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G.I.-30 SEPT. 1976

GEOCRES No. 30M12-157

DIST. 6 REGION

W.P. No. 127-66-72

CONT. No. 82-108

W. O. No.

STR. SITE No. 24-81-466

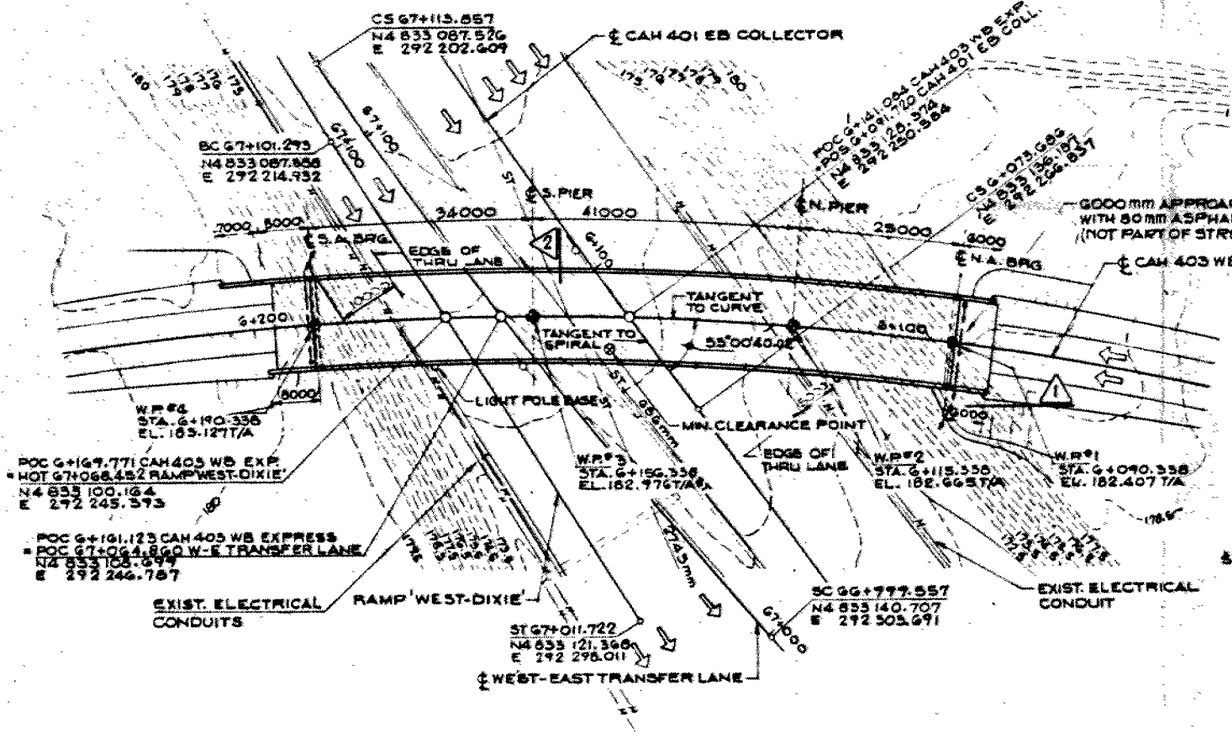
HWY. No. 403

LOCATION Bridge 26, 403 W.B. Core over 401 E.B. Coll.

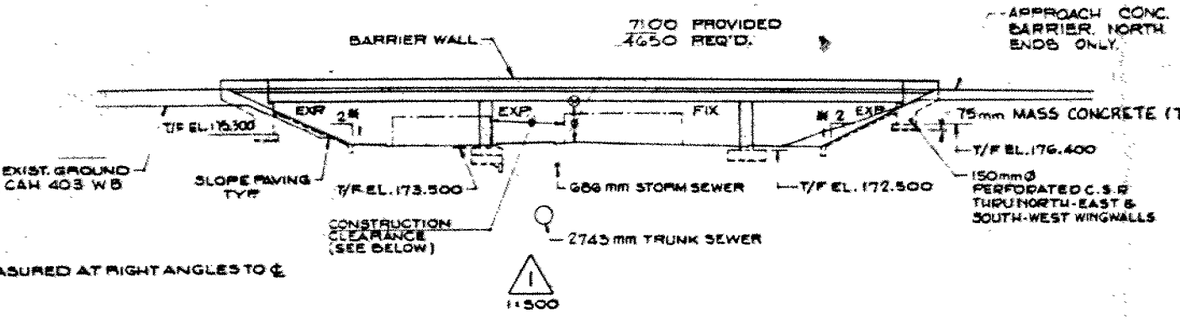
No of PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

