FOUNDATION INVESTIGATION REPORT
For
Proposed Structure at the
Crossing of New Hwy. #427
and Campus Road
District No. 6 (Toronto)
W.O. 72-11006 -- W.P. 273-66

1. INTRODUCTION:

The Foundation Office was requested to carry out a subsurface investigation at the crossing of new Hwy. #427 and Campus Rd., in the Borough of Etobicoke, York County. The request was contained in a memo from the Central Regional Office (Mr. G. C. E. Burkhardt, Regional Bridge Planning Engineer) dated December 29, 1971. Subsequently, an investigation was carried out by this Office to determine the subsoil, bedrock and groundwater conditions at the site.

The results of the investigation are presented in this report, together with our recommendations for the design of the structure foundations as well as the stability and settlement considerations associated with the approach fills and cuts.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located some 200 feet east of the junction of Campus Road and Indian Line Road, in the Borough of Etobicoke, Metropolitan Toronto. The terrain is gently undulating in relief between elevations 540 and 546. The area has been utilized for small industrial developments; many one and two storey factories and warehouses are located here.

The site is located in the physiographic region known as the "Peel Plain." The characteristic deposit in this region

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is a ground moraine laid down during the Wisconsinan Glacial Age. In the vicinity of the area under investigation, the moraine is primarily composed of a cohesive, stoney glacial till whose thickness typically ranges between 72 feet and 88 feet. In this region the Humber River and Etobicoke Creek have cut deep valleys into the overburden. There is, therefore, no large undrained depression, swamp or bog, although in many of the instream areas drainage is still imperfect.

The overburden is underlain by grey shale bedrock of the Meaford-Dundas formation, Ordovician Period. Available geological information indicates that the surface of the bedrock varies somewhere between elevation 458 and 473.

3. FIELD AND LABORATORY WORK:

A total of six boreholes, all of which were accompanied by a dynamic cone penetration test, was carried out at the site during the course of the field investigation. The boreholes and the cone penetration tests were advanced by means of a continuous flight auger machine (Penn drill) or a diamond drill rig, both of which were adapted for soil sampling purposes.

Samples were obtained at required depths in a 2-inch O.D. split-spoon sampler which was hammered into the soil. The method of driving the split-spoon conformed to the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. Bedrock was proven at three of the boring locations by obtaining BX size rock core samples.

During sampling and drilling operations, detailed logs of the borings were made; these logs contain a record of drilling and sampling techniques used, together with the soil types and bedrock encountered.

The location and elevation of all the boreholes are shown on Drawing No. 72-11006A, together with a number of estimated stratigraphical sections across the site. Surveying

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of the site was carried out by the personnel from the Engineering Surveys Section, Central Region. The elevations shown in this report are referred to a geodetic datum.

All samples were subjected to a careful visual examination in the field, and subsequently in the laboratory. Following this examination, laboratory testing was carried out on selected representative samples to determine the following physical properties of the overburden.

Natural Moisture Content
Atterberg Limits
Grain-Size Distribution

The results of these tests are plotted on the Record of Borelog Sheets as well as the figures located in the Appendix.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The predominant stratum across the site is composed of a very stiff to hard cohesive glacial till with a thickness ranging from 71 feet to 85 feet. This glacial deposit is covered in certain areas by fill material composed of clayey silt with sand and gravel; the fill was up to 8 feet thick. Underlying the glacial till is shale bedrock.

From ground surface downward the soil types and bedrock encountered are as follows:

4.2) Fill:

On the south side of Campus Rd. a fill has been placed over the parent subsoil. The fill material is composed of a clayey silt with sand and gravel. The depth of fill, at B.H.'s #4 and 5, was found to be 8 feet.

Standard Penetration Tests, carried out within the cohesive fill are plotted on the Record of Borehole sheets. This testing gave 'N' values in the order of 11 to 12 blows/ft.

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Based on these values it is estimated that the fill has been subjected to a moderate degree of compaction.

4.3) Glacial Till (Heterogeneous Mixture of Clayey Silt, Sand and Gravel):

Directly under a thin cover of topsoil or under the fill, is the predominant stratum across the site which is of glacial origin. This glacial till is composed of a heterogeneous mixture of clayey silt, sand and gravel. The thickness of this cohesive stratum varies from 71 feet at B.H.'s #1 and 3, to 85 feet at B.H. #2. Grain-size distribution curves for representative samples of this cohesive deposit are plotted in envelope form on Figure No. 1.

Atterberg limit tests were carried out on samples obtained from the cohesive glacial till. The results of this testing is summarized in tabular form as follows:

Liquid Limit (W_L) (%)	16	- 39
Plastic Limit (W_P) (%)	12	- 20
Natural Moisture Content (W) (%)	6	- 18

Based on these values, it is estimated that the cohesive deposit has a matrix, which is inorganic and of low plasticity.

The Standard Penetration Tests, carried out within this glacial till stratum, are plotted on the Record of Borehole sheets. This testing gave 'N' values which ranged from 16 blows/ft. to 100 blows for 1 inch. Based on this testing it is estimated that the consistency of this deposit varies from very stiff to hard.

4.4) Shale Bedrock:

The cohesive parent glacial till is directly underlain by bedrock, which was proven in 3 of the boreholes by obtaining up to 16 feet of BX size rock core samples. Over the site the bedrock surface was found to vary between elevations 473 and 458, which corresponds to depths below ground surface ranging from

71 to 85 feet. The bedrock is composed of a grey shale; the upper 6 to 8 feet of which is in a weathered state. Below this zone the bedrock is in a sound condition, as evidenced by the high percentage of core recovered.

The bedrock core samples were examined by Mr. K. W. Ingham, Geologist, Department of Transportation and Communications. Mr. K. W. Ingham presented the result of his bedrock examination in a memo to this Office, dated February 29, 1972; this letter is appended to this report.

5. GROUNDWATER CONDITIONS:

Groundwater level observations have been carried out, during the period of the investigation, in the open boreholes. These observations indicate that the groundwater level varies between elevations 540 and 542, which corresponds to depths below ground surface of from 3 to 10 feet.

6. DISCUSSIONS AND RECOMMENDATIONS:

6.1) General:

It is proposed to extend the present airport expressway northerly toward Finch Ave. following closely to the existing Indian Line Rd. This expressway will be designated as Hwy. #427. Interchanges are contemplated at the crossings of Dixon Rd., Belfield Expressway (Hwy. #409), Rexdale Blvd. and Finch Ave. In addition, structures will be required at the crossing of Mimico Creek complex, American Drive, Goreway Drive, Canadian National Railway, Woodbine Racetrack Entrance and Morningstar Drive. At present, the northern limit of this project is not decided.

