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DIST. 4 REGION

W.P. No. 83-74-20

CONT. No. 86-74

W. O. No.

STR. SITE No. 36-1336-61

HWY. No. Q.E.W

LOCATION Beach Blvd. Overpass

No of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



Ministry of
Transportation and
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foundation investigation and design report

F

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 83-74-20 DIST 4
HWY QEW STR SITE 36-1336-61

Beach Boulevard

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FOUNDATION INVESTIGATION REPORT

For

W.P. 83-74-20; Site 36-1336-61

Beach Boulevard Overpass Widening

Hwy. QEW, District 4, Hamilton

INTRODUCTION:

This report summarizes the results of a foundation investigation required for the proposed overpass widening and its approaches.

The fieldwork was conducted during the period from 84 05 01 to 84 05 10 utilizing continuous-flight auger machines equipped with 82 mm I.D. hollow-stem augers. Wash-boring techniques were employed where necessary.

This fieldwork consisted of 6 dynamic cone penetration tests/sampled boreholes.

SITE DESCRIPTION

The site is located in the City of Hamilton, Regional Municipality of Hamilton-Wentworth at the intersection of Beach Boulevard and the QEW.

There is an existing overpass at this location.

According to Chapman & Putnam (1966), the site lies within the 'Iroquois Plain' physiographic area, at this location near the south end of the Burlington Bar.

The local topography is relatively flat, with the level of Beach Boulevard approximately 6 m below the grade of the QEW.

SUBSURFACE CONDITIONS

General

The Record of Borehole Sheets (Appendix), illustrate the conditions at the borehole locations. The locations of the boreholes, and stratigraphical profiles based on the borehole data, are shown on Drawing No. 837420-A.

The thickness of overburden is approximately 23 m. The bedrock surface dips gently towards the north.

The sequence (from the surface downwards to bedrock) of subsurface materials at this site is summarized below:

Material	Thickness
silty clay to silty sand fill	1.5 - 5.5 m
silty sand to sand	10.0 - 12.2 m
silty clay	4.6 - 8.7 m

Subsurface Material Descriptions

SILTY CLAY (CL); SOME/WITH SAND, TRACE/SOME GRAVEL

This soft to stiff fill material was encountered at the surface at BH #1, #2, #5 and #6, where its thickness ranges from 1.8 to 4.9 m. The material also contains occasional boulders and occasional zones of organic material.

Physical properties of the material, as determined from field and laboratory tests, are summarized as follows:

	<u>Range</u>	<u>Average</u>	<u>Median</u>
Natural Moisture Content (w)	13.0 - 56.5%	24.7%	19.5%
Liquid Limit (w_L)	21.5 - 54.5%	34.6%	31.0%
Plastic Limit (w_p)	14.5 - 33.0%	18.9%	15.5%

Figure 1 illustrates a typical grain size distribution for this material.

SILTY SAND; TRACE/SOME GRAVEL, TRACE CLAY

This very loose to compact fill material was encountered at the surface at BH #3 and #4, where it ranges in thickness from 4.9 to 5.5 m. The material also contains occasional boulders, occasional zones of gravel, occasional zones of organics, and occasional zones of silty clay.

Physical properties of the material, as determined from field and laboratory tests, are summarized as follows:

	<u>Range</u>	<u>Average</u>	<u>Median</u>
Natural Moisture Content (w)	4.0 - 7.0%	5.5%	5.5%

Figure 2 illustrates a typical grain size distribution for this material.

SILTY SAND TO SAND; TRACE/SOME GRAVEL

This compact to very dense material underlies the fill at all the borehole locations, where its thickness ranges from 10.0 to 12.2 m. The material also contains occasional gravelly zones.

SILTY CLAY (CL); SOME SAND, TRACE/SOME GRAVEL

This very stiff to hard material underlies the SILTY SAND TO SAND at all borehole locations where its thickness ranges from 4.6 to 8.7 m. Transitional zones, grading from silty clay with shaly layers to weathered shale were encountered within this deposit, immediately above the bedrock.

Bedrock

The bedrock is shale of the Queenston formation.

Groundwater

At the time of the field investigation the elevation of the groundwater was $75.4 \pm \text{m}$.