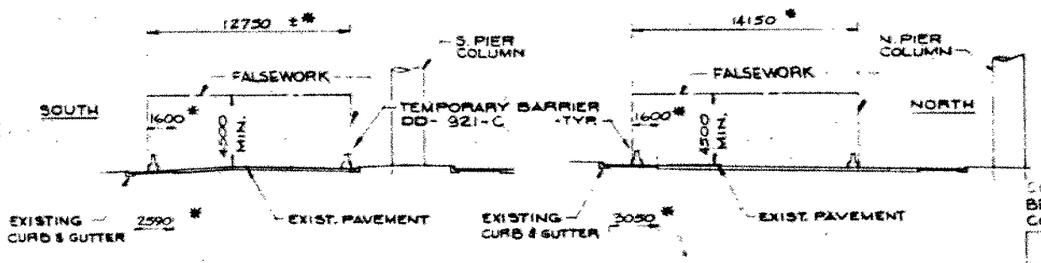


PLAN
1:500



NOTE
* MEASURED AT RIGHT ANGLES TO ℄

1:500



RAMP 'WEST-DIXIE' CAH 401 EB COLLECTOR

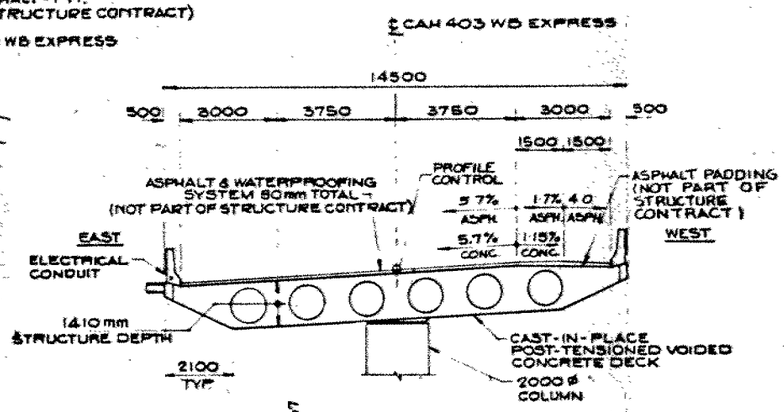
CONSTRUCTION CLEARANCE DIAGRAMS
1:200

CONCRETE QUANTITIES ARE LISTED BELOW FOR THE APPROPRIATE CONCRETE LUMP SUM TENDER ITEMS

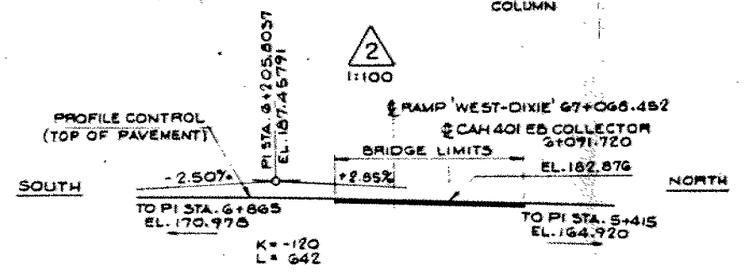
CONCRETE QUANTITIES		
CONCRETE IN ABUTMENTS & WINGWALLS	277	m³
CONCRETE IN RETAINING WALLS	15	m³
CONCRETE IN PIER	51	m³
CONCRETE IN PRESTRESSED DECK	1403	m³
CONCRETE IN BARRIER WALLS	72	m³
CONCRETE IN APPROACH SLABS	41	m³
CONCRETE IN SLOPE PAVING	61	m³

METRIC

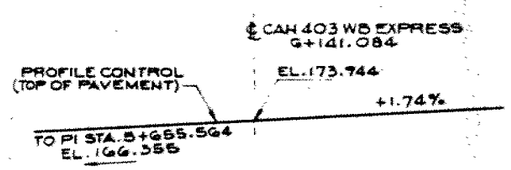
DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.



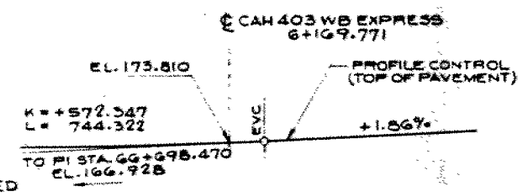
2
1:100



PROFILE OF CAH 403 WB EXPRESS
N.T.S.



PROFILE OF CAH 401 EB COLLECTOR
N.T.S.



PROFILE OF RAMP 'WEST-DIXIE'
N.T.S.

REGISTERED PROFESSIONAL ENGINEER D.C. CRAMM PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

DISTRICT 6	
CONT No	
WP No 127-66-72	
CAH 403 WB EXPRESS OVER CAH 401 EB COL. & RAMP 'WEST-DIXIE' BRIDGE NO. 26 GENERAL ARRANGEMENT	SHEET

PARKER CONSULTANTS — Consulting Professional Engineers — Hamilton · London · Ottawa · Jarvis

GENERAL NOTES

CLASS OF CONCRETE
DECK AND COLUMNS — 35 MPa
BARRIER WALLS, ABUTMENTS, WINGWALLS & RETAINING WALL STEM, PIER & ABUTMENT FOOTINGS — 30 MPa
RETAINING WALL FOOTING — 20 MPa

CLEAR COVER TO REINFORCING STEL
FOOTINGS — 100±25mm
COLUMNS, ABUTMENTS, WINGWALLS AND RETAINING WALL — 80±20mm
DECK — TOP 70±20 mm; BOT 50±10 mm
REMAINDER — 70±20 mm UNLESS NOTED

REINFORCING STEEL
REINFORCING STEEL SHALL BE GRADE 400 EXCEPT AS NOTED.
BARS MARKED WITH SUFFIX 'C' SHALL BE COATED BARS.

CONSTRUCTION
THE CONTRACTOR SHALL FINISH THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS TO A TOLERANCE OF ± 3 mm.

LIST OF ABBREVIATIONS

W.P. DENOTES WORKING POINT
T/A TOP OF ASPHALT
T/F TOP OF FOOTING
I.F. INSIDE FACE
O.F. OUTSIDE FACE
E.F. EACH FACE

LIST OF DRAWINGS

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN J.C.L.	CHECK D.C.C.	LOADING OHBDC & 79	DATE 82-07-14
DRAWING G.S.N.	CHECK D.C.C.	SITE 24-81-466	DWG

