

~~XXXXXXXXXXXXXXXXXXXX~~

MEMORANDUM

30M(11-7)

TO: Mr. G. C. E. Burkhardt, (2)
Regional Bridge Planning Eng.,
Central Region,
90 Floral Parkway.

FROM:

Foundations Office,
Design Services Branch,
Central Bldg., Downsview.

ATTENTION:

DATE:

September 20, 1971.

OUR FILE REF.

IN REPLY TO

SEP 22 1971

SUBJECT:

FOUNDATION INVESTIGATION REPORT
FOR

Proposed Structure (Bridge #1)
And Related Retaining Walls
At the Crossing of
Belfield Expressway & Kipling Ave.
District #6 (Toronto)
W.O. 71-11034 -- W.P. 269-65

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 recommendations contained therein, will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

AGS/ao
Encl.

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER.

cc: Messrs. B. R. Davis
A. Rutka
D. W. Farren
G. K. Hunter (2)
H. Greenland
B. J. Giroux
G. A. Wrong
T. J. Kovich
B. A. Singh
De Leuw, Cather (R. Barr)

Foundations Files
Documents

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FOUNDATION INVESTIGATION REPORT
For
Proposed Structure (Bridge #1)
And Related Retaining Walls
At the Crossing of
Belfield Expressway & Kipling Ave.
District #6 (Toronto)
W.O. 71-11034 -- W.P. 269-65

1. INTRODUCTION:

The Foundation Section was requested to carry out a subsurface investigation at the crossing of proposed Belfield Expressway and Kipling Avenue, in the Borough of Etobicoke, York County. The request was contained in a memo from the Bridge Office (Mr. G. C. E. Burkhardt, Regional Bridge Planning Engineer), dated May 12, 1971. Subsequently, an investigation was carried out by this Section 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. SITE AND GEOLOGY:

The site is located approximately at the intersection of Belfield Expressway and Kipling Ave. in the Borough of Etobicoke, Metropolitan Toronto. The terrain is gently undulating in relief between about elevations 514 to 520. The area has been developed 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 is a ground moraine laid down during the Wisconsin Glacial Age. In the vicinity of the area under investigation, the moraine is primarily composed of a basically cohesive, stoney glacial till extending to a depth of 140 feet below ground surface.

3. FIELD AND LABORATORY WORK:

A total of nine sampled boreholes, each of which was accompanied by a dynamic cone penetration test, were 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, 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.

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 encountered.

The location and elevation of all the boreholes are shown on Drawing #71-11034A, together with an estimated stratigraphical section across the site. Surveying at the site was carried out by the personnel from the Draughting Section, Materials and Testing Office, Department of Transportation and Communications. The elevations given 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 on the figures located in the Appendix.

4. SUBSOIL CONDITIONS:

4.1) General:

The predominant stratum across the site is a competent glacial till extending up to at least 140 ft. below existing ground surface. Bedrock was not proven in any of the borehole locations but through previous investigations in the vicinity it was found that the glacial till is underlain by shale bedrock.

The subsoil conditions as determined at the various borehole locations, are shown on the accompanying Borelog sheets. The stratigraphical sections, shown on Drawing No. W.O. 71-11034A, have been inferred from this data.

4.2) Glacial Till:

The glacial till is present immediately beneath a thin topsoil cover (6 inches). The stratum was never fully penetrated, but was proven to a depth of 140 feet in borehole #2. The upper 25.5 to 37 feet of the stratum is cohesive, being composed of a matrix of clayey silt, sand and gravel. Below this cohesive zone the glacial till is granular in nature, i.e. it is of a heterogeneous mixture of silt, sand and gravel with a trace of clay. A layer of silty sand approximately 3 feet thick was encountered within the upper cohesive portion of the glacial till at borehole #7, between elevations 503.4 and 500.4. Grain size distribution curves for samples obtained within the two distinct zones are plotted in envelope form on the figures listed below.

Figure No. 1 - Upper Cohesive Glacial Till

Figure No. 2 - Lower Granular Glacial Till

These figures are located in Appendix I of this report.

Atterberg limit tests were carried out on samples from the glacial till. These are plotted on the Borelog sheets and are summarized on the plasticity chart, Figure No. 3.

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

4.2) Glacial Till: (cont'd) ...

The results are tabulated below:

		<u>Upper Cohesive Zone</u> <u>Range (Average)</u>		<u>Lower Granular Zone</u> <u>Range (Average)</u>	
Liquid Limit (%)	(W _L)	16 - 27	(21.5)	14 - 17	(15.5)
Plastic Limit (%)	(W _P)	12 - 16	(14.5)	11 - 13	(12)
Natural Moisture Content (%)	(W)	6 - 13.5	(10.5)	6.5 - 18.5	(9.5)

Referring to the table, it can be seen that the upper cohesive portion of the glacial till is inorganic with a plasticity in the low range. The limited number of tests carried out on the granular portion of the glacial till, however, indicate that this material is basically non-plastic. The natural moisture content within the cohesive zone of the structure is typically 2 to 5 per cent below the plastic limit.

Standard penetration testing was performed within the stratum; the values are plotted on the Borelog sheets. In the upper cohesive portion of the glacial till the 'N' values range from 9 blows/foot generally increasing with depth to 300 blows for 3 inches. Based on these results it is estimated that the consistency of this zone generally varies from stiff to hard. The 'N' values in the granular zone of the glacial till varies between 113 blows per foot and 300 blows for 3 inches, indicating a relative density of very dense.

5. GROUNDWATER CONDITIONS:

Groundwater level observations have been carried out during the period of this investigation, in the open boreholes. The results are shown on the Record of Borelog sheets and summarized on Drawing No. W.O. 71-11034A. These observations indicate that the groundwater level varies between elevations 506 and 516 which corresponds to depths of from 2 to 12 feet below existing ground surface, being typically 3 feet below ground surface.

6. DISCUSSIONS AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct an east-west expressway in the vicinity of Belfield Road which will connect Hwy. #401 in the Islington/Kipling area with the Toronto International Airport. The new Belfield Expressway will be 33 miles long and will require interchanges at Kipling Ave., Martin Grove Road, Attwell Drive, new Hwy. #427 and Airport Road. In addition, structures will be required at the crossings of Iron Road, Canadian National Railways, old Hwy. #27 and Mimico Creek with the proposed expressway.

This discussion deals with the proposed overpass structure and related retaining walls (R-1 & R-2) at the crossing of the Belfield Expressway and Kipling Avenue.

The proposed overpass at Kipling Avenue and Belfield Expressway will be a two span structure (78 feet - 67 feet) incorporating a centre pier with closed end abutments. The new bridge will be approximately 95 ft. wide. The profile grade of the Belfield Expressway at the overpass location will be at about elevation 538, i.e. of the order 20 feet above the existing ground surface. The grade of Kipling Avenue will remain relatively unchanged at elevation 518.

The predominant stratum across the site is an extensive deposit of glacial till extending at least 140 feet below existing ground surface.

The foundations for the overpass structure and the related retaining walls (R-1 & R-2) can be supported on spread footings within the parent subsoil. The recommendations for these respective elements are discussed in the sections to follow.

The cohesive stratum is periodically underlain by between 7 and 18 feet of very dense gravelly sand to sandy silt, which, in turn, is followed by shale bedrock.

The abutments and piers for the two structures, as well as the retaining walls, can be founded on shallow foundations located within the clayey silt stratum.

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

6.1) General: (cont'd) ...

Recommendations pertaining to the specific structure elements will be presented separately in the subsections to follow.

6.2) Structure Foundations - Bridge #1:

6.2.1) Abutments:

The 'closed-type' abutments for the proposed overpass can be founded on spread footings using an allowable safe bearing pressure up to 3 t.s.f. at or below elevation 512. The base of the footing should be at least 4 feet below the finished grade of Kipling Avenue in order to provide sufficient frost protection.

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

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

The abutment walls will retain between 20 and 22 feet of parent subsoil. The foundation subsoil, beneath the walls, is competent; therefore, no deep-seated rotational type stability problems are anticipated.

6.2.2) Centre Pier:

At the time of foundation investigation borings were not carried out in the vicinity of centre pier location in view of the presence of numerous underground utilities. It is believed that the subsoil conditions will be similar to those encountered in the general area. For design purposes a conservative value of 2.5 t.s.f. may be used for allowable bearing pressure. Prior to the construction, after the removal of underground utilities this office will carry out additional borings in order to provide positive recommendations.

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

6.2) Structure Foundations - Bridge #1: (cont'd) ...

6.2.2) Centre Pier: (cont'd) ...

It is believed that District personnel will advise this Office prior to four weeks commencement of the construction in order to carry out the borings at this location.

Any areas to be sub-excavated for the removal of the underground utilities should be backfilled with properly compacted granular "A" material or with lean mass concrete to the footing formation level.