DISCUSSION AND RECOMMENDATIONS

It is proposed to widen the existing QEW. At the Beach Boulevard Overpass, this proposal will involve the extension of the existing abutments by 7± m on the west side, and 5± m on the east side. The proposal will also involve widening the existing 6± m high approach embankments.

The existing overpass is supported on 0.3± m O.D. concrete-filled steel tube piles. The base of the pile caps is at elev. 75.3± m (reference: drawing no. 1336-52-5, General 56-42).

General Recommendations

EARTH PRESSURE CALCULATIONS

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
GRANULAR 'A'	35°	22.0 kN/m ³
GRANULAR 'B'	30°	21.2 kN/m ³

SETTLEMENT CONSIDERATIONS

Differential settlements for the proposed abutment extensions and proposed retaining walls will be negligible. Therefore the proposed additions may be rigidly connected to the existing structure.

FINAL SLOPE STABILITY

No stability problems are anticipated for embankments or cuts with slopes of 2:1 or flatter. If steeper slopes are required, please contact this section for recommended slope angles.

TEMPORARY SLOPE STABILITY

If the existing wingwalls do not provide the necessary protection for the QEW during construction, the required road protection may be achieved with steel sheeting.

FROST PROTECTION

The minimum cover required for frost protection is 1.2 m.

DE-WATERING

Major de-watering problems are not anticipated as the recommended pile caps base elevations are at or above the existing groundwater elevation.

UNDERGROUND UTILITY CONSIDERATION

Any trenches (e.g. underground utilities) encountered within the footing areas should be excavated and backfilled with properly compacted granular material.

Design Details

STRUCTURE

Both the proposed abutment extensions and the proposed retaining walls should be supported on steel H-piles equipped with reinforced tips and driven to bedrock, with pile caps founded at the same elevation as the existing pile cap bases.

The following design values are recommended for the H-piles:

Working Stress Design Method:

<u>Pile Type</u>	<u>Safe Capacity</u>
310 HP 110	1150 kN per pile
310 HP 79	830 kN per pile

O.H.B.D.C. Method:

<u>Pile Type</u>	<u>Factored Capacity at U.L.S.</u>	<u>Capacity at S.L.S. Type II</u>
310 HP 110	1600 kN per pile	1150 kN per pile
310 HP 79	1150 kN per pile	830 kN per pile

APPROACHES

Major construction problems are not anticipated for the approaches.

MISCELLANEOUS

The fieldwork for this project was carried out under the supervision of Mr. T.W. Miller, Student Engineer, and Mr. D.H. Dundas, Foundations Engineer.

The report was written by Mr. Dundas and reviewed by Mr. K.G. Selby, Chief Foundations Engineer.

The equipment used was owned and operated by Dominion Soil Investigation . Inc., and by Master Soil Investigation Ltd.



