

72-F-156	127-66-05	HWY. 401 & DIXIE RD.	30M12-22
W.O.	W.P.	LOCATION	GEOCRES NO.

● DATA ON FILE IN SOIL MECHANICS SECTION

REFER TO: W.P. FILE CONF. 74-109

REMARKS _____

GEOCRES INDEXING CARD FOR REPORTS NOT MICROFILMED

GI-20 AUG. 74

MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundation Engineer,
West Building.

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

ATTENTION: H. Devata

DATE: February 16, 1973.

OUR FILE REF.

IN REPLY TO

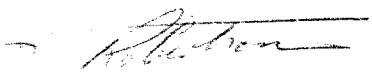
SUBJECT: Dixie Road Underpass (Bridge #21),
Site 24-183, W.P. 127-66-05,
Highway 401, District 6.

The following drawings, appropriately marked in red, indicates the probable location of footings for the above noted structure.

Site Plan	
Graphical Alignment Plan (Partial)	3983-2A-
Numbering Key Plan	
Contract Key Plan	
3 - Sketches showing existing utilities	
401 - Core Profile	3983-2B-1
401 - E.B. Collector Profile	3983-2B-2
401 - W.B. Collector Profile	3983-2B-3
Dixie Road Profile	3983-2B-5

Would you please conduct a foundation investigation of sufficient magnitude to assist the Structural Office in designing the proposed bridge.

JSTR:lc
Encl.


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

c.c. J. Anderson
J. D. Barclay
R. Fitzgibbon
W. Roters

MEMORANDUM

TO: Mr. G.C.E. Burkhardt, (3) FROM: Foundations Office,
Regional Structural Planning Eng., Design Services Branch,
Central Region, West Bldg., Downsview.
3501 Dufferin St., Downsview.

ATTENTION: DATE: May 18, 1973.

OUR FILE REF.

IN REPLY TO

MAY 25 1973

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
The Proposed New Dixie Road
Underpass at Hwy. 401 Crossing
(Bridge No. 21) Site 24-183
Twp. of Mississauga, County of Peel
District #6, Toronto
W.O. 72-11156 - W.P. 127-66-05
CONT-74-109



Attached we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above-mentioned 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
Atch.

c.c. E. J. Orr
B. R. Davis
A. Rutka
R. S. Pillar
H. Greenland
B. J. Giroux
C. Mirza
G. A. Wong
B. A. Singh

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATIONS ENGINEER.

Foundations Files
Documents

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FOUNDATION INVESTIGATION REPORT
For
The Proposed New Dixie Road
Underpass at Hwy. 401 Crossing
(Bridge No. 21) Site 24-183
Twp. of Mississauga, County of Peel
District #6, Toronto
H.O. 72-11156 - W.P. 127-66-05

1. INTRODUCTION:

The Foundations Office was requested to carry out a subsurface investigation at the site of the proposed Bridge No. 21 (Dixie Road underpass at Hwy. 401 crossing). The request was contained in a memo from Mr. G.C.E. Burkhardt, Structural Planning Engineer, Central Region, dated February 16, 1973. Subsequently, an investigation was carried out by this office to determine the subsoil, bedrock and groundwater conditions at the site.

This report presents the factual information obtained from this investigation together with recommendations pertaining to the foundation design of the proposed structure and stability considerations associated with the approach fills.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located immediately to the east of the existing Dixie Road bridge crossing Hwy. 401, in the Town of Mississauga, County of Peel. The topography of the terrain is flat to gently undulating in relief between elevations 520 and 530.

The site is located in the physiographic region known

as the "Peel Plain." The characteristic deposit in the vicinity of the area under investigation is mainly composed of a cohesive glacial till underlain by shale bedrock.

2. FIELD AND LABORATORY WORK:

The subsoil investigations were carried out by putting down nine sampled boreholes each accompanied by a dynamic cone penetration test. The borings were advanced by means of a standard diamond drill rig adapted for soil sampling purposes.

Disturbed samples within the overburden were obtained, at required depths, in a 2" O.D. split-spoon sampler which was driven into the soil in accordance with the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. The bedrock was proven in all boreholes by obtaining BXL size core samples.

Groundwater levels were observed in the open boreholes during the period of investigation.

The soil, bedrock and groundwater conditions encountered at the boring locations, are presented in the Record of Borehole sheets. The locations and elevations of the various boreholes were surveyed by District No. 6 (Toronto) construction personnel. The elevations in this report are referenced to a Geodetic Datum. Boring locations, tied into a coordinate system, and elevations together with estimated stratigraphical sections are shown on Drawing No. 72-11156A.

All the samples were subjected to a careful visual examination in the field and subsequently in the laboratory. Following this examination, various laboratory tests were carried out on selected representative samples to determine the physical properties of the soil; namely,

Natural Moisture Content

Atterberg Limits

Grain-Size Distribution

The results of these tests are plotted on the Record of Borehole sheets and summarized on Fig. 1, which is contained in the Appendix of this report.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The predominant stratum across the site is a heterogeneous mixture of clayey silt, sand and gravel (glacial till). The thickness of this stratum varies from 30 to 40 ft. This cohesive deposit is underlain by shale bedrock. In certain locations the glacial till is overlain by up to 28 feet of fill material (approach embankments for existing Dixie Road structure).