This discussion deals with the proposed overpass structure at the crossing of Hwy. #427 and Campus Rd., in the Borough of Etobicoke, Metropolitan Toronto. Discussions with regard to other structures along the expressway will be covered in separate foundation reports.

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It is proposed to construct a 50 ft. single-span structure having a width of 150 feet. The profile grade of Hwy. #427, in the vicinity of the structure, will be at about elevation 556. The proposed profile grade of Campus is to be at about elevation 538. The associated approaches will, therefore, be approximately 18 feet in the longitudinal and 10 feet in the transverse direction.

The predominant stratum across the site is a cohesive glacial till, consisting of a heterogeneous mixture of clayey silt, sand and gravel. The thickness of this deposit ranges 71 to 85 feet. This cohesive glacial till deposit is covered in certain areas by fill, composed of clayey silt with sand and gravel; the fill is up to 8 feet in thickness. Underlying the predominant glacial till is shale bedrock.

6.2) Structure Foundations:

As mentioned elsewhere the profile grade of Campus Rd. in the vicinity of the structure is to be at about elevation 538. At least 4 feet of earth cover should be provided above the base of the foundations in order to satisfy the frost protection requirements in this area. Taking this into consideration the foundations could be founded at or below elevation 534. At and below this elevation the subsoil is competent; therefore, the closed-type abutments could be founded on spread footings. These footings can be designed using a safe allowable bearing pressure of 3.5 t.s.f.

The base of the footings will be located approximately 6 to 8 feet below the groundwater level recorded during the period of investigation. The excavations will be carried out in a relatively impervious cohesive stratum. Therefore, no major dewatering problems are anticipated. Any minor seepage or surficial runoff into the excavations could be readily handled by using standard techniques, such as pumping from sumps. During construction of the abutment footings care should be taken to ensure that the foundation subsoil will not be softened by

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groundwater seepage or uncontrolled surface runoff. In this regard it is recommended that a lean concrete working slab should be placed at the footing formation level immediately after the completion of the excavations.

Settlement will be induced in the cohesive glacial till by the imposed footing pressure. The till is competent in nature; therefore, the settlement will be negligible in magnitude, providing the subsoil is not softened as discussed above.

If the structure is designed as a rigid frame, then a coefficient of earth pressure at rest (K_o) of 0.5 should be assumed for the granular fill placed behind the wall, when designing the abutments. However, if some movement of the wall is permitted, then a coefficient of active earth pressure (K_a) of 0.33 can be used.

The granular backfill behind the wall should be allowed to drain in order to prevent the build up of excess hydrostatic groundwater pressures in this area. This can be accomplished by providing weep-holes at the base of the walls. The location and spacing of these weep holes should be determined in accordance with current D.T.C. practices.

It is recommended that a value of 2,500 p.s.f. be used in the computations to determine the sliding resistance between the concrete base of the footing and the underlying cohesive till stratum.

The closed-type vertical wall sections will be inherently stable with respect to a deep-seated rotational type of failure in the foundation subsoil located beneath the spread footings.

6.3) Approach Embankments:

The approaches, for the structure will extend approximately 10 feet above the existing ground surface. In addition, cuts up to 8 ft. will be required. Fills and cuts of this height will be inherently stable with respect to a deep-seated rotational type of failure, providing i) the fills are composed of properly compacted material and ii) standard 2:1 slopes are employed for fill and cut sections.

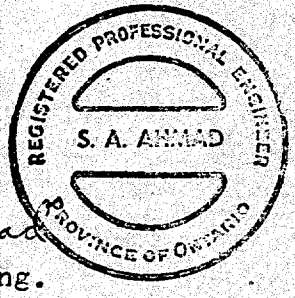
The cohesive subsoil will settle due to the surcharge loading of the approach fills. Since the foundation subsoil is heavily over-consolidated this settlement will be negligible in magnitude.

7. MISCELLANEOUS:

The field work, performed during the period of January 6 to January 10, 1972, was carried out under the immediate supervision of Mr. V. Korlu, Project Foundation Engineer.

The drilling equipment was owned and operated by Master Soil Investigations Ltd., Toronto.

This report was prepared by Mr. S. Ahmad, Project Foundation Engineer. This project was under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.



Shaheen Ahmad

Shaheen Ahmad, P. Eng.

M. Devata

M. Devata, P. Eng.

SA/ao
March 3, 1972.

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 72-11006 LOCATION Co-ords. 15,874,679 N; 972,830 E. ORIGINATED BY VK
W.P. 273-66 BORING DATE Jan. 3 & 4, 1972 COMPILED BY TT
DATUM Geodetic BOREHOLE TYPE Penn Drill and Diamond Drill CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
544.1	Ground Level					
0.0	Het.mix.of clayey silt sand & gravel, occ. clayey silt seams		1	SS	23	540
			2	SS	34	
	Very Stiff to Hard		3	SS	47	
			4	SS	46	530
	Brown / Grey		5	SS	34	
			6	SS	17	
	Glacial Till		7	SS	34	
						520
			8	SS	33	
			9	SS	41	
						510
			10	SS	44	
			11	SS	100/4"	
						500
			12	SS	100/3"	
			13	SS	189	
						490
			14	SS	21	
						480
473.1			15	SS	100/1"	
71.0	Shale Bedrock					470
	Weathered / Sound		16	BX	100%	
461.1						
83.0	End of Borehole					

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT 20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.

REMARKS

▼ 542.4
Feb. 4/72

GR. SA. SI. CL.
4 29 50 17
2 18 58 22

20
15 ⊕ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 72-11006 LOCATION Co-ords. 15,874,655 N; 972,665 E. ORIGINATED BY VK
W.P. 273-66 BORING DATE Jan. 6 & 7, 1972 COMPILED BY TT
DATUM Geodetic BOREHOLE TYPE Penn Drill and Diamond Drill CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w — WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
544.0	Ground Level						SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE			
0.0	Het.mix.of clayey silt & sand & trace of gravel		1	SS	30	590				Feb.4/72 ▼539.5
	occ. clayey silt seams		2	SS	39			○		4 31 49 18
	Glacial Till Very Stiff to Hard		3	SS	62					
	Brown		4	SS	50	530		○		
	Grey		5	SS	29					
			6	SS	37			○		
			7	SS	39	520				
			8	SS	40					
			9	SS	50	510				
			10	SS	160			○		5 27 50 18
			11	SS	100/3"	500				
			12	SS	106/4"			○		
			13	SS	133	490				
			14	SS	100/6"	480				
						470				
458.5			15	SS	100/1"	460		○		5 43 45 7
85.5	Shale Bedrock									
454.0	Sound		16	BX	100%					
90.0	End of Borehole									

20
15 ⊹ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 72-11006 LOCATION Co-ords. 15,874,649 N; 972,762 E. ORIGINATED BY VK

W.P. 273-66 BORING DATE Jan. 5, 1972 COMPILED BY TT

DATUM Geodetic BOREHOLE TYPE Penn Drill and Diamond Drill CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
545.3	Ground Level					545
0.0	Het.mix.of clayey silt,sand & gravel		1	SS	30	
	Glacial Till		2	SS	28	540
	occ. clayey silt seams		3	SS	61	
	Very Stiff to Hard		4	SS	73	
	Brown		5	SS	42	530
	Grey		6	SS	59	
			7	SS	34	
			8	SS	29	520
			9	SS	70	
			10	SS	72	510
			11	SS	95	
			12	SS	84	500
			13	SS	100/6"	
472.3						490
73.0	Shale Bedrock		14	BX	15%	480
464.3	weathered		15	BX	25%	
81.0	sound		16	BX	95%	470
457.8			17	BX	100%	460
87.5	End of Borehole					

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w

WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.

