

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M12-235

DIST. 6 REGION

W.P. No. 659-93-01

CONT. No. 96-12

W. O. No.

STR. SITE No. 37-0984

HWY. No. 427

LOCATION CNR Overhead

NBL & SBL

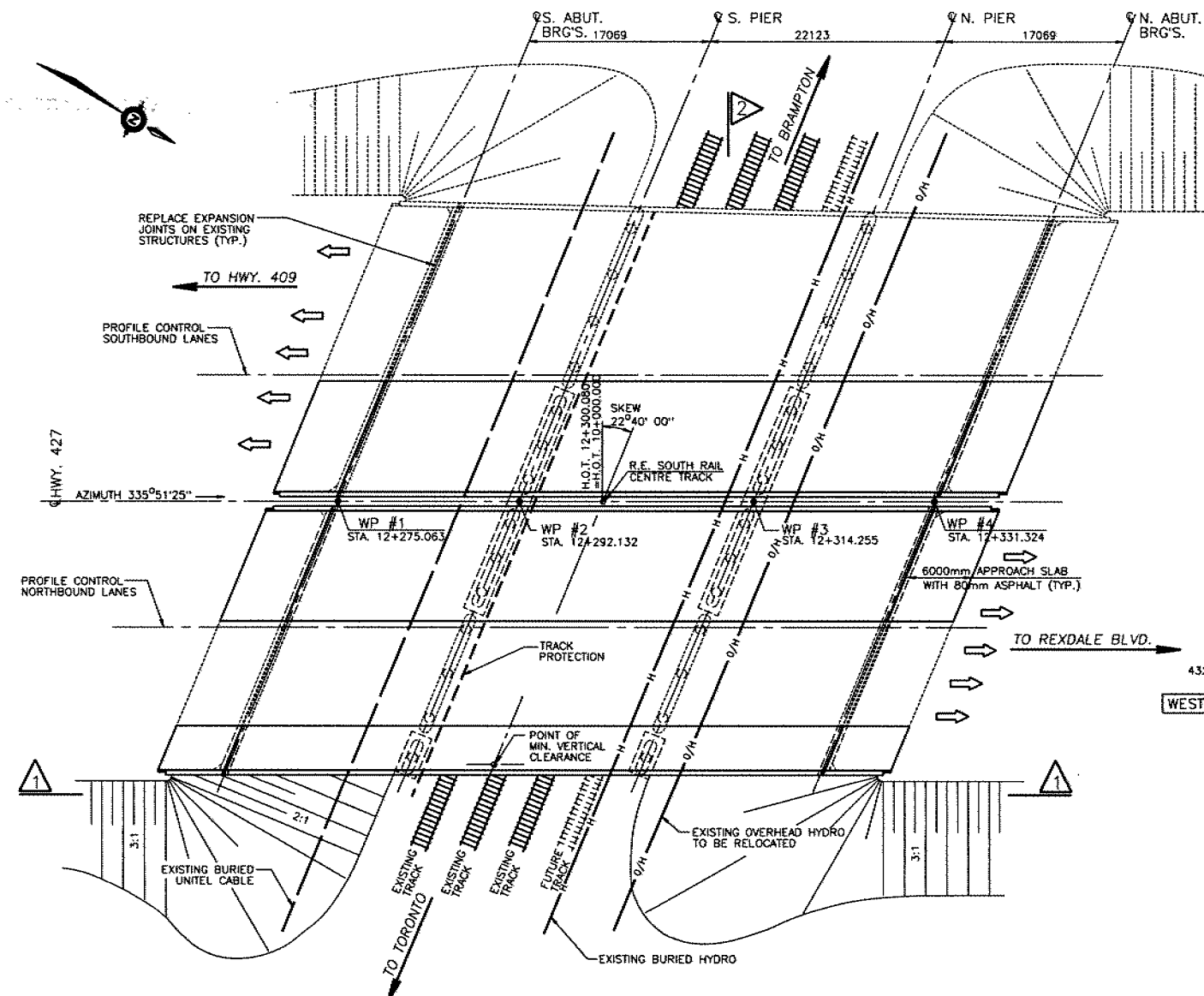
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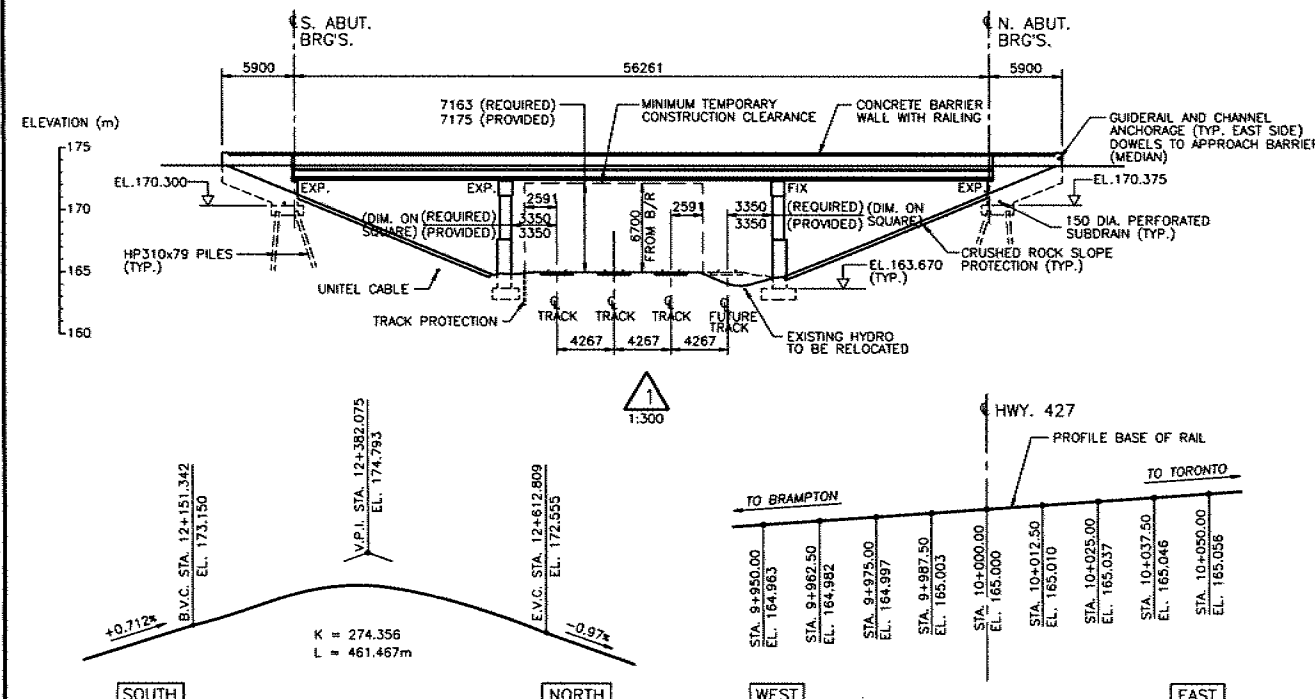
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

SKK Rev. by John Goodwin - MR1: .../home/.../john/.../2022-1.dwg DATE: 11/29/94 09:27:36



PLAN
1:300



PROFILE OF HIGHWAY 427
N.T.S.

PROFILE OF C.N.R.
N.T.S.

GENERAL NOTES:

- CLASS OF CONCRETE**
ALL CONCRETE UNLESS OTHERWISE NOTED 30 MPa
- CLEAR COVER TO REINFORCING STEEL**
FOOTINGS 100 ± 25
ABUTMENTS AND WINGWALLS 70 ± 20
DECK
TOP 70 ± 20
BOTTOM 40 ± 10
REMAINDER UNLESS OTHERWISE NOTED 70 ± 20
- REINFORCING STEEL**
REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX "C" DENOTE COATED BARS.
- CONSTRUCTION NOTES**
THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESSES FROM THE TOP OF BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESSES ARE DIFFERENT FROM THOSE GIVEN WITH THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE REINFORCING STEEL TO SUIT.
DOWELS TO BE SET IN 250mm DEEP HOLES AND GROUTED WITH EPOXY RESIN GROUT. DIAMETER OF HOLES TO BE AS PER MANUFACTURER'S RECOMMENDATIONS.
THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND ELEVATIONS OF THE EXISTING WORK AND ALL DETAILS ON SITE AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
UNLESS OTHERWISE SHOWN, SAWCUTS SHALL BE 25mm DEEP OR TO THE FIRST LAYER OF REINFORCING STEEL, WHICHEVER IS LESS.