The boundary of the various deposits, as determined in the boreholes, are shown on the accompanying Record of Borehole sheets. The stratigraphical sections, shown on Drawing No. 72-11156A have been inferred from this data. From the top of existing embankment fill downward the soil and bedrock encountered are as follows:

4.2) Fill Material:

A number of boreholes were put down through the approach embankments for the existing Dixie Road structure. At these locations between 21 (B.H. #8) and 28 (B.H. #4) feet of fill material was encountered. The fill material is composed of a cohesive clayey silt with some sand and gravel, which is similar, in composition to the underlying glacial till deposit.

The Atterberg Limit tests performed on samples gave the following results.

	<u>Range</u>	<u>Average</u>
Liquid Limit (W_L) %	27 - 34	30
Plastic Limit (W_p) %	16 - 20	18
Natural Moisture Content (W) %	16 - 23	19

Based on the above values, it is estimated that the fill material is of low plasticity. The Standard Penetration tests carried out within this fill material are plotted on the Record of Borehole sheets. The testing gave "N" values ranging from 4 to 42 blows per foot. It is estimated that the fill material has generally been well compacted.

Grain-size distribution curves for samples obtained in this fill material are shown on Fig. 2 in the Appendix.

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

The predominant stratum across the site is a heterogeneous mixture of clayey silt, sand and gravel. It is found directly beneath the fill material where it exists, or below a thin topsoil cover elsewhere. The thickness of this deposit varies from 30 to 40 ft.

Atterberg Limit tests were performed on samples obtained in this layer. The results, which are shown on the Record of Borehole sheets and on the Plasticity Chart (Fig. 1) are also summarized as follows:

	<u>Range</u>	<u>Average</u>
Liquid Limit (W_L) %	19 - 28	23
Plastic Limit (W_p) %	12 - 18	15
Natural Moisture Content (W) %	9 - 13	11

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

The Standard Penetration tests carried out within this glacial deposit, are plotted on the Record of Boreholes sheets. The "N" values obtained from these tests range from 26 blows per foot to 100 blows per 2 inches. It is estimated that the consistency of the glacial till is generally hard.

Grain-size distribution curves for samples obtained in this material are shown on Fig. 3 in the Appendix.

4.4) Bedrock:

Underlying the glacial till deposit is the shale bedrock which was proven in all of the nine boreholes by obtaining BXL core samples. It is estimated that the bedrock surface elevation in the investigated area varies from 488.6 ft. (B.H. #9) to 503.8 ft. (B.H. #4).

The bedrock is composed of a dark grey interbedded shale and limestone. The upper zone of the bedrock is in a weathered condition. It is estimated that the weathered zone

varies in thickness from 1 foot in B.H. #1 to 15 ft. in B.H.#7. The estimated elevations of the sound shale bedrock as observed in the boreholes are tabulated below:

	<u>Elevation</u>
B.H. #1	494.0
B.H. #3	498.6
B.H. #4	496.8
B.H. #5	492.2
B.H. #7	486.6
B.H. #8	486.8
B.H. #9	479.6
B.H. #10	481.1
B.H. #11	486.8

5. GROUNDWATER CONDITIONS:

The groundwater levels were measured in the open boreholes during the period of field investigation (March 1973). The results of the readings are shown on the Record of Borehole sheets as well as on Drawing No. 72-11156A.

The observations indicate that the groundwater level varies between elevations 522 (B.H. #11) and 525 (B.H. #1) which corresponds to a level of approximately 1 foot below the natural ground surface. A perched water level varying from elevations 527 to 534 was observed within the existing embankment fills.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

In conjunction with the construction program of Hwy.'s 403 410 and 401, the existing Hwy. 401 from Hwy. 27 westerly to Hwy. 10, is to be developed as a 16 lane basic core-collector. A number of interchanges are proposed for this portion of Hwy. 401; specifically,

- 1) Hwy. 401/Hwy. 403/Hwy. 410 complex.
- 2) Hwy. 401/Dixie Road Interchange.

- 3) Hwy. 401/Airport Entrance/Ftobicoke Creek Complex.
- 4) Hwy. 401/First Line Interchange.

This report will deal with the proposed Bridge No. 21 (Hwy. 401 and Dixie Road interchange). The proposed new 104 foot wide underpass structure is to have five spans (58' - 90' - 80' - 90' - 118').

The proposed profile grade of Hwy. 401 in the vicinity of the structure will be at about elevation 528, while that of Dixie Road will vary between elevations 550 and 553. The ground level at the proposed approach embankments varies between elevations 522 and 524. The maximum height of the embankment in the longitudinal and transverse directions will be of the order of 22 to 28 feet, respectively.

The predominant stratum across the site is a heterogeneous mixture of clayey silt, sand and gravel - glacial till deposit. Its thickness varies from 30 ft. to 40 ft. and has hard consistency.

6.2) Structure Foundations:

6.2.1) Piers:

The cohesive glacial till is competent. It is recommended that the piers be supported on spread footings founded within the hard glacial till stratum. A minimum of 4 ft. of earth cover should be provided to the underside of the footings for frost protection purposes. Taking this into consideration, the various pier footings may be founded at or below elevation 520.