REMARKS

GR SA SI CL

Feb.4/72 ▼542.3

3 29 50 18

5 32 46 17

8 34 40 18

20
15 ⊕ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTI

JOB 72-11006 LOCATION Co-ords. 15,874,689 N; 972,744 E. ORIGINATED BY VK
W.P. 273-66 BORING DATE Jan. 6, 1972 COMPILED BY TT
DATUM Geodetic BOREHOLE TYPE Pen Drill & Cone CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
549.2	Ground Level					
0.0	Fill					
			1	SS	11	
541.7	Stiff to Very Stiff		2	SS	17	
7.5			3	SS	35	540
	Glacial Till		4	SS	48	
	Brown		5	SS	93	
	Grey		6	SS	32	530
			7	SS	120/9"	
	Glacial Till		8	SS	100/3"	
	Het.mix.of clayey					
	silt,sand & gravel.		9	SS	43	520
	Hard					
			10	SS	77	
			11	SS	95	510
			12	SS	95	
498.8			13	SS	150/5"	500
50.4	End of Borehole					
						490

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ UNCONFINED ✦ FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
w_p — w — w_L
WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.

REMARKS

GR.SA.SI.

23 27 38

▽542.2

Feb.4/72

20
15 ✦ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 72-11006 LOCATION Co-ords. 15,874,614 N; 972,682 E. ORIGINATED BY VK

W.P. 273-66 BORING DATE Jan. 5, 1972 COMPILED BY TD

DATUM Geodetic BOREHOLE TYPE Pen Drill & Cone CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT (20 40 60 80 100) / SHEAR STRENGTH P.S.F. (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE)	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w — WATER CONTENT % (10 20 30)	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
544.0	Ground Level									
0.0	Het.mix.of clayey silt,sand & gravel. Very Stiff to Hard		1	SS	33	540				4 27 51 18 ▼539.5 Feb.4/72
			2	SS	29					
	Brown		3	SS	62					
	Grey		4	SS	53	530				
			5	SS	32					
			6	SS	33					
	Glacial Till		7	SS	48					
			8	SS	31	520				
			9	SS	48					
			10	SS	102	510				
			11	SS	77					
	occ. silt seams		12	SS	100/6"	500				
492.5			13	SS	144/11"					
51.5	End of Borehole					490				

20
15 ⊹ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 6

FOUNDATION SECTI

JOB 72-11006 LOCATION Co-ords. 15,874,719 N; 972,812 E. ORIGINATED BY VK
W.P. 273-66 BORING DATE Jan. 4, 1972 COMPILED BY TT
DATUM Geodetic BOREHOLE TYPE Pen Drill & Cone CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
549.1	Ground Level					
0.0	Fill					
			1	SS	12	
541.6	Stiff to Very Stiff		2	SS	16	
7.5			3	SS	36	540
			4	SS	48	
			5	SS	62	
	Brown		6	SS	46	530
	Grey		7	SS	33	
			8	SS	27	
	Glacial Till					520
	Het.mix.of clayey		9	SS	39	
	silt,sand & gravel.		10	SS	51	
	Very Stiff to Hard					510
			11	SS	50	
			12	SS	57	
						500
			13	SS	103/6"	
492.6			14	SS	172	
56.5	End of Borehole					490

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT 20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % 10 20 30

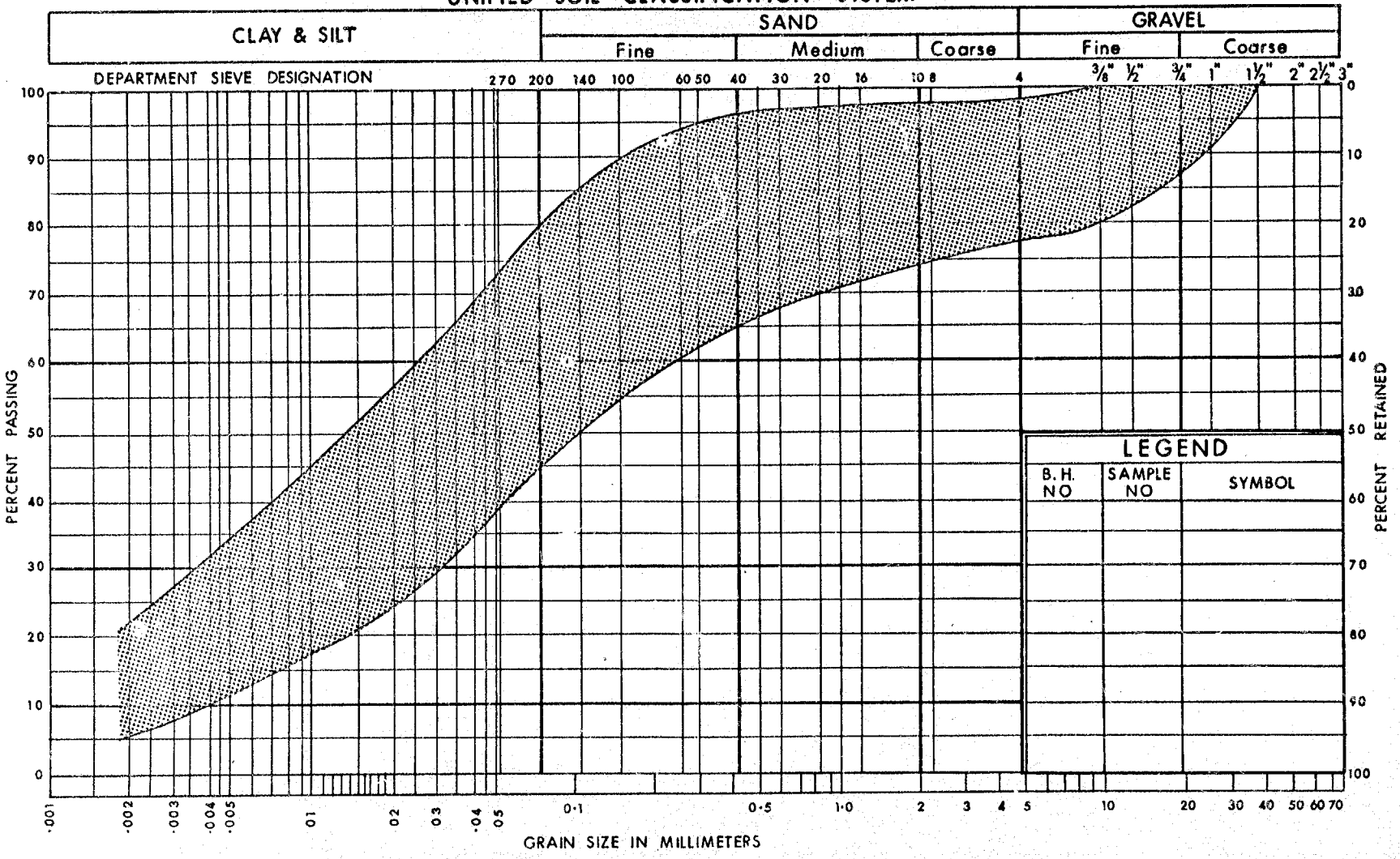
BULK DENSITY γ P.C.F.