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

DRAWING LIST

- GENERAL ARRANGEMENT
- TRAFFIC STAGING & REMOVALS
- TRACK PROTECTION
- FOOTING LAYOUT
- FOOTING REINFORCEMENT
- SOUTH ABUTMENT
- NORTH ABUTMENT
- WINGWALLS
- PIERS - NORTHBOUND STRUCTURE
- PIERS - SOUTHBOUND STRUCTURE
- PRESTRESSED GIRDERS & BEARINGS
- DECK LAYOUT AND SCREED ELEVATIONS
- DECK REINFORCEMENT
- EXPANSION JOINT DETAILS - EXIST. STRUCT.
- JOINT ANCHORAGE AND ARMOURING
- BARRIER WALL WITH RAILING
- RAILING FOR BARRIER WALL
- 6000mm APPROACH SLAB
- STANDARD DETAILS
- ELECTRICAL EMBEDDED WORK
- QUANTITIES
- QUANTITIES

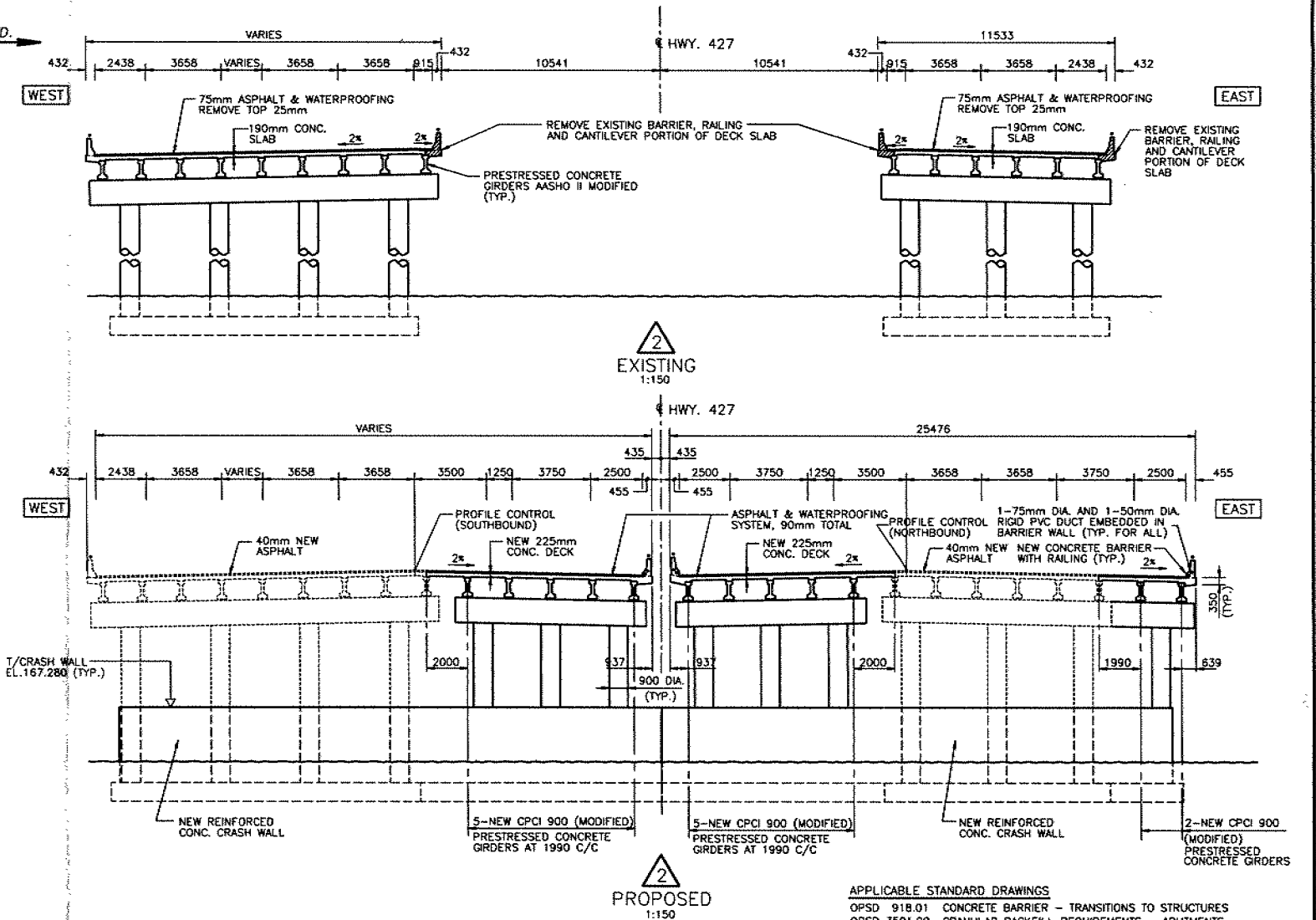
DIST 6
CONT No
WP No 659-93-01

HIGHWAY 427 WIDENING
C.N.R. OVERHEAD

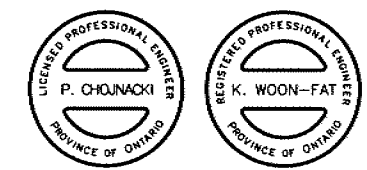
GENERAL ARRANGEMENT

McCORMICK RANKIN
CONSULTING ENGINEERS

SHEET



PROPOSED
1:150



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

APPLICABLE STANDARD DRAWINGS				
OPSD 918.01	CONCRETE BARRIER - TRANSITIONS TO STRUCTURES			
OPSD 3501.00	GRANULAR BACKFILL REQUIREMENTS - ABUTMENTS			
OPSD 4010.00	GUIDE RAIL AND CHANNEL ANCHORAGE			
REVISIONS				
NO.	DESCRIPTION	DATE	BY	CHK
1	DESIGN KWF	CHK PC	CODE OHBDC 1991	DATE NOV. 1994
2	DRAWN JPN	CHK RSS	SITE 37-984	STRUCT SCHEME DWG 1

CONT No
WP No 659-93-01

HIGHWAY 427 WIDENING
C.N.R. OVERHEAD

FOOTING LAYOUT

MCCORMICK RANKIN
CONSULTING ENGINEERS



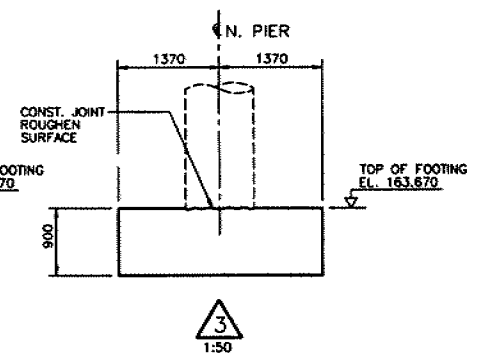
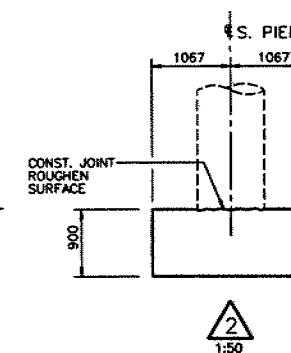
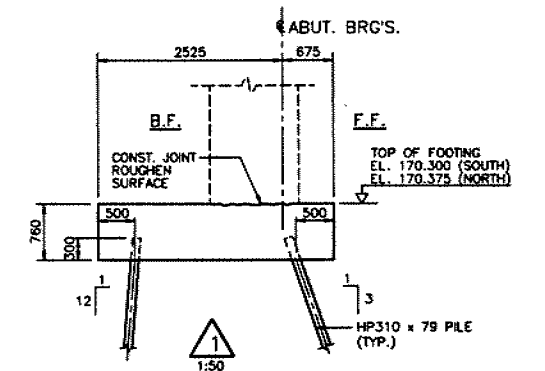
SHEET

NOTES :

1. LEGEND

--- DENOTES BATTERED PILES
F.F. FRONT FACE
B.F. BACK FACE

- PILES TO BE DRIVEN TO REFUSAL AND CONTROLLED BY THE HILEY FORMULA IN ACCORDANCE WITH STANDARD SS103-10 OR SS103-11 ASSUMING CAPACITY OF 2670 kN.
- PILE SPACING IS MEASURED AT THE UNDERSIDE OF FOOTINGS.
- PILE LENGTHS SHOWN ARE THE THEORETICAL LENGTH BELOW CUT-OFF.
- PILES SHALL BE EQUIPPED WITH DRIVING SHOES.
- PILES SHALL BE DRIVEN IN HOLES PRE-DRILLED TO A DEPTH OF 3.0m BELOW UNDERSIDE ELEVATION OF EXISTING PILE CAP AND BACK-FILLED WITH GRANULAR MATERIAL UPON COMPLETION OF PILE DRIVING.



