

G.I.F-30 SEPT. 1976

GEOCRES No. 30M15-47DIST. 87 REGION W.P. No. 59-75-01CONT. No. 80-55W. O. No. STR. SITE No. HWY. No. 401LOCATION Albert #10Waverly Rd & 401No. of PAGES - =====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

INDEX

<u>Page No.</u>	<u>Description</u>
1	Index
2	Abbreviations & Symbols
3- 14	Foundation Investigation Reports For
	W.P. 59-75-01 Culvert No. 10, Sta. 353+68 Hwy. 401, District 7, Port Hope Retaining Walls
	W.P. 59-75-04 Courtice Road Overpass

NOTE: For purposes of the contract these reports supercede all other foundation reports prepared by or for the Ministry in connection with the above mentioned projects.

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS N_c .

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

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

S_u (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCK QUALITY: 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 DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4" 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	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG. $\bar{C}IU$ = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

SS SPLIT SPOON
WS WASH SAMPLE
ST SLOTTED TUBE SAMPLE
BS BLOCK SAMPLE
CS CHUNK SAMPLE
TW THINWALL OPEN
TP THINWALL PISTON
OS OSTERBERG SAMPLE
FS FOIL SAMPLE
RC ROCK CORE
PH T.W. ADVANCED HYDRAULICALLY
PM T.W. ADVANCED MANUALLY

EARTH PRESSURE TERMS

μ COEFFICIENT OF FRICTION
 δ ANGLE OF WALL FRICTION
 k_o COEFFICIENT OF EARTH PRESSURE AT REST
 k_A COEFFICIENT OF ACTIVE EARTH PRESSURE
 k_P COEFFICIENT OF PASSIVE EARTH PRESSURE
 i ANGLE OF INCLINATION OF SURCHARGE
 w SLOPE ANGLE-BACKFACE OF WALL
 β ANGLE OF SLOPE
 N_q, N_c, N_{γ} BEARING CAPACITY FACTORS
 D_f DEPTH OF FOOTING
 B, L FOOTING DIMENSIONS

INDEX PROPERTIES

γ UNIT WEIGHT OF SOIL (BULK DENSITY)
 γ_w UNIT WEIGHT OF WATER
 γ_d UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
 γ' UNIT WEIGHT OF SUBMERGED SOIL
 G_s SPECIFIC GRAVITY OF SOLIDS
 e VOIDS RATIO
 e_o INITIAL VOIDS RATIO
 e_{max} e IN LOOSEST STATE
 e_{min} e IN DENSEST STATE
 D_r RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$
 n POROSITY
 w WATER CONTENT
 w_L LIQUID LIMIT
 w_P PLASTIC LIMIT
 w_S SHRINKAGE LIMIT
 I_P PLASTICITY INDEX = $w_L - w_P$
 L_L LIQUIDITY INDEX = $\frac{w - w_P}{I_P}$
 I_C CONSISTENCY INDEX = $\frac{w_L - w}{I_P}$
 A_c ACTIVITY = $\frac{I_P \text{ of soil}}{I_P \text{ of } 2\mu m \text{ Soil Fraction}}$
 O_m ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u(\text{undisturbed})}{S_u(\text{remoulded})}$

STRENGTH PARAMETERS

ϕ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_R RESIDUAL SHEAR STRENGTH
 c COHESION INTERCEPT
 $\sigma_1, \sigma_2, \sigma_3$ NORMAL PRINCIPAL STRESSES
 u PORE WATER PRESSURE
 u_e EXCESS u
 r_u PORE PRESSURE RATIO
 q_u UNCONFINED COMPRESSIVE STRENGTH
 s_u UNDRAINED SHEAR STRENGTH
 ϵ LINEAR STRAIN
 γ SHEAR STRAIN
 ν POISSON'S RATIO
 E MODULUS OF ELASTICITY
 G MODULUS OF SHEAR DEFORMATION
 k_s MODULUS OF SUBGRADE REACTION
 m, n STABILITY COEFFICIENTS
 A, B PORE PRESSURE COEFFICIENTS

