

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 40P2-28

DIST. 4 REGION

W.P. No. 164-60-01

CONT. No. 83-10

W. O. No.

STR. SITE No. 23-291

HWY. No. 403

LOCATION Hwy 53 and Hwy 403
Overhead


No. of PAGES -

=====
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

RECORD OF BOREHOLE No 3

W P 164-60-01 LOCATION Sta. 13+346.2, 10.7 m Lt. of Hwy. 53 ORIGINATED BY J.B.
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 72 04 10 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
288.3	Ground Level													
	Silty Clay Low Plasticity Some Sand Grayish Brown Firm to Hard		1	SS	5		288							0 21 57 22
			2	SS	21		286							
			3	SS	51									
			4	SS	40									
			5	SS	30		284							
			6	SS	12									
283.3	Silt to Sandy Silt Traces of Clay Compact to Dense		7	SS	11		282							
5.0			8	SS	15									
			9	SS	30		280							0 3 89 8
279.1	Silty Clay With Sand Trace of Gravel (Glacial Till) Very Stiff to Hard Gray		10	SS	29		278							
9.1			11	SS	28									
			12	SS	33		276							
			13	SS	100/		274							5 37 47 11
			14	SS	100/									
							272							
272.1	End of Borehole													
16.2														

RECORD OF BOREHOLE No 4

W P 164-60-01 LOCATION Sta. 13+403.6, 9.1 m Lt. of Hwy. 53 ORIGINATED BY J.B.
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 72 04 06 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH					WATER CONTENT (%)				
								20 40 60 80 100					W _p	W	W _L		
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE										
288.6	Ground Level																
0.0	Silty Clay Low Plasticity Some Sand Traces of Gravel Firm to Hard Grayish Brown		1	SS	7		288									6 13 55 26	
			2	SS	15												
			3	SS	28												
			4	SS	31												
			5	SS	41												
			6	SS	33												
			7	SS	27												
			8	SS	24												
281.0	Silt to Sandy Silt Traces of Clay Loose to Compact		9	SS	25		280										
7.6				10	SS	5		278									
277.9				11	SS	24		276									
10.7	Silty Clay With Sand Trace of Gravel (Glacial Till) Very Stiff to Hard		12	SS	33		274										
				13	SS	100/	23 cm										
272.5				14	SS	100/	15 cm										
16.2	End of Borehole						272										

+3, x5 : Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 5

W P 164-60-01 LOCATION Sta. 13+296.2, 9.1 m Rt. of Hwy. 53 ORIGINATED BY J.B.
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger COMPILED BY
DATUM Geodetic DATE 72 03 29 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100								
								SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE								
							WATER CONTENT (%) 10 20 30									
288.2 0.0	Ground Level															
	Silty Clay Low Plasticity Some Sand Traces of Gravel Stiff to Hard Grayish Brown		1	SS	16		288									
			2	SS	35											
			3	SS	59		286									
			4	SS	100											
			5	SS	100	23 cm	284									
			6	SS	118											
			7	SS	25											
281.3 6.9	Sandy Silt Traces of Clay Compact to Very Dense		8	SS	1		282									
			9	SS	13		280									
			10	SS	59		278									
277.5 10.7	Silty Clay With Sand Trace of Gravel (Glacial Till) Hard		11	SS	100	23 cm	276									
275.1 13.0			12	SS	100	8 cm										
	End of Borehole						274									

RECORD OF BOREHOLE No 6

W P 164-60-01 LOCATION Sta. 13+352.6, 12.2 m Rt. of Hwy. 53 ORIGINATED BY J.B.
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 72 03 30 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W _p	W	W _L		
								SHEAR STRENGTH						
288.3	Ground Level													
283.4 4.9	Silty Clay Low Plasticity Some Sand Traces of Gravel Firm to Hard Grayish Brown		1	SS	7									
			2	SS	12									
			3	SS	37									
			4	SS	61									
			5	SS	30									
	6	SS	35											
	7	SS	24											
	8	SS	28											
	9	SS	35											
	10	SS	23											
	276.7	Silt to Sandy Silt Trace of Clay Compact to Dense		11	SS	29								
11.6	Silty Clay With Sand, Trace of Gravel (Till) Hard													
274.9 13.4	End of Borehole													

METRIC

CONT No
WP No 164-60-01

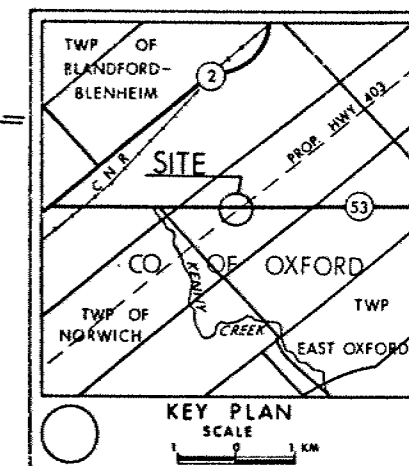
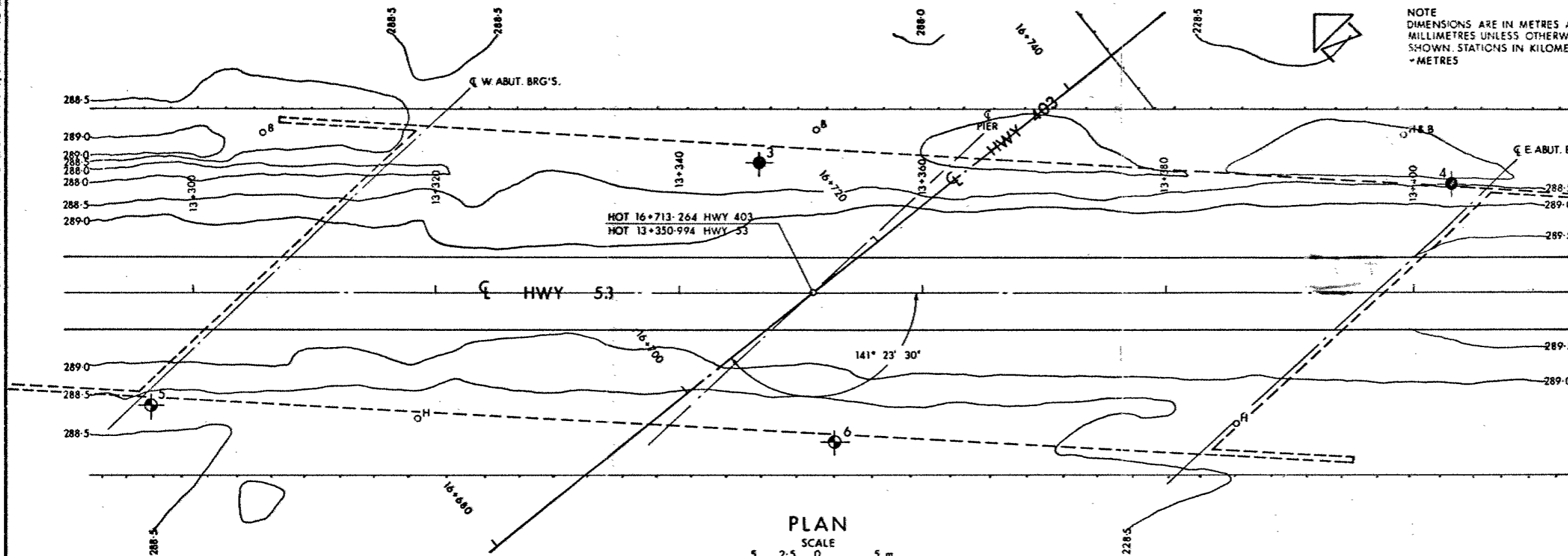
HWY. 53 INTERCH. U'PASS.

BORE HOLE LOCATIONS & SOIL STRATA



SHEET

NOTE
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE
SHOWN. STATIONS IN KILOMETRES
+METRES



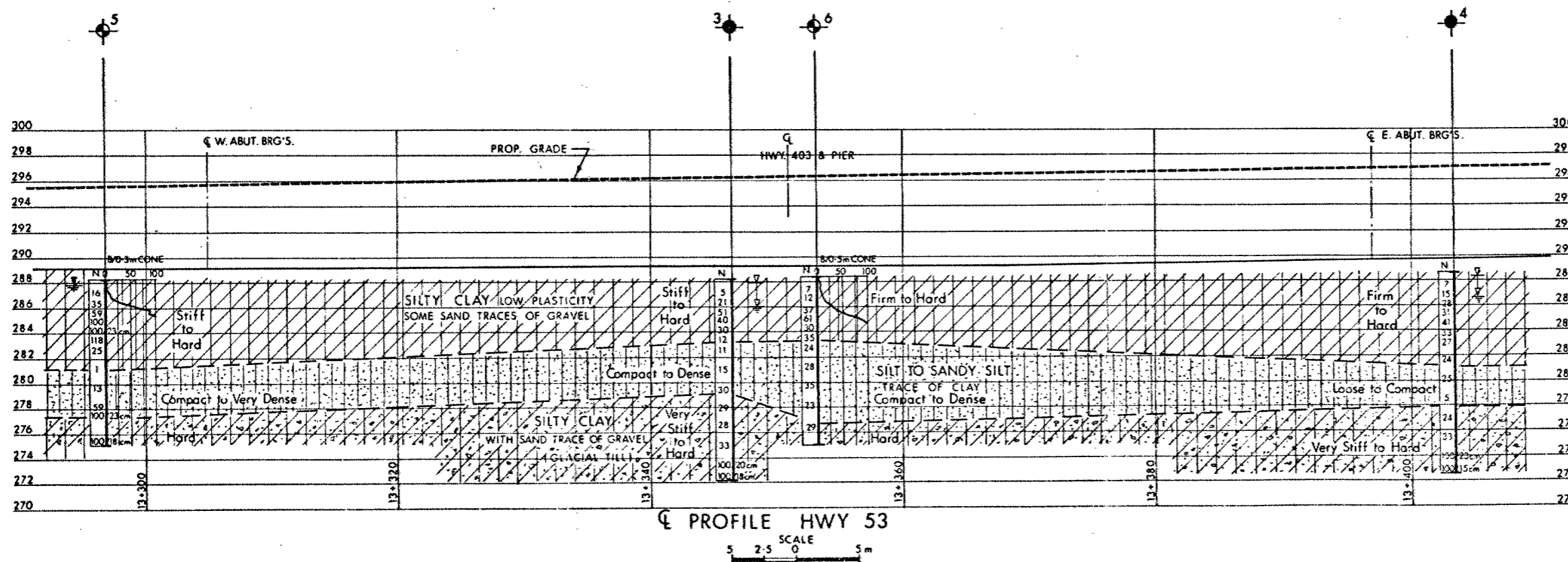
LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation 72 04 10
- HEAD
- ARTESIAN CONDITION
- ENCOUNTERED

