

MEMORANDUM

23-69-09  
Found. Invest

To: Mr. G. K. Hunter,  
Regional Road Design Engineer,  
Regional Office (Toronto),  
Central Bldg.

FROM: Foundation Section,  
Materials & Testing Div.,  
Room 107, Lab. Bldg.

DATE: May 19, 1967

OUR FILE REF.

IN REPLY TO

MAY 29 1967

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Proposed Sewer Between Kennedy Rd.,  
And Birchmount Rd. South of Hwy. #401,  
District #6 (Toronto)

W.J. 67-F-28 -- W.P. 252-61-7

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

We believe that you will find the factual data and recommendations contained therein, adequate for your design requirements. Should additional information be required, please feel free to contact our Office.

AGS/EdaF

Attach.

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
G. K. Hunter (3)  
F. Allen  
W. S. Melinyshyn  
T. J. Kovich  
B. A. Singh

Foundations Files  
Gen. Files ✓

*A. G. Stiermac*  
A. G. Stiermac  
PRINCIPAL FOUNDATION ENGINEER

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FOUNDATION INVESTIGATION REPORT  
For  
Proposed Sewer Between Kennedy Rd.,  
And Birchmount Rd. South of Hwy. #401,  
District #6 (Toronto)  
W.J. 67-F-28 -- W.P. 252-61-7

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1. INTRODUCTION:

The Foundation Section was requested to carry out a field investigation at the site of a proposed 42 - 54 inch sub-trunk sewer in Scarborough Township. The request was contained in a memorandum dated March 9, 1967, from Mr. J. H. Blevins, Senior Expressway Design Engineer. An investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the site. This report contains the results of our investigation, together with our recommendations pertaining to the foundation of the proposed sub-trunk sewer.

2. DESCRIPTION OF SITE:

The proposed sewer starts 950 ft. west of Birchmount Road and runs parallel and south of Hwy. #401 to Kennedy Rd., in the Township of Scarborough. The sewer crosses two main streets as well as a double C.P.R. track. The topography ranges from flat to undulating. The sewer is located within the right-of-way of Hwy. #401.

Physiographically, the site is located in the region referred to as the 'South Slope'. The main deposit is a gently rolling till plain with low drumlins.

3. FIELD WORK:

A total of 11 sampled boreholes and 2 dynamic cone penetration tests was carried out during the course of the field work. Drilling equipment consisted of a Pennsylvania type

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

continuous flight auger and a conventional diamond drill adapted for soil sampling purposes. 'Disturbed' samples were recovered at required depths by means of a split-spoon sampler driven into the soil by means of a 140-lb. hammer imparting an energy of 350 ft.-lbs. per blow, according to the specifications of the Standard Penetration Test. All samples were visually examined in the field before being transported to the laboratory.

The locations and elevations of all eleven borings were surveyed by personnel from District #6 Engineering Surveys Section, and are shown on Drawing No. 67-F-28A, together with the estimated stratigraphical profile in the Appendix of this report.

4. LABORATORY TESTING:

All samples were subjected to a careful visual inspection in the laboratory. Laboratory tests were then conducted on selected representative samples to determine:

- i) Natural Water Content
- ii) Grain-Size Distribution

The results of these tests are summarized and plotted on the Record of Borehole sheets contained in the Appendix of this report.

5. SOIL TYPES AND SOIL CONDITIONS:

5.1) General:

Subsoil conditions over the site area were found to be generally uniform. Three types of materials were encountered at this site, namely, fill material consisting of either organic silt with some sand or clayey silt with some sand, sandy silt to silty sand with traces of gravel and clay, and sand and gravel with traces of silt.

cont'd. /3 ...

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

5.2) Fill Material:

In borehole #4, a ten-foot layer of organic silt with some sand and traces of gravel was encountered at the ground surface. A five-foot layer of clayey silt with some sand was observed at the ground surface in borehole #11. In both layers the consistency was found to be stiff.

5.3) Sandy Silt to Silty Sand:

This deposit consisting of sandy silt to silty sand with traces of gravel and clay, was found in all eleven boreholes. The natural moisture content varied from 6% to 23%. Standard Penetration Tests gave 'N' values ranging from 20 blows/ft. to 50 blows for 1 inch, indicating a relative density from compact to very dense. Typical grain-size distribution curves are shown in the Appendix of this report. This deposit was encountered at the ground surface and extended to the end of boring in all boreholes except in boreholes #4 and #11 where the fill was encountered on top of the deposit.

