

#

62-F-85

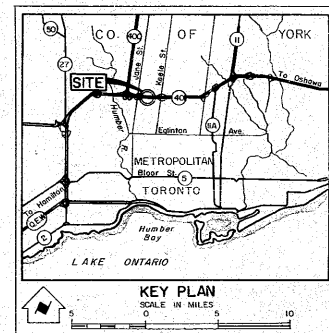
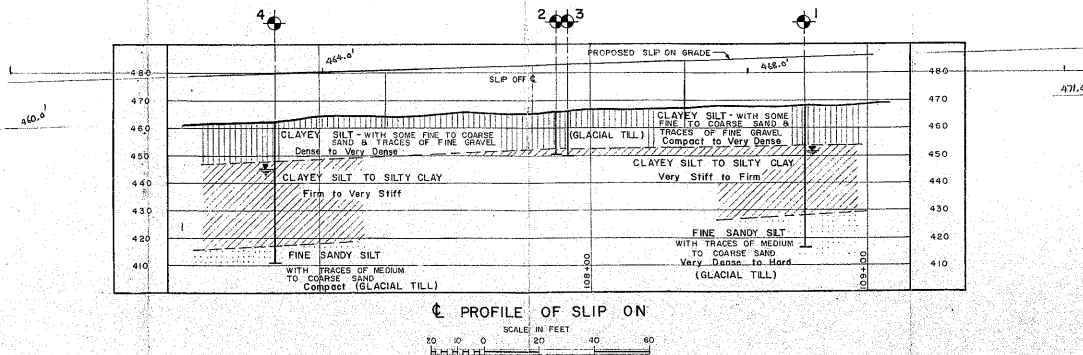
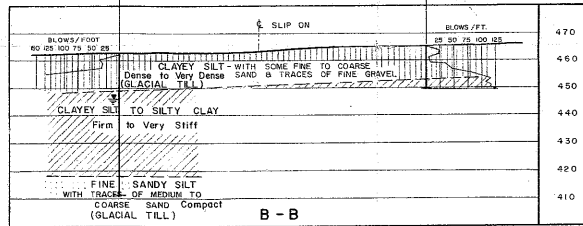
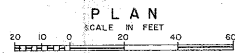
W.P. 105-62

#


HWY. 401

N. SERVICE ROAD


SLIP ON & SLIP OFF




### LEGEND




Bore Hole



Cone Penetration Hole



Bore & Cone Penetration Hole



Water Levels established at time of field investigation, July 7, 1962

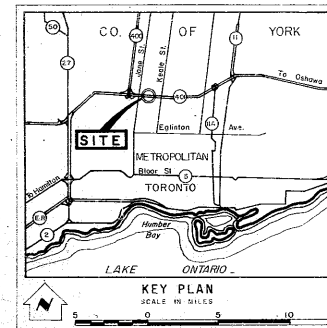
  

NO.	ELEVATION	401 STATION	OFFSET
1	468.0	108 +55	185' LT.
2	465.5	107 +68	170' LT.
3	465.5	107 +64	205' LT.
4	462.5	106 +59	186' LT.

- NOTE -

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & RESEARCH SECTION			
SLIP ON & SLIP OFF			
FOR			
NORTH SERVICE ROAD & HIGHWAY NO. 40			
BETWEEN JANE ST. & KEELE ST.			
ORIGINATED 1	HULLBEC	DISTRICT NO. 6	DATE AUG. 5, 1962
DRAWN	F. CLARK	M.P. NO. 105-62	JOHN NO. 62-F-85
CHECKED <i>W. J. Smith</i>		CONT. NO.	DRAWING NO.
APPROVED	<i>W. J. Smith</i>		62-F-85A



**LEGEND**

- Bore Hole
- ⊕ Cone Penetration Hole
- ⊕ Bore B Cone Penetration Hole
- Water Levels established at time of field investigation.

NO.	ELEVATION	STATION	OFFSET
5	4 6 8' - 4"	2 7 4 + 52	20' RT.
6	4 6 2' - 9	2 7 6 + 29	17'8" RT.
7	4 7 2' - 3	2 7 3 + 35	21'8" RT.
8	4 6 0' - 5	2 7 7 + 38	14'6" RT.

NOTE: HWY. NO. 401 STATIONS USED.

**NOTE**  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION

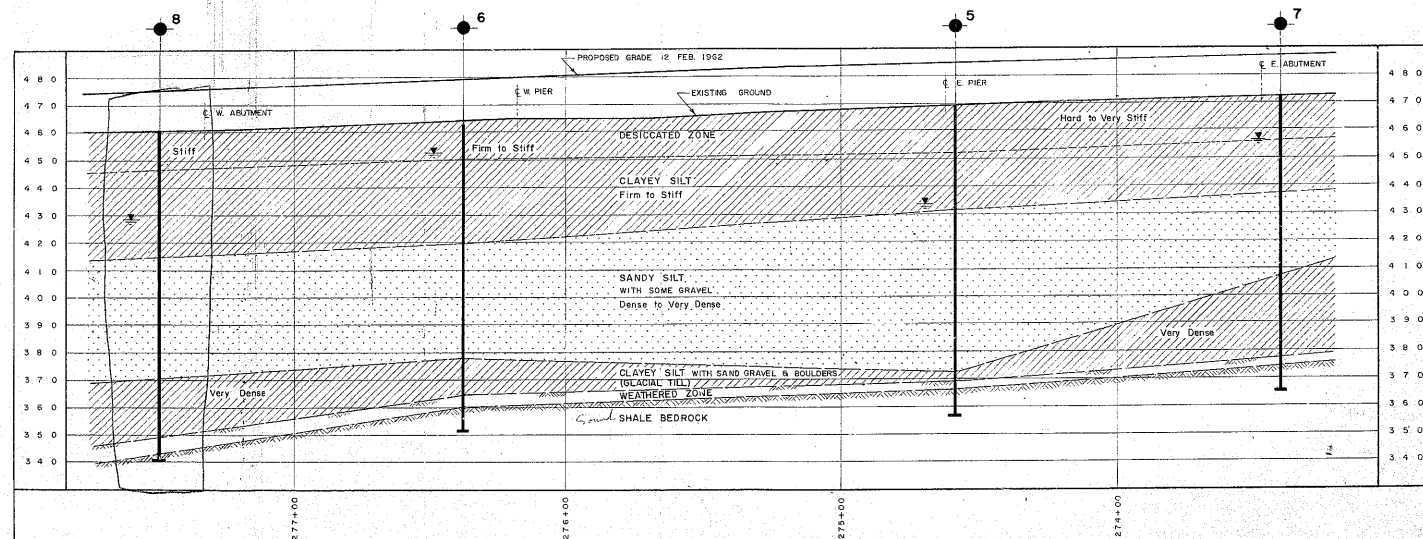
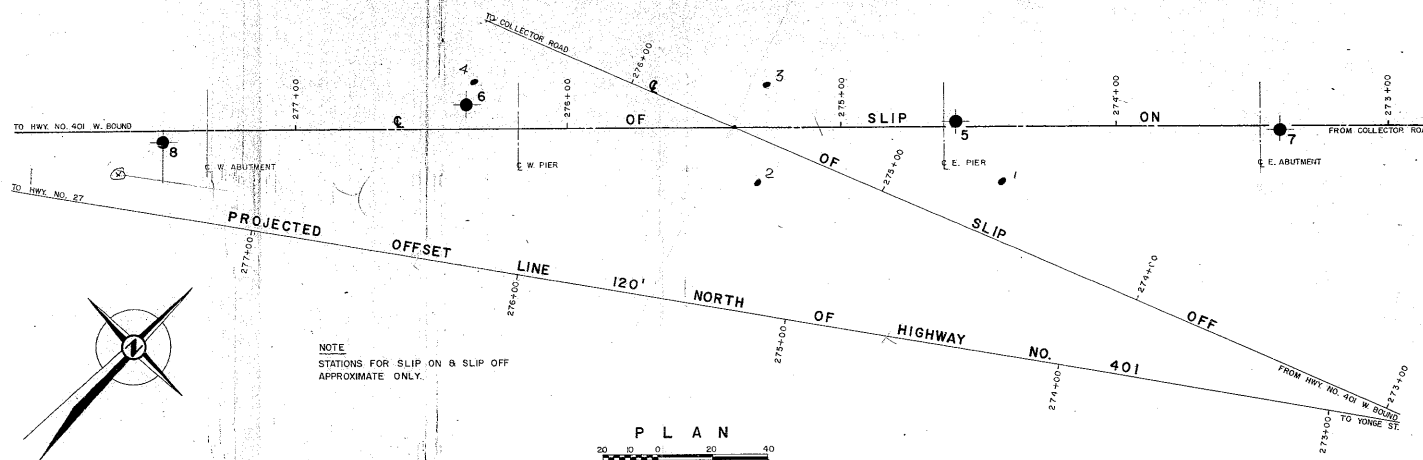
**SLIP ON & SLIP OFF**  
(BASKET WEAVE BRIDGE)