PILE DESIGN DATA

CAPACITY AT SLS COMBINATION 1 890 kN
FACTORED CAPACITY AT ULS 1150 kN

PLAN
1:100

PILE DATA					
LOCATION	BATTER	QUANTITY	LENGTH #	CUT-OFF ELEVATION	MIN. PILE PENETRATION #
SOUTH ABUTMENT	1:12	10	26.0m	169.840	143.8
	1:3	10	27.4m		
NORTH ABUTMENT	1:12	10	30.3m	169.915	139.6
	1:3	10	31.9m		

(*) APPROXIMATE

WORKING POINT DATA

	STATION	NORTHING	EASTING
WP #1	12+275.063	4 840 363.153	295 731.733
WP #2	12+292.132	4 840 378.728	295 724.751
WP #3	12+314.255	4 840 398.917	295 715.703
WP #4	12+331.324	4 840 414.492	295 708.721



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

APPLICABLE STANDARD DRAWINGS

OPSD 3301.00 SPLICE AND DRIVING SHOE DETAILS FOR STEEL H-PILES

REVISIONS	DESCRIPTION	DATE
DESIGN KWF CHK PC	CODE OHBDC 1991	DATE NOV. 1994
DRAWN NSP CHK PC	SITE 37-984 STRUCT	SCHEME DWG 4

Foundation Investigation Report
for
Highway 427 Widening
CNR Overhead NBL and SBL
W.P. 659-93-01, Site 37-0984
Central Region
CONT 96-12

The following report is a copy of the factual information from the Foundation Investigation and Design Report for WP 213-65-00, Contract 78-111. The foundation investigation report was prepared for the existing structures by MTO Foundations Unit and represents the subsurface conditions for the proposed widening of the existing CNR Overhead structures at Highway 427.

Imperial units of measure are used in the report and on the Record of Borehole sheets. The original ground elevations shown on the borehole logs may differ from present day elevations as a result of the construction of the existing structures.

This report contains the detailed subsurface conditions, the Record of Borehole sheets, and the location of the borings in plan.



D. Dundas

D. Dundas, P.Eng.
Sr. Foundation Engineer

FOUNDATION INVESTIGATION REPORT

For

Twin Overhead Structures at the Crossings
of the N.B. and S.B. Lanes of Hwy. #427

With the C.N.R.

Borough of Etobicoke, County of York

District No. 6 (Toronto)

W.O. 72-11022

-

W.P. 213-65

1. INTRODUCTION:

The Foundations Office was requested to carry out a subsurface investigation for the twin three span structures to be constructed at the crossings of the proposed N.B. and S.B. lanes of Hwy. 427 with the C.N.R., in the Borough of Etobicoke, County of York. The request was contained in a memo from the Bridge Office (Mr. G.C.E. Burkhardt, Regional Structural Planning Engineer, Central Region) dated January 31, 1972. Subsequently, an investigation was carried out by this Office to determine the subsoil, bedrock and groundwater conditions at the site.

The factual data obtained from this investigation, together with our recommendations for the design of the structure foundations as well as the stability considerations associated with the approach fills, are presented in this report.

2. DESCRIPTION OF SITE AND GEOLOGY:

The site is located immediately to the east of Indian Line Road, approximately 1-1/4 miles south of Rexdale Blvd., in the Borough of Etobicoke. The area has been developed for commercial purposes; numerous industrial buildings are present. The terrain is flat to gently undulating in relief between elevations 540 and 550. A single line C.N.R. track traverses across the

site; the track is located in a cut section which extends some 5 to 6 feet below the surrounding ground level.

The site is located in the physiographic region known as the "Peel Plain." The characteristic deposit in this region is a ground moraine laid down during the Wisconsin Glacial Age. In the vicinity of the area under investigation the moraine is primarily composed of a cohesive glacial till whose thickness generally ranged from 70 to 85 feet. Interglacial deposits of granular material are frequently found interbedded within the glacial till. The overburden is underlain by grey shale bedrock of the Meaford-Dundas formation, Ordovician Period.

3. FIELD AND LABORATORY WORK:

Ten boreholes, all of which were accompanied by a dynamic cone penetration test were put down during the field investigation phase. The boreholes and the cone penetration tests were advanced by means of a continuous flight auger machine (C.M.E.) adopted for soil sampling purposes.

At required depths samples were obtained by means of a 2" O.D. split-spoon sampler. The method of driving the split-spoon conformed to the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. Bedrock was proven at four of the boring locations by obtaining BX size rock core samples. The groundwater level conditions across the site, during the period of the investigation, were determined by recording the water levels in the open boreholes.

During sampling and drilling operations, detailed logs of the borings were made. These logs contain a record of the drilling and sampling techniques used, together with the soil types and bedrock encountered. The location and elevation of all the boreholes are shown on Drawing No. W.O. 72-11022A, together with a number of estimated stratigraphical sections across the site. Surveying at the site was carried out by personnel from the Central Region Engineering Survey Section. The elevations given in this

report are referenced to a Geodetic datum.

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

Natural Moisture Content

Atterberg Limits

Grain-Size Distribution

The results of these tests are plotted on the Record of Borehole sheets as well as Figures 1, 2 and 3, all of which are located in Appendix I of this report.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The predominant stratum across the site is a stiff to hard cohesive glacial till, the base of which extends anywhere from 48 to 84 feet below existing ground surface. Over the major portion of the site a compact to very dense silty sand to sandy silt deposit is interbedded within the glacial till. The thickness of the granular deposit varies from 4 to 34 feet. The overburden is underlain by sound shale bedrock.

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. 72-11022A, have been inferred from this data. From ground surface downward, the soil types and bedrock encountered are as follows:

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

The thin (1 to 1.5 feet thick) topsoil cover is underlain by a glacial till stratum which is composed of a heterogeneous mixture of clayey silt with sand and gravel. The base of this stratum extends anywhere from 48 feet (B.H. #6) to 84 feet (B.H. #9)

existing ground surface. The upper 11 to 14 feet of the till is brown in colour which indicates that this zone has been subjected to desiccation, below this zone of stratum is grey. Fragments of shale were encountered in the lower 6 to 16 feet of the glacial till at many of the boring locations.

Grain-size distribution curves for samples of the cohesive stratum, obtained with a 2-inch O.D. split-spoon sampler, are shown on Figure No. 1 in Appendix I. Atterberg limit tests were performed on samples of the glacial till, the results were plotted on the Record of Borelog sheets, as well as on a Plasticity Chart (Figure #2), are summarized in tabular form below.

	<u>Range</u>	<u>Average</u>
Liquid Limit (W_L) (%)	17 - 37	27
Plastic Limit (W_p) (%)	12 - 20	16
Natural Moisture Content (W) (%)	10 - 20	15

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

The Standard Penetration Tests, carried out with this glacial till stratum, are plotted on the Record of Borehole sheets. This testing gave "N" values ranging from 13 blows/ft. to in excess of 100 blows per foot. Based on this testing it is estimated that the consistency of this cohesive deposit varies from stiff to hard.

4.3) Silty Sand to Sandy Silt:

In some areas a granular deposit is interbedded within the glacial till deposit, while at other locations this granular material extends from the base of the till to bedrock. The granular deposit is composed of a compact to very dense ('N' values 23 to 162 blows/ft.) silty sand to sandy silt with a trace of clay and gravel. Its thickness varies from 4 feet (B.H. #10) to 34.5 feet (B.H. 7). Grain-size distribution curves for samples of this granular material are shown on Figure No. 3.

4.4) Shale Bedrock:

The overburden is underlain by bedrock, which was proven in four of the boreholes by obtaining between 4 and 5 feet of BX size rock core samples. The bedrock surface was found to vary between elevations 458 and 472, corresponding to depths of from 76.5 to 84 feet below existing ground surface.

