DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 80M12-195

DIST. 6 REGION

W.P. No. 103-69-17

CONT. No. 87-75

W. O. No.

STR. SITE No. 24-81-313

HWY. No. 410

LOCATION Etobicoke Creek

N.B. Struct. Widening

No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

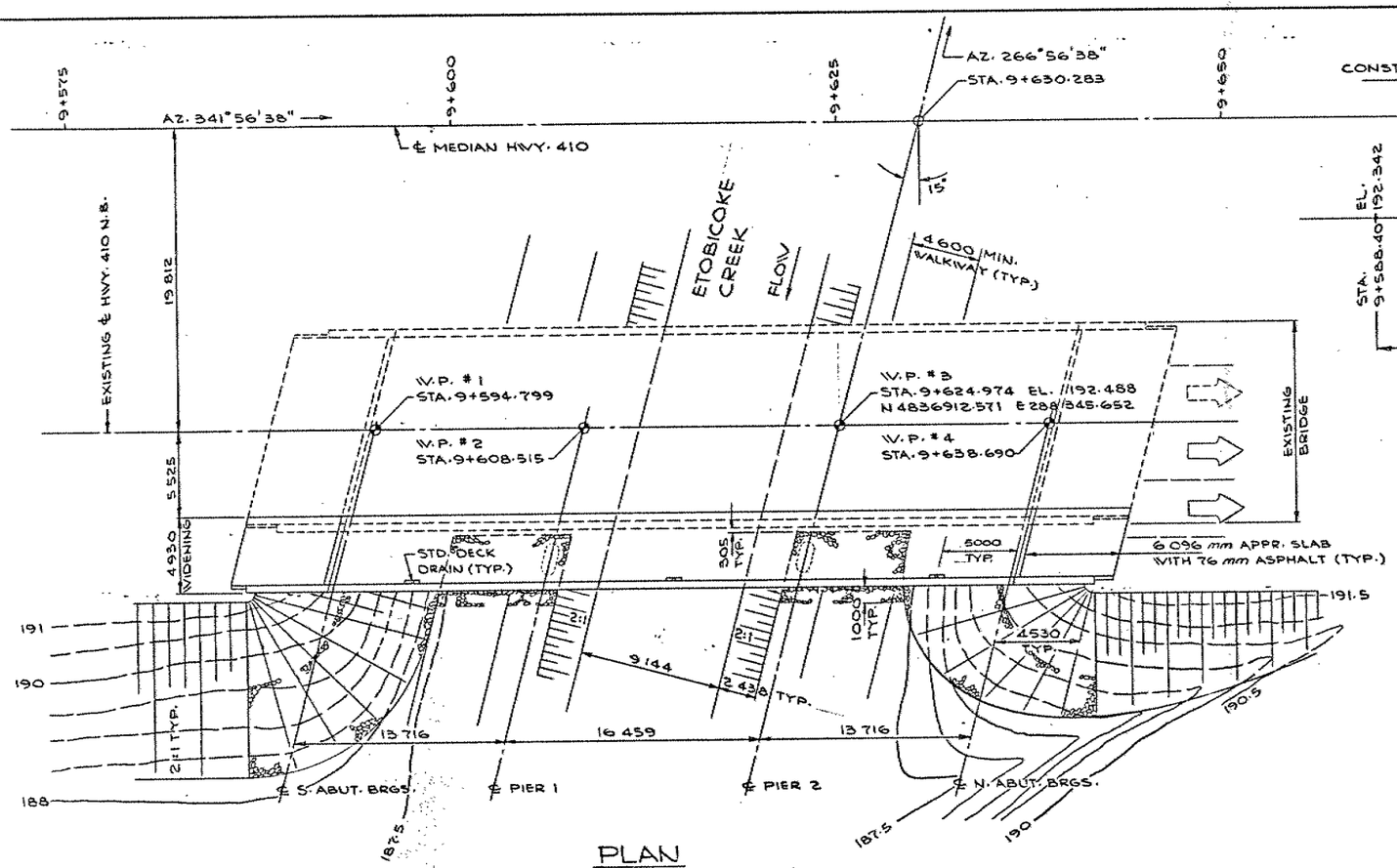
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

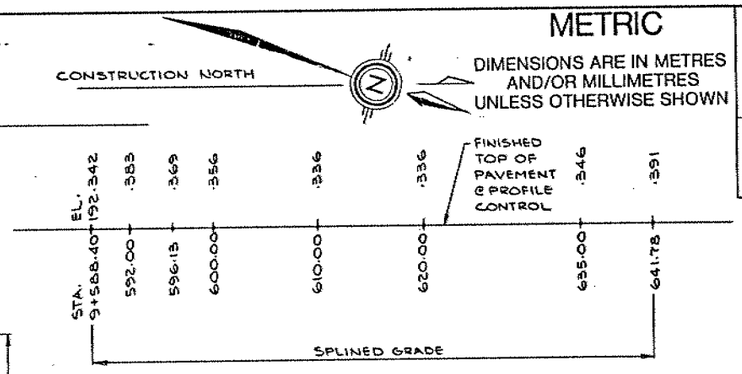
DIST. No 6
CONT No
WP No 103-69-17

ETOBICOKE CK. BRIDGE
N.B. STRUCTURE WIDENING
GENERAL ARRANGEMENT

SHEET



PLAN
1:200



PROFILE OF HWY. 410 N.B.
N.T.S.

LIST OF DRAWINGS

R1-1 GENERAL ARRANGEMENT
R1-2 BOREHOLE LOCATION & SOIL STRATA
R1-3 REMOVALS
R1-4 FOUNDATION WIDENING
R1-5 PIER WIDENING
R1-6 SOUTH ABUTMENT
R1-7 NORTH ABUTMENT
R1-8 PRESTRESSED GIRDERS & BEARINGS
R1-9 DECK DETAILS & REINFORCING
R1-10 BARRIER WALL WITH RAILING
R1-11 APPROACH SLAB WIDENING
R1-12 JOINT ANCHORAGE AND ARMOURING
R1-13 RAILING FOR BARRIER WALL
R1-14 BRIDGE DATE & SITE NUMBER DATA
R1-15 STANDARD DETAILS
R1-16 AS CONSTRUCTED ELEV. & DIM.
R1-17 QUANTITIES-I
R1-18 QUANTITIES-II

GENERAL NOTES

CLASS OF CONCRETE

MASS CONCRETE	: 20 MPa
ABUTMENT FOOTINGS	: 20 MPa
PIER FOOTINGS	: 30 MPa
ABUTMENTS & WINGWALLS	: 30 MPa
PIERS	: 30 MPa
PRESTRESSED GIRDERS	: 40 MPa
DECK	: 30 MPa
BARRIER WALL	: 30 MPa
APPROACH SLABS	: 30 MPa

CLEAR COVER TO REINF. STEEL

FOOTINGS	: 100 ± 25
ABUTMENTS & WINGWALLS — F.F.	: 80 ± 20,
B.F.	: 70 ± 20
PIERS	: 80 ± 20
DECK — TOP : 70 ± 20	BOTTOM : 40 ± 10
BARRIER WALL	: 70 ± 20
APPROACH SLABS	: 75 ± 25