Footings so founded could be designed using an allowable bearing pressure of up to 3.5 t.s.f. Settlement will be induced in the cohesive glacial till by the imposed footing pressure. Since the cohesive till is highly preconsolidated, the settlement will take place during or immediately following the construction period. This settlement should not exceed 1 inch in magnitude, provided care is exercised to ensure that the foundation subsoil is not softened by uncontrolled surface runoff or groundwater seepage. In this regard, it would be advantageous to place a lean

concrete working slab over the subsoil as soon as the excavations reach the footing foundation level.

The base of the footings will be located below the groundwater level recorded during the period of the field investigation (March 1973). In view of the impervious nature of the overburden, no major dewatering problems are anticipated. Any minor surface runoff and/or groundwater seepage into the excavations could be handled by conventional methods; e.g., by pumping from sumps, etc.

The abutments may be perched within the approach fills and supported on end-bearing piles driven to practical refusal within the glacial till deposit. The pile driving in the field should be controlled by employing the Hiley Dynamic Pile Driving Formula. The design load per pile will depend on the pile sections chosen; e.g., 12 BP 53 steel H-pile could be designed for 70 tons per pile. For estimating purposes, it can be assumed that the design load will be realized at the tip elevation of 510 at the south and north abutments.

No bouldery or rock fill should be placed in areas where piles are to be driven. A minimum of 4 feet of earth cover should be provided to the underside of the pile caps to satisfy the frost protection requirements.

6.3) Approach Embankments:

The maximum height of the approaches will be of the order of 28 ft. The subsoil across the site is competent and consequently no stability problems are anticipated provided that:

- 1) The topsoil be stripped from within the plan limits of the proposed embankments prior to placing the new fills.
- 2) The new embankments be constructed with standard 2:1 slopes and be properly keyed to the existing embankment in accordance with the current M.T.C. standards.

7. MISCELLANEOUS:

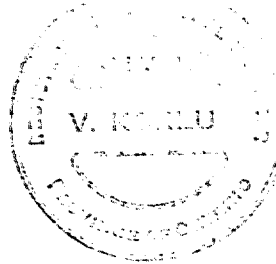
The field work carried out during the period of

March 1 to March 26, 1973, was supervised by Mr. V. Korlu, Project Foundations Engineer, who also prepared this report.

The equipment used was owned and operated by Longyear Co. of Toronto.

This project was carried out under the general supervision of Mr. M. Devata, Supervising Foundations Engineer, who also reviewed this report.


V. Korlu, P. Eng.




M. Devata, P. Eng.

VK/ao
May 15, 1973.

APPENDIX I

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

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

FROM: K. W. Ingham

ATTENTION:

DATE: May 15, 1973

OUR FILE REF.

IN REPLY TO

SUBJECT: Foundation Investigation 72-11156;
Hwy. 401 and Hwy. 410 Interchange

The bedrock intersected in 9 boreholes drilled at this site was found to be typical of the Dundas formation, which is in itself the characteristic bedrock in the general area. It is primarily a thin to medium bedded dark grey shale with occasional layers of limestone and silty limestone generally ranging in thickness from 0.1 to 0.3 ft. and rarely exceeding 0.5 ft.

The formation is generally weathered in the upper layers and frequently transitional with a thin overlying till layer containing frequent shale and limestone fragments. Occasional shale layers near the top of the bedrock may be weathered to a clay-like consistency but normally shale in the badly weathered zone is soft, platy bedded and fractured. The badly weathered material grades through a zone of moderate weathering into the fresh bedrock.

The bedrock elevation for each hole is given below together with the depth of weathered rock.

<u>Hole No.</u>	<u>Bedrock Elevation</u>	<u>Depth of Weathering</u>
1	495.4	3.0
3	500.7	3.1
4	496.8	-
5	492.3	-
7	486.7	1.1
8	489.9	5.0
9	479.6	-
10	481.1	1.3
11	486.8	0.2

K. W. Ingham
Geologist.

KWI:mv

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1

JOB 72-11156

LOCATION Co-ords. 15,859,587 N; 963,757 E.

ORIGINATED BY VK

W.P. 127-66-05

BORING DATE March 1, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Wash and bore with BK, NX Casing

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 Y P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W _P	W	W _L	
525.1	Ground Level														
0.0	Ret. mix. of clayey silt, sand and gravel		1	SS	51	520									GR SA SI CL
			2	SS	151										
			3	SS	172	9"									
	Brown		4	SS	110	6"									
	Grey		5	SS	159	510									6 42 38 11
	(Glacial Till)		6	SS	160	3"									
			7	SS	100	3"									
	Hard					500									
195.0	Weathered		8	SS	100	3"									
194.0	Sound		9	BXL	70%										
31.4	Shale Bedrock														
	occ. limestone		10	BXL	100%	490									
187.0	interbedding														
38.4	End of Borehole					480									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 72-11156

LOCATION Co-ords. 15,859,676 N; 963,674 E.