KING'S HIGHWAY NO. 401 NORTH SERVICE ROAD DIST NO. 6r  
CO. YORK METROPOLITAN TORONTO  
TWP. NORTH YORK LOT 9 & 10 CON. 10 W

**BORE HOLE LOCATIONS & SOIL STRATA**

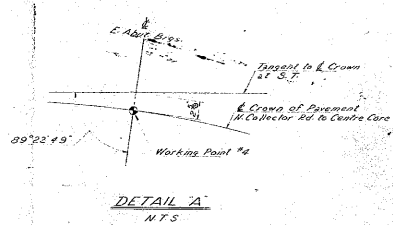
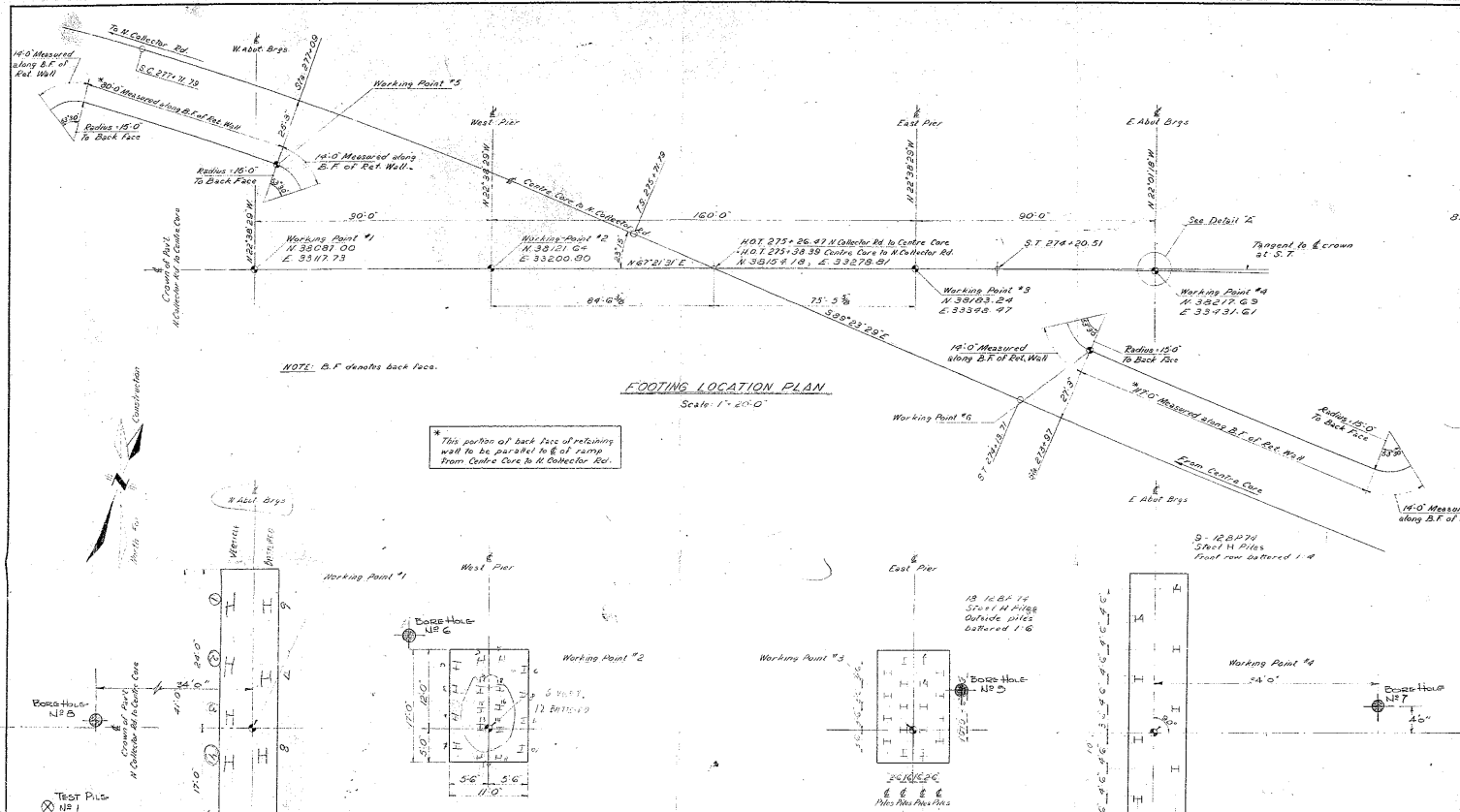
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DRAWN D.M.	CHECKED <input checked="" type="checkbox"/>	208 NO. 42 - F - 85	<b>62 - F - 85 B</b>
DATE: 14 DEC. 1962	SITE NO.		BRIDGE DRAWING NO.
APPROVED <i>[Signature]</i>			

H. Riddow 13626/3581



PROFILE SLIP ON  
0 20 40





- NOTES:**
- The piles shall be driven by means of a DeLong D28 Hammer into the very dense sandy silt & gravel stratum at a depth of 32.00'-2. For a distance of at least 3 feet so that the number of blows per foot of the pile driving hammer are in excess of 200.
  - The final 6 inches of driving shall be such that the number of blows per inch are in excess of 20.
  - The ultimate capacity computed by the Winkler formula, as shown on S.W.D. Standard DD-1's, shall exceed 300 Tons.
  - Design load per pile = 120 Tons.