REMARK
GR.SA.SI.
8 35 43
▼542.
Feb.4/72

20
15 ⊹ 5 % STRAIN AT FAILURE
10

FORM OD-MT-
REV. AUG. 1971

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

ONTARIO

DESIGN SERVICES BRANCH

GRAIN SIZE DISTRIBUTION

GLACIAL TILL

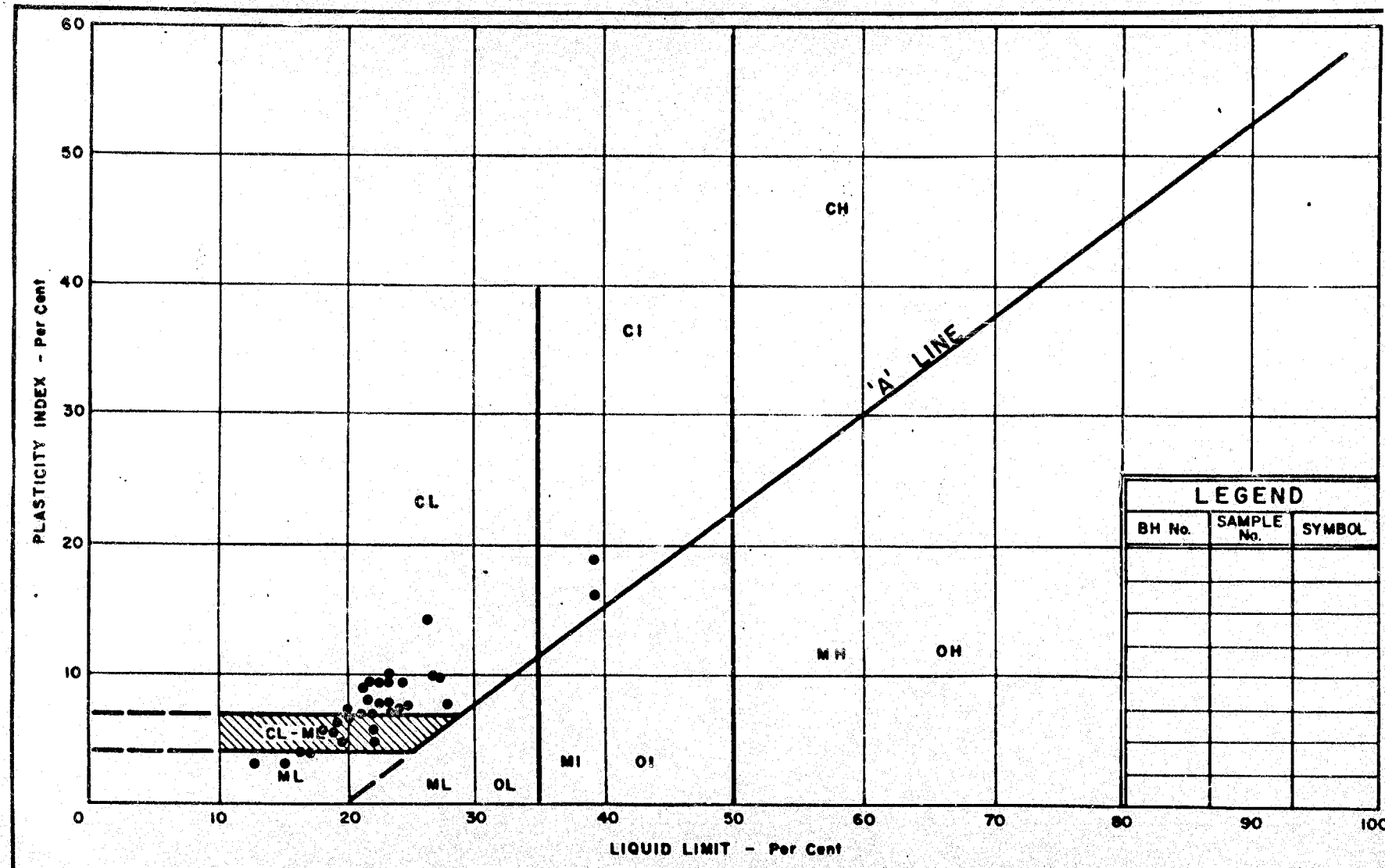
HET. MIXTURE CLAYEY SILT, SAND, & GRAVEL

W.P. No. 273—66

JOB No. 72—11006

FIG. 1

FORM OB-MT-252
REVISED JUL[illegible] 1966



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

PLASTICITY CHART
GLACIAL TILL
HET. MIXTURE CLAYEY SILT, SAND, & GRAVEL

W.P. No. 273—66
JOB No. 72—11006
FIG. 2

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 :-

CONSISTENCY	'N' BLOWS/FT.	c LB./SQ.FT.
VERY SOFT	0 - 2	0 - 250
SOFT	2 - 4	250 - 500
FIRM	4 - 8	500 - 1000
STIFF	8 - 15	1000 - 2000
VERY STIFF	15 - 30	2000 - 4000
HARD	> 30	> 4000

DENSENESS	'N' BLOWS/FT.
VERY LOOSE	0 - 4
LOOSE	4 - 10
COMPACT	10 - 30
DENSE	30 - 50
VERY DENSE	> 50

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

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	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
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 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
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ε	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