The centre pier foundations should be provided with a minimum cover of 4 feet for frost protection purposes.

6.2.3) Related Considerations:

Excavations for the pier and abutment footings may be carried out below the prevailing groundwater level at certain locations. In view of the relatively impervious nature of the cohesive subsoil at the footing formation level, no major dewatering problems are anticipated, during the excavation phase. Any minor groundwater seepage of surface run-off into the excavations could be handled using standard techniques, such as pumping from sumps.

During construction of the abutment and pier footings, care should be taken to ensure that the foundation subsoil will not be softened by surface run-off or groundwater seepage. A lean concrete working slab should be placed at the footing formation level immediately after the completion of the excavations.

Providing this provision is adopted, the differential settlement between the spread footing supported centre pier and adjacent abutments should be negligible in magnitude. This differential should be realized during or immediately following the construction of the structures.

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

6.3) Retaining Walls (No's R-1, R-2):

The retaining walls, having heights which range from 5 to 19 feet, can be founded on spread footings located within the glacial till stratum. The founding level should be commensurate with the frost protection requirements in the area, as discussed in Subsection 6.2.1.. Spread footings, supporting these retaining walls can be designed using an allowable bearing pressure of 3.0 t.s.f. at or below elevation 513.0.

Comments made with regard to dewatering of the excavations for the pier and abutments are applicable for the retaining wall foundations as well.

The following values can be used in the design of the retaining structure:

Coefficient earth pressure at rest $K_0 = 0.5$ (Rigid Wall)

Coefficient of active earth pressure $K_a = 0.33$ (Some movement at the top of wall permitted)

Sliding resistance between the concrete and the soil -
2,000 p.s.f.

In order to relieve the build-up of excess hydrostatic pressure behind the retaining structures suitable drainage measures should be provided. If the embankments are not constructed of a relatively free-draining type of granular material, the following measures should be taken:

An 8-ft. wide vertical strip of free-draining granular material should be provided behind the wall; the remainder of the backfill could consist of locally available earth similar to that used for embankment construction. In addition to the 8-ft. wide gravel strip behind the wall, a horizontal layer of gravel, 4 feet thick, should be built into the backfill at half the height of the wall, and should extend for a distance equal to one-half the height of the wall. No horizontal drains would be required for that portion of the retaining wall having a height of less than 12 feet.

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

6.3) Retaining Walls (No's R-1, R-2): (cont'd) ...

Suitable weep holes should be provided at the base of the wall at a maximum spacing of 10 ft. Department Standard SD-4-58, prepared for various retaining wall backfilling requirements for Hwy. 401 Toronto Bypass, may be used for design and construction purposes.

6.4) Approach Fills - Vicinity of Structures:

As discussed in Subsection 6.1, the height of the approach fills will vary between 20 and 22 feet. No stability problems are anticipated for fills of this height with standard 2:1 slopes.

7. MISCELLANEOUS:

The field work was performed during the period of June 17 to June 29 and also from June 7 to June 15, 1971, under the supervision of Mr. V. Korlu, Project Foundation Engineer.

Equipment used was owned and operated by F. E. Johnston Drilling Co. Ltd., Toronto.

This report was prepared* by Mr. M. Logan (Student Technician).

The investigation was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.

September, 1971.

APPENDIX I

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 71-11034

LOCATION Co-ords. 880,104 N; 983,153 E.

ORIGINATED BY VK

W.P. 269-65

BORING DATE June 16, 1971

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger & sample with Pendrill

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.					WATER CONTENT %				
517.5	Ground Level							20 40 60 80 100					w_p — w — w_L			
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE								
0.0	Het. mixture of clayey silt, sand & gravel		1	SS	19											516.
	Very Stiff to Hard		2	SS	43	510										3 22 55 20
			3	SS	101											3 25 52 20
			4	SS	95											
	Brown changing to Grey below el. 503.		5	SS	58	500										
			6	SS	71											
			7	SS	64											
			8	SS	300/3"	490										
	Glacial Till		9	SS	81											
483.5			10	SS	160	480										
34.0	Het. mixture of silt, sand and gravel, trace of clay.		11	SS	175											
	Very Dense		12	SS	135/4"	470										8 36 41 15
			13	SS	300/6"											
			14	SS	300/5"	460										3 39 51 7
						450										
			15	SS	240/6"	440										
						430										
	Grey		16	SS	100/3"	410										5 70 (55)
						400										
402.5																
115.0	End of Borehole					400										

20
15-5 % STRAIN AT FAILURE
10

ORIGINATED BY VK

COMPILED BY JK

CHECKED BY

376.6	
740.0	End of Borehole

FOUNDATION SECTION

ORIGINATED BY VK

COMPILED BY VK

CHECKED BY: *[Signature]*

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	20 40 60 80 100	20 40 60 80 100	10 20 30		
516.2	Ground Level										
0.0	Het. mix. of clayey silt sand and gravel		1	SS	9						
	Stiff to Hard		2	SS	40	510					
	Brown changing to Grey below El. 499.		3	SS	61						
	Glacial Till		4	SS	72						
			5	SS	54	500					
			6	SS	55						
			7	SS	55						
489.7			8	SS	119	490					
26.5	Het. mix. of silt, sand and gravel, trace of clay.		9	SS	152						
	Very Dense		10	SS	200/5"	480					
			11	SS	250/6"						
			12	SS	157/6"	470					
	Grey		13	SS	300/3"						
			14	SS	300/5"	460					
455.7			15	SS	170/6"						
60.5	End of Borehole					450					

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 71-11034

LOCATION

Co-ords. 880,122 N; 983,315 E.

ORIGINATED BY VK

W.P. 269-65

BORING DATE

June 23, 1971

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE

Auger and sample with Pendrill

CHECKED BY

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS			
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT						WATER CONTENT %		
							20	40	60	80			100	w_p — w — w_L	
						SHEAR STRENGTH P.S.F.									
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE									
516.1	Ground Level														
0.0	Het. mix. of clayey silt, sand & gravel		1	SS	28										
			2	SS	35	510									
	Very Stiff to Hard		3	SS	52										
			4	SS	84										
	Brown changing to Grey below el. 500.		5	SS	58	500									
			6	SS	63										
			7	SS	55										
496.6	Glacial Till		8	SS	100/3"	490									
25.5	Het. mix. of silt, sand & gravel, trace of clay		9	SS	100/6"										
			10	SS	200/5"	480									
	occ. layers of clayey silt up to 6" thick		11	SS	220/6"										
			12	SS	176/6"	470									
			13	SS	200/3"										
	Very Dense		14	SS	237/6"	460									
			15	SS	200/6"										
	Grey		16	SS	115/6"	450									
445.1			17	SS	100/4"										
71.0	End of Borehole					440									

510.1
F 25 52 22

6 37 48 9

2 41 44 13

1 74 (25)

FOUNDATION SECTION

ORIGINATED BY **VE**

COMPILED BY VK

CHECKED BY

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT PLASTIC LIMIT WATER CONTENT		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	W _p	W _L		
516.6	Ground Level									
0.0	Net mix. of clayey silt, sand & gravel.		1	SS	26					
	Very Stiff to Hard		2	SS	54	510				6 30 43 21
	Brown changing to Grey		3	SS	65					
	below el. 504.		4	SS	41					
			5	SS	31	500				9 33 44 14
	Glacial Till		6	SS	48					
			7	SS	74					
			8	SS	125	490				
486.6										
30.0	End of Borehole					480				

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 71-11034 LOCATION Co-ords. 879,848 N; 982,883 E. ORIGINATED BY VK
 W.P. 269-65 BORING DATE June 29, 1971 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Washbore with Diamond Drill CHECKED BY

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	10		
517.4	Ground Level													
0.0	Het. mix. of clayey silt sand and gravel.		1	SS	55									
	Hard		2	SS	38									
	Brown changing to Grey below el. 505.		3	SS	59									
503.4			4	SS	100/3"									
11.0	Silty sand		5	SS	60									
500.4			6	SS	74									
17.0	Glacial Till		7	SS	77									
494.9	End of Borehole													
22.5														

513.0
4 25 50 21

0 92 (8)