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS

HYDRAULIC TERMS

h HYDRAULIC HEAD OR POTENTIAL
 q RATE OF DISCHARGE
 v VELOCITY OF FLOW
 i HYDRAULIC GRADIENT
 j SEEPAGE FORCE PER UNIT VOLUME
 η COEFFICIENT OF VISCOSITY
 k COEFFICIENT OF HYDRAULIC CONDUCTIVITY
 k_h k IN HORIZONTAL DIRECTION
 k_v k IN VERTICAL DIRECTION
 m_v COEFFICIENT OF VOLUME CHANGE
 c_v COEFFICIENT OF CONSOLIDATION
 C_c COMPRESSION INDEX
 C_r RECOMPRESSION INDEX
 d DRAINAGE PATH DISTANCE
 T_v TIME FACTOR
 U DEGREE OF CONSOLIDATION
 O_c OVERCONSOLIDATION RATIO (OCR)

FOUNDATION INVESTIGATION REPORT

For

Culvert No. 10, Sta. 353+68
Retaining Walls
Hwy. 401, District 7, Port Hope
W.P. 59-75-01

INTRODUCTION

To accommodate the Highway 401 widening in this area within the existing property limits, retaining walls will be constructed at both ends of the above listed culvert. The results of a foundation investigation for these walls is contained in this report. Fieldwork, which was carried out December 5th and 6th, 1978, consisted of four sampled boreholes to a maximum depth of 21.5 feet.

DESCRIPTION OF SITE AND GEOLOGY

The site is located about one mile west of the Waverly Road and Highway 401 interchange. The existing structure is a 14'x8'x240' concrete box culvert at Sta. 353+68 on Highway 401 referred to as Culvert No. 10.

The area is located in the physiographical region known as the Iroquois Plain. In this area the subsoil is a mosaic of till plains, drumlins and areas of silty lacustrine deposits dating from the Pleistocene Epoch.

SUBSURFACE CONDITIONS

Subsurface conditions at the site were found to be generally uniform. At the south end of the culvert immediately under a foot of topsoil is a 6 to 7.5 foot thick layer of fill material. The upper 3.5 feet is made up of clayey silt, sand, gravel and trace of organics and the lower portion of fill material is mainly composed of silty sand to sandy gravel. At the north end of the culvert, fill material

consisting of sandy gravel with clay and a trace of organics is found only at the northeast corner. Here it has a thickness of up to 4.5 feet. The fill material is generally compact. Underlying the above mentioned fill material is the original subsoil which consists of a heterogeneous mixture of clayey silt, sand and gravel (glacial till). This deposit was investigated down to a maximum depth of 21.5 feet.

The physical properties of the glacial till as determined from laboratory testing are summarized as follows.

Liquid Limit	(W _L)%	12-15
Plastic Limit	(W _p)%	10-12
Moisture Content	(W) %	4-7

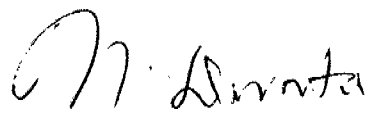
The Standard Penetration Tests gave 'N' values in the range of 20 to over 100 blows per foot, generally decreasing with depth. Based on these 'N' values the consistency of this stratum is estimated to be very stiff to hard.

The boundaries between the various soil types are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with an estimated stratigraphical profile based on borehole data, is shown on Sheet No. 89-1

Groundwater

Groundwater levels were measured in the open boreholes during the field investigation. The groundwater level was found to vary between elevation 278 and 279.0 which corresponds to 1 to 7 feet below the existing ground surface. The groundwater levels are shown on the Record of Borehole Sheets, as well as on Sheet No.


P.J. Stuart
Foundations Engineer


M. Devata
Senior Foundations Engineer

March 21, 1980.

APPENDIX



RECORD OF BOREHOLE No 1

W P 59-75-01 LOCATION Coords. N 15 947 317; E 1 208 018 ORIGINATED BY V.K.
DIST 7 HWY 401 BOREHOLE TYPE 3 1/2 H.S.M.V. Auger COMPILED BY V.K.
DATUM Geodetic DATE December 6, 1978 CHECKED BY [Signature]

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				
280.0	Ground Level															
0.0	Topsoil															
	Heterogeneous Mixture of Clayey Silt, Sand and Gravel, Glacial Till		1	SS	100/	5"										
			2	SS	100/	6"										
	Brown		3	SS	100/	5"										
	Grey		4	SS	75											
			5	SS	85											
258.5	Hard		6	SS	42											
21.5	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 2

W P 59-75-01 LOCATION Coords. N 15 947 344; E 1 208 180 ORIGINATED BY V.K.
DIST 7 HWY 401 BOREHOLE TYPE 3 1/2" H.S.M.V. Auger COMPILED BY V.K.
DATUM Geodetic DATE December 6, 1978 CHECKED BY R.J.