JUL 22 1982

CONT No
WP No 127-66-72

SHEET

CAH 403 WB EXPRESS OVER
CAH 401 EB COL & RAMP 'WEST-DIXIE'
BRIDGE NO. 26
FOUNDATION LAYOUT & REINFORCING

PARKER CONSULTANTS — Consulting Professional Engineers
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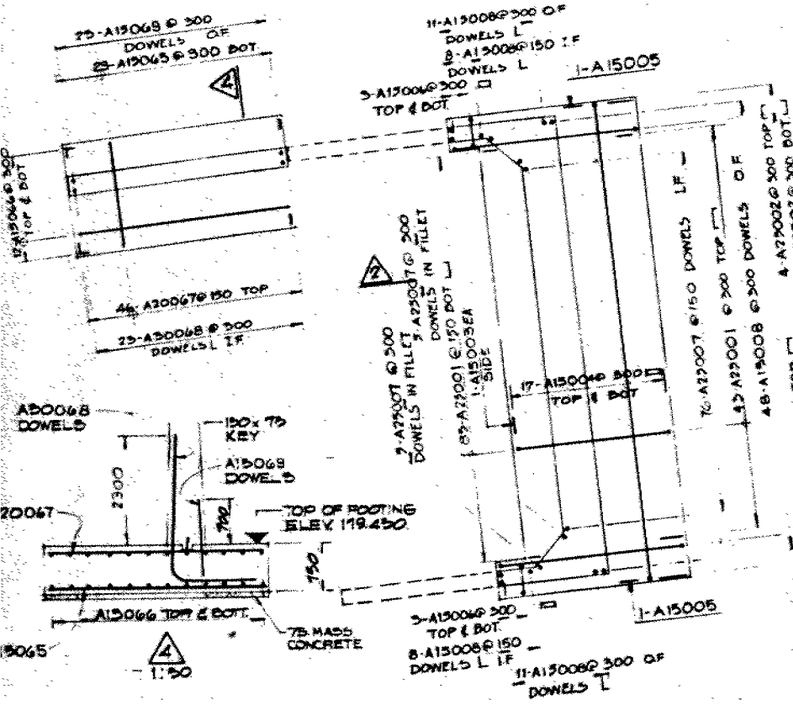
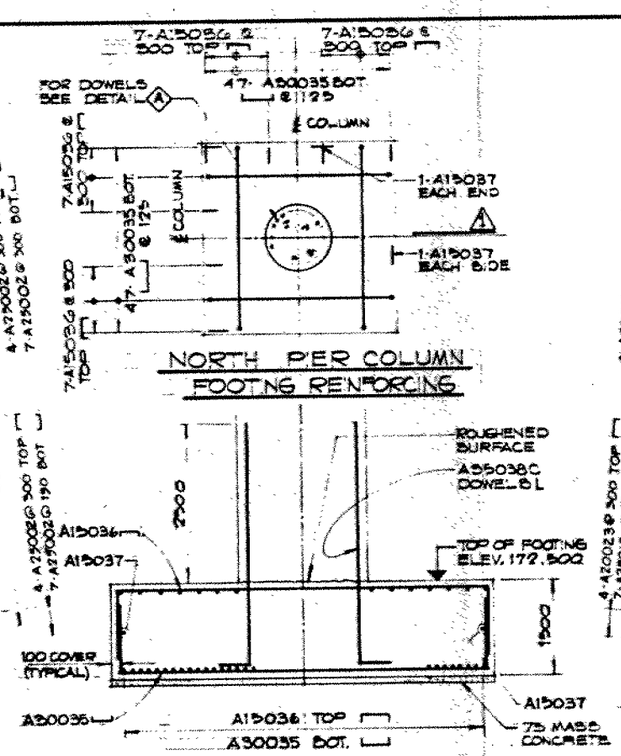
METRIC