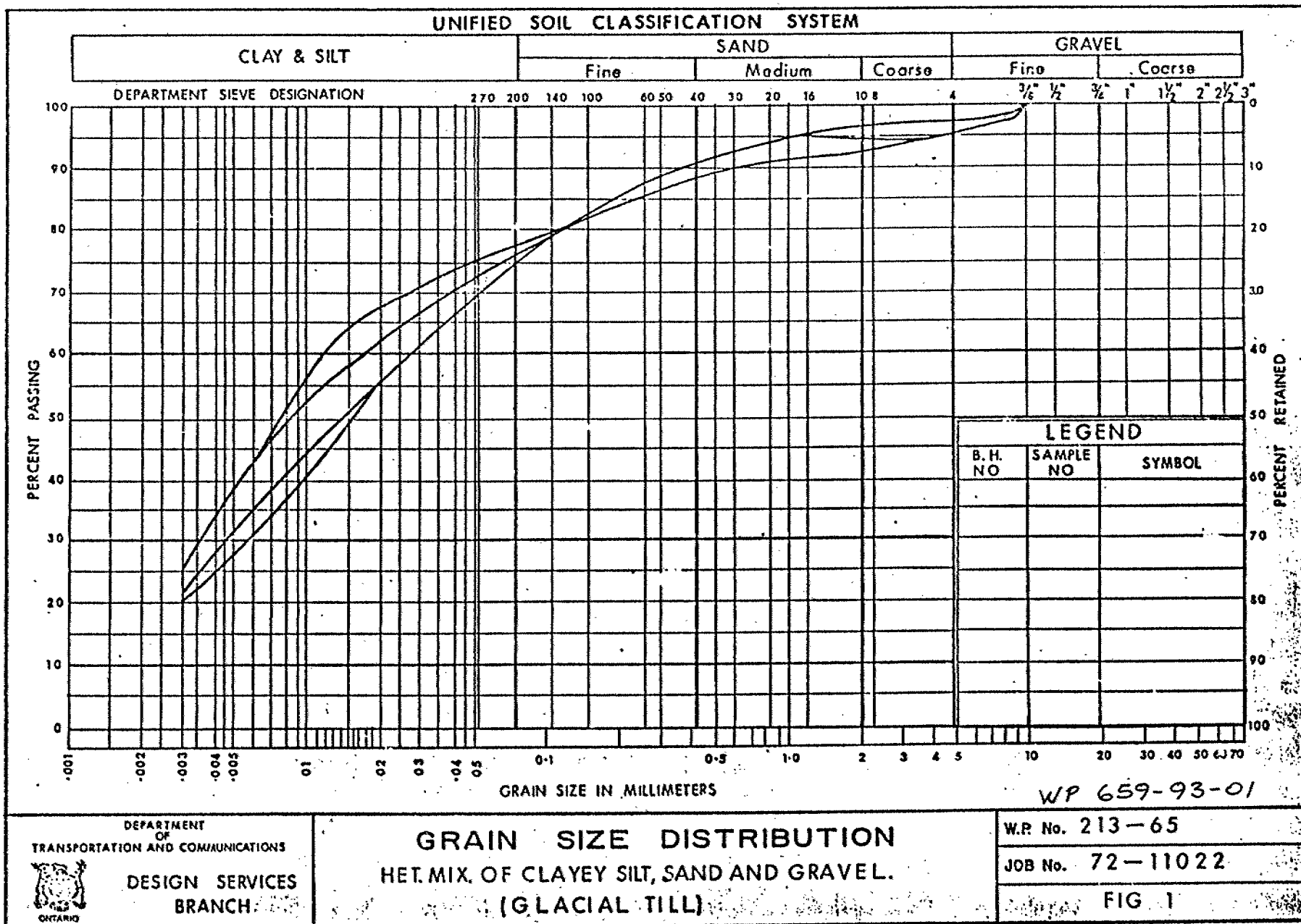
The bedrock is composed of a grey shale, which is in a sound state as evidenced by the high percentage of core recovered.

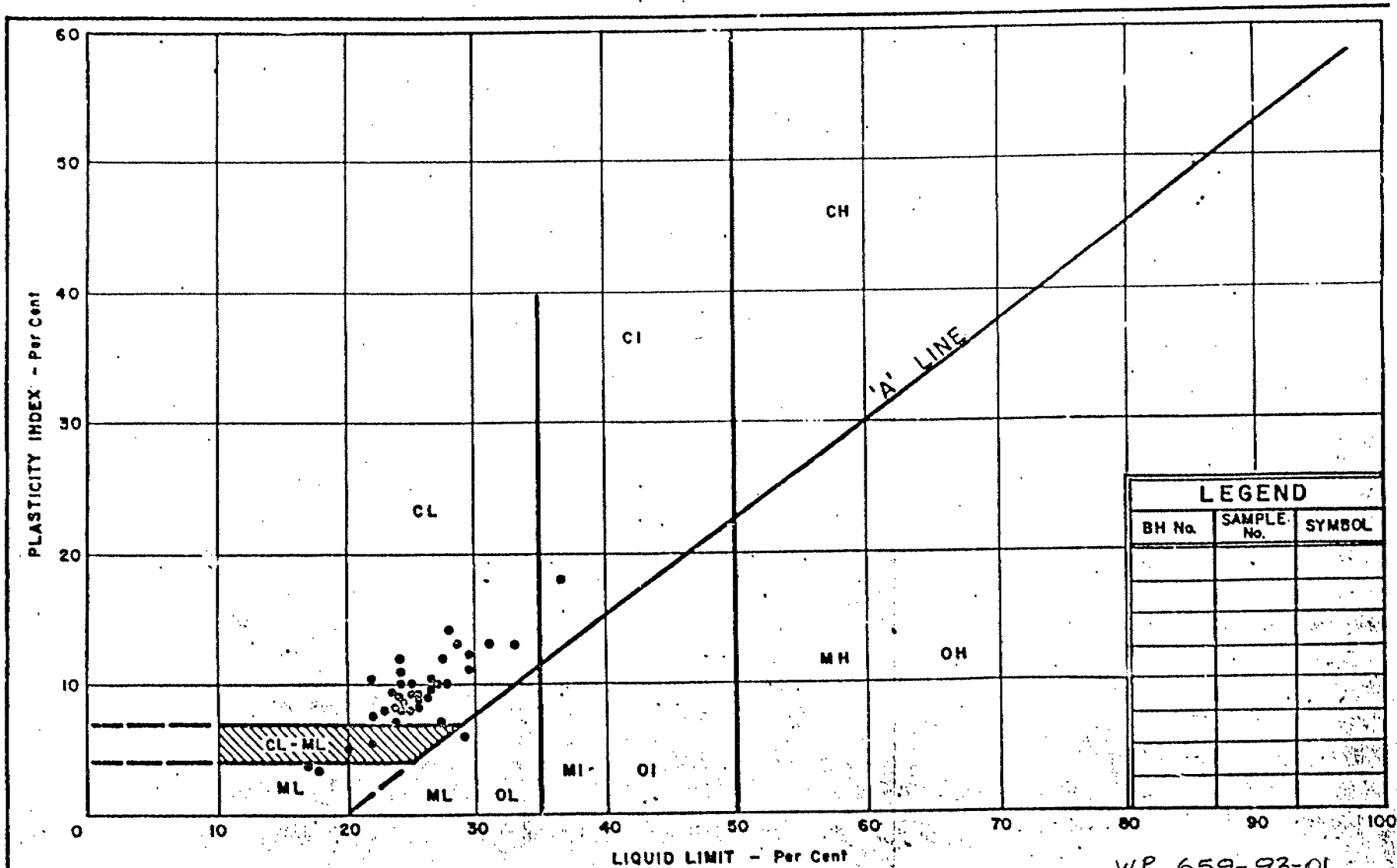
5. GROUNDWATER CONDITIONS:

The groundwater level conditions, across the site, were observed by taking readings in the open boreholes during the period of the field investigation (March 1972). The results of the readings are shown on the borelog sheets as well as on Drawing No. 72-11022A.

The observations indicate that the groundwater level, during this time, was located between elevations 541 and 542.5, which corresponds to levels ranging from existing ground surface to 6.5 feet below ground surface.