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
284.8	Ground Level																
0.0	Topsoil																
279.3	Sandy Gravel With Clay and Trace of Organics (Fill) Brown		1	SS	16		280										42 37 19 2
5.5	Heterogeneous Mixture of Clayey Silt, Sand and Gravel Glacial Till		2	SS	135/11												14 39 37 10
			3	SS	65												
			4	SS	55												
			5	SS	90												
263.3	Hard		6	SS	20												
21.5	End of Borehole						260										

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

W P 59-75-01 LOCATION Coords. N 15 947 127; E 1 208 334 ORIGINATED BY V.K.
 DIST 7 HWY 401 BOREHOLE TYPE 3½" H.S.M.V. Auger COMPILED BY V.K.
 DATUM Geodetic DATE December 5, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L
								SHEAR STRENGTH							
281.2	Ground Level														
0.0	TOPSOIL														
	Clayey Silt, Sand, Gravel, Organics		1	SS	6		280								
272.1	Sandy Gravel, Very Dense (Fill) Brown		2	SS	65										
8.5	Grey		3	SS	85		270								
	Heterogeneous Mixture of Clay, Silt, Sand and Gravel		4	SS	81										
	Glacial Till		5	SS	67										
259.7	Hard		6	SS	47		260								
21.5	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

W P 59-75-01 LOCATION Coords. N 15 947 143; E 1 208 400 ORIGINATED BY V.K.
 DIST 7 HWY 401 BOREHOLE TYPE 3 1/2" H.S.M.V. Auger COMPILED BY V.K.
 DATUM Geodetic DATE December 5, 1978 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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
283.5	Ground Level													
0.0	Topsoil													
	Clayey Silt, Sand & Gravel & Organics (Fill)		1	SS	10		280							0 31 64 5
276.5	Silty Sand and Gravel		2	SS	26									
7.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel		3	SS	110									8 49 33 10
	Glacial Till		4	SS	100/	6"	270							
	Hard		5	SS	65									
262.0			6	SS	56									
21.5	End of Borehole						260							

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity
 20
 15
 10
 5 (%) STRAIN AT FAILURE

FOUNDATION INVESTIGATION REPORT

For

Courtice Road Overpass
W.P. 59-75-04, Site 21-158
Hwy. 401, District 7, Port Hope

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project. The fieldwork consisted of two sampled boreholes advanced February 17, 1978 by means of a continuous flight auger machine equipped with solid and hollow stem augers. The boreholes ranged in depth from 20.5 to 26.0 feet below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located approximately 5 miles east of Oshawa City on Hwy. 401 in the Regional Municipality of Durham. The area is located in the physiographical region known as Iroquois Plain. In this area the subsoil is a mosaic of till plains, drumlins and areas of silty lacustrine deposits.

SUBSURFACE CONDITIONS

Subsurface conditions at the site were found to be generally uniform. The original ground under about 18 inches of existing roadbed is a glacial till composed of a heterogeneous mixture of silt and sand with some clay and gravel, generally slightly cohesive in character. The results of grain size distribution testing performed on representative samples from the overall glacial till deposit are shown in an envelope form on Figure 1 of the Appendix.

The physical properties of the glacial till as determined from laboratory testing are summarized as follows:

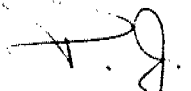
		<u>Range</u>
Liquid Limit	(W_L)%	13-14
Plastic Limit	(W_p)%	11-11.5
Moisture Content	(W) %	3.5-8
Plasticity Index	(I_p)%	1.5-2.5

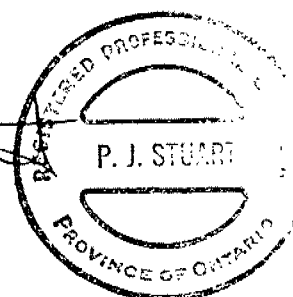
The Standard Penetration Tests gave 'N' values in the range of 13 to over 100 blows per foot, generally increasing with depth. Based on these 'N' values the relative consistency of this deposit is stiff to hard, generally in the hard range. The lower boundary of the glacial till deposit was not established but was proven to a maximum thickness of 24.5 feet.