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

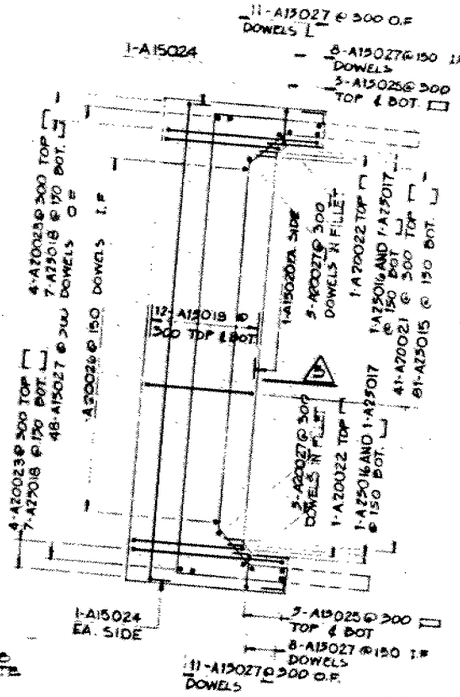


SOUTH ABUTMENT & RETAINING WALL FOOTING REINFORCING

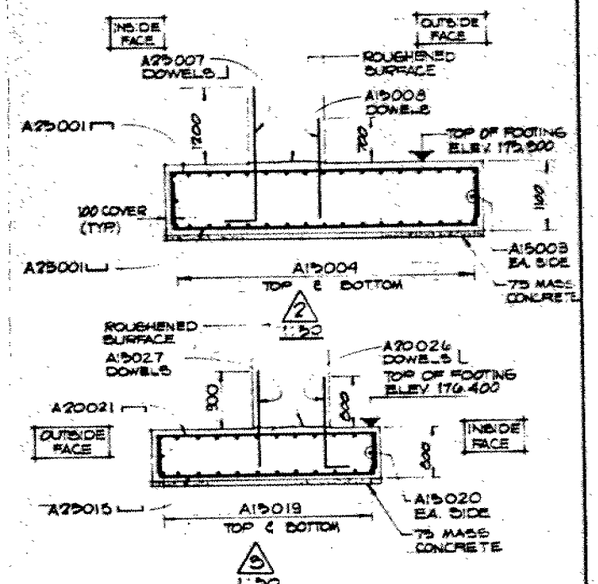


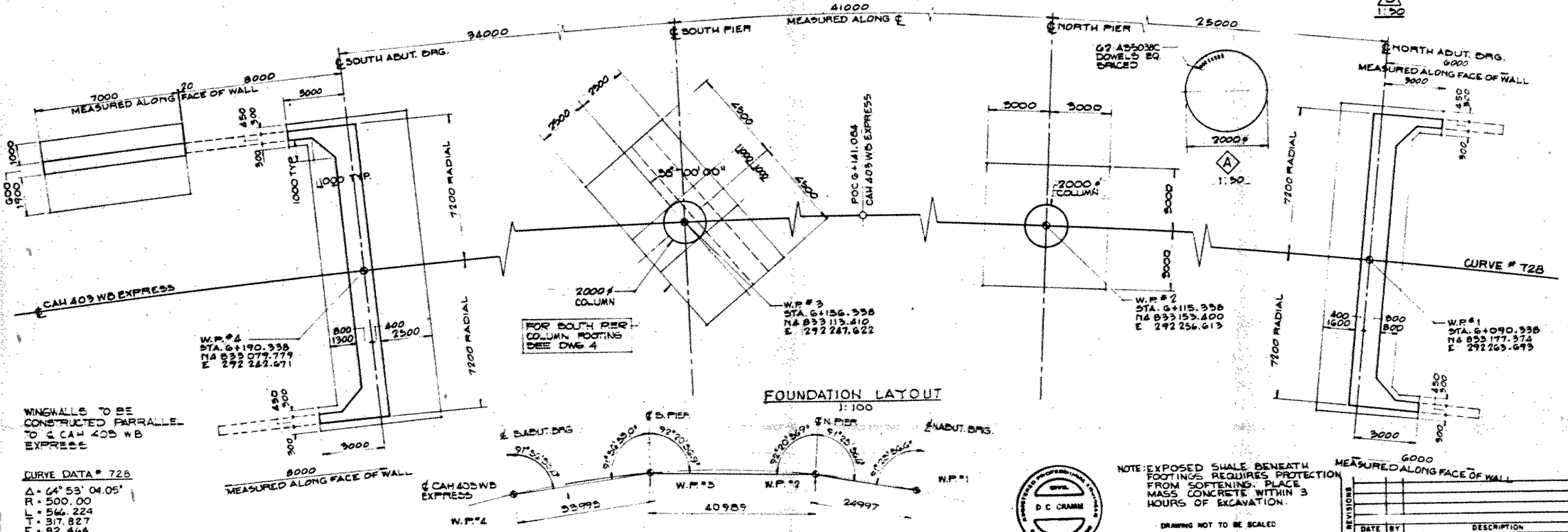
NORTH PIER COLUMN FOOTING REINFORCING

1:50



NORTH ABUTMENT FOOTING REINFORCING





FOUNDATION LAYOUT
1:100

ALIGNMENT LAYOUT
N.T.S.

NOTE: EXPOSED SHALE BENEATH FOOTINGS REQUIRES PROTECTION FROM SOFTENING. PLACE MASS CONCRETE WITHIN 3 HOURS OF EXCAVATION.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REGISTERED PROFESSIONAL ENGINEER — CIVIL — D C CRAMM — PROVINCE OF ONTARIO

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	J.C.L.	CHECK D.C.C.	LOADING OHBDC A 7B DATE 82.07.14
DRAWING	G.S.N.	CHECK D.C.C.	SITE No 24-81-466 DWG 3

JUL 2

CONT 82-108

Ontario

Ministry of
Transportation and
Communications

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 127-66-72 DIST 6

HWY 403 STR SITE 24-81-466

Bridge #26, Highway 403 W.B. Expressway Over Highway 401 E.B. Collector and Dixie Road Sub-Collector

DISTRIBUTION

G.C.E. Burkhardt (3)
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GEOCRES 30M12-157

DATE APR 16 1982

FOUNDATION INVESTIGATION REPORT
For
Bridge #26
Highway 403 W.B. Expressway Over
Highway 401 E.B. Collector and
Dixie Road Sub-Collector
W.P. 127-66-72, Site 24-81-466
Hwy. 403, District 6, Toronto.

INTRODUCTION:

This report summarizes the factual information obtained from a foundation investigation program performed at the above-mentioned structural site and provides detailed recommendations pertaining to the structure foundations and related earthworks.

The fieldwork was carried out between 82 02 16 and 82 02 19 and consisted of advancing 3 sampled boreholes using solid stem continuous flight augers with bedrock being cored in two of the borings. The depth of borings ranged from 2.6 metres to 12.3 metres terminating within the shale bedrock.

Site Description and Geology

The structure site is located immediately east of the existing Hwy. 403 W.B. Collector structure (Bridge #27) over Hwy. 401 E.B. Collector and Dixie Road Sub-Collector which was constructed under Contract 75-16 as part of the Hwy. 401/403 Interchange complex.

Land use in the area is changing from predominately farming to industrial subdivision development. Topography across the site is generally flat to gently undulating with ground surface sloping gradually towards Lake Ontario.

The site is located in the physiographic region known as the "Peel Plain". The characteristic deposit, in the vicinity of the area under investigation, is composed of cohesive glacial till, whose thickness varies from nil to 15 metres. The overburden is underlain by shale bedrock of the Meaford-Dundas Formation, Ordivician Period.

Subsurface Conditions

Borings carried out at the structure site indicates generally uniform subsurface conditions. The overburden consists of a shallow deposit of cohesive glacial till underlain by shale bedrock. The upper portion of the shale was found to be weathered. In previous highway cut areas, exposed shale has been covered with a thin veneer of fill.