APPENDIX





WP 659-93-01



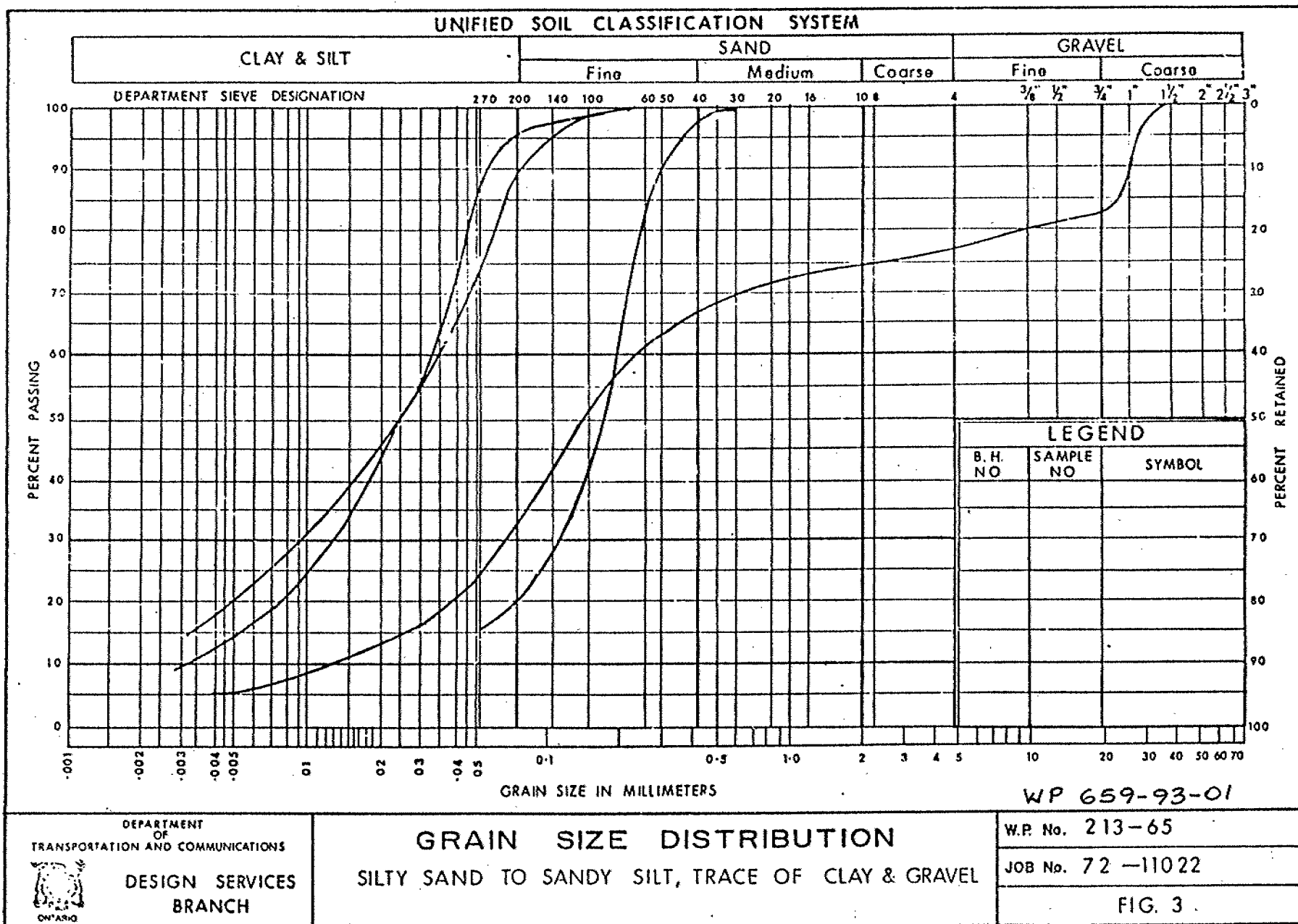
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART GLACIAL TILL

WP No. 213-65

JOB No. 72-11022

FIG. 2



DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No 1

FOUNDATIONS OFFICE

IMPERIAL

WP 659-93-01

CO-ORDS: N 4840 353.2, E 275 735.9

JOB 72-11022

LOCATION Co-ord's 880,424 N. 970,262 E.

ORIGINATED BY V.K.

WP 21 65

BORING DATE March 13, 1972

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Auger and Sample with C.M.E.

CHECKED BY LB

SOIL PROFILE			SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE					
545.7	Ground level.								
0.0	Het. mixture of clayey silt, sand & gravel. Glacial Till.		1	SS	20				4.1. 542.5
			2	SS	24				4 6 75 15
			3	SS	33				
532.7	Brown		4	SS	27				
13.0	Grey		5	SS	20				
	Very stiff to hard.		6	SS	20				
			7	SS	19				
			8	SS	20				
			9	SS	24				
			10	SS	23				
			11	SS	55				
			12	SS	110				5 17 64 14
			13	SS	53				
474.7			14	SS	100				
71.0	End of borehole.								

20
15 \div 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 2

FOUNDATIONS OFFICE
IMPERIAL

WP 659-93-01

Co-ORDS: N4 840 364.5, E 295 760.2

JOB 72-11022

LOCATION Co-ord's 880,461 N. - 970,342 E.

ORIGINATED BY Y.K.

W.P. 213-65

BORING DATE March 6, 1972

COMPILED BY Y.K.

DATUM Geodetic

BOREHOLE TYPE Auger and Sample with C.H.V. Machine.

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W ₁ W _P — W _L WATER CONTENT % 10 20 30	BULK DENSITY Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
546.9	Ground level.									
0.0	1. mixture of clayey silt, sand & gravel. Glacial Till.		1	SS	17	540				
			2	SS	36					
532.9	Brown		3	SS	57					
14.0	Grey.		4	SS	37	530				
	Stiff to hard.		5	SS	13					
			6	SS	19	520				
			7	SS	22					
			8	SS	15	510				
			9	SS	24					
			10	SS	44	500				
			11	SS	100/5"	490				
			12	SS	120/5"	480				
469.9	Fragments of shale		13	BXL	Rec 40%	470				
77.0	Shale Bedrock.		14	BXL	Rec. 90%					
465.9	Grey. Sound									
81.0	End of borehole.					460				

20
15 ± 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

WP 659-93-01

JOB 72-11022

W.P. 213-65

DATUM Geodetic

RECORD OF BOREHOLE No 3

Co-ordinates 840 375.2, E 295 755.4

LOCATION Co-ord's 880,496 N. 970,326 E.

BORING DATE March 13, 1972

BOPEHOLE TYPE Auger and Sample with C.H.E. Machine

FOUNDATIONS OFFICE

IMPERIAL

ORIGINATED BY V.K.

COMPILED BY V.K.

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 _P W _P — W — W _L WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE						BLOWS/FOOT
547.9	Ground level.									
0.0	Het. mixture of clayey silt, sand & gravel.		1	SS	29	540			W.L. 542.4 1 22 60 17	
	Glacial Till.		2	SS	27					
			3	SS	76					
535.4	Brown.		4	SS	26	530				
12.5	Grey.		5	SS	19					
	Very stiff to hard.		6	SS	18					
			7	SS	23	520				
			8	SS	19					
			9	SS	25					
512.9	156.3			10	SS	31	510			
35.0	Silty sand, traces of clay & gravel.			11	SS	40				
	Dense.									
423.9						500				
44.0	Het. mix. of clayey silt, sand & gravel.		12	SS	97					
	Glacial Till.									
	Hard.		13	SS	55	490				
					480					
477.4			14	SS	1007	470				
70.5	End of borehole.									

15 $\frac{20}{10}$ 5 % STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 4

FOUNDATIONS OFFICE

WP 659-93-01

Co-ords: N 4840 395.6, E 235 745.3

IMPERIAL

JOB 72-11022

LOCATION: Co-ord's 880,563 N. 970,291 E.

CREATED BY V.K.

W.P. 213-65

BORING DATE March 7, 1972

CHECKED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Auger and Sample with C.M.E. Machine.

CHECKED BY LD

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 $W_p - W_L$ WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F. GR. SA. ST. CL.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
548.4	Ground level.									
0.0	Het. mix. of clayey silt, sand & gravel. Glacial Till.		1	SS	26					
			2	SS	35					
36.9	Brown		3	SS	63					
11.3	Grey		4	SS	59					
	Very stiff to hard.		5	SS	23					
			6	SS	27					
			7	SS	39					
			8	SS	31					
			9	SS	37					
512.4	156.2		10	SS	90					
36.0	Silty sand, traces of clay and gravel. Dense.		11	SS	44					
502.4										
46.0	Het. mix. of clayey silt, sand & gravel. Glacial Till.		12	SS	51					
	Hard.									
			13	SS	72					
			14	SS	100.73"					
	Fragments of shale		15	BXL	Rec. 5%					
471.9										
76.5	Shale bedrock.		16	BXL	Rec. 90%					
467.4	Grey. Sound									
81.0	End of borehole.									

20
15 \pm 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 5

FOUNDATIONS OFFICE

WP 659-93-01

COORDS: N 4840415.7, E 255735.6

IMPERIAL

JOB 72-11022

LOCATION Co-ord's 880,629 N. 970,261 N.

ORIGINATED BY V.K.

W.P. 213-65

BORING DATE March 6, 1972

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Auger and Sample with C.M.E. Machine

CHECKED BY

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W _c W _p — W _c — W _L	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER					
546.5	Ground level.							
0.0	Het. mix. of clayey silt, sand & gravel. Glacial Till.		1	SS	37			
			2	SS	26			
535.5	Brown		3	SS	55			
11.0	Grey.		4	SS	23			
	Stiff to hard.		5	SS	13			
			6	SS	17			
			7	SS	29			
			8	SS	36			
			9	SS	28			
508.5	155		10	SS	74			
38.0	Silty sand, traces of clay & few gravel. Dense.		11	SS	30			
500.5								
46.0	Het. mix. of clayey silt, sand & gravel. Glacial Till. Hard.		12	SS	36			
			13	SS	71			
476.4	Fragments of shale		14	SS	100			
70.1	End of borehole.							

20
15 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 6

FOUNDATIONS OFFICE

WP 659-93-01

CO-ORDS: N 4840 362.7, E 295 697.8

IMPERIAL

JOB 72-11022

LOCATION Co-ord's 880,455 N. 970,137 E.