No	ELEVATION	STATION	OFFSET C/L HWY 53
3	288.3	13+346-2	10.7 LT.
4	288.6	13+403-6	9.1 LT.
5	288.2	13+296-2	9.1 RT.
6	288.3	13+352-6	12.2 RT.

NOTE

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



REVISIONS	DATE	BY	DESCRIPTION

Geocres No 40P2-28

HWY No 403	DIST 4
SUBMIT K CHECKED	DATE 81 03 30
DRAWN OL J CHECKED	APPROVE
	SITE 23-291
	DWG 2

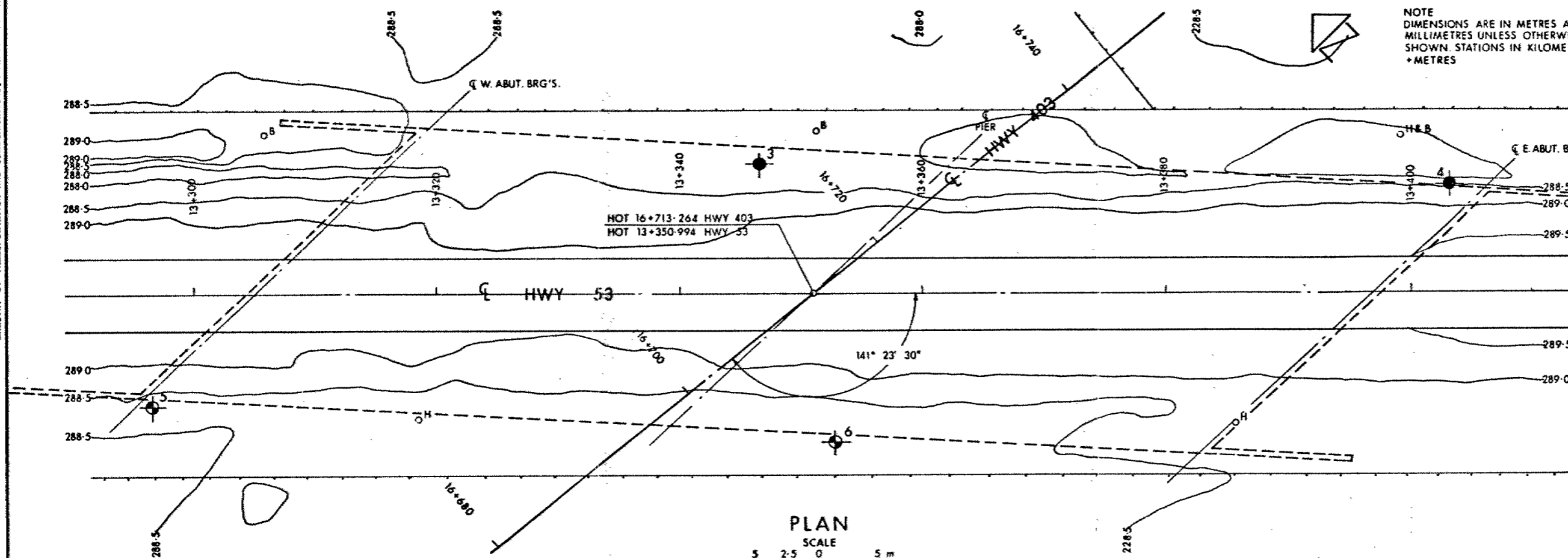
METRICCONT No
WP No 164-60-01

HWY. 53 INTERCH. U'PASS.

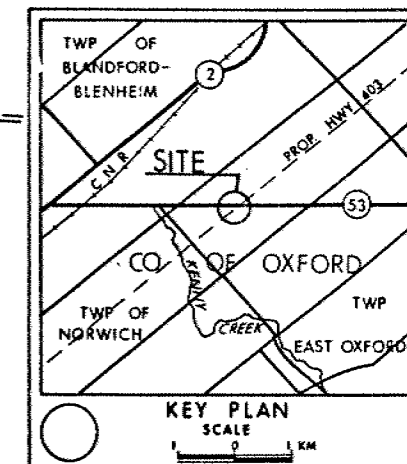
BORE HOLE LOCATIONS & SOIL STRATA



SHEET

NOTE
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE
SHOWN. STATIONS IN KILOMETRES
+METRES

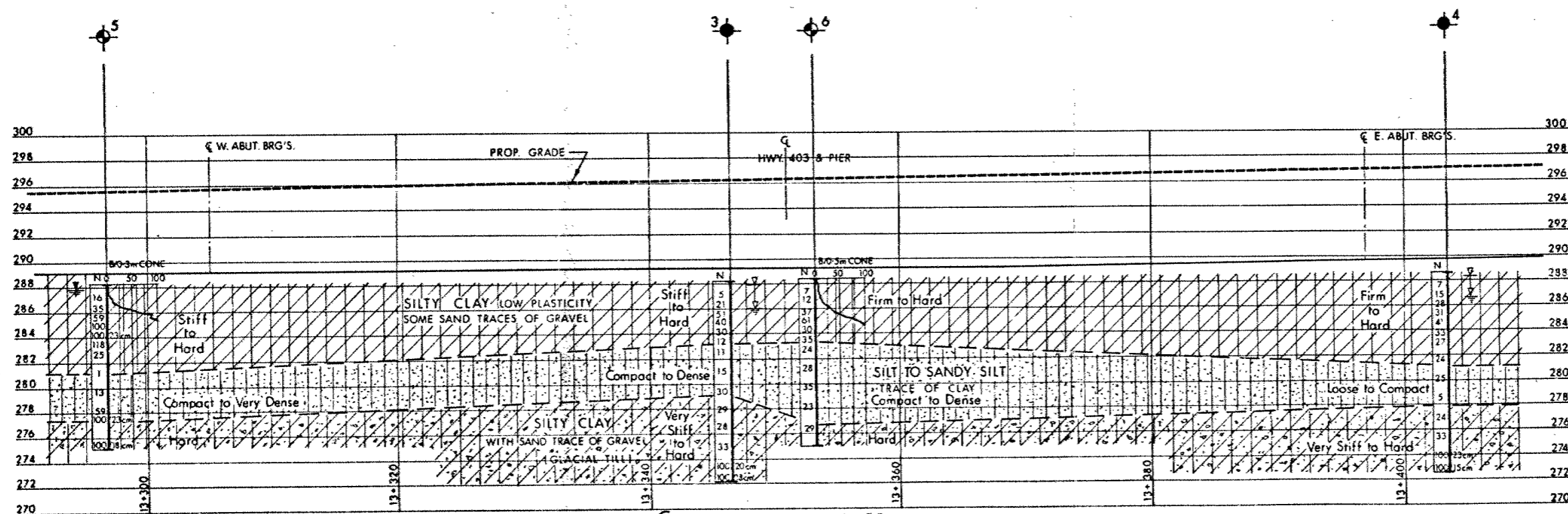
PLAN

SCALE
5 2.5 0 5 m

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (5rd Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation 72 04 10
- HEAD
- ARTESIAN CONDITION
- ENCOUNTERED

No	ELEVATION	STATION	OFFSET C/L HWY 53
3	288.3	13+346.2	10.7 LT.
4	288.6	13+403.6	9.1 LT.
5	288.2	13+296.2	9.1 RT.
6	288.3	13+352.6	12.2 RT.



PROFILE HWY 53

SCALE
5 2.5 0 5 m

NOTE

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

REVISIONS	DATE	BY	DESCRIPTION

Geocres No 40P2-28

HWY No 403	DIST 4
SUBMIT K CHECKED DATE 81 03 30	SITE 23-291
DRAWN OL J. CHECKED APPROVED	DWG 2

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

To: Mr. G.C.E. Burkhardt, (4) FROM: Foundations Office,
Regional Structural Planning Engineer, Design Services Branch,
Central Region, Central Bldg., Downsview.
90 Floral Pkwy.,
ATTENTION: Downsview, Ontario. DATE: June 8, 1972.
OUR FILE REF. IN REPLY TO JUN 16 1972

SUBJECT:

40P2-28
GEOCRES No.