5.4) Sand and Gravel:

This deposit consisted of sand and gravel with traces of silt. This deposit was encountered below the sandy silt to silty sand stratum in boreholes #8 and #11 and extended to the end of the boreholes. The water content ranged from 6% to 12%. 'N' values from Standard Penetration Tests varied from 130 blows for 6 inches to 200 blows for 5 inches, indicating a very dense relative density.

6. GROUNDWATER CONDITIONS:

Groundwater levels were observed during the course of the field investigation. No water was observed in boreholes #1 to #4 inclusive. The groundwater level ranged from elev. 548.0 to 555.0 in boreholes #5 to #10 inclusive, with the exception of borehole #6. In this vicinity, the groundwater level is under

cont'd. /4 ...

6. GROUNDWATER CONDITIONS: (cont'd.) ...

investigation and will be reported later. In boreholes #11 and #8 (65-F-101), the water level varied from elev. 540.0 to 543.0. The water levels will be somewhat lower during the summer of the year.

7. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct a 42 - 54 inch sub-trunk sewer in Scarborough Township. The invert elevation of the sewer is such that excavations up to 32 feet in depth will be necessary if an open cut installation is carried out. This sub-trunk sewer connects to the trunk 'D' sewer in the southwest quadrant of Kennedy Road and Hwy. #401.

As described in Section 5, the subsoil over the entire site is chiefly sandy silt to silty sand with traces of gravel and clay. The invert elevations of the sewer intersect in the above stratum which has a relative density ranging from compact to very dense. Provided that the new sewer is installed without causing any deterioration in the condition of the subsoil, foundation pressures up to 4.0 t.s.f. may be assumed for design purposes. It will be necessary, therefore, to ensure that no disturbance of the excavation bases occur during construction, which could cause softening or loosening of the soil.

Since the invert elevation is above the groundwater level at boreholes #1 to #8 inclusive, no dewatering problems are anticipated. The water level is one to two feet above the invert elevation in boreholes #9 and #10. If construction is carried on during the dry season, the water table could be lower than that observed during the period of the investigation; hence, no major dewatering problems would be anticipated.

If open cut installation is used, proper shoring methods should be adopted according to the Trenching Act. Since the material in the vicinity of the invert elevation of the sewer is granular in nature, no additional bedding material is necessary to allow for proper drainage.

8. SUMMARY:

A foundation investigation at the site of a proposed 42 - 54 inch sub-trunk sewer south of Hwy. #401 between Birchmount and Kennedy Rds. in Scarborough Township, is reported.

Subsoil at the site consists of fill material consisting of either organic silt with some sand or clayey silt with some sand in boreholes #4 and #11 respectively, sandy silt to silty sand with traces of gravel and clay, and sand and gravel with traces of silt. At the proposed invert elevation of the sewer the soil is sandy silt to silty sand which has a compact to a very dense relative density. The groundwater level at the time of the investigation, ranged from elevation 540 to 555.0.

Foundation pressures of up to 4.0 tons/sq.ft. on undisturbed material, are recommended for the new sewer.

No dewatering problems are anticipated, in general; however, in the vicinity of boreholes #9 and #10, dewatering problems will depend upon the seasonal fluctuation of the groundwater table.

9. MISCELLANEOUS:

The field work for this report was carried out during the period April 12 - April 18, 1967, under the supervision of Mr. A. M. Seppala, Project Foundation Engineer, who also prepared this report.

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

Mr. K. G. Selby, Supervising Foundation Engineer, reviewed this report.

May 1967

APPENDIX I



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 67-F-28  
W.P. 252-61-7  
DATUM Geodetic

LOCATION Coordinates 56.993N, 86.266 E  
BORING DATE April 25, 1967  
BOREHOLE TYPE Continuous Flight Auger

ORIGINATED BY AMS  
COMPILED BY AMS  
CHECKED BY HR

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			BULK DENSITY $\gamma$ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					SHEAR STRENGTH P.S.F.					WATER CONTENT %
							20	40	60	80	100						
583.8	GROUND LEVEL																
0.0	Sandy silt to silty sand with traces of gravel and clay.  Very Dense		1	SS	69	580									Gr.2, Sa.40 Sl.& Cl.58		
			2	SS	102												
			3	SS	77												
			4	SS	63	570											
			5	SS	147												
			6	SS	71												
			7	SS	115												
			8	SS	91	560											
552.3	End of Borehole		9	SS	122									Gr.0, Sa.71 Sl.& Cl.29			
31.5																	