ORIGINATED BY V.K.

W.P. 213-65

BORING DATE March 10, 1972

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Auger and Sample with C.H.E. 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				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				WATER CONTENT %			P.C.F.			
						● QUICK TRIAXIAL × LAB VANE										
										10 20 30						
546.6	Ground level.															
0.0	Het. mix. of clayey silt, sand & gravel. Glacial Till.		1	SS	20										541.1 w_L	
			2	SS	32										1 27.56.16	
			3	SS	50											
533.1	Brown		4	SS	52											
13.5	Grey		5	SS	18											
	Very stiff to hard.		6	SS	30											
			7	SS	41											
			8	SS	46											
			9	SS	31											
			10	SS	70											
			11	SS	124											
			12	SS	191											
498.6	162.0		13	SS	48										22 44 30 4	
48.0	Silty sand, traces of clay and some gravel.		14	SS	152											
	Dense to very dense.		15	SS	1007.2											
476.5																
70.1	End of borehole.															

20
15 \pm 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 7

FOUNDATIONS OFFICE

WP 659-93-01

Co-ords N 4840373.4, E 255493.2

IMPERIAL

JOB 72-11022

LOCATION Co-ord's 880,490 N. 970,122 E.

ORIGINATED BY V.K.

W.P. 213-65

BORING DATE March 7, 1972

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Auger and Sample with C.M.E. Machine.

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L WATER CONTENT % 10 20 30	BULK DENSITY P.C.F. γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE					
548.8	Ground level.								
0.0	Het. mix. of clayey silt, sand & gravel. Glacial Till.		1	SS	14				
			2	SS	29				
534.8	Brown.		3	SS	29				
14.0	Grey.		4	SS	14				
	Stiff to hard.		5	SS	15				
			6	SS	28				
			7	SS	20				
			8	SS	21				
			9	SS	20				
502.8	153.3								
46.0	Sandy silt to silty sand with traces of clay and gravel. Very dense.		10	SS	100				
			11	SS	57				
			12	SS	74				
468.3	Shale Bedrock.		13	SS	10074				
80.5	Grey Sound		14	BXL	Rec. 90%				
463.3									
85.5	End of borehole.								

20
15 \div 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

DESIGN SERVICES BRANCH				RECORD OF BOREHOLE NO 8				FOUNDATIONS OFFICE				
WP 659-93-01				Co-ords: N 840 392.6, E 295 684.7				ORIGINATED BY V.K.				
JOB 72-11022				LOCATION Co-ord's 880,553 N. 970,094 E.				COMPILED BY V.K.				
W.P. 213-65				BORING DATE March 8, 1972				CHECKED BY <u>LD</u>				
DATUM Geodetic				BOREHOLE TYPE Auger and Sample with C.M.E. Machine.								
SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLAT	NUMBER		TYPE	BLOWS/FOOT	BLOWS / FOOT	20 40 60 80 100	PLASTIC LIMIT	WATER CONTENT		
545.6	Ground level.											
0.0	Het. mix. of clayey silt, sand & gravel. Glacial Till.		1	SS	34							
			2	SS	40							
534.6	Brown.		3	SS	55							
11.0	Grey.		4	SS	21							
	Very stiff to hard.		5	SS	22							
			6	SS	38							
			7	SS	43							
			8	SS	50							
			9	SS	89							
			10	SS	96							
504.6	153.8		11	SS	109							
41.0	Silty sand with traces of clay and gravel.											
	Very dense.											
494.6			12	SS	108							
51.0	Het. mix. of clayey silt, sand & gravel. Glacial Till.											
	Hard.		13	SS	97							
475.5			14	SS	100							
70.1	End of borehole.											

20
15 \div 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 9

FOUNDATIONS OFFICE

WP 659-93-01

CO-ORDS: N 4840414.2, E 295475.5

IMPERIAL

JOB 72-11022

LOCATION Co-ord's 880,624 N, 970,064 E,

ORIGINATED BY V.K.

W.P. 213-65

BORING DATE March 6, 1972

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Auger and Sample with C.M.E. Machine

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
542.1	Ground level.									
0.0	Het. Mix. of clayey silt, sand and gra. Glacial Till.		1	SS	27					2 24 53 21
			2	SS	41					
531.1	Brown		3	SS	57					
11.0	Grey		4	SS	39					
	Very stiff to hard.		5	SS	39					
			6	SS	51					
			7	SS	61					
			8	SS	41					
			9	SS	22					
			10	SS	133					3 19 68 10
			11	SS	150					
494.1	EL 150.0		12	SS	73					
48.0	Silty sand, gravel with traces of clay.		13	SS	162					47 41 10 2
488.1	Very dense.									
54.0	Het. mix. of clayey silt, sand & gravel. Glacial Till		14	SS	116					
	Hard									
	Fragments of shale		15	SS	1007					
458.1			16	BXL	1007					
84.0	Shale bedrock.		17	BXL	Rec.					
453.1	Grav. Sound									
89.0	End of borehole.									

20
15 \div 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 10

WP 659-93-01

CO-ORDS: N 4840 425.5, E 255 701.7

JOB 72-11022

LOCATION Co-ord's 880.661 N. 970.150 E.

W.P. 215-65

BORING DATE March 3, 1972

ORIGINATED BY V.K.

COMPILED BY V.K.

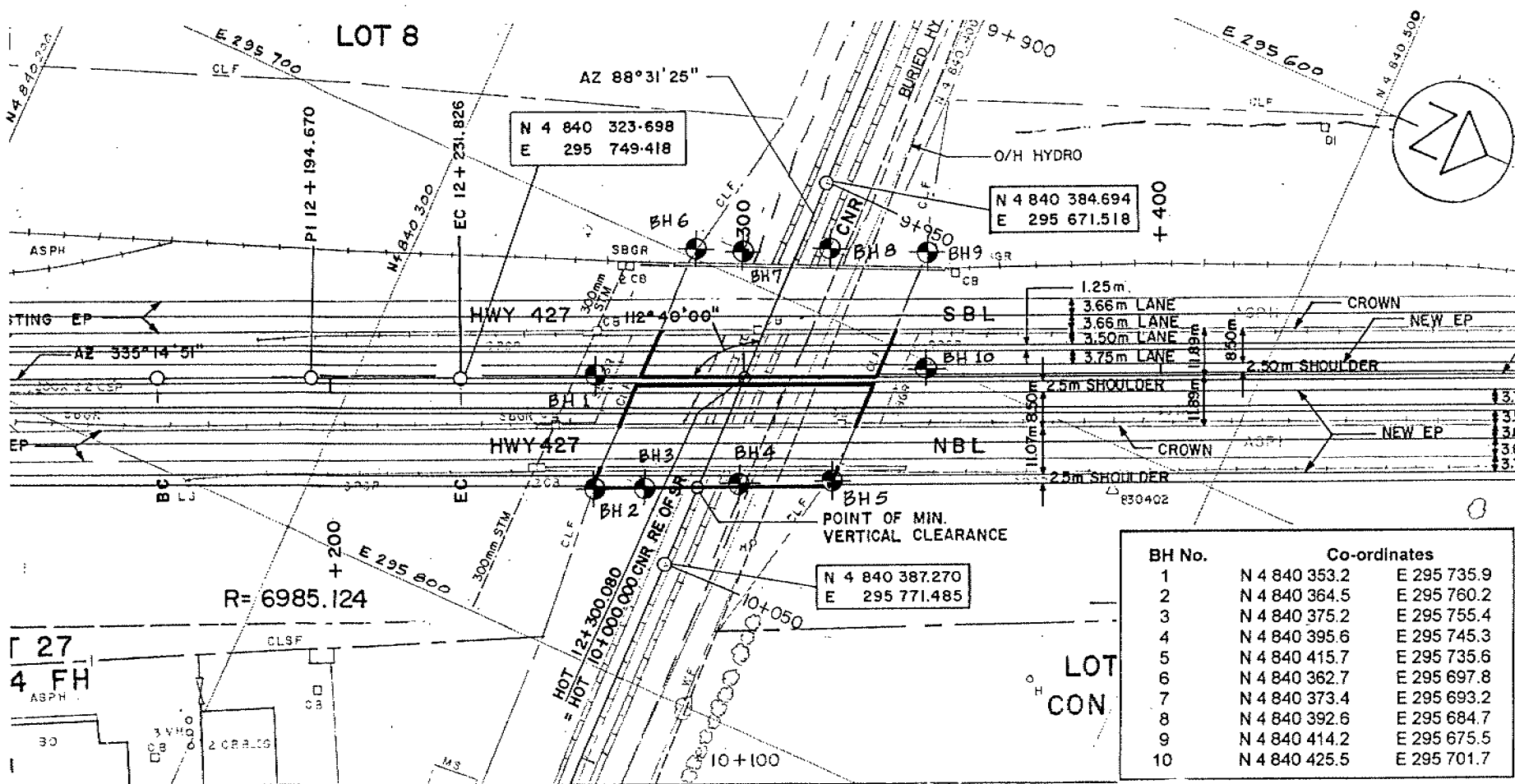
DATUM Geodetic

BOREHOLE TYPE Auger and Sample with C.M.E. Machine.

