

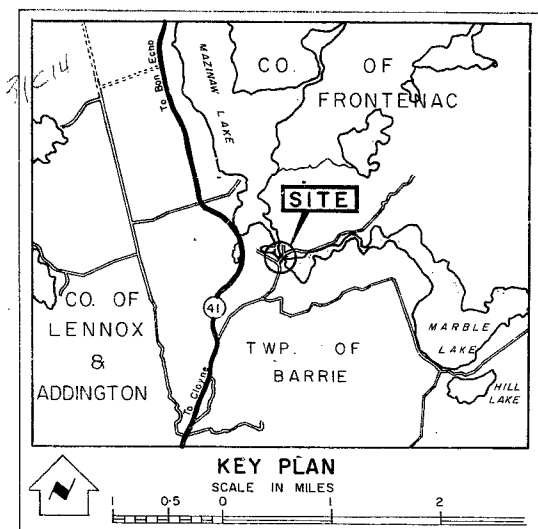
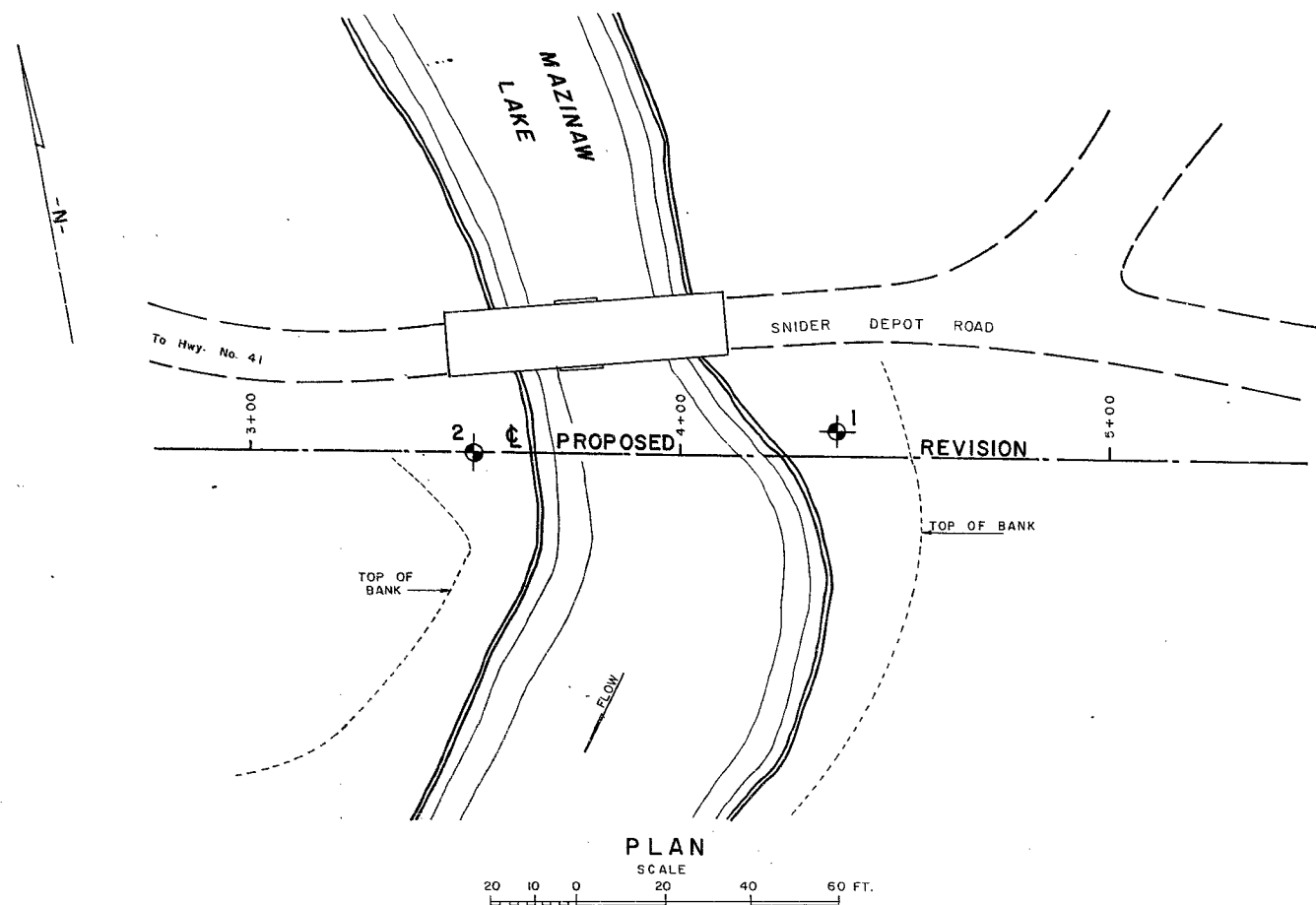
#63-F-93

