

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

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 Street, Downsview.  
ATTENTION: DATE: May 25, 1973.  
OUR FILE REF. IN REPLY TO JUN - 5 1973

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For  
Proposed Hwy. 401 W.B. Collector Overpass  
Over Revised Heart Lake Road (Bridge #51)  
Site No. 24-314, District #6 (Toronto)  
W.O. 72-11176 - W.P. 127-66-06  
CONT. 75-16

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  
Attch.  
c.c. E. J. Orr  
B. R. Davis  
A. Rutka  
R. S. Pillar  
H. Greenland  
B. J. Giroux  
C. Mirza  
G. A. Wrong  
B. A. Singh  
Fenco (Attn: Mr. R. Adachi)

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

Foundations Files  
Documents

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FOUNDATION INVESTIGATION REPORT  
For  
Proposed Hwy. 401 W.B. Collector Overpass  
Over Revised Heart Lake Road (Bridge #51)  
Site No. 24-314, District #6 (Toronto)  
W. O. 72-11176 -- W.P. 127-66-06

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1. INTRODUCTION:

The Foundations Office was requested to carry out a subsurface investigation at the above-mentioned structure site. The request was contained in a memorandum from Mr. G.C.E. Burkhardt, Regional Structural Planning Engineer, Central Region, dated March 7, 1973.

Following this request, a foundation investigation was carried out by this office to determine the subsoil, bedrock and groundwater conditions existing at this site. This report presents the factual data obtained from this investigation together with recommendations pertaining to the foundation design of the structure and stability considerations associated with the approach cuts.

2. DESCRIPTION OF SITE AND GEOLOGY:

The site is located some 400 feet north of the existing intersection of Hwy. 401 and Heart Lake Road, in the Town of Mississauga, County of Peel. The terrain, in the vicinity of the structure site, is flat to gently undulating in relief between elevation 562 and 570, with the exception of the existing roadway (Heart Lake Road) which is up to 30 feet higher than the surrounding terrain. The land was mainly developed for farming purposes.

The site is located in the physiographical region known as "Peel Plain". The characteristic deposit in the vicinity of the area under investigation, is composed of a cohesive glacial till whose thickness is, in general, less than 12 feet. In this region, the Credit River, Oakville Creek and Etobicoke Creek have cut deep valleys into the overburden. There is, therefore, no large undrained depression, swamp or bog in this area, although in many of the interstream areas, drainage is still imperfect. The overburden is underlain by shale bedrock of the Meaford-Dundas Formation, Ordovician Period.

### 3. FIELD INVESTIGATION AND LABORATORY WORK:

Four sampled boreholes, each accompanied with a dynamic cone penetration test, were put down at the site, using a continuous flight auger machine, adapted for soil sampling purposes.

Samples of the overburden were obtained in a 2" O.D. split-spoon sampler at required depths. The sampler was driven into the soil with an energy of 350 ft.-lbs. per blow, in accordance with the specifications for Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. Bedrock was proven in all of the boreholes by obtaining BXL size rock core samples. Groundwater level observations were carried out, during the period of the field investigation, in the open boreholes.

The soil, bedrock and groundwater conditions, encountered at the boring locations, are presented in the individual Record of Borehole sheets. Field surveying was carried out by the personnel from District #6 (Toronto). The elevations in this report are referenced to a Geodetic Datum. The locations, which were tied into a co-ordinate system, and elevations of the various boreholes are shown on Drawing No. 72-11176A, together with estimated stratigraphical sections.

All the samples were subject to a careful examination in the field and subsequently in the laboratory. Following

this examination, laboratory tests were carried out on selected representative samples to determine the physical properties of the overburden encountered, namely:

Grain-size Distribution  
Atterberg Limits  
Natural Moisture Contents

The results of the laboratory testing are summarized on Figure Nos. 1 and 2, contained in the Appendix of this report.

The bedrock core samples were inspected by Mr. K. W. Ingham, Geologist.

#### 4. SUBSOIL CONDITIONS:

##### 4.1) General:

The predominant stratum across the site is composed of a heterogeneous mixture of clayey silt to silty clay and traces of sand and gravel. The thickness of this cohesive glacial till stratum is generally less than 12 feet. The overburden is underlain by shale bedrock.

The stratigraphical sequence encountered in the borings is plotted on the Record of Borehole sheets. Stratigraphical sections have been inferred from this data and plotted on Drawing No. 72-11176A. The subsoil and bedrock encountered from ground surface downward, is presented in the subsections to follow.

##### 4.2) Heterogeneous Mixture of Clayey Silt to Silty Clay and traces of Sand and Gravel (Glacial Till):

Directly beneath a thin topsoil cover (max. 1 foot) is this predominant stratum across the site. It is composed of a heterogeneous mixture of clayey silt to silty clay and traces of sand and gravel (Glacial Till). The thickness of this deposit varies from 9 feet (BH #2) to 12 feet (BH #3)

Grain size distribution curves, for samples of this cohesive stratum, are shown on Figure #1 in the Appendix. Atterberg Limit tests were also performed on samples of The Glacial Till. The results, which are shown on the Record of Borehole sheets and on the Plasticity Chart (Figure #2) are

summarized as follows:

		<u>Range</u>	<u>(Average)</u>
Liquid Limit ( $W_L$ )	%	29 - 43	(37)
Plastic Limit ( $W_P$ )	%	19 - 26	(23)
Natural Moisture Content (W)	%	7 - 17	(13)

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

Standard Penetration tests, carried out within this stratum, 'N' values ranging from 18 to over 100 blows per foot.

It is estimated that the consistency of the glacial till varies from very stiff to hard.

#### 4.3) Bedrock:

The cohesive glacial till stratum is directly underlain by bedrock which was proven at all of the boring locations, by obtaining up to 18 feet of BXL size rock core samples. The rock core samples were examined carefully by Mr. K.W. Ingham, Geologist. A detailed description of the bedrock encountered in the boreholes were presented in a memo from Mr. Ingham, a copy of which is appended to this report.

The bedrock surface was found to vary between elevation 555 (B.H. #1) and 557 (B.H. #3). The bedrock is a dark grey shale with occasional limestone layers. The upper 2 to 3.5 feet of the bedrock is found to be moderately weathered and/or fractured.