D. H. Dundas

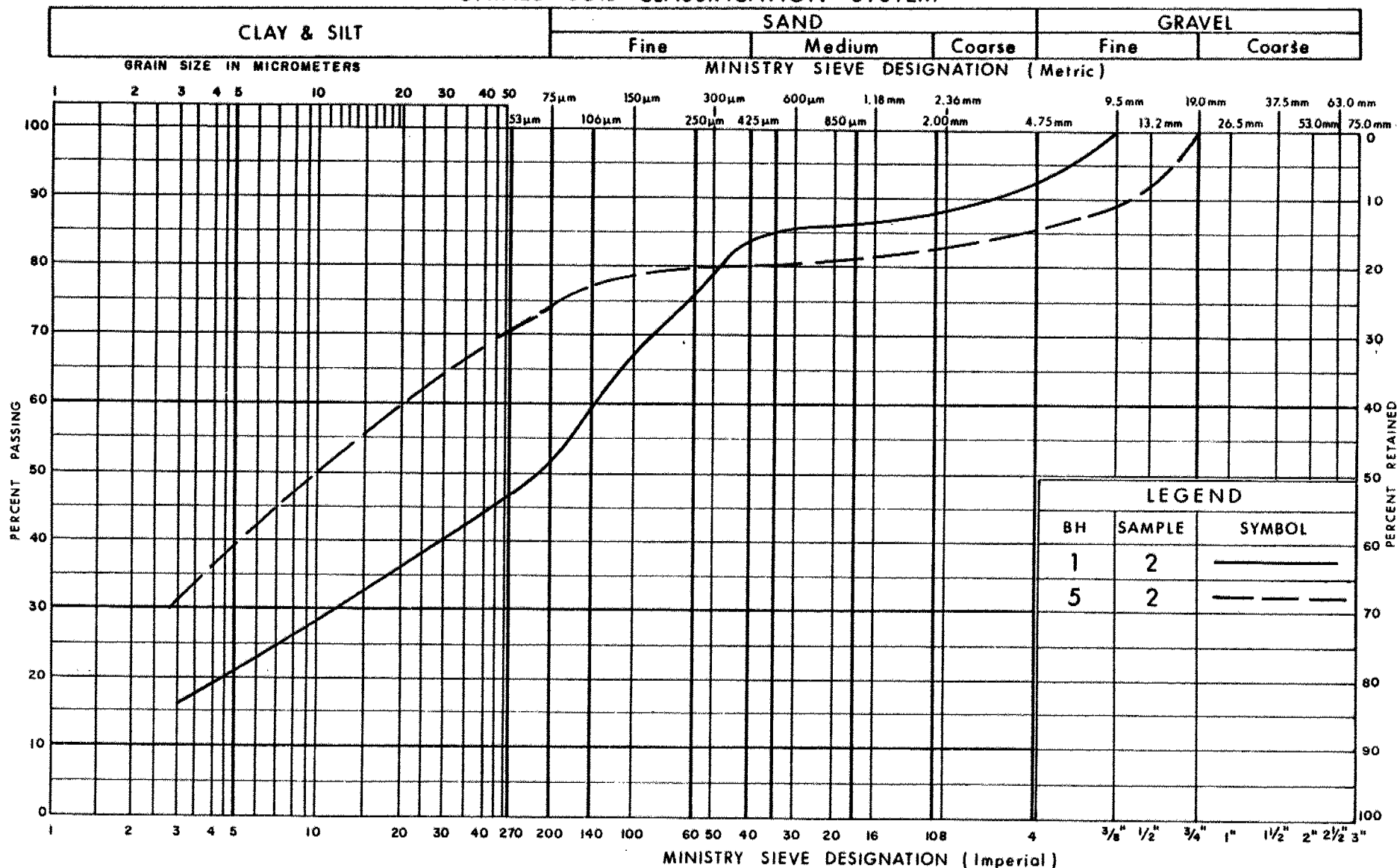
D. H. Dundas, P.Eng.
Foundations Engineer