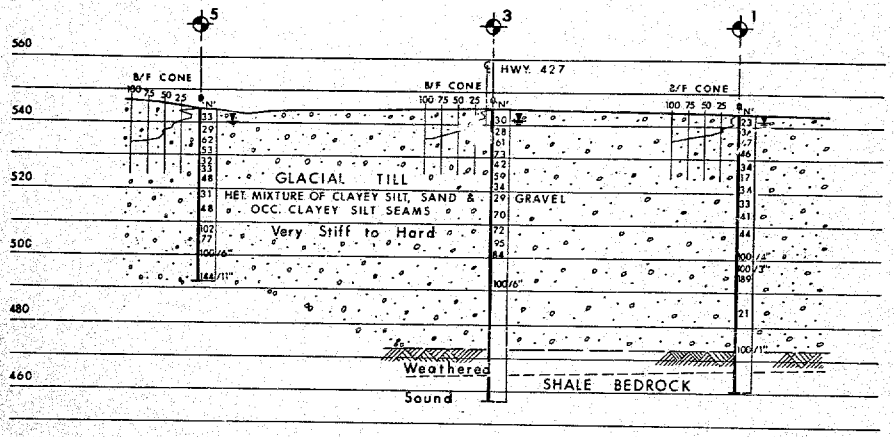
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

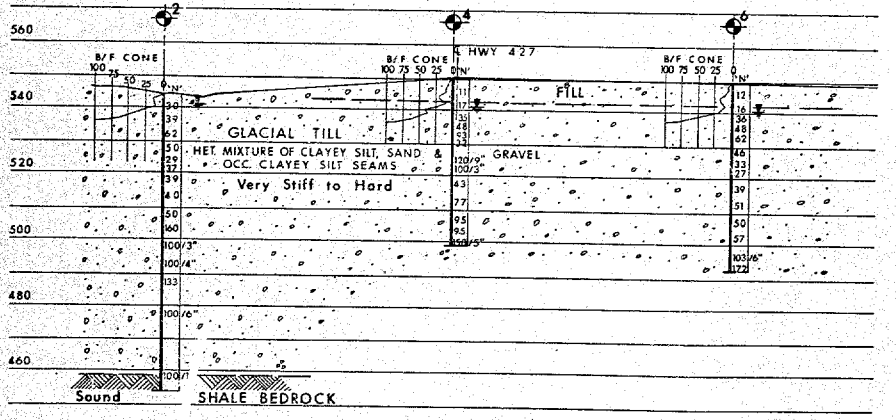
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY. DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

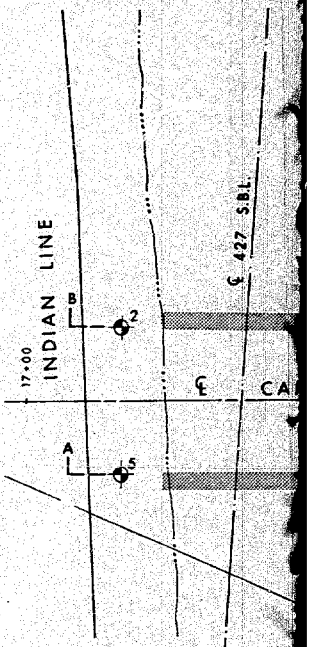


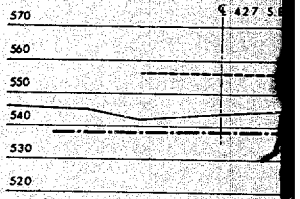
SECTION A—A



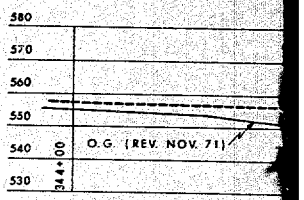
SECTION B—B

SCALE
0 10 20 30 40 50 60 70 80 FT

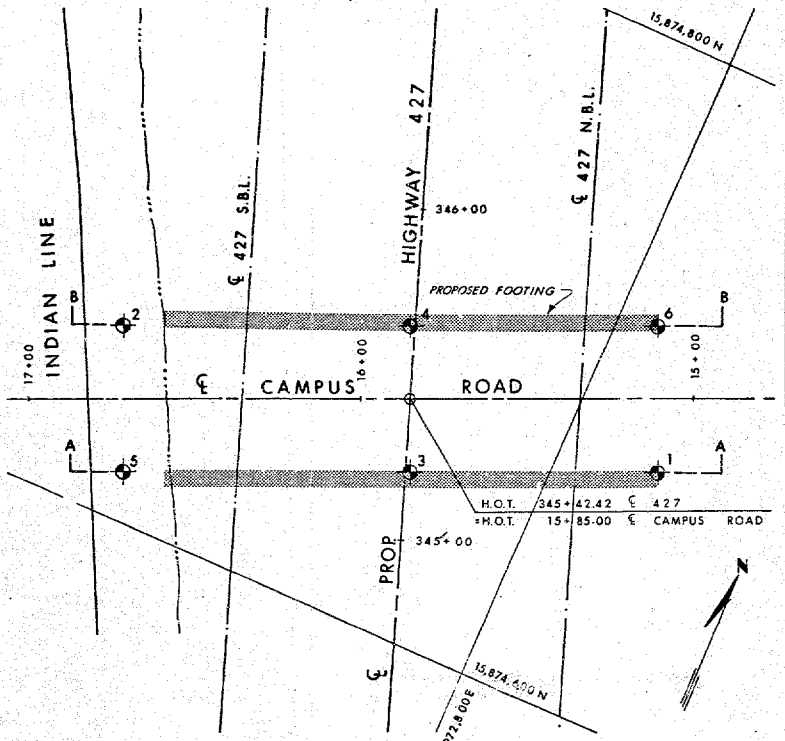




PROFILE



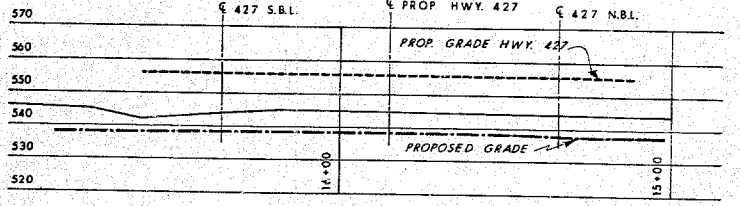
PRO



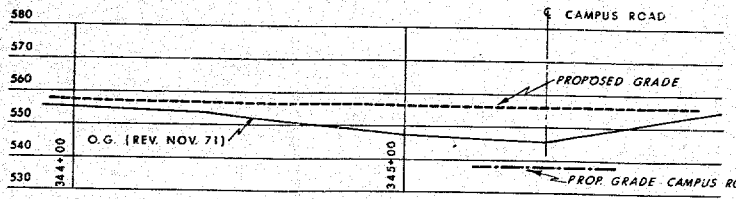
PLAN

SCALE

0 10 20 40 60 80 FT.