ORIGINATED BY VK

WP 127-66-05

BORING DATE March 5, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX & KX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L		BULK DENSITY	REMARKS		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT		PLASTIC LIMIT — w_p				WATER CONTENT — w	
							20	40	60	80				100
SHEAR STRENGTH P.S.F.							○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL		x LAB VANE	
							WATER CONTENT %		10		20		30	
523.6	Ground Level													
0.0	Het. mix. of clayey silt, sand & gravel		1	SS	69	520								
			2	SS	63									
			3	SS	127	9"								
	Brown Grey		4	SS	134	510								
	(Glacial Till)		5	SS	164									
	Hard		6	SS	162									
500.7			7	SS	123	3"								
22.0	Weathered		8	BXL	30%	500								
188.6	Sound													
25.0	Shale Bedrock		9	BXL	100%									
492.6														
31.0	End of Borehole					490								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4

JOB 72-11156

LOCATION Co-ords. 15,859,626 N; 963,583 E.

ORIGINATED BY VK

WP 127-66-05

BORING DATE March 7, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX & NX Casing

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		20	40	60	80	100	w_p	w	w_L	
549.8	Ground Level														
0.0	Clayey silt with some sand and gravel. Fill		1	SS	11										
			2	SS	10										
			3	SS	18	540									
	Stiff to Hard		4	SS	53										
			5	SS	33										
			6	SS	21	530									
			7	SS	15										
			8	SS	42										
521.8			9	SS	33										
28.0	Het. mix. of clayey silt, sand & gravel. (Glacial Till)		10	SS	40	520									
			11	SS	183										
	Hard		12	SS	71										
			13	SS	176.7"	510									
503.8			14	SS	11.8										
46.0						500									
496.8	Weathered		15	SS	163.1"										
53.0	Sound														
492.8	Shale Bedrock		16	NXL	100%										
57.0	End of Borehole					190									

FOUNDATIONS OFFICE

JOB 72-11156 LOCATION Co-ords. 15,859,743 N; 963,609 E.
WP 127-66-05 BORING DATE March 26, 1973
DATUM Geodetic BOREHOLE TYPE Wash & Bore with BX & NX Casing

ORIGINATED BY VK
COMPILED BY VK
CHECKED BY

20
15 ϕ 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 7

JOB 72-11156

LOCATION Co-ords. 15,858,800 N; 963,551 E.

ORIGINATED BY VK

W.P. 127-66-05

BORING DATE March 9, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX, NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	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
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE					
524.0	Ground Level								
0.0	Het. mix. of clayey silt, sand & gravel.		1	SS	51				
			2	SS	83				
			3	SS	115				
	Brown Grey		4	SS	147				
	(Glacial Till)		5	SS	100				
502.0	Hard		6	SS	120				
22.0									
186.6	Weathered								
37.4	Sound								
181.6	Shale Bedrock		7	BXL	100				
42.4	End of Borehole								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 8

JOB 72-11156

LOCATION Co-ords. 15,859,750 N; 963,458 E.

ORIGINATED BY VK

WP 127-66-05

BORING DATE March 22, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX & NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	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
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE					
544.1	Ground Level								
0.0	Clayey silt with some sand & few gravel.		1	SS	4				
	Fill		2	SS	10				
			3	SS	16				
	Firm to Hard		4	SS	10				
			5	SS	20				
			6	SS	37				
523.1			7	SS	43				
21.0	Het. mix. of clayey silt,		8	SS	68				
			9	SS	146	21"			
	Brown Grey		10	SS	151	29"			
	Sand and gravel (Glacial Till)		11	SS	173				
			12	SS	221	6"			
	Hard		13	SS	100	3"			
489.8									
54.3	Weathered		14	BXL	40%				
486.8									
57.3	Sound		15	BXL	100%				
479.8									
64.3	End of Borehole								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 9

JOB 72-11156 LOCATION Co-ords. 15,859,866 N; 963,484 E. ORIGINATED BY VK
 WF 127-66-05 BORING DATE March 14, 1973 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Wash & Bore with BK & MK Casing CHECKED BY VK

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.	REMAR
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W_p	W	W_L	
523.6	Ground Level														
0.0															
	Het. mix. of clayey silt		1	SS	51	520									
			2	SS	112										
			3	SS	239										
	Brown Grey		4	SS	155	510									
	sand and gravel		5	SS	111										
	(Glacial Till)		6	SS	173										
			7	SS	150	500									
	Hard		8	SS	100 3"										
488.6						490									
35.0															
479.6	Weathered					480									
44.0	Sound														
474.6	Shale Bedrock		9	EXL	100%										
49.0	End of Borehole					470									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 10

JOB 72-11156 LOCATION Co-ords. 15,859,818 N; 963,392 E. ORIGINATED BY VK
 WP 127-66-05 BORING DATE March 19, 1973 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Wash & Bore with BY & NX Casing 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 Y P C F	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	100	W _P	W	W _L		
549.1	Ground Level														
0.0	Clayey silt with some sand & few gravel		1	SS	16										
	Fill		2	SS	23										
	Stiff to Very Stiff		3	SS	18										
			4	SS	25										
			5	SS	74										
			6	SS	23										
526.1			7	SS	27										
23.0			8	SS	51										
	Het. mix. of clayey silt, sand & gravel		9	SS	67										
	(Glacial Till)		10	SS	125										
			11	SS	100 3"										
	Hard		12	SS	142										
			13	SS	163 11"										
489.1			14	SS	100 3"										
60.0															
481.1	Weathered														
66.0	Sound														
476.1	Shale Bedrock		15	EXL	100%										
73.0	End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 11

JOB 72-11156

LOCATION Co-ords. 15,859,908 N; 963,440 E.