FOUNDATION INVESTIGATION REPORT
For
The Overhead Structure of Hwy. #53 and
Proposed Hwy. #403, District #4, Hamilton
W.O. 72-11044 -- W.P. 164-60-00

CONT 83-10

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.
cc: D. W. Farren
B. R. Davis
A. Rutka
P. J. Harvey
C. R. Robertson
B. J. Giroux
T. J. Kovich
G. A. Wrong
B. A. Singh

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

Foundations Files
Documents ✓

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF THE SITE AND GEOLOGY.
 3. FIELD AND LABORATORY INVESTIGATIONS.
 4. SUBSOIL CONDITIONS.
 - 4.1) General.
 - 4.2) Clayey Silt with Some Sand and Traces of Gravel.
 - 4.3) Silt to Sandy Silt Traces of Clay.
 - 4.4) Sandy Silts with some Clay and Gravel (Glacial Till).
 - 4.5) Groundwater Conditions.
 5. DISCUSSION AND RECOMMENDATIONS.
 - 5.1) General.
 - 5.2) Foundations.
 - 5.3) Approach Fills and Excavations.
 6. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT

For

The Overhead Structure of Hwy. #53 and
Proposed Hwy. #403 District #4 Hamilton
W.O. 72-11044 W.P. 164-60-00

1. INTRODUCTION:

The Foundations Office was requested by Mr. S. Jants, Bridge Planning Technician, Southwestern Region, to carry out a foundation investigation at the site of the proposed crossing of Hwy. #53 and Hwy. #403, some 17.1 miles west of Brantford west limits. The request was dated March 1, 1972. The field and subsequent laboratory investigations were carried out under the supervision of this Office. Boreholes were located in the field and ground elevations at borehole locations were related to geodetic benchmarks by personnel of the Engineering Surveys Office, Southwestern Region.

Presented in this report are the results of the investigations, together with recommendations concerning foundations.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The proposed bridge site is located along existing Hwy. #53, some 2 miles south-east of the crossing of Hwys. #2 and 53. The immediate vicinity is relatively flat; the land is under cultivation, occupied by crops and pastures. Hwy. #53 has concrete pavement of 20 ft. width, the grade of the road at the proposed crossing is 1-2 feet higher than the general ground surface.

Geologically, the area belongs to the physiographic region known as the "Mount Elgin Ridges", consisting of a succession of ridges and vales. The ridges are morains of pale brown calcareous clay or silty clay, while in the vales it is common to find alluvium of gravel, sand or silt. The ridges are well drained, while poor drainage prevails in the hollows.

3. FIELD AND LABORATORY INVESTIGATIONS:

Some eight sampled boreholes and adjacent to B.H.'s 5 and 6, two dynamic cone penetration tests were carried out, during the course of the field work. Borings were placed at the locations of the proposed footings as shown on attached Drawing #72-11044A. The estimated stratigraphical sections through the locations of the abutments and the piers are also shown on the drawing. Samples were taken by means of split spoon samplers, which were driven to the soils according to the method called Standard Penetration Test. Penetration resistances (N= blows/ft.) together with the results of laboratory tests are recorded on the attached borelogs.

Upon recovery and again in the laboratory all the soil samples were examined and classified by using some simple routine tests.

Representative samples were further tested in the laboratory in order to determine natural moisture contents, Atterberg limits and grain-size characteristics of the various layers.

4. SUBSOIL CONDITIONS:

4.1) General:

Subsoil at the site from ground level downward was found to comprise of clayey silts, silts to sandy silts and sandy silts with clay and gravel (Glacial Till). Some minor variations of the stratigraphy were noted in the individual boreholes. A brief description of the deposits is as follows:

4.2) Clayey Silt with Some Sand and Traces of Gravel:

The uppermost deposit within a depth of 14-23 feet was identified to be clayey silt with some sand and traces of gravel, extending from ground level to elevation 922 feet-932 feet. The consistency of the surficial 5-6 feet of soils is firm to stiff, with penetration "N" values of 5 blows/ft. to 15 blows/ft.. Beneath this elevation the consistency increases rapidly; "N" values generally ranging from 20 blows/ft. to over 100 blows/ft.. The range of plastic limits was recorded to be from 15% to 19%, and liquid limits from 23% to 32%. The natural moisture contents lie at or below the plastic limits.

4.3) Silt to Sandy Silt Traces of Clay:

Underlying the clayey silts a 10-27 feet thick layer of silt to sandy silt was recorded, extending down to elevation 896 feet - 914 feet. This basically granular type material contains traces of clay particles, amounting some 5-8% of the total weight. The range of the constituent sand grains was measured to be 3% - 50% and those of silts 44% - 89%. Since this deposit is located totally under the groundwater level, some boiling in the borings was evident on account of the unbalanced hydrostatic heads. Due to this condition the obtained penetration "N" values were rather erratic, ranging from 1 blow/ft. to 89 blows/ft.. The very small values may safely be disregarded, because these are the results of the loosening effect of the upward water pressure in the boreholes. The natural moisture contents of the samples vary between 16% and 21%, occasionally reaching 30% by dry weight.

4.4) Sandy Silts with some Clay and Gravel (Glacial Till):

The silts were underlain by glacial tills, extending to the bottom of the borings, the deepest of which was 55 feet below ground level, terminating at elevation 890 feet. The glacial deposit was classified to be sandy silt with some clay and gravel. Due to the presence of 11-16% of clay, the material is essentially cohesive. Grain-size analyses performed on samples taken in this deposit yielded 5-10% gravel, 31-37% sand, 43-47% silt and 11-16% clay-size particles. The average plastic limit moisture content was found to be 12%, the liquid limit 15%, with 8-10% natural moisture within the samples tested. The over consolidated nature of the glacial till was further emphasised by the hard consistency, the majority of penetration "N" values being over 100 blows/ft..

4.5) Groundwater Conditions:

Very high water levels were encountered in every borehole as shown on the borelog sheets. Groundwater was usually first observed around elevation 938 - 940 feet, some 6 - 8 feet below ground surface. Waterlevels, however, have further risen in the open boreholes, and stabilized at some 1-2 feet below ground level, within a few days. It is assumed that the noted water level was near the yearly high water table of this area.

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

It is proposed to build a twin-overpass structure at the crossing of future Hwy. #403, Line D and Hwy. #53 in the Township of East Oxford. The bridge is planned to have three spans, the end spans being 80 feet long with a 113.5 feet long central span. It is postulated that perched abutments will be constructed. The grade of proposed Hwy. #403, at the crossing will be roughly at elevation 569 feet, some 20 - 21 feet above the existing grade of Hwy. #53.

The foundation investigation revealed a soil stratigraphy, consisting of a surficial stratum of clayey silts with firm to hard consistency, followed by silts to sandy silts, which in turn is underlain by hard glacial tills.

5.2) Foundations:

Beneath the uppermost 5 - 6 feet layer the very stiff to hard clayey silts were found to possess sufficient shear strength to support the proposed bridge on spread footings. Foundations under the piers as well as under the abutments may consequently be designed with spread footings. Footings should be placed at or below elevation 940 feet, using design loads up to 3 TSF on the footing bases. A minimum cover of 4 feet should be provided for frost protection.

Alternatively, the perched abutments, or if desired, the piers as well as the abutments can be designed to be supported on end-bearing piles, driven into the hard glacial till. The use of steel H piles appears to be the most economical. Piles should be driven according to Standard BD-82-7 using the appropriate design load. It is estimated that at the locations of the east abutments and east piers safe loads equal to the structural strength of the particular pile used will be reached by driving the piles to elevation 890 - 895 feet.

Under the west abutments and the west piers above bearing capacities may be reached by driving the piles to approximate elevation 900 feet. Pile caps at the abutment locations may be poured within the approach fills. In this case no bouldery material should be used for the fills at these locations, to facilitate pile driving through the

embankments. At the pier locations pile caps should be placed 4 feet below finished ground level.

5.3) Approach Fills and Excavations:

No stability problems are foreseen for the approach fills, provided that they are built with 2 horizontal to 1 vertical slopes.

No special dewatering scheme will likely be necessary for the footing excavations, since the clayey silts have sufficient cohesive strength to resist quick conditions, when excavated below groundwater level. Seepage water in the excavations may be handled by conventional open pumping. If the excavations remain open for some time, a lean concrete working slab might be necessary at the bottom of the excavations to prevent the soils from softening.

6. MISCELLANEOUS:

The field work carried out during the period of March 29 - April 12, 1972 was supervised by Mr. J. Bangs, Project Foundations Engineer.

Equipment used was owned and operated by P.V.K. Drilling Company, Burford, Ontario.

This report was written by Mr. A. K. Barsvary, Senior Foundations Engineer and reviewed by Mr. K. G. Selby, Supervising Foundations Engineer.

A. K. Barsvary

A. K. Barsvary, P. Eng.



K. G. Selby

K. G. Selby, P. Eng.

AKB/ht

June 6, 1972.

APPENDIX I

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 72-11044

LOCATION Sta. 114 + 77, 91 Ft. Rt. of ϕ Hwy. 53

ORIGINATED BY W.V.