The boundaries between the various soil types, insitu and laboratory test results are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with a profile showing an estimated soil stratigraphy based on borehole data, are shown on Drawing No. 1276672-A.

The various soil types encountered are briefly described in the following paragraphs.

Silty Clay, Gravel and Sand (Glacial Till)

The surficial deposit overlying the site consists of a shallow deposit of glacial till composed of a silty clay of intermediate plasticity with varying amounts of gravel and some sand. Typical grain size distribution curves for representative samples from this deposit are shown on Figure 1. An increasing frequency of fragments, and detached slabs of weathered shale and limestone were encountered within the lower portion of this till. A thin veneer of fill consisting of the reworked parent till of the area was found to overly shale where previous highway cuts had been advanced.

Results of limited water content and Atterberg Limit testing are plotted on the Plasticity Chart (Figure 2) and summarized as follows:

		Range	Average
Water Content	(w) %	8-22	16
Liquid Limit	(W_L) %	40-43	42
Plastic Limit	(W_p) %	19-20	20
Plasticity Index	(I_p) %	19-24	22

These results indicate the cohesive matrix of the glacial till consists of an inorganic silty clay of intermediate plasticity (CI).

Based on interpretation of Standard Penetration Test 'N' values ranging from 27 to in excess of 100 blows per 0.3 metres, the consistency of this deposit ranges from very stiff to hard.

Bedrock

The shale bedrock was encountered immediately beneath the glacial till deposit across the site. The upper 0.8 to 2.1 metres of the bedrock is in a weathered condition. The natural bedrock surface varies between elevations 177.1 to 177.5 corresponding to depths of approximately 2.6 to 2.1 metres below original ground surface prior to cut excavations for the existing Hwy. 401 collectors.

Bedrock surface is sloping gently in a northeasterly direction across the site.

The rock is described as a dark grey, fine textured, soft shale interbedded with thin layers of light grey, fine to medium texture, medium hard limestone. This formation is generally weathered in the upper layers and frequently transitional with the overlying till layer containing frequent fragments and detached slabs of shale and limestone. The badly weathered zone of shale near the top of bedrock grades through a zone of moderate weathering into intact bedrock.

Groundwater Conditions

No stabilized water levels were obtained during augering operations in the three borings. Upon completion of rock coring, the induced drill water remained perched within the borings, indicating a low permeability for both the till and shale strata. The depressed profile grades of the existing Hwy. 401/Dixie Road Sub-collector geometry effectively drains the immediate structure site to an minimum elevation of approximately 173, however a perched water table within the glacial till can be expected during periods of high rainfall.

DISCUSSION AND RECOMMENDATION

As part of the upgrading of Highways 401 and 403 to a collector/core network, East and West Bound Collector Overpass structures are required at the crossing of Hwy. 401 E.B. Expressway and Dixie Road Sub-collector. The proposed W.B. structure (Bridge #26) will consist of a 3 span (34 - 41 - 25 metres) continuous post-tensioned voided concrete structure some 14.5 metres wide. A proposed Hwy. 403 profile grade ranging from 182.4 to 183.1, existing Hwy. 401 E.B. profile grade of 173.9, and average natural ground surface elevation of roughly 180 will necessitate maximum approach fill heights in the order of 3.0 metres.

In consideration of the proximity of competent shale bedrock to ground surface across the site, recommendations pertaining to the foundations of the new structure and related earthworks are summarized as follows:

The design of shallow foundations founded on an unyielding medium such as shale bedrock will not be governed by settlement since the bearing capacity at the S.L.S. Type II is much larger than the factored capacity at U.L.S. Perched abutments can be supported on spread footings founded within the weathered shale for a factored bearing capacity at the U.L.S. of 1,000 kPa.

Pier footings can be supported on shallow spread footings located and designed in a similar manner as the abutment footings or within the intact shale for a factored capacity at the U.L.S. of 1500 kPa.

A minimum earth cover of 1.25 metres should be provided to the underside of the footings, since the shale is considered susceptible to frost action.

The base of all footing excavations should be covered immediately upon exposure with a working slab of lean concrete to protect the exposed shale from weathering and softening.

Earth pressures against the abutment walls should be computed as per Subsection 6.6.1.2.2 of the O. H. B. D. C. Manual with provisions made from adequate drainage behind the abutment.

Provided backfill to the abutments consists of free draining granular material and adequate provisions are made for an appropriate drainage scheme, the following equivalent fluid pressures may be assumed for compution of earth pressures.

a) At ultimate limit state

- active condition	8.0 kPa/m
- at rest condition	10.0 kPa/m

b) At serviceability limit state

- active condition	6.5 kPa/m
- at rest condition	8.5 kPa/m

All organic and softened material should be stripped from within the plan limits of the immediate approach embankments prior to placement of any fill.

In addition, all new fill material should be properly benched in the existing slopes as per current MTC standards.

A constraint on the use of heavy vibratory equipment within a restricted distance to the back of abutment wall should be included as per current MTC directives.

Resistance to sliding of the abutment footings can be calculated assuming a coefficient of friction of 0.8 between the underside of the concrete footing and the rough shale surface.

No major dewatering difficulties are anticipated for footing excavations in consideration of the relatively low permeability of the shale bedrock. Localized seepage into excavations can be controlled by perimeter ditches and pumping from corner sumps.

No stability problems are anticipated for permanent embankment slopes constructed to a 2:1 geometry.

Temporary cut slopes will stand at a 1:1 geometry or steeper, however, these slopes will weather rapidly and show signs of surficial distress if not protected in a reasonable length of time.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. V. Parker, Field Technician, utilizing equipment owned and operated by Atcost Drilling Co., Toronto. This report was written by Mr. T. J. Kazmierowski, Foundations Engineer and reviewed by Mr. M. Devata, Senior Foundations Engineer.