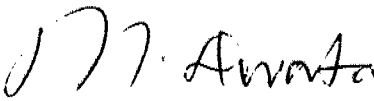
The boundaries between the various soil types are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with an estimated stratigraphical profile based on borehole data, is shown on Drawing No. 21-158-2.

Groundwater

Groundwater conditions were observed by measuring in the open boreholes during and after the completion of the foundation investigation. The groundwater level was found to vary between elevation 305.0 to 303.5 which corresponds to 3 to 4.5 feet below the existing ground surface. The groundwater levels are shown on the Record of Borehole Sheets, as well as on Drawing No. 21-158-2.


P.J. Stuart
Foundations Engineer





M. Devata
Senior Foundations Engineer

March 21, 1980.

APPENDIX



Ministry of
Transportation and
Communications

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

13

RECORD OF BOREHOLE No 1

W P 59-75-04 LOCATION Coords. N 15,944,512; E 1,194,158 ORIGINATED BY V.K.
DIST 7 HWY 401 BOREHOLE TYPE 3 1/2 H.S. Auger COMPILED BY V.K.
DATUM Geodetic DATE February 17, 1978 CHECKED BY [Signature]

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 (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE			'N' VALUES	20					
308.0	Ground Level												
0.0	(Fill)												
1.5	Glacial Till Heterogeneous Mixture of Silt, Sand With Some Gravel and Clay		1	SS	39	W.L.							23 57 15 5
			2	SS	25								26 33 32 9
			3	SS	36								
			4	SS	18								43 28 20 9
			5	SS	28								
			6	SS	52								12 20 52 16
282.0			7	SS	135/11"								
26.0	End of Borehole												

RECORD OF BOREHOLE No 2

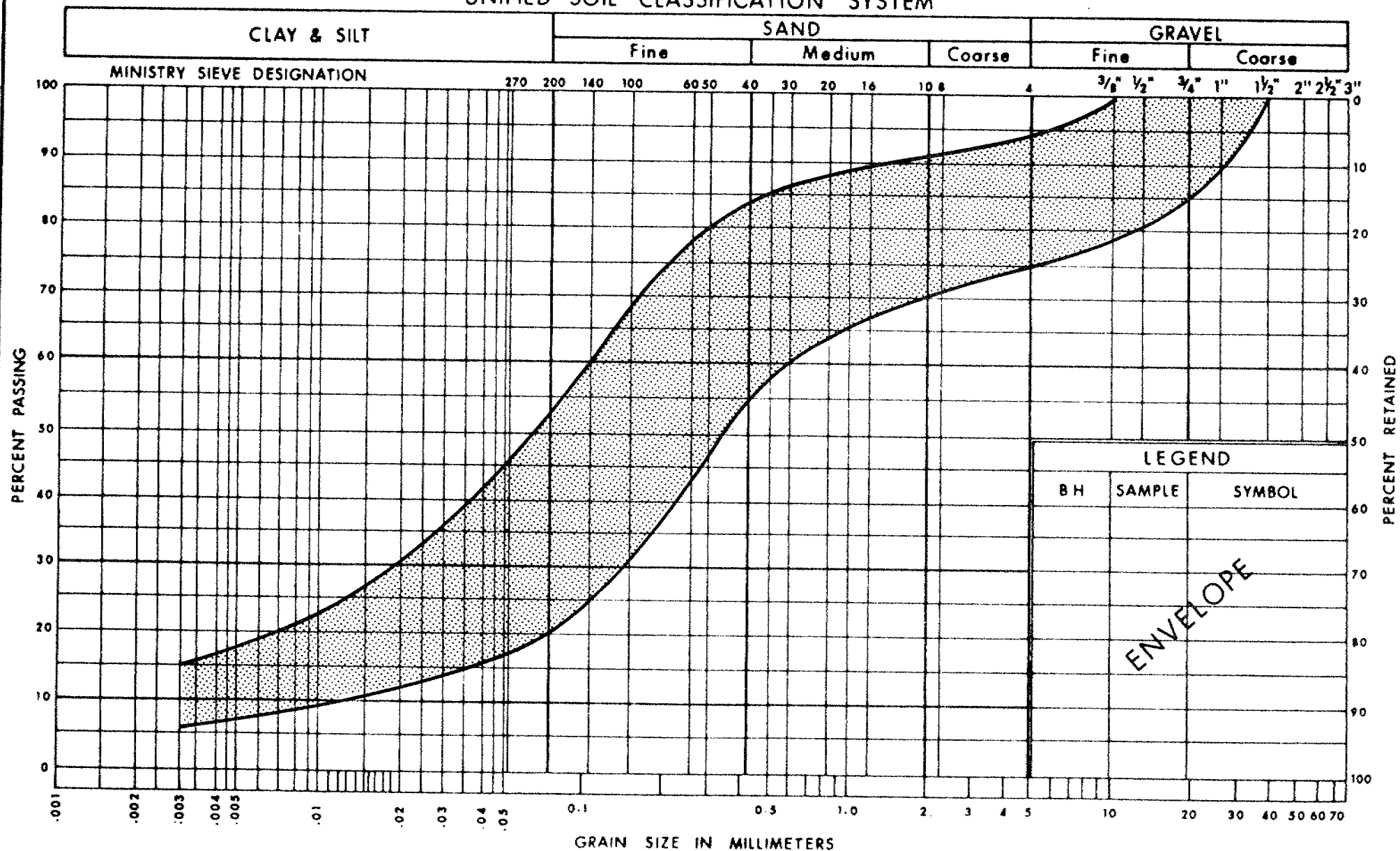
W P 59-75-04 LOCATION Coords. N 15,944,503; E 1,194,124 ORIGINATED BY V.K.
DIST 7 HWY 401 BOREHOLE TYPE 3 1/2 H.S. Auger COMPILED BY V.K.
DATUM Geodetic DATE February 17, 1978 CHECKED BY [Signature]