AND AS NOTED

REINFORCING STEEL

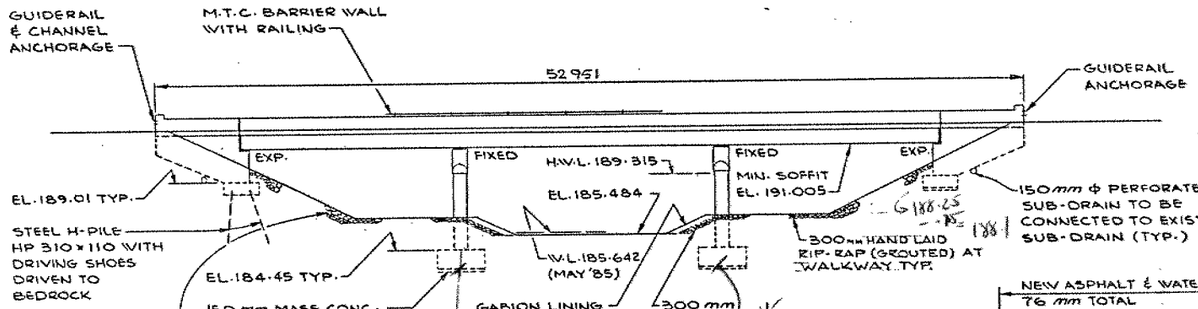
REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED.
BARS MARKED WITH SUFFIXES 'C' SHALL BE COATED BARS.

CONSTRUCTION NOTES

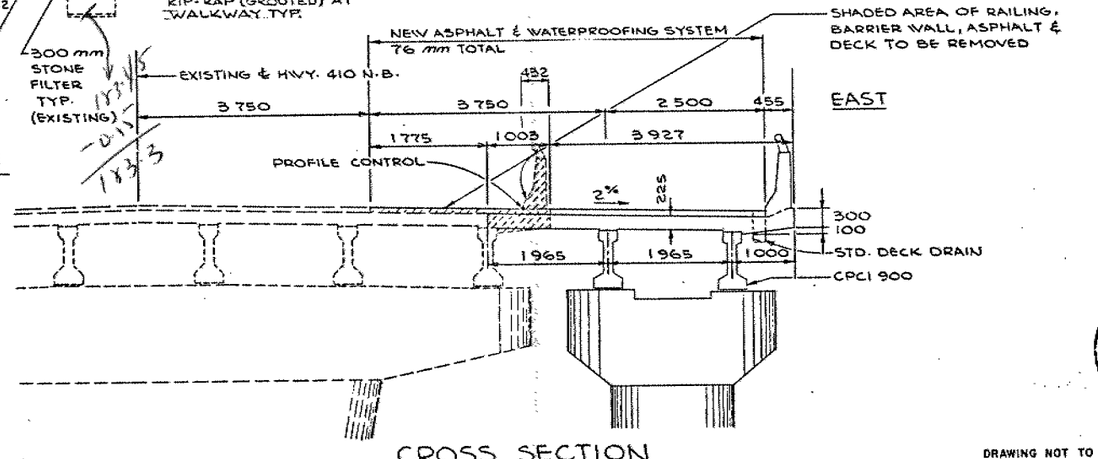
THE CONTRACTOR SHALL FINISH THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS TO A TOLERANCE OF ± 3 mm.
ALL DIMENSIONS AND ELEVATIONS REQUIRED FOR THE STRUCTURE WIDENING SHALL BE CHECKED IN THE FIELD BY THE CONTRACTOR. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER.

REFERENCE BRIDGE

ETOBICOKE CREEK BRIDGE : W.P. 103-69-09



ELEVATION
1:200



CROSS SECTION
1:50

B. M. 193.435

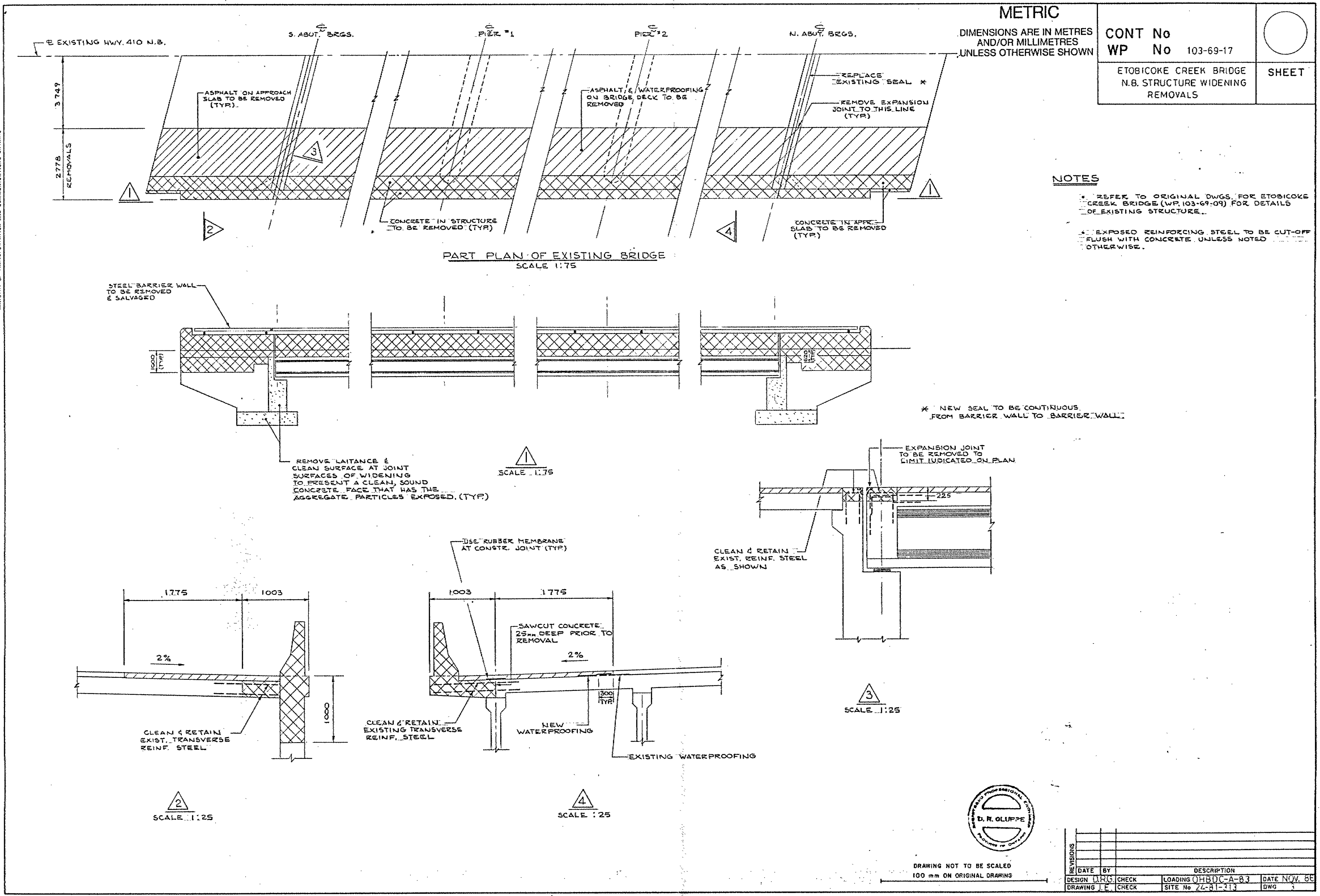
GEODETIC DATUM
STEEL STUD TOP OF HAND RAIL
SE. CORNER BRIDGE
25.8 RT. 9+588.1

* SUPERSTRUCTURE AND PIERS DESIGNED TO OHBDC-A-83 LOADING
ABUTMENT DESIGNED TO HS2044 LOADING

D. R. GILUPPE
PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
	DATE	BY	DESCRIPTION
DESIGN DRG	CHECK	LOADING OHBDC-A-83*	DATE NOV. 86
DRAWING RW	CHECK	SITE No 24-81-313	DWG 1