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p w w_L WATER CONTENT % 10 20 30	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE					
544.3	Ground level.								
0.0	Het. mix. of clayey silt, sand and grav. Glacial Till.		1	SS	33	540			W.L. 540.8
			2	SS	18				28 54 17
533.3	Brown Grey		3	SS	50				
11.0			4	SS	13	530			
	Stiff to hard.		5	SS	12				
			6	SS	21				
			7	SS	15	520			
			8	SS	42				
			9	SS	18				
510.3	155.5					510			
34.0	Silty sand, trace of cl. & gra. Compact.		10	SS	23				
506.3									
38.0	154.2		11	SS	100/	500			
	Het. mix. of clayey silt, sand & gravel.								
	hard.		17	SS	22	490			
			13	SS	160/	480			
	Fragments of shale								
474.2			14	SS	100/				
70.1	End of borehole.					470			

20
15 \diamond 5 % STRAIN AT FAILURE
10



NOTE
For Subsoil Information Refer
to Record of Borehole Sheets.

PLAN



WP 659-93-01
SITE 37-984

HWY 427 & CANADIAN NATIONAL RAILWAYS

MEMORANDUM



To: G. Al Bazi, P. Eng.
Head, Design Section
7th Floor, Atrium Tower

From: Pavements and Foundations
Room 315, Central Building

Re: Proposed Hwy. 427 Widening
CNR Overhead NBL & SBL.
W.P. 659-93-01, Site No. 37-0984
District 6, Toronto

Date: September 29, 1994

Tel: 235-3731
Fax: 235-5240

We refer to the request from B. Stofko of McCormick Rankin Consulting Engineers for the soil parameters to be used in the design of the temporary track protection for the above noted project. The type and details of the shoring system are not given.


Based on a review of the original foundation report, we have come up with the following simplified stratigraphy for the native subsoils:

Upper cohesive glacial till - from original grade to El. 510' (155.4 m)
Silty Sand to Sandy silt - from El. 510' to 500' (155.4 to 152.4 m)
Lower cohesive glacial till - from El. 500' (152.4 m) to bedrock
For shoring design, the following parameters are recommended:

	ϕ	C_u	γ
Existing Fill	28°	0	19kN/m ³
Upper Cohesive Till	0	100 kPa	20kN/m ³
Silty Sand/Sandy Silt	34°	0	20kN/m ³
Lower Cohesive Till	0	200 kPa	21kN/m ³

Groundwater level assumed to be at El. 543' (165.5 m)

We believe the above is sufficient for your purposes. If you require further information, please contact us.



David Kwok, P. Eng.
Project Foundation Engineer
for
Paul Payer, P. Eng.
Sr. Foundation Engineer

DK/PP/mm

c.c. - John Lam, P. Eng. (Structural Section)

memorandum



To: George Al-Bazi, P. Eng.
Design Engineer
Structural Office

Date: 94 05 30

From: Foundation Design Section
Room 315, Central Building

Subject: Proposed Hwy 427 Widening
From south of Hwy 409 to Steeles Avenue
W.P.615-89-00
District 6, Toronto

As per your verbal request (94 05 27), we provide the recommendations regarding caisson construction for the proposed widening at the following locations:

Hwy 427-Hwy 409 Interchange (W.P.657-93-01, Site No. 37-0985)

As an alternative to pile foundation, the abutments and central pier can be supported on caissons socketed 1.5 m into bedrock. Minimum caisson diameter should be 900 mm to allow for down-the hole cleaning and inspection. The following axial design values may be assumed in accordance with the O.H.B.D.C.:

Factored Bearing Capacity at U.L.S. = 3500 kPa
Bearing Capacity at S.L.S. Type II will not govern the design

For caisson foundation, the differential settlement between the new and existing foundations will be negligible. Due to the presence of non-cohesive layers in the glacial till stratum, liners are required for caisson construction.

For preliminary design purpose, the following are the anticipated tip elevations for caisson construction:

NBL Median

South Abutment	El 463 ft (141.1 m)
North Abutment	El 465 ft (141.7 m)
Central Pier	El 458 ft (139.6 m)

These tip elevations are estimated based on available borehole data. Actual founding elevations may vary and have to be verified in the field. Caisson caps should be constructed at the same elevation as the existing pile caps. Alternatively, caisson caps may be omitted and 'pile bent' type of construction be adopted. Shoring requirements associated with caisson caps can be eliminated in pile bent construction.

CNR Overhead NBL & SBL (W.P.659-93-01, Site No. 37-0984)

As an alternative to H-pile foundation and shallow footings, the abutments and piers can be supported on caissons socketed 1.5 m into bedrock. Minimum caisson diameter should be 900 mm to allow for down-the hole cleaning and inspection. The following axial design values may be assumed in accordance with the O.H.B.D.C.:

Factored Bearing Capacity at U.L.S. = 3500 kPa
Bearing Capacity at S.L.S. Type II will not govern the design

For caisson foundation, the differential settlement between the new and existing foundations will be negligible. Due to the presence of non-cohesive layers in the glacial till stratum, liners are required for caisson construction.

For preliminary design purpose, the following are the anticipated tip elevations for caisson construction:

	<u>NBL/SBL Median</u>	<u>NBL Outer Edge</u>
South Abutment	El 465 ft (141.7 m)	El 465 ft (141.7 m)
North Abutment	El 463 ft (141.1 m)	El 467 ft (142.3 m)
South Pier	El 463 ft (141.1 m)	El 465 ft (141.7 m)
North Pier	El 467 ft (142.3 m)	El 467 ft (141.7 m)

These tip elevations are estimated based on available borehole data. Actual founding elevations may vary and have to be verified in the field. Caisson caps should be constructed at the same elevation as the existing pile caps. Alternatively, caisson caps may be omitted and 'pile bent' type of construction be adopted. Shoring requirements associated with caisson caps can be eliminated in pile bent construction.

Albion Road Overpass (W.P.662-93-01, Site No. 37-1110)

According to the original foundation report, the subsurface stratigraphy typically consists of cohesive glacial till strata extending down to El. 166-168 m, followed by a major deposit of non-cohesive glacial till material. Bedrock was not encountered during the field investigation.

Based on the available borehole data, it is considered that caisson construction is not a viable solution for the proposed widening. For caissons to terminate in competent material, they have to penetrate into the non-cohesive till stratum or penetrate this stratum and rest on bedrock. Caisson excavation through this material may encounter problems on base instability. There are also potential sub-artesian or artesian conditions that may affect caisson construction.

An alternative to shallow footing construction is to support the abutments on steel H-piles. It is recommended that the abutments for the widening be supported by steel H-piles driven into the competent glacial till stratum. The following pile capacities should be employed in the design as per O.H.B.D.C :

	<u>HP 310X79</u>	<u>HP 310X110</u>
Factored Axial Capacity at U.L.S.	1150 kN/pile	1600 kN/pile
Axial Capacity at S.L.S. Type II	890 kN/pile	1150 kN/pile

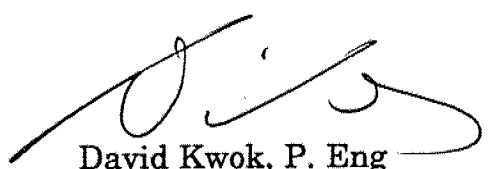
Piles shall be driven in accordance with Standard SS 103-10 or SS 103-11 using an ultimate capacity of 2670 kN/pile for HP 310X79 and 3450 kN/pile for HP 310X110, but must be driven below the following design elevations:

NBL Outer Side

South Abut.	El 163.0 m
North Abut.	El 164.0 m

The glacial till stratum typically consists of boulders. Piles should be equipped with reinforced pile tips in accordance with OPSD-3301.00.

Pile caps should be located at the same elevation as the existing pile caps. For frost protection, an earth cover of 1.2 m should be provided. In order to avoid adverse effects of pile driving on the existing foundation, it is recommended pre-augering be carried out at new pile locations to a depth of 3 m below the bottom elevation of the existing foundation. These pre-augered holes should be backfilled with suitable granular material upon completion of pile driving.


David Kwok, P. Eng
Project Foundation Engineer
for
Paul Payer, P. Eng.
Senior Foundation Engineer

c.c. Has Shah (Planning & Design)
John Lam (Structural Section)

memorandum



To: V.F. Boehnke, P. Eng.
Head, Structural Section
Central Region

Attn: John Lam, P. Eng.