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 9

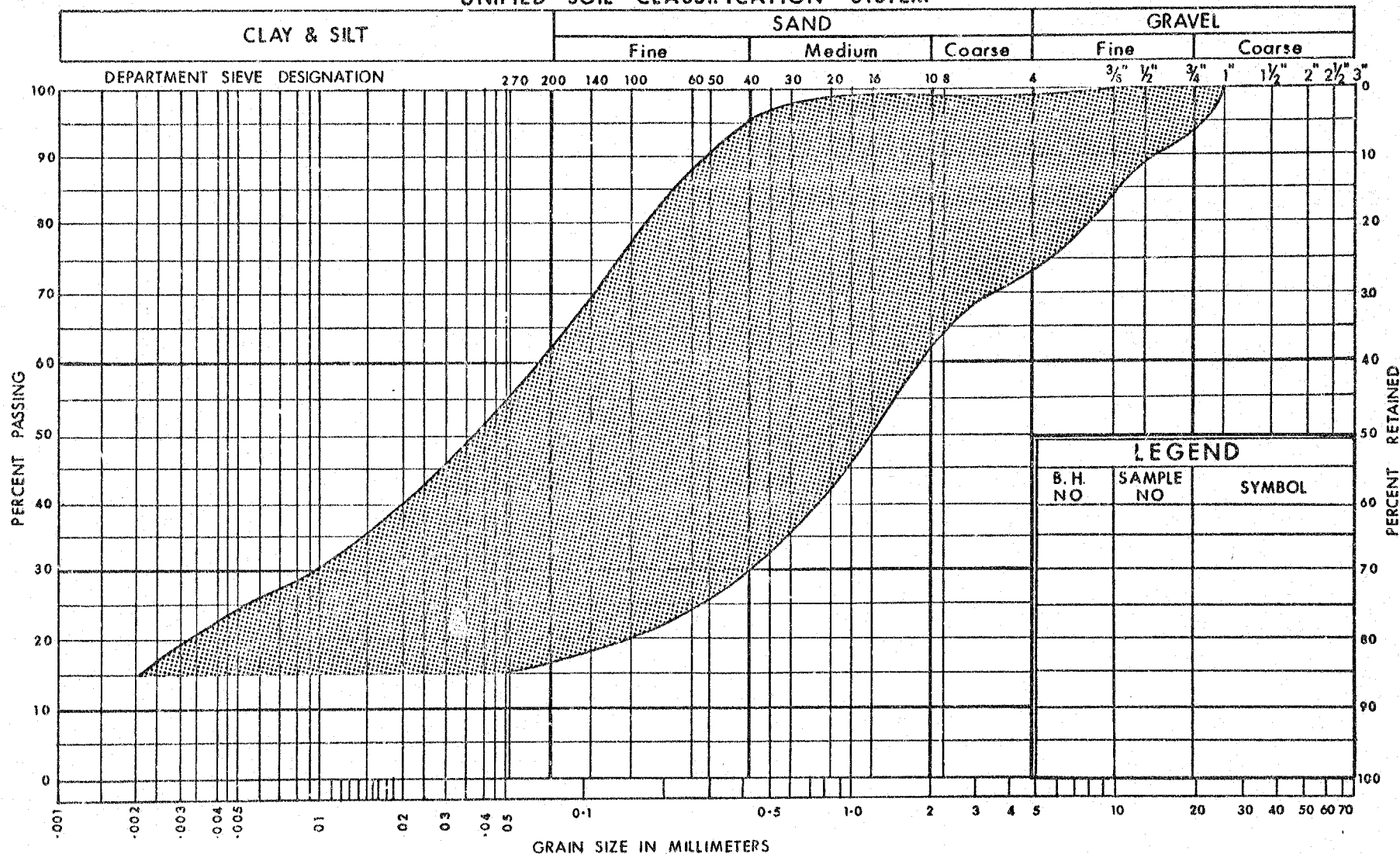
FOUNDATION SECTION

 JOB 71-11034 LOCATION Co-ords. 879,586 N; 983,067 E.
 W.P. 269-65 BORING DATE June 24, 1971
 DATUM Geodetic BOREHOLE TYPE Auger & Sample with Pendrill

 ORIGINATED BY VK
 COMPILED BY VK
 CHECKED BY

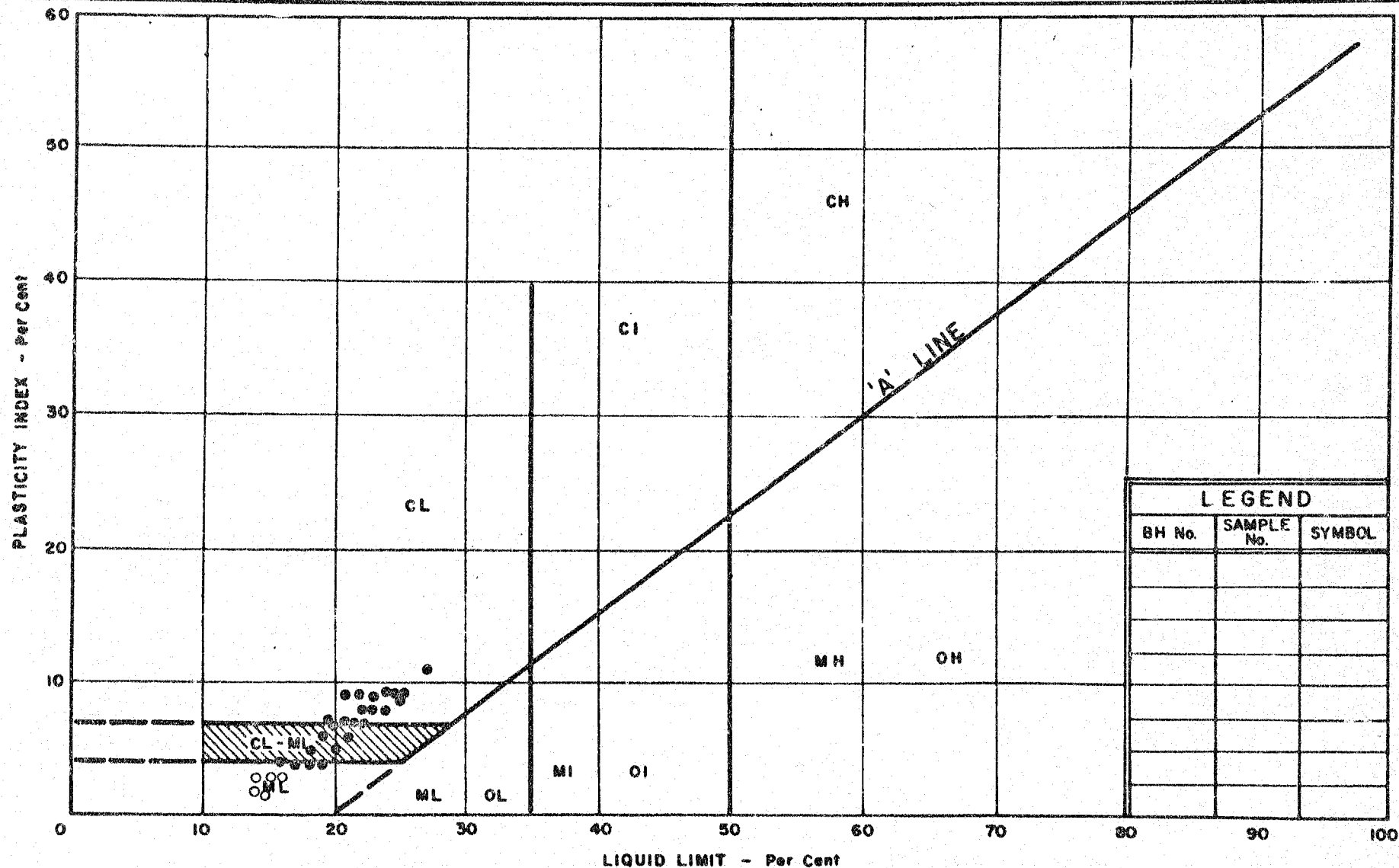
SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE				w_p — w — w_L				
513.7	Ground Level										10 20 30				
0.0	Het. mix. of clayey silt, sand & gravel		1	SS	30	510									512.2
	Very Stiff to Hard		2	SS	58										2 30 47 21
	Brown changing to Grey below el. 501.		3	SS	131										
			4	SS	93	500									
			5	SS	146										
			6	SS	33										
			7	SS	60	490									
	Glacial Till		8	SS	97										
			9	SS	89	480									
476.7			10	SS	132										5 32 47 16
37.0	Het. mix. of silt, sand & gravel. Trace of clay.														
472.2	Very Dense		11	SS	123										
41.5	End of Borehole					470									

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
GLACIAL TILL (GRANULAR)

W.P. No.	269 - 65
JOB No.	71 - 11034
FIG. 2	



LEGEND		
BH No.	SAMPLE No.	SYMBOL



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART GLACIAL TILL

• COHESIVE ○ GRANULAR

WP No. 269-65

JOB No. 71-11034

FIG. 3

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

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
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGS 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
$\bar{\sigma}$	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 (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