### FOUNDATION & PILE LAYOUT

Scale: 1/4" = 1'-0" (Longitudinal Spacing Not to Scale)

PILES REQUIRED			
Location	No.	Length	Type
W. Abut.	2	54'-0"	12 B.P. 74 Steel H. Piles
W. Pier	18	71'-0"	do
E. Pier	18	87'-0"	do
E. Abut.	2	80'-0"	do

### SECTION A-A

Flange Plate 8" x 12" (2 Required) per pile

### STEEL H PILES

SPURC SIDE PLATE

REVISIONS	DATE	BY	DESCRIPTION
1	12/20/63	J.W.	RETAINING WALLS REVISED

**DEPARTMENT OF HIGHWAYS ONTARIO**  
BRIDGE DIVISION

**WESTBOUND BASKET WEAVE BR HWY 401**  
**BETWEEN KYLE ST and JANE ST**

KING'S HIGHWAY No. 401 DIST. No. G  
CO. York  
TWP. North York LOT CON.

**FOUNDATION LAYOUT**

APPROVED: [Signature] DATE: 12/20/63  
DESIGN: A.G. CHECK: B.C. CONTRACT: No. 105-68  
DRAWING: F.J.W. CHECK: B.C. No. 105-68  
DATE: June 1963 LOADS: 1400-SIG DRAWING: D-5208-3

PRINT RECORD	NO.	FOR	DATE
	320	5	52

W.P. 105-62

Mr. A. M. Toye,  
Bridge Engineer.  
Materials & Research Division,  
(Foundation Section)  
Attention: Mr. S. McCombie.

August 10, 1962.

D.H.O. FOUNDATION INVESTIGATION  
REPORT.  
W.J. 62-F-85 -- W.P. 105-62.

Re: Proposed Basket Weave Structure at  
Privet Road & Hwy. #401, Toronto,  
District #6.

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

We believe that the factual data and recom-  
mendations contained therein, should prove adequate for  
your future design work. Should you require further  
information, please do not hesitate to contact our Office.

KYL/MdeF  
Attach.

cc: Messrs. A. M. Toye (2)  
H.A. Tregaskes  
H. D. McMillan  
G. K. Hunter  
C. Fraser  
T. J. Kovich  
J. Roy  
J. E. Gruspier  
E. R. Saint  
F. Norman  
A. Watt  
Foundations Office ✓  
Gen. Files.

*KYL*  
K. Y. Lo,  
SUPERVISING FOUNDATION ENGR.  
For:

A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.

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-

# FOUNDATION INVESTIGATION

For

Proposed Basket Weave Structure at  
Privet Road & Hwy. #401, Toronto,  
District #6.  
W.J. 62-F-85 -- W.P. 105-62.

## 1. INTRODUCTION:

A request for a foundation investigation at the site of the proposed basket weave bridge at Privet Rd. & Hwy. #401 was received from the Bridge Location Section in a memo dated July 12, 1962.

A field investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the location of the proposed bridge. Presented in this report are the results of this investigation, together with recommendations pertaining to the design of the proposed structure foundations.

## 2. DESCRIPTION OF SITE:

The basket weave structure is about 180 ft. north of Hwy. #401 Centre Line at Station 107+50 in Metropolitan Toronto. The structure is part of the proposed new Hwy. #401 system.

At the site the immediate topography is rolling with a slight downward slope in a westerly direction. The site area is flat and has a grass cover.

Physiographically, the site lies in the South Slope Region which is the south slope of an interlobate moraine. This moraine consists of a clayey till deposited during the Pleistocene Ice Epoch.

cont'd. /2 ...



### 3. FIELD INVESTIGATION PROCEDURE:

A total of four auger boreholes and four dynamic cone penetration tests was carried out in the field investigation. Two of the boreholes were sampled boreholes and the other two were exploratory boreholes only. During the field work, disturbed and undisturbed samples were obtained. Disturbed samples were obtained by means of a standard split-spoon sampler driven into the soil with an energy of 350 ft. lbs. per blow. Undisturbed samples were obtained by means of 2-inch I.D. Shelby tubes which were pushed into the soil hydraulically. Some disturbed samples were also obtained in the Shelby tubes. In-situ vane tests were carried out wherever possible, at elevations 12" below the various sample depths.

A measure of the relative density of the predominantly granular deposits was obtained by means of the Standard Penetration tests.

Ground water levels in the boreholes were recorded throughout the duration of the investigation.

### 4. LABORATORY TESTS:

Samples were visually examined and classified at the site as well as in the laboratory.

Laboratory tests were carried out to determine:-

- (a) Natural Moisture Content.
- (b) Atterberg Limits.
- (c) Unit Weight.
- (d) Unconfined Compressive Strength.
- (e) Grain Size Distribution.

Laboratory and field test results are summarized and included under Appendix I of this report.

5. SOIL TYPES AND SOIL CONDITIONS:

5.1) General:

The subsoil at the site consists of two glacial ice deposits and one fluvial deposit within the depths tested. The first 14 ft. of subsoil from the ground level consists of a very dense clayey silt with some sand (glacial till) which is underlain by approximately 25 ft. of firm to stiff clayey silt to silty clay and by fine sandy silt (glacial till), respectively.

The boundaries of the various deposits are shown on the accompanying borelog sheets. The estimated stratigraphical profiles and cross sections shown on Drawing #62-F-85A are based on information from the boreholes. From ground level downwards, the various soil types are as follows:-

5.2) Clayey Silt with some Sand (Glacial Till):

This stratum was established in all boreholes and it extended from the ground surface to elevations 454' and 448' in Borehole No's 1 and 4, respectively. The depth of this stratum is 14 ft. The clayey silt is of low plasticity and contains some fine to coarse sand and traces of fine gravel. The gravel particles found were bulky and subrounded with a maximum size of 3/4". The material was found to be compact to very dense with an average 'N' value of 60 blows/ft.

cont'd. /4 ...

5. SOIL TYPES AND SOIL CONDITIONS: (cont'd.) ...

5.3) Clayey Silt to Silty Clay:

This material was found in all boreholes and it underlies the above-mentioned glacial deposit. This stratum is 26 ft. and 30 ft. in thickness, extending to elevations 428' and 418' in Borehole No's 1 and 4. The clayey silt to silty clay has the following average properties:-

Moisture Content	:	25.8%
Liquid Limit	:	32.3%
Plastic Limit	:	17.5%
Bulk Density	:	129 %
Shear Strength -		
Field Vane	:	830 p.s.f.
Quick Triaxial	:	600 p.s.f.