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
CONT No
WP No 103-69-17
ETOBICOKE CREEK BRIDGE
N.B. STRUCTURE WIDENING
REMOVALS
SHEET
℄ EXISTING HWY. 410 N.B.
S. ABUT. ℄ BRGS.
PIER ℄ #1
PIER ℄ #2
N. ABUT. ℄ BRGS.
3749
2778 REMOVALS
ASPHALT ON APPROACH SLAB TO BE REMOVED (TYP.)
ASPHALT & WATERPROOFING ON BRIDGE DECK TO BE REMOVED
REPLACE EXISTING SEAL *
REMOVE EXPANSION JOINT TO THIS LINE (TYP.)
CONCRETE IN STRUCTURE TO BE REMOVED (TYP.)
CONCRETE IN APPR. SLAB TO BE REMOVED (TYP.)
PART PLAN OF EXISTING BRIDGE
SCALE 1:75
NOTES
• REFER TO ORIGINAL DWGS. FOR ETOBICOKE CREEK BRIDGE (WP. 103-69-09) FOR DETAILS OF EXISTING STRUCTURE.
• EXPOSED REINFORCING STEEL TO BE CUT-OFF FLUSH WITH CONCRETE UNLESS NOTED OTHERWISE.
STEEL BARRIER WALL TO BE REMOVED & SALVAGED
1000 (TYP)
620 (TYP)
REMOVE LAITANCE & CLEAN SURFACE AT JOINT SURFACES OF WIDENING TO PRESENT A CLEAN, SOUND CONCRETE FACE THAT HAS THE AGGREGATE PARTICLES EXPOSED. (TYP.)
SCALE 1:75
* NEW SEAL TO BE CONTINUOUS FROM BARRIER WALL TO BARRIER WALL.
EXPANSION JOINT TO BE REMOVED TO LIMIT INDICATED ON PLAN
225
CLEAN & RETAIN EXIST. REINF. STEEL AS SHOWN
SCALE 1:25
USE RUBBER MEMBRANE AT CONSTR. JOINT (TYP)
1775
1003
2%
1000
CLEAN & RETAIN EXIST. TRANSVERSE REINF. STEEL
SCALE 1:25
SAWCUT CONCRETE 25mm DEEP PRIOR TO REMOVAL
300 TYP.
CLEAN & RETAIN EXISTING TRANSVERSE REINF. STEEL
NEW WATERPROOFING
EXISTING WATERPROOFING
SCALE 1:25
D. R. OLUPPE
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING
REVISIONS
DATE
BY
DESCRIPTION
DESIGN D.R.G.
CHECK
DRAWING J.E.
CHECK
LOADING OHBDC-A-83
SITE No 24-81-313
DATE NOV. 86
DWG

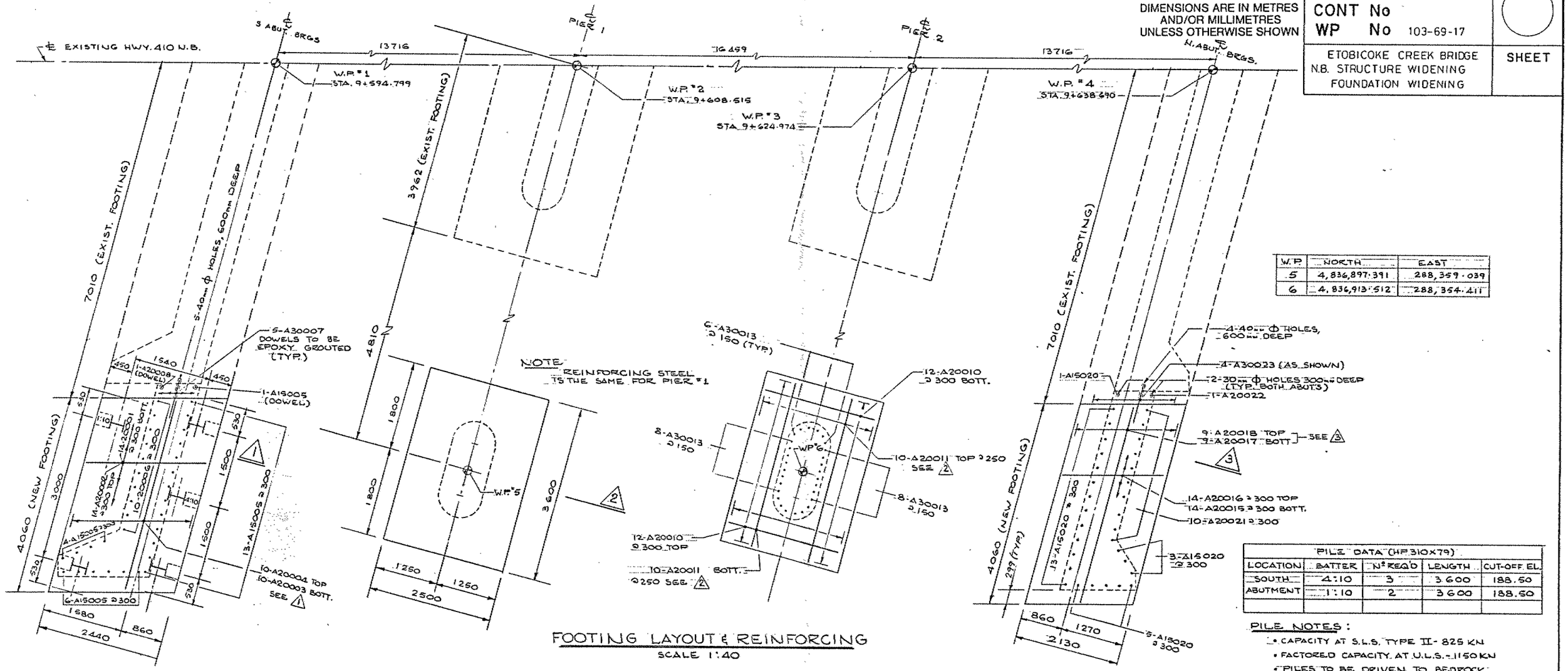
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No 103-69-17

ETOBICOKE CREEK BRIDGE
N.B. STRUCTURE WIDENING
FOUNDATION WIDENING

SHEET



W.P.	NORTH	EAST
5	4,836,897.391	288,359.039
6	4,836,913.512	288,354.411

FOOTING LAYOUT & REINFORCING

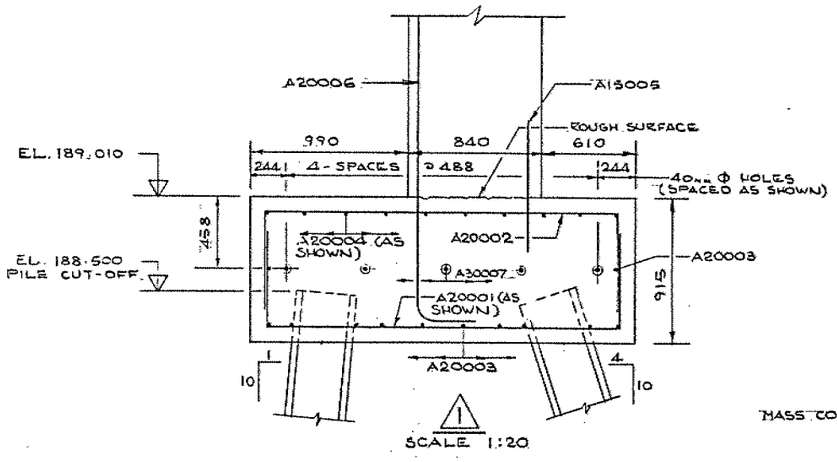
SCALE 1:40

PILE DATA (HP310X79)

