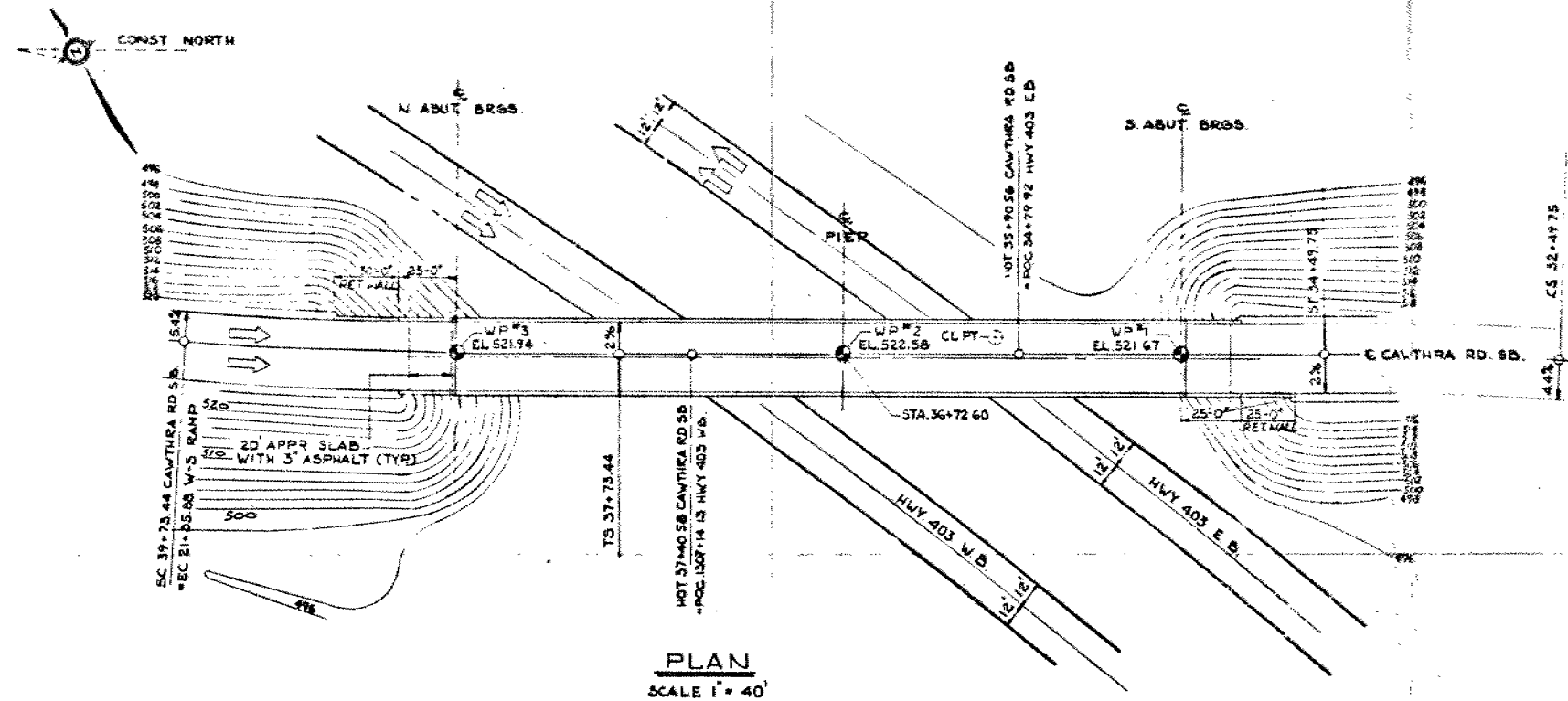
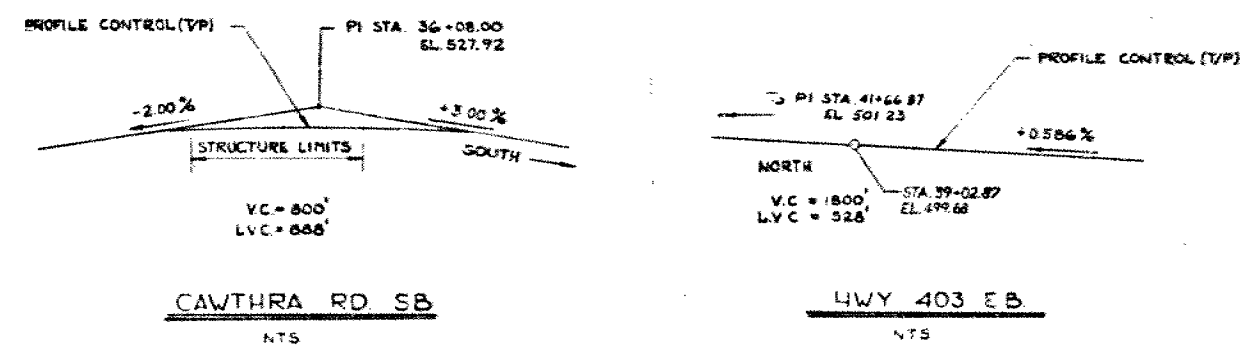
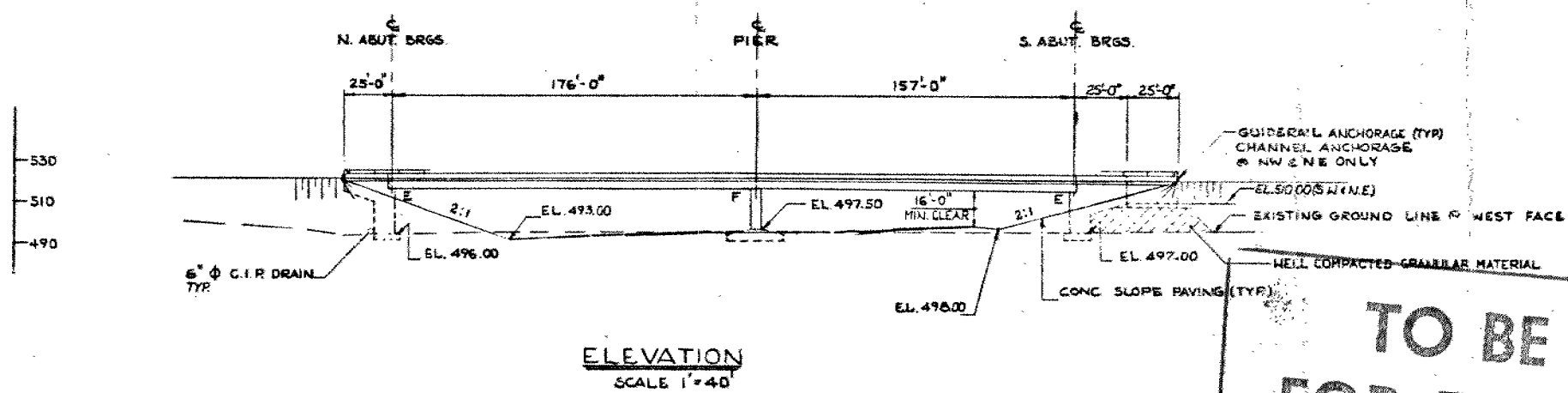


REMARKS: _____



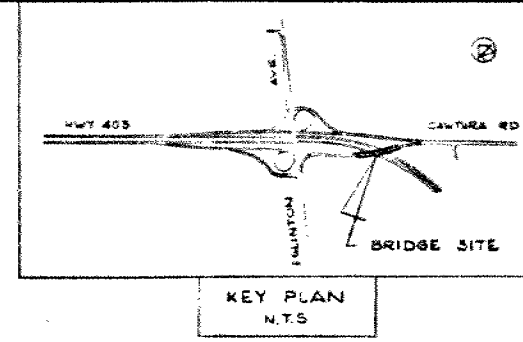
GEODETTIC BENCH MARK

TOPD 648 - EL. 522.078 (1965)
 CONCRETE MONUMENT AT NORTHEAST SIDE
 OF HWY 10, 0.6 MILES NORTHWEST OF BURNHAMTHORPE
 RD., 39 FT. NORTHEAST OF E. OF HWY, 12 FT. NORTHWEST
 OF E. OF DRIVEWAY TO F. E. WOODS PROPERTY, 80 FT.
 SOUTHEAST OF TELEPHONE POLE.
 TABLET IN TOP OF MONUMENT AT GROUND LEVEL.



**TO BE USED
 FOR ESTIMATING
 PURPOSES ONLY**

DATE **AUG. 25 1977**



DIST. NR 6	CONT No	SHEET
WP No 127-66-25	CAWTHRA PD SB UNDERPASS	
BRIDGE #38		
GENERAL LAYOUT		

LIST OF DRAWINGS

1. GENERAL LAYOUT
2. BORE HOLE LOCATIONS & SOIL STRATA
3. FOOTING DETAILS
4. SOUTH ABUTMENT & WINGWALLS
5. NORTH ABUTMENT & WINGWALLS
6. PIER DETAILS
7. RETAINING WALLS
8. DECK DETAILS
9. DECK REINFORCING
10. LONGITUDINAL CABLE DETAILS
11. TRANSVERSE CABLE DETAILS
12. BARRIER WALL (2'-8" HIGH)
13. STEEL RAILING (SING. TUBE)
14. 20 FT. APPROACH SLAB
15. DETAILS OF CONCRETE SLOPE PAVING
16. STANDARD DETAILS I
17. STANDARD DETAILS II
18. AS CONSTRUCTED ELEV. & DIM.

CONCRETE QUANTITIES:

CONCRETE IN PIER	= 14 CU. YD. (5000 P.S.I.)
ABUTMENTS, WINGWALLS & RET. WALLS	= 370 CU. YD. (3000 P.S.I.)
PRESTRESSED CONCRETE BRIDGE DECK	= 1346 CU. YD. (5000 P.S.I.)
CONCRETE IN BARRIER WALLS	= 62 CU. YD. (5000 P.S.I.)
CONCRETE IN APPROACH SLABS	= 40 CU. YD. (3000 P.S.I.)
CONCRETE IN SLOPE PAVING	= 64 CU. YD. (3000 P.S.I.)

GENERAL NOTES

CLASS OF CONCRETE

COLUMNS, DECK & BARRIER WALLS	: 5000 P.S.I.
PIER FOOTING	: 5000 P.S.I.
ABUTMENT FOOTINGS	: 4000 P.S.I.
REMAINDER	: 3000 P.S.I.

REINFORCING STEEL CLEAR COVER

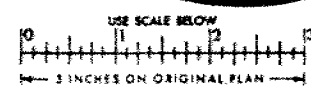
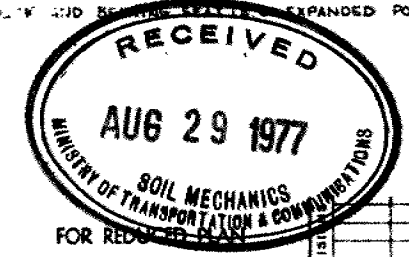
FOOTINGS, ABUTMENTS & PIERS	: 8"
DECKS	TOP : 2" BOTTOM : 1 1/2"
GRADE OF REINFORCING STEEL	: COL. SPL. STIRRUPS (CABLE SUPPORTS G50, REMAINDER G60)

TO ACHIEVE THE MIN. CLEAR COVER OF 2" SPECIFIED THE TOP LAYER OF DECK REINF. SHALL BE PLACED PRIOR TO CONCRETING, WITH A CLEAR COVER OF 2 1/2" ± 1/2" TOLERANCE.

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL 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.

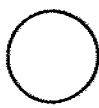
FORMWORK BETWEEN THE END OF THE DECK AND BALLAST WALL, AND UNDERSIDE OF D.V. AND BEARING SEATS (EXPANDED POLYSTYRENE) SHALL BE REMOVED.