T. J. Kazmierowski, P. Eng.
Foundation Engineer

M. Devata, P. Eng.
Senior Foundations Engineer

APPENDIX

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 1 METRIC

W P 127-66-72 LOCATION Co-ords. N 4 833 185 E 292 261 ORIGINATED BY V.P.

DIST 6 HWY 401/403 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.

DATUM Geodetic DATE 82-02-16 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						
179.7	Ground Surface										
0.0	(Glacial Till) Silty Clay, some Sand & Gravel, fragments and slabs of Lime-Stone & Weathered Shale V. Stiff to Hard		1	SS	27		178				
			2	SS	70/13 cm						
177.1			3	SS	70/13 cm						
2.6	End of Borehole Refusal to Augers on probable bedrock.						176				

OFFICE REPORT ON SOIL EXPLORATION

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

15 20 10 5 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 2 METRIC

W P 127-66-72 LOCATION Co-ords. N 4 833 155; E 292 252 ORIGINATED BY V.P.

DIST 6 HWY 401/403 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.

DATUM Geodetic DATE 82-02-18 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT N (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						
173.0	Ground Surface										
0.0 / 172.4	Fill										
0.6	weathered Grey Shale Bedrock with thin layers of Limestone		1	SS	80/10 cm		172				
			2	SS	60/5 cm		170				
	Good Quality		3	BXL RC	REC 100%		168				
166.9 / 6.1	End of Borehole						166				

+3, ×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 3

METRIC

W P 127-66-72 LOCATION Co-ords. N 4 833 078; E 292 248 ORIGINATED BY V.P.

DIST 6 HWY 401/403 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.

DATUM Geodetic DATE 82-02-19 CHECKED BY

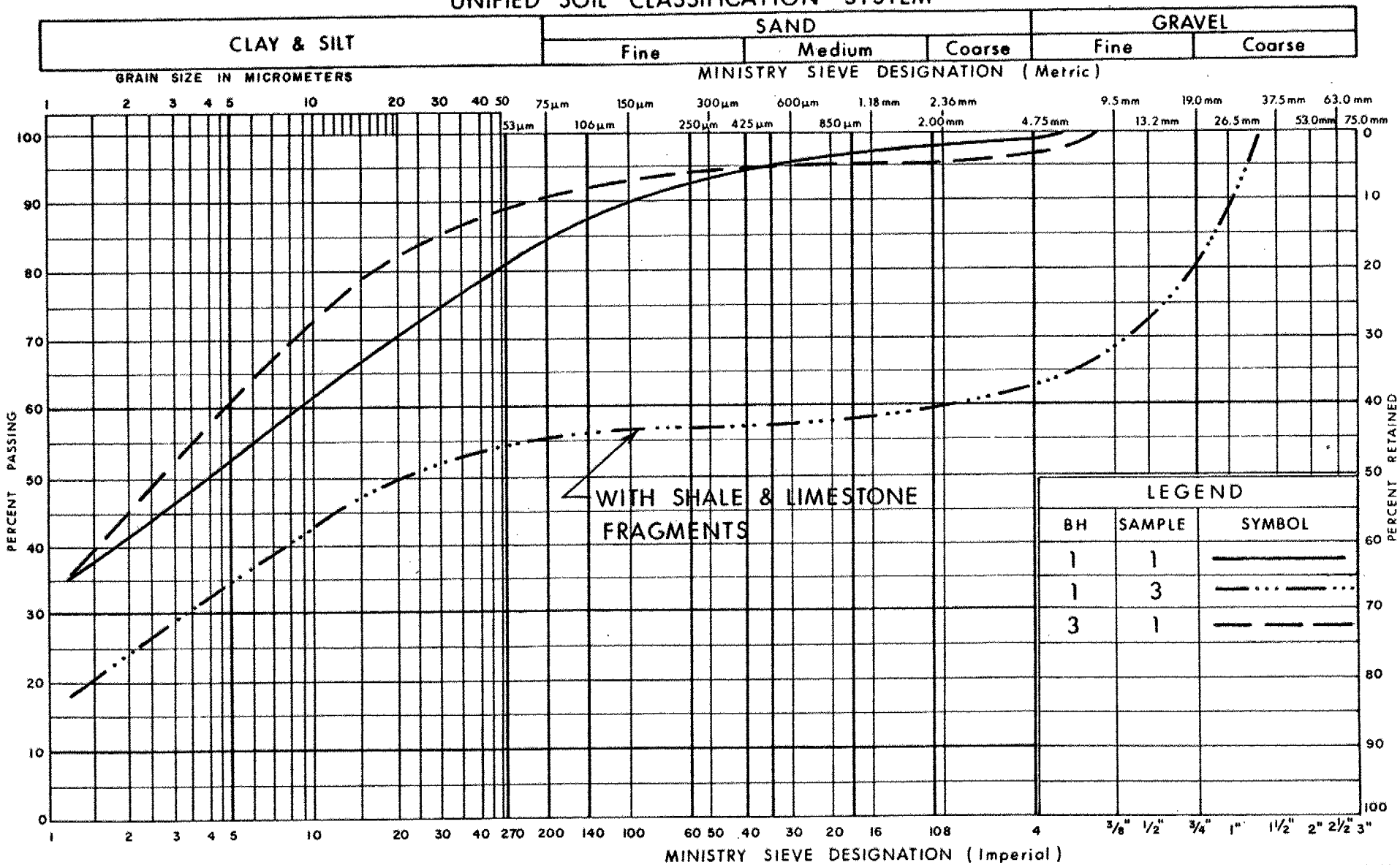
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
179.6	Ground Surface										
0.0	(Glacial Till) Silty Clay with Sand & Gravel occ. Limestone fragments.		1	SS	50/ 3 cm						
177.5	Grey, brown, hard		2	SS	75/ 11 cm		178				
2.1	Grey weathered Shale Bedrock with layers of Limestone		3	SS	70/ 8 cm						
			4	SS	70/ 6 cm		176				
			5	SS	75/ 11 cm						
			6	SS	50/ 2 cm						
			7	SS	50/ 3 cm		174				
			8	SS	50/ 0 cm		172				
			9	BXL RC	--						
			10	BXL RC	REC 100%		170				
			11	BXL RC	REC 100%		168				
167.3											
12.3	End of Borehole						166				