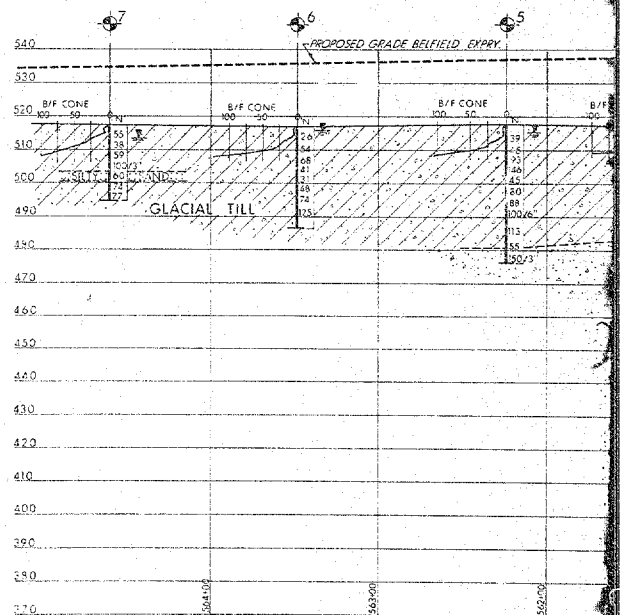
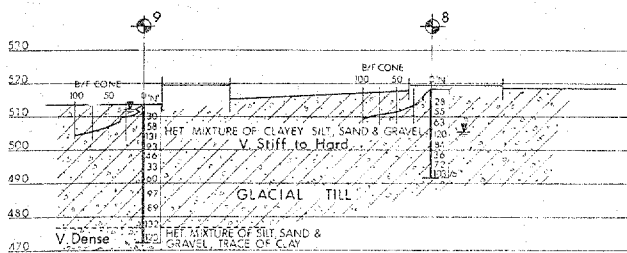
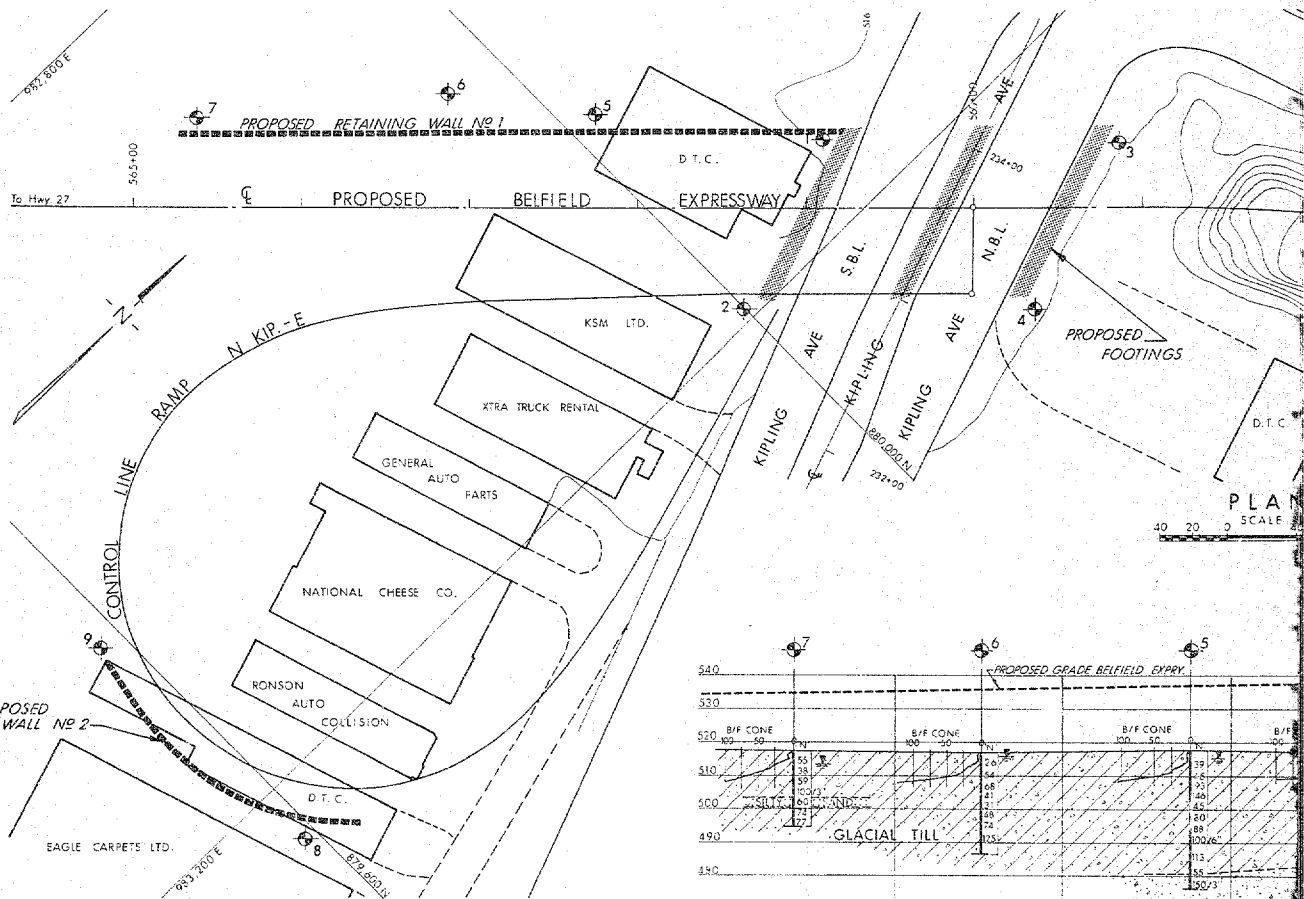
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

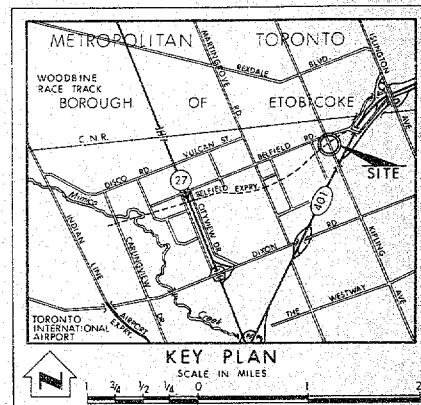
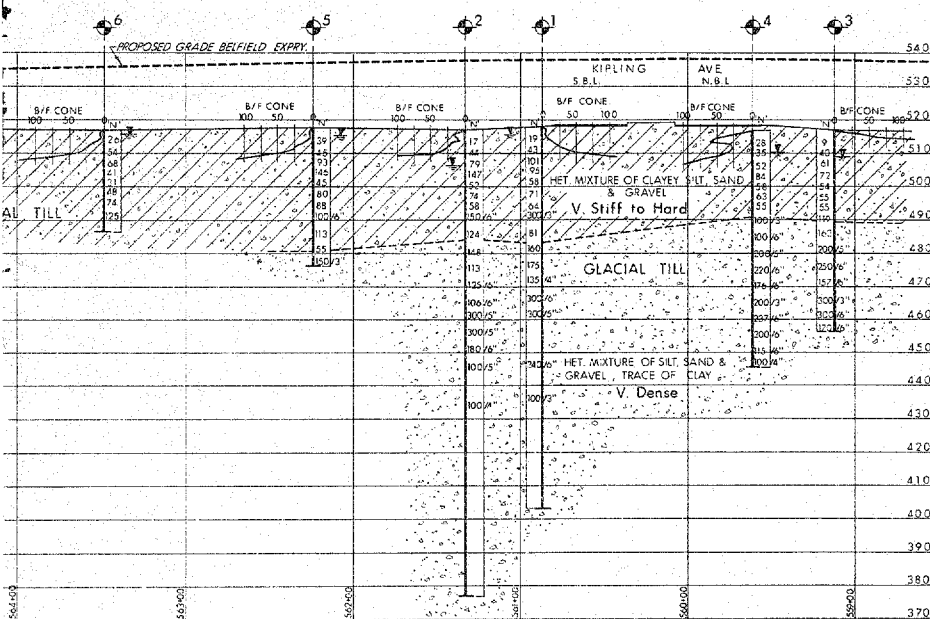
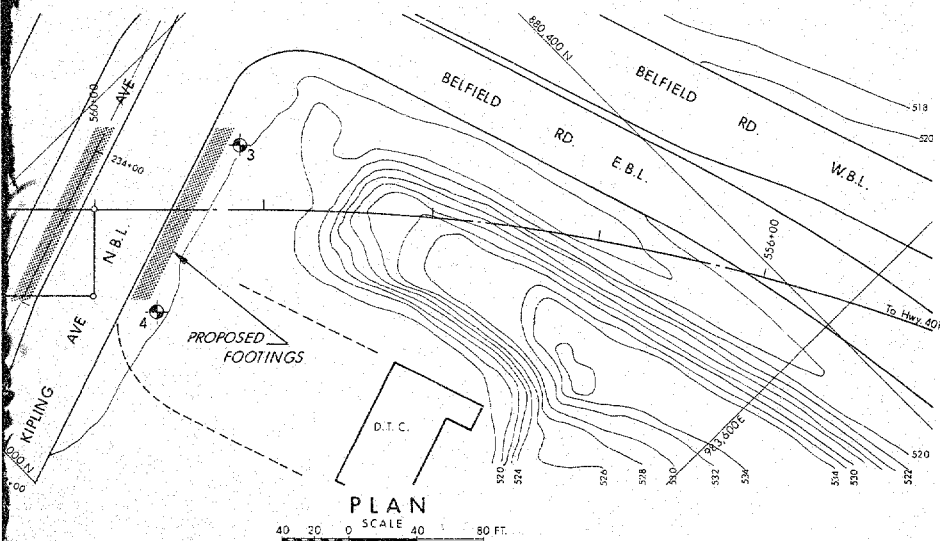
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