PROFILE CAMPUS ROAD



PROFILE HWY. 427

SCALE

0 10 20 40 60 FT.

REF. No. 8-80-91

KEY PLAN

SCALE IN MILES

LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation. FEB. 4, 1972

NO.	ELEVATION	CO-ORDINATES NORTH	EAST
1	544.1	15,874,679	972,830
2	544.0	15,874,655	972,665
3	545.3	15,874,649	972,762
4	549.2	15,874,689	972,744
5	544.0	15,874,614	972,682
6	549.1	15,874,719	972,812

— 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.

REVISIONS			
DATE	BY	DESCRIPTION	

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS
DESIGN SERVICES BRANCH — FOUNDATION OFFICE

CAMPUS ROAD

HIGHWAY NO. 427 PROPOSED DIST. NO. 6
CO. METROPOLITAN TORONTO
TWP. ETOBICOKE LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD. V.K.	CHECKED	W.P. NO. 273-66	DRAWING NO. 72-11006A
DRAWN T.T.	CHECKED	JOB NO. 72-11006	
DATE 4 FEB. 1972		SITE NO.	BRIDGE DRAWING NO.
APPROVED PRINCIPAL FOUNDATION ENGINEER		CONT. NO.	

Ministry of Transportation and Communications
Ontario

Memorandum

To: Mr. M. R. Ernesaks,
Regional Manager,
Central Region, Toronto.

From: Structural Office,
West Building, Downsview.

Attention:

Date: January 11, 1977.

Our File Ref.

In Reply to

Subject: Highway 427 Overpass at Campus Road,
W. P. 273-66, Site 37-986,
District 6, Toronto.

Please change the D4 quantities for the following tender items to read:

South Bound Lane Bridge

Earth Excavation for Bridge Foundation	108 cu yd
Mass Concrete	18 cu yd
Concrete in Bridge Foundation	90 cu yd

North Bound Lane Bridge

Earth Excavation for Bridge Foundation	108 cu yd
Mass Concrete	18 cu yd
Concrete in Bridge Foundation	90 cu yd.

Please change also the quantities of Material Supplied by MTC to Contractor to read:

Normal Portland Cement (Bridge)	235 Ton*
Normal Portland Cement (Approach Slabs)	16 Ton*

*Each, South Bound & North Bound Lane Bridge.

WV/WL/cf

W. Vielrose,
for: W. Lin,
Regional Structural Design Engineer.

c.c. N. Zoltay
J. Wear
H. Greenland
A. McKim
B. Giroux
C. Farrell
E. Van Beilen
C. Mirza

Murty
John
WP 273-66

Mr. G.C.E. Burkhardt
Structural Planning Office
3501 Dufferin Street

Mr. M.D. Bendayan

Soil Mechanics Section
Geotechnical Office
West Building, Downsview

July 23, 1975

HWY. 427 OVERPASS AT CAMPUS ROAD
W.P. 273-66, Site 37-986
District 6, Toronto

Further to your memo dated July 17, 1975, we have reviewed the subsoil conditions and other related information contained in our Foundation Report W.O. 72-11006 taking into account the proposed redesign of the structure. It is understood that there is no change in alignment except an increase in span approximately 8 ft. longer than the original proposal. The subsoil at this site generally consists of very stiff to hard glacial till (het. mixture of clayey silt, sand and gravel) and in our opinion for a minimal increase in the span length, there will be no need for an additional investigation and our recommendations discussed in our Foundation report will be applicable for the redesign.

V. Korlu
Project Engineer

For

M. Devata
Supervising Engineer

c.c. C.S. Grebski
R.D. Gunter
R. Fitzgibbon
H. Greenland
Files
Record Services

Ministry of Transportation and Communications
Ontario

Memorandum

To: Mr. C. Mirza,
Head, Soil Mechanics Section,
West Building.

From: G. C. E. Burkhardt,
Structural Planning Office,
3501 Dufferin Street.

Attention:

Date: July 17, 1975.

Our File Ref.

In Reply to

Subject: Hwy. 427 Overpass at Campus Road,
W.P. 273-66, Site 37-986,
District 6, Toronto.

The bridge design re. above grade-separation (completed in December, 1972) was based on your Foundation Report W.O. 72-11006 issued on March 10, of the same year. Further to this, recent planning revisions determined that a new ramp be developed adjacent to the Hwy. 427 N.B. lanes in the area of the freeway overpass at Dixon Road so as to allow traffic from the south to exit at Campus Road. As a result of this, and to allow for heavy vehicles to properly make left turns into future Campus Road, the pavement approaching the bridge has to be widened on the north side.

It is therefore necessary to redesign subject structure based on a span approximately 8 ft. longer than the original proposal.

Please note that both Hwy. 427 and the crossing road horizontal alignments remained unaltered. The only difference occurred in the Campus Road profile which, to satisfy the increased structure depth required by the new span, had to be slightly lowered.

In view of the above would you kindly review the recommendations contained in W.O. 72-11006 and advise us of any possible changes you wish to make.

We are attaching three prints each of:

- Plan of Hwy. 427 at Campus Road (1" = 40')
- Profile of Campus Road 1" = 100' Horizontal
  1" = 10' Vertical
- Profile of Hwy. 427 1" = 100' Horizontal
  1" = 10' Vertical

As per current scheduling your reply is due by September 10, 1975.

MDB:lm
Attach.

M. D. Bendayan,
STRUCTURAL PLANNING ENGINEER,
for:
G. C. E. Burkhardt,
REG. STRUCTURAL PLANNING ENG.

c.c. R. Fitzgibbon
J. Anderson
E. Shedler
R. D. Gunter

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. M. Devata,
Sup. Foundation Engr.

FROM: K. W. Ingham

ATTENTION:

DATE: March 10, 1972

OUR FILE REF.

IN REPLY TO

SUBJECT: Foundation Investigation 72-11006;
Bridge Footing; Highway 427

Three boreholes, Nos. 1, 2 and 3 intersected bedrock at the site. The rock is a dark grey shale with thin bands of calcareous shale and beds of limestone and siltstone. A small amount of till was recovered at the top of each hole and this appears to be underlain by 2.0 to 8.0 ft. of moderately fractured bedrock and then the undisturbed shale. The depth to bedrock and corresponding elevation for each hole is given below.