#### 5. GROUNDWATER CONDITIONS:

The groundwater level conditions across the site, were observed by taking readings in the open boreholes during and after the field investigation. The results of the readings are shown on the Record of Borehole sheets, as well as on Drawing No. 72-11176A.

The observations indicate that the groundwater levels vary between elevations 563 and 566, which corresponds to levels 1 to 2 feet below the existing ground surface

#### 6. DISCUSSION AND RECOMMENDATIONS:

##### 6.1) General:

In conjunction with the construction program of Hwy. 401 and Hwy. 403, the existing Hwy. 401 from Hwy. 27 westerly to 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:

- i) Hwy. 401/Hwy. 403/Hwy. 410 Complex
- ii) Hwy. 401/Dixie Road Interchange
- iii) Hwy. 401/Airport Entrance/Etobicoke Creek Complex
- iv) Hwy. 401/First Line Interchange

This report will deal with the proposed Bridge No. 51 (Hwy. 401 W.B. Collector over Revised Heart Lake Road) in the Hwy. 401/Hwy. 403/Hwy. 410 Complex. The proposed single-spanned structure will be 74 feet wide. The proposed profile grade of Hwy. 401 W.B. Collector, in the vicinity of the structure, will vary from elevations 564 to 565, while that of Heart Lake Road will be at elevation 541. The existing ground surface varies from elevation 564 to 569. Therefore, cuts up to 4 feet high will be necessary for Hwy. 401. An additional cut of up to 24 feet will be required to reach the proposed grades for Heart Lake Road in the vicinity of the structure.

The predominant stratum across the site is composed of a 9 to 12 foot thick cohesive glacial till which is underlain by shale bedrock.

In the subsections to follow the foundation support for the underpass structure will be discussed. In addition, the stability considerations associated with the approach cuts will be presented.

#### 6.2) Closed-type Abutment Foundations:

In the vicinity of the structure, the proposed profile grade of Heart Lake Road is well below the bedrock surface. Therefore, it is recommended that the closed-type abutments be supported on spread footing type of foundation located within the shale bedrock. A minimum of 4 feet earth cover should be provided to the underside of the footings, since the shale is considered susceptible to frost action. Taking this into consideration the footings should be founded at or below elevation 537.

An allowable bearing value of up to 10 t.s.f. may be used in designing the footings, founded as recommended. The horizontal resistance of the footing may be computed using a coefficient of friction of 1.0 between rough concrete surface and shale.

In order to simplify dewatering for the footing excavations, it is recommended that the approach cuts be completed to profile grades prior to the construction of the structure foundations. If this procedure is followed, the resulting depth of excavation for the footings will be in the order of 4 feet below the finished grade. Any minor groundwater seepage or surface runoff into the excavations can be handled by ordinary pumping methods.

The settlement of the footings will be negligible in magnitude, provided that measures are exercised to prevent the shale from being softened by groundwater seepage or uncontrolled surface runoff. It may be advantageous to protect the shale, at the footing foundation level, by covering it with a lean concrete working slab immediately after the completion of the excavation.

If the structure is designed as a rigid frame, then a coefficient of earth pressure at rest ( $K_0$ ) 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.

In order to relieve the buildup of excess hydrostatic pressure behind the wall, suitable drainage measures should be provided. 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 M.T.C. standards.

### 6.3) Approach Cuts:

#### 6.3.1 Hwy. 401:

The approach cuts for Hwy. 401, up to 4 feet deep, will be made through the cohesive glacial till. No stability problems are anticipated for this portion of the cuts provided standard 2:1 slopes are used.



6.3.2) Heart Lake Road:

As mentioned previously (Section 6.1), an additional cut of up to 24 feet deep will be required in the vicinity of the structure in order to reach the proposed grades of Heart Lake Road. This cut will be made through the cohesive glacial till and into the shale bedrock.

According to experience gained by District Construction personnel from the construction of the 427-Q.E.W. interchange, the shale, once it was exposed to the atmosphere, appeared to be susceptible to weathering and erosion. The shale bedrock encountered at the proposed structure site is of the same formation as that of the shale existing at the 427-Q.E.W. interchange. Therefore, it is recommended that the cuts through the shale bedrock be treated as earth cuts and be constructed with 2:1 slopes. It is further recommended that the cut slopes be protected with an adequate cover of topsoil and sodded.

The groundwater level established during the period of field investigation, is some 27 feet above the bottom of the proposed approach cut. Some seeping through, and consequently local sloughing of the shale can, therefore, be expected. However, this problem will be temporary in duration and minor in nature, since the excavation will result in a general lowering of the ground water level across the site.

7. MISCELLANEOUS:

The field work was carried out between March 19 and March 23, 1973, under the supervision of Mr. V. Korlu, Project Foundations Engineer.

Drilling equipment was owned and operated by Canadian Longyear Ltd., Toronto.

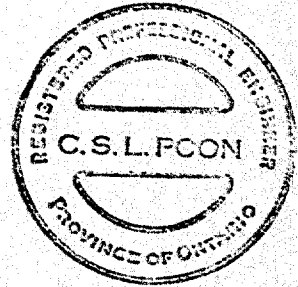
This report was prepared by Mr. C. S. Poon, Project Foundations Engineer, and reviewed by Mr. M. Devata, Supervising Foundations Engineer.

*C. S. Poon*

C. S. Poon, P. Eng.

*M. Devata*

M. Devata, P. Eng.



CSP/ks  
May 24, 1973.

APPENDIX 1

## MEMORANDUM

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

FROM: K. W. Ingham

ATTENTION:

DATE: May 2, 1973

OUR FILE REF.

IN REPLY TO

SUBJECT:

Foundation Investigation 72-11176;  
Hwy. 401 and Hwy. 410 Overpass

A brief description is given below for 4 boreholes drilled to bedrock at this site, together with the appropriate bedrock elevation.

Hole No. 1

Bedrock at 555.1

- 9.3 - 9.9 Limestone; medium grey, fine grained,  
thin bedded, moderately fractured.
- 9.9 - 25.2 Shale; dark grey, thin to medium  
bedded, occasional limestone layers  
0.05 - 0.2 ft. in thickness,  
moderately fractured in the upper 2.0 ft.