DATE	BY	DESCRIPTION
DESIGN	CHECK	LOADING
DRAWING	CHECK	SITE No 24-377 DWS

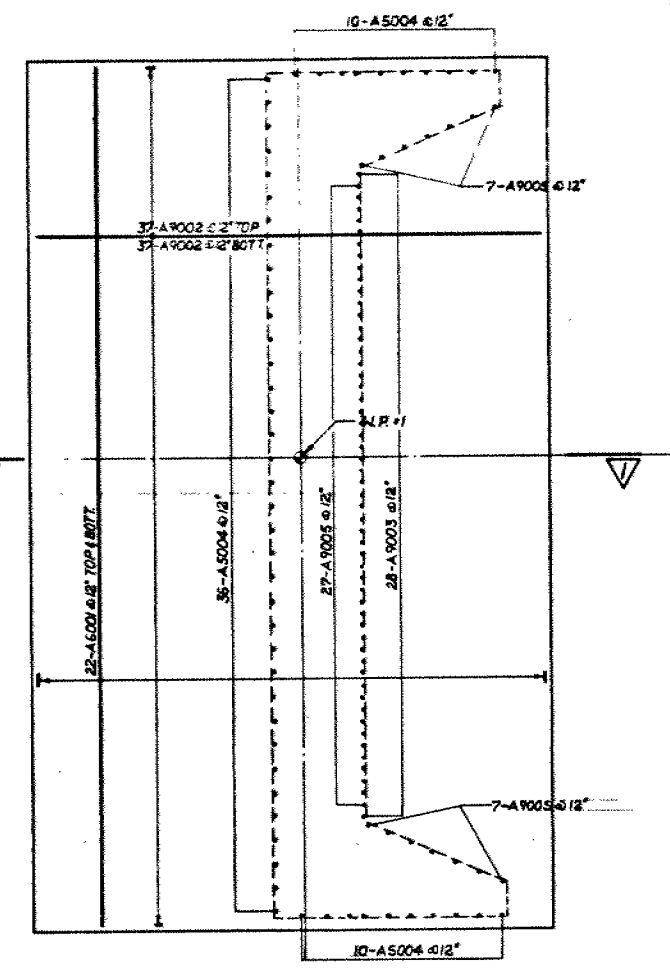
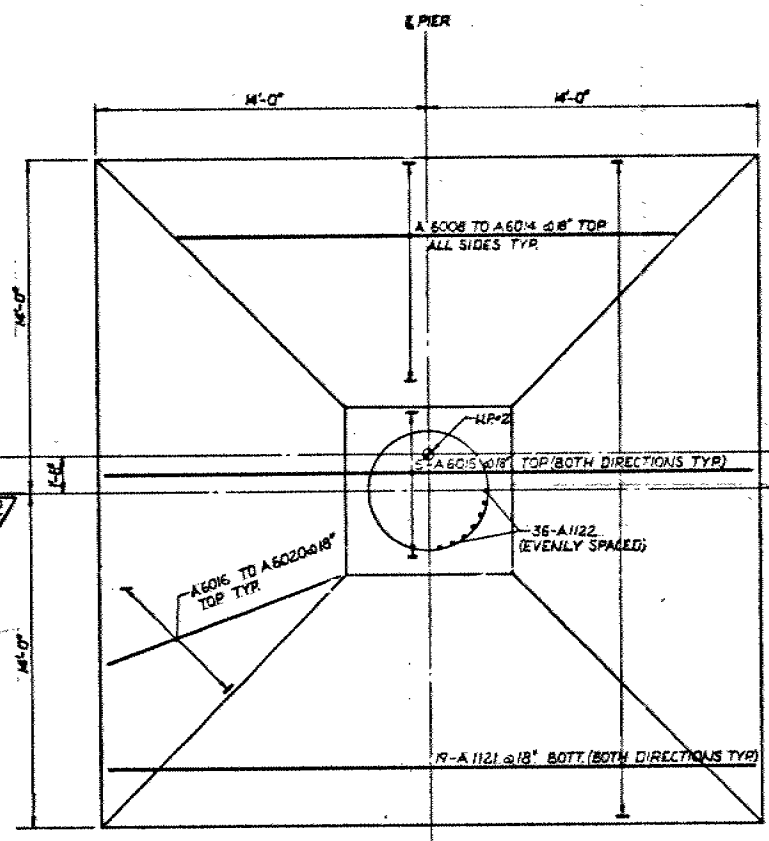
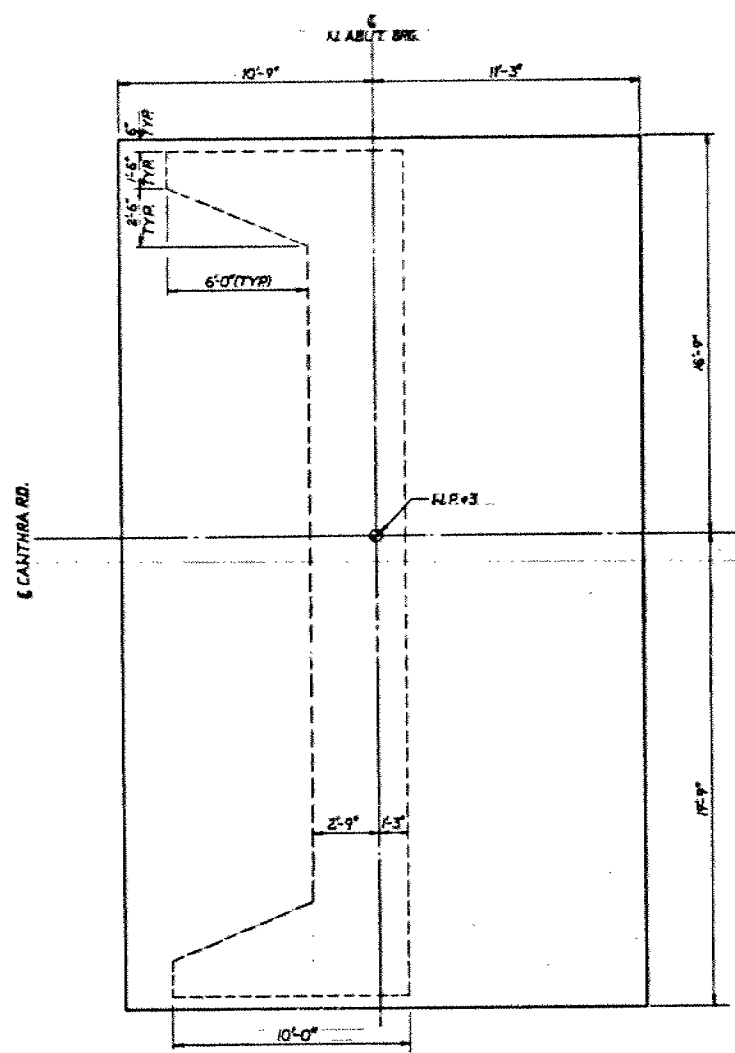
DIST NO. 6
CONT No
WP No 127-66-25

CANTHRA RD. SB UNDERPASS
BRIDGE 38
FOOTING DETAILS

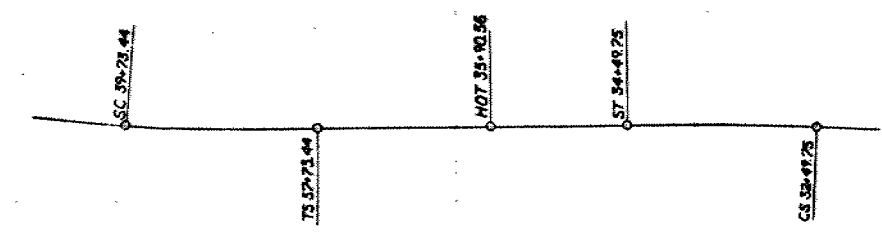


SHEET

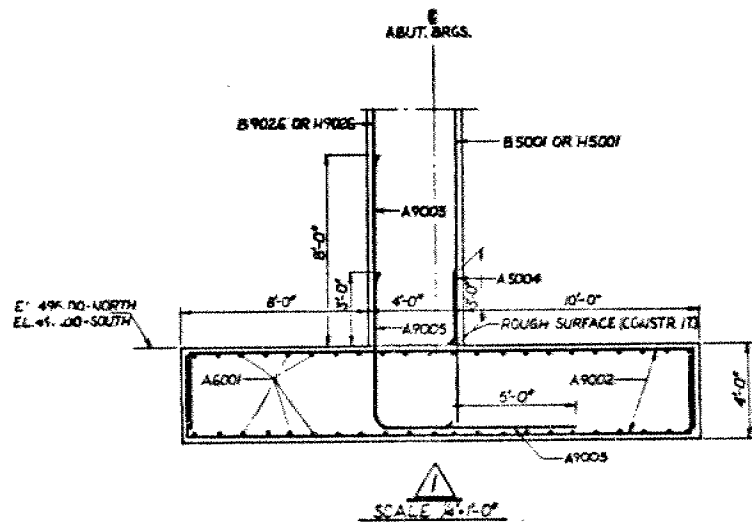
COORDINATES			
HP	STATION	NORTH	EAST
1	35+15.60	843 614.91	964 953.14
2	36+72.60	846 694.27	964 817.68
3	38+48.60	848 783.49	964 665.96



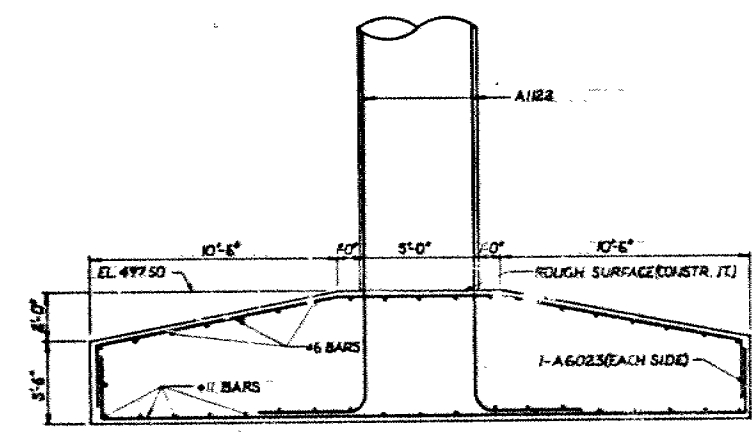
FOOTING LAYOUT
SCALE: 1/4"=1'-0"



ALIGNMENT DETAILS



SCALE: 1/4"=1'-0"

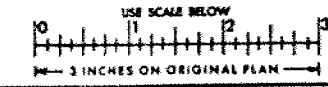


SCALE: 1/4"=1'-0"

COORDINATES		
STATION	NORTH	EAST
CS 32+49.75	848 477.53	965 180.71
ST 34+49.75	848 581.62	965 009.96
HT 35+70.56	848 652.81	964 888.46
TS 37+73.44	848 745.26	964 730.67
SC 39+73.44	848 850.81	964 560.86



FOR REDUCED PLAN



REVISIONS	DATE	BY	DESCRIPTION
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

30M12-75

TO: Mr. G.C.E. Burkhardt, (3)
Regional Structural Planning Eng.,
Central Region,
3501 Dufferin St.,
ATTENTION: Downsview, Ontario.

FROM: Foundations Office,
Design Services Branch,
West Bldg., Downsview.

DATE: August 27, 1973.

OUR FILE REF. IN REPLY TO AUG 31 1973

SUBJECT:

CONT 79-77
FOUNDATION INVESTIGATION REPORT
For

*The Proposed Structure at the Crossing of
Hwy. #410 S.B.L. and Hwy. #403
(Bridge #38), District #6
Town of Mississauga, County of Peel
W.O. 73-11039 -- W.P. 127-66-25*

30M12-75
GEOCRES No

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

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

Foundations Files
Documents

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 - 4.3) Silty Sand with Gravel.
 5. GROUNDWATER CONDITIONS.
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 - 6.2) Foundations.
 - 6.2.1) Piers.
 - 6.2.2) Abutments.
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 7. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For
The Proposed Structure at the Crossing of
Hwy. #410 S.B.L. and Hwy. #403
(Bridge #38)
Town of Mississauga, County of Peel
W.O. 73-11039 -- W.P. 127-66-25

1. INTRODUCTION:

The Foundations Office was requested to carry out a subsurface investigation at the site of the proposed Bridge #38 (Hwy. 410 S.B.L. over Hwy. 403) in the Town of Mississauga, County of Peel. The request was contained in a memo from Mr. G.C.E. Burkhardt, Regional Structural Planning Engineer, Central Region, dated May 22, 1973. Subsequently, an investigation was carried out by this Office to determine the subsoil and groundwater conditions in this area.