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 67-F-28

LOCATION Co-ordinates 57,077 N, 86,570 E

ORIGINATED BY AMS

W.P. 252-61-7

BORING DATE April 25, 1967

COMPILED BY AM

DATUM Geodetic

BOREHOLE TYPE Continuous Flight Auger

CHECKED BY AM

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 20    40    60    80    100					WATER CONTENT — W			
							SHEAR STRENGTH P.S.F.					WP — WL			
580.5	GROUND LEVEL														
0.0	Silty sand to sandy silt with some gravel and traces of clay.  Very Dense.		1	SS	67	580									Gr. 11, Sa. 81 Si. & Cl. 8
			2	SS	54										
			3	SS	70	570									
			4	SS	92										
			5	SS	113										
			6	SS	103	560									
			7	SS	133										
			8	SS	168										
549.0			9	SS	116	550									
31.5	End of Borehole														

DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-F-28

W. P. \_\_\_\_\_ 252-61-7

DATUM Geodetic

# RECORD OF BOREHOLE NO. 3

LOCATION Co-ordinates 57.164 N. 86.875 E

BORING DATE April 13, 1967

BOREHOLE TYPE BX Casing and Auger Out

**FOUNDATION SECTION**

ORIGINATED BY AMS

COMPILED BY AMS

CHECKED BY AK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT % 10 20 30				
570.0	GROUND LEVEL														
0.0	Silty Sand to Sandy Silt with traces of gravel and clay. Loose to Very Dense.		1	SS	8	560									Gr.2, Sa.49 Si.47, Cl.2
			2	SS	12										
			3	SS	30										
			4	SS	146/11"										
			5	SS	100/6"										
553.5															
16.5	End of Borehole					550									Gr.5, Sa.43 Si.46, Cl.6

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 67-F-28LOCATION Co-ordinates 57,252 N, 87,176 EORIGINATED BY AMSW.P. 252-61-7BORING DATE April 12 & 13, 1967COMPILED BY AMSDATUM GeodeticBOREHOLE TYPE Continuous Flight AugerCHECKED BY AMS

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT _____ WL PLASTIC LIMIT _____ WP WATER CONTENT _____ W <div><div>WP</div><div>W</div><div>WL</div></div>				BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT % <div><div>10</div><div>20</div><div>30</div></div>					
578.3	GROUND LEVEL															
0.0	Organic silt with some sand & traces of gravel.		1	SS	12	570										
	Stiff		2	SS	11											
568.3			3	SS	35											
10.0	Sandy silt to silty sand with traces of gravel and clay.		4	SS	81/6"	560										
	Compact to very dense.		5	SS	162/10"											
			6	SS	135											
			7	SS	137/9"											
			8	SS	100/6"	550										
548.8			9	SS	150											
29.5	End of Borehole					540										

Gr. 4, Sa. 45  
Si. 51  
Gr. 5, Sa. 46  
Si. 44, Cl. 5  
Elev. 552.3

Gr. 4, Sa. 45  
Si. 51Gr. 5, Sa. 46  
Si. 44, Cl. 5  
Elev. 552.3

**CHECKED BY**

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		BLOWS / FOOT		WATER CONTENT %			
583.4	GROUND LEVEL											
0.0	Silty sand to sandy silt with some gravel and traces of clay.		1	SS	20	580						
			2	SS	107							
			3	SS	58							
			4	SS	100/6"	570						
			5	SS	130/6"							
			6	SS	100/9"							
			7	SS	100/11"	560						
			8	SS	100/6"							
			9	SS	100/9"							
			10	SS	100/5"							
			11	SS	100/8"	550						
545.1			12	SS	100/9"							
38.3	End of Borehole					540						



DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-F-28

W.P. 252-61-7

DATUM Geodetic

LOCATION Co-ordinates 57.490 N. 87.704 E

BORING DATE April 13 & 14, 1967

BOREHOLE TYPE Continuous Flight Auger

**FOUNDATION SECTION**

ORIGINATED BY AMS

COMPILED BY AMS

**CHECKED BY**

[illegible]



DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-F-28

W. P. 252-61-7

DATUM Geodetic

LOCATION Co-ordinates 57,671 N, 88,254 E

BORING DATE April 17 & 18, 1967

BOREHOLE TYPE Continuous Flight Auger

# RECORD OF BOREHOLE NO. 8

**FOUNDATION SECTION**

ORIGINATED BY AMS

COMPILED BY AMS

CHECKED BY AK

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.	WATER CONTENT % 10      20      30				
578.8	GROUND LEVEL											
0.0	Sandy silt to silty sand with some clay and traces of gravel.		1	SS	44							
			2	SS	116	570						Gr. 5, Sa. 42 Si. 43, Cl. 10
			3	SS	100/6"							
	Dense to Very Dense.		4	SS	100/5"							
			5	SS	100/2"	560						
			6	SS	125/3"							Gr. 3, Sa. 53 Si. 34, Cl. 16
			7	SS	100/3"	550						
545.8			8	SS	150/6"							▼ W.L. = 548.8
33.0	Sand with trace of											Gr. 6, Sa. 46
542.8	silt & gr. Very Dense		9	SS	200/5"							Si. 43, Cl. 5
36.0	End of Borehole					540						



DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-F-28

W.P. 252-61-7

DATUM Geodetic

LOCATION Co-ordinates 57.749 N. 88576 E

BORING DATE April 18, 1967

BOREHOLE TYPE Continuous Flight Auger

**FOUNDATION SECTION**

ORIGINATED BY AMS

COMPILED BY AMS

CHECKED BY [Signature]

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		
569.5	GROUND LEVEL											
0.0	Sandy silt to silty sand with traces of gravel and clay.		1	SS	38							
			2	SS	100/7"	560						
			3	SS	100/5"							
	Dense to Very Dense.		4	SS	100/9"							
			5	SS	100/9"	550						
			6	SS	50/1"							
541.5			7	SS	100/6"							
28.0	End of Borehole					540						



DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

RECORD OF BOREHOLE NO. 11

**FOUNDATION SECTION**

JOB 67-F-28

LOCATION Co-ordinates 57,896 N., 89,126E

ORIGINATED BY AMS

W. P. 252-61-7

BORING DATE April 18, 1967

COMPILED BY AMS

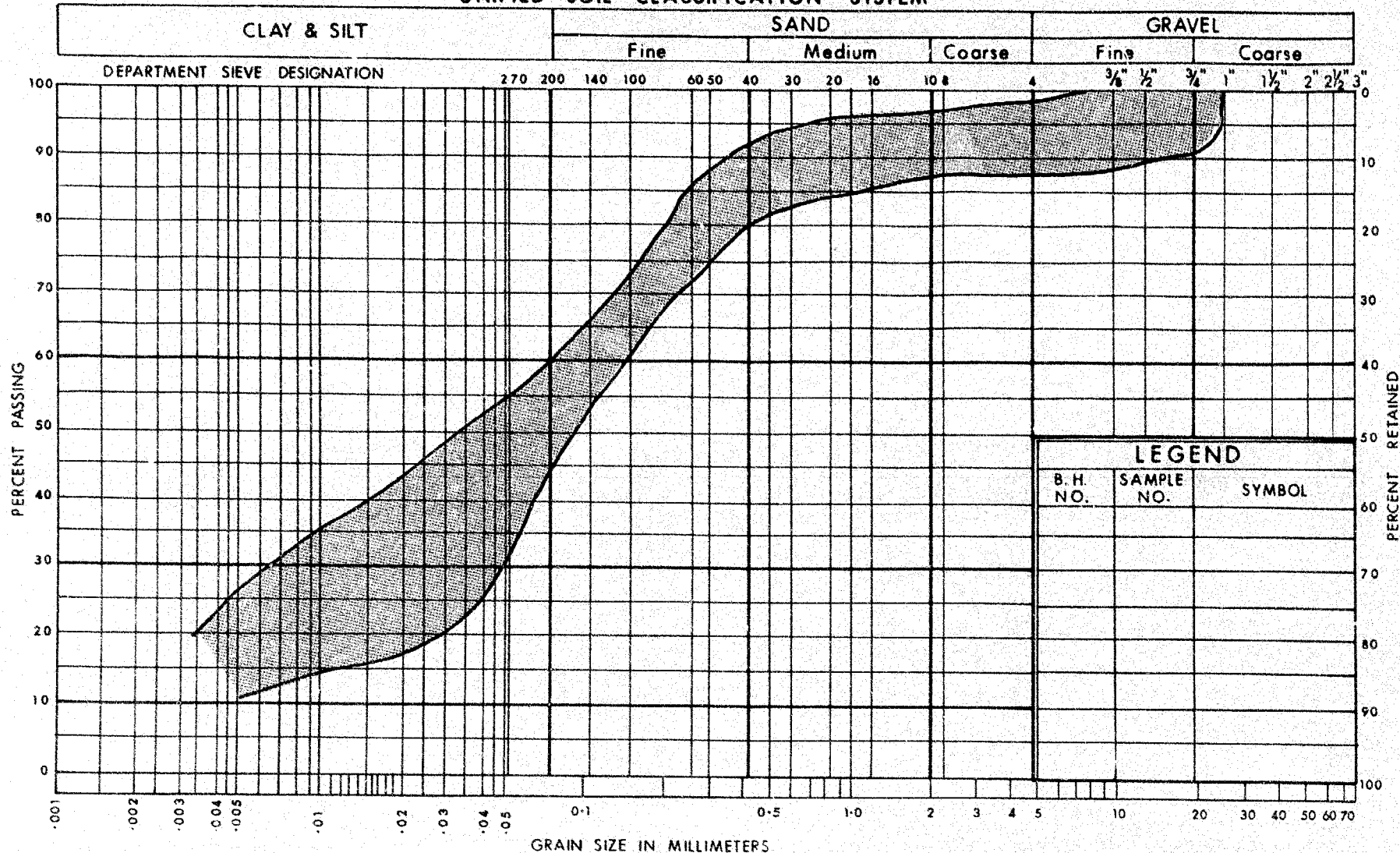
DATUM Geodetic

BOREHOLE TYPE Continuous Flight Auger

CHECKED BY                     

[illegible]

# UNIFIED SOIL CLASSIFICATION SYSTEM



## LEGEND

B. H. NO.	SAMPLE NO.	SYMBOL



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

GRAIN SIZE DISTRIBUTION  
SANDY SILT TO SILTY SAND  
TRACES OF GRAVEL & CLAY

W.P. No 252-61-7

JOB No. 67-F-28

# UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT

SAND

GRAVEL

Fine

Medium

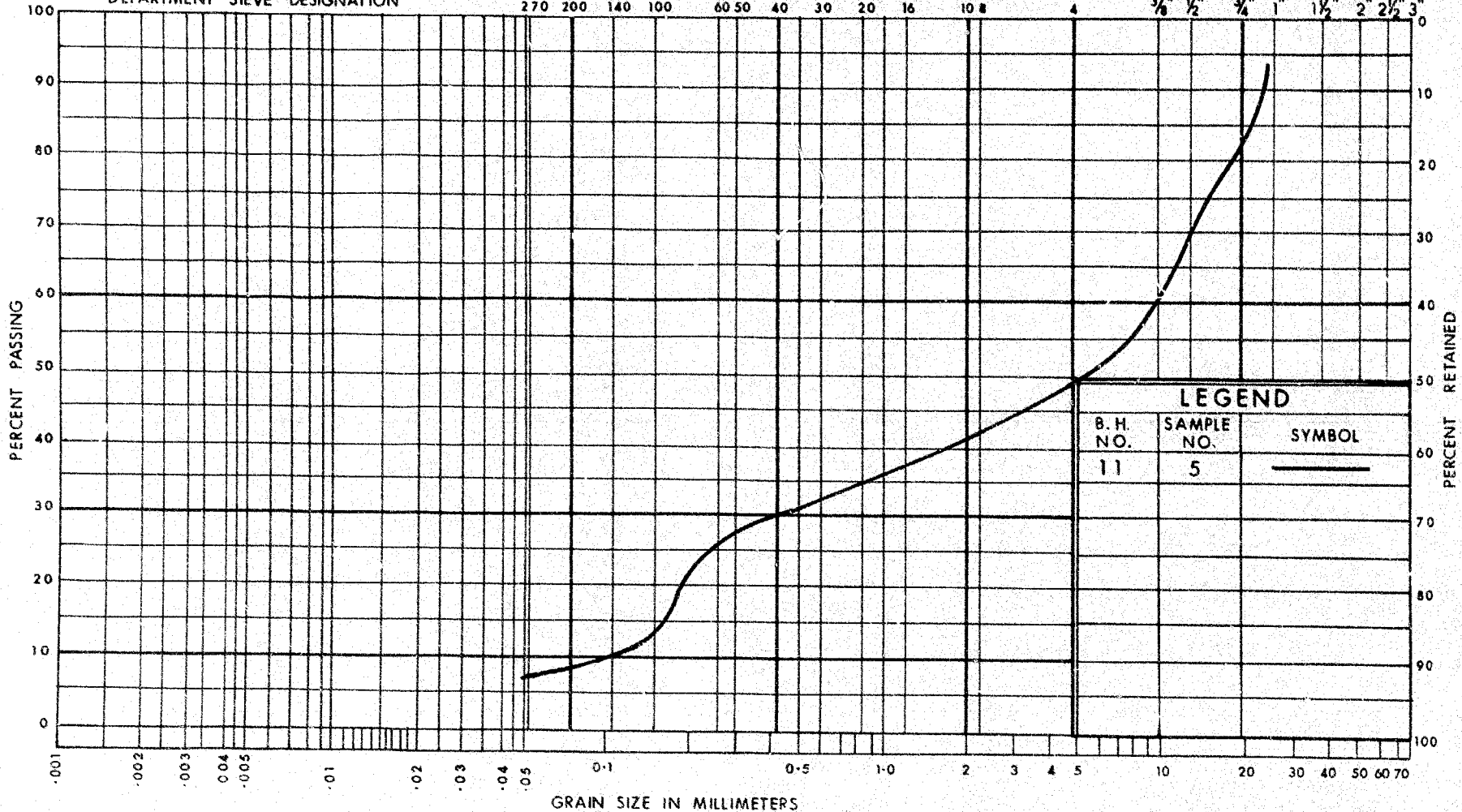
Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION

270 200 140 100 60 50 40 30 20 16 10 8 4 3/4" 1/2" 3/4" 1" 1 1/2" 2" 2 1/2" 3"



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

GRAIN SIZE DISTRIBUTION  
SAND & GRAVEL TRACE OF SILT

W.P. No. 252-61-7

JOB No. 67-F-28

## 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
$\tau_f$	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
$S_i$	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

#67-F-28

W.P. #252-61-7

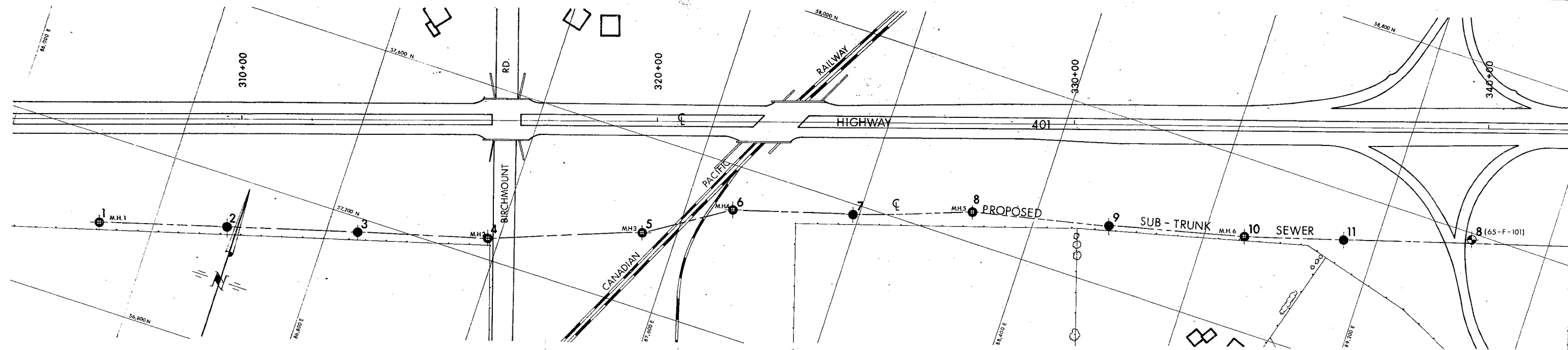
BIRCHMOUNT RD.

! KENNEDY RD.