Hole No. 2

Bedrock at 555.4

- 9.0 - 9.2 Limestone; medium grey, fine grained,  
silty.
- 9.2 - 9.5 Shale; dark grey, thin to platy bedded,  
badly weathered.
- 9.5 - 9.7 Limestone; medium grey, fine grained,  
slightly silty, prominent vertical joint.
- 9.7 - 11.1 Shale; dark grey, thin to platy bedded,  
badly weathered.
- 11.1 - 19.0 Shale; dark grey, thin to platy bedded,  
weathered zones 12.8 - 13.3 ft.,  
14.0 - 14.2 ft., 16.5 - 16.7 ft.,  
17.2 - 17.5 ft. and 17.8 - 17.9 ft.
- 19.0 - 19.4 Limestone; medium grey, fine grained,  
thin bedded, slightly silty.
- 19.4 - 21.1 Shale; dark grey, thin bedded.

Hole No. 2 (Continued)

- 21.1- 21.4 Limestone; medium grey, fine grained.  
21.4 - 25.0 Shale; dark grey, thin to medium bedded, minor thin limestone layers.

Hole No. 3

Bedrock at 556.6

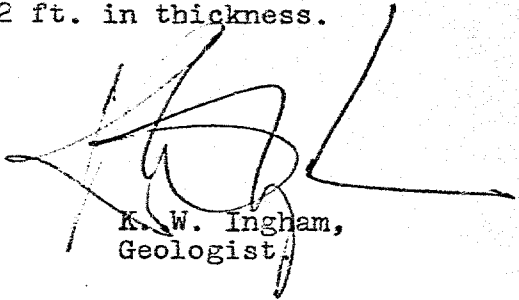
- 12.2 - 12.6 Shale; dark grey, thin bedded, moderately weathered and fractured.  
12.6 - 15.0 Limestone; medium grey, fine grained, thin to medium bedded, occasional to frequent thin shale layers, moderately fractured throughout.  
15.0 - 25.2 Shale; dark grey, thin to medium bedded, slightly weathered 17.5 - 18.2 ft.

Hole No. 4

Bedrock at 556.5

- 12.0 - 13.0 Limestone; medium grey, fine grained, thin to medium bedded.  
13.0 - 14.6 Limestone; dark grey, fine grained, thin to medium bedded, shaly, slightly silty, frequent thin shale seams.  
14.6 - 15.4 Shale; dark grey, thin bedded, badly to moderately weathered.  
15.4 - 15.8 Limestone; medium grey, fine grained, medium bedded, slightly silty.  
15.8 - 26.0 Shale; dark grey, thin to medium bedded, occasional thin lenses of silty limestone and layers of limestone 0.1 to 0.2 ft. in thickness.

KWI:mv

  
K. W. Ingham,  
Geologist

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE No 1

JOB 72-11176

LOCATION Co-ords. 15,857,752 N; 959,212 E.

ORIGINATED BY VK

W.P. 127-66-06

BORING DATE Mar. 23, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Wash &amp; Bore with BX &amp; NX Casing

CHECKED BY *SK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — $w_L$			BULK DENSITY	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT — $w_p$						
							20	40	60	80	100	WATER CONTENT — $w$				
							SHEAR STRENGTH P.S.F.								$w_p$ — $w$ — $w_L$	
○ UNCONFINED + FIELD VANE						● QUICK TRIAXIAL x LAB. VANE			WATER CONTENT %			$\gamma$	F.C.F.			
564.4	Ground Level											35 30 45		GR. SA. SI. CL.		
0.0	Het. mix. of clayey silt, some sand and traces of gravel (glacial till)		1	SS	37	560						○		563.4		
555.1	Hard		2	SS	100%							○		0 11 71 18		
9.3	Moderately fractured		3	SS	100%							○				
552.4			4	RC	100%											
12.0	Bedrock - Shale with occ. limestone layers.		5	BXL	100%	550										
539.1	Sound		6	BXL	100%	540										
25.3	End of Borehole					530										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 2

JOB 72-11176

LOCATION Co-ords. 15,857,706N; 959,276 E.

ORIGINATED BY VK

W.P. 127-66-06

BORING DATE Mar. 22, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Wash & Bore with BX & NX Casing

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — W <sub>L</sub> PLASTIC LIMIT — W <sub>P</sub> WATER CONTENT — W			BULK DENSITY Y	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>		
564.4	Ground Level															
0.0	Het. mix. of clayey silt, some sand and traces of gravel. (Glacial Till)		1	SS	61	560										0 16 55 29
555.4	Hard		2	SS	55/6											
9.0	Weathered		3	BXL	100%											
553.3	Bedrock - Shale with occ. limestone layers.		4	BXL	98%	550										
11.1			5	BXL	100%											
			6	BXL	100%	540										
538.5	Sound		7	BXL	100%											
25.9	End of Borehole					530										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 3

JOB 72-11176 LOCATION Co-ords. 15,857,671 N; 959,117 E.  
 W.P. 127-66-06 BORING DATE March 19, 1973  
 DATUM Geodetic BOREHOLE TYPE Wash & Borw with BX & NX Casing

ORIGINATED BY VK  
 COMPILED BY VK  
 CHECKED BY VK

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 20 40 60 80 100					PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$ $w_p$ — $w$ — $w_L$				
						SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT % 15 30 45			P.C.F. GR. SA. SI. CL.		
568.8	Ground Level															
0.0	Het. mix. of silty clay, some sand and traces of gravel. (Glacial Till)		1	SS	18										566.9	
			2	SS	47										0 6 69 25	
556.6	Very Stiff to Hard		3	SS	113/111"											
12.2	Weathered and fractured		4	RC BXL	80%											
553.8																
15.0	Bedrock - Shale with occ. limestone layers.		5	BXL	95%											
			6	BXL	100%											
543.6	Sound		7	BXL	100%											
25.2	End of Borehole															



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 4

JOB 72-11176

LOCATION Co-ords. 15,857,614 N; 959,157 E.