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

2. DESCRIPTION OF SITE AND GEOLOGY:

The site is located some 1,000 ft. south of the intersection of Eglinton Avenue (Base Line Road) and Cawthra Road, in the Town of Mississauga, County of Peel. The land is flat to gently undulating between elevations 494 and 498. In this area, the land is primarily developed for farming purposes.

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 composed of a cohesive

glacial till whose thickness is quite variable. 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 AND LABORATORY WORK:

Ten sampled boreholes, each accompanied with a dynamic cone penetration test, were put down during the course of the field investigation. The borings were advanced by means of 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 washhammered into the soil with a driving energy of 350 ft.-lb. per blow in accordance with the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration testing.

Groundwater level observations were carried out during the period of investigation, in the open boreholes. In addition, piezometers were installed at two boring locations where artesian water pressure was encountered. The location of the piezometers are shown on Drawing No. 73-11039A. The outflow of groundwater from the boreholes were successfully sealed off.

The soil and groundwater conditions encountered at the boring locations are presented in the Record of Borehole sheets. The location and ground elevation of the various boreholes were surveyed in the field by construction personnel from District #6 (Toronto). The elevations in this report are referenced to a Geodetic Datum. The borehole locations (referenced to a co-ordinate system) and elevations, together with estimated stratigraphical sections, are shown on Drawing No. 73-11039A.

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

examination, laboratory testing was carried out on selected representative samples to determine the various physical properties of the overburden; namely,

Natural Water Contents

Atterberg Limits

Grain-Size Distribution

The results of the laboratory testing were presented on the Record of Borehole sheets as well as summarized on Figures No. 1 and 3, inclusive, all of which are contained in the Appendix of this report.

4. SUBSOIL CONDITIONS:

4.1) General:

The predominant stratum across the site is composed of heterogeneous mixture of hard clayey silt, sand and gravel (glacial till). The thickness of this deposit varies from 21 to 28 ft. The cohesive glacial till is underlain by a granular deposit of silty sand with gravel, which was not fully penetrated at any of the boring locations.

The boundaries 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. 73-11039A have been inferred from this data. From ground surface downward, the various soil types encountered are as follows:

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

This is the predominant stratum across the site. It is composed of a heterogeneous mixture of clayey silt, sand and gravel (glacial till). The thickness of this deposit varies from 21 feet (B.H. #10) to 28 feet (B.H. #5).

Grain-size distribution curves, for samples of this cohesive deposit, are shown on Figure No. 2 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 No. 1), are tabulated below:

	<u>Range</u>	<u>(Average)</u>
Liquid Limit (W_L) %	16 - 28	(23)
Plastic Limit (W_P) %	12 - 18	(15)
Natural Moisture Content (W) %	7 - 17	(11)

Based on the above values, it may be concluded that the glacial till has a matrix, which is inorganic and of low plasticity.

The results of Standard Penetration Tests, carried out within the glacial till, are plotted on the Record of Borehole sheets and Drawing No. 73-11039A. The testing gave 'N' values generally ranging from 21 to over 100 blows/ft. In several localized zones, 'N' values are as low as 10 blows/foot.

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

4.4) Silty Sand with Gravel:

This granular deposit was found underlying the glacial till stratum. It consists of silty sand with gravel. This stratum was not fully penetrated at any of the boring locations. Standard penetration testing was carried out within this granular deposit. The results gave 'N' values ranging from 29 blows per foot to 100 blows for 4 inches, with the higher values being dominant. The relative density of this deposit is, therefore, from compact to very dense.

5. GROUNDWATER CONDITIONS:

An artesian groundwater pressure head was encountered at three boring locations (B.H. #5, 7 & #10). This artesian condition was encountered once the borings penetrated through the cohesive glacial till stratum down into the lower granular deposit. Once this occurred, water rapidly filled the borehole and continuously flowed out of the borehole. The water flowed out of the boreholes was clear, indicating no loss of fines in the aquifer. In order to establish the groundwater table and to observe the

variations in artesian pressure head at various depths, two piezometers were installed at B.H.'s #5 and #10. The location and relative depth of the piezometers are shown on Drawing No. 73-11039A. Piezometric water levels were observed periodically. These observations indicate that the artesian pressure head was found to be as much as 14 feet above the ground surface, corresponding to an elevation of 511.

At the other boring locations where artesian conditions were not observed during the drilling operation, water level readings were taken in the open boreholes. The results of the observations are plotted on the Record of Borehole sheets and Drawing No. 73-11039A. At B.H.'s #3, #6, #8 and #9, where the boreholes were terminated at a level very close to the upper boundary of the silty sand deposit, water rose to the existing ground surface approximately 1 to 2 days after the completion of the boreholes. At the other boring locations, namely B.H.'s #1, #2 and #4, which were terminated within the cohesive glacial till, a perched water level was found to be at 12 to 18 feet below the ground surface, corresponding to elevations from 477 to 484.

6. DISCUSSIONS AND RECOMMENDATIONS:

6.1) General:

This report will deal with the Proposed Bridge No. 38 (Hwy. 410 S.B.L. over Hwy. 403). This 54-foot-wide structure is to have five spans (110'-185'-121'-164'-98'). The proposed profile grade of Hwy. 410 S.B.L. in the vicinity of the structure will vary from elevation 520 to elevation 525, while that of Hwy. 403 is to vary between elevations 494 and 501. To reach these grades, approach embankments of up to 35 and 28 feet high in the transverse and longitudinal directions, respectively, will be necessary.

The subsoil consists of a 21 to 28 foot thick cohesive glacial till underlain by an extensive deposit of silty sand with gravel, which was found to be the primary source of artesian water at certain locations.

In the subsections to follow the foundation support for the proposed structure together with stability and settlement considerations associated with the approach fills will be discussed.

6.2) Foundations:

6.2.1) Piers:

The subsoil is competent, therefore, it is recommended that the piers be supported on spread footings located within the hard parent glacial till deposit. In order to fulfill the frost protection requirements, the underside of the footings should be at least 4 feet below the finished grade. The recommended founding elevations for the piers are as follows:

<u>Location</u>	<u>Station</u>	<u>Recommended Founding Elevation</u>	<u>Refer to B.H.'s</u>
Pier #1	34+50	492	#3 & #4
Pier #2	36+14	493	#5
Pier #3	37+35	494	#6
Pier #4	39+20	490	#7 & #8

An allowable bearing value of up to 3.5 t.s.f. may be used in designing the footings, founded as recommended. In computing the lateral resistance of the footings, an adhesion value of 2,500 p.s.f. may be used between the rough concrete surface and glacial till.

The excavations for the pier footings will be carried out within the cohesive glacial till. In view of the relatively impervious nature of the glacial till, no major dewatering problems are anticipated. Any groundwater seepage and/or uncontrolled surface runoff into the excavations could be handled by employing ordinary pumping methods.

The foundation subsoil will settle due to the imposed foundation loading. The subsoil is composed of a competent cohesive glacial till, thus the settlement will be of a recompression nature. For a spread footing foundation of the size contemplated, imposing the aforementioned pressure, it is estimated that the

settlement should not exceed one half of an inch, provided the subsoil is not softened by groundwater seepage or uncontrolled surface runoff. It may be advantageous to protect the cohesive glacial till, at the founding level, by covering it with a lean concrete working slab immediately after the completion of the excavation.

6.2.2) Abutments:

The abutments for this structure may be perched within the approach fills. The presence of artesian condition at certain locations precludes the use of end-bearing piles driven well into the very dense granular stratum to support the abutments, since the piles may penetrate and disturb the artesian zone in the granular subsoil and consequently endanger the stability of the overall structure complex. In view of this, it is recommended that the abutments be supported on spread footings or short piles terminated within the cohesive glacial till. These two alternatives are discussed separately as follows:

- i) The abutments may be supported on spread footings perched within the approach fills. The material, below the tops of the footings, should consist of well compacted Granular 'A' and should extend to a horizontal distance of at least 10 feet from the footing edges in the plane of the footing tops. This portion of the fill should be constructed with side slopes no steeper than 1:1. The remainder of the fill should be completed to about profile grade for a distance of about 50 feet behind the abutments before re-excavating for the abutment footings. An allowable bearing value of 2.5 t.s.f. may be used in footing design.
- ii) The abutment footings may be perched within the approach fills and supported on short piles driven to a level at least 10 feet above the upper boundary of the granular deposit to ensure that the artesian zone is not disturbed. The piles should be terminated at the elevations given below:

<u>Location</u>	<u>Tip Elevation</u>	<u>Refer to B.H.'s</u>
West Abutment	485	#9 and #10
East Abutment	480	#1 and #2

12-3/4" O.D. tubular piles driven to the above elevations may be designed for a safe load of 30 tons/pile. No rock or bouldery fill should be placed in areas where piles are to be driven.

6.3) Approach Embankments:

As mentioned elsewhere in this report, the maximum height of the approaches will be of the order of 35 feet. Subsoil conditions are generally favourable and consequently no deep-seated rotational type of failure is anticipated provided 2:1 slopes are adopted.

The fill itself and the natural subsoil will settle. The magnitude of this combined settlement is estimated to be of the order of 2 inches. The majority portion of this settlement, which occur within the fill itself, should take place within two months following the placement and compaction of the fills. In view of this, it is recommended that the embankments should be constructed and left in place for a period of two months prior to the construction of the structure, if spread footings are chosen to support the abutments. If the above-mentioned scheme is adopted, the differential settlement between the spread footing supported abutment and adjacent pier should not exceed 1/2 inch.

7. MISCELLANEOUS:

The field work was carried out between June 13 and June 20, 1973, under the supervision of Mr. V. Korlu, Project Foundations Engineer.

The drilling equipment used was owned and operated by Canadian Longyear Co. Ltd., Toronto.

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

C.S. Poon

C. S. Poon, P. Eng.



M. Devata

M. Devata, P. Eng.

CSP/ao
August 23, 1973.

APPENDIX I

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1

JOB 73-11039

LOCATION Co-ords. 848,490 N; 965,080 E.

ORIGINATED BY VK

W.P. 127-66-25

BORING DATE June 20, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger & sample with CME Machine

 CHECKED BY *[Signature]*

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	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
494.5	Ground Level									
0.0	Het. mix. of clayey silt, sand & gravel		1	SS	10	490				
			2	SS	41					
			3	SS	76					
	Brown Grey (Glacial Till)		4	SS	48	480				
			5	SS	36					
			6	SS	32					
	Stiff to Hard		7	SS	58					
469.0			8	SS	24	470				
25.5	End of Borehole									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2

JOB 73-11039

LOCATION Co-ords. 848,542 N; 965,112 E

ORIGINATED BY VK

W.P. 127-66-25

BORING DATE June 20, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and sample with CME Machine

CHECKED BY *[Signature]*

SOIL PROFILE			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	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT 20 40 60 80 100			SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					w_p — w — w_L WATER CONTENT % 10 20 30																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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0.0	Het. mix of clayey silt, sand and gravel		1	SS	25																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 73-11039

LOCATION Co-ords. 848,543 N; 964,994 E.