W.P. MUNIC.

SNIDER DEPOT

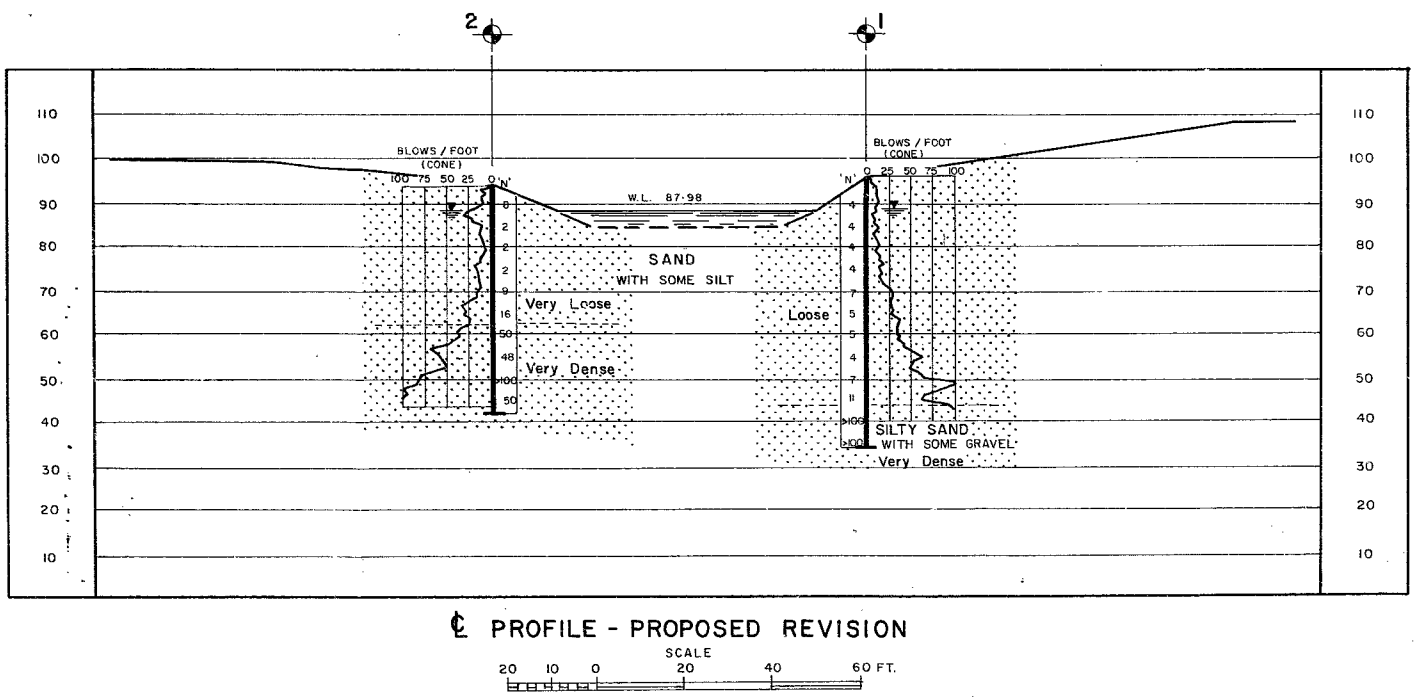
RD. & MAZINAW

LAKE BRIDGE



LEGEND			
	BORE HOLE		
	CONE PENETRATION HOLE		
	BORE & CONE PENETRATION HOLE		
	WATER LEVELS ESTABLISHED AT TIME OF FIELD INVESTIGATION.		
	(AUG. 22, 1963)		
NO.	ELEVATION	STATION	OFFSET
1	95.5	4+36	5' LT.
2	94.0	3+52.5	CL

NOTE  
THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DETERMINED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED TO BE CONTINUOUS AND MAY BE SUBJECT TO CONSIDERABLE ERROR.



DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & RESEARCH SECTION			
MAZINAW LAKE BRIDGE			
AND			
SNIDER DEPOT ROAD			
ORIGINATED V. KORLU	DISTRICT NO. 10	DATE SEPT. 23, 1963	
DRAWN F. CLARK	W.P. NO. —	JOB NO. 63-F-93	
CHECKED [Signature]	SCALE	DRAWING NO.	
APPROVED [Signature]	AS SHOWN	63-F-93A	

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

TO: Mr. A. M. Toye,  
Bridge Engineer,  
Bridge Division.

FROM: Mr. A. G. Stermac,  
Principal Foundation Engr.,  
Foundation Section,  
Materials & Research Division.

Attention: Mr. K.L. Kleinsteinber

DATE: October 31, 1963

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For

Proposed New Structure at the  
Crossing of Relocated Snider Depot  
Road and Mazinaw Lake, County of  
Frontenac, Twp. of Barrie, Lot 31,  
Conc. IX, District No. 10, Kingston;  
W.J. 63-F-93 -- (Municipal Job)

Attached, we are forwarding to you, our detailed  
foundation investigation report on the subsoil conditions  
existing at the above-noted structure location.

We believe that you will find the factual data and  
recommendations contained therein, adequate for your future  
design work. Should further information be required, please  
feel free to call on our Office.

KYL/MdeF

Attach.


cc: Messrs. K. L. Kleinsteinber (3)

J. P. Howard

G. E. French

J. E. Gruspier

Foundations Office ✓  
Gen. Files

  
K. Y. Lo,  
SUPERVISING FOUNDATION ENGR.  
For:  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.

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-

# FOUNDATION INVESTIGATION REPORT

For

Proposed New Structure at the  
Crossing of Relocated Snider Depot  
Road and Mazinaw Lake, County of  
Frontenac, Twp. of Barrie, Lot 31,  
Conc. IX, District No. 8, Kingston.  
W.J. 63-F-93 -- (Municipal Job)

## 1. INTRODUCTION:

The Municipal Bridge Liaison Engineer, Mr. K.L. Kleinsteinber, requested the Foundation Section, in a memo dated July 26, 1963, to carry out an investigation at the above-mentioned location. Subsequently, the field investigation was carried out at the site to determine the subsoil conditions. This report contains the results of this investigation, together with the recommendations pertaining to the design of the structure foundations and approach embankments.

## 2. DESCRIPTION OF SITE:

Snider Depot Road is a 15-ft. wide gravel road and runs from east to west at this location. The existing structure over Mazinaw Lake is only 14 ft. wide and some 65 ft. long, which carries only single-lane traffic. The timber deck of the bridge is in poor condition, primarily due to decay.

## 3. DESCRIPTION OF FIELD AND LABORATORY WORK:

Field work consisted of two boreholes and two dynamic cone penetration tests. The boring was carried out by means of conventional diamond drilling equipment adapted for soil sampling purposes.

Samples were recovered at required depths by means of a

cont'd. /2 ...

3. DESCRIPTION OF FIELD AND LABORATORY WORK: (cont'd.) ...

2" O.D. split-spoon sampler and the energy used in driving it, conforms to the requirements of the Standard Penetration Test.

Detailed logs of each borehole and penetration test are given on the records of boreholes at the end of this report. The locations and elevations of all boreholes are shown on Dwg. No. 63-F-93A, appended to this report.

Samples were visually examined and identified in the field as well as in the laboratory.