ORIGINATED BY VK

WP 127-66-05

BORING DATE March 26, 1973

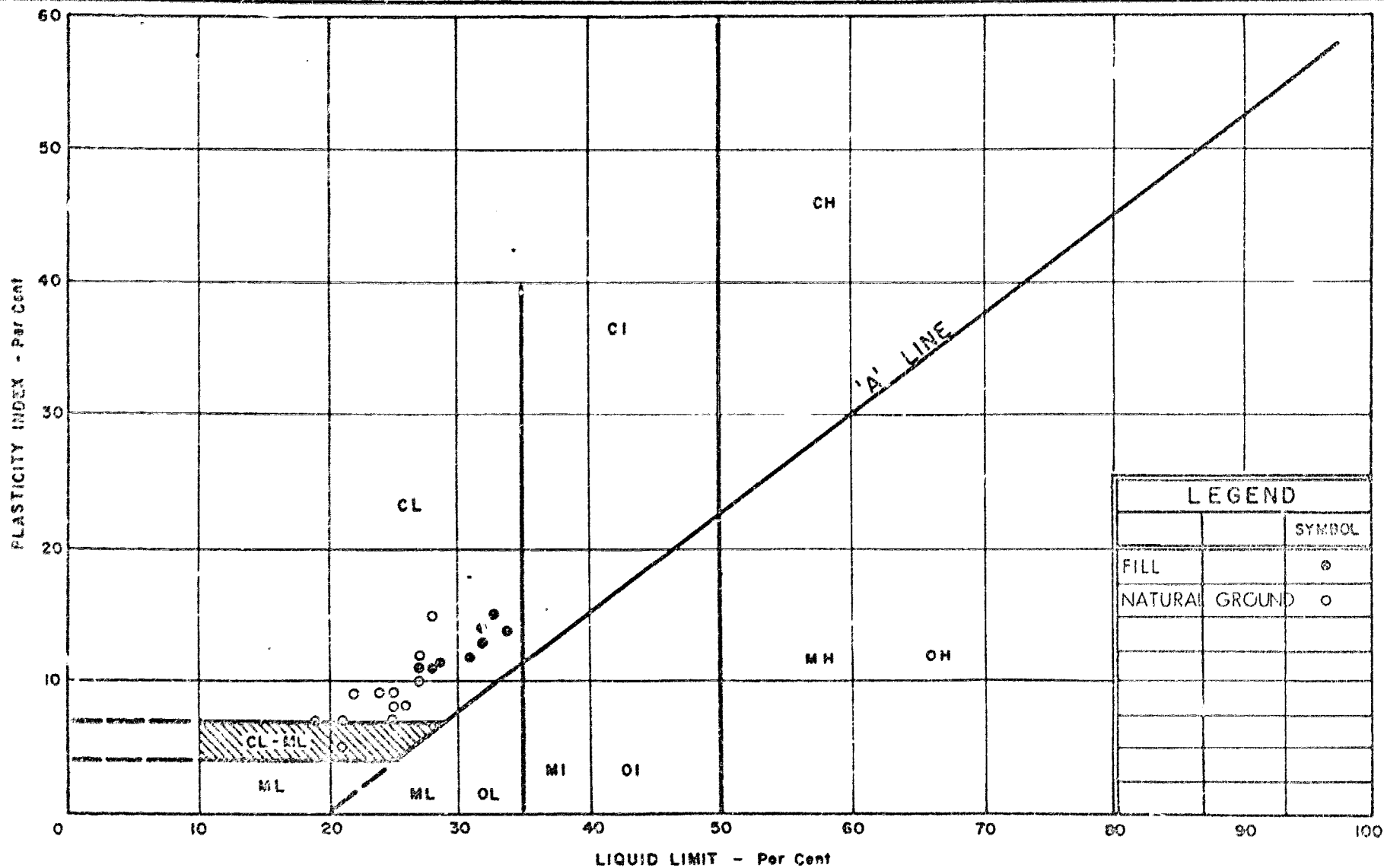
COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX & NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT W_L		BULK DENSITY	REMARK
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		20	40	60	100	PLASTIC LIMIT W_p	WATER CONTENT W		
522.8	Ground Level												
0.0	Het. mix. of clayey silt, sand and		1	SS	26								
			2	SS	51								
			3	SS	100	3"							
	Brown Grey		4	SS	130	4"							
	gravel		5	SS	153	6"							
	(Glacial Till)		6	SS	155	500							
496.8	Very Stiff to Hard		7	SS	166	3"							
26.0			8	SS	100	3"							
486.8	Weathered					490							
36.0	Sound												
481.3	Shale Bedrock		9	BXL	100%								
41.5	End of Borehole					480							