ORIGINATED BY VK

W.P. 127-66-25

BORING DATE June 19, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and sample with CME Machine

CHECKED BY *[Signature]*

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		
							SHEAR STRENGTH P.S.F.					W_p	W	W_L		
							<input type="radio"/> UNCONFINED + FIELD VANE <input checked="" type="radio"/> QUICK TRIAXIAL x LAB VANE									
496.0	Ground Level															
0.0	Het. mix. of clayey silt, sand & gravel.		1	SS	25											
	Brown		2	SS	51	490										
	Grey		3	SS	68											
	(Glacial Till)		4	SS	56											
	Very Stiff to Hard		5	SS	61	480										
			6	SS	59											
			7	SS	47											
			8	SS	62	470										
468.0	Silty sand and some gravel. Very Dense		9	SS	150	10"										
465.5	End of Borehole															
30.5																
						460										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 4

JOB 73-1k039

LOCATION Co-ords. 848,599 N; 965,026 E.

ORIGINATED BY VK

W.P. 127-66-25

BORING DATE June 20, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger & sample with CME Machine

CHECKED BY C/K

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. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L		
496.1	Ground Level															
0.0	Het. mix. of clayey silt, sand & gravel.		1	SS	28											
			2	SS	93	490										8 31 51 10
	Brown		3	SS	63											4 25 51 20
	Grey		4	SS	54											484.4
	(Glacial Till)		5	SS	54											1 20 64 15
			6	SS	52	480										
	Very Stiff to Hard		7	SS	73											
470.9			8	SS	130											24 29 38 9
25.5	End of Borehole					470										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 5

JOB 73-11039

LOCATION Co-ords. 848,655 N; 961,864 E.

ORIGINATED BY VK

W.P. 127-66-25

BORING DATE June 18, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger & Sample with CME Machine

 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	W_P	W	W_L		
497.5	Ground Level															
0.0	Het. mix. of clayey silt, sand & gravel.		1	SS	27											
			2	SS	94	490										
	Brown Grey		3	SS	32											4 30 46 20
	(Glacial Till)		4	SS	27											
			5	SS	17											6 37 50 7
	Very Stiff to Hard		6	SS	26	480										
			7	SS	23											6 38 46 10
			8	SS	60											
469.5			9	SS	100	470										15 45 36 4
28.0	Silty sand and some gravel.		10	SS	90											Tip 465.0
						460										462.5
			11	SS	100 1/4"											9 41 42 8
	Very Dense					450										
			12	SS	100 1/4"											1 23 74 2
						440										
434.5																
63.0	End of Borehole					430										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 6

JOB 73-11039
W.P. 127-66-25
DATUM Geodetic

LOCATION Co-ords. 848,716 N; 964,759 E.
BORING DATE June 15, 1973
BOREHOLE TYPE Auger and Sample with CME Machine

ORIGINATED BY VK
COMPILED BY VK
CHECKED BY [Signature]

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	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
498.0	Ground Level									
0.0	Het. mix. of clayey silt, sand & gravel.		1	SS	28					5 36 43 16
	Brown		2	SS	60					7 32 48 13
	Grey		3	SS	25					8 43 41 8
	(Glacial Till)		4	SS	16					
	Stiff to Hard		5	SS	12					
			6	SS	21					
475.5			7	SS	52					
22.5	End of Borehole									

OFFICE REPORT OF SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 7

JOB 73-11039

LOCATION Co-ords. 848,788 N; 964,583 E.

ORIGINATED BY VK

W.P. 127-66-25

BORING DATE June 14, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and sample with CME Machine

 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. P. GR. S. A. S. I. CL.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L		
495.7	Ground Level															
0.0	Het. mix. of clayey silt, sand and gravel		1	SS	37											
	Brown		2	SS	35	490										4 26 53 17
	Grey		3	SS	31											
	(Glacial Till)		4	SS	34											3 33 52 12
	Very Stiff to Hard		5	SS	26	480										
			6	SS	40											17 36 37 10
472.7			7	SS	47											
23.0	Silty sand and gravel		8	SS	163	10"										32 37 26 5
465.2	Very Dense		9	SS	55											Art. 58 29 10 3
30.5	End of Borehole															465.7
						460										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 8

JOB 73-11039

LOCATION Co-ords. 848,839 N; 964,617 E.

ORIGINATED BY VK

W.P. 127-66-25

BORING DATE June 15, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger & Sample with CME Machine

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. GRS	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	w_p	w	w_L		
495.8	Ground Level															
0.0	Het. mix. of clayey silt, sand & gravel		1	SS	46	490										h 28 52 16
	Brown Grey		2	SS	63											h 29 50 17
	(Glacial Till)		3	SS	30											
			4	SS	43											
	Stiff to Hard		5	SS	11	480										3 29 52 16
			6	SS	25											h 27 44 25
			7	SS	82											
173.3	End of Borehole															
24.5	End of Cone Test					470										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 9

JOB 73-11039

LOCATION Co-ords. 848,850 N; 964,488 E.

ORIGINATED BY VK

W.P. 127-66-25

BORING DATE June 14, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and sample with CME Machine

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 Y	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	W _P	W	W _L		
497.7	Ground Level															
0.0	Het. mix. of clayey silt, sand & gravel		1	SS	29	490										3 31 47 19
	Brown		2	SS	65											
	Grey		3	SS	40											
	(Glacial Till)		4	SS	17	480										6 43 40 11
			5	SS	16											
	Very Stiff to Hard		6	SS	24											
475.2			7	SS	53											7 33 44 16
22.5	End of Borehole					470										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 10

JOB 73-11039

LOCATION Co-ords. 848,901 N; 964,527 E.

ORIGINATED BY VK

W.P. 127-66-25

BORING DATE June 13, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and sample with CME Machine

CHECKED BY

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	20	40	60	80	100	PLASTIC LIMIT W_P		
497.6	Ground Level						SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							○ UNCONFINED + FIELD VANE				W_P W W_L				
							● QUICK TRIAXIAL × LAB VANE				WATER CONTENT %				
											10 20 30				
0.0	Het. mix of clayey silt, sand & gravel (Glacial Till)		1	SS	35										
			2	SS	98										
	Brown Grey		3	SS	41										
			4	SS	44										
	Very Stiff to Hard		5	SS	42										
			6	SS	24										
476.6			7	SS	59										
21.0			8	SS	100 1/4"										
	Silty sand & gravel.		9	SS	25										
			10	SS	105										
	Compact to Very Dense														
418.6															
79.0	End of Borehole														

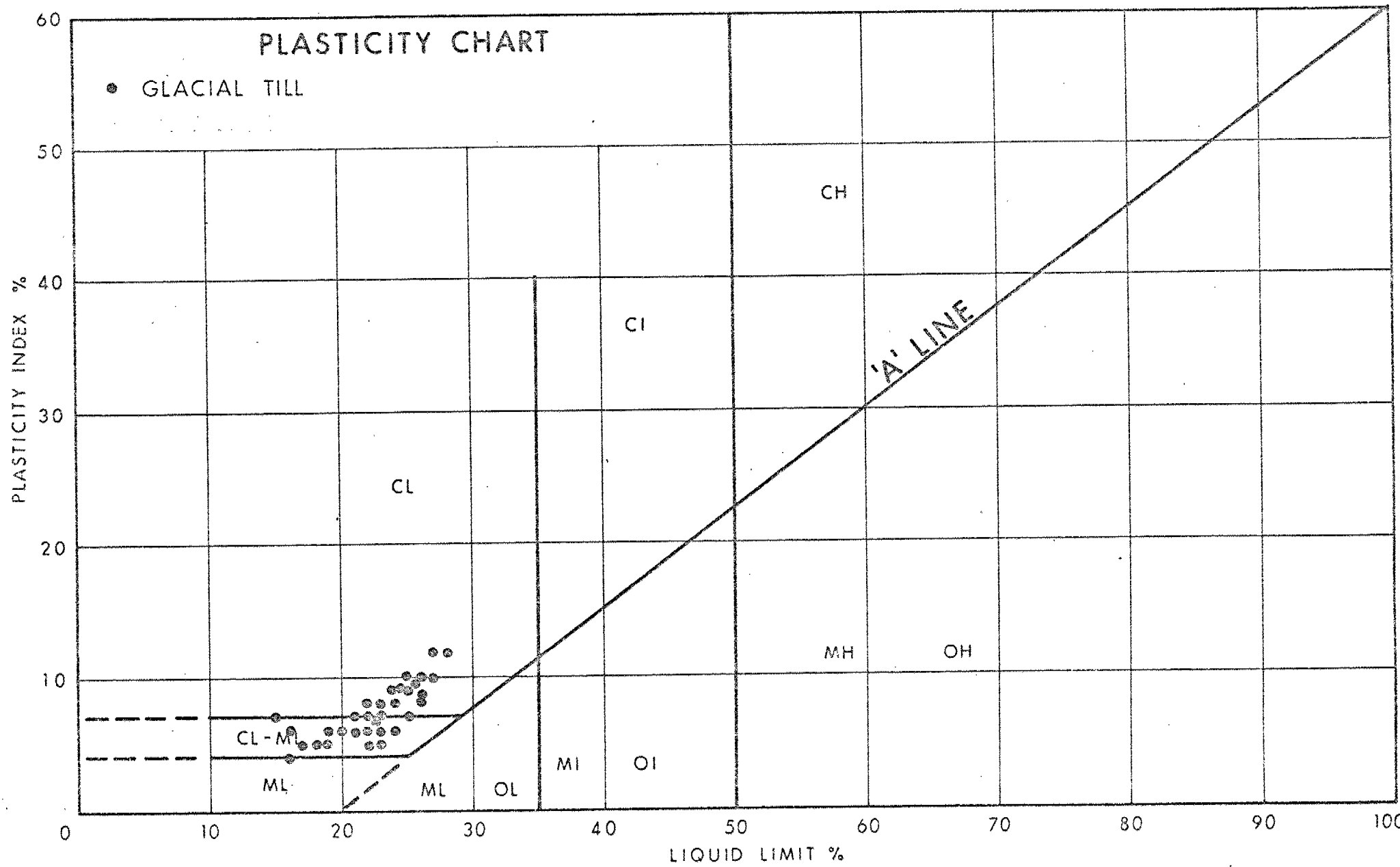
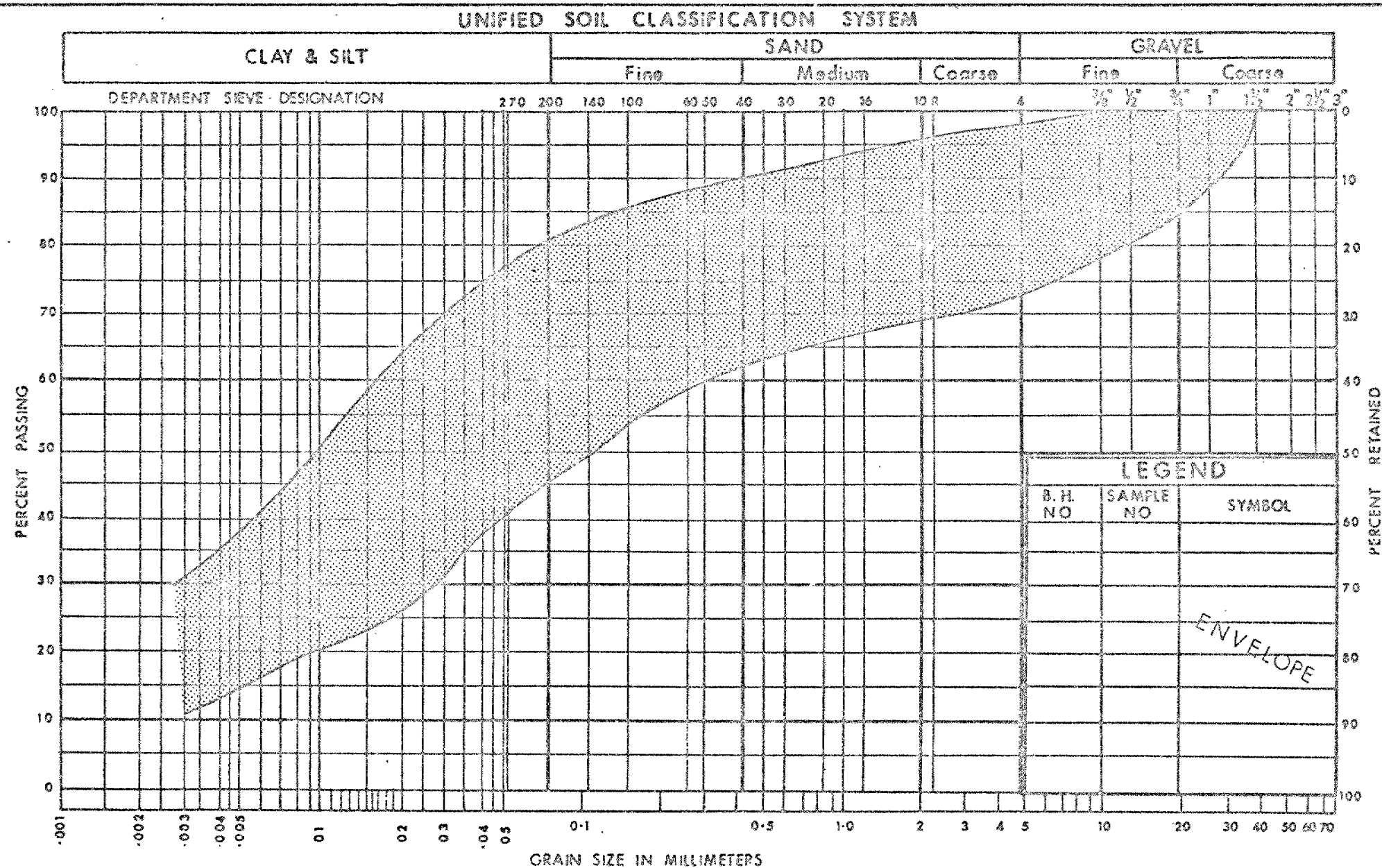