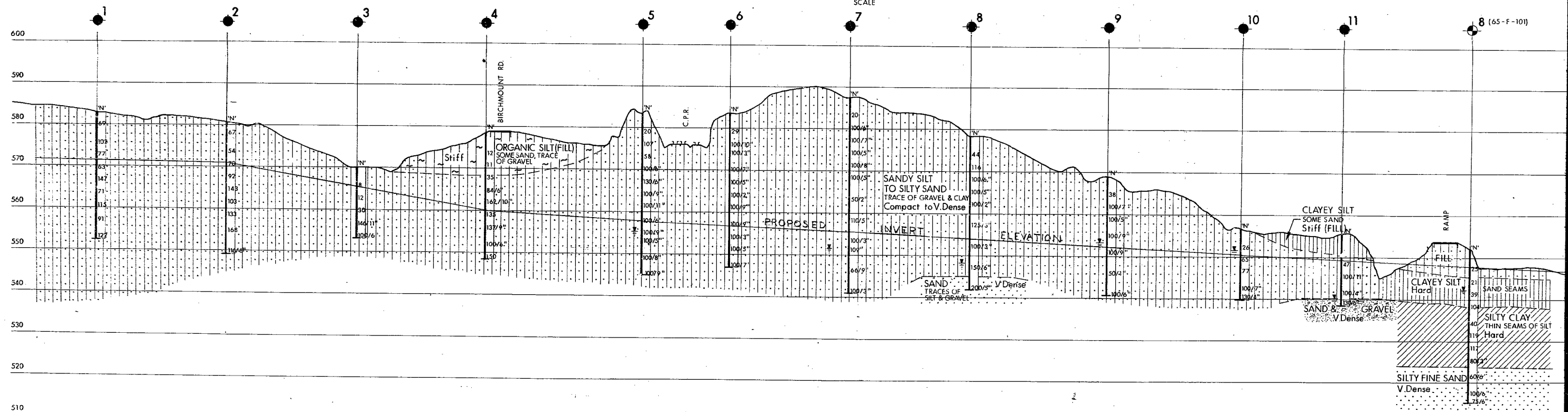
SUB-TRUNK

SEWER

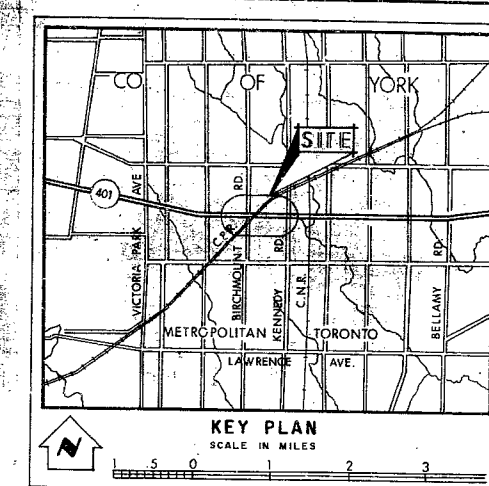
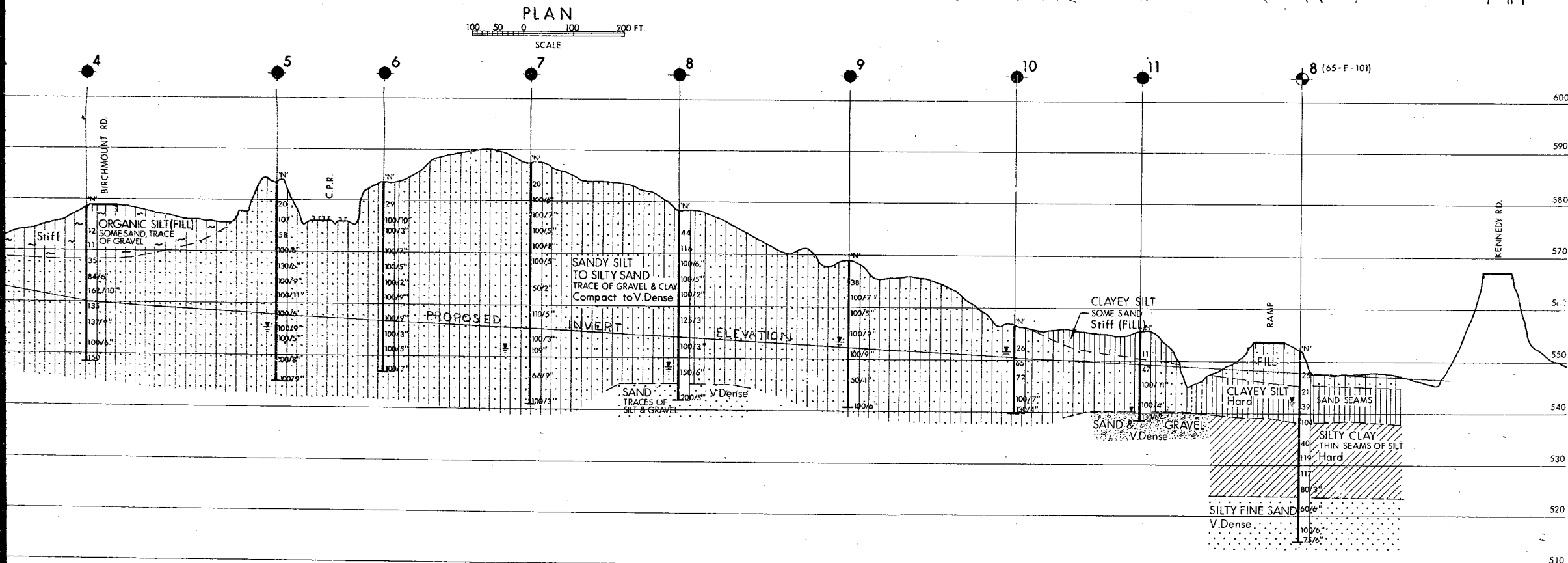
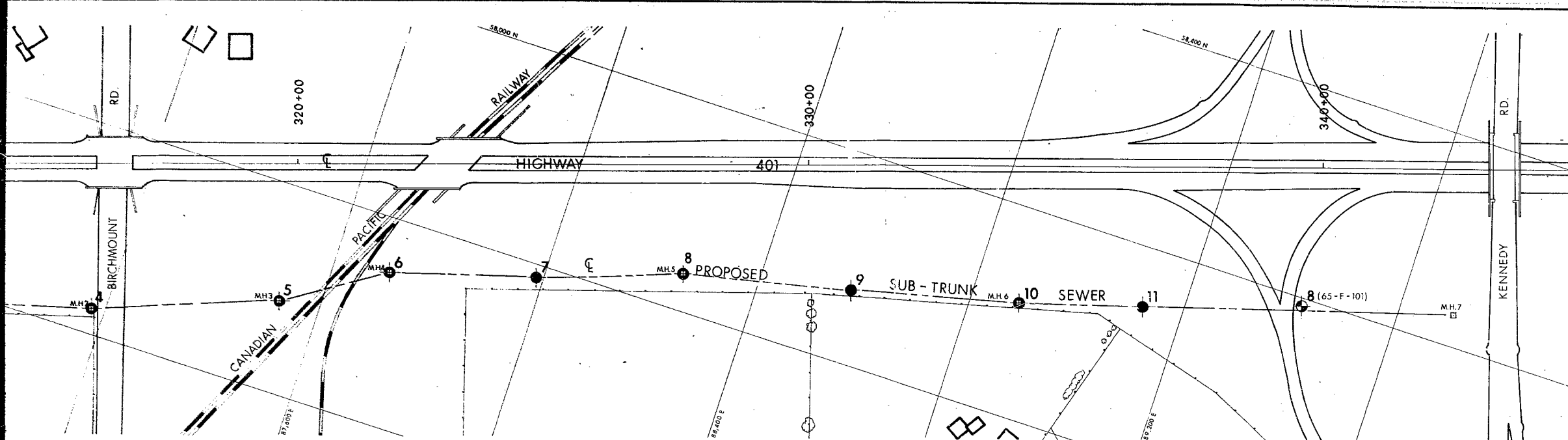