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100										WATER CONTENT (%)		
								SHEAR STRENGTH										WATER CONTENT (%)		
308.0	Ground Level																			
0.0	(Fill)																			
1.5	Glacial Till Heterogeneous Mixture of Silt, Sand With Some Gravel and Clay		1	SS	41	W.L.							o	H		11 39 38 12				
			2	SS	108															
			3	SS	13								o			6 42 40 12				
	Stiff to Hard		4	SS	40															
			5	SS	161								o			17 37 37 9				
287.5			6	SS	125/11"															
20.5	End of Borehole																			

+3, x5: Numbers refer to Sensitivity 20
15-5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION GLACIAL TILL

HET MIXTURE OF SILT, SAND WITH SOME GRAVEL & CLAY

FIG No 1

W P 59-75-04

Cont 80-55

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

WP 59-75-01

DIST 7

HWY 401

STR SITE

Culvert No. 10, Sta. 353+68
Retaining Walls

DISTRIBUTION

G.C.E. Burkhardt (3)
R.D. Gunter
M.R. Ernesaks
D.E. Thrasher (2)

C. Grebski
G.A. Wrong
B.J. Giroux
R.S. Pillar

R. Hore

R. Fitzgibbon)
J. Anderson) cover only
G. Sloan)

Files ✓

SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	79 01 31	BnA
TUBES	—	—
ROCK CORES	—	—

Cont 80-55

GEOCRES 30M15-47

DATE JAN 18 1979

FOUNDATION INVESTIGATION REPORT

For

Culvert No. 10, Sta. 353+68
Retaining Walls
Hwy. 401, District 7, Port Hope
W.P. 59-75-01

INTRODUCTION

The above mentioned existing culvert was originally proposed to be extended to accommodate Hwy. 401 widening in this area and also normal side slopes were adopted for embankment construction. However, property restrictions dictated that the original proposal of culvert extension has to be changed and retaining walls are to be provided at both ends of the existing culvert.

This report contains the results of the foundation investigation carried out at the site of the above mentioned project on December 5, 1978 to December 6, 1978.

The field investigation consisted of four sampled boreholes carried out by means of continuous flight auger machines equipped with solid and hollow stem augers to a maximum depth of 21.5 feet below ground surface.