W.P. 164-60-00

BORING DATE April 12, 1972

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

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		SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							○ UNCONFINED	● QUICK TRIAXIAL	+ FIELD VANE	x LAB. VANE	w_p	w	w_L		
945.7	Ground level.														
0.0	Clayey silt.		1	SS	12	940									3 4 53 40
	Traces of sand and gravel.		2	SS	28										
			3	SS	17										
			4	SS	38										
	Stiff to hard.		5	SS	65										
			6	SS	45		930								
	Greyish brown.		7	SS	41										
922.7			8	SS	36	920									0 50 44 6
23.0	Silty sand to sandy silt, traces of clay.		9	SS	26										
	Stiff to hard.		10	SS	89	910									
	Grey.		11	SS	26										
			12	SS	20	900									
			13	SS	16										
895.7			14	SS	100	8"									10 31 43 16
50.0	Sandy silt with clay and gravel. Hard.														
890.7	Glacial Till.														
55.0	End of borehole.														

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 72-11044

LOCATION Sta. 112 + 70, 76 Ft. Rt. of Ø Hwy. 53

ORIGINATED BY J.B.

W.P. 164-60-00

BORING DATE April 11, 1972

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

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		SHEAR STRENGTH P.S.F.					WATER CONTENT %				
												w_p — w — w_L				
946.6	Ground level.															
0.0	Clayey silt with traces of sand and gravel.		1	SS	5											3 9 53 35
	Firm to hard.		2	SS	20											
	Greyish brown.		3	SS	49											
			4	SS	85											
			5	SS	74											
			6	SS	34											
			7	SS	20											
926.6																
20.0	Silt to sandy silt.		8	SS	11										0 11 84 5	
	Traces of clay.															
	Stiff to hard.		9	SS	10											
			10	SS	30											
911.6																
35.0	Sandy silt with clay and gravel.		11	SS	36											
	Glacial Till.															
	Hard.		12	SS	100/8"											
898.5			13	SS	100/9"	900										
48.1	End of borehole.															

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

DESIGN SERVICES BRANCH

JOB 72-11044

LOCATION Sta. 114 + 41, 37 Ft. Rt. of Ø Hwy. 53

ORIGINATED BY J.B.

W.P. 164-60-00

BORING DATE April 7 - 10, 1972

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger.

CHECKED BY

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 GR. SA. SI. CL.
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.						WATER CONTENT %				
							○ UNCONFINED			+ FIELD VANE			w_p — w — w_L				
						● QUICK TRIAXIAL			x LAB. VANE			10 20 30					
945.8	Ground level.																
0.0	Clayey silt some sand		1	SS	5											0 21 57 22	
	Firm to hard.		2	SS	21												
	Greyish brown.		3	SS	51												
			4	SS	40												
			5	SS	30												
929.3			6	SS	12												
16.5	Silt to sandy silt.		7	SS	11												
	Traces of clay.																
	Stiff to hard.		8	SS	15												
915.8			9	SS	30											0 3 89 8	
30.0	Sandy silt with clay and traces of gravel.		10	SS	29												
	Glacial Till.		11	SS	28												
	Very stiff to hard.		12	SS	33												
	Grey.		13	SS	100/8"											5 37 47 11	
892.8			14	SS	100/7"												
53.0	End of borehole.																


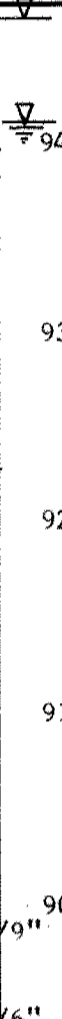

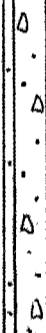
DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 72-11044 LOCATION Sta. 112 + 59, 29 Ft. Rt. of \varnothing Hwy. 53 ORIGINATED BY J.B.
 W.P. 164-60-00 BORING DATE April 6, 1972 COMPILED BY A.K.B.
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

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		SHEAR STRENGTH P.S.F.					WATER CONTENT %					
												w_p	w	w_L			
946.9	Ground level.																
0.0	Clayey silt with some sand and traces of gravel. Firm to hard. Greyish brown.		1	SS	7											6 13 55 26	
			2	SS	15												
			3	SS	28												
			4	SS	31												
			5	SS	41												
			6	SS	33												
			7	SS	27												
			8	SS	24												
921.9	Silt to sandy silt. Traces of clay. Very stiff to soft.																
25.0			9	SS	25												
911.9			10	SS	5												
35.0	Sandy silt with some clay and gravel. Glacial Till. Very stiff to hard.																
			11	SS	24												
			12	SS	33												
			13	SS	100/9"												
893.9			14	SS	100/6"												
53.0	End of borehole.																

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 72-11044

LOCATION Sta. 116 + 12, 30 Ft. Lt. of E Hwy. 53

ORIGINATED BY J.B.

W.P. 164-60-00

BORING DATE March 29, 1972

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

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		SHEAR STRENGTH P.S.F.					WATER CONTENT %				
							20	40	60	80	100					
945.4	Ground level.															
0.0	Clayey silt with some sand & traces of gravel.		1	SS	16											
			2	SS	35											
			3	SS	59											
	Stiff to hard.		4	SS	100											
	Greyish brown.		5	SS	100/9"											
			6	SS	118											
			7	SS	25											
922.9			8	SS												
22.5	Sandy silt with traces of clay.		9	SS	13											
	Stiff to hard.		10	SS	59											
910.4																
35.0	Sandy silt with some clay & gravel.		11	SS	100/9"											
	Glacial Till.															
902.7	Hard.		12	SS	100/3"											
42.7	End of borehole.															

20
15-5 % STRAIN AT FAILURE
10

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 6

FOUNDATION SECTION

JOB 72-11044

LOCATION Sta. 114 + 24, 41 Ft. Lt. of \angle Hwy. 53

ORIGINATED BY J.B.

W.P. 164-60-00

BORING DATE March 30, 1972

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80		
945.8	Ground level.											
0.0	Clayey silt with some sand and traces of gravel. Firm to hard. Greyish brown.		1	SS	7							
			2	SS	12							
			3	SS	37							
			4	SS	61							
			5	SS	30							
929.8			6	SS	35							
16.0	Silt to sandy silt. Traces of clay. Very stiff to hard.		7	SS	24							
			8	SS	28							
			9	SS	35							
			10	SS	23							
907.8			11	SS	29							
38.0	Sandy silt with clay and gravel.											
901.8	Glacial Till.											
44.0	End of borehole.											

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 72-11044

LOCATION Sta. 115 + 94, 80 Ft. Lt. of \angle Hwy. 53

ORIGINATED BY J.B.

W.P. 164-60-00

BORING DATE April 5, 1972

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

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		SHEAR STRENGTH P.S.F.						WATER CONTENT %				
							<div><div>○ UNCONFINED</div><div>● QUICK TRIAXIAL</div><div>+ FIELD VANE</div><div>x LAB. VANE</div></div>						<div><div>w_p</div><div>w</div><div>w_L</div></div>				
945.7	Ground level.																
0.0	Clayey silt with some sand, traces of gravel.		1	SS	12												
			2	SS	20												
	Stiff to hard.		3	SS	58												
			4	SS	44												
	Greyish brown.		5	SS	60												
			6	SS	21												
927.7			7	SS	4												
18.0	Silt to sandy silt. Traces of clay.		8	SS	1												
	Very soft to firm.		9	SS	7												
914.7																	
31.0	Sandy silt with sand and gravel.		10	SS	100/8"												
	Glacial Till. Hard.		11	SS	100/9"												
	Greyish brown.		12	SS	100/7"												
902.6																	
43.1	End of borehole.																

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 72-11044

LOCATION Sta. 113 + 87, 92 Ft. Lt. of E Hwy. 53

ORIGINATED BY J.B.

W.P. 164-60-00

BORING DATE April 4, 1972

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

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	SHEAR STRENGTH P.S.F.	WATER CONTENT %			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE	w_p	w	w_L		
946.1	Ground level.										
0.0	Clayey silt with traces of sand and gravel.		1	SS	7						
	Firm to hard.		2	SS	10						
	Greyish brown.		3	SS	61						
			4	SS	54						
932.1			5	SS	55						
14.0	Sandy silt, traces of clay.		6	SS	21						
	Stiff to hard.		7	SS	31						
			8	SS	15						
			9	SS	12						
911.1			10	SS	54						
35.0	Sandy silt, some clay and gravel.		11	SS	100/10"						
	Glacial Till. Hard.		12	SS	100/8"						
897.1	Greyish brown.		13	SS	100						
49.0	End of borehole.										