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

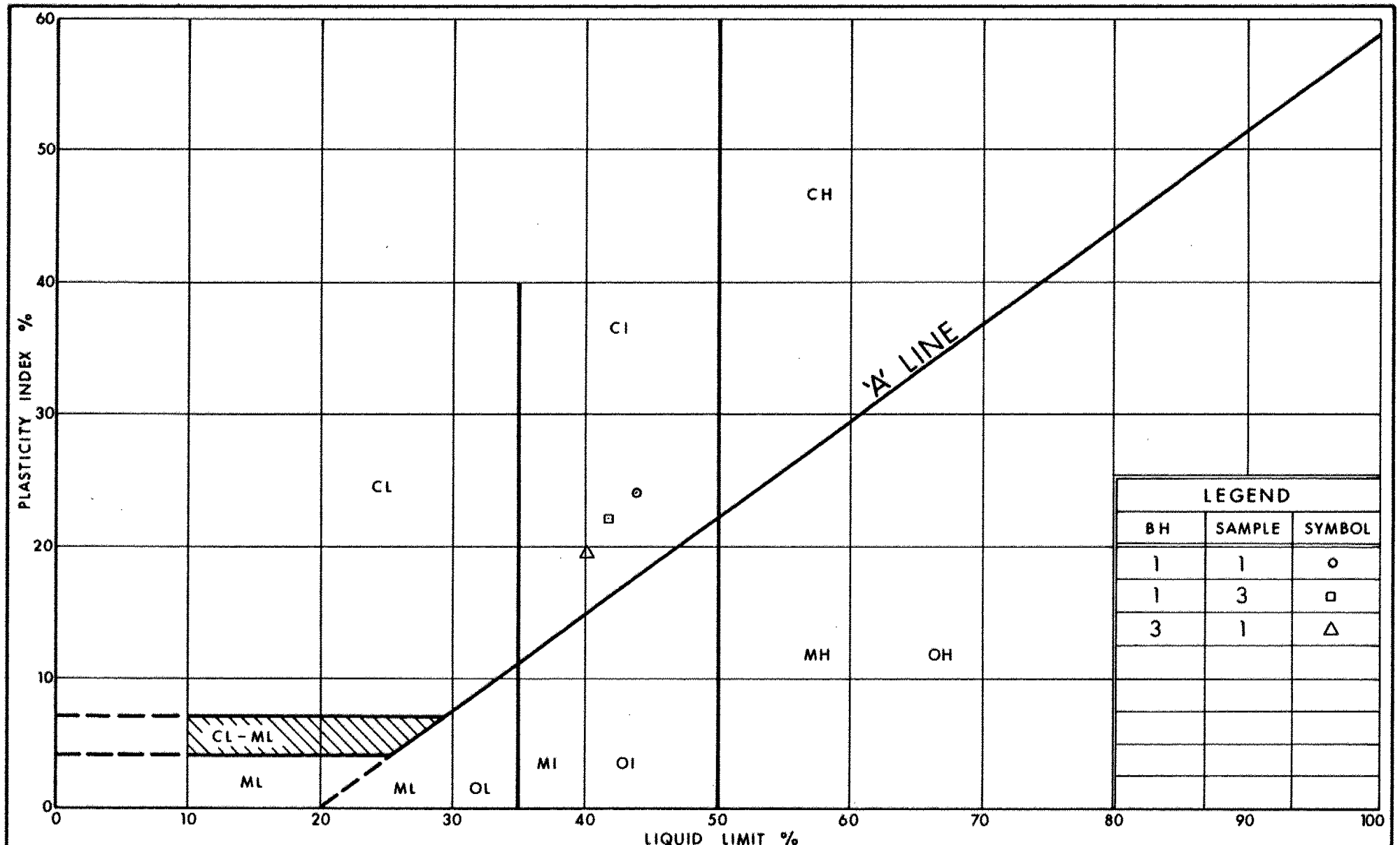
UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation and Communications
Ontario

GRAIN SIZE DISTRIBUTION
(GLACIAL TILL)
SILTY CLAY SOME SAND & GRAVEL

FIG No 1
W P 127-66-72



Ministry of Transportation and Communications
Ontario

PLASTICITY CHART
(GLACIAL TILL MATRIX)
SILTY CLAY OF INTERMEDIATE PLASTICITY

FIG No 2
W P 127-66-72

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	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_U	1	UNIFORMITY COEFFICIENT
γ	kN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_S	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL				k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	j	kN/m^3	SEEPAGE FORCE
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE			