K. G. Selby

K. G. Selby, P.Eng.
Chief Foundations Engineer (West)

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM



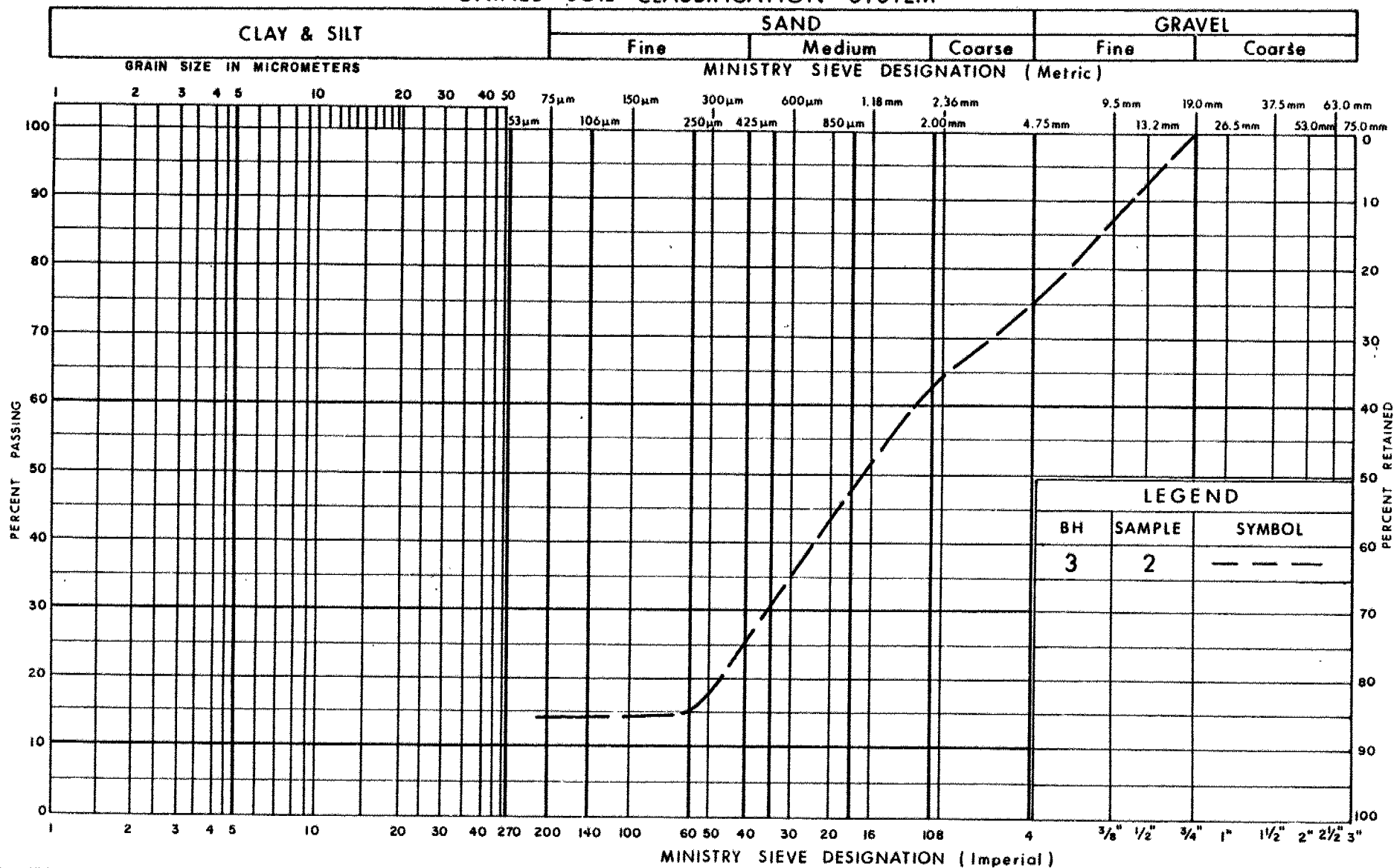
Ministry of
Transportation and
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GRAIN SIZE DISTRIBUTION
SILTY CLAY
SOME/ WITH SAND, TRACE / SOME GRAVEL

FIG No 1

W P 83-74-20

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
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GRAIN SIZE DISTRIBUTION
SILTY SAND
TRACE / SOME GRAVEL, TRACE CLAY

FIG No 2

W P 83-74-20

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 (RQD), 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

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 = $\frac{c_u}{\tau_r}$

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

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	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{\max}	1, %	VOID RATIO IN LOOSEST STATE	j	kn/m^2	SEEPAGE FORCE
γ'	kn/m^3	UNIT WEIGHT OF SUBMERGED SOIL						



RECORD OF BOREHOLE No 1

METRIC

W P 83-74-20 LOCATION Co-ords. N 4 791 286.0; E 282 695.5 ORIGINATED BY TM
DIST 4 HWY QEW BOREHOLE TYPE Cone Test, H-S Auger COMPILED BY DD
DATUM Geodetic DATE 84 05 01 - 03 CHECKED BY E SO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	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								
77.7	Ground Surface												
0.0	Silty Clay (CL) some/with sand trace/some gravel occ. boulders Soft to Stiff		1	SS	14								8 40 40 12
			2	SS	7								
			3	SS	5								
			4	SS	5								
	and sand		5	SS	3								
72.8			6	SS	7								
4.9			7	SS	7								0 91 9
			8	SS	12								
	Silty Sand to Sand trace/some gravel occ. traces of clay Compact to Very Dense		9	SS	67								
			10	SS	48								
			11	SS	62								
			12	SS	15								
			13	SS	60								
			14	SS	24								
60.6			15	SS	78								
17.1	Silty Clay (CL) some sand trace/some gravel Hard		16	SS	54								19 25 41 15
	occ. shaly layers		17	SS	112								
56.0			18	SS	60/8cm								
21.7	Probable Bedrock Shale End of Borehole												

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 2

METRIC

W P 83-74-20 LOCATION Co-ords. N 4 791 260.0; E 282 709.0 ORIGINATED BY TM
 DIST 4 HWY QEW BOREHOLE TYPE Cone Test, R-S Auger COMPILED BY DD
 DATUM Geodetic DATE 84 05 03 - 09 CHECKED BY ES