From: Foundation Design Section
Room 315, Central Building

Subject: Proposed Hwy 427 Widening
CNR Overhead NBL & SBL
W.P.659-93-01, Site No. 37-0984
District 6, Toronto

Date: 94 05 25

We refer to your memorandum dated 94 02 15 and the updated E-plan attached therein. Based on this and the subsequent discussions, we provide herewith our detailed foundation recommendations for the proposed widening of the above structure. This memorandum is intended to include and supplement the recommendations given in our previous memorandum dated 93 12 03.

Based on the updated plan, it is understood that the widening will be carried out in the median of both the NBL and SBL structures and on the outer side of the NBL as well. The existing structures have three spans. Both abutments are supported on 12BP53 (HP 310X79) piles and the piers are supported by shallow spread footings.

The predominant soil stratum across the site is a stiff to hard cohesive glacial till. Over the major portion of the site, a compact to very dense silty sand to sandy silt deposit is interbedded within the glacial till or exists below the glacial till, overlying bedrock. The overburden is underlain by shale bedrock, at El. 458.1 ft. to 471.9 ft. (139.6 m to 143.8 m)

Foundation

Abutment -

It is recommended that the abutments for the widening be supported by steel H-piles driven to refusal into the competent cohesive glacial till stratum. The following pile capacities should be employed in the design as per O.H.B.D.C.:

	<u>HP 310X79</u>	<u>HP 310X110</u>
Factored Axial Capacity at U.L.S.	1150 kN/pile	1600 kN/pile
Axial Capacity at S.L.S. Type II	890 kN/pile	1150 kN/pile

Piles shall be driven in accordance with Standard SS 103-10 or SS 103-11 using an ultimate capacity of 2670 kN/pile for HP 310X79 and 3450 kN/pile for HP 310X110, but must be driven below the following design elevations:

	<u>NBL Outer Side</u>	<u>NBL/SBL Median</u>
South Abut.	El 485 ft (147.8 m)	El 475 ft (144.8 m)
North Abut.	El 476 ft (145.1 m)	El 485 ft (147.8 m)

The glacial till stratum typically consists of boulders. Piles should be equipped with reinforced pile tips in accordance with OPSD-3301.00.

Pile caps should be located at the same elevation as the existing pile caps. For frost protection, an earth cover of 1.2 m should be provided. New piles should be properly arranged to avoid interference with existing piles. In addition, in order to avoid adverse effects of pile driving on the existing pile foundation, it is recommended pre-augering be carried out at new pile locations to a depth of 3 m below the bottom elevation of the existing pile cap. These pre-augered holes should be backfilled with suitable granular material upon completion of pile driving.

Pier -

At pier locations, new footings constructed immediately adjacent to the existing footings should be founded at the same elevation to avoid undermining or overstressing of footings. According to the contract drawings, the existing footings are designed to be founded at El. 534 \pm ft. (162.8 \pm m). The actual elevation should be verified on site during construction. For footings founded on very stiff cohesive glacial till, the design bearing capacities as per the O.H.B.D.C. are as follows:

Factored Bearing Capacity at U.L.S. = 400 kPa
Bearing Capacity at S.L.S. Type II = 250 kPa

Based on the above design capacities, the resulting differential settlement between the new and existing footings will be less than 25 mm.

Following excavation to grade, 150 mm thick lean concrete shall be placed within 4 hours of excavation to prevent deterioration of the founding material.

Sliding resistance between concrete and native cohesive glacial till material should be calculated in accordance with O.H.B.D.C. Section 6-8.4.3 with an unfactored adhesion of 100 kPa.

For footing construction, an earth cover of 1.2 m should be provided for frost protection.

Alternative Design -

Should caisson foundation be adopted, please contact our office for details. Pile bent construction on caissons can eliminate caisson caps and associated shoring requirements.

Backfill

Backfill to abutments or retaining walls should consist of granular material in accordance with MTO Standard Special Provision No. 109F03 (92 03). Computation of earth pressure shall be in accordance with Section 6.7.4 of the O.H.B.D.C. Unfactored properties for backfill materials are provided in the following table:

<u>Material</u>	ϕ	γ
Granular 'A'	35°	22.8 kN/m ³
Granular 'B'	30°	21.2 kN/m ³

Construction

Temporary excavation is required for the construction of the pile caps and footings. Cut slopes may be formed at an angle of 1H:1V or flatter up to a maximum height of 3 m. Shoring may be required when excavation is carried out close to the existing structure. Soil parameters for the design of track protection will be provided after the location and extent of shoring requirements are identified by your office.

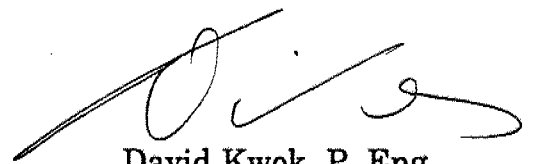
No major dewatering measure is required. Minor seepage from sand layers or surface

runoffs can be handled by sump pumping.

Miscellaneous

The original memorandum dated 93 12 03 was prepared by Balu Iyer, Senior Foundation Engineer.

We believe the above is sufficient for your present purposes. Should you require further information, please contact our office. We will comment further when the design drawings are available.



David Kwok, P. Eng
Project Foundation Engineer
for

Paul Payer, P. Eng.
Senior Foundation Engineer

c.c. Has Shah
(Planning & Design)

George Al-Bazi
(Structural Office)

MEMORANDUM



To: V. Boehnke
Head, Structural Section
Central Region

Date: December 3, 1993

Attn: J. Lam, P. Eng.

From: Foundation Design Section
Room 315, Central Bldg.

Tel: 235-3731
Fax: 235-5240

Re: Proposed Widening - Hwy 427
CNR Overhead at Hwy 427
W.P. 659-93-01
District 6, Toronto

Further to your memorandum dated 1993 09 23, we provide herewith foundation recommendations for the proposed Hwy 427 widening at the above mentioned location. It is understood that the widening will be carried out in the median area.

The existing structure ^{5 spans} has 3 spans. Both abutments are supported on HP 12 X 53 (imperial units) piles and the two piers are supported on shallow spread footings.

The predominant soil stratum across the site is a stiff to hard cohesive glacial till. Over the major portion of the site, a compact to very dense silty sand to sandy silt deposit is interbedded within the glacial till or exists below the glacial till, overlying bedrock. The overburden is underlain by shale bedrock, at El. 458.1 ft. to 471.9 ft. (139.6 m to 143.8 m).

Foundation

Piers

It is recommended that the piers for the new widening be supported on shallow footings, founded within the cohesive till at the same elevation as the existing footings. The new footings shall be designed using a factored ULS capacity of 400 kPa and a design capacity of 250 kPa from a serviceability point of view, corresponding to a settlement of 15 mm or less. Somewhat conservative bearing capacities are recommended, to avoid large differential settlements between the old and new footings.

Following excavation to grade the base should be protected with lean concrete to avoid softening or disturbance of the cohesive glacial till stratum.

The pier footings shall be provided with a minimum frost cover consisting of 1.2 m of earth or equivalent insulation.

Abutments

The abutments of the widening shall be supported on 310 X 79 or 310 X 110 steel-H piles, using the following axial capacities as per O.H.B.D.C.

	<u>310 X 79 pile</u>	<u>310 X 110 pile</u>
Factored Axial Capacity at U.L.S., kN	1150	1600
SLS Type II Capacity, kN	890	1150

Pile driving should be controlled by the Hiley Formula as per MTO Standards SS 103-10 or SS 103-11, assuming ultimate capacity of 2670 kN for the 310 X 79 pile and 3450 kN for the 310 X 110 pile.

The steel-H piles should be equipped with reinforced pile tips in accordance with OPSD-3301.00.

Pile caps should be located at the same elevation as the existing ones. For frost protection, an earth cover of 1.2 m or equivalent insulation should be provided.

The pile layout for the widening should take into account the existing pile configuration.

Construction

Temporary excavation for the construction of pile caps and shallow footings may be carried out at 1H:1V or flatter slopes, provided the depth of excavation is 3 m or less. Shoring will be required when excavation is carried out close to existing structures and the railway tracks.

No major dewatering measures will be required at this site. Minor seepage or surface runoff entering the excavation shall be handled by sump pumping.

Placement and compaction of backfill shall be as per OPSS Standards.

We trust that the above recommendations are sufficient for your present purposes. Please call this office if you require clarification or elaboration on items discussed herein.



Balu Iyer, P. Eng.
Sr. Foundation Engineer

BI/jb

c.c. - Paul Jankowski, Sr. Proj. Eng.
George Al-Bazi, Design Eng.