4. SUBSOIL CONDITIONS:

4.1) General:

Subsoil at the site consists mainly of granular deposits having a relative density of loose to very dense. A detailed description of this granular deposit encountered in each boring, is given in Appendix I of this report. The estimated stratigraphical profile of Dwg. No. 63-F-93A is based upon this information.

4.2) Silty Sand:

A deposit of silt and sand was observed in all the boreholes immediately below the ground surface. The percentage of silt and sand varied somewhat throughout the stratum, but in general, the deposit may be described as fine to coarse sand with silt, changing to silty sand with gravel. The lower boundary of the stratum was not determined, but extends at least to a depth of 61 ft. from the ground surface. Standard Penetration values ranged from 2 blows/ft. to in excess of 100 blows/ft. The 'N' values were observed to be well over 40 blows/ft. below elev. 43.5 in B.H. #1 and elev. 60.0 in B.H. #2.

cont'd. /3 ...

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

4.2) Silty Sand: (cont'd.) ...

This indicates that the deposit is essentially loose to compact above elev. 43.5 and elev. 60.0 in B.H. #1 and B.H. #2, and changing to very dense below the above-mentioned elevations.

5. GROUND WATER CONDITIONS:

No attempt was made to establish an accurate ground water level by means of piezometers. Observations carried out during the time of the field investigation, indicated that the water level in the boreholes was approximately 5 to 7 ft. below the natural ground. The exact water levels observed at the time of investigation, are shown in the borehole logs (Appendix I).

The water level of Mazinaw Lake at the crossing was at elev. 88.0 which corresponds to the water levels in the boreholes.

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct a 55-ft. single-span structure where the relocated Snider Depot Road crosses the Mazinaw Lake. The new structure will be located approximately 30 ft. south of the present bridge.

Subsoil at the site generally consists of loose to very dense granular deposits. The maximum and minimum depths to the dense stratum were observed to be 52.0 ft. and 35.0 ft. at the east and west banks of the lake, respectively.

Because of the presence of 27 ft. to 47 ft. of loose sand, adequate bearing capacity may not be achieved using spread footing support. Therefore, the structure should be supported on end-bearing

cont'd. /4 ...

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

piles driven into the very dense sand stratum. For example, 14" Ø timber piles, untreated (if pile caps are formed below the lake or ground water level), driven to practical refusal into the very dense sand stratum, a safe design load of 25 tons/pile may be used. However, the driving of piles in the field by the use of the Hiley Formula, as per D.H.O. Standards DD-1218 and DD-1219.

A dewatering scheme will be necessary, as excavations for pile caps will be carried out below the prevailing ground water level.

At the time of writing this report, the proposed grade of the relocated Snider Depot Road was not available. However, the subsoil generally consists of granular material and, consequently, no stability problems are anticipated for the standard 2:1 side slopes.

7. SUMMARY:

Subsoil at the site generally consists of a granular deposit having a loose to very dense relative density. Maximum and minimum depths to the very dense stratum of sand were observed to be 52 ft. and 35 ft., respectively.

A 55-ft. single-span structure is proposed at the crossing of relocated Snider Depot Road and Mazinaw Lake.

The structure can be supported on end-bearing timber piles driven to practical refusal into the very dense sand stratum. A safe design load of 25 tons/pile may be used for 14" Ø untreated timber piles. A dewatering scheme will be necessary, as excavations for the pile caps will be carried out below the prevailing water level.

cont'd. /5 ...



7. SUMMARY: (cont'd.) ...

Approach fill stability problems are not anticipated for the standard 2:1 side slopes.

8. MISCELLANEOUS:

The field work, performed during the period from August 19 to August 22, 1963, together with the preparation of this report, was undertaken by Mr. V. Darlu, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. M. Devata, Senior Foundation Engineer, who reviewed this report.

Equipment used was owned and operated by Dominion Soil Investigation Ltd.

October 1963

APPENDIX I.

