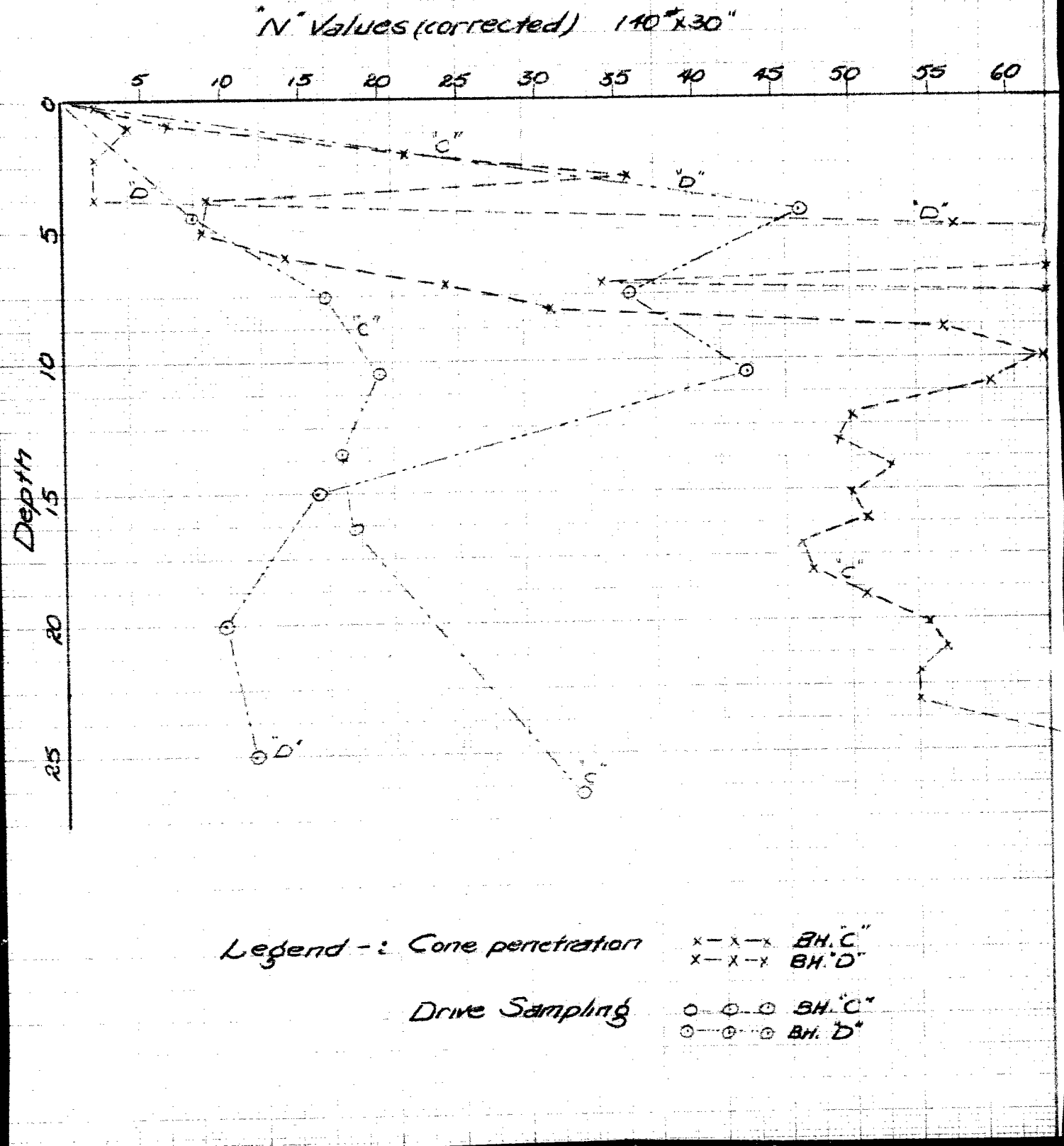
Borehole N°	Sample N°	Depth below ground-surface feet	Natural moisture content %	Unconfined compression strength lbs/sq.ft
BH.A	4	10'-6"to 11'-6"	24.2	1,260
	5	13'-0"to 14'-0"	17.4	
	6	15'-6"to 16'-6"	18.0	
	7	21'-0"to 22'-0"	25.3	2,300
	9	31'-0"to 32'-0"	28.8	1,280
BH.B	5	12'-6"to 13'-6"	21.8	
	6	15'-6"to 16'-6"	18.7	
	7	21'-0"to 22'-0"	30.1	
	8	26'-0"to 27'-0"	19.0	

* * *

F59-89

Graph of "N" Values vs Depth
Boreholes "C" and "D"

Brantford - Pk. Rd. N
Sept 4, 1959



Legend - : Cone penetration
BH. "C"
BH. "D"

Drive Sampling
BH. "C"
BH. "D"

ONTARIO
DEPARTMENT OF HIGHWAYS

Memo to Mr. Ken Peaker. *Date* August 28/59.