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H.		SAMPLE ADVANCED HYDRAULICALLY
	P.M.		SAMPLE ADVANCED MANUALLY

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL 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

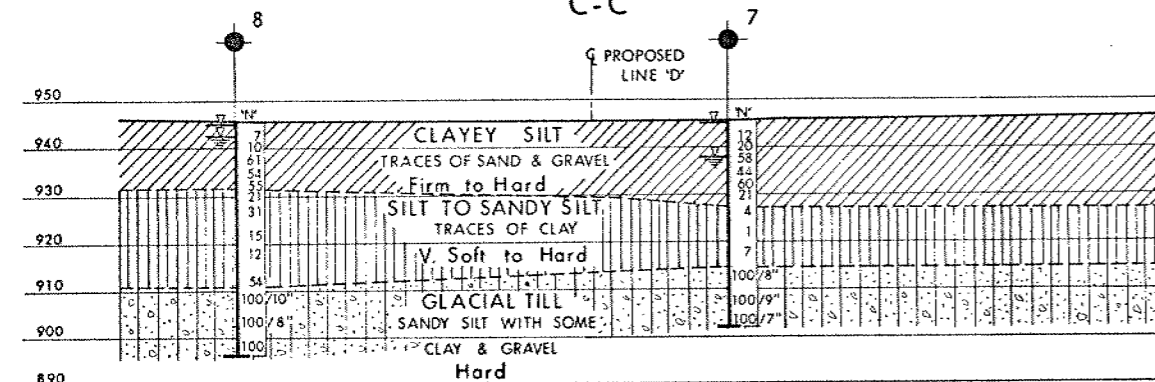
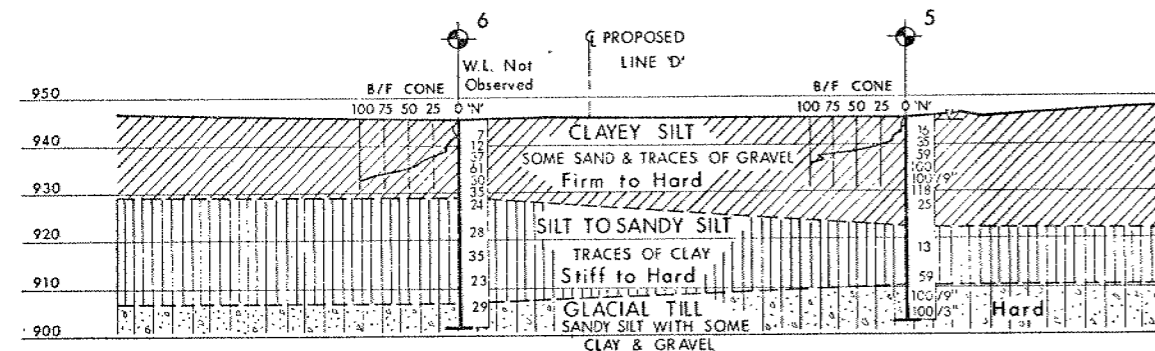
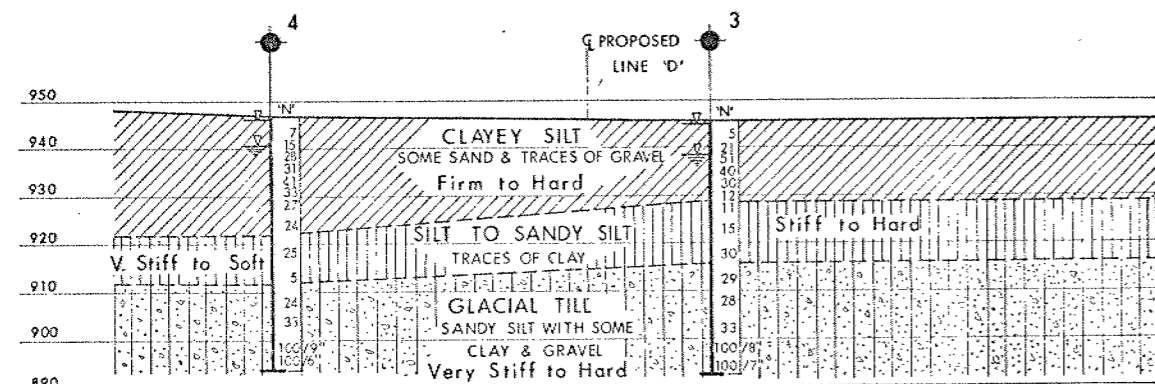
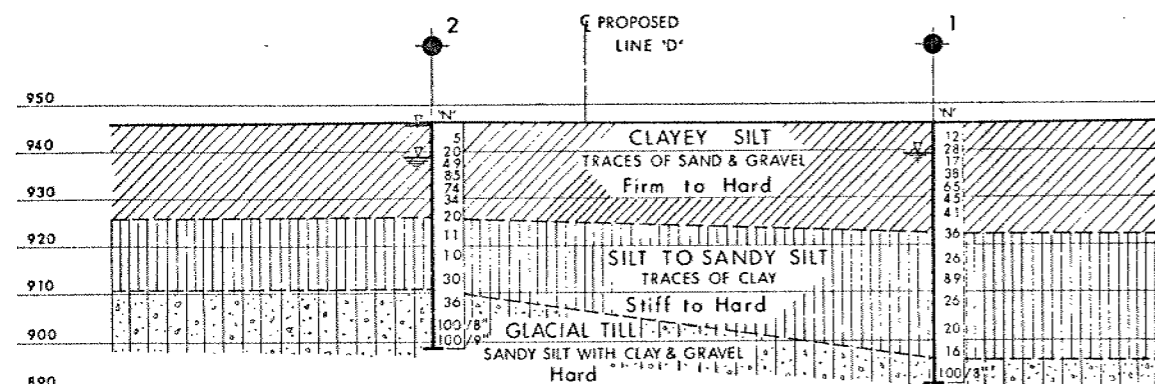
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

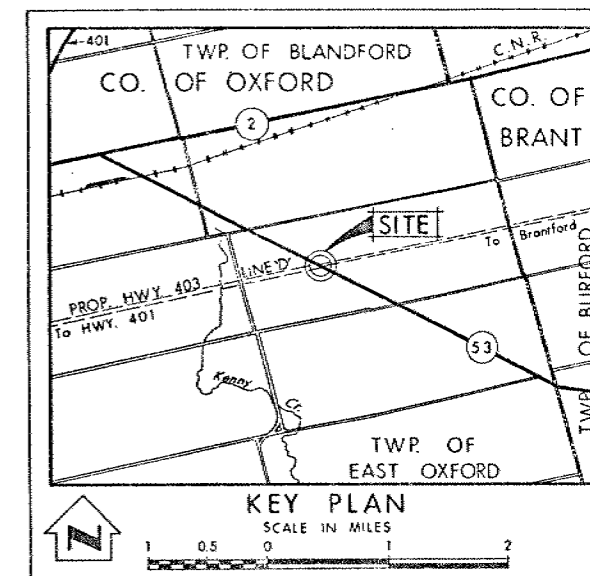
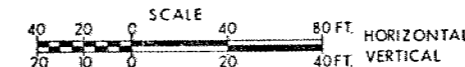
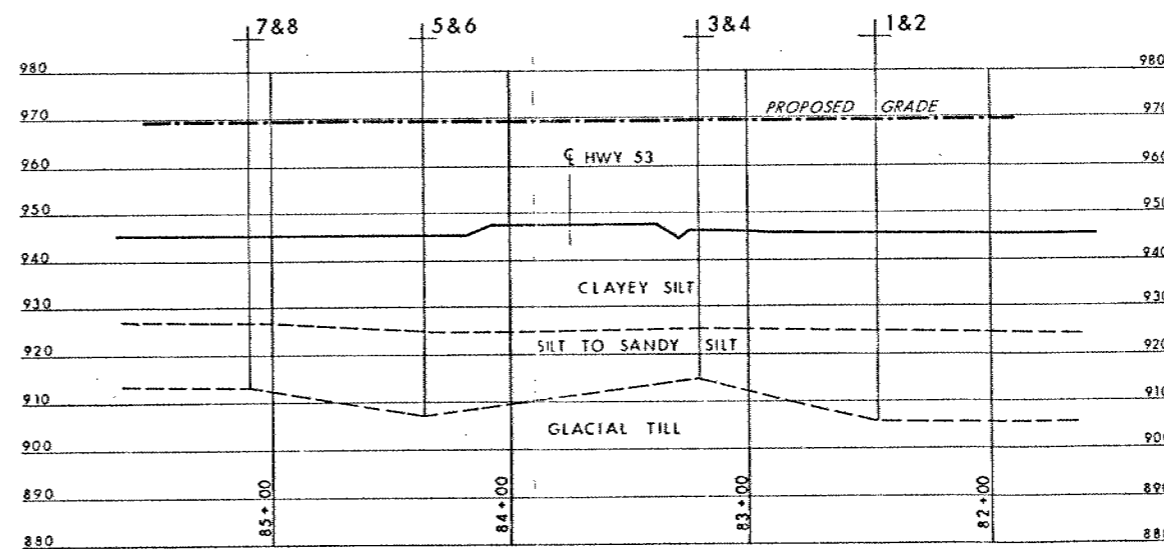
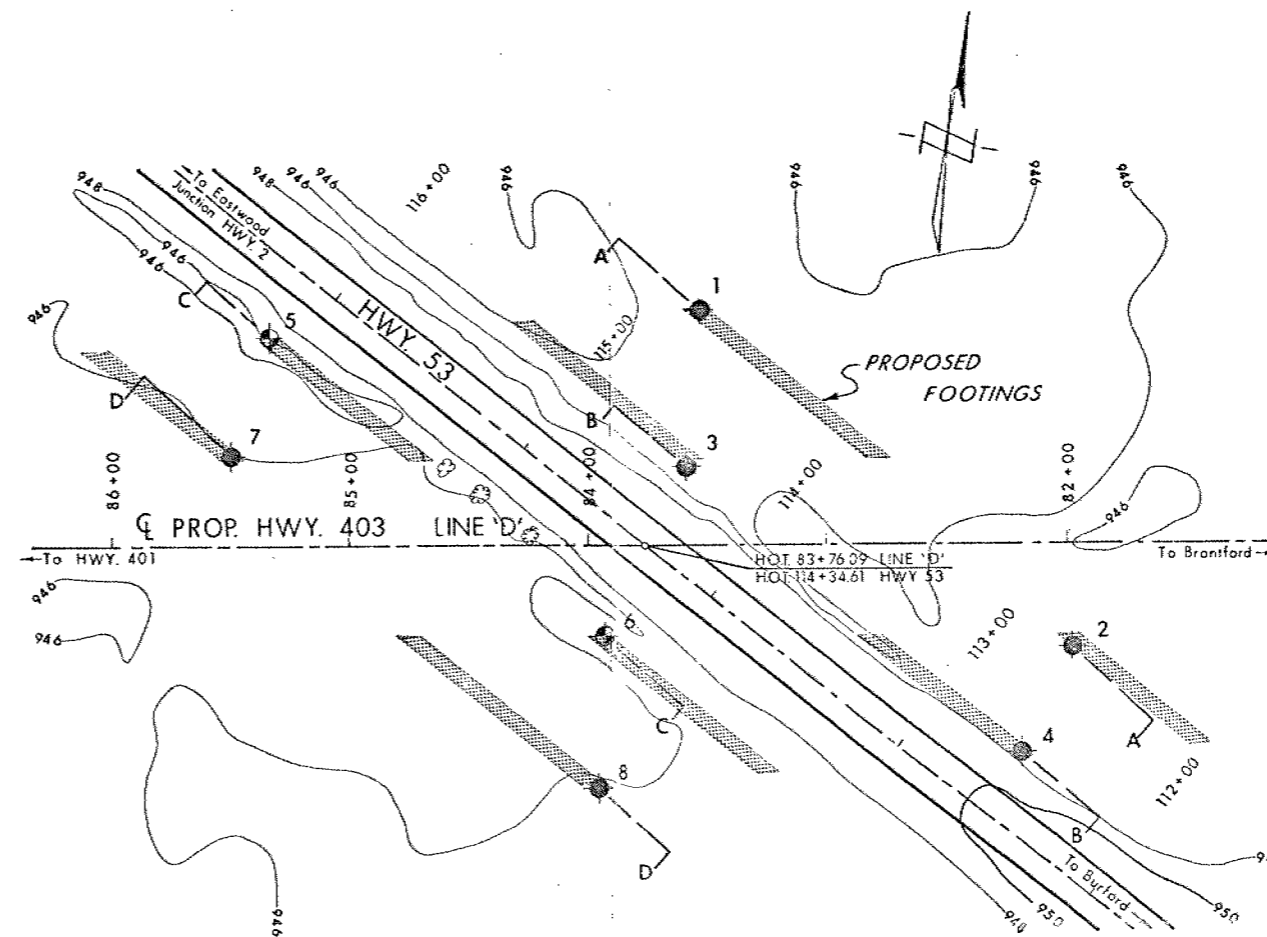
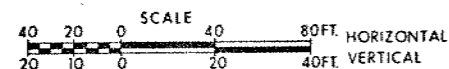
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