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



PRINT RECORD
NO. FOR DATE



LEGEND

- Bore Hole
- ⊕ Cone Penetration Test
- ⊕ Bore Hole & Cone Test
- ⊕ Water Levels established at time of field investigation, JUNE 1971

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	517.5	880,104	983,153
2	516.6	879,999	983,193
3	516.2	880,228	983,279
4	516.1	880,122	983,315
5	517.1	880,018	983,047
6	516.6	879,965	982,978
7	517.4	879,848	982,883
8	517.7	879,592	983,235
9	513.7	879,586	983,067

— 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

KIPLING AVENUE
BRIDGE NO 1 & RETAINING WALLS NO 1 & 2
HIGHWAY NO. BELFIELD EXPRESSWAY DIST. NO. 6
CO. YORK METROPOLITAN TORONTO
TWP. ETOBICOKE LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD. V.K.	CHECKED: <u> </u>	W.P. NO. 269-65	DRAWING NO.
DRAWN S.O.	CHECKED: <u> </u>	JOB NO. 71-11034	71-11034 A
DATE 25 AUG 1971	SITE NO.		BRIDGE DRAWING NO.
APPROVED: <u> </u>	CONT. NO.		
PRINCIPAL FOUNDATION ENGINEER			

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. G.C.E. Burkhardt,
Regional Structural Planning Engineer,
Central Region,
90 Floral Parkway.

FROM: Foundations Office,
Design Services Branch,
Downsview, Ontario.

ATTENTION:

DATE: June 6, 1972.

OUR FILE REF.

IN REPLY TO JUN 9 1972

SUBJECT: Proposed Structure (Bridge #1)
And Related Retaining Walls No. 1 and 2
at the Crossing of
Belfield Expressway & Kipling Ave.
District #6 (Toronto)
W.O. 71-11034 - W.P. 269-65

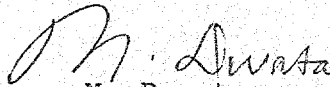
Foundation investigation for the above-mentioned structure and retaining walls was conducted by this Office during June, 1971, based on the information supplied by Regional Structural Location Section. A detailed Report W.O. 71-11034, containing all the factual information, together with the recommendations pertaining to the foundations of the structure and related retaining walls and stability considerations of the approaches, was submitted by this Office.

Since the submission of the report, length of the retaining wall #R-2 has been increased by approximately 150 feet. As a result of this, the Foundations Office carried out an additional boring, during March, 1972, to supplement the original field data. The new borehole (B.H. #10) revealed that the subsoil conditions at this location were similar to those carried out initially.

Based on the recent information we conclude that the recommendations contained in our Foundation Report W.O. 71-11034 will be applicable for the additional portion of the retaining wall R-2. A revised drawing 71-11034A showing all the borings carried out at this site is included with this memo, together with the Record of Boreholes sheet of B.H. #10. This memo, together with the enclosed borelog sheet and revised drawing should be included in the corresponding Foundation Report.

June 6, 1972.

Should you require any further information with regard to this project, please feel free to contact this Office.



M. Devata,

SUPERVISING FOUNDATIONS ENGINEER

MD/ht
Attach.

c.c. B.R. Davis
A. Rutka
D.W. Farren
P.J. Harvey
G.A. Wrong
H. Greenland
B.J. Giroux
T.J. Kovich
B.A. Singh
Deleuw, Cather Ltd. (R. Barr)

Foundations Files
Documents



DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 10

FOUNDATION SECTION

JOB 71-11034

LOCATION Co-ords. 879,703N. 982,972 E.

ORIGINATED BY H.S.

W.P. 269-65

BORING DATE March 27, 1972

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Continuous Flight Auger (Penn Drill)

CHECKED BY

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ	REMARKS		
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		20	40	60	80			100	w_p
						SHEAR STRENGTH P.S.F.						WATER CONTENT %		
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE								
515.0	Ground level.													
	Het. mix. of clayey silt, sand & gravel.		1	SS	37									
	Hard.		2	SS	87									
	Glacial Till.		3	SS	100/3"									
	Brown.		4	SS	94									
	Grey		5	SS	109/6"									
			6	SS	100/6"									
			7	SS	90									
			8	SS	100/5"									
			9	SS	105/6"									
482.0			10	SS	116/6"									
33.0	Het. mix. of silt, sand & gravel.		11	SS	42									
	Trace of clay. Occ. layer of clayey silt.		12	SS	100/5"									
	Very dense.		13	SS	100/3"									
			14	SS	100/5"									
450.0														
65.0	Silty sand.		15	SS	100									
	Very dense.													
435.0														
80.0	End of borehole.													