DESCRIPTION OF SITE AND GEOLOGY

The site is located about one mile west of Waverly Road and Hwy. 401 interchange. The existing structure is a 14'x8'x240' concrete box culvert at Sta. 353+68 on Hwy. 401 referred to as Culvert No. 10.

The area is located in the physiographical region known as the Iroquois Plain. In this area the subsoil is a mosaic of till plains, drumlins and areas of silty lacustrine deposits dating from the Pleistocene Epoch.

SUBSURFACE CONDITIONS

Subsurface conditions at the site were found to be generally uniform. At the south end of the culvert immediately under a foot of topsoil is a 6 to 7.5 foot thick layer of fill material. The upper 3.5 feet is made up of clayey silt, sand, gravel and trace of organics and the lower portion of fill material is mainly composed of silty sand to sandy gravel. At the north end of the culvert, only at the northeast corner (B.H. 2) under a foot of topsoil, fill material up to 4.5 feet thick is made up of sandy gravel with clay and trace of organics. The fill material is generally compact. Underlying the above mentioned fill material is the original subsoil which consists of a heterogeneous mixture of clayey silt, sand and gravel (glacial till). This deposit was investigated down to a maximum depth of 21.5 feet.

The physical properties of the glacial till as determined from laboratory testing are summarized as follows.

Liquid Limit	(W _L)	%	12-15
Plastic Limit	(W _p)	%	10-12
Moisture Content	(W)	%	4- 7

The Standard Penetration Tests gave 'N' values in the range of 20 to over 100 blows per foot, generally decreasing with depth. Based on these 'N' values the consistency of this stratum is estimated to be very stiff to hard.

The boundaries between the various soil types are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with an estimated stratigraphical profile based on borehole data, is shown on Drawing No. 597501-A.

Groundwater

The groundwater level conditions were observed by measuring in the open boreholes during the field investigation. The groundwater level was found to vary between elevation 278 and 279.0 which corresponds to 1 to 7 feet below the existing ground surface. The groundwater levels are shown on the Record of Borehole Sheets, as well as on Drawing No. 597501-A.

DISCUSSION AND RECOMMENDATIONS

It is planned to widen the existing Hwy. 401 at this site. This will require lengthening of the existing culvert No. 10 at Sta. 353+68 of Hwy. 401. However, due to the property restrictions in this area, it was decided to add wingwalls of 20 feet and 60 feet in length and maximum 15 feet high to both sides of the existing concrete box culvert and use them as retaining walls.

The subsoil at this site consists of mainly very stiff to hard glacial till overlain by 6 to 7.5 feet of fill at the south end and about 4.5 feet at the northeast corner of the existing culvert.

The proposed retaining walls can be founded on spread footings within the competent glacial till stratum at or below elevation 277.0 at the north end and at or below elevation 274.0 at the south end of the existing structure.

Any reworked or unsuitable backfill material in the area of the new footing base should be subexcavated to the full depth and replaced with mass concrete or well compacted Granular 'A'. It is recommended that a construction joint should be provided between the new footing and the existing structure in order to articulate any possible differential movements. The new footings for the retaining walls may be designed using an allowable bearing pressure of up to 4 t.s.f. During construction care should be exercised at all times to prevent any loss of ground beneath the existing footings. In all cases the base of the footing should have a minimum earth cover of 4 feet in all directions to prevent any damage due to frost action.

If the retaining structure is of a concrete cantilever type and some movement at the top of the wall is permitted, a coefficient of active pressure (K_a) of 0.33 may be used for the granular backfill behind the wall. In computing the lateral resistance of the footings, an adhesion value of 2000 p.s.f. may be used between the rough concrete and the undisturbed glacial till.


The backfill and drainage measures should be as per current MTC methods. In addition, the effects due to the sloping surcharge of the ground behind the retaining structure and the use of heavy vibratory compaction equipment, should also be taken into account in the computation of earth pressure.

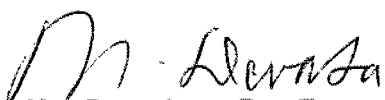
It is believed that the water in the channel will be properly controlled during the construction of the walls. The footing base will be located below the prevailing water level. In view of the impervious nature of the subsoil no major dewatering problems are anticipated. Any minor surface runoff or groundwater seepage into the excavations could be handled by pumping from sumps.