## ABBREVIATIONS USED IN THIS REPORT

### PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

### DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS:-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

### TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H.	SAMPLE ADVANCED HYDRAULICALLY	
	P.M.	SAMPLE ADVANCED MANUALLY	

### SOIL TESTS

Q <sub>u</sub>	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Q <sub>cu</sub>	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q <sub>d</sub>	DRAINED TRIAXIAL	S	SENSITIVITY

# ABBREVIATIONS USED IN THIS REPORT

## SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
$S_r$	DEGREE OF SATURATION
$w_L$	LIQUID LIMIT
$w_p$	PLASTIC LIMIT
$I_p$	PLASTICITY INDEX
s	SHRINKAGE LIMIT
$I_L$	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
$I_C$	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
$e_{max}$	VOID RATIO IN LOOSEST STATE
$e_{min}$	VOID RATIO IN DENSEST STATE
$I_D$	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY $D_r$ IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
$m_v$	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
$C_v$	COEFFICIENT OF CONSOLIDATION
$C_c$	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
$T_v$	TIME FACTOR = $\frac{C_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

## GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

## STRESS AND STRAIN

u	PORE PRESSURE
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

## EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

## FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
$k_s$	MODULUS OF SUBGRADE REACTION

## SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

Copy for the information of

Mr. A. Stermac

Principal Foundation Engineer  
Lab. Bldg.

Mr. T. Kovich,  
Regional Soils Engineer,  
Lab. Bldg.

G.C.E. Burkhardt

July 26, 1963

63-F-93  
County of Frontenac  
New Snider Depot Bridge,  
Twp. of Barrie, Lot 31, Con. IX  
Structure Site No. 7-1

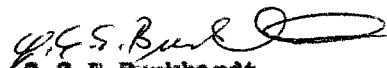
Attached please find a copy of a letter from the Municipal District of Kingston, requesting a foundation investigation at above mentioned bridge site.

We will forward to you a preliminary plan, as soon as we receive the plan. If you should have men and equipment available to carry out the work in the meantime, we could arrange with the Consultant, a meeting at the site, in order to give your men the location of the proposed structure.

Please notify us if and when you could carry out the work requested.

GCER/m

c.c. Mr. A. Stermac

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



## Department of Highways

Municipal Roads Branch,  
Kingston, Ontario.  
July 17th, 1963.

62-F-93

Mr. K. L. Kleinsteinber,  
Municipal Bridge Liaison Engineer,  
Bridge Office,  
Dept. of Highways,  
Downsview, Ontario.

Re: New Snider Depot Bridge, Twp. of Barrie,  
County of Frontenac, Lot 31, Conc. IX.

Dear Sir:

The County of Frontenac has recently assumed the existing 56 foot structure at the above noted location and a new structure is proposed. J. D. Lee and Company has been advised to undertake the design and they wish a foundation investigation be carried out at the proposed site of the new structure. A preliminary site plan is not yet available as the Consultant is waiting for information regarding a Hydro dam located upstream from the proposed site.

Would you arrange for a foundation investigation at this site and advise us as to the date the investigation will commence. The site plan should be ready by that time and we will arrange for one of the Consultant's representatives to be present at the site.

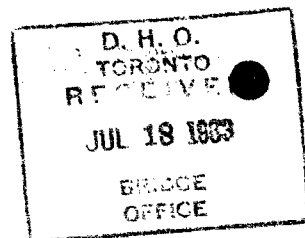
Yours truly,

G. E. FRENCH,  
District Municipal Engineer.

PAS/jd

c.c. Mr. R. B. Allison,  
County Engineer.

STRUCTURE SITE No. 7-1





FOUNDATION SECTION

SOIL PROFILE						DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LQUID LIMIT ——— L	PASTIC LIMIT ——— wp	WATER CONTENT — w	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER TYPE BLOWS / FOOT	ELEV. SCALE		20 40 60 80 100	wP	wL	P.C.F.		
94.0	Groundlevel										
O.O											
G.W. 5.5	Sand with some silt fine to coarse. Very loose to very dense.		1 SS 8	90							
			2 SS 2								
			3 SS 2	80							
			4 SS 2								
			5 SS 9	70							
			6 SS 16								
			7 SS 50	60							
			8 SS 48								
			9 SS >100	50							
42.5			10 SS 50	40							
51.5	End of borehole.			30							