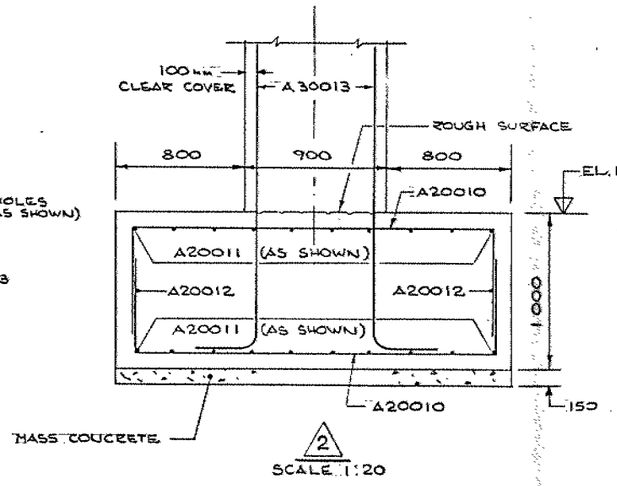
LOCATION	BATTER	N° REQ'D	LENGTH	CUT-OFF EL.
SOUTH ABUTMENT	4:10	3	3600	188.50
	1:10	2	3600	188.50

PILE NOTES :

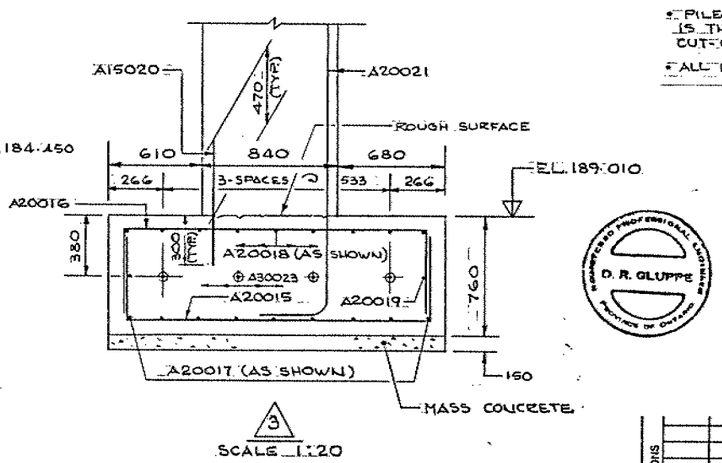
- CAPACITY AT S.L.S. TYPE II - 825 KN
- FACTORED CAPACITY AT U.L.S. - 1150 KN
- PILES TO BE DRIVEN TO BEDROCK
- PILE SPACING TO BE MEASURED AT UNDERSIDE OF FOOTINGS.
- PILE LENGTH SHOWN ON THIS DRAWING IS THEORETICAL LENGTH BELOW CUT-OFF ELEVATION.
- ALL DOWELS TO BE EPOXY GROUTED.



1 SCALE 1:20



2 SCALE 1:20



3 SCALE 1:20

D. R. GLUPPE — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN O.R.G.	CHECK	LOADING	OHBDC-A-83	DATE	NOV. 86
DRAWING I. F.	CHECK	SITE No	24-81-213	DWG	4

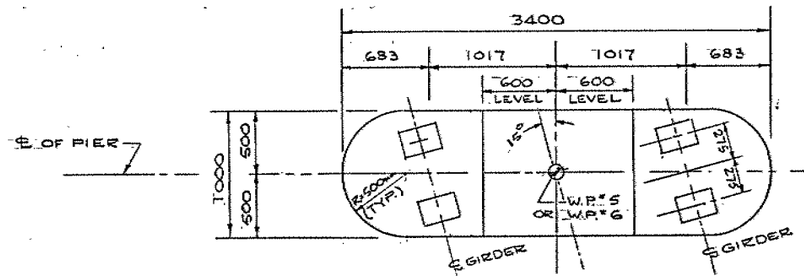
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