5.4) Fine Sandy Silt (Glacial Till):

This material was found in Boreholes No. 1 and 4 and it extended to the entire depths tested. The boreholes were terminated at elevations 416.5' and 411', respectively. This material is a fine sandy silt with traces of med. to coarse sand. The relative density of the fine sandy silt varied from compact to very dense.

6. GROUND WATER LEVEL:

The ground water levels were observed in the boreholes during the time of the field investigation. The water level was observed at elevations 451' and 445.5' in Borehole No's 1 and 4, respectively.

## 7. DISCUSSION AND RECOMMENDATIONS:

### 7.1) General:

It is proposed to construct a basket weave bridge on the north side of Hwy. #401, Station 107+70 approx., in Metropolitan Toronto. The subsoil consists of a very dense stratum of clayey silt (glacial till), underlain by a firm to stiff clayey silt to silty clay and a compact to very dense fine sandy silt.

### 7.2) Structure Foundation:

It is recommended to found the structure on 6-ft. wide spread footings as high as possible in the very dense stratum of clayey silt till. The base of the footings should not be placed deeper than 7 ft. below the present ground level and should have a minimum of 5 ft. of soil cover for frost protection. Under these conditions, a safe design load of 2.0 T.S.F. may be employed.

### 7.3) Structure Approaches:

No stability problems are anticipated for embankments provided 2:1 slopes are used.

### 7.4) Settlement:

Settlement of a small order, probably in the order of 1 to 2 inches, is anticipated in the firm to stiff layer of clayey silt to silty clay. It is therefore recommended to construct the approaches before construction of the structure begins.

### 7.5) Dewatering:

No dewatering problems are anticipated.

8. SUMMARY:

- (1) It is proposed to construct a basket weave bridge on the north side of Hwy. #401, Station 107+70 approx., in Metropolitan Toronto.
- (2) The subsoil consists of 14 ft. of very dense clayey silt with some sand (glacial till) underlain by 27 ft. of firm to stiff clayey silt to silty clay, followed by compact to very dense fine sandy silt.
- (3) It is recommended to found the structure on 6-ft. wide spread footings in the very dense stratum of clayey silt till. If recommendations are followed as stated in Section 7.2, a design load of 2.0 T.S.F. may be employed.
- (4) No stability problems are anticipated for embankments provided 2:1 slopes are used.
- (5) Settlement of a small order, probably 1 to 2 inches, is anticipated. It is recommended to construct the approaches before construction of the structure begins.
- (6) Dewatering will not be a problem.

9. MISCELLANEOUS:

The field work was undertaken during the period from July 5th to July 9th, 1962 by Mr. I. Holubec, who also prepared the report under the supervision of Mr. K. G. Selby.

August 1962.

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

Qu	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	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
$\tau$	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
$S_i$	SENSITIVITY

## GENERAL

T	+ 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

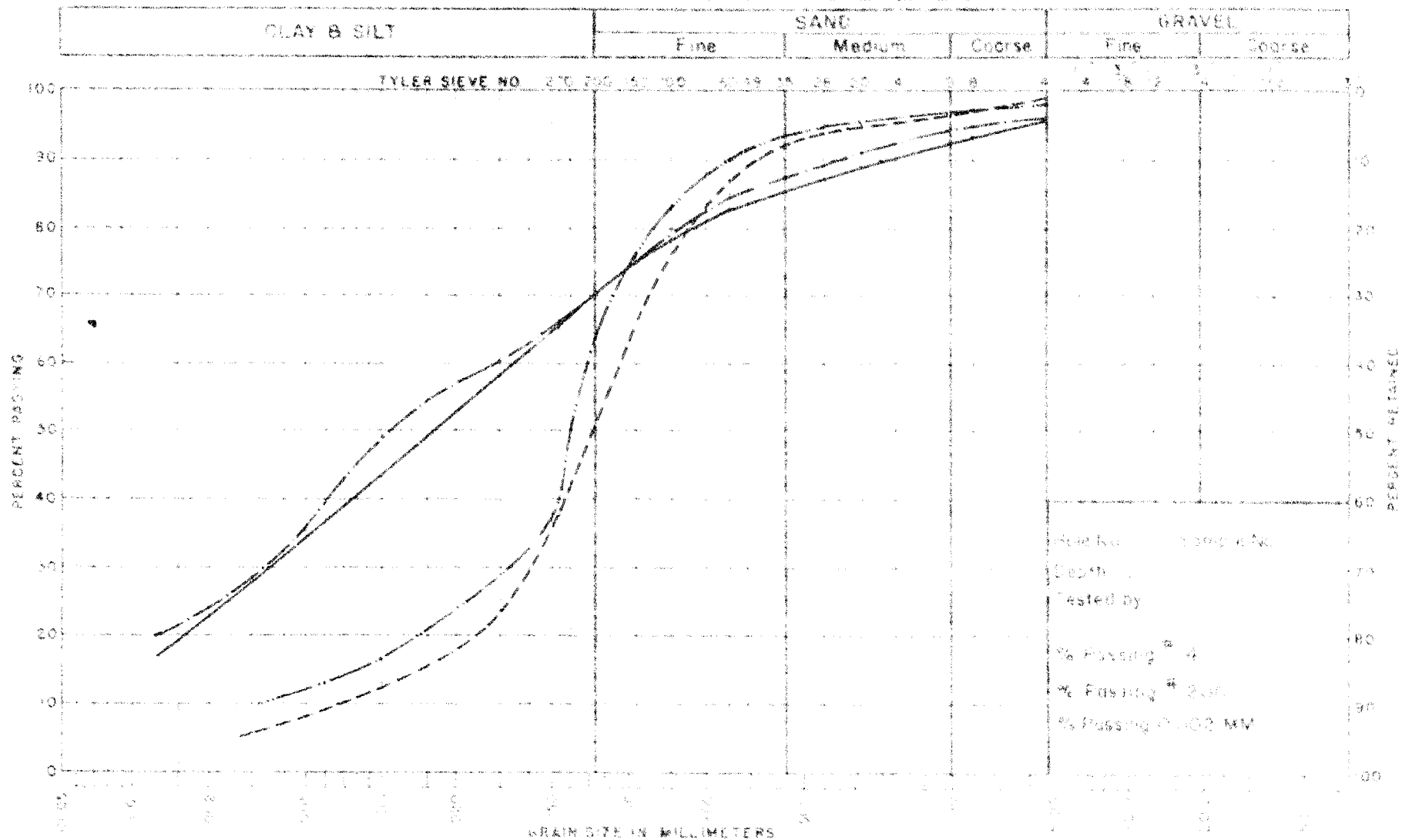
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
$K_s$	MODULUS OF SUBGRADE REACTION