ORIGINATED BY VK

W.P. 127-66-06

BORING DATE March 21, 1973

COMPILED BY VK

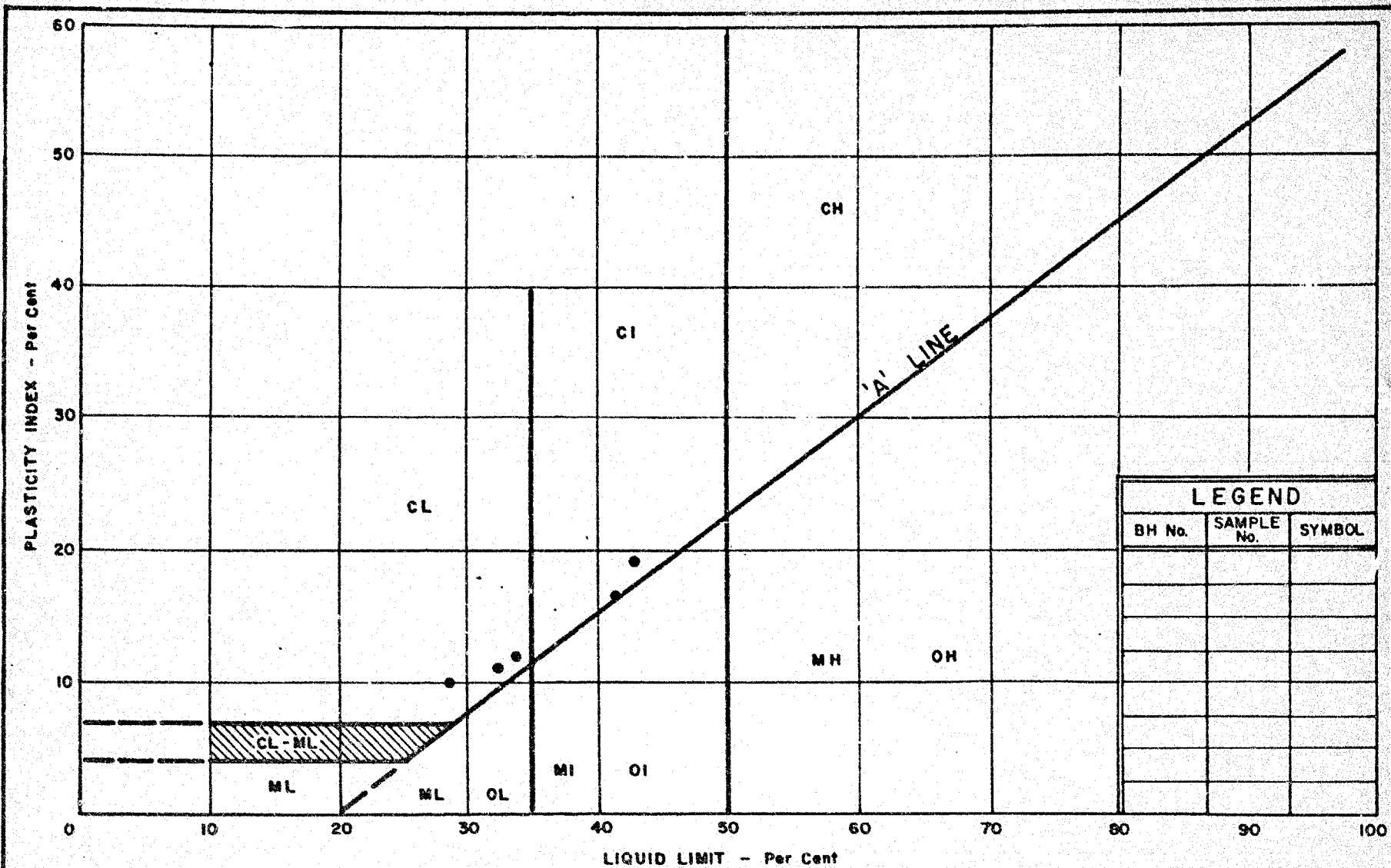
DATUM Geodetic

BOREHOLE TYPE Wash &amp; Bore with BX &amp; NX Casing

CHECKED BY *AK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT — W <sub>L</sub> PLASTIC LIMIT — W <sub>P</sub> WATER CONTENT — W W <sub>P</sub> — W — W <sub>L</sub>	BULK DENSITY Y	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
568.5	Ground Level									
0.0	Het. mix. of silty clay, some sand and traces of gravel. (Glacial Till)		1	SS	30					
			2	SS	95/9					
556.5	Very Stiff to Hard		3	SS	64/8					
12.0	Weathered		4	RC BXL	80%					
553.1										
15.4	Bedrock - Shale with occ. limestone layers.		5	BXL	100%					
			6	BXL	100%					
542.5	Sound									
26.0	End of Borehole									





LEGEND		
BH No.	SAMPLE No.	SYMBOL



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

## PLASTICITY CHART GLACIAL TILL

HET. MIX. OF CLAYEY SILT TO SILTY CLAY, SAND & GRAVEL

WP. No. 127 - 66 - 06

JOB No. 72 - 11176

FIG. 2

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTPENETRATION 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
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" " ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTPENETRATION 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	✓ 1 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

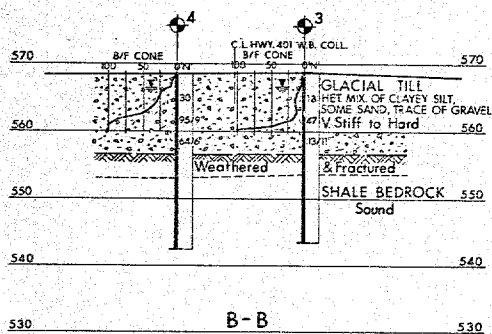
S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