FIG.1



DESIGN SERVICES
BRANCH

GRAIN SIZE DISTRIBUTION

GLACIAL TILL

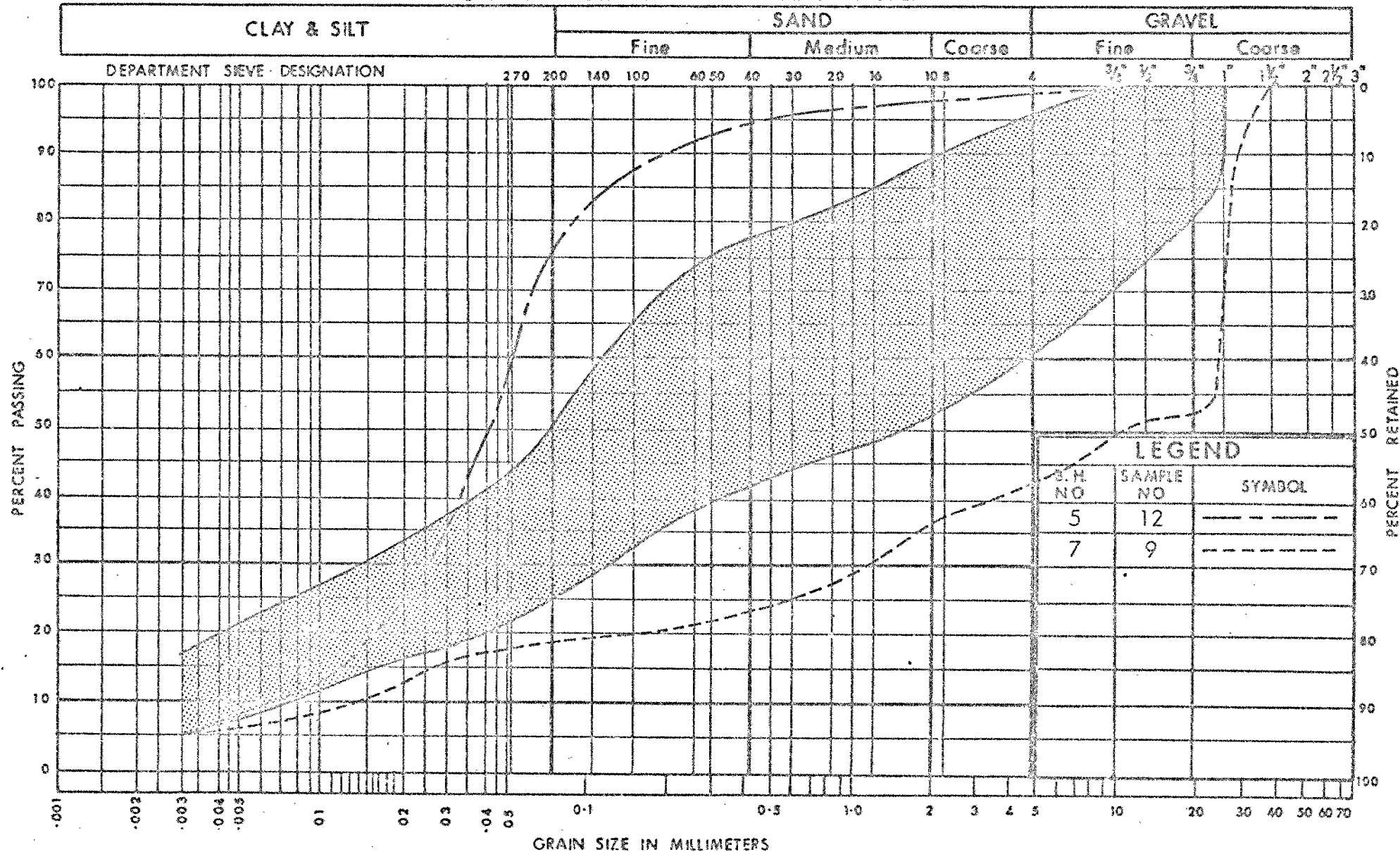
HET. MIX. OF CLAYEY SILT, SAND & GRAVEL

W.P. No. 127-66-25

JGB No. 73 - 11039

FIG. 2

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS



DESIGN SERVICES
BRANCH

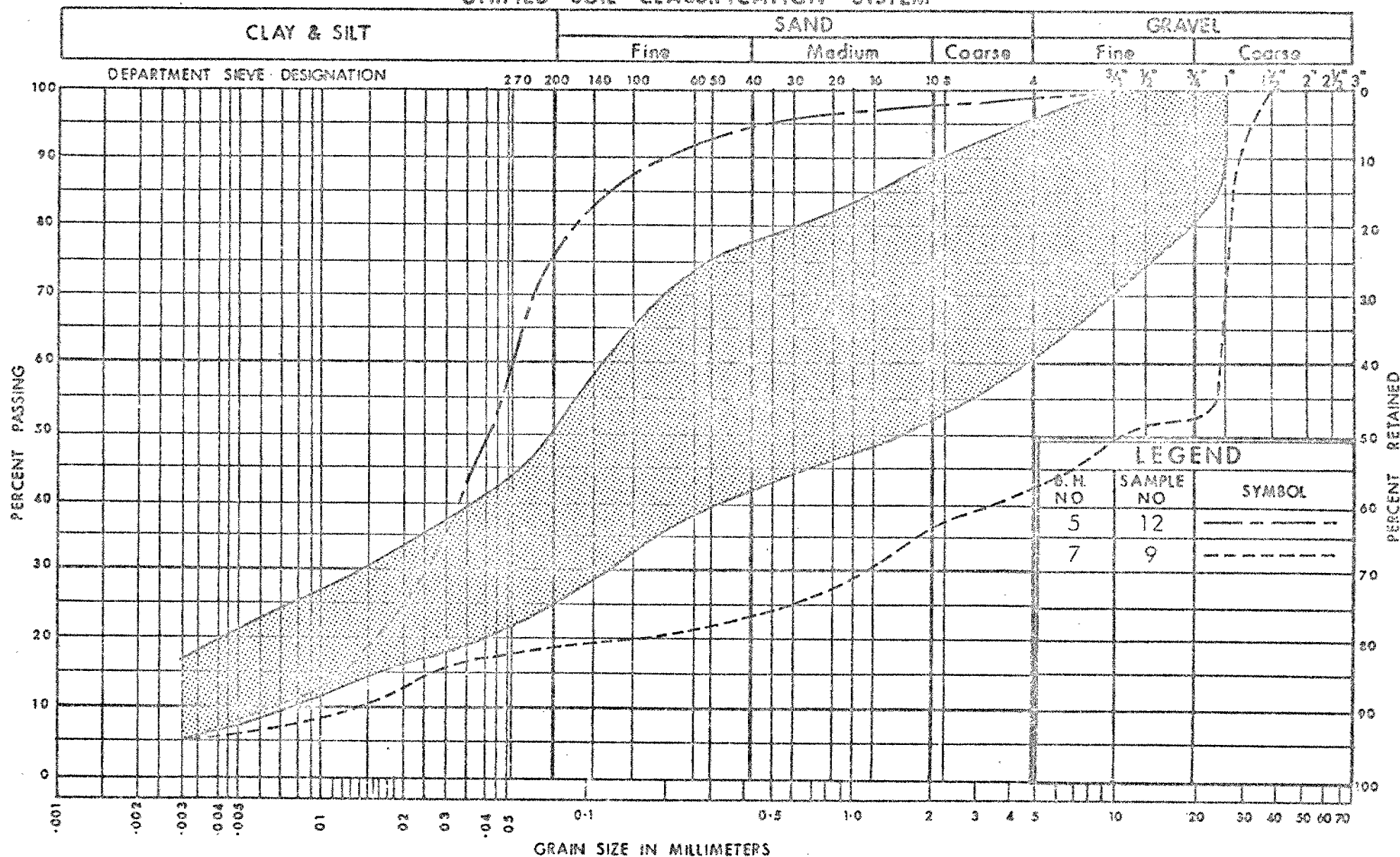
GRAIN SIZE DISTRIBUTION
SILTY SAND
SOME GRAVEL

W.P. No. 127-66-25

JOB No. 73-11039

FIG. 3

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES
BRANCH

GRAIN SIZE DISTRIBUTION

SILTY SAND

SOME GRAVEL

W.P. No. 127-66-25

JOS No. 73-11039

FIG. 3

FOUNDATION
INVESTIGATION & DESIGN
REPORT

SOIL MECHANICS SECTION

ENGINEERING SERVICES BRANCH
GEOTECHNICAL OFFICE



Ontario

Ministry of
Transportation and
Communications

FOUNDATION INVESTIGATION & DESIGN REPORT
ADDENDUM

W.P. 127-66-25

DIST. 6

HWY. 403 (410) STR. SITE 24-327

Proposed Structure at the Crossing
of (Hwy. 410) Cawthra Road S.B. and Hwy. 403

DISTRIBUTION

G.C.E. Burkhardt (3)
R.S. Pillar
C.S. Grebski
B.J. Giroux
G.A. Wrong
M.R. Ernesaks
R.D. Gunter
H. Greenland

R. Hore

J. Anderson)
R. Fitzgibbon) cover only
G. Sloan)
Files ✓

SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	17th Dec/76	M.D.
TUBES	"	"
ROCK CORES	"	"

GEOCRES

30M12-75
GEOCRES No.

DATE DEC 08 1976

INTRODUCTION

In June, 1973, this Section carried out a subsurface investigation at the above mentioned structure location. A detailed report containing all the factual information obtained, as well as recommendations pertaining to the design of foundations and related earth works, was submitted on August 31, 1973 (Report. W.O. 73-11039 and W.P. 127-66-25).

The concept of Hwy. 403 between Hwy. 401 and Hwy. 10 has been changed considerably; the most notable of the changes being a reduction in the median width and a reduction in the lane requirements. These changes necessitated a redesign of the new structure with two spans. Our initial comments were submitted to you in a memorandum dated September 22, 1976, indicating that additional boreholes will be carried out due to the sensitive nature of the subsurface conditions. This additional investigation consisting of seven sampled boreholes (B.H. #11 to 17) is completed.