MISCELLANEOUS

The fieldwork was carried out during December 5-6, 1978 under the supervision of Mr. V. Korlu, Project Engineer, who also prepared this report.

The drilling equipment was owned and operated by Eastern Soil Investigation Ltd. of Toronto. This report was reviewed by Mr. M. Devata, Supervising Engineer.


V. Korlu, P. Eng.
Project Engineer


M. Devata, P. Eng.
Supervising Engineer

January, 1979

APPENDIX



RECORD OF BOREHOLE No 1

W P 59-75-01 LOCATION Coords. N 15 947 317; E 1 208 018 ORIGINATED BY V.K.
DIST 7 HWY 401 BOREHOLE TYPE 3 1/2 H.S.M.V. Auger COMPILED BY V.K.
DATUM Geodetic DATE December 6, 1978 CHECKED BY [Signature]

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						
280.0	Ground Level													
0.0	Topsoil													
	Heterogeneous Mixture of Clayey Silt, Sand and Gravel, Glacial Till		1	SS	100/	5"	W.L.							24 35 31 10
	Brown		2	SS	100/	6"								
	Grey		3	SS	100/	5"	270							14 36 41 9
			4	SS	75									
			5	SS	85									
258.5	Hard		6	SS	42		260							
21.5	End of Borehole													



RECORD OF BOREHOLE No 2

W P 59-75-01 LOCATION Coords. N 15 947 344; E 1 208 180 ORIGINATED BY V.K.
DIST 7 HWY 401 BOREHOLE TYPE 3 1/2" H.S.M.V. Auger COMPILED BY V.K.
DATUM Geodetic DATE December 6, 1978 CHECKED BY [Signature]

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							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
284.8	Ground Level							20 40 60 80 100							
0.0	Topsoil														
279.3	Sandy Gravel With Clay and Trace of Organics (Fill) Brown		1	SS	16		280							42 37 19 2	
5.5	Heterogeneous Mixture of Clayey Silt, Sand and Gravel Glacial Till		2	SS	135/11									14 39 37 10	
			3	SS	65										
			4	SS	55		270								
			5	SS	90										
263.3	Hard		6	SS	20										
21.5	End of Borehole						260								



Ministry of
Transportation and
Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

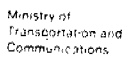
RECORD OF BOREHOLE No 3

W P 59-75-01 LOCATION Coords. N 15 947 127; E 1 208 334 ORIGINATED BY V.K.
DIST 7 HWY 401 BOREHOLE TYPE 3 1/2" H.S.M.V. Auger COMPILED BY V.K.
DATUM Geodetic DATE December 5, 1978 CHECKED BY *[Signature]*

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					
281.2	Ground Level																
0.0	Topsoil																
	Clayey Silt, Sand, Gravel, Organics		1	SS	6		280										
	Sandy Gravel, Very Dense (Fill) Brown		2	SS	65												53 42 (5)
8.5	Grey Heterogeneous Mixture of Clay, Silt, Sand and Gravel		3	SS	85		270										
	Glacial Till Hard		4	SS	81												
			5	SS	67												
259.7			6	SS	47		260										
21.5	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 4

W P 59-75-01 LOCATION Coords. N 15 947 143; E 1 208 400 ORIGINATED BY V.K.
DIST 7 HWY 401 BOREHOLE TYPE 3 1/2" H.S.M.V. Auger COMPILED BY V.K.
DATUM Geodetic DATE December 5, 1978 CHECKED BY W.F.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT <div>20 40 60 80 100</div>	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													
283.5	Ground Level												
0.0	Topsoil												
	Clayey Silt, Sand & Gravel & Organics (Fill)		1	SS	10		280						0 31 64 5
276.5	Silty Sand and Gravel		2	SS	26								
7.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel		3	SS	110								8 49 33 10
	Glacial Till		4	SS	100/	6"	270						
	Hard		5	SS	65								
262.0			6	SS	56								
21.5	End of Borehole						260						

+3, x5 : Numbers refer to Sensitivity

15 ϕ 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS N_c .