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



SECTIONS



LEGEND

Bore Hole

Cone Penetration Test

Bore Hole & Cone Test

Water Levels established at time of field investigation.

HEAD

Artesian Water

APRIL, 1972

ENCOUNTERED

NO.	ELEVATION	STATION	HWY 53 OFFSET
1	945.7	114 + 77	91' RT.
2	946.6	112 + 70	76' RT.
3	945.8	114 + 41	37' RT.
4	946.9	112 + 59	29' RT.
5	945.4	116 + 12	30' LT.
6	945.8	114 + 24	41' LT.
7	945.7	115 + 94	80' LT.
8	946.1	113 + 87	92' LT.

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION & COMMUNICATIONS DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE			
HIGHWAY 53			
HIGHWAY NO. 403 LINE 'D'		DIST. NO. 4	
CO. OXFORD		TWP. EAST OXFORD	
LOTS 4 & 5		CON. 2	
BORE HOLE LOCATIONS & SOIL STRATA			
SUBMD. A, B	CHECKED <input checked="" type="checkbox"/>	W.P. NO. 164-60-00	DRAWING NO.
DRAWN O.E.	CHECKED <input checked="" type="checkbox"/>	JOB NO. 72-11044	72-11044A
DATE	JUNE 9, 1972	S.T.E. NO.	BRIDGE DRAWING NO.
APPROVED	<i>William</i>	CONT. NO.	

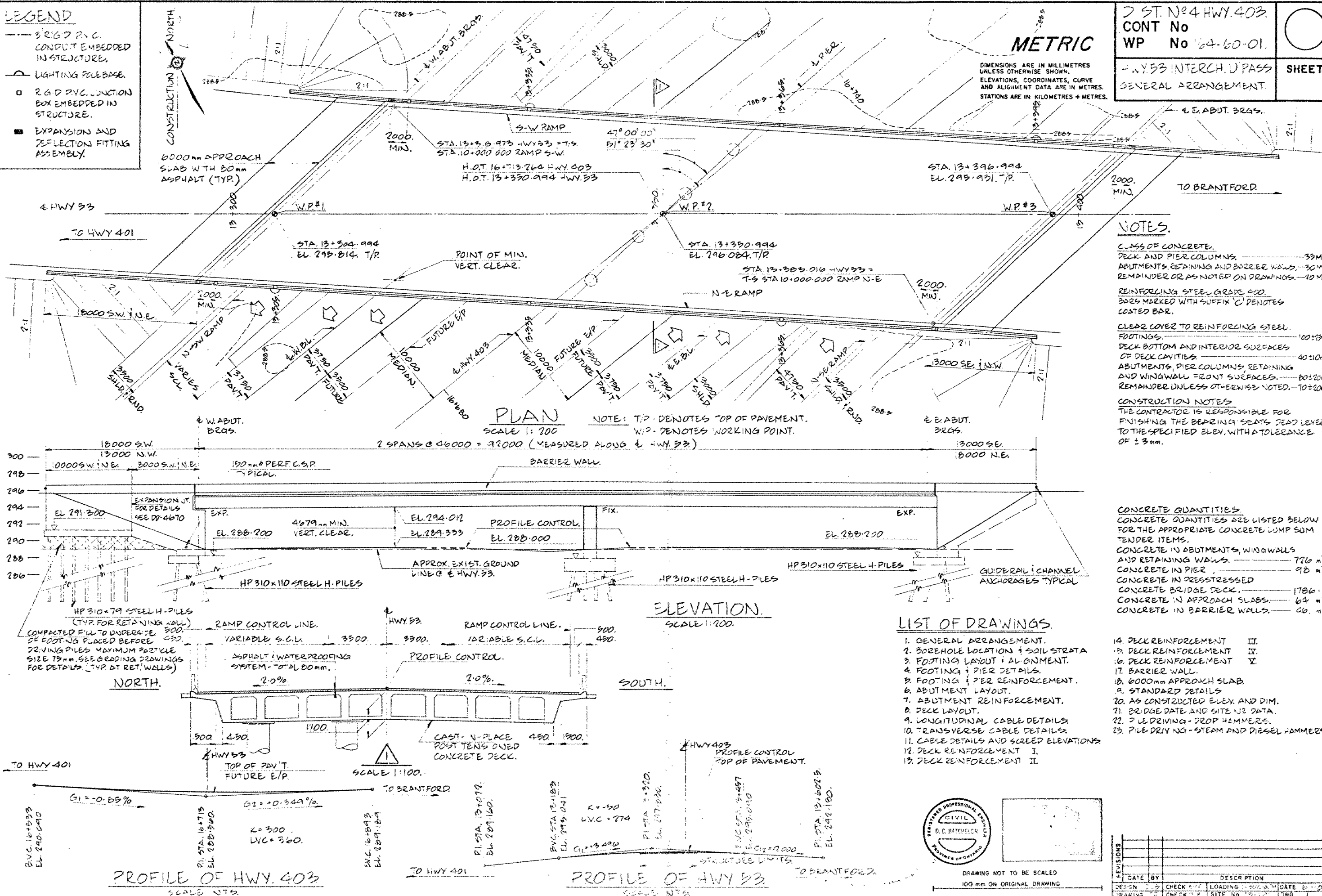
- LEGEND**
- 3" RIGID P.V.C. CONDUIT EMBEDDED IN STRUCTURE.
 - LIGHTING POLE BASE.
 - 2" RIGID P.V.C. JUNCTION BOX EMBEDDED IN STRUCTURE.
 - EXPANSION AND DEFLECTION FITTING ASSEMBLY.

METRIC

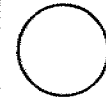
DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN. ELEVATIONS, COORDINATES, CURVE AND ALIGNMENT DATA ARE IN METRES. STATIONS ARE IN KILOMETRES + METRES.