This addendum presents the factual data obtained from the supplementary investigation, together with our recommendations pertaining to foundation design and the associated approach embankments.

SUBSURFACE CONDITIONS

Seven sampled boreholes (No's. 11 to 17) carried out in the recent investigation revealed that the subsoil conditions encountered in the vicinity of the revised structure location are very similar to those encountered previously. The predominant stratum at this site is composed of a heterogeneous mixture of clayey silt, sand and gravel (glacial till). In certain locations the glacial till deposit contained thin layers or seams of silt to silty sand. In the recent investigation all the boreholes were terminated in the glacial till stratum since artesian conditions were encountered in the previous investigation once the boreholes penetrated through the cohesive overburden (glacial till) into the granular deposit.

Standard Penetration testing carried out within the deposit gave 'N' values which range from 14 blows/ft. to 89 blows/ft., being typically greater than 20 blows/ft. Based on these values it is estimated that the cohesive portion of the glacial till varies from very stiff to hard. The granular layers have a relative density of compact.

GROUNDWATER CONDITIONS

The previous investigation revealed the presence of artesian condition below the cohesive glacial till stratum. However, the supplementary boreholes were terminated in the cohesive glacial till stratum at a depth of 20 feet below existing ground surface. Initially, water in the boreholes was observed at 16 feet below ground surface but stabilized at a depth of 0-2 feet below ground surface approximately 1 to 2 days after the completion of the boreholes.

Subsurface conditions of the original investigation, together with the data of the supplementary investigation are shown on revised Dwg. #1276625-A. This drawing, together with the supplementary borehole log sheets is enclosed. These should be attached to the foundation report, together with the addendum.

DISCUSSION AND RECOMMENDATIONS

The structure for the revised scheme will consist of two spans (168'-160') having a total length of 328 feet. The profile grade of Hwy. 403 in the vicinity of the structure will vary from elevation 494.5 to elevation 499.5, while that of Cawthra Road (SB) will be maximum 522.5. To reach these grades, approach embankments of up to 23 to 28 feet in height in the transverse and longitudinal directions, respectively, will be necessary.

The subsoil consists of a 21 to 28 foot thick cohesive glacial till underlain by an extensive deposit of silty sand with gravel which was found to be the primary source of artesian water at certain locations as established in the previous investigation.

Foundation for Pier And Abutments

The pier and the respective abutments should be supported on spread footings located within the parent glacial till stratum. In order to fulfill the frost requirements, the underside of the footings should be at least 4 feet below the finished grade. The recommended footing elevations are as follows:

<u>Location</u>	<u>Recommended Founding Elevation</u>	<u>Refer to B.H.s</u>
Pier	492.0	#'s 12, 13, 14 & 15
East Abutment (closed type)	493.0	#11
West Abutment (closed type)	492.0	#16 and #17

An allowable bearing pressure up to 3.0 t.s.f. may be used in designing the footings, founded as recommended. In computing the lateral resistance of the footings, an adhesion value of 2,500 p.s.f. may be used between the rough concrete surface and glacial till.

The excavations for the footings will be carried out within the cohesive glacial till. In view of the relatively impervious nature of the glacial till, no major dewatering problems are anticipated. Any groundwater seepage and/or uncontrolled surface runoff into the excavations could be handled by employing ordinary pumping methods.

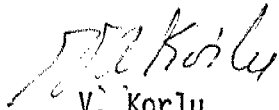
The foundation subsoil will settle due to the imposed foundation loading. The subsoil is composed of a competent cohesive glacial till, thus the settlement will be of a recompression nature. For a spread footing foundation of the size contemplated, imposing the aforementioned pressure, it is estimated that the settlement should not exceed one half of an inch, provided the subsoil is not softened by groundwater seepage or uncontrolled surface runoff. It may be advantageous to protect the cohesive glacial till, at the founding level, by covering it with a lean concrete working slab immediately after the completion of the excavation.

Approach Embankments

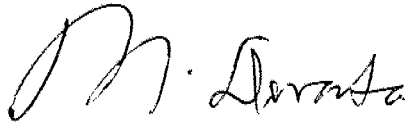
As mentioned elsewhere in this report, the maximum height of the approaches will be of the order of 28 feet. Subsoil conditions are generally favourable and consequently no deep seated rotational type of failure is anticipated provided 2:1 slopes are adopted.

The fill itself and the natural subsoil will settle. The magnitude of this combined settlement is estimated to be of the order of 2 inches. The majority portion of this settlement, which occur within the fill itself, should take place within two months following the placement and compaction of the fills.

We trust that this addendum presents all the factual data obtained for the supplementary investigation for the revised concept. This addendum should be read in conjunction with our original foundation investigation report submitted on August 31, 1973. A revised Dwg. #1276625-A, together with the additional Record of Borehole Sheets (B.H. #11 to #17) is enclosed. If we can be of any further assistance, please contact our Section.


V. Korlu
Project Engineer




M. Devata
Supervising Engineer

MD/VK/gs
November, 1976

RECORD OF BOREHOLE NO 11

WP 127-66-25 LOCATION Co-ords. N. 848,597 ; E. 964,945 ORIGINATED BY VK
 DIST 6 HWY 403 BORING DATE November 8, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE 3 1/2" Hollow Stem Augers & Cone Test CHECKED BY *etf.*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_p WATER CONTENT w W_p — w — W_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100			
496.5	Ground Level													
0.0			1	SS	27									
			2	SS	63									
			3	SS	45									
			4	SS	36									
			5	SS	23									
477.0			6	SS	26									
19.5	End of Borehole													

Brown
 Grey
 Het. mix. of clayey
 silt, sand & gravel
 (Glacial Till)
 Very Stiff to Hard

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 12

WP 127-66-25 LOCATION Co-ords. N. 848,684 E. 964,790 ORIGINATED BY VK
 DIST 6 HWY 403 BORING DATE November 9, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE 3 1/2" Hollow Stem Augers & Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100		
497.7	Ground Level												
0.0			1	SS	39								4 23 55 18
			2	SS	43								23 29 46 6
	Brown		3	SS	61								
	Grey		4	SS	32								
	Het.mix.of clayey		5	SS	22								
	sand and gravel		6	SS	23								
	(Glacial Till)		7	SS	24								7 36 47 10
478.7	Very Stiff to Hard												
19.0	End of Borehole												

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 13

WP 127-66-25 LOCATION Co-ords. N. 848,698 E. 964,837 ORIGINATED BY VK
DIST 6 HWY 403 BORING DATE November 8, 1976 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE 3 1/2" Hollow Stem Augers & Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100			
497.8	Ground Level													
0.0			1	SS	27									5 23 51 21
			2	SS	37	490								18 26 39 17
			3	SS	53									
			4	SS	42									
			5	SS	47									9 31 43 17
478.3	Very Stiff to Hard		6	SS	60	480								
19.5	End of Borehole													

20
15 \diamond 5 % STRAIN AT FAILURE
10

RECORD OF BOREHOLE NO 14

WP 127-66-25

LOCATION Co-ords. N. 848,668 E. 964,819

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE November 9, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE 3 1/4" Hollow Stem Augers

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
497.3	Ground Level									
0.0			1	SS	33					1 23 58 18
			2	SS	32					
	Brown		3	SS	49					8 30 46 16
	Grey		4	SS	18					
	Het. mix. of clayey silt, sand & gravel (Glacial Till)		5	SS	18					
			6	SS	14					10 29 46 15
478.3	Stiff to Hard		7	SS	22					
19.0	End of Borehole									

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 15

WP 127-66-25 LOCATION Co-ords. N. 848,713 E. 964,808 ORIGINATED BY VK
DIST 6 HWY 403 BORING DATE November 9, 1976 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE 3 1/2" Hollow Stem Augers & Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w w_p — w — w_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100			
497.6	Ground Level													
0.0	Het. mix. of clayey silt, sand & gravel (Glacial Till)		1	SS	29									3 26 51 20
	— — Brown		2	SS	31									22 19 45 14
	— — Grey		3	SS	64									5 28 53 14
	with thin layers or pockets of silty sand		4	SS	14									
478.1	Stiff to Hard		5	SS	11									
19.5	End of Borehole		6	SS	21									

20
15 5 % STRAIN AT FAILURE
10

RECORD OF BOREHOLE NO 16

WP 127-66-25

LOCATION Co-ords. N. 848,756 E. 964,655

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE November 10, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE 3 1/2" Hollow Stem Augers & Cone Test

CHECKED BY *[Signature]*

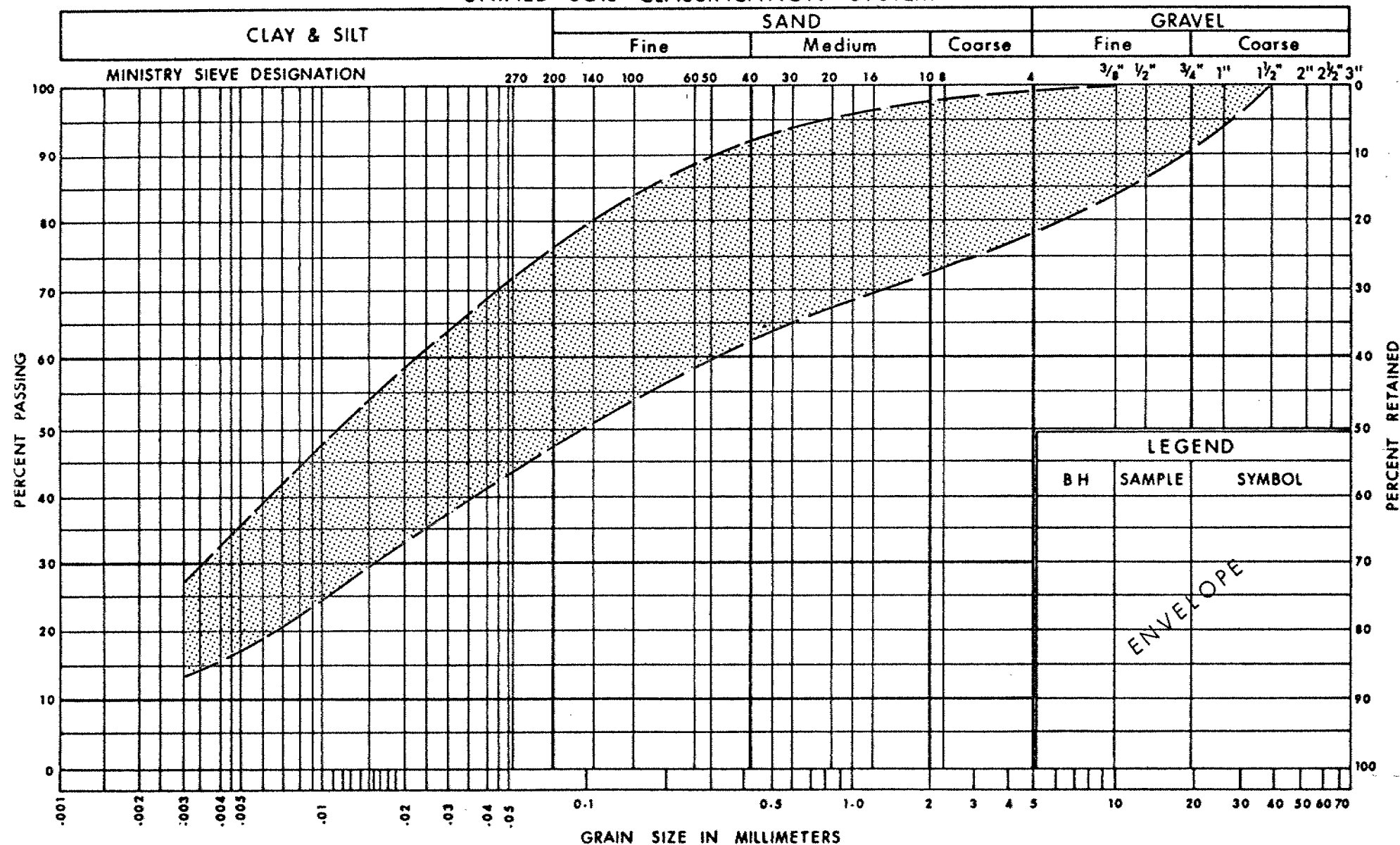
SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L	UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
495.4	Ground Level									
0.0										
			1	SS	25					6 24 53 17
			2	SS	70					8 24 48 20
			3	SS	39					7 24 55 14
			4	SS	28					
			5	SS	23					
			6	SS	19					
476.4	Very Stiff to Hard		7	SS	19					
19.0	End of Borehole									