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	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									
77.7 0.0	Ground Surface													
	Silty Clay (CL) some/sand trace/some gravel occ. boulders Soft to Stiff		1	SS	13									20 19 43 18
			2	SS	7									
			3	SS	6									
	occ. zones of organics (peat)		4	SS	3									0 18 60 22
73.7 4.0			5	SS	7									
	Silty Sand to Sand trace/some gravel occ. traces of clay Compact to Very Dense		6	SS	3									
			7	SS	27									
			8	SS	62									
	Occ. gravelly zones		9	SS	37									
			10	SS	52									52 35 9 4
			11	SS	32									
			12	SS	91									
			13	SS	100									
62.8 14.9			14	SS	41									
	Silty Clay (CL) some sand trace/some gravel Hard		15	SS	60									
			16	SS	96									
	occ. shaly layers		17	SS	102									
57.0 20.7			18	SS	86/15 cm									
	Probable Bedrock shale End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION



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Ontario

RECORD OF BOREHOLE No 3

METRIC

W P 83-74-20 LOCATION Co-ords. N 4 791 318.5; E 282 666.0 ORIGINATED BY TM
DIST 4 HWY QEW BOREHOLE TYPE H-S Auger, Cone Test COMPILED BY TM
DATUM Geodetic DATE 84 05 03 - 04 CHECKED BY SO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) * 20 40 60	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
77.6	Ground Surface										
0.0	Silty Sand trace/some gravel trace clay occ. boulders Loose to Compact		1	SS	27						25 60 15
			2	SS	6						
			3	SS	5						
	occ. gravelly zones		4	SS	7						67 23 10
			5	SS	21						
	occ. silty clay zones		6	SS	5						
72.1											
5.5	Silty Sand to Sand trace/some gravel occ. traces of clay Compact to Very Dense		7	SS	28						
			8	SS	57						
			9	SS	50						
	occ. gravelly zones		10	SS	101						
			11	SS	47						
			12	SS	46						
			13	SS	9						
60.5			14	SS	127						
17.1	Silty Clay (CL) some sand trace/some gravel Hard		15	SS	48						
			16	SS	54/10 cm						
			17	SS	60/10 cm						
	occ. shaly layers		18	SS	76/15 cm						
			19	SS	83/15 cm						
53.1											
24.5	Probable Bedrock Shale End of Borehole										

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



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Communications

RECORD OF BOREHOLE No 4

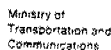
METRIC

W P 83-74-20 LOCATION Co-ords. N 4 791 312.0; E 282 678.0 ORIGINATED BY DD
DIST 4 HWY QEW BOREHOLE TYPE H-S Auger, Cone Test COMPILED BY TM
DATUM Geodetic DATE 84 05 09 - 10 CHECKED BY JS 50

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	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								
77.6	Ground Surface												
0.0	Silty Sand trace/some gravel trace clay occ. boulders Very Loose to Compact occ. zones of organics		1	SS	11								
			2	SS	6								
			3	SS	5								
			4	SS	3								
			5	SS	2								
72.7			6	SS	7								
4.9	Silty Sand to Sand trace/some gravel occ. traces of clay Compact to Very Dense occ. gravelly zones		7	SS	21								
			8	SS	7								
			9	SS	24								
			10	SS	29								
			11	SS	124								
			12	SS	38								
			13	SS	40								
62.7			14	SS	23								
14.9	Silty Clay (CL) some sand trace/some gravel Very Stiff to Hard		15	SS	120								
			16	SS	77								
53.9													
23.7	Probable Bedrock Shale End of Borehole												

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



METRIC

W P 83-74-20 LOCATION Co-ords. N 4 791 332.5; E 282 719.0 ORIGINATED BY TM
DIST 4 HWY QEW BOREHOLE TYPE H-S Auger, Cone Test COMPILED BY TM
DATUM Geodetic DATE 84 05 09-10 CHECKED BY SO

[illegible]

+3, x5; Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 6

METRIC

W P. 83-74-20 LOCATION Co-ords. N 4 791 364.5; E 282 701.5 ORIGINATED BY TM
 DIST 4 HWY QEW BOREHOLE TYPE H-S Auger, Cone Test COMPILED BY TM
 DATUM Geodetic DATE 84 05 09 - 10 CHECKED BY SO