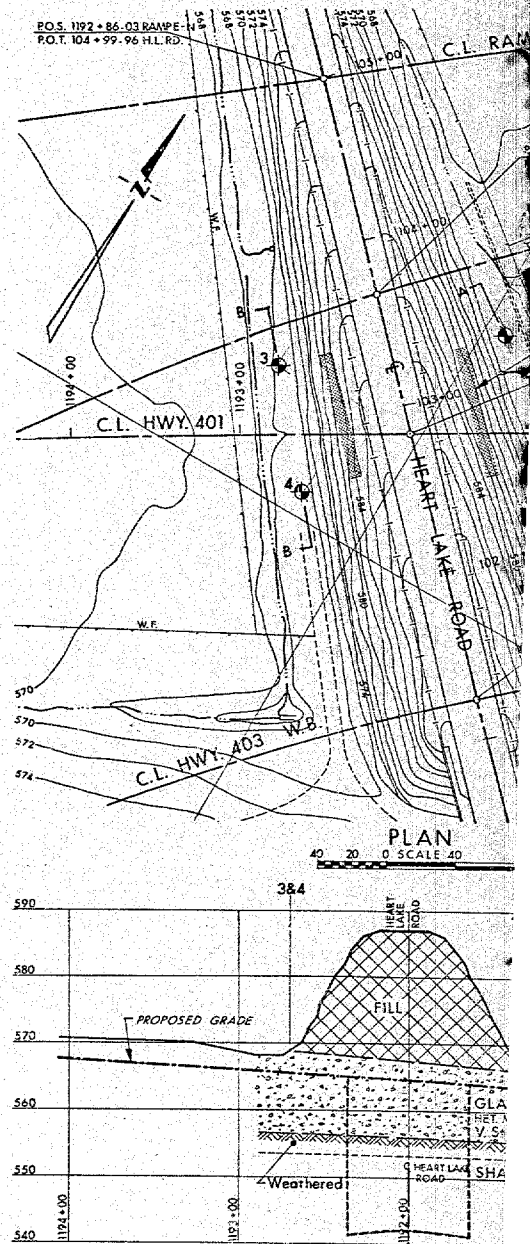
U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

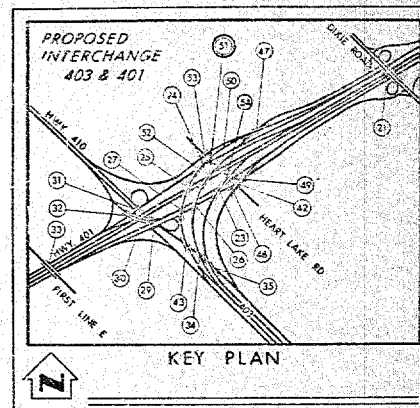
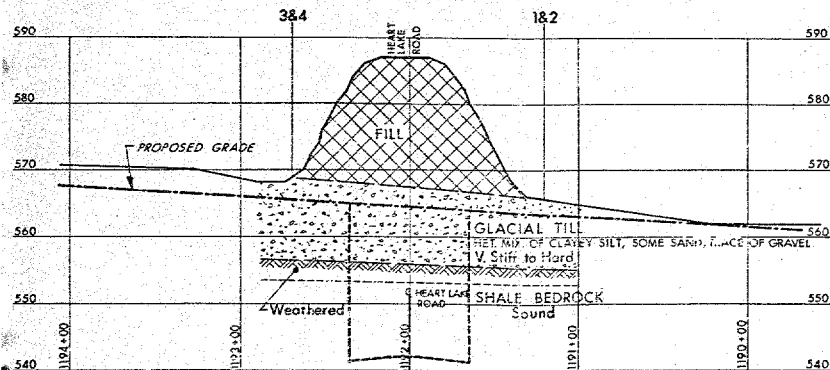
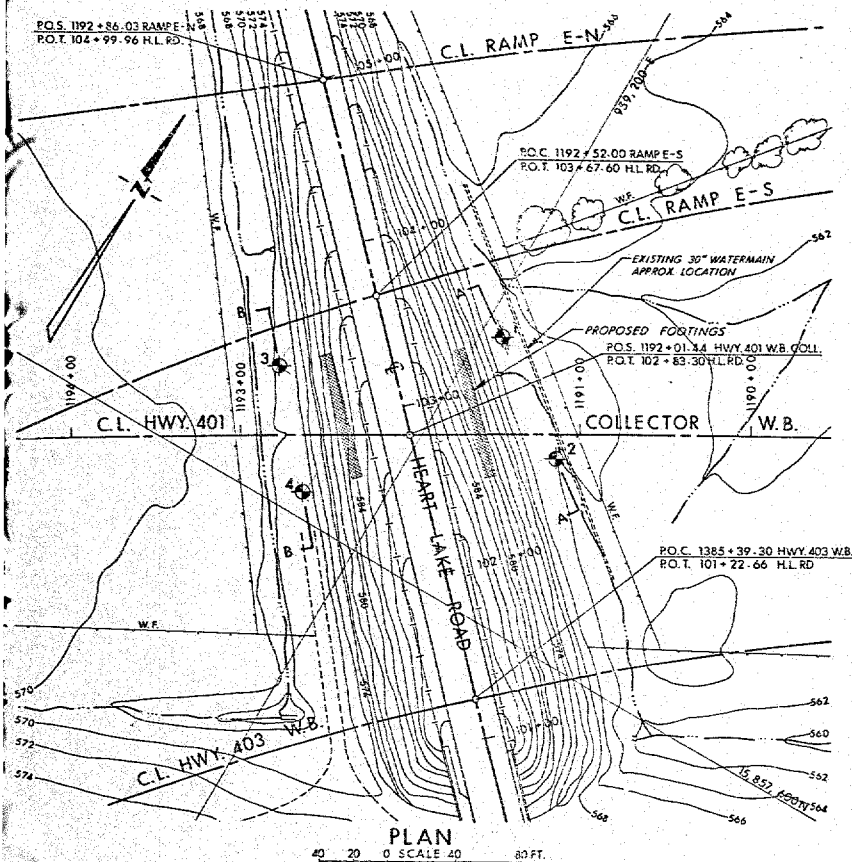


SECTIONS & PROFILE

HORIZ. 40 20 0 SCALE 40 80 FT.

VERT. 10 5 0 10 20 FT.





### LEGEND

- Bore Hole
- ⊕ Cone Penetration Test
- ⊕ Bore Hole & Cone Test
- W Water Levels established at time of field investigation, March 1973.

NO.	ELEVATION	CO - ORDINATES	
		NORTH	EAST
1	564.4	15,857,752	959,212
2	564.4	15,857,704	959,276
3	568.8	15,857,671	959,117
4	568.5	15,857,614	959,157

### NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO  
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

### BRIDGE No. 51

HWY. 401 W.B. COLL. OVER HEART LAKE ROAD

HIGHWAY NO. 401 & 403 DIST. NO. 5

CO. PEEL

TOWN OF MISSISSAUGA LOT CON.