RECORD OF BOREHOLE NO 17

WP 127-66-25 LOCATION Co-ords. N. 848,797 E. 964,680 ORIGINATED BY VK
 DIST 6 HWY 403 BORING DATE November 10, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE 3 1/2" Hollow Stem Augers & Cone Test CHECKED BY VJ

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
495.9	Ground Level									
0.0										
	Brown Grey Het. mix. of clayey silt, sand & gravel (Glacial Till)		1	SS	26	490				7 23 55 15
			2	SS	89					9 28 50 13
			3	SS	46					8 30 50 12
			4	SS	28					
			5	SS	44					
			6	SS	30	480				
476.9	Very Stiff to Hard		7	SS	47					
19.0	End of Borehole									

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION GLACIAL TILL

HET. MIXTURE OF CLAYEY SILT, SAND & GRAVEL

FIG No	1
W P	127-66-25

W P 127 - 66 - 25

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
WS	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 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 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
$\log_e a$ 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

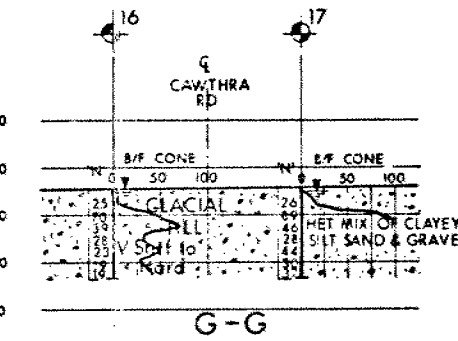
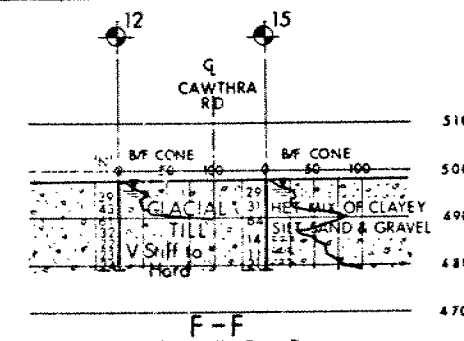
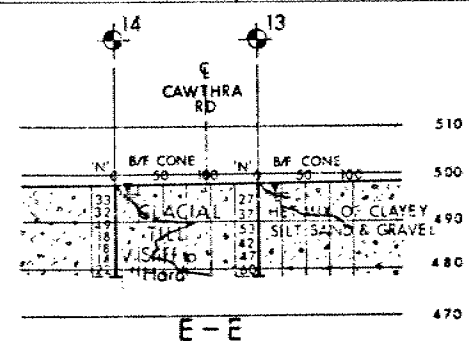
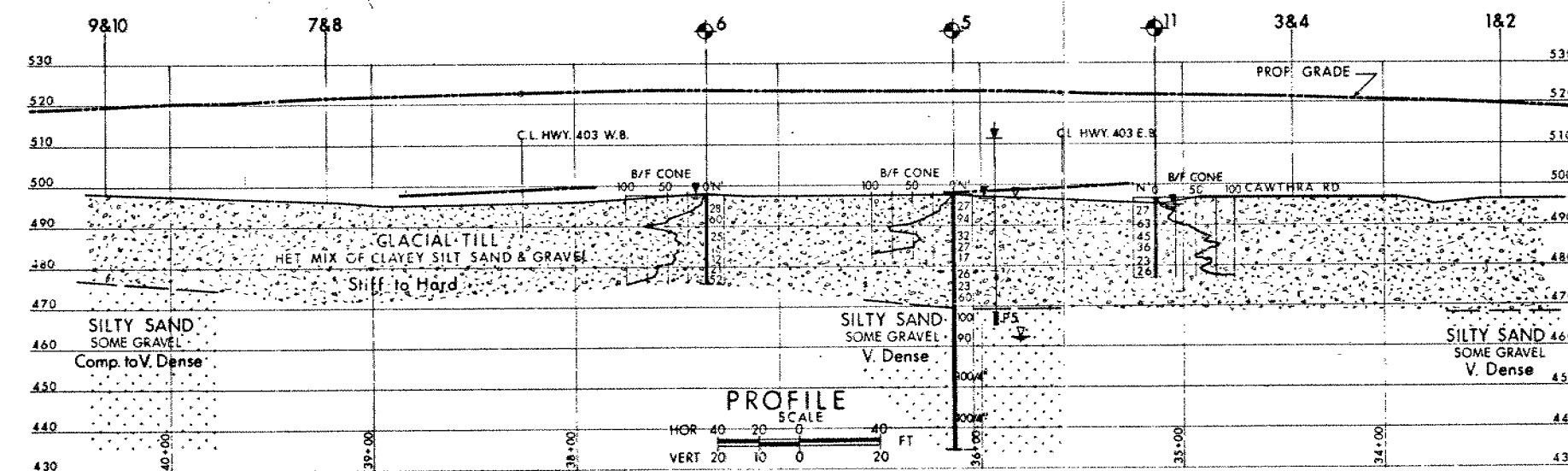
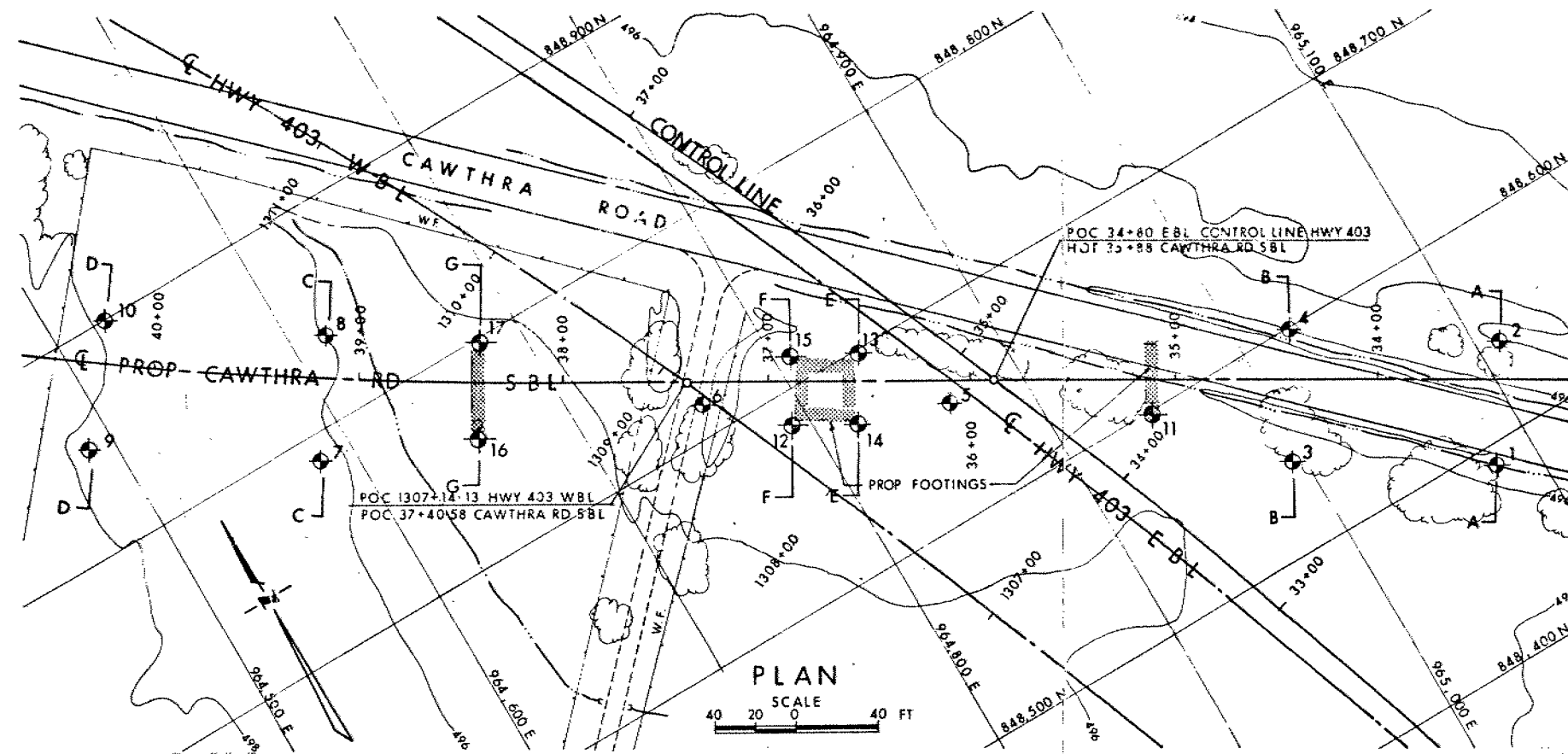
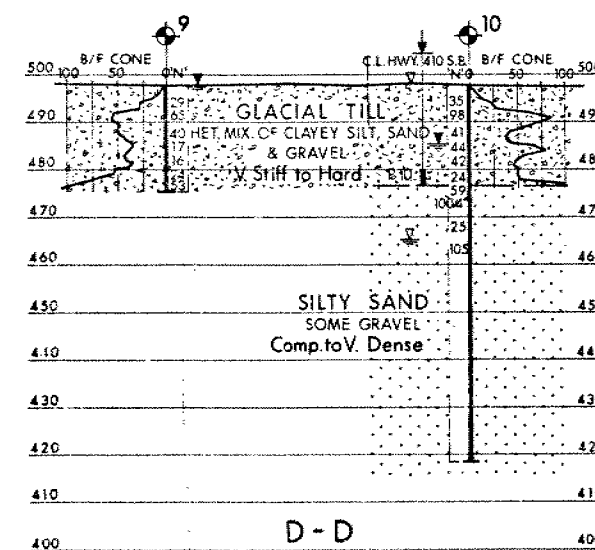
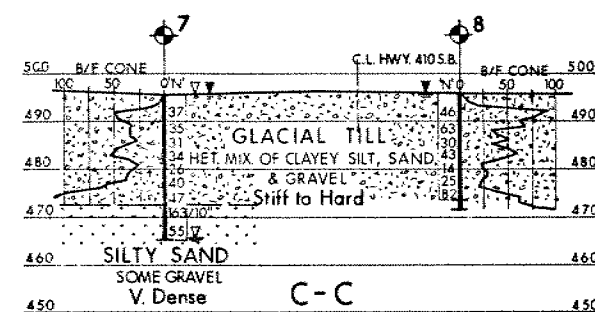
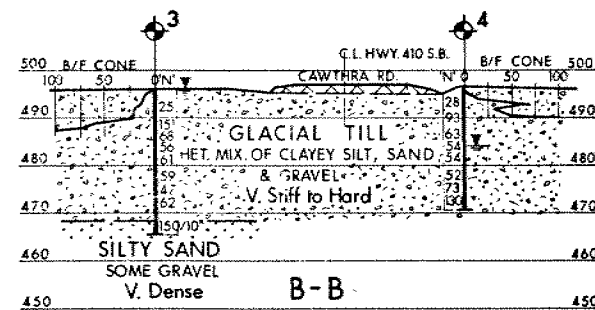
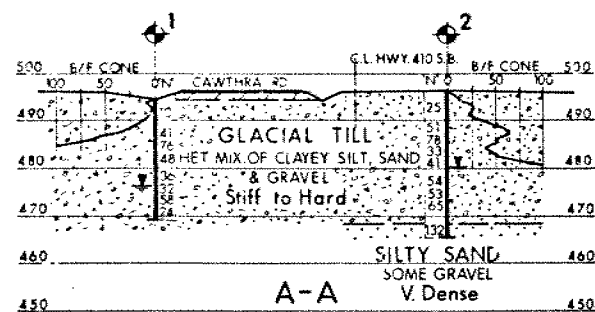
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