Hole No.	Depth to Bedrock - ft.	Bedrock Elevation - ft.
1	85.6	458.4
2	77.0	467.1
3	75.5	469.8

K. W. Ingham,
Geologist.

KWI:mv

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30 M 12 - 52

DIST. 6 REGION CENTRAL

W.P. No. 273 - 66 - 00

CONT. No. 77 - 46

W. O. No. 72 - 11006

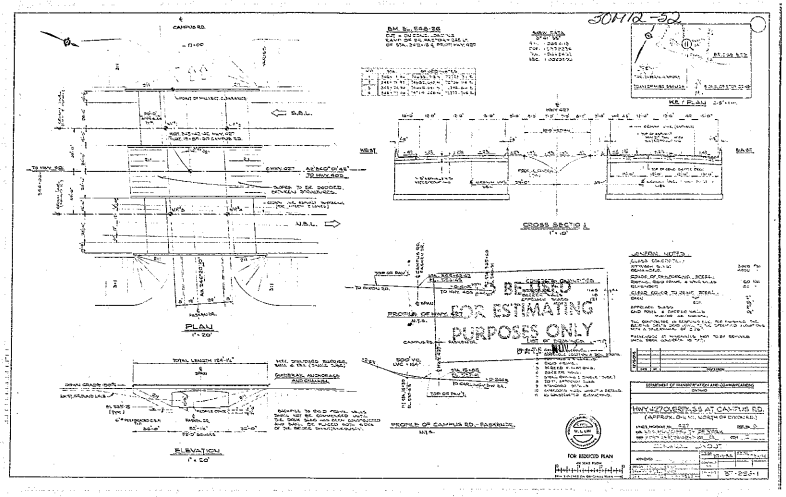
STR. SITE No.

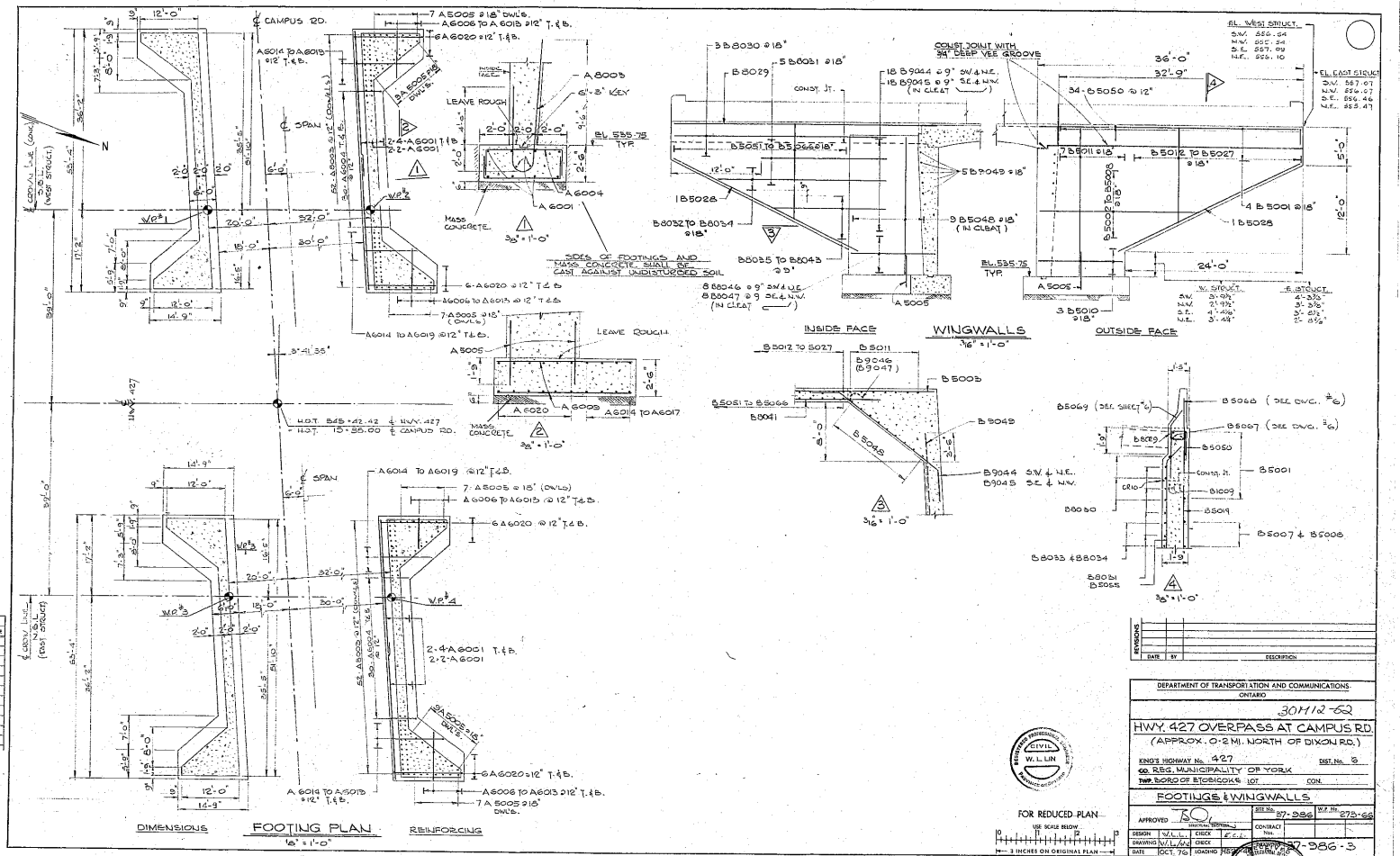
HWY. No. 427

LOCATION STRUCTURE AT THE CROSSING OF NEW HWY 427 AND CAMPUS ROAD.

OVERSIZE DRAWINGS TO BE INSERTED WITH THIS REPORT 3

REMARKS:


30112-52
CAMPUS RD.
PLAN
ELEVATION
CROSS SECTION
KEY PLAN
FOR ESTIMATING PURPOSES ONLY
FOR REVISED PLAN



PRINT RECORD

No.	SCR	DATE

REVISIONS

DATE	BY	DESCRIPTION

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
ONTARIO

30M12-62

HWY. 427 OVERPASS AT CAMPUS RD.
(APPROX. 0·2 MI. NORTH OF DIXON RD.)

KING'S HIGHWAY No. 427 DIST. No. 8
CO. R.S.G. MUNICIPALITY OF YORK
TWP. BORO OF ETOBICOKE LOT CON.