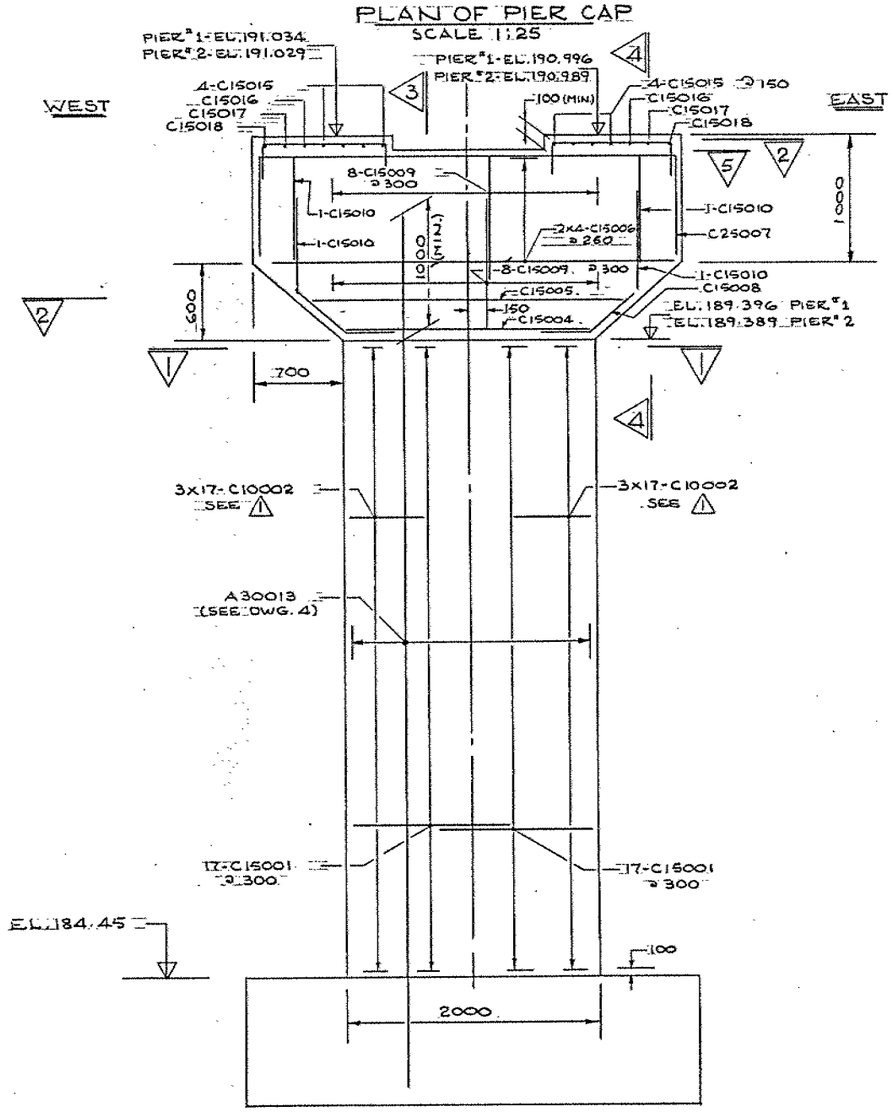
CONT No
WP No 103-69-17

ETOBICOKE CREEK BRIDGE
N.B. STRUCTURE WIDENING
PIER WIDENING

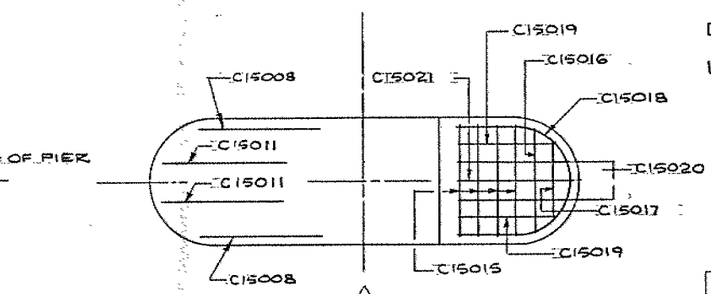
SHEET



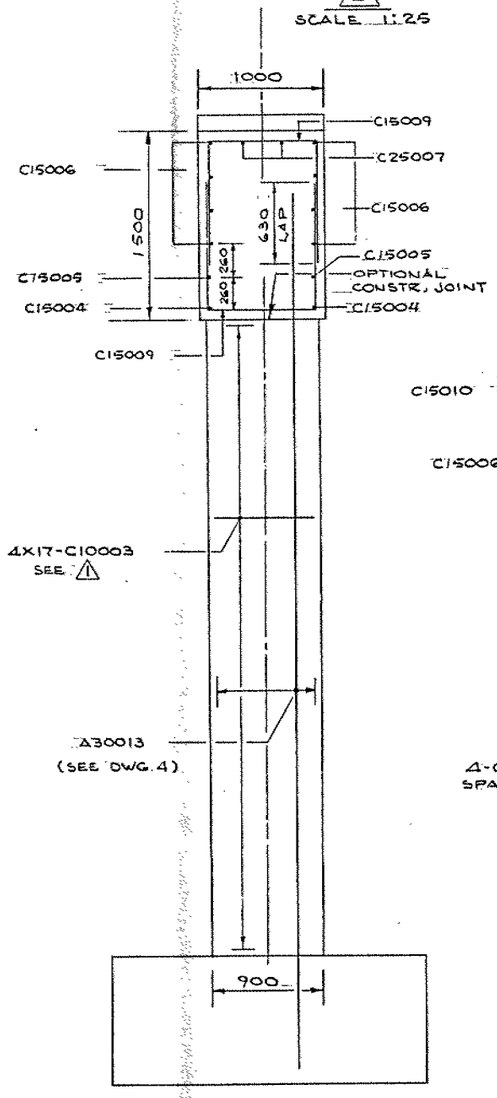
PLAN OF PIER CAP
SCALE 1:25



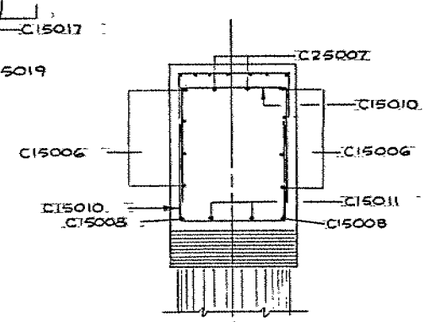
ELEVATION
SCALE 1:25



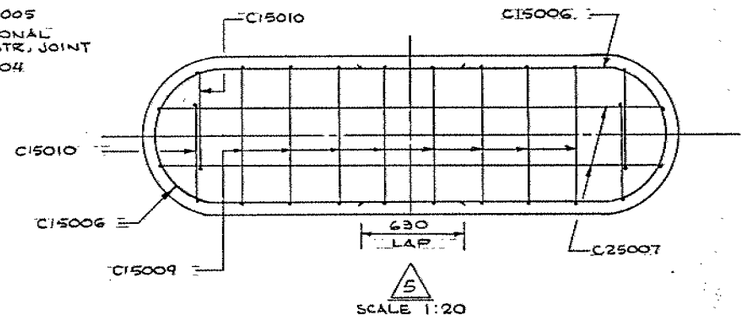
2 SCALE 1:25



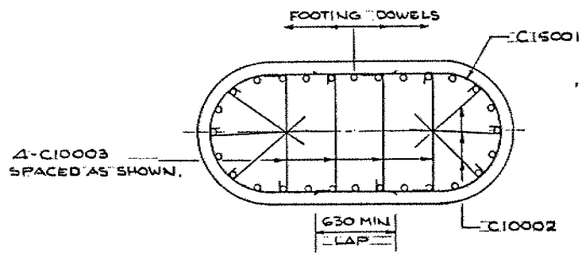
3 SCALE 1:25



4 SCALE 1:25



5 SCALE 1:20



1 SCALE 1:20

NOTE

FOR BEARING DETAILS SEE DWG. 8

D. R. GLUPPE

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION

DESIGN DRG	CHECK	LOADING OHBDC-A-83	DATE NOV. 86
DRAWING J.E	CHECK	SITE No 24-81-313	DWG 5

Ministry of
Transportation and
Communications
Ontario

CONT 87-75

5

FOUNDATION DESIGN SECTION

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 103-69-17 DIST #6

HWY 410 STR SITE 24-81-313

ETOBICOKE CREEK
N. B. STRUCTURE WIDENING

DISTRIBUTION

G. C. E. Burkhardt (3)
T. J. Kazmierowski (acting)
A. Wittenberg
J. Smrcka (2)
K. Bassi
J. H. Peer
T. Yakutchuk
R. Fitzgibbon (cover only)
M. MacLean (cover only)
FILE COPY

GEOCRES 30M12-195

DATE MAR 2 6 1986

FOUNDATION INVESTIGATION REPORT
for
N.B.L. Structure Widening
Hwy. #410
W.P. 103-69-17; Site No. 24-81-313
District 6, Toronto

INTRODUCTION

This report summarizes the factual information obtained from a foundation investigation carried out at the above-mentioned site on 86 02 01. The fieldwork consisted of 1 borehole (BH 109) advanced by means of B-casing and augering from a portable tripod drill machine. The depth of this borehole extended 2.7 m below the existing ground surface.

In 1976 a foundation investigation was carried out for the existing NBL structure. The investigation consisted of 12 sampled boreholes (BH 1 - BH 12). The location of the boreholes pertinent to this specific project (BH 1-6, 11, 12) are shown on DWG 1036917-A. The log sheets for these boreholes are also included in the Appendix. The information on these log sheets is provided for reference only and is not used in the description of the subsurface conditions at this site.

SITE DESCRIPTION

The site is located on Hwy. 410 approximately 1.5 km south of Steeles Ave. at Etobicoke Creek. The site is situated in the City of Brampton, Regional Municipality of Peel.

Land use in the vicinity of the site is predominantly agricultural.

The site is located in the physiographic region known as the "Peel Plain", as described in The Physiography of Southern Ontario (Chapman and Putnam, 1984). The deposit characterizing this area consists of a cohesive glacial till deposit underlain by shale bedrock of the Georgian Bay Formation (formerly known as the Meaford-Dundas formation), Ordovecian Period. The area under investigation is drained by Etobicoke Creek.