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

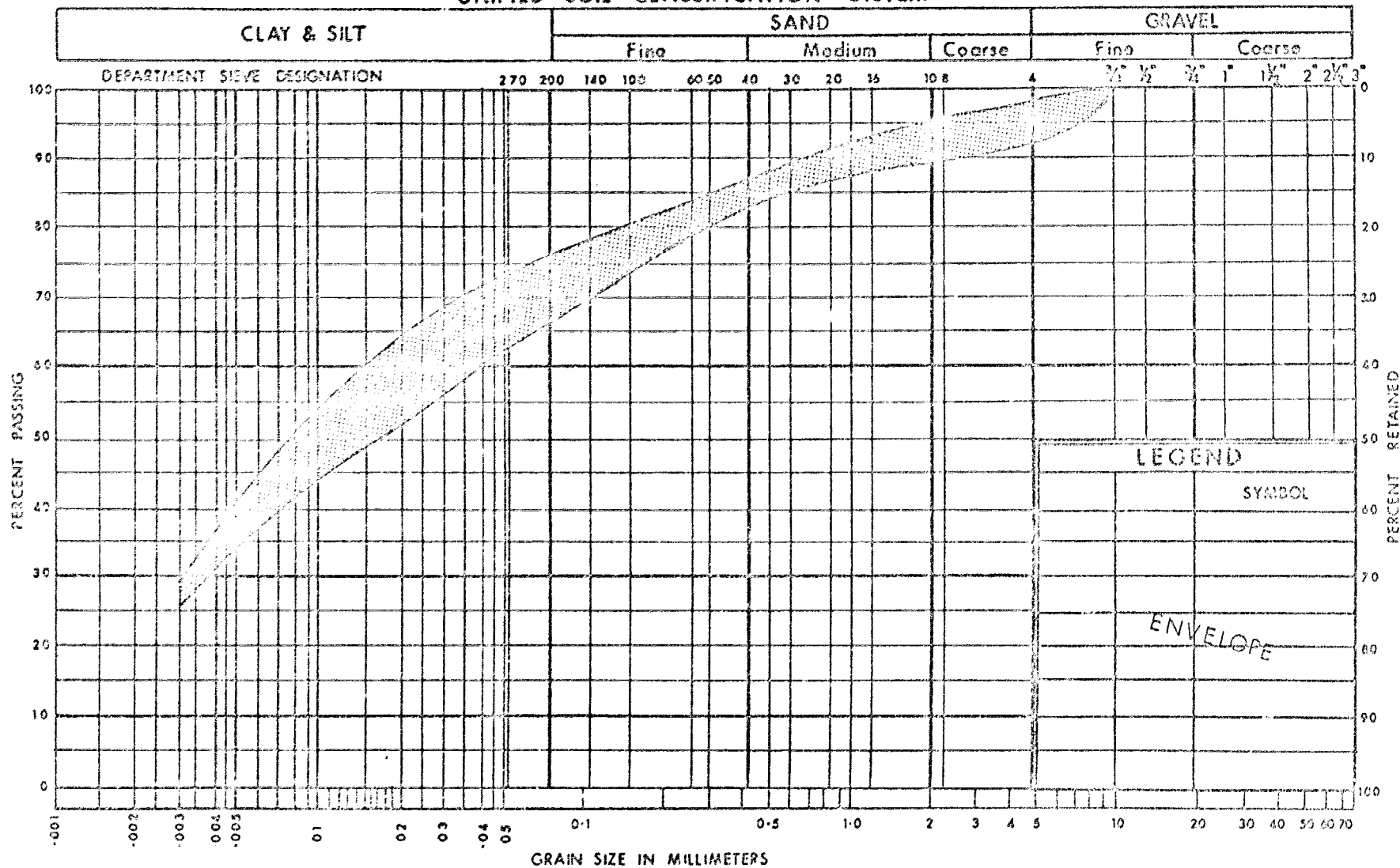
PLASTICITY CHART

VLR No. 127 - 66 - 05

JOB No. 72 - 11156

FIG. 1

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT
TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES
BRANCH