### BORE HOLE LOCATIONS & SOIL STRATA

SUBNO. V.K. [CHECKED] ✓	W.P. NO. 127-66-06	DRAWING NO.
DRAWN S.R. [CHECKED] ✓	W.O. NO. 72-11176	72-11176 A
DATE MAY 24, 1973	SITE NO.	BRIDGE DRAWING NO.
APPROVED [Signature]	CONT. NO.	
PRINCIPAL FOUNDATION ENGINEER		

Design Services Branch,  
1201 Wilson Avenue,  
Downsview, Ontario.  
M3M 1J8

March 20, 1973.

Telephone: 248-3282.

Canadian Longyear Limited,  
35 Brydon Drive,  
Rexdale, Ontario.

Dear Sirs:

This letter confirms our request of March 16, 1973,  
for the supply of a diamond drill together with all necessary  
equipment, as specified under the terms of our Contract  
Agreement, at Hwy. 01 and Hwy. 10 on March 19, 1973.

Mobilization will be from your yard at Toronto.


Our Project Number is N.O. 72-11176. ✓

Yours truly,

MD/ao

cc: W. W. Fry  
(Attn: Mrs. M. Andrews)

For:

  
M. Devata,  
Supervising Foundations Engineer,  
A. G. Sternac,  
Principal Foundations Engineer.

Foundations Files  
Documents



## MEMORANDUM

72-11176

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

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

ATTENTION: Mr. Devata

DATE: March 7, 1973.

OUR FILE REF.

IN REPLY TO: *May 23/73*

SUBJECT: Hwy. 401 W.B. Collector Overpass  
Over Heart Lake Road - Bridge #51,  
Site 24-314, W.P. 127-66-060,  
District 6, Toronto.

The above structure is a part of the Hwy. 401/403/410 interchange as covered by W.P. 127-66-01. The location is shown on the attached "Scheme of the Interchange".

You are kindly requested to prepare the Foundation Report for this structure (due date May 23, 1973).

Attached are also two copies of "Fenco Drawing No. 3983-3K-3 on which the following information is shown.

- a) Proposed structure type and footing locations (marked in red).
- b) Profiles of all intersecting roads.
- c) Co-ordinates of control point and alignments.

Point 1, as marked in red on the drawing, has been staked out by Fenco.

Co-ordination of boreholes will be carried out on your request by District Forces under the supervision of Mr. I. Tremain.

The approximate location of the existing 30" diameter watermain is shown in red on the attached drawing. This is the only underground utility in this area according to the information available.

MAA:lc  
Attach.

*(Signature)*  
M. A. Almer,  
STRUCTURAL PLANNING ENGINEER,  
for:  
G. C. E. Burkhardt,  
REG. STRUCTURAL PLANNING ENG.

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

*Longest (Mar 19, 73)*

*2000*  
*22-11176*  
*11/1*

MEMORANDUM

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

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

ATTENTION:

DATE: August 28, 1973.

OUR FILE REF.

IN REPLY TO

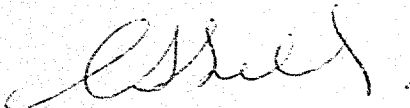
SUBJECT: Hwy. 401 W.B.C. Over Heart Lake Road,  
Bridge 51,  
W.P. 127-66-06, Site 24-314,  
Hwy. 401, District No. 6

73-11-176

Attached herewith are prints of the Preliminary Bridge  
Plan Drawing D 24-314-P1 the above mentioned structure.

The estimated cost of the proposed structure is \$200,000  
which includes tender, materials, engineering and sundry  
construction.

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



C. S. Grebski,  
Structural Design Engineer.

/cls

Attach.

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

No comments.  
J.K. O'Brien Sept 11/73

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

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

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

ATTENTION:

DATE: December 28, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Hwy. 401 W.B.C. over Heart Lake Rd.,  
Bridge No. 51,  
W.P. 127-66-06, Site 24-314,  
Hwy. 401, District #6.

72-11-176

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

Kindly give us your comments at your earliest  
convenience.

CSG/jh  
Attach.

c.c. Foundation Office

*A. Radkowski*  
for C. S. Crebski  
Structural Design Engineer

*See letter of Jan 4/74.*

*C. Poon*

Mr. C. S. Grebski,  
Structural Design Engineer,  
Structural Office,  
West Bldg., Downsview.

Geotechnical Office,  
Engineering Services Branch,  
West Bldg., Downsview.

January 4, 1974.

Hwy. 401 W.B. Collector Over Heart Lake Rd.  
Bridge #51, Site 24-314, District #6 (Toronto)  
W.O. 72-11176      W.P. 127-66-06

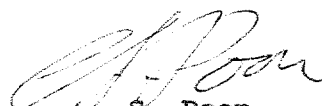
We have reviewed the final structural drawings 24-314-1 and -3 for the above project and submit the following comments.

The foundation investigation was carried out for the originally proposed single-span close-abutment structure. It is understood that a three-span structure will be adopted at this location. As a result of this, none of the borings put down are located at the pier locations. However, the proposed founding elevation of the pier footings is approximately 15 feet (4.5 m) below the established sound bedrock surface in this general area. In view of this the recommendations pertaining to spread footing founded on sound shale bedrock given in our Foundation Report W.O. 72-11176 will still be applicable for the pier footings.

The founding elevations of the west and east abutment footings as shown on Drawing No. 24-314-3 are 554.8 and 552.7, respectively. On the same drawing, there is a note stating that "footings to be founded on sound bedrock." At the above-mentioned elevations, the bedrock as determined in the corresponding boreholes, is slightly fractured and/or weathered. (Refer to Geologist Report, w.O. 72-11176) It is, therefore, recommended that if the above-mentioned note is to be retained, the founding elevation of the west and east abutment footings should be at or below elevations 553 and 552, respectively. Alternatively, the present founding levels as shown on the drawing may be maintained, using a reduced allowable bearing pressure of 5 t.s.f. (480 KN/m<sup>2</sup>) and the above-mentioned note should be deleted.

Should you have further queries regarding this project, please contact this Office.