SUBSURFACE CONDITIONS

General

The predominant material across this site is a glacial deposit described as a heterogeneous mixture of silty clay, sand, gravel. This cohesive deposit is underlain by Shale bedrock of the Georgian Bay formation. Other deposits such as sitly clay, sand with silt, and sand and gravel were, however, encountered within this river valley.

The boundaries between the subsoil types, insitu and laboratory test results, as well as groundwater levels are shown on the Record of Borehole Sheets in the Appendix. The location of each borehole is shown in plan on DWG No. 1036917-A together with a longitudinal stratigraphical section.

The various soils encountered at this site, and specifically at BH 109 are described as follows:

Borehole BH 109

Extending from the ground surface (Elev. 191.2) down to a depth of 1.4 m is a deposit of silty clay, some sand, trace gravel. Based on visual observation, this cohesive material can be described as a silty clay of low plasticity (CL group on the Atterberg chart). Based on the interpretation of a 'N' value of 9 blows/0.3 m, this material can be considered to have a stiff consistency.

Underlying this material is a 0.7 m thick deposit characteristic of this site: hard glacial till composed of a heterogeneous mixture of silty clay, sand, gravel. The cohesive silty clay matrix of this material can be described as a silty clay of low plasticity (CL group on the Atterberg chart). Based on visual observation, this material is composed of approximately 15% gravel, 25% sand, and 60% silt and clay. The thickness of this deposit varies appreciably across the site.

At approximately Elev. 189.1, bedrock was encountered at this location. The bedrock was highly weathered in the upper 0.6 m as evidenced by the fact that it was easily augered, and split-spoon samples were obtained.

Other

- Subsequent to the investigation of 1976, fill material was placed at the south end of this site to form the approach fill. The fill material which is encountered is in the order of 3 m high and consists of a silty clay of low plasticity, some sand, trace gravel. In addition, the site is covered with a veneer of organic topsoil in the order of 150 mm or more.

- It should be noted that all non-cohesive soils across this site will experience "boiling" when subjected to an unbalanced hydrostatic pressure.

- For additional information on the soils across this site reference should be made to the various Record of Borehole sheets in the Appendix.

Groundwater Conditions

The groundwater level was not established in BH 109. However, in the 1976 investigation the following levels were obtained:

BH #	GWL Elev.
1	186.5
2	186.3
3	186.4
4	186.3
5	186.2
6	186.3
11	185.7

On 85 12 03 the water level in the creek at this site was found at Elev. 186.2. On 85 05 06 the water level in the creek at this site was found to be at Elev. 185.6.

DISCUSSION AND RECOMMENDATIONS

The existing 3-span structure (13.7 m-16.5 m-13.7 m) at this location of Highway 410 crossing of Etobicoke Creek was constructed as the initial stage and carries one lane in each direction. As part of the second stage of the Highway 410 development, separated 3-lane structures in each direction are required. This will be accomplished by widening the existing structure by one lane (east side) and therefore, providing a 3-lane structure for the northbound Highway 410. In addition, a new 3-lane structure is required for the southbound traffic. Within the area investigated fills of up to 4 m high are required on the south side of the proposed structure widening. On the north side the existing ground may have to be cut up to 4 m.

The area investigated is situated in the City of Brampton, Regional Municipality of Peel. The site is located in the physiographic region known as the "Peel Plain". The characteristic deposit of this region is a glacial-till. The till is underlain by shale bedrock of the Georgian Bay Formation (formerly known as the Meaford-Dundas Formation). The shale bedrock is exposed at the creek bottom and partially on the north bank of Etobicoke Creek.

The following are our recommendations for the design and construction of the widening of the existing northbound structure:

South

Abutment: The south abutment widening can be perched within the south approach fill and can be supported on steel H piles driven down to the shale bedrock. For estimating purposes it can be assumed that piles will penetrate down to Elev. 185.3. HP 310 x 110 piles can be designed using 1600 kN U.L.S. and 1150 kN at S.L.S. II. A joint should be provided between the existng abutment and the new abutment widening to compensate for potential variable rates of settlement.

The maximum grain size in fill material used in the area of the widening should be restricted to 75 mm so as to facilitate the pile driving.

S & N

Piers: The piers can be founded on spread footings at or below Elev. 183.3 using a loading at U.L.S. of 1000 kPa. This is the same elevation as the existing footings. Since the footing widenings will be founded on the shale bedrock, a 150 mm lean concrete working slab should be provided as soon as the excavation is opened. A joint should be provided between the existing and new footing and pier.

North

Abutment: The abutment footing can be lengthened along the same founding elevation as the existing (Elev. 188.2) using a loading of 1000 kPa at the U.L.S., and 500 kN at the S.L.S. Type II.

The proposed footing lengthening will be founded on weathered shale bedrock at this elevation, and consequently, a 150 mm working slab should be provided at the base of the excavation as soon as it is opened.

Since the area around the north abutment was excavated for the original construction of the existing footing some disturbance of the surrounding soil may have resulted. Any loose or fill material should be removed and replaced with mass concrete.

A joint should be provided between the existing abutment and the new widening to compensate for potential variable rates of settlement.

General Recommendations

- Friction angle between the concrete and shale can be taken as 24°.
- Adhesion between the concrete and hard glacial till can be taken as 75 kPa.
- A dewatering scheme is required for the excavations of the new pier footings. The scheme could perhaps include a creek diversion or a sheeted cofferdam.

- Additional fill will be stable with 2:1 side and front slopes provided that fill material used below the prevailing groundwater level is of a non-cohesive (granular) nature, all surficial organic material is removed, and new fill is benched into existing as per MTC standards. Anticipated settlements are tolerable.

- Cuts will be stable with 2:1 side slopes.

- Backfill to structures should consist of granular material in accordance with MTC Standard Special Provision #121 (83-10). Computation of earth pressures should be in accordance with Section 6.6.1.2. of the O.H.B.D.C. For design purposes, the physical properties of the backfill are as follows:

Material	ϕ	γ
Gran. 'A'	35°	22.0 kN/m^3
Gran. 'B'	30°	21.2 kN/m^3

- 1.2 m frost cover or equivalent should be provided to all underside of footings.

- Abutments should normally be designed for the active earth pressure (Ka) condition. The at-rest (Ko) condition should only be used in cases where the deflection of the abutment is prevented by the propping action of the deck, such as in the case with a rigid frame structure. Similarly, the at-rest condition can be used for abutments on spread footings founded on unyielding material unless the abutment can deflect sufficiently to mobilize the active earth pressure.

- Because of the proximity of the creek channel to the pier footings the banks should be protected with 0.6 m thick rip-rap in the vicinity of the piers so as to prevent possible scour. Geotextile should be provided under the rip-rap. The rip-rap should extend to the high water line.

Miscellaneous

The fieldwork for this investigation was carried out under the supervision of F. Saccon, Project Foundations Engineer, utilizing equipment owned and operated by Atcost Drilling Inc., of Concord, Ontario. This report was prepared by L. Politano, Project Foundations Engineer and reviewed by M. Devata, Chief Foundations Engineer (East).

L. Politano, P.Eng.
Project Foundations Engineer

M. Devata, P.Eng.
Chief Foundations Engineer
(East)

March 1986

A P P E N D I X

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 1 METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 885.2; E 288 337.5 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core and Cone Test COMPILED BY V.K.
DATUM Geodetic DATE 76 04 30 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.8	Ground Level										
0.0	Silty Clay with Sand and Gravel (Glacial Till)										
185.9							186				
0.9	Gravel with Silty Sand and trace Clay Compact		1	SS	19				○		61 28 (11)
185.3											
1.5	weathered		2	BXL	REC 65%		185	100/5 cm			
	Bedrock										
	Grey Shale with occ. layers of Limestone		3	BXL	REC 80%		184				
							183				
182.0	Sound		4	BXL	REC 100%						
4.8	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
Ontario

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 2 METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 890.7; E 288 354.5 ORIGINATED BY V.K.

DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core and Cone Test COMPILED BY V.K.

DATUM Geodetic DATE 76 04 29 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
187.0	Ground Level										
0.0	Silty Sand with Gravel, Trace Clay Compact		1	SS	19		186				37 46 (17)
185.6											
1.4	weathered		2	BXL	REC 50%		185	100/5 cm			
	BEDROCK Grey Shale with occ. layers of Limestone		3	BXL	REC 100%		184				
183.5	Sound										
3.5	End of Borehole										

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3 METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 915.7; E 288 346.0 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing and BXL Rock Core COMPILED BY V.K.
DATUM Geodetic DATE 76 05 05 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
186.5	Ground Level										
0.0	Gravel with Shale fragments						186				
185.5											
1.0	BEDROCK Grey Shale with occ. layers of Limestone		1	BXL	REC 100%		185				
			2	BXL	REC 100%		184				
182.5	Sound						183				
4.0	End of Borehole										

$+^3$, $\times^5$: Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 4 METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 911.4; E 288 331.7 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing and BXL Rock Core COMPILED BY V.K.
DATUM Geodetic DATE 76 05 04 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.3	Ground Level										
0.0	Gravel with Shale fragments						186				
185.5											
0.8	BEDROCK										
	Grey Shale with occasional layers of Limestone		1	BXL	REC 100%		185				
							184				
	Sound		2	BXL	REC 100%						
182.6							183				
3.7	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 5 METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 888.5; E 288 371.6 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing, BXL Rock Core and Cone Test COMPILED BY V.K.
DATUM Geodetic DATE 76 04 29 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.4	Ground Level										
0.0	Silty Sand with traces of Gravel, Clay Loose		1	SS	8	▼	187		○		10 40 43 7
185.7							186				
1.7	weathered		2	BXL	REC 80%		185				
	BEDROCK Grey Shale with occasional layers of Limestone		3	BXL	REC 90%		184				
	Sound		4	BXL	REC 100%		183				
182.4											
5.0	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, x5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 6 METRIC

W P 103-69-09 LOCATION CO-ORDS. N 836 914.4; E 288 363.1 ORIGINATED BY V.K.

DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing and NXL Rock Core COMPILED BY V.K.

DATUM Geodetic DATE 76 05 04 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
186.3	Ground Level										
0.0 / 185.5	Gravel with Shale fragments						186				
0.8	BEDROCK Grey Shale with occasional layers of Limestone		1	NXL	REC 100%		185				
			2	NXL	REC 100%		184				
182.5	Sound						183				
3.8	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 11 METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 851.3; E 288 343.8 ORIGINATED BY V.K.

DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core and Cone Test COMPILED BY O.Y.

DATUM Geodetic DATE 76 06 25 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.7	Ground Level										
0.0	Silty Sand with Gravel, Trace Clay Compact						187				
185.8			1	SS	14		186		○		38 24 28 10
1.8	Silty Clay, Sand and Gravel (Glacial Till) Stiff to Hard					▼	185				
184.5			2	SS	100/15cm						
3.2	weathered						184				
	Bedrock-Grey Shale with occasional layers of Limestone Stone		3	RC BXL	REC 100%		183				
182.6											
5.1	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 12 METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 941.9; E 288 335.6 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY V.K.
DATUM Geodetic DATE 76 07 30 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ ORG. CONT.	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
196.9	Ground Level										
0.0	Silty Sand, Trace Organics					*					
	Loose		1	SS	5		196			1.2%	0 68 31 1
195.4											
1.5	Silty Clay, Sand and Gravel										
	(Glacial Till)		2	SS	21		195				0 10 57 33
			3	SS	26		194				0 13 47 40
			4	SS	20		193				2 15 41 42
			5	SS	23		192				
	Brown / Grey		6	SS	125		191				18 24 40 18
	Very Stiff						190				
188.8			7	SS	100/ 15 cm		189				
8.1	Shale Bedrock		8	BXL	REC 85%		188				
187.8											
9.1	End of Borehole										

* Ground water level not established

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 109 METRIC

W P 103-69-17 LOCATION CO-ORDS: N 4 836 927.8; E 288 349.2 ORIGINATED BY F.S.
DIST 6 HWY 410 BOREHOLE TYPE (Portable Tripod) B Casing COMPILED BY L.P.
DATUM Geodetic DATE 86 02 01 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
191.2	Ground Surface										
0.0	Topsoil					*	191				
	Silty Clay, Trace Sand, Gravel										
189.8	Stiff		1	SS	9						
1.4	Heterogeneous Mixture of Silty Clay, Sand, Gravel						190				
189.1	(Glacial Till) Hard		2	SS	46						
2.1	Shale Bedrock						189				
188.5	Weathered		3	SS	90/15 cm						
			4	SS	100/10 cm						
2.7	End of Borehole										

* Groundwater level not established

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	>3m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES
ρ_w	kg/m^3	DENSITY OF WATER
γ_w	kN/m^3	UNIT WEIGHT OF WATER
ρ	kg/m^3	DENSITY OF SOIL
γ	kN/m^3	UNIT WEIGHT OF SOIL
ρ_d	kg/m^3	DENSITY OF DRY SOIL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL

e	1,%	VOID RATIO
n	1,%	POROSITY
w	1,%	WATER CONTENT
S_r	%	DEGREE OF SATURATION
w_L	%	LIQUID LIMIT
w_p	%	PLASTIC LIMIT
w_S	%	SHRINKAGE LIMIT
I_p	%	PLASTICITY INDEX = $w_L - w_p$
I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	1,%	VOID RATIO IN LOOSEST STATE
e_{min}	1,%	VOID RATIO IN DENSEST STATE
I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
D	mm	GRAIN DIAMETER
D_n	mm	n PERCENT - DIAMETER
C_U	1	UNIFORMITY COEFFICIENT
h	m	HYDRAULIC HEAD OR POTENTIAL
q	m^3/s	RATE OF DISCHARGE
v	m/s	DISCHARGE VELOCITY
i	1	HYDRAULIC GRADIENT
k	m/s	HYDRAULIC CONDUCTIVITY
j	kN/m^3	SEEPAGE FORCE