Subject Re: Report on Foundation Investigation for Proposed Park Road North Bridge, City of Brantfor

From Larry Soderman.

Ken Kleinsteiber of the Bridge Office has requested that we review the contents of Universal Geotechnique's report for the above structure.

In particular, Ken is concerned about the possibility of using spread footings founded at 724'. At this elevation and below, the Consultants have defined a deposit of sand, with "N" values varying from 65 to 20. They have submitted no grading curves and, generally, the report is inadequate. Before we can confirm the use of spread footings, it will be necessary to resolve the density of the sand layers -- Ken is suspicious that the material is frozen.

Two short borings - 25 feet should be adequate - Bruce Davis will be sending us authorization in memo form with the charge number noted.

Larry

UNIVERSAL
GEOTECHNIQUE
LIMITED

Dist. 28-4

59-F-264M

REPORT

on

FOUNDATION INVESTIGATION

for proposed

PARK ROAD NORTH BRIDGE

CITY OF BRANTFORD

ONTARIO

Report N° T.357/59

2924 Bloor Street West,
Toronto 18, Ontario.

REPORT

on

FOUNDATION INVESTIGATION

for proposed

PARK ROAD NORTH BRIDGE

CITY OF BRANTFORD

ONTARIO

INTRODUCTION

The City of Brantford propose to replace the old timber bridge, which at present carries the Park Road North traffic over the Canadian National Railway line, with a new structure for which designs are being prepared by De Leuw, Cather & Company of Canada Limited, Consulting Engineers.

Universal GEOTECHNIQUE Limited were requested to carry out a foundation investigation in accordance with the Consulting Engineers' requirements and this Report contains the pertinent data and the findings of the investigation.

AVAILABLE INFORMATION

It is understood that the design for the proposed bridge envisages a simply supported structure 72 feet wide and comprising 9 longitudinal beams supported on abutments of reinforced concrete 30 feet high and 3 feet thick. Beam reactions from dead and live loads are estimated as 54 kips.

Drawing N° C 67-81 was provided by the Engineers to show the location of 2 exploratory boreholes, and drawing N° 2 of this Report has been reproduced therefrom.

THE SITE

The new bridge will be constructed on the site of the existing bridge which is situated where Park Road North crosses the C.N.R. track just South of Hackborne Road.

The rail track at this point is in a cutting heightened by the fill approaches to the existing bridge.

SUBSURFACE EXPLORATION

Subsurface exploration consisted of 2 exploratory boreholes positioned on either side of the rail track and in the positions shown on drawing N° 2, the work being carried out during the period 3rd to the 7th of February, 1959.

Soil samples were obtained at intervals of about 2-1/2 feet to a depth of 15 feet and thereafter at intervals of 5 feet. Where noticeable changes of strata occurred, the depths of such changes were recorded.

Due to an obstruction, borehole BH.B was moved 8 feet westward from its originally designated position.

The state of compaction of essentially cohesionless soil and the consistency of cohesive soil were determined by standard penetration tests taken during the operation of soil sampling. (The standard penetration test, as referred to in this Report, involves the recording of the number of blows (N) of a 140 lb. hammer falling 30 inches that are required to drive a 2 inch diameter split barrel sampler 1 foot into the soil at the bottom of the borehole, after an initial penetration of 6 inches).

Details of the strata encountered as determined by laboratory examination of the soil samples, together with the results of standard penetration tests, are given on the borehole logs.

The positions of the boreholes were staked and the elevations of the ground surface obtained by the Staff of GEOTECHNIQUE, the elevations being referred to the top of the north rail just opposite borehole BH.A, the elevation of which was taken as 727.65.

Subsurface conditions given in this Report are those indicated by material encountered in the boreholes. The accuracy of extrapolation to obtain the soil profile should be associated directly with the geological conditions and inversely with the spacing of the boreholes.

GEOLOGICAL FEATURES

The site is within an area forming the Northern extremity of a region known as the Norfolk Sand Plain: This sand plain is essentially a large deltaic deposit laid down by glacial melt waters which drained into Lake Warren.

From the information obtained from the exploratory boreholes, the strata down to the explored depths can be classified as follows:

(a) **TOP SOIL**

A thin cover of a few inches of brown loam with organic matter was present in both boreholes.

(b) **SANDS & SILTS**

The fine silty sands and sandy silts belong to the same lithological unit as the stratified silts and clays described in the next classification, and are essentially of lacustrine origin: They have been separated only because of the distinct difference in their engineering properties. The silty sands and sandy silts are present above elevation 716 and below elevation 691 approximately.