CSP/ao

  
S. Poon,  
Project Foundations Eng.,  
For: M. Devata,  
Supervising Foundations Eng.

WP 127-66-06

Mr. D. Hopper  
Manager  
Contract Control Office

Soil Mechanics Section  
Geotechnical Office

April 4, 1975

INFORMATION TO CONTRACTOR DURING PERIOD OF TENDER CALLING

This is to confirm the information given to you by telephone on March 26, 1975 that the following foundation reports were examined by Mr. Henry Shelegy, P. Eng., Division Manager of Kilmer Van Nostrand Co. Limited, at our office on March 25, 1974:

- 1) Bridge #51; Structure Site 24-314, W.P. 127-66-06, Dist. #6
- 2) Bridge #49; Structure Site 24-316, W.P. 127-66-08, Dist. #6
- 3) Bridge #31; Structure Site 24-323, W.P. 127-66-20, Dist. #6
- 4) Bridge #29; Structure Site 24-324, W.P. 127-66-22, Dist. #6.

N. DEVATA  
Supervising Engineer.

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M12-24

DIST. 6 REGION CENTRAL

W.P. No. 127-44-06

CONT. No. 75-16

W. O. No. 72-11176

STR. SITE No. 24-374

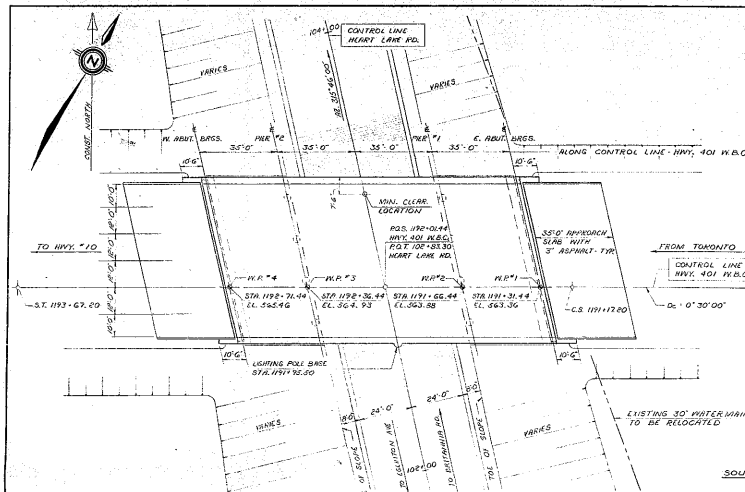
HWY. No. 401

LOCATION Collector Overpass

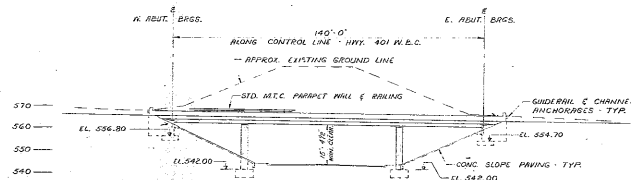
AT HEART LANE RD AND BRIDGE #51

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT 2

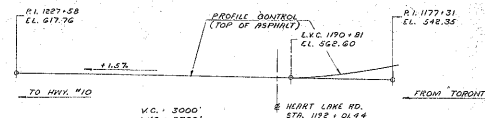
REMARKS Documents to be unfolded  
before microfilmed



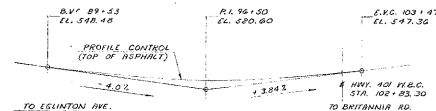
PLAN  
1" = 20' 0"



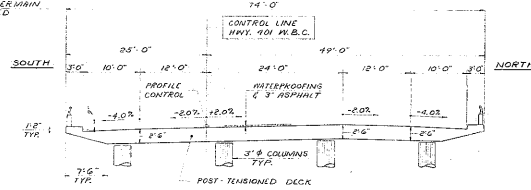
ELEVATION  
1" = 20' 0"



PROFILE OF HWY 401 W.B.C.  
N.T.S.



PROFILE OF HEART LAKE ROAD  
N.T.S.



TYPICAL SECTION  
1/8" = 1' 0"

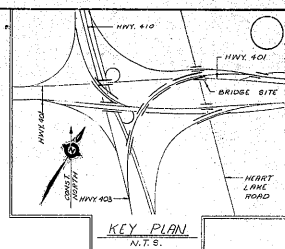
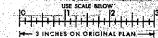
# LIST OF DRAWINGS

- SHEET 1 GENERAL LAYOUT
- 2 BORE HOLE LOCATIONS & SOIL STRATA
- 3 FOOTING LAYOUT
- 4 ABUTMENT LAYOUT
- 5 ABUTMENT REINFORCING
- 6 PIER DETAILS
- 7 BEARING LAYOUT & DETAILS
- 8 DECK LAYOUT & ELEVATIONS
- 9 CRABE DETAILS
- 10 DECK REINFORCING I
- 11 DECK REINFORCING II
- 12 PARAPET WALL DETAILS
- 13 STANDARD STEEL PARAPET RAIL
- 14 35 FOOT APPROACH SLAB
- 15 DETAILS OF CONC. SLOPE PAVING
- 16 STANDARD DETAILS I
- 17 STANDARD DETAILS II
- 18 ELEC. EMBEDDED WORK
- SHEET 19 ELEC. STANDARDS

B.M. T.D.M. 425 EL 572.01  
TABLET ON SOUTH FACE OF NORTH  
ABUTMENT WALL AT WEST END,  
50' RIGHT OF STA. 1191+31.44 EXISTING  
2ND LINE EAST STRUCTURE.