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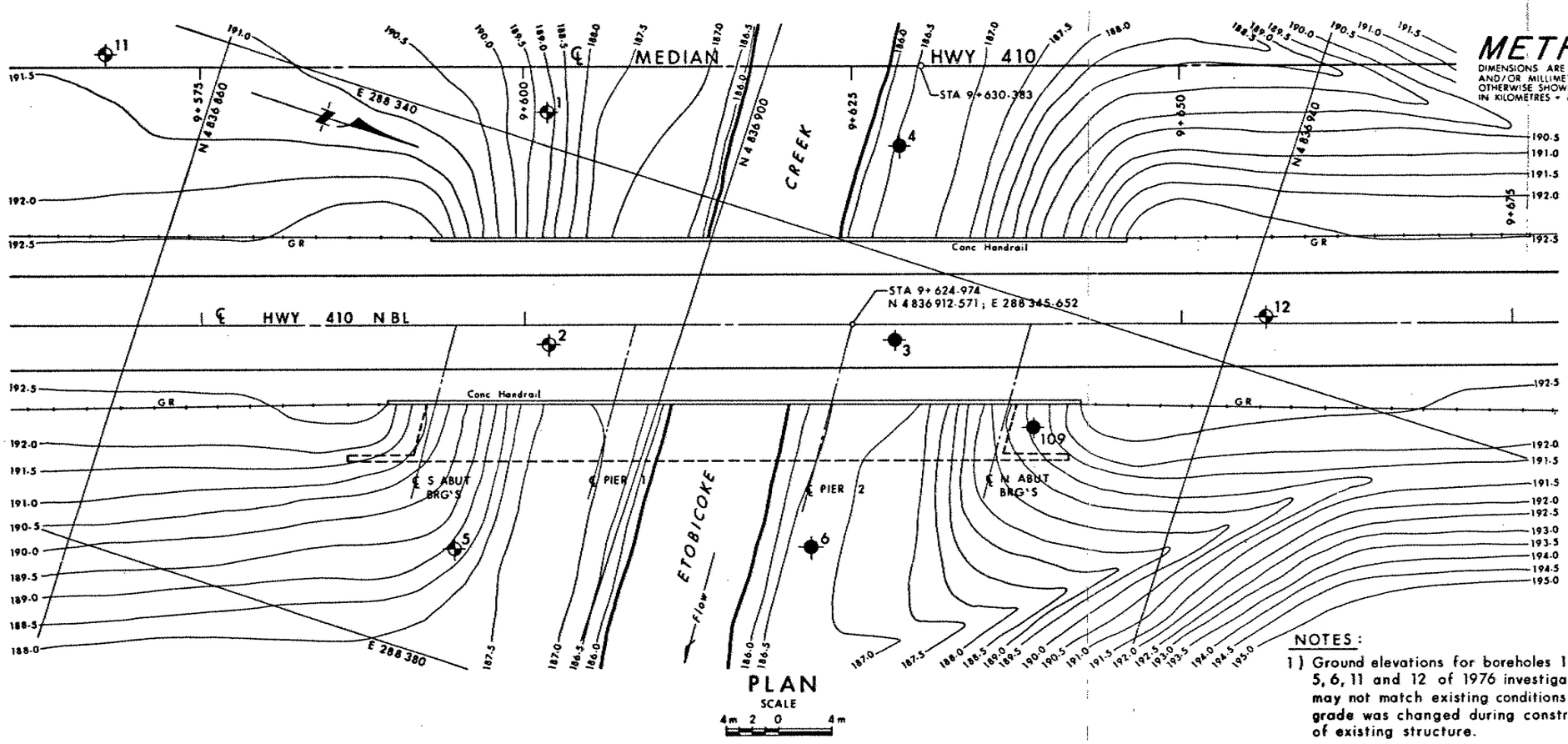
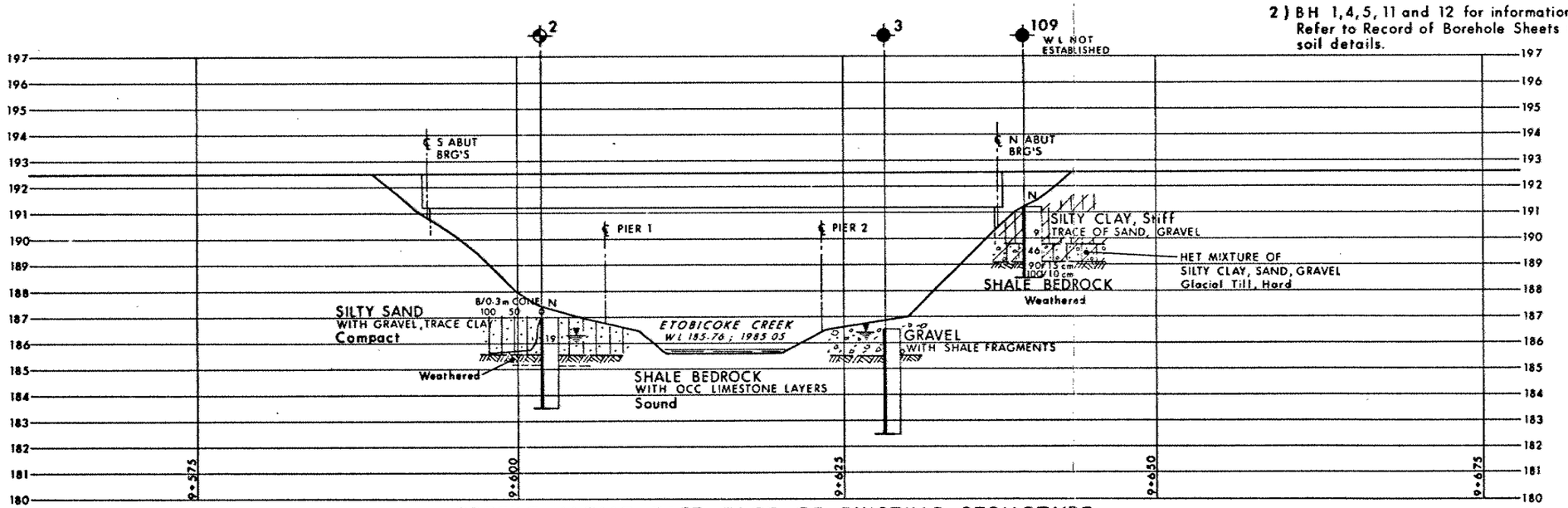


PLAN

SCALE
4m 2 0 4m



PROFILE ALONG EAST FACE OF EXISTING STRUCTURE

SCALE
HOR 4m 2 0 4m
VERT 2m 1 0 2m

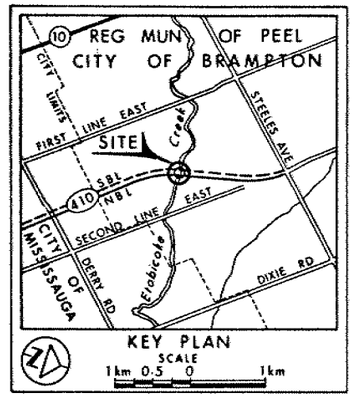
REF No E-6052-1; 1985 05

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

CONT No
WP No 103-69-17

ETOBICOKE CREEK BRIDGE
N B STRUCTURE
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



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)
- WL at time of investigation 1976 04, 1976 05

NOTES:

1) Ground elevations for boreholes 1, 2, 3, 4, 5, 6, 11 and 12 of 1976 investigation may not match existing conditions since the grade was changed during construction of existing structure.

2) BH 1, 4, 5, 11 and 12 for information only. Refer to Record of Borehole Sheets for soil details.

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	186·8	4 836 885·2	288 337·5
2	187·0	4 836 890·7	288 354·5
3	186·5	4 836 915·7	288 346·0
4	186·3	4 836 911·4	288 331·7
5	187·4	4 836 888·5	288 371·6
6	186·3	4 836 914·4	288 363·1
11	187·7	4 836 851·3	288 343·8
12	196·9	4 836 941·9	288 335·6
109	191·2	4 836 927·8	288 349·2

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV	DATE	BY	DESCRIPTION

Geocres No 30M12-195

HWY No 410 NBL			DIST 6
SUBM'D L.P.	CHECKED	DATE 1986 03 25	SITE 24-81-313
DRAWN	CHECKED	APPROVED	DWG 1036917-A