## SLOPES

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



# UNIFIED SOIL CLASSIFICATION SYSTEM



NOTES

BOREHOLE -1, SAMPLE 3

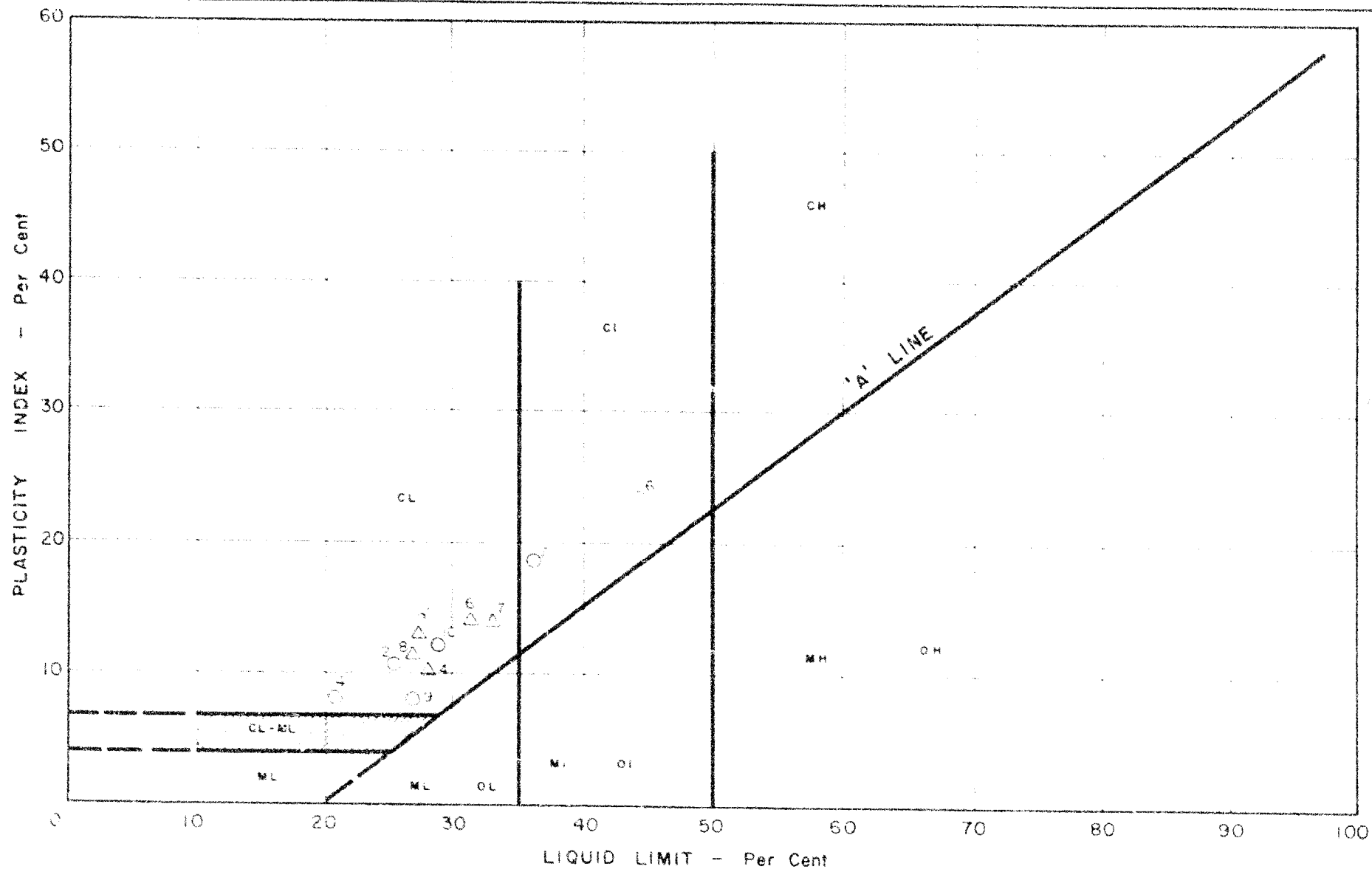
" -1 " II

" -4 " 3

" -4 " II

DEPARTMENT OF HIGHWAYS, ONTARIO  
MATERIALS & RESEARCH SECTION  
GRAIN SIZE DISTRIBUTION

Job No. 62-F-85 W.P. No. 105-62  
Location: HWY. NO. 401



MEMORANDUM

Ken  
June 13, 1963  
RCS

To: Mr. A. G. Sternac, FROM: K. G. Bassi  
Principal Foundations Engineer,  
Room 107 Lab. Bldg.  
Att.: Mr. K. G. Selby DATE: June 12, 1963.

Our File Ref.

IN REPLY TO

SUBJECT: Retaining Walls - Basket Weave Bridges  
between Jane St. & Keele St. - Hwy. 401  
Dist. 5 W.P. 104-62 & W.P. 105-62

Enclosed herewith are tentative plans D 5207-3,4, and 5, and D 5208-3,4, and 5 showing the locations, elevations and details of the proposed retaining walls. These retaining walls have been adapted from the D.H.O. Standard for Cantilever Retaining Walls, a copy of which is attached for your information. The maximum toe pressures are indicated on the Standard.

Would you please review the footing elevations to ensure that the bearing pressures are not excessive.

KGB:go

  
K. G. Bassi,  
Bridge Project Engineer.

Mr. A. M. Toye,  
Bridge Engineer.  
Materials & Research Division,  
(Foundation Section)  
Attention: Mr. B. Davis.

September 6, 1962.

Re: W.J. 62-F-85 -- W.P.105-62.

Re: Proposed Structure for North Service Rd.  
& Hwy. #401 between Jane St. & Keele St.,  
District #6, Toronto.

The original foundation investigation for the above-mentioned proposed structure was carried out with the assumption that the profile grade of the "slip off" section would be approximately the same as the existing ground level. We now understand that a cut of 10 feet is proposed.

Our original recommendation was that the structure should be supported on spread footings placed at a shallow depth in the hard crust which extends for a depth of some 12 to 15 feet below ground level. In view of the proposed cut, this recommendation no longer applies and piled foundations should therefore be used. 12 $\frac{1}{2}$ " steel tube piles driven to a depth of about 5 to 10 feet below the surface of the fine sandy silt stratum should provide a design load of about 40 tons per pile. The surface of this silt stratum is shown on Dwg. #62-F-85A and varies from el. 428.0 in B.H. #1 to el. 418.0 in B.H. #4. Pile driving should be controlled in the field by means of the Hiley Formula according to D.H.C. Standards DD 1215 & 1219. In this case, the Hiley Formula must not be applied until the tips of the piles are within the above-mentioned silt stratum. However, we would strongly suggest that a pile loading test be carried out.

If you have any further queries in connection with this matter, please contact this office.

KGS/ndef  
cc: Foundations Office  
Gen. Files

K. G. Selby,  
SR. FOUNDATION ENGR.  
For:  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.

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

Attention: Mr. B. Davis.

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

December 13, 1962.