METRIC

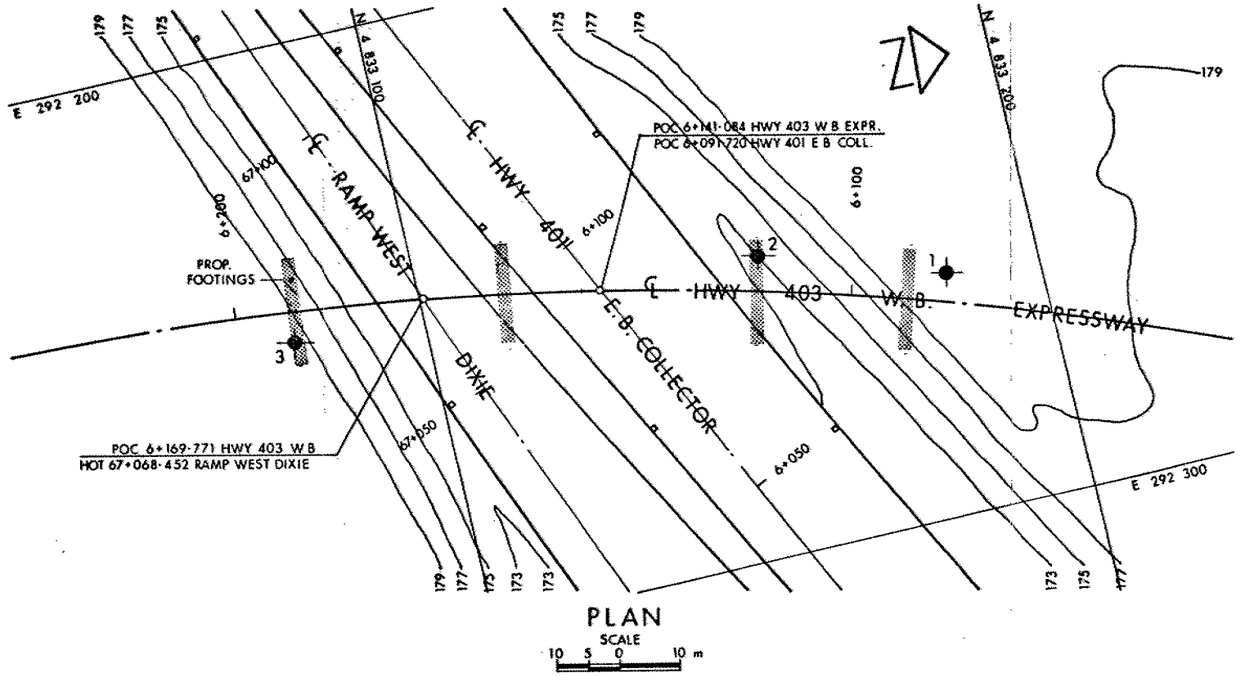
NOTE: DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES

CONT No
WP No 127-66-72

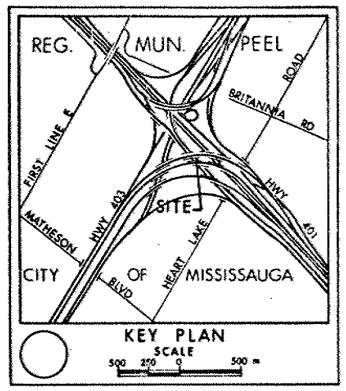
HWY 403 W.B. EXPRESSWAY OVER HWY 401 E.B. COLLECTOR & DIXIE RD SUB COLLECTOR
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

BRIDGE No 26



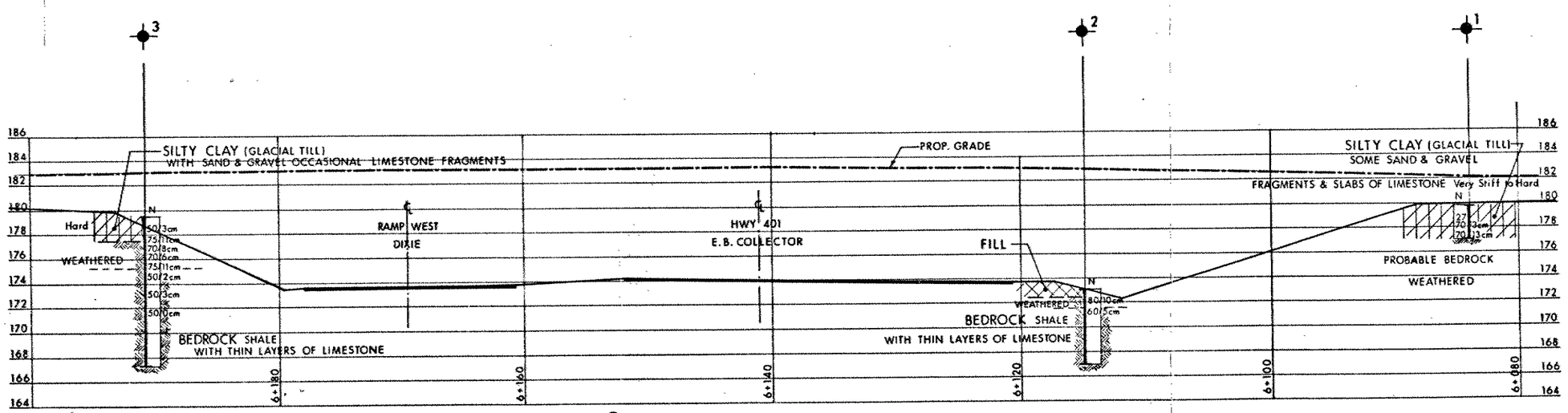
PLAN
SCALE 10 5 0 10 m



KEY PLAN
SCALE 500 250 0 500 m

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



℄ PROFILE HWY 403 W. B. EXPRESSWAY
SCALE 5 2·5 0 5 m

No	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
1	179·7	4 833 185	292 261
2	173·0	4 833 155	292 252
3	179·6	4 833 078	292 248

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 30M12-157

HWY No 401 & 403			DIST 6
SUBM'D T. K.	CHECKED	DATE 82 03 24	SITE 24-81-466
DRAWN O.L. J.	CHECKED	APPROVED	DWG 1276672-A