2 ST. N^o 4 HWY. 403
CONT No
WP No 164-60-01.
HWY 53 INTERCH. U PASS
GENERAL ARRANGEMENT.

SHEET



DIST. NO 4 HWY 403
CONT No
WP No 64-60-01

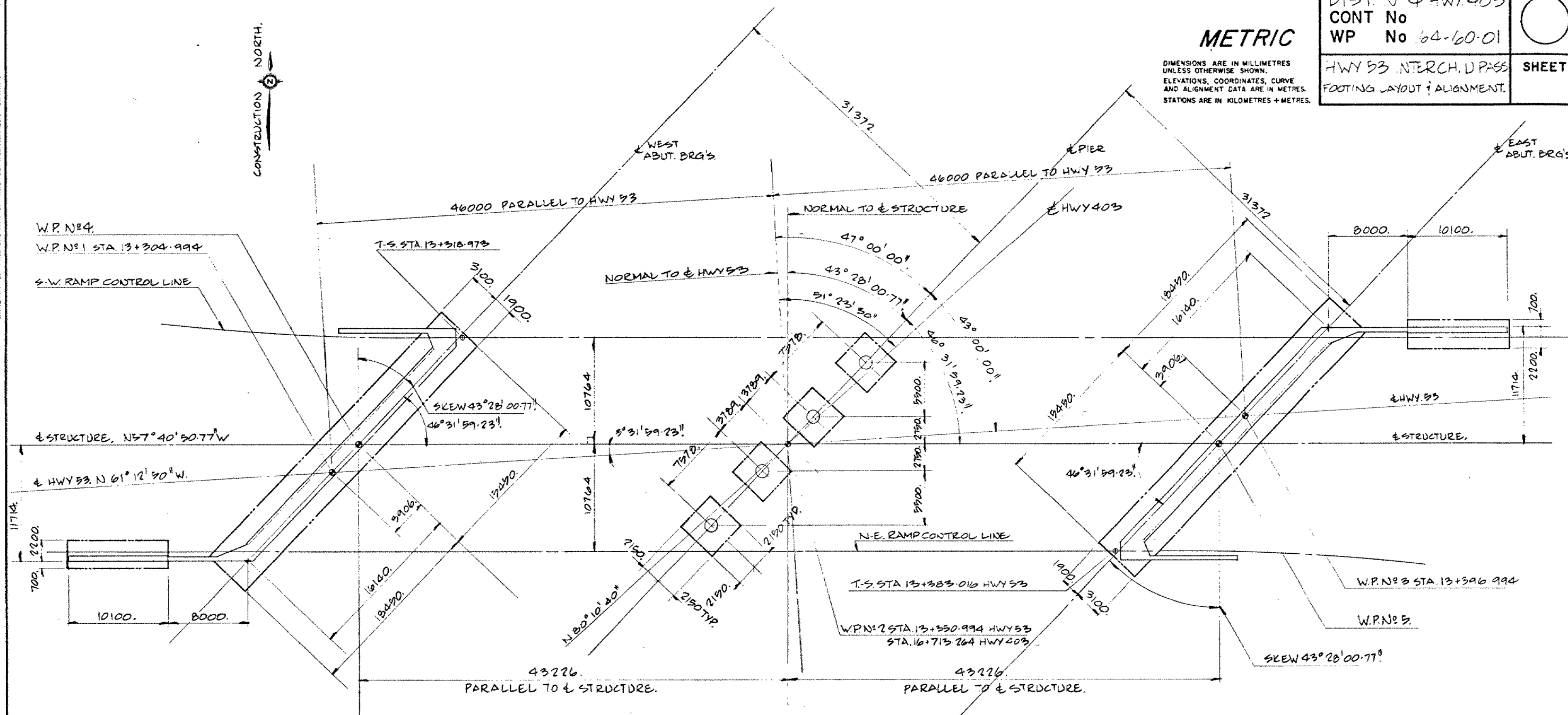


HWY 53 INTERCH. D PASS
FOOTING LAYOUT & ALIGNMENT.

SHEET

METRIC

DIMENSIONS ARE IN MILLIMETRES
UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE
AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.



PLAN

SCALE 1:200.

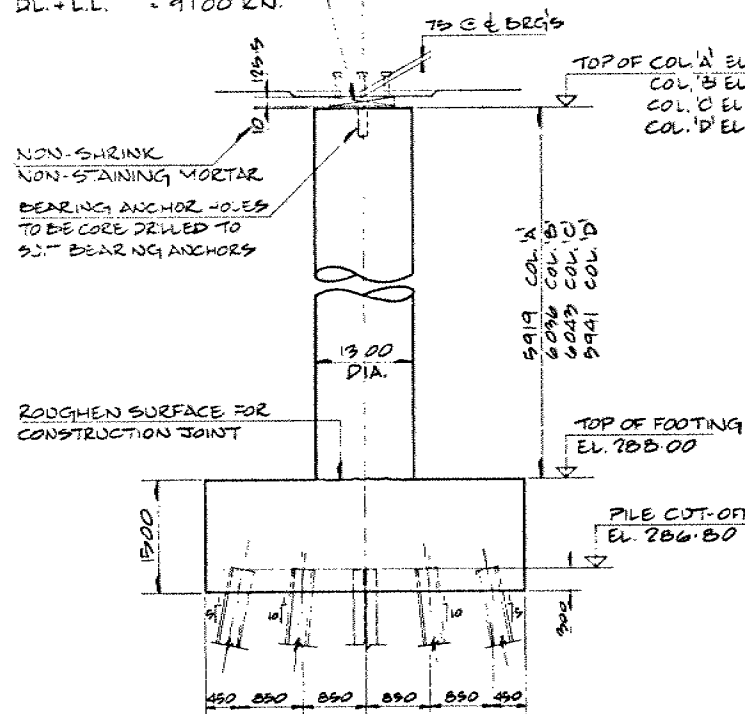
SKEW 43° 28' 00.77"	
SIN. —	0.687935.
COS. —	0.723777.
TAN. —	0.947867.



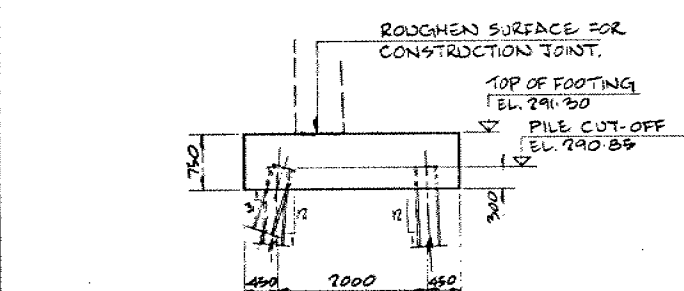
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN			
CHECK			
DRAWING			

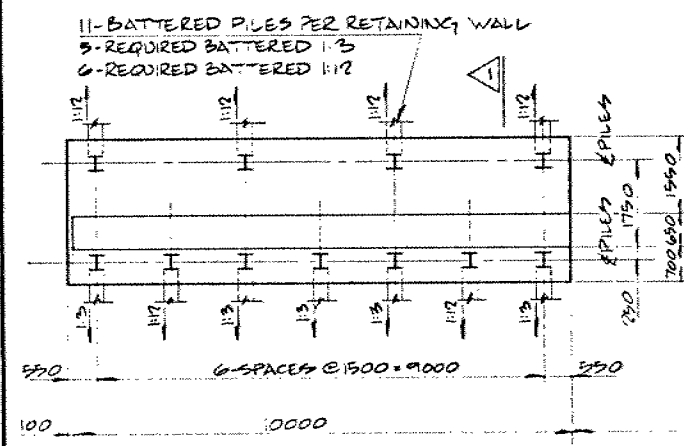
FIXED BEARING, WABO-TYPE
35-2100 OR APPROVED EQUAL
4- REQUIRED
DEAD LOAD = 7330 KN
DL+LL = 9100 KN