D.H.O. SUPPLEMENTARY FOUNDATION INVESTIGATION REPORT -  
Proposed Structure for North Service Rd. and Hwy. #401  
between Jane St. and Keele St., District #6, Toronto.  
-- W.J. 62-F-85 -- W.P. 105-62. --

1. INTRODUCTION:

Since the original foundation investigation for the above structure was carried out, changes have been made in the design proposals to such an extent that our former recommendations are no longer practicable. Because of the very large loadings and the fact that little or no settlements can be tolerated, it now becomes necessary to support the structure by means of piled foundations. In order to decide upon the most suitable type of pile and design load, further borings were carried out at the site. The results of these borings, together with our recommendations, are contained in this report.

2. FIELD WORK:

A total of four borings was carried out at the site using a diamond drill adapted for soil sampling purposes. Soil samples were obtained by means of a standard split-spoon sampler. Rock core samples were obtained by means of an AXT core barrel drilled 10'

cont'd. /2 ...

Mr. A. M. Toye, Bridge Engr.  
Attention: Mr. B. Davis.

Dec. 13/62.

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2. FIELD WORK: (cont'd.) ...

into the bedrock. All survey work was carried out by D.H.O. personnel from Toronto District. The locations and elevations of all borings are shown on the accompanying Drawing #62-F-85B.

3. SUBSOIL TYPES:

Subsoil at the site consists of the following strata:

- (i) About 40' of clayey silt with the upper 14' desiccated, and having a hard to stiff consistency, and the lower 26' having a firm to stiff consistency.
- (ii) About 45' of dense to very dense sandy silt with occasional gravels.
- (iii) A very dense deposit of glacial origin, varying in depth from 3 to 30 feet, consisting of a heterogeneous mixture of clayey silt, sand, gravel and boulders.
- (iv) Shale bedrock with a weathered zone at the surface extending for a depth of from two to six feet.

4. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct a three-span structure at this site. The reactions at the piers will be in the order of 1800 tons and at the abutments, in the order of 600 tons. For the proposed

cont'd. /3 ...

Mr. A. M. Toye, Bridge Engr.  
Attention: Mr. B. Davis.

Dec. 13/62.

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

footings, design requirements are such that the maximum loading is required over the smallest possible area. To achieve this, it is suggested that the entire structure be supported on steel H-piles driven to bedrock. A design load of up to 70 tons per pile may be used in the case of 12 BP at 74 sections. Because of the existence of the extensive weathered zone in the shale bedrock, it would probably be advisable to carry out a pile loading test to ensure that the design loads are being achieved. This test could probably be carried out during the course of the main contract.

5. SUMMARY:

Additional borings have been carried out at the site of the proposed structure for the North Service Rd. and Hwy. #401 between Jane St. and Keele St. These borings revealed the presence of deposits of clayey silt, sandy silt, and glacial till. Shale bedrock was located at depths ranging from 95' to 100' below ground level. It is recommended that the proposed structure be supported on piled foundations. Details are given in (4) above.

cont'd. /4 ...

Mr. A. M. Toye, Bridge Engr.  
Attention: Mr. B. Davis.

Dec. 13/62.

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6. MISCELLANEOUS:

The field work was carried out during the period  
24/9/62 to 17/10/62.

Equipment used was owned and operated by Canadian  
Longyear, Ltd., and the project was supervised by Mr. H. Szymanski  
of the D.H.O.

This report was written by Mr. K. G. Selby.

KGS/MdeF  
Attach.

cc: Messrs. A. M. Toye (2)  
H. A. Tregaskes  
H. D. McMillan  
G. K. Hunter (2)  
C. Fraser  
T. J. Kovich  
J. Roy  
J. E. Gruspier  
E. R. Saint  
F. Norman

Foundations Office ✓  
Gen. Files.



APPENDIX I.

Mr. B. E. Davis,  
Bridge Design Engineer,  
Bridge Division.

Attention: Mr. C. Bassi

Mr. A. G. Stermac,  
Principal Foundation Engr.,  
Foundation Section,  
Materials & Research Division.  
July 10, 1963

B.H.C. FOUNDATION INVESTIGATION --  
Proposed Retaining Walls at Basket Weave Structure  
for North Service Road, Hwy. #401, Toronto By-Pass.  
W.J. 62-F-85B -- District #6 -- W.P. 105-62

Following your memo dated June 12, 1963, we have carried out four borings at the sites of the above-mentioned retaining walls. The borings revealed the presence of a stiff to very stiff deposit of clayey silt extending for at least 15 ft. below the proposed footing levels. In view of these facts, we believe that an allowable pressure of 2 tons per sq. ft. may be used for design purposes.

We are forwarding, for your information, the records of B.H.'s #9 - #12, inclusive. These, together with this memo, should be attached to Foundation Report #62-F-85B.

If you have any further queries in connection with this matter, please contact this Office.

KGS/MdeP  
Attach.

cc: Messrs. B. Davis (2)  
H. A. Tregaskes  
H. D. McMillan  
G. K. Hunter (2)  
C. Fraser  
T. J. Kovich  
A. Watt

K. G. Selby,  
SENIOR FOUNDATION ENGR.  
For:  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.

Foundations Office  
Gen. Files

PILE LOADING TESTS AT SITE OF  
PROPOSED BASKET WEAVE STRUCTURES  
FOR NORTH AND SOUTH SERVICE ROADS  
BETWEEN KEELE AND JANE STREETS,  
HWY. #401, DISTRICT #6, TORONTO.

Synopsis:

It is proposed to carry out a pile load test at each of the sites of the proposed structures mentioned above. The purpose of these tests is to determine an appropriate design load for the piles to be used in the future structures and to obtain information on pile driving conditions. In both cases, the piles will be steel 'H' sections 12 BF at 74. At the north site, pile length will be about 120', and at the south site, about 110'. It is intended to test the piles up to a maximum of 300 tons. The procedure of the tests will be in general, in accordance with the National Building Code of Canada, but slight modifications to the latter will be made if the D.H.O. finds it necessary. The Contractor will be solely responsible for carrying out the following work at each site:

(1) Driving the pile vertically to an elevation which will be determined by the D.H.O., and as directed by the D.H.O. The hammer to be used for driving the pile should have an energy of not less than 37,000 ft.-lbs. per blow. A suitable anvil must be provided so as to afford maximum protection for the pile top.

(2) Splicing and cutting off the pile as necessary.

(3) Providing and erecting an adequate reaction in the form of a box loaded with sufficient material to provide the necessary load of 300 tons the resultant of which is vertically above the centre of the particular pile.

cont'd. /2 ...

(4) Providing and placing any material required to form a level base and working area for the above-mentioned loading box in (3).

(5) Providing and operating a jack with a minimum capacity of 300 tons as directed by the D.H.C.

(6) Providing and fixing two reference beams adjacent to the pile to be tested. The design and length of these beams must be such that no settlement due to the load of the box on the ground is caused at the reference beam supports. Provision must also be made to check the elevations of the reference beams to an accuracy of not less than 0.1" referred to a permanent bench mark, at times to be decided by the D.H.C.