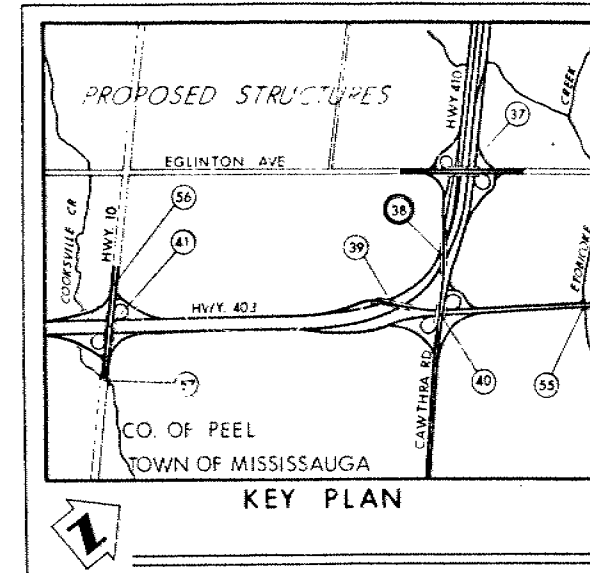
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

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



-NOTE-
The boundaries between soil strata have been established only at bore hole locations. Between bore holes the boundaries are assumed from geological evidence.



LEGEND			
	Bore Hole		
	Cone Penetration Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation, June 1973.		
	Piezometers		
	Head Artesian Water Level		
	Encountered		
NO.	ELEVATION	CO - ORDINATES	
		NORTH	EAST
1	494.5	848,490	965,080
2	496.2	848,542	965,112
3	496.0	848,543	964,994
4	496.4	848,599	965,026
5	497.5	848,655	964,864
6	498.0	848,716	964,759
7	495.7	848,788	964,583
8	495.8	848,839	964,617
9	497.7	848,850	964,488
10	497.6	848,901	964,527
11	496.5	848,597	964,945
12	497.7	848,684	964,790
13	497.8	848,698	964,837
14	497.3	848,668	964,819
15	497.6	848,713	964,808
16	495.4	848,756	964,655
17	495.9	848,797	964,680

REVISIONS	DATE	BY	DESCRIPTION
19 11 76			BORE HOLES 11-17 & SECTIONS E-E F-F G-G ADDED

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

BPIDGE No. 38
(CAWTHRA ROAD S.B.)

HIGHWAY NO. 403 DIST. NO. 6
CO. PEEL
TOWN OF MISSISSAUGA LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD V.K. [CHECKED] W.P. NO. 127-65-23
DRAWN S.R. [CHECKED] W.D. NO. 73-11239
DATE AUGUST 7, 1973 SITE NO.
APPROVED [Signature] CONT NO.

1276625-A
BRIDGE DRAWING NO.

Mr. G.C.E. Burkhardt
Head, Structural Section
Central Region
3501 Dufferin St., Downsview

Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building

79 04 05

Re: Backfill Behind Abutments
Use of Vibratory Equipment 127-66-12/25

Further to your memorandum dated 79 03 27 we suggest the following recommendations for the three structures which you have indicated.

In general, the use of vibratory equipment for the compaction of granular backfill behind the abutments and retaining structures should be as outlined in the enclosed draft operational constraint. This restriction may be included as a 'Special Provision to Contractors' under the appropriate item of the D-4.

Artesian conditions do exist at the Hwy. 403 Eglinton Avenue Structure Site 24-319 and Cawthra Road, Site No. 24-327. It should be noted that the artesian zone is overlain by a 12 foot thick layer of competent cohesive material immediately beneath footing formation level. In view of this we do not foresee any problems with regard to compaction of granular backfill material provided similar operative constraints are employed.

If you need any further clarification, please contact us.

Original Signed by
M. DEVATA

M. Devata
Supervising Engineer

MD/gs

cc: D. MacDonald
C.S. Grebski
Files ✓

memorandum



To: Mr. M.S. Devata,
Supervising Engineer,
Soil Mechanics Section,
Central Building, Downsview.

Date: 1979-03-27

RE: Backfill Behind Abutments,
Use of Vibratory Equipment

I would appreciate it very much, if you could give me your recommendations for the new procedures of the use of vibratory equipment near abutments for several structures, as discussed with you by phone. The structures in question are:

- 127-66-12/25
- (a) Highway 403, Eglinton Ave. Structure Site No. 24-319 and Cawthra Road, Site No. 24-327.

We have artesian conditions in this area. At the present time the contract documents call for no vibratory equipment to be used near the abutments at all. We believe this will create problems, and recommend to use hand operated equipment. Your comments please.

- (b) Ford Drive Interchange at Q.E.W. and Hwy. 403.

At the now prepared contract, we have several rigid frames and one 3-cell-concrete-culvert, where we again need clear recommendations for the use of hand operated equipment.

- (c) All other contracts with bridges and retaining walls.

We would appreciate it very much, if you could tell us when the new general specifications are published. In the meantime could we receive a copy of the draft specifications?

I would appreciate it very much, if you could forward your comments to me as soon as possible.

GCEB:gj


G.C.E. Burkhardt,
Head, Structural Section.



OPERATIONAL CONSTRAINT

General

The contractor shall not be permitted to use other than hand operated vibratory type compaction equipment within the restricted zone behind all abutments, wingwalls and retaining walls for compaction of fill material.

Restricted Zone

- (a) The area within a plane extending from the junction of the back face of the wall and the footing proceeding upwards at a slope of 1.5 vertical to 1 horizontal.
- (b) The area within 4 feet from the back face of the wingwall.

Hand Operated Vibratory Equipment

Hand operated vibrating equipment shall have a force per second output no greater than that of the Bomag BW 75.

Compaction

The fill material shall be compacted to a minimum of 90% and a maximum of 95% of the maximum dry density as determined by current Ministry practice in Form 501.

Mr. G.C. Burkhardt
Regional Structural Planning Engineer
Central Region
3501 Dufferin Street, Downsview

Soil Mechanics Section
Geotechnical Office
West Building, Downsview

May 27, 1976

W.P. 127-66-12, Br. #37
Eglinton Underpass, Hwy. 403
W.P. 127-66-25, Br. #38
Ramp SB to Cawthra Road, Hwy. 403
Central Region, District #6

This is to provide you with our comments on preloading of the approach fills of Br. #37 & Br. #38 and founding elevation of the centre pier footing of Br. #38. This information was requested in a progress meeting held on May 18, 1976.

1. Preloading is required if the abutment footings are perched within the approach fills. This is because of settlements within the fill. A preloading period of two months is considered sufficient.
2. It is recommended that the centre pier footing be founded at elev. 490 with a design capacity of 3 tsf.

B. Ly
B. Ly
Project Engineer

For: M. Devata
Supervising Engineer

cc: N. Sen
W. Lin
Files ✓
Record Services

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

Soil Mechanics Section,
Geotechnical Office,
West Building, Downsview.

July 31st, 1974.

RE: Proposed Structure at the Crossing of Hwy. #410
S.B.L. and Hwy. #403 (Bridge #38), District #6,
Town of Mississauga, County of Peel,
W.P. 127-66-25, Site 24-327, W.O. 73-11039.

As requested we have reviewed the proposed footing elevations for the abovementioned structure and submit the following comments:

1. Pier No. 1 can be located at the elevation shown on your drawing (elev. 485.0) with an allowable bearing pressure of 3.5 t.s.f.
2. For Pier No. 2 we have recommended a minimum founding elevation 489.0 in our memo dated November 1st, 1973. However, the recent preliminary structural drawing indicates an elev. 484.0. At this elev. the subsoil conditions are not favourable and in view of this we can only suggest a safe allowable bearing pressure of 1.5 t.s.f. If higher loads are required the footing should be located at a higher elevation as recommended previously.
3. The preliminary structural drawing indicates an elev. 485.5 for Pier No. 3. It should be noted that in this area a high artesian head prevails. Consequently, this footing must be located not lower than elev. 489.0.
4. Pier No. 4 can be founded as per the recent preliminary structural drawing at elev. 483.0 with an allowable bearing pressure of 2.5 t.s.f. If 3 t.s.f. is required for the footing design at this location, the pier footing should be located at elev. 488.0.

- 2 - July 31st, 1974.

Mr. C.G.E. Burkhardt - RE: W.P. 127-66-25.

We believe the foregoing comments will be adequate for your design requirements. Should you have further queries please contact our Office.

V. Korlu,
Project Engineer,
For: M. Devata,
Supervising Engineer.

VK/mj

c.c. B.R. Davis
R.S. Pillar
H. Greenland
B.J. Giroux
D. Gunther
G.A. Wrong
C.C. Parker Ltd. (attn: Mr. R. Lewis)

Files
Documents

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. G.C.E. Burkhardt, (2) FROM: Foundations Office,
Regional Structural Planning Eng., Design Services Branch,
Central Region, West Bldg., Downsview.
3501 Dufferin St., Downsview.

ATTENTION: Mr. D. H. Bye, DATE: November 1, 1973.
Structural Planning Supervisor.

OUR FILE REF. IN REPLY TO

SUBJECT: Proposed Structure at the Crossing of Hwy. #410
S.B.L. and Hwy. #403 (Bridge #38), District #6,
Town of Mississauga, County of Peel
W.P. 127-66-25, Site 24-327, W.O. 73-11039

Further to your memo of October 17, 1973, with regard to lowering the grades of Hwy. #403 and Hwy. #410 S.B.L. in the vicinity of Structure #38 area, we have reviewed all the available data and submit the following comments:

- 1) Recommendations regarding the abutment foundations as given in our foundation report W.O. 73-11039 will be still applicable.
- 2) The revised founding elevations for the piers taking into consideration of the new grades are as follows:

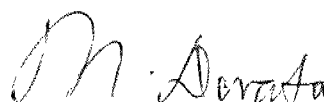
Location	Station	Refer to B.H.'s	Recommended Minimum Founding Elev.	Allowable Bearing Pressure
Pier #1	34 + 50	#3 & #4	491.0	3.5 t.s.f.
Pier #2	36 + 14	#5	489.0	2.5 t.s.f.
Pier #3	37 + 35	#6	491.5	2.5 t.s.f.
Pier #4	39 + 20	#7 & #8	488.0	3.0 t.s.f.

In order to comply with the frost protection requirements for Pier #2 and #3, it is necessary to adopt raised median section rather than a depressed (ditch type) median in the vicinity of the structure between E.B. lanes and W.B. lanes of Hwy. 403. Other comments contained in our foundation report W.O. 73-11039 are still applicable.

Due to the prevailing artesian conditions in the subsoil of this area certain construction measures are required to ensure the integrity of the pier foundations.

- 1) Excavations for the pier foundations should be carried out in a relatively short period of time to minimize dewatering of the excavations and further possible softening of the foundation material due to seepage or surface runoff water into the excavations. If footing excavations have to be exposed for a considerable period of time, a working concrete slab should be poured as the excavations are completed.
- 2) Backfilling of the four excavations to the final finish grade should be completed without any undue delay.

Should you have any further queries regarding this project, please feel free to contact our Office.



M. Devata,

SUPERVISING FOUNDATIONS ENGINEER.

MD/ao

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
C.C. Parker Ltd. (Attn: R. Lewis)

Foundations Files
Documents