GRAIN SIZE DISTRIBUTION FILL

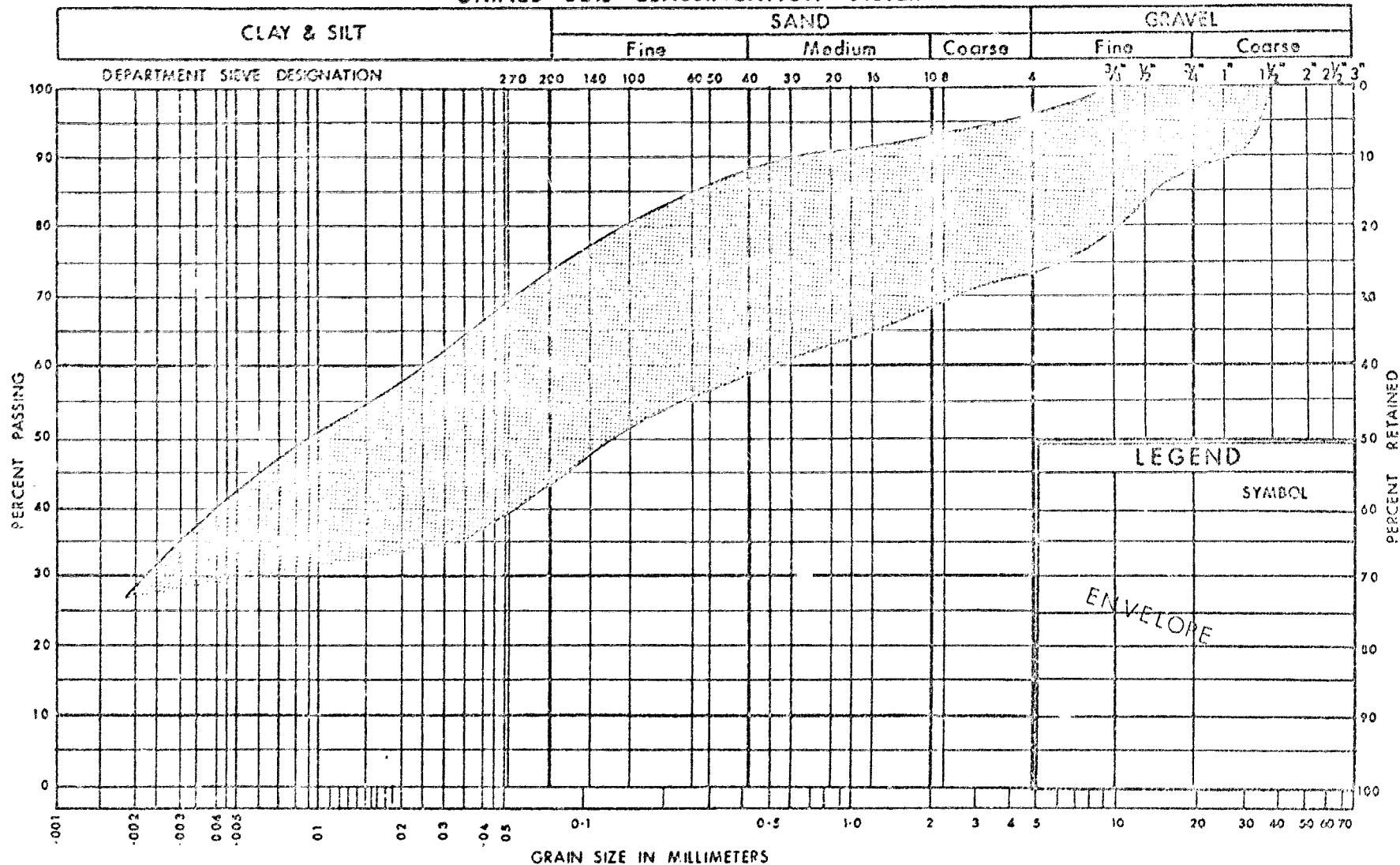
CLAYEY SILT WITH SOME SAND & TRACE OF GRAVEL

W.P. No. 127-66-05

JOB No. 72-11156

FIG. 2

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS



DESIGN SERVICES
BRANCH

GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET. MIX. OF CLAYEY SILT, SAND & GRAVEL

W.P. No. 127 - 66 - 05

JOB No. 72 - 11156

FIG. 3

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

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	O.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 "		
CAO	" " DRAINED "		

ABBREVIATIONS & SYMBOLS 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
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
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
$\log_e a$ 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 (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

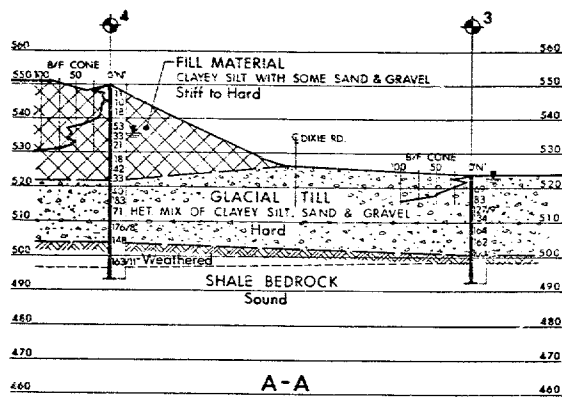
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

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



MEMORANDUM

TO: Mr. G. Burkhardt,
3501 Dufferin Street,
Downsview, Ontario.

FROM: Structural Office,
West Building,
Downsview, Ontario.

ATTENTION:

DATE: August 8, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Dixie Road Underpass,
Bridge #21,
W.P. 127-66-05, Site 24-183,
Hwy. 401, District #6.

72-11-156

Attached herewith are prints of the Preliminary Bridge
Plan Drawing D 24-183-P1 the above mentioned structure.

The estimated cost of the proposed structure is \$1,100,000
which includes tender, materials, engineering, and sundry construction.

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

WL/CSG/js
Attached.

c.c. B. R. Davis
W. D. Birch
A. E. McKim
W. McFarlane
M. Stoyanoff
A. Stermac ✓
J. Anderson
E. Fitzgibbon

W. Lin

W. Lin
for
C. S. Grebski
Structural Design Engineer

FOUNDATIONS OFFICE

REVIEW OF DESIGN DRAWINGS:

W.P. 127-66-05...
W.O. 72-115.6.....