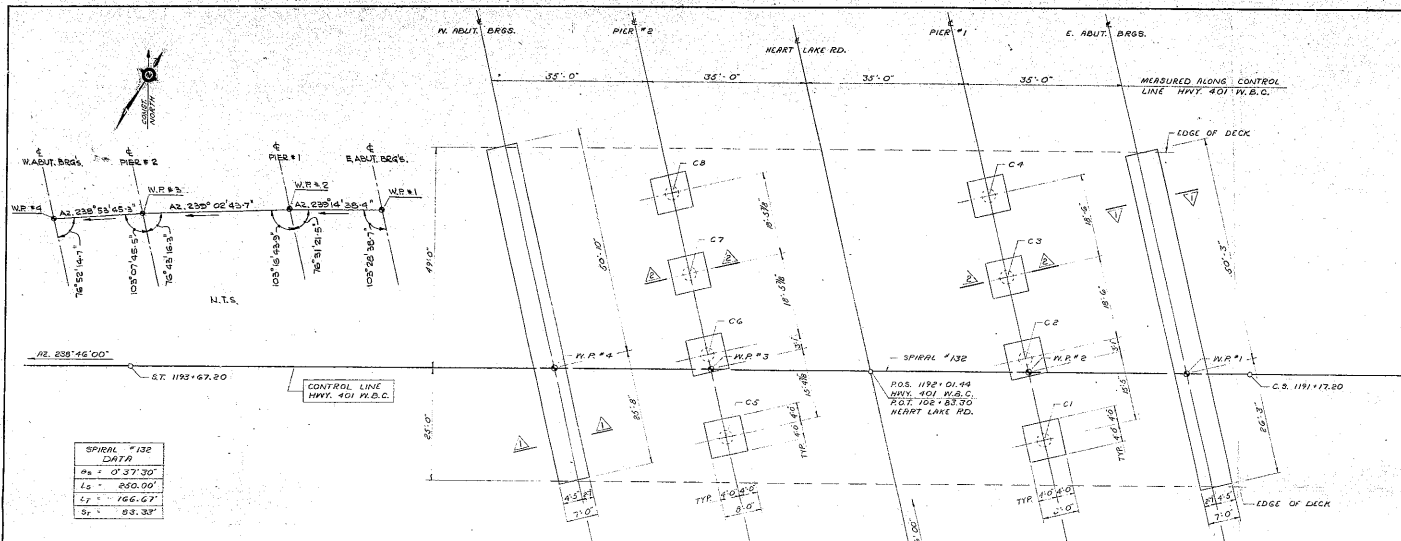
FOR REDUCED PLAN



## GENERAL NOTES:

- CLASS OF CONCRETE
- PIER COLUMNS - 4000 P.S.I.
- DECK, CURBS OVER DECK, PARAPET WALLS - 3000 P.S.I.
- APPROACH SLABS - 4000 P.S.I.
- REINFORCER - 3000 P.S.I.
- CLEAN COVER TO REINFORCING STEEL
- FOOTINGS, PIER COLUMNS & ABUTMENTS - 3" DECK TOP
- DECK BOTTOM - 1 1/2" CURBS
- PARAPET WALLS - 1 1/2" AND/OR AS NOTED ON DRAWINGS.
- CONSTRUCTION NOTES
- THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF 1/8".
- NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED, STRENGTHENED & GROUTED.
- ELECTRICAL
- FOR ELECTRICAL EMBEDDED WORK AND DETAILS SEE ELECTRICAL DRAWINGS.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO	
HWY 401 W.B.C. OVER HEART LAKE RD. BRIDGE NO. 51	
ENGINE'S HIGHWAY NO. 401	DIST. NO. 6
DO. P.C.E.	CON. II. JTE. C
TWP. 01 MISSISSAUGA	CON. II. JTE. C
GENERAL LAYOUT	
APPROVED: [Signature]	CONTRACT NO.
DESIGN: [Signature]	WE. NO. 107-66-06
CHECK: [Signature]	DATE: DEC 77
DATE: DEC 77	SHEET 1



**SPIRAL "132" DATA**

$P_k = 0^\circ 37' 30''$
$L_s = 840.00'$
$E_T = 166.67'$
$S_T = 89.33'$

PIER COLUMN LOCATIONS				
LOCATION	POINT	STATION	COORDINATES	
			NORTH	EAST
PIER #1	C1	1191+66.86	857 683.61	959 239.46
	C2	1191+82.15	857 636.87	959 287.51
	C3	1191+71.44	857 710.10	959 208.63
	C4	1191+75.71	857 723.38	959 192.74
	C5	1192+32.93	857 647.61	959 176.42
PIER #2	C6	1192+37.14	857 660.86	959 161.53
	C7	1192+41.35	857 674.10	959 146.63
	C8	1192+45.55	857 687.35	959 131.74

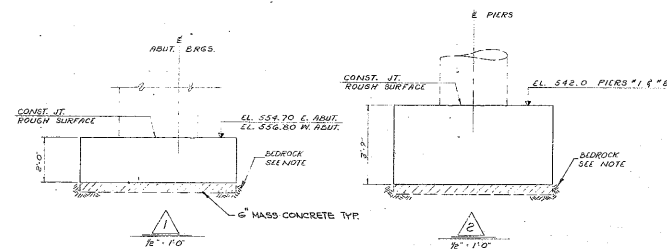
**CONTROL LINES**

LOCATION	POINT	STATION	COORDINATES	
			NORTH	EAST
CONTROL LINE HWY 401 W.B.C.	C.S.	1191+17.20	857 719.81	959 266.03
	P.O.S.	1192+01.44	857 676.63	959 192.63
	S.T.	1193+67.20	857 690.96	959 057.60

**WORKING POINTS**

LOCATION	P.P.	STATION	COORDINATES	
			NORTH	EAST
CONTROL LINE HWY 401 W.B.C.	1	1191+31.44	857 712.55	959 253.78
	2	1191+66.44	857 694.66	959 223.71
	3	1192+36.44	857 658.65	959 163.68
	4	1192+71.44	857 640.57	959 133.71

**FOOTING LAYOUT**  
1" = 10'



NOTE: FOOTINGS TO BE FOUNDED ON SOUND BEDROCK.

30M12-24  
SHEET NO.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO	
HWY 401 W.B.C. OVER HEART LAKE RD. BRIDGE NO. 51	
ENGINE'S HIGHWAY No. 401	DIST. No. G
CO. PEEL	TWP. OF WINDUSSHAW
LOT. 5	CON. II-III E
FOOTING LAYOUT	
APPROVED: [Signature]	CONTRACT No.
DRAWN: [Signature]	W.P. No. 187-66-06
CHECK: [Signature]	SHEET 3



FOR REDUCED PLAN  
1" = 10'  
1" = 3 INCHES ON ORIGINAL PLAN