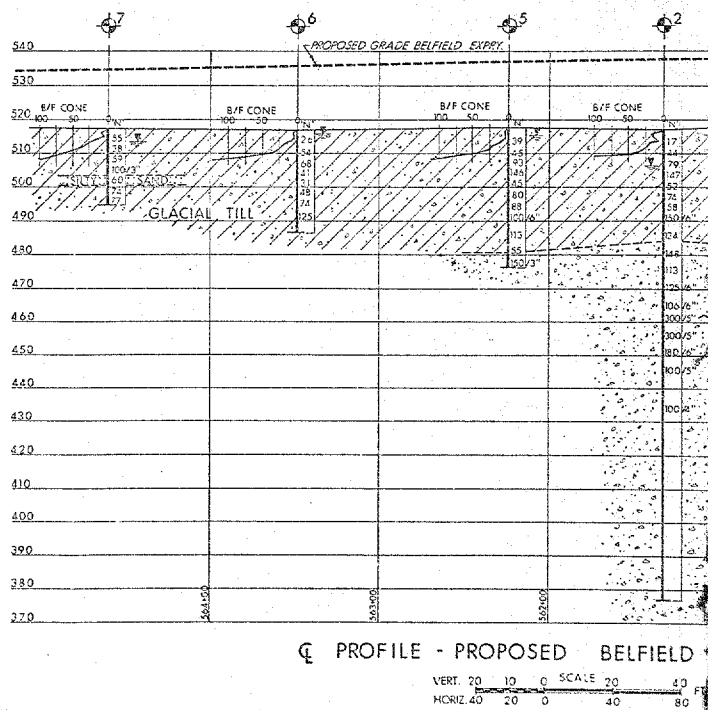
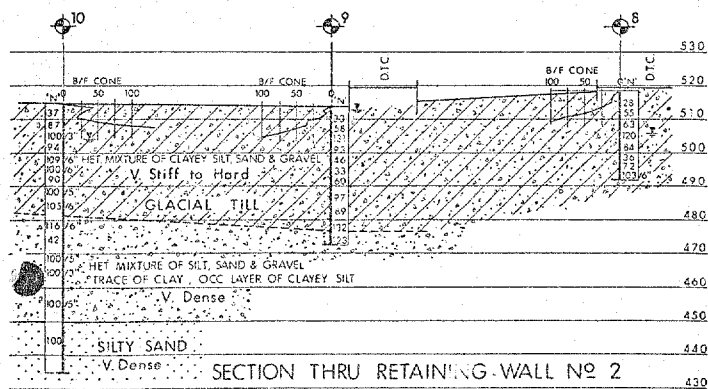
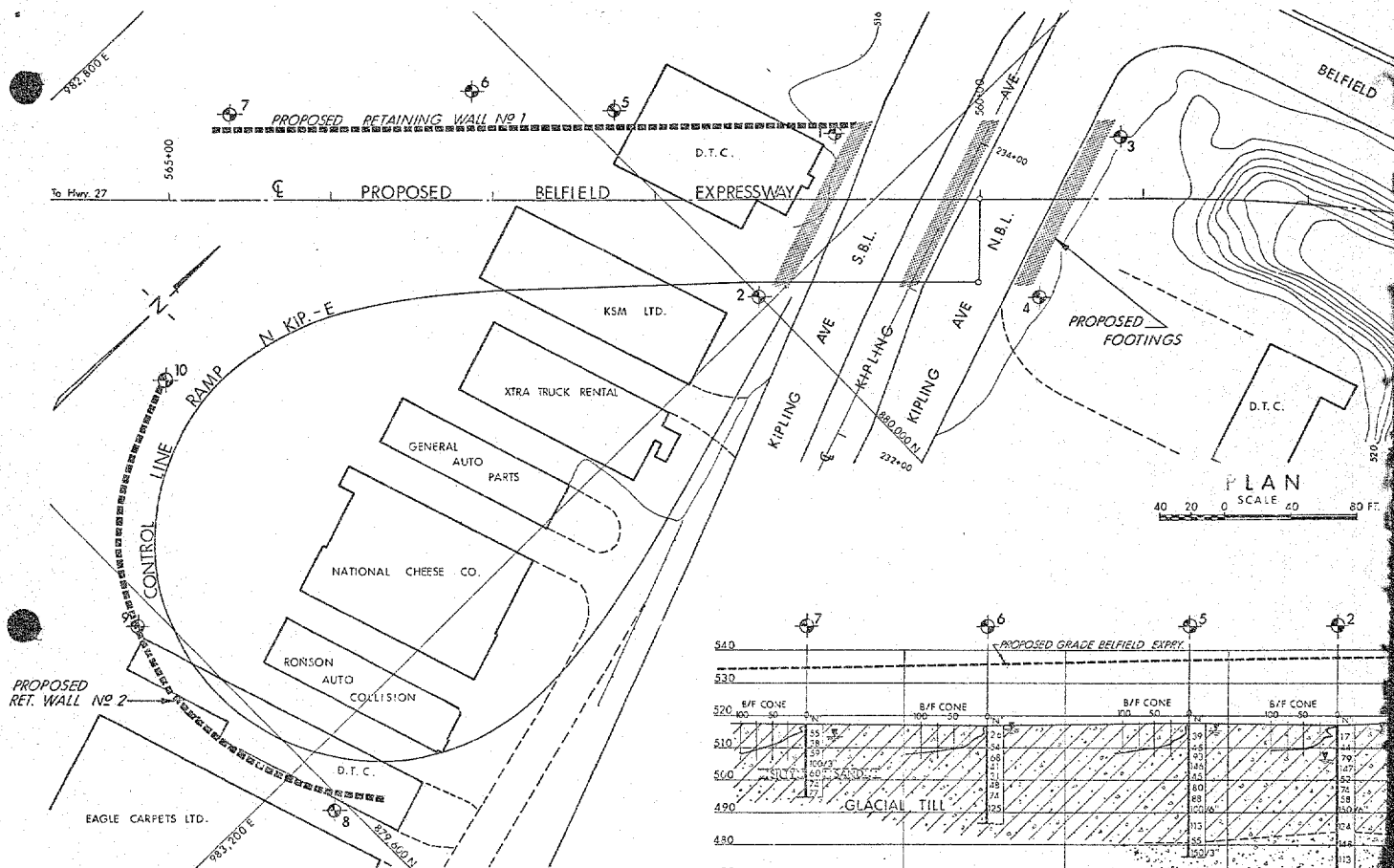
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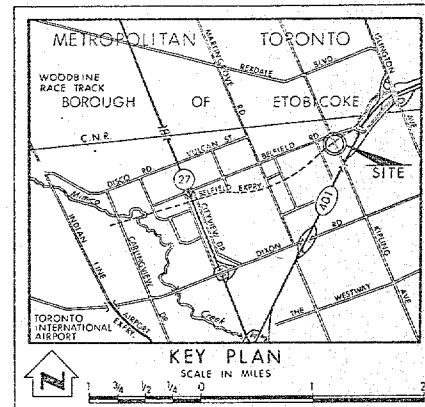
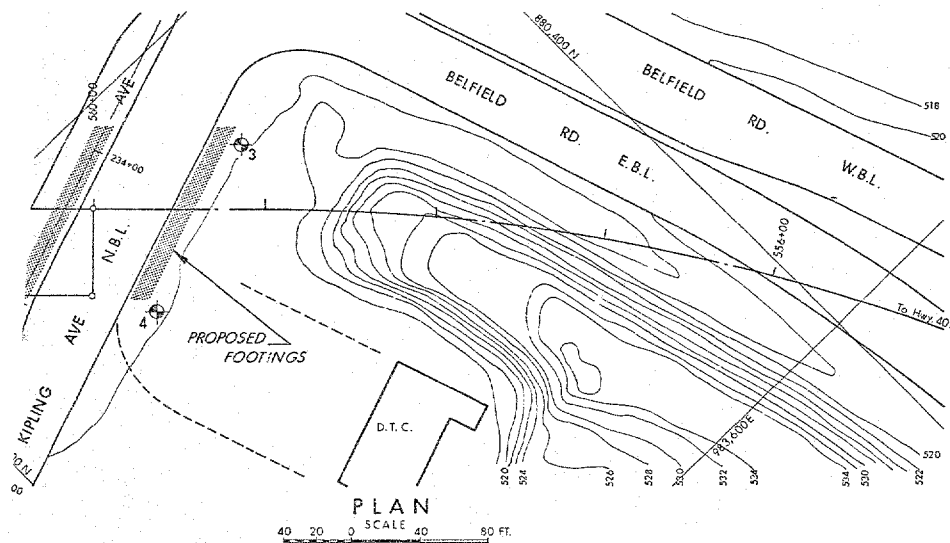
W_L 504.0

in open B.H.

20 36 34 10

0 73 (27)





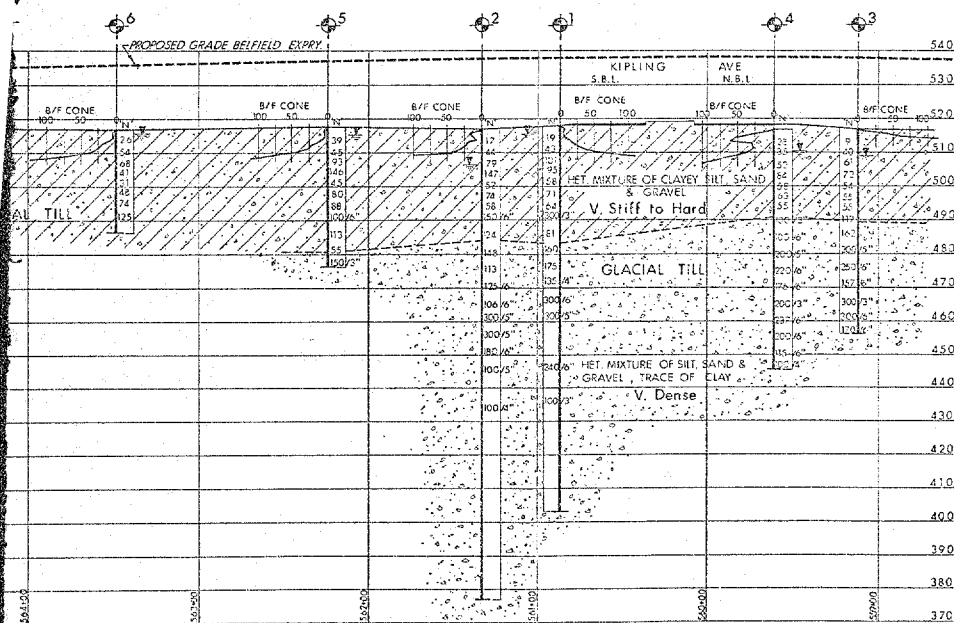
LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation, JUNE 1971 & MAR. 1972

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	517.5	880,104	983,153
2	516.6	879,999	983,193
3	516.2	880,228	983,279
4	516.1	880,122	983,315
5	517.1	880,018	983,047
6	516.6	879,965	982,978
7	517.4	879,848	982,883
8	517.7	879,592	983,235
9	513.7	879,586	983,067
10	515.0	879,703	982,972

— 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.



PROFILE - PROPOSED BELFIELD EXPRESSWAY

VERT. SCALE 20 10 0 40 FT.
HORIZ. SCALE 20 0 40 80 FT.

REVISIONS	DATE	BY	DESCRIPTION
	MAY 72	S.O.	BORE HOLE 10 ADDED & RET. WALL 2 ALTERED

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS
DESIGN SERVICES BRANCH - FOUNDATION OFFICE

KIPLING AVENUE
BRIDGE NO 1 & RETAINING WALLS NO 1 & 2
HIGHWAY NO. BELFIELD EXPRESSWAY DIST NO. 6
CO. YORK METROPOLITAN TORONTO
TWP. ETOBICOKE LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBWD. V.K.	CHECKED	W.P. NO. 269-55	DRAWING NO.
DRAWN S.O.	CHECKED	JOB NO. 71-11034	71-11034 A
DATE 25 AUG. 1971		SITE NO.	BRIDGE DRAWING NO.
APPROVED <i>W. J. M. M.</i>		CONT. NO.	

Long

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. G.C.E. Burkhardt (2) FROM: Soil Mechanics Section,
Regional Structural Planning Geotechnical Office,
Engineer, West Building, Downsview.
Central Region, Toronto.

ATTENTION: DATE: July 29th, 1974.