(7) Provide 4 measuring gauges with a minimum accuracy of 0.001" per division, one to be attached to each corner of the pile in a manner approved by the D.H.C.

(8) Providing all necessary personnel to carry out the above work and for the recording of all data as directed by the D.H.C. General supervision at all times, and occasional direct supervision will be provided by the D.H.C. All recorded data will remain the property of the D.H.C.

(9) At completion of the work, the Contractor must cut off or extract the pile (decision to be made by the D.H.C.), and clear the site to the satisfaction of the D.H.C.

April 29/63

K. G. Selby  
SR. FOUNDATION ENGINEER

Mr. E. R. Davis,  
Bridge Design Engr.,  
Bridge Division.

Attention: Mr. C. Bassi

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

June 20, 1963

Pile Loading Tests for Basket Weave Structures  
Between Jane St. and Keele St., Highway #401,  
Toronto By-Pass - Dist. #6 - Contract #18-8-63.

We have recently completed two pile loading tests at the sites of the above-mentioned proposed structures, and are now in a position to make specific recommendations regarding the design loads and method of driving control for the piles to be used in the structure foundations. A complete report will be forwarded to you in the near future.

Tests were carried out on two 12 BP at 74 steel H-piles with standard reinforced tips. The tests showed that a design load of 120 tons per pile is within the requirements of the National Building Code of Canada. The maximum immediate settlement under such a loading is anticipated to be about  $3/8$ ".

In order that an adequate pile capacity is achieved in the field, the following method of control is recommended:

- (1) The piles should be driven by means of a Delmag D 22 Hammer.
- (2) Standard reinforcing should be provided for the pile tips.
- (3) The piles should be driven into the very dense sandy silt and gravel stratum, shown on Foundation Drawings 62-F-85B & 86B, for a distance of at least 3 feet so that the blows per foot of the pile driving hammer are in excess of 200.
- (4) The final 6 inches of driving should be such that the number of blows per inch are in excess of 20.
- (5) An ultimate capacity of at least 300 tons should be computed by means of the Hiley Formula, as shown on D.H.C. Standard DD 1219.

cont'd. /2 ...

Mr. E. R. Davis,  
Attn: Mr. C. Bassi.

- 2 -

June 20, 1963

If the above recommendations are followed, we believe that a safe design of 120 tons per pile can be achieved, provided such a load is structurally acceptable for reasons other than soil capacity.

If you have any further queries in connection with this matter, please contact this Office.

KGS/MdeF

cc: Foundations Office  
Gen. Files

*K. G. Selby*  
K. G. Selby,  
SENIOR FOUNDATION ENGR.  
For:  
A. G. Sternac,  
PRINCIPAL FOUNDATION ENGR.

DEPARTMENT OF HIGHWAYS ONTARIO  
MEMORANDUM

KEN

APRIL 29, 1963

also

To: Mr. A. G. Stermac,  
Principal Foundation Engineer,  
Room 107, Lab. Building,  
DOWNSVIEW, Ontario.

FROM: B. Davis

DATE: April 25, 1963

Our File Ref.

IN REPLY TO

SUBJECT: East & Westbound Basketweave Bridges-  
Hwy. 401 between Keele St. & Jane St.  
Dist. #6, Toronto, W.P. 104-62 & 105-62.

The Foundation Investigation Reports for the above structures call for the abutments and piers to be supported on 12 BP 74 Steel "H" Piles driven to bedrock. Basing our design on the recommended design load of 70 tons per pile we find that we shall require approximately 5500 l.ft. of piles for each structure. As the piles are fairly long (100 ft. average) we feel that there would be a considerable saving if the design load per pile could be increased to say, even 100 tons. With this in view, would you please arrange to carry out a pile load test at each of the above mentioned structures.


Besides providing a basis for increasing the design load per pile, the pile load tests should also provide valuable information to the Contractors for bidding purposes.

\*  
NOTE: - PILE LOAD TEST REPORTED UNDER

\* 63-F-71

(CONTRACT IB-8-63)

BD/rp

  
B. Davis,  
Bridge Design Engineer.

FOUNDATION SECTION

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		PLASTIC LIMIT		WATER CONTENT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	20	40	60	80	100		
68.0	Groundlevel					470							
0.0	Clayey silt with some fine to coarse sand and traces of fine gravel. Compact to very dense. (Glacial Till)		1	SS	37								
			2	SS	74	460							
			3	SS	60								
54.0			4	SS	26								
14.0			5	SS	18	450							
	Clayey silt to silty clay. Very stiff to firm.		6	SS	7								
			7	Tw	PH	440							
			8	Tw	PH								
			9	Tw	PH	430							
28.0			10	Tw	26 for 6"								
40.0	Fine sandy silt with traces of med. to coarse sand. Very dense to hard. (Glacial Till)		11	SS	26	420							
16.5			12	SS	46								
51.5	End of borehole.					410							





RECORD OF BOREHOLE NO. 3

CLASSIFIED BY I.N.

PREPARED BY \_\_\_\_\_ U.S.

RECEIVED BY L.H.

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT --- % PLASTIC LIMIT --- % WATER CONTENT --- %		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.	WATER CONTENT %		
465.5	Groundlevel								
	Clayey silt with some sand, compact to very dense.				460				
	(Glacial Till)								
451.5									
449.5	Clayey silt to silty clay.				450				
16.0	End of borehole.								
					440				

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

# RECORD OF BOREHOLE NO. 4

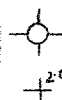
FOUNDATION SECTION

JOB 62-F-85 LOCATION Hwy. #401, Sta. 106+59, 186' Lt. of E ORIGINATED BY I.H.  
W P 105-62 BORING DATE July 9, 1962. COMPILED BY H.S.  
DATUM 462.5' BOREHOLE TYPE 4 1/2" Auger borehole. CHECKED BY I.H.

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — % PLASTIC LIMIT — % WATER CONTENT — %		BULK DENSITY pcf	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	WATER CONTENT %	WATER CONTENT %		
						20	40	60	80	100		
						SHEAR STRENGTH P S F						
						500	1000	1500	2000	2500		
462.5	Groundlevel											
0.0	Clayey silt with some fine to coarse sand and traces of fine gravel. Dense to very dense. (Glacial Till)	1	SS	44	460							
		2	SS	83							139	
		3	SS	84								
448.5		4	SS	83	450							
14.0	Clayey silt to Silty clay. Firm to very stiff.	5	SS	10								
		6	TW	PH	440							
		7	TW	PH							120	
		8	TW	PH	430							
		9	TW	PH							127	
		10	TW	26	420							
417.5												
45.0	Fine sandy silt with traces of med. to coarse sand, compact. (Glacial Till)	11	TW	17	410							
51.5	End of borehole.											

Note:

Strain  
Sensitivity



W.L.  
445.5  
From borehole observations.