PLAN  
SCALE 0 100 200 FT.



PROFILE  
HOR. 0 100 200 FT.  
VERT. 0 10 20 FT.  
SCALE



**LEGEND**

- Bore Hole
- ⊕ Cone Penetration Hole
- ⊕ Bore & Cone Penetration Hole
- ≡ Water Levels established at time of field investigation, APRIL 1967.
- Manhole

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	583.8	56,992	86,266
2	580.5	57,077	86,570
3	570.0	57,166	86,875
4	578.3	57,252	87,176
5	583.4	57,386	87,526
6	583.8	57,490	87,704
7	587.8	57,580	87,979
8	578.8	57,671	88,254
9	569.5	57,749	88,576
10	557.2	57,826	88,890
11	556.0	57,896	89,126

**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 & TESTING DIVISION - FOUNDATION SECTION

**PROPOSED SUB-TRUNK SEWER**  
BETWEEN BIRCHMOUNT RD. & KENNEDY RD. SOUTH OF HIGHWAY 401

KING'S HIGHWAY NO. \_\_\_\_\_ DIST. NO. 6  
CO. YORK METROPOLITAN TORONTO  
TWP. SCARBORO LOT \_\_\_\_\_ CON. \_\_\_\_\_

**BORE HOLE LOCATIONS & SOIL STRATA**

SUBM'D A.S.	CHECKED <input checked="" type="checkbox"/>	W.P. NO. 252-61-7	M.B.T. DRAWING NO.
DRAWN B.S.	CHECKED <input checked="" type="checkbox"/>	JOB NO. 67-F-28	67-F-28A
DATE 12 MAY 67	SITE NO.	BRIDGE DRAWING NO.	

APPROVED *[Signature]* PRINCIPAL FOUNDATION ENGINEER

REF. NO. B-1-29