SCALE 1:50

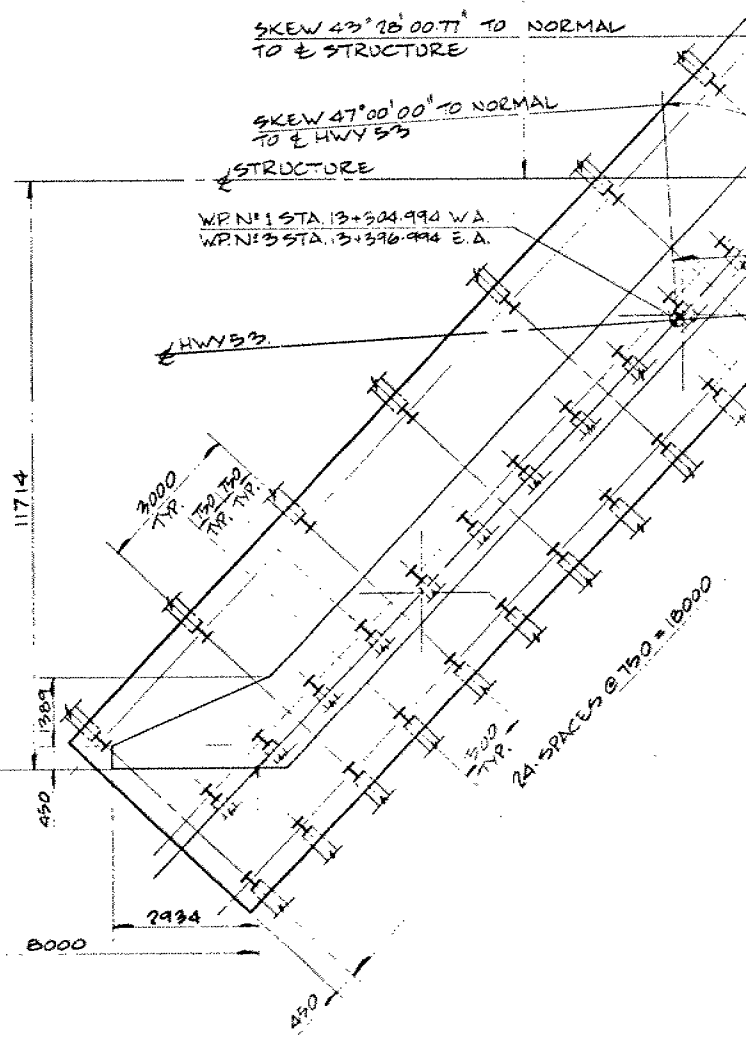


SCALE 1:50

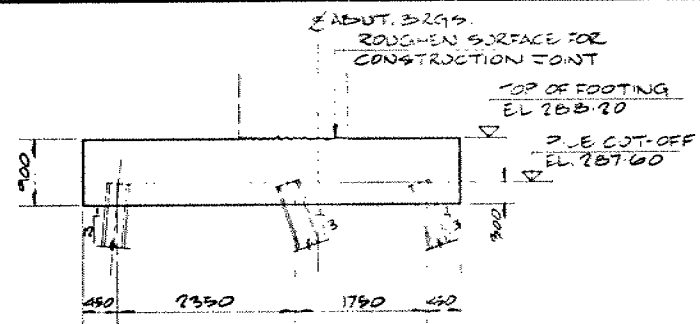


RETAINING WALL FOOTING LAYOUT
SCALE 1:75

LOCATION	N°	LENGTH
WEST ABUTMENT		
1:3	45	11250
1:12	12	10750
RETAINING WALL		
1:3	5	14750
1:12	6	14000
PIER		
1:5	32	14750
1:10	16	14000
EAST ABUTMENT		
1:3	45	14500
1:12	12	13750
RETAINING WALL		
1:3	5	18000
1:12	6	17000



ABUTMENT FOOTING LAYOUT
SCALE 1:75



SCALE 1:50

PIER FOOTING LAYOUT
SCALE 1:75

METRIC

DIMENSIONS ARE IN MILLIMETRES
UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE
AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.

DIST. N° 4 HWY 403
CONT No
WP No 164-60-01

HWY 53 INTERCH. D.PASS
FOOTING & PIER DETAILS



SHEET

OUTER PILES BATTERED 1:3
B-REQUIRED PER PIER
INNER PILES BATTERED 1:10
4-REQUIRED PER PIER

- NOTES
- PILE DATA
 - PILES FOR ABUTMENTS AND PIERS SHALL BE HP310x110 STEEL H-PILES
 - PILES FOR N.E. & S.W. RETAINING WALL SHALL BE HP310x79 STEEL H-PILES
 - PILE LENGTH SHOWN ON THE DRAWING IS THE THEORETICAL LENGTH BELOW CUT-OFF
 - DRIVING SHOES TO BE PROVIDED ON ALL PILES IN ACCORDANCE WITH STANDARD DD 3301.

PILE DESIGN DATA

HP310x110 DESIGN LOAD AT SLR TYPE II = 9000 KN
FACTORED CAPACITY AT ULS = 16000 KN

HP310x79 DESIGN LOAD AT SLR TYPE II = 6500 KN
FACTORED CAPACITY AT ULS = 11500 KN

PILE CONSTRUCTION DATA

PILES TO BE DRIVEN IN ACCORDANCE WITH STANDARD SS 03-10 OR SS 103-11 USING AN ULTIMATE CAPACITY OF 7700 KN PER PILE FOR HP310x110 PILES AND 19500 KN PER PILE FOR HP310x79 PILES, BUT MUST BE DRIVEN BELOW,

EL. 277.0 FOR WEST ABUTMENT AND S.W. RETAINING WALL,
EL. 273.0 FOR THE PIERS AND
EL. 274.0 FOR THE EAST ABUTMENT AND N.E. RETAINING WALL.



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION

FOUNDATIONS OFFICEREVIEW OF DESIGN DRAWINGS:

W.P. ..164-60-01.....

W.O.

Foundation Report By:

...AKB. & P.P.....

Review of Design Drawings By:

...P.P.....

Design Drawing No.'s:

...#1 #3 #4.....

1. Does footing design comply with our report or subsequent memos? YES
2. If answer to 1. is No, is present design acceptable? —
3. Has sufficient field work been done? YES
4. Are estimated pile lengths shown on Drawings correct? YES
If not, make a new list.
5. If excavation of unsuitable soil is recommended, is this shown on Drawings? —
6. Are approaches designed in accordance with our report? Check slopes and berm lengths. YES
7. Do you anticipate any construction problems?
i.e., dewatering, stability of temporary slopes or excavations. No.
8. Summarize your comments; on separate sheet if necessary.

No comments!

Drawings Received19.....
 Reviewed ...Jan. 6...1982

SignedP. Bayl.....

memorandum



To: Mr. V.F. Boehnke
Head, Structural Section
Southwestern Region Attention: S. Jants

Date: 1981 05 01

From: Pavement & Foundation Design Section
Room 313, Central Building

Re: Hwy. #53 Interchange
W.P. 164-60-00; Site 23-291
Hwy. #403, District #4 (Hamilton)

Introduction

In response to your request of 81 02 11 we have reviewed our original foundation investigation report, W.O. 72-11044 (issued on June 19, 1972), in which the recommendations were related to overpass twin-structures. Since that time, the original proposals have been changed to a three-span, single underpass structure. This new proposal also includes the construction of retaining walls adjacent to the four corners of the future structure. In light of this new proposal our recommendations (metric) are as follows.

Structure Foundations

The entire structure (abutments, pier and retaining walls) may be supported on spread footing type foundations placed at or below El. 286. For design purposes a safe design load of 450 kPa may be assumed. The anticipated settlement of the footings under such a loading is about 30 mm.

As an alternative the footings may be supported on end-bearing steel 'H' piles driven into the very stiff to hard glacial till stratum. For HP 310 x 110 steel 'H' piles with reinforced tips, the maximum permissible load is 1100 kN. The piles should be driven to the following minimum levels:

West abutment and adjacent retaining walls: El. 277 \pm
Pier: El. 273 \pm
East Abutment and Adjacent retaining walls: El. 274 \pm

The pile driving should be in accordance with M.T.C. Standards SS 103-11 or SS 103-10. The driving energy should not be less than 50,000 Joules per blow.

continued...../2

Approach Embankments

Fills up to 7.5 metres are required to attain the proposed profile grade (El. 296.5) of Hwy. #53 at this location. No stability problems are anticipated for fills of this height provided with 2:1 forward and side slopes. Long term settlement of the cohesive portion of the subsoil induced by the construction of the approach fills is estimated to be in the range of 25-30 mm.

The fill should consist of well compacted acceptable material. Care should be taken that no material having grain sizes larger than 75 mm is placed at locations where piles have to be driven.

Other Considerations

The frost protection requirements in this area is 1.2 m of earth cover.

In order to estimate the earth pressures on the abutment walls, the following values are recommended:

Unit weight of granular backfill: 21.2 kN/m^3
Coefficient of active earth pressure : $K_a = 0.35$
Coefficient of earth pressure at rest: $K_o = 0.5$

A suitable drainage system should be provided to relieve the build-up of excess hydrostatic pressure behind the walls.


Should spread footing type supports be selected, the base of the excavations should be protected against softening by pouring an approximate 15 cm thick lean concrete immediately upon exposure.

A shearing resistance value of 50 kPa against sliding is assumed to apply between the base of footings and the cohesive (silty clay) subsoil.

Miscellaneous

A revised, new metric drawing and foundation investigation report will be prepared for contract purposes.

Should additional information be required please contact our Office.


P. Payer

Foundations Engineer

For: K.G. Selby

Senior Foundations Engineer

PP:ea

cc: S.C. Grebski

PILE INFORMATION TO BE ADDED TO DWG - 4, "FOOTING AND PIER DETAILS"
 HWY 53 INTERCHANGE U'PASS, HWY 403, WP 164-60-01 SITE 23-291

PILE DATA

- PILES FOR ABUTMENTS AND PIER SHALL BE HP 310x110 STEEL H-PILES.
- PILES FOR N.E. & S.W. RETAINING WALLS SHALL BE HP 310x79 STEEL H-PILES.
- PILE LENGTH SHOWN ON THE DRAWING, IS THE THEORETICAL LENGTH BELOW CUT-OFF.
- DRIVING SHOES TO BE PROVIDED ON ALL PILES IN ACCORDANCE WITH STANDARD DD 3301.

PILE DESIGN DATA

HP 310x110 { DESIGN LOAD AT S.L.S. TYPE II = 900.0 KN
 FACTORED CAPACITY AT U.L.S. = 1600.0 KN

HP 310x79 { DESIGN LOAD AT S.L.S. TYPE II = 650.0 KN
 FACTORED CAPACITY AT U.L.S. = 1150.0 KN

PILE CONSTRUCTION DATA

PILES TO BE DRIVEN IN ACCORDANCE WITH STANDARD
 SS 103-10 OR SS 103-11 USING AN ULTIMATE CAPACITY OF
2700.0 KN PER PILE FOR HP 310x110 PILES AND
1950.0 KN PER PILE FOR HP 310x79 PILES, BUT
 MUST BE DRIVEN BELOW,

EL. 277.0 FOR THE WEST ABUTMENT
 AND S.W. RETAINING WALL,
 EL. 273.0 FOR THE PIER AND
 EL. 274.0 FOR THE EAST ABUTMENT
 AND N.E. RETAINING WALL.

Earth pressure should be calculated as per Subsection 6.6.1.2.2
 of the OHBDC.

D. H. Dundas

81 10 23