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	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
77.5	Ground Surface												
0.0	Silty Clay (CL) *		1	SS	16								
75.7	Soft to Stiff		2	SS	6								
1.8			3	SS	5								
			4	SS	10								
			5	SS	18								
			6	SS	61								
			7	SS	36								
	Silty Sand to Sand		8	SS	59								
	trace/some gravel		9	SS	56								
	occ. traces of clay		10	SS	100/23 cm								
	Compact to		11	SS	75/23 cm								
	Very Dense		12	SS	43								
61.8	End of Borehole												
15.7	* some/with sand												
	trace/some gravel												
	occ. boulders												

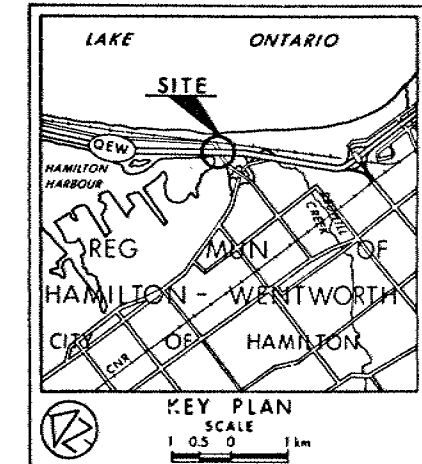
+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

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

CONT No
WP No 83-74-20

BEACH BLVD
BORE HOLE LOCATIONS & SOIL STRATA



- 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 1984 05

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	77.7	4 791 286.0	282 695.5
2	77.7	4 791 260.0	282 709.0
3	77.6	4 791 318.5	282 666.0
4	77.6	4 791 312.0	282 678.0
5	77.5	4 791 332.5	282 719.0
6	77.5	4 791 364.5	282 701.5