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 62-P-85 LOCATION Sta. 274+52 201' Rt. of E Hwy. #401 ORIGINATED BY H.S.  
W.P. 105-62 BORING DATE Sept. 24, 1962. COMPILED BY H.S.  
DATUM 468.4' BOREHOLE TYPE Washboring. CHECKED BY R.K.

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY PCF	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.		W P W L	WATER CONTENT % 20 40 60		
468.4 0.0	Groundlevel					470						
	Desiccated zone - Hard to very stiff.											
452.4 16.0			1	SS	P							
	Clayey silt. Firm to stiff.					440						WL in casing on 26/9/62
431.4 37.0			2	SS	39							433.4 35.0
			3	SS	>100							
			4	SS	42	410						Sa. 17% Si. 65% Cl. 18%
	Sandy silt with some gravel.		5	SS	49							
	Dense to very dense.		6	SS	102							Gr. 10% Sa. 33% Si. 51% Cl. 6%
			7	SS	85	380						Gr. 12% Sa. 3% Si. 77% Cl. 8%
			8	SS	>100							
372.4			9	SS	>100							Gr. 13% Sa. 39% Si. 34% Cl. 14%
369.7	Clayey silt with sand		11	V. Dense								
369.7	Gravel & boulders (glacial)											
358.9	Weathered zone.		10	SS	>100							
101.5	Sound Bedrock (Grey Shale)		11	RC	-							
357.4												
111.0	End of borehole.					350						

FOUNDATION SECTION

Depth (ft)	Soil Description	Soil Type	Soil Color	Soil Moisture	Soil Temperature	Soil pH	Soil S&P	Soil Analysis
462.9	Groundlevel							
0.0	Desiccated zone.							
450.5	Hard to very stiff.							
12.0	Clayey silt.	1	SS	P				
	Firm to stiff.							
419.9		2	SS	58				
43.0		3	SS	37				
	Sandy silt with some gravel.	4	SS	76				
	Dense to very dense.	5	SS	>100				
		6	SS	>100				
377.9		7	SS	>100				
85.0	Clayey silt with sand, gravel and boulders. (Glacial Till) Very dense.	8	RC	-				
364.9		9	RC	-				
98.0		10	RC	-				
360.9	Weathered zone.	11	RC	-				
102.0	Sound Bedrock (Grey Shale)	12	RC	-				
351.9								
111.0	End of Borehole.							

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. 7

FOUNDATION SECTION

JOB 62-F-85 LOCATION Sta. 273+35 (218' Rt.) ORIGINATED BY H.S.  
W.P. 105-62 BORING DATE Oct. 4, 1962. COMPILED BY H.S.  
DATUM 472.3 BOREHOLE TYPE Washboring CHECKED BY B.K.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY P O F	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.			WATER CONTENT % 20 40 60				
472.3 0.0	Groundlevel  Desiccated zone.  Hard to very stiff.					480								WL in bore- hole on 10/10/62  ▽ 456.3 16.0
456.3 16.0	Clayey silt.  Firm to stiff.		1	SS	3	450								
437.3 35.0	Sandy silt with  some gravel.		2	SS	61									
407.3 65.0	Clayey silt with sand, gravel and boulders. (Glacial Till)  Very dense.		3	SS	88	420								GR. 27% SA. 46% SI. 22% CL. 5%
377.3 92.8	Weathered zone.		4	SS	>100	390								GR. 34% SA. 11% SI. 36% CL. 19%
372.8 97.5	Sound Bedrock (Grey Shale)		5	RC	-									
365.8 106.5	End of borehole.		6	RC	-									
			7	RC	-									
			8	RC	-									
			9	RC	-									
						360								

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. B

FOUNDATION SECTION

JOB 62-F-85 LOCATION Sta. 277+38 (146' Rt of E. Hwy. #401) ORIGINATED BY H.S.  
 W.P. 105-62 BORING DATE Oct. 11, 1966 COMPILED BY H.S.  
 DATUM 460.5' BOREHOLE TYPE Wash boring CHECKED BY B.K.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.			WP	W	WL		
460.5 0.0	Groundlevel					460								
	Disturbed zone. Hard to very stiff.													
446.5 14.0	Clayey silt firm to stiff.		1	SS	9	430								
			2	SS	7									
425.5 45.0	Silty sand with some gravel. Dense to very dense.		3	SS	15	400								
			4	SS	100									
370.5 90.0	Clayey silt with sand gravel and boulders. (Glacial Till) Very dense.		5	RC	-	370								
			6	RC	-									
			7	RC	-									
349.5			8	RC	-									
311.0	Weathered zone.		9	RC	-									
343.0														
317.5	Sound Bedrock (grey shale)		10	RC	-	340								
340.5														
120.0	End of borehole													

WL in casing on 17/10/62  
 $\frac{2}{2} = 428.5$   
 $\frac{2}{2} = 32.0$

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. 9

FOUNDATION SECTION

JOB 62-F-85B LOCATION 220.0' W of N-Collector Rd Center Core (65.0' North) ORIGINATED BY B.K.  
 W.P. 105-62 BORING DATE June 20, 1963. COMPILED BY B.K.  
 DATUM 459.7 BOREHOLE TYPE Auger CHECKED BY K.S.

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT		WATER CONTENT — W			
459.7	Groundlevel					460						
0.0	Clayey silt.  Very stiff to stiff.		1	SS	25							
			2	SS	41							
			3	SS	23	450						
			4	SS	13							
			5	SS	9							
443.2	End of borehole.					440						

 W.L.  
 445.4' ▼  
 14.3



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

JOB 62-F-85B LOCATION 145.0' W of N-Collector Rd Center Cora (35.0' North). ORIGINATED BY B.K.  
W.P. 105-62 BORING DATE March 20, 1963. COMPILED BY B.K.  
DATUM 460.2' BOREHOLE TYPE Auger CHECKED BY K.S.

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — WP	WATER CONTENT — W		
460.2	Groundlevel				460						
0.0											
	Clayey silt.		1	SS		27					
	V. stiff to stiff.		2	SS		35					
			3	SS	450	34					
			4	SS		13					
			5	SS		10					
			6	SS	440	5					
438.7											
21.5	End of borehole.										
					430						

W.L.  
457.3' ▼  
2.9



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

# RECORD OF BOREHOLE NO. 12

FOUNDATION SECTION

JOB 62-F-85B LOCATION 170.0' E to N-Collector Rd Center Core (42.0' South) ORIGINATED BY B.K.  
W.P. 105-62 BORING DATE June 20, 1963. COMPILED BY B.K.  
DATUM 471.1' BOREHOLE TYPE Auger CHECKED BY K.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — WL — PLASTIC LIMIT — WP — WATER CONTENT — W —			BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.			WATER CONTENT % wp — w — WL					
471.1	Groundlevel					470									
0.0															
	Clayey silt.		1	SS	11										
			2	SS	34										
	V. stiff to stiff.		3	SS	27										
						460									
			4	SS	16										
			5	SS	7										
454.6						450									
16.5	End of borehole.														

W.L.  
457.8

13.3

W.L.  
457.8  
13.3