Foundations Report by: V. Kodu.....
Review of Design Drawings by: J. T. Bang.....
Design Drawing No.'s:
.....

1. Does footing design comply with our report or subsequent memos? *No*
2. If answer to 1. is 'No', is present design acceptable? *YES*
3. Has sufficient field work been done? *YES*
4. Are estimated pile lengths shown on Drawings correct? *N/A (see memo)*
If not, make a new list.
5. If excavation of unsuitable soil is recommended, *N/A*
is this shown on drawings?
6. Are approaches designed in accordance with our report? *Yes*
Check slopes and berm lengths.
7. Do you anticipate any construction problems?
i.e. dewatering, stability of temporary *NO*
or excavations.

8. Summarize your comments; on separate sheet is necessary.

{ pier foundations changed. Report recommends spread footings, Design using pile foundation

Note: Talked to Mr. Lin: reasons for using piles as follows:
on Sept 20/73
(a) large load on pier (5.6 tons per sq. ft.)
(b) close to 401, does not wish to make deep excavation in this area
(c) using short pile more feasible.

Drawings Received Aug. 9 1973..
Reviewed Sept. 17 1973..

Signed J. T. Bang.....

Mr. C.S. Grebski,
Structural Design Engineer,
West Building, Downsview.

Foundations Office,
Design Services Branch,
West Building, Downsview.

September 25, 1973.

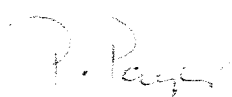
Dixie Road Underpass at Hwy. # 401 Crossing,
Bridge # 21, Site No. 24-183,
District No. 6 (Toronto),
W.O. 72-11156 - W.P. 127-66-05

We have reviewed the preliminary bridge plan Drawing D 24-183-P1 for the new Dixie Road underpass structure and we submit the following comments:

In our foundation report (W.O. 72-11156) we have recommended that the piers be founded on spread footings with an allowable bearing pressure up to 3.5 t.s.f. It appears from the preliminary drawing that the piers are supported on piled foundations. In this case the piers will be supported on end-bearing piles driven to practical refusal within the glacial till deposit. The pile driving in the field should be controlled by employing the Hiley Formula. The allowable capacity of a pile will be dependent on the pile section chosen. For example 12 BP 53 steel H-piles may be designed for a safe design load of 70 tons. For estimating purposes, it can be assumed that the piles will meet practical refusal at the following elevations:

Pier # 1	Elevation 510
Pier # 2	Elevation 505
Pier # 3	Elevation 508
Pier # 4	Elevation 508-510

PP/MD/zh


P. Payer,
SENIOR FOUNDATIONS ENGINEER,
for M. Devata,
SUPERVISING FOUNDATIONS ENGINEER.

cc: D.A. MacDonald,
Foundations Files, ✓
Documents.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. R. Stermac
Principal Foundation Engineer
Room 107
West Bldg.

ATTENTION:

FROM: C.S. Grebski
Structural Design Engineer
Structural Office
West Bldg.

DATE: November 27th, 1973

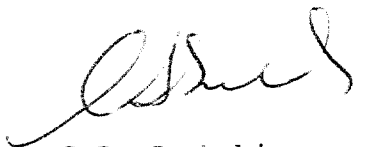
OUR FILE REF.

IN REPLY TO

SUBJECT: Dixie Road Underpass
Bridge #21
W.P. 127-66-05, Site 24-183
Rwy. 401, District #6

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.



C.S. Grebski
Structural Design Engineer

CSG:AMF

Attached

c.c. Foundation Office

*Comments
20-21
We have reviewed
and approved the structural loads
B. Lee McK.*

FOUNDATIONS OFFICE

REVIEW OF DESIGN DRAWINGS:

W.P. ...127-66-05...

W.O. ...78-111.56.....

Foundations Report by:H. K. K.

Review of Design Drawings by:H. K. K.

Design Drawing No.'s: ...Final.....

1. Does footing design comply with our report or subsequent memos? - Yes

2. If answer to 1. is 'No'; is present design acceptable?

3. Has sufficient field work been done? - Yes

4. Are estimated pile lengths shown on Drawings correct? If not, make a new list. - Yes

5. If excavation of unstuitable soil is recommended, is this shown on drawings?

6. Are approaches designed in accordance with our report? Check slopes and berm lengths.

7. Do you anticipate any construction problems? i.e. dewatering, stability of temporary slopes or excavations. - No.

8. Summarize your comments; on separate sheet is necessary.

No comments.

Drawings Received19.....

ReviewedNov. 28. 1973..

SignedH. K. K.

OVERSIZES DRAWINGS

~~RECORD OF BOREHOLE #~~

General drawing
Footings Layout
Footings Detail

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30m12-22

DIST. 6 REGION CENTRAL

W.P. No. 127-44-05

CONT. No. 74-109

W. O. No. 72-F-156

STR. SITE No. 24-183

HWY. No. 401

LOCATION HWY. 401 & DIXIE ROAD

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT 2-3

REMARKS: DOCUMENTS TO BE UNBOLDED
BEFORE MICROFILMED