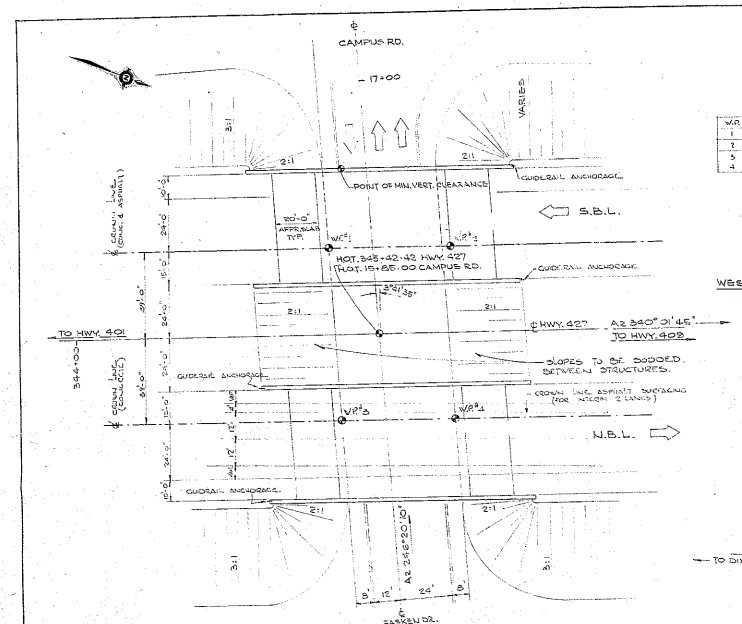
FOOTINGS & WINGWALLS

APPROVED — DESIGNING ENGINEER
SITE No. 87-386 W.P. No. 873-66
CONTRACT Nos.
DESIGN W.L.L. CHECK E.C.L.
DRAWING W.L.L. CHECK
DATE OCT. 76 LOADING No. 1 DRAWING No. 87-386-3

REGISTERED PROFESSIONAL ENGINEER CIVIL W. L. LIN ONTARIO

FOR REDUCED PLANS
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

MAR 03 1977

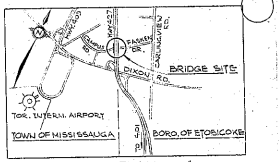


PLAN
1" = 20'

B.M. EL. 548.26
CUT + ON CONC. LOADING RAMP OF BR., FACTORY 265' LT. OF STA. 342+15 ℄ PROP. HWY. 427

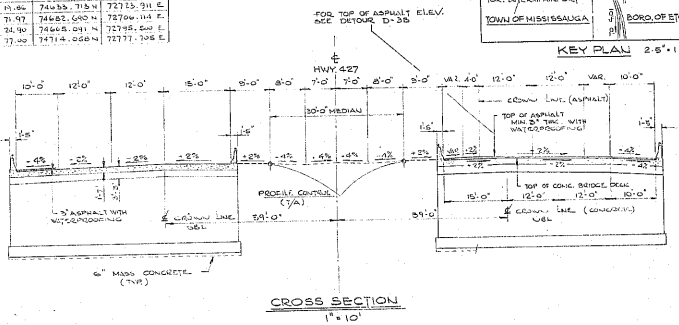
W.P.	STA.	COORDINATES
1	345+11.86	74655.715 N 72715.911 E
2	345+71.97	74682.680 N 72766.114 E
3	343+24.90	74665.091 N 72795.500 E
4	345+17.00	74714.058 N 72777.106 E

SKEW DATA
S 5° 41' 35" E
SIN. 0.064113
COS. 0.997934
TAN. 0.064545
SEC. 1.002053

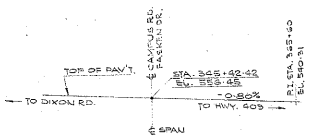


KEY PLAN 2.5" = 1 MI.

FOR TOP OF ASPHALT EL. EV. SEE DETOUR D-35



CROSS SECTION
1" = 10'



PROFILE OF HWY. 427
N.T.S.

CONCRETE QUANTITIES
FOR THE LUMP SUM TENDER ITEMS.

BRIDGES	637.5 cu yd
BARRIER WALLS	19.0 " "
APPROACH SLABS	60.5 " "

N.B. THE ABOVE QUANTITIES ARE FOR EACH, NBL & SBL STRUCTURES.

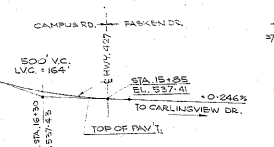
GENERAL NOTES:

CLASS CONCRETE:	
APPROACH SLABS	3000 PSI
REMAINDER	4000 "
GRADE OF REINFORCING STEEL:	
FOOTING, RIGID FRAME & WING WALLS	60 KSI
REMAINDER	60 "
CLEAR COVER TO REINF. STEEL:	
DECK TOP	2"
DECK BOT.	1"
APPROACH SLABS	2"
END POSTS & BARRIER WALLS AND/OR AS SHOWN.	1½"

FALSEWORK AT WINGWALLS NOT TO BE REMOVED UNTIL DECK CONCRETE IS SET.

ELEVATION
1" = 20'

BACKFILL TO RIGID FRAME WALLS SHALL NOT BE COMMENCED UNTIL THE DECK SLAB HAS BEEN CONSTRUCTED AND SHALL BE PLACED BOTH SIDES OF THE BRIDGE SIMULTANEOUSLY.



PROFILE OF CAMPUS RD. - FASKEN DR.
N.T.S.

LIST OF DRAWINGS.

57-986-1. GENERAL LAYOUT.
2. BOREHOLE LOCATION & SOIL STRATA.
3. FOOTINGS & WINGWALLS.
4. RIGID FRAME.
5. SCREED ELEVATIONS.
6. BARRIER WALL.
7. STEEL RAILING. (SINGLE TUBE.)
8. 30 FT. APPROACH SLAB.
9. STANDARD DETAILS.
10. AS CONSTRUCTED ELEVATIONS.
11. EMBEDDED WORK (LIGHTING) LAYOUT & DETAILS.
12. EMBEDDED WORK (LIGHTING) STD. DETAILS.

PAINT RECORD

No.	ISS	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
ONTARIO

30H12-52

HWY. 427 OVERPASS AT CAMPUS RD.
(APPROX. 0.2 MI. NORTH OF DIXON RD.)

KING'S HIGHWAY No. 427 DIST. No. 6
RES. MUNICIPALITY OF YORK
TWP. BORO. OF ETOBICOKE LOT 23 CON. IV

GENERAL LAYOUT

APPROVED ORIGINAL SIGNED				SDT No.	57-986
				W.P. No.	273-66
DESIGN	W.L.L.	CHECK	E.C.L.	CONTRACT No.	
DRAWING	W.L.L.	CHECK		DRAWING No.	57-986-1
DATE	JULY '76	LOADING	HS 20-44		

CIVIL W. L. LIN PROFESSIONAL ENGINEER PROVINCE OF ONTARIO

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

RECEIVED
MAR 09 1977
HIGHWAY ENGINEERING DIVISION