OUR FILE REF. IN REPLY TO

SUBJECT: RE: Addendum to Foundation Investigation Report
for Proposed Bridge No. 1, Highway 409 at
Kipling Avenue, Contract #74-04,
W.O. 71-11034, W.P. 269-65.

Contr 74-64

A detailed foundation investigation report for the above structure was submitted on September 22nd, 1971. At the time of the foundation investigation, no borings were put down at the proposed centre pier location in view of the presence of numerous underground utilities. It was mentioned in the report that this Office would carry out additional borings in order to confirm the preliminary recommendations, prior to construction.

This Section carried out an additional investigation consisting of three borings (B.H.'s #10-#12) on July 19, 1974, upon receiving request from Toronto District Construction personnel. The boring locations and a stratigraphical section are shown on a sketch appended to this memo. Based on the subsoil information obtained, it is concluded that the centre pier may be supported on spread footing founded on elevation 512, using a bearing pressure of 2.5 t.s.f. (as used by the structural designer), provided that

- i) any backfill material to the underground utilities encountered below founding level be completely subexcavated and replaced with mass concrete.
- and ii) the footing excavation should be inspected and approved by a representative from this Section.

The foregoing has been discussed between Mr. G. Henderson Project Supervisor and Mr. V. Korlu of our Section immediately after the completion of the additional field work.

M. Devata
M. Devata,
Supervising Engineer.

MD/mj
c.c. E.J. Orr G.A. Wrong
B.R. Davis B.A. Singh
R.S. Pillar G. Henderson
H. Greenland Files ✓
B.J. Giroux Documents
D. Gunther

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 10

JOB 71-11034 (Cont. 74-64)

LOCATION Co-ords. 880,169 N; 983,208 E.

ORIGINATED BY VK

W.P. 269-65


BORING DATE July 19, 1974

COMPILED BY AP/

DATUM Geodetic

BOREHOLE TYPE Auger & sample with Pendrill

CHECKED BY

SOIL PROFILE			SAMPLES			Ft./m ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. UNIT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % w_p — w — w_L			
519.0	Ground Level											
0.0	Het. mix of clayey silt, sand & gravel		1	SS	17	510						
	Very stiff to hard		2	SS	22							
			3	SS	30							
			4	SS	58							
			5	SS	59							
	Glacial Till			SS	55	500						
			7	SS	45							
			8	SS	34							
489.5						490						
488.5			9	SS	100/6"							
30.5	End of Borehole											
	Het. mix of silt, sand & gravel, trace of clay. Very dense.					480						

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 11

JOB 71-11034 (Cont. 74-64)

LOCATION Co-ords. 880,064 N: 983,244 E.

ORIGINATED BY VK

W.P. 269-65

BORING DATE July 19, 1974

COMPILED BY AP

DATUM Geodetic

BOREHOLE TYPE Auger & sample with Pendrill

CHECKED BY

SOIL PROFILE			SAMPLES			ft/m	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w				BULK DENSITY γ	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3 m)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT % w_p — w — w_L						
519.0 0.0	Ground Level														P.C.F.	GR SA SI CL	
	Het. mix of clayey silt, sand & gravel		1	SS	24	510											
			2	SS	31												
	Very stiff to hard		3	SS	38												
			4	SS	59												
			5	SS	71	500											
	Brown		6	SS	39												
	Grey		7	SS	63												
	Glacial Till		8	SS	52												
490.0 29.0				9	SS	105	490										
	Boulder						6"										
	Het. mix of silt, sand & gravel			10	SS	110	480										
	Trace of clay					5"											
	Very Dense																
469.0 50.0			11	SS	100	470											
	End of Borehole																
						460											

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 12

JOB 71-11034 (Cont. 74-64)

LOCATION _____

Co-ords. 880,117 N; 983,225 E.

ORIGINATED BY VK

W.P. 269-65

BORING DATE _____

July 19, 1974

COMPILED BY AP

DATUM Geodetic

BOREHOLE TYPE _____

Auger & sample with Pendrill

CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ft./m	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT w_L				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT (0.3 m)				PLASTIC LIMIT w_p					
						SHEAR STRENGTH P.S.F.				WATER CONTENT %						
519.0	Ground Level															
0.0	Het. mix. of clayey silt, sand & gravel		1	SS	33	510										
	Very stiff to hard.		2	SS	49											
	Glacial Till		3	SS	77											
503.5																
15.5	End of Borehole					500										

PENETRATION RESISTANCE

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

TERMS TO BE USED IN DESCRIBING SOILS :-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	D.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTSOIL 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
w_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
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF σ
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF σ 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
$\bar{\sigma}$	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 (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

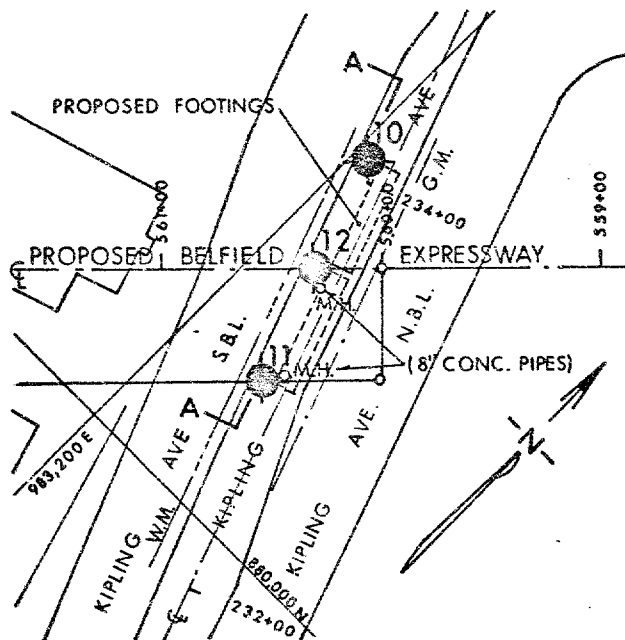
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

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
β	ANGLE OF SLOPE TO HORIZONTAL

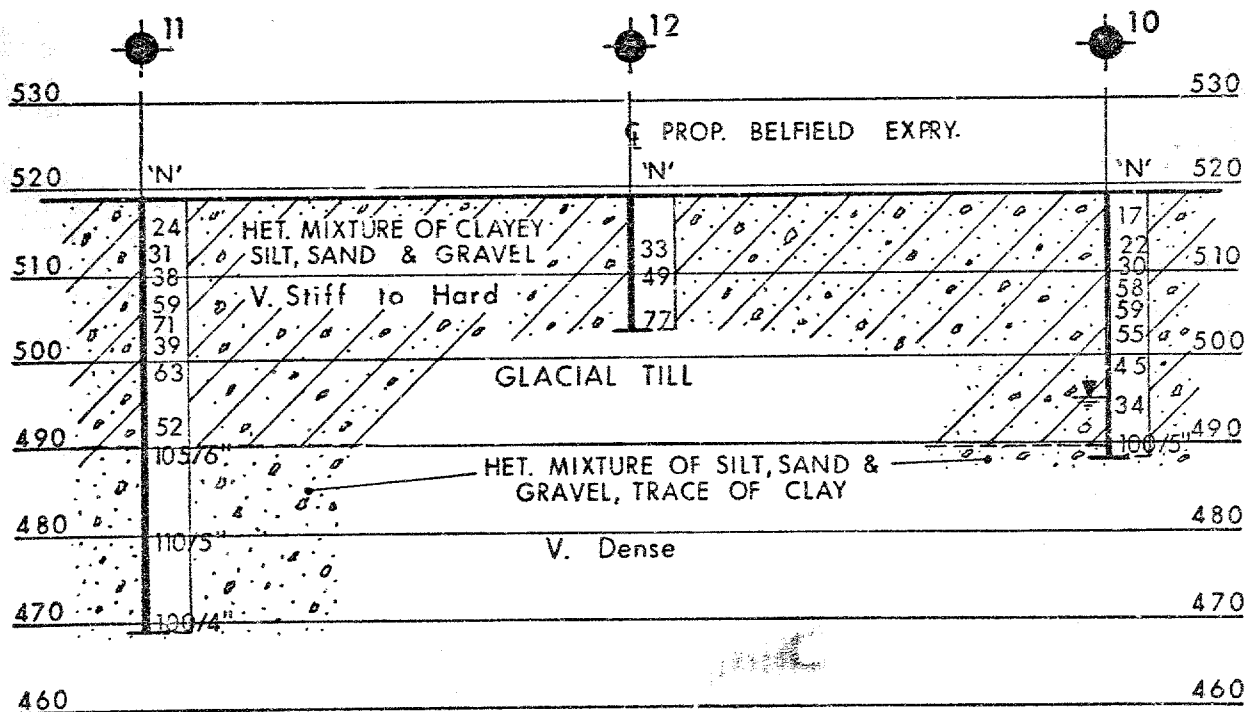


PLAN
SCALE 1" = 80'

B.H.	ELEV.	CO-ORDINATES	
		NORTH	EAST
10	519.0	880,169	983,208
11	519.0	880,064	983,244
12	519.0	880,117	983,225

Water Levels established
JULY 1974

Bore Hole



SECTION A-A
SCALE 1" = 20'

MEMORANDUM

71-11034

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

ATTENTION:

FROM: G. C. E. Burkhardt,
Bridge Planning Section,
Central Building.