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

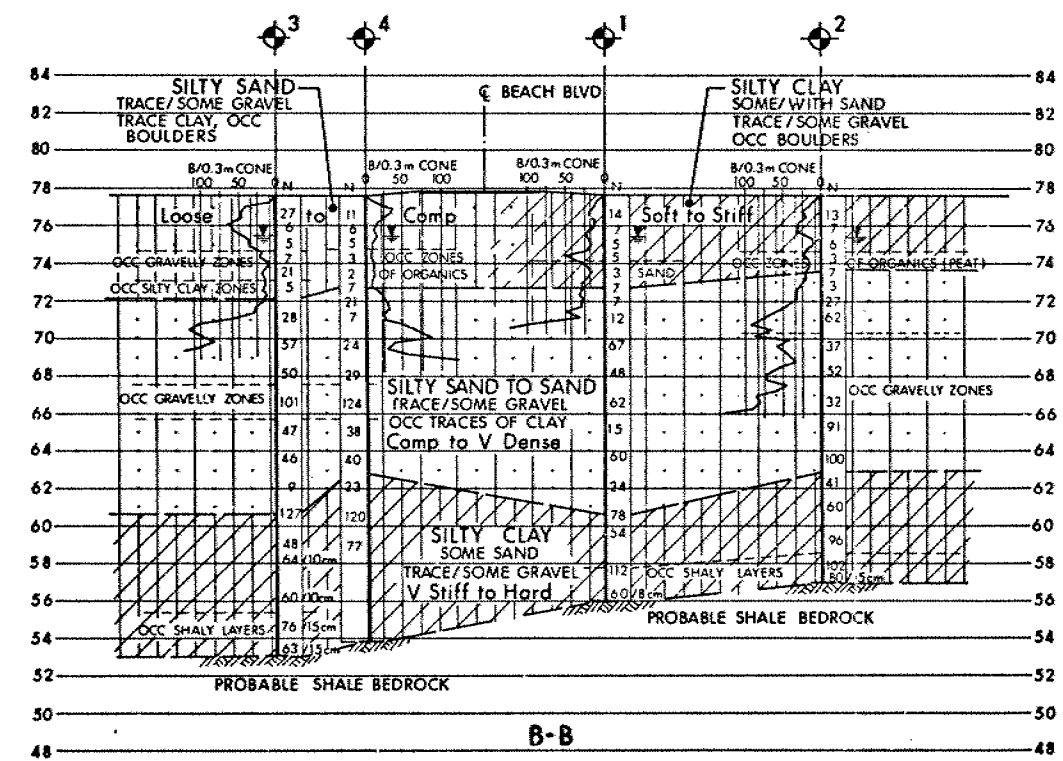
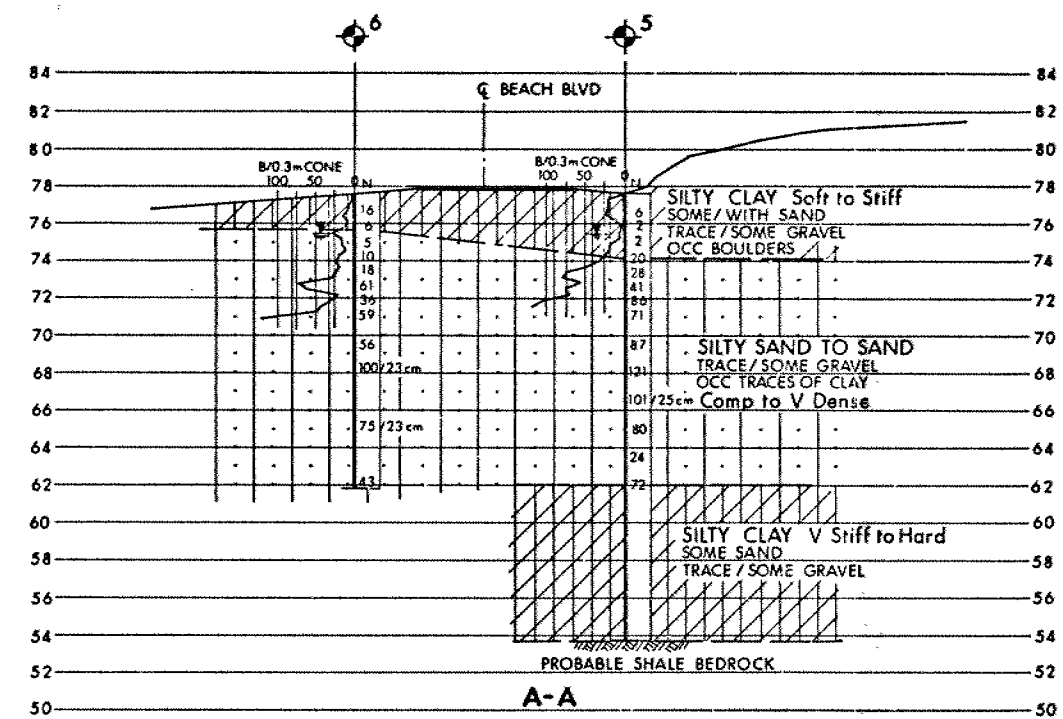
NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2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

REV	DATE	BY	DESCRIPTION

Geocres No 30M5-142

HWY No.	QEW	DIST
SUBM'D DD	CHECKED	DATE 1984 06 15
DRAWN SO	CHECKED	DATE 1984 06 15

REF NO 5-2183-1 - COLE, SHERMAN & ASSOC LTD



METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

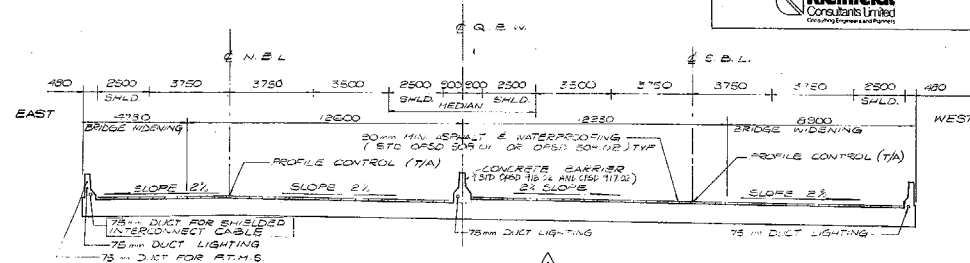
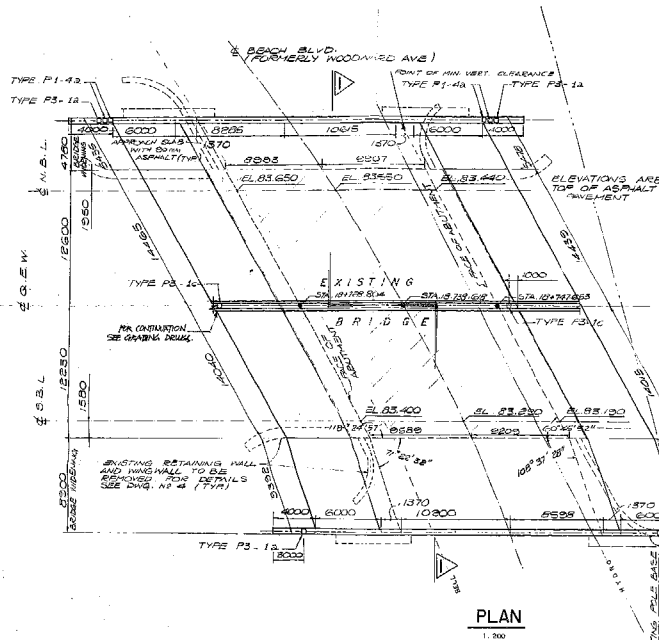
CONT No
WP No 83-74-20