These deposits range from a firm to dense state of compaction and exhibit only occasional traces of bedding.

(c) STRATIFIED SILTS & CLAYS

The stratified silts and clays do not exhibit very pronounced bedding, silts generally grading into clays and clays grading into silts, but locally silt seams appear in silty clays and clay seams in silts.

The clays are generally of a soft to firm consistency, whilst the silts can be described as firm.

Free water was encountered at an approximate elevation of 722 during the period of exploration.

DISCUSSION

Soil Conditions

The results of the subsurface exploration and subsequent laboratory testing confirm the presence of deltaic deposits beneath the proposed site. For engineering purposes the strata can be divided as follows:

(a) Upper stratum of sands and silts about 10 feet thick.

(b) Intermediate stratum of silts and clays about 25 feet thick.

(c) Lower stratum of sands and silts - 10 feet penetrated.

Foundations

The upper sands and silts exhibit variable density and the stratum is of limited thickness. They would support shallow foundations of small width designed for an allowable bearing capacity of 1-1/2 tons/sq.ft. but the close proximity of the relatively soft underlying stratified silts and clays causes concern with regard to foundations for a bridge.

It is estimated that the loading on the abutment foundation will probably not exceed 12 tons per foot run, and based on this value the use of spread footings designed for an allowable bearing capacity of 1-1/2 tons/sq.ft. and located 6 feet below the existing ground surface, would probably result in a settlement of several inches due to consolidation.

If the foregoing degree of settlement is beyond tolerable limits, then pile foundations deriving support from the lower sands and silts that exist in a denser state is an obvious choice.

No particular construction difficulties need be envisaged but care should be taken not to disturb the fine sands and silty sands during any excavation below the water table.

CONCLUSIONS

Whilst it is possible to use spread footings for the support of the abutments to the proposed bridge, care would have to be taken in their design and a possible settlement of several inches would have to be allowed for.

If pile foundations are adopted they could derive support from the lower sands and silts which exist below about elevation 691 and are in a dense state.

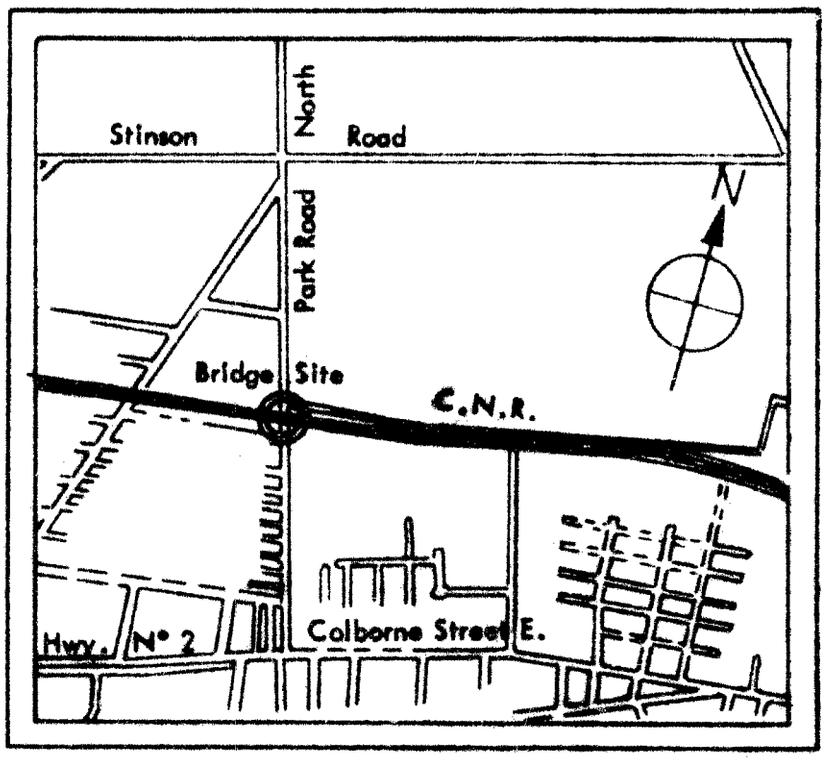
Universal GEOTECHNIQUE Limited,

L. Baskin, P.Eng.
Engineering Geologist.

February, 1959.

Report N° T. 357/59

KEY PLAN



SCALE

0 1000 2000 3000 4000 5000 ft.

PROJECT Proposed Park Road North Bridge, Brantford.

TITLE Key Plan

DRG. NO. 1 ORDER NO. T.357/59

UNIVERSAL GEOTECHNIQUE LIMITED