DATE: May 12, 1971.

OUR FILE REF.

IN REPLY TO

SUBJECT: Kipling Avenue Overpass,
Site 37-963, W.P. 269-65,
Belfield Expressway,
District 6.

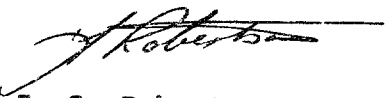
The attached marked up print 271-067, details the approximate location of the proposed footings for the above detailed structure. Also enclosed are prints taken from the Functional Planning Report showing the proposed grade.

Due to the tight schedule on this project field reconnaissance reports are not available at this time but will be forwarded in the near future.

Would you kindly arrange to have a foundation investigation of sufficient magnitude to allow the Bridge Office to proceed with the structure design.

JSR:lc
Attach.

c.c. R. Fitzgibbon
R. Strain


J. S. Robertson,
REG. BRIDGE PLANNING SUPERVISOR,
for:
G. C. E. Burkhardt,
REG. BRIDGE PLANNING ENGINEER.

COMPLETION DATE JULY 21/71.

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundation Engineer,
Room 107,
Central Building.

ATTENTION:

FROM: G. C. E. Burkhardt,
Structural Planning Office,
90 Floral Parkway.

DATE: February 16, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: Kipling Avenue Overpass - Bridge #1,
Site 37-963, W.P. 269-65, 71-11-034 ✓
Martin Grove Road Underpass - Bridge #2,
Site 37-964, W.P. 270-65, 71-11-035
Iron Street Underpass - Bridge #3,
Site 37-965, W.P. 285-66, 71-11-134; 71-11-037
C.N.R. Spur Subway - Bridge #4,
Site 37-966, W.P. 271-65, 71-11-034
C.N.R. Spur Subway - Bridge #8,
Site 37-975, W.P. 84-71-01,
City View Drive Underpass - Bridge #9,
Site 37-977, W.P. 272-65,
Hwy. 27 Underpass - Bridge #5,
Site 37-967, W.P. 273-65, 71-11-038
Attwell Road Overpass - Bridge #6,
Site 37-968, W.P. 275-65, 71-11-039
Mimico Creek Bridge - Bridge #7,
Site 37-969, W.P. 276-65, 71-11-040
Retaining Walls R1, R2, R3, R4, R5, R6, R7, R8,
R9, R11, R12, R13, R14, R15, R16,
R17, & R20,
District 6, Highway 409 (Belfield Expressway).

The enclosed marked up drawings shows the revised location of footings for the above noted structures. As the original sites were investigated by your office and the results recorded in the Foundation Investigation Reports for Belfield Expressway we are solicitating your advice as whether the information in the report will be sufficient to cover the intended relocation.

RE: Highway 409,
(Belfield Expressway).

Please advise this office as to your intentions and findings in this matter.

JSTR:lc
Encl.



J. S. T. Robertson,
STRUCTURAL PLANNING SUPERVISOR,
for:
G. C. E. Burkhardt,
REG. STRUCTURAL PLANNING ENG.

c.c. R. Fitzgibbon
J. Anderson

Department of Highways Ontario
Copy for the information of

A. STERMAC

Mr. G.C.E. Barkhardt
Regional Bridge Planning Engineer
90 Floral Parkway
Downsview, Ontario

Structural Office
West Building
DOWNSVIEW, Ontario

June 19, 1972

Kipling Ave. Overpass
Bridge #1
W.P. 269-65 Site 37-963
Hwy. No. 409 District 6

71-11-034

Attached herewith are prints of the
Preliminary Bridge Plan Drawing D-37-963-P1 for
the above mentioned structure.

The estimated cost of the proposed
structure is \$362,000 which includes tender, materials,
engineering and sundry construction.

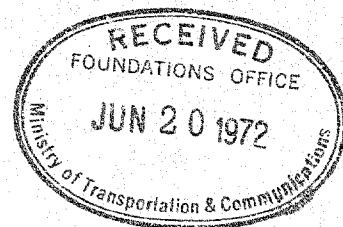
Any comments or revisions you may have
should be submitted within three weeks.

CSG/hvh
Encl.

C.S. Grebski
Structural Design Engineer

cc A. McKim
B. Davis
A. Stermac (2)
J. Anderson

No Comment.
M. Devita
June 28/72



DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

Copy for the information of

A. Stermac,
Principal Foundation Engineer,
Room 107, West Bldg.

Structural Office,
West Bldg., Downsview.
March 15th, 1973.

Kipling Avenue Overpass,
Bridge #1,
W.P.#269-65, Site #37-963,
Hwy. #409, District #6.

71-11-034

DAE

Attached herewith we are submitting the final bridge
drawings which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

CSG:dp
Attach.

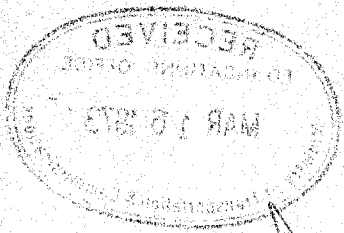
C.S. Grebski,
Structural Design Engineer.

cc. Foundation Office. ✓

Please note our comments with regard to center
pier in Foundation Report P. 6 - P. 7. (W 72-11034)
C. J. Poon

Recd 71-11034 A Finalized
Sent to Structural Office
31 May 73
HML

M. Levina
March 21/73



Telephone: (416) 248-3282.

Soil Mechanics Section,
Geotechnical Office,
West Building,
1201 Wilson Avenue,
DOWNSVIEW, Ontario. M3M 1L7

July 19th, 1974.

Master Soil Investigation,
104 Kenhar Drive,
WESTON, Ontario. M9L 1N4

Dear Sirs:

This letter confirms our request by telephone of July 18th, 1974 for the supply of a Type I Auger (Item 5.1(I), together with all necessary equipment, as per your Tender for Supply Contract S74-1577, at Toronto, Ontario, (Kipling & Hwy. 404) on July 18th, 1974, temporarily stopping on project W.P. 127-66-37.

Mobilization will be from our Project W.P. 127-66-37.

Our Project Number is W.P. 269-65, W.O. 71-11034.

Yours truly,

M. Devata,
Supervising Engineer.

MD/mj
c.c. W.W. Fry
ATTN: Mrs. M. Porter

Files
Documents

Mr. G.C.E. Burkhardt (2)
Regional Structural Planning
Engineer,
Central Region, Toronto.

Soil Mechanics Section,
Geotechnical Office,
West Building, Downsview.
July 29th, 1974.

RE: Addendum to Foundation Investigation Report
for Proposed Bridge No. 1, Highway 409 at
Kipling Avenue, Contract #74-04,
W.O. 71-11034, W.P. 269-65.

A detailed foundation investigation report for the above structure was submitted on September 22nd, 1971. At the time of the foundation investigation, no borings were put down at the proposed centre pier location in view of the presence of numerous underground utilities. It was mentioned in the report that this Office would carry out additional borings in order to confirm the preliminary recommendations, prior to construction.

This Section carried out an additional investigation consisting of three borings (B.H.'s #10-#12) on July 19, 1974, upon receiving request from Toronto District Construction personnel. The boring locations and a stratigraphical section are shown on a sketch appended to this memo. Based on the subsoil information obtained, it is concluded that the centre pier may be supported on spread footing founded on elevation 512, using a bearing pressure of 2.5 t.s.f. (as used by the structural designer), provided that

- i) any backfill material to the underground utilities encountered below founding level be completely subexcavated and replaced with mass concrete.
- and ii) the footing excavation should be inspected and approved by a representative from this Section.

The foregoing has been discussed between Mr. G. Henderson Project Supervisor and Mr. V. Korlu of our Section immediately after the completion of the additional field work.

M. Devata,
Supervising Engineer.

MD/mj

c.c.	E.J. Orr	G.A. Wrong
	B.R. Davis	B.A. Singh
	R.S. Pillar	G. Henderson
	H. Greenland	Files
	B.J. Giroux	Documents
	D. Gunther	

*One complete set of
addendum filed at
near of 2 copy of
rev. 1.*

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M11-71

DIST. 6 REGION CENTRAL

W.P. No. 269-05

CONT. No. 74-64

W. O. No. 71-11034

STR. SITE No. 37-963

HWY. No. 427

LOCATION RET. WALL BELFIELD
EXPWY. + F. PLING

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. Fig 2

REMARKS: Documents to be unfiled
before microfilmed