WIDENING & DECK REHABILITATION OF
THE Q.E.W.-BEACH BLVD. OVERPASS

GENERAL ARRANGEMENT



SHEET



NOTE: FOR BRIDGE CONSTRUCTION & TRAFFIC
STAGING SEE DIV. 2

GENERAL NOTES:

- CLASS OF CONCRETE
FOOTINGS & APPROACH SLABS
REMAINER 20Mpa
30Mpa
- REINFORCING STEEL
REINFORCING STEEL SHALL BE GRADE 400
UNLESS OTHERWISE SPECIFIED
- BARs MARKED WITH THE SUFFIX 'C' SHALL
BE COATED BARS
- CLEAR COVER TO REINFORCING STEEL
FOOTINGS 100 ± 25
ABUTMENTS, VIADUCTS
AND RETAINING WALLS 80 ± 20
DECK 70 ± 20
TOP 50 ± 10
BOTTOM 70 ± 20
UNLESS OTHERWISE NOTED

CONSTRUCTION NOTES:

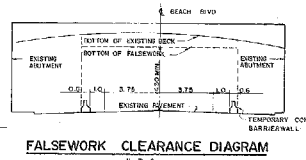
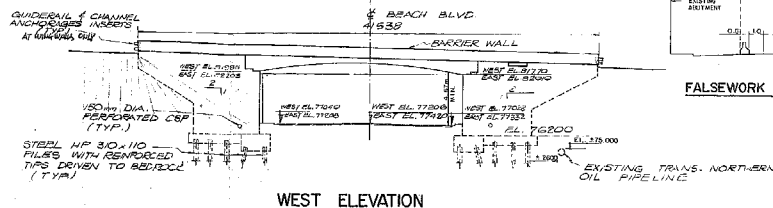
ALL DIMENSIONS AND ELEVATIONS REQUIRED FOR THE STRUCTURE
WIDENING SHALL BE CHECKED IN THE FIELD BY THE CONTRACTOR
BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH ABUTMENTS
KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME.
AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN
500 mm.

LIST OF DRAWINGS

- GENERAL ARRANGEMENT
- CONSTRUCTION/Traffic STAGING
- ONE-SIDE LOCATION AND SOIL STRATA
- REMOVALS
- EXIST FOUNDATION WIDENING
- WEST FOUNDATION WIDENING
- EAST ABUTMENT WIDENING - NORTH SIDE
- EAST ABUTMENT WIDENING - SOUTH SIDE
- WEST ABUTMENT WIDENING - NORTH SIDE
- WEST ABUTMENT WIDENING - SOUTH SIDE
- EAST DECK WIDENING
- WEST DECK WIDENING
- DECK ELEVATIONS
- BARREL WALL
- APPROACH SLAB
- BRIDGE DATE & SITE NUMBER DATA
- ROADWAY PROTECTION
- QUANTITIES - STRUCTURE
- QUANTITIES - STRUCTURE

FOR APPROVAL ONLY

DEC 28 1984



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

DATE	BY	CHECK	DESCRIPTION
DESIGN	K.C.	CHECK S.B.	LOADING, Q.E.W.-A-83
DRAWING	J.A.	CHECK P.C.	SITE No. 38-1336-61 DWG 1