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON "A" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

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

S_u (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCK QUALITY: 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 DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4"+ 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	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG. $\bar{C}IU$ = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

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

EARTH PRESSURE TERMS

μ COEFFICIENT OF FRICTION
 δ ANGLE OF WALL FRICTION
 k_o COEFFICIENT OF EARTH PRESSURE AT REST
 k_A COEFFICIENT OF ACTIVE EARTH PRESSURE
 k_P COEFFICIENT OF PASSIVE EARTH PRESSURE
 i ANGLE OF INCLINATION OF SURCHARGE
 w SLOPE ANGLE-BACKFACE OF WALL
 β ANGLE OF SLOPE
 N_q, N_c, N_{γ} BEARING CAPACITY FACTORS
 B_f BIRTH OF FOOTING
 B, L FOOTING DIMENSIONS

INDEX PROPERTIES

γ UNIT WEIGHT OF SOIL (BULK DENSITY)
 γ_w UNIT WEIGHT OF WATER
 γ_d UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
 γ' UNIT WEIGHT OF SUBMERGED SOIL
 G_s SPECIFIC GRAVITY OF SOLIDS
 e VOIDS RATIO
 e_o INITIAL VOIDS RATIO
 e_{max} e IN LOOSEST STATE
 e_{min} e IN DENSEST STATE
 D_r RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$
 n POROSITY
 w WATER CONTENT
 w_L LIQUID LIMIT
 w_p PLASTIC LIMIT
 w_s SHRINKAGE LIMIT
 I_p PLASTICITY INDEX = $w_L - w_p$
 I_L LIQUIDITY INDEX = $\frac{w - w_p}{w_L - w_p}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{w_L - w_p}$
 A_c ACTIVITY = $\frac{I_p}{2.45 - I_p}$
 O_m ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u(\text{undisturbed})}{S_u(\text{remoulded})}$

STRENGTH PARAMETERS

ϕ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_R RESIDUAL SHEAR STRENGTH
 c COHESION INTERCEPT
 $\sigma_1, \sigma_2, \sigma_3$ NORMAL PRINCIPAL STRESSES
 u PORE WATER PRESSURE
 u_R EXCESS " u "
 r_u PORE PRESSURE RATIO
 q_u UNCONFINED COMPRESSIVE STRENGTH
 s_u UNDRAINED SHEAR STRENGTH
 ϵ LINEAR STRAIN
 γ SHEAR STRAIN
 ν POISSON'S RATIO
 E MODULUS OF ELASTICITY
 G MODULUS OF SHEAR DEFORMATION
 k_s MODULUS OF SUBGRADE REACTION
 m, n STABILITY COEFFICIENTS
 A, B PORE PRESSURE COEFFICIENTS

HYDRAULIC TERMS

h HYDRAULIC HEAD OR POTENTIAL
 q RATE OF DISCHARGE
 v VELOCITY OF FLOW
 i HYDRAULIC GRADIENT
 j SEEPAGE FORCE PER UNIT VOLUME
 η COEFFICIENT OF VISCOSITY
 k COEFFICIENT OF HYDRAULIC CONDUCTIVITY
 k_h k IN HORIZONTAL DIRECTION
 k_v k IN VERTICAL DIRECTION
 m_v COEFFICIENT OF VOLUME CHANGE
 c_v COEFFICIENT OF CONSOLIDATION
 C_c COMPRESSION INDEX
 C_r RECOMPRESSION INDEX
 d DRAINAGE PATH DISTANCE
 T_v TIME FACTOR
 U DEGREE OF CONSOLIDATION
 U_c OVERCONSOLIDATION RATIO (OCR)

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS

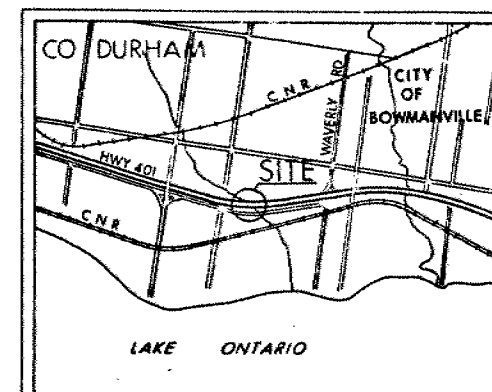
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO
09-MT-508 Q-75

CONT No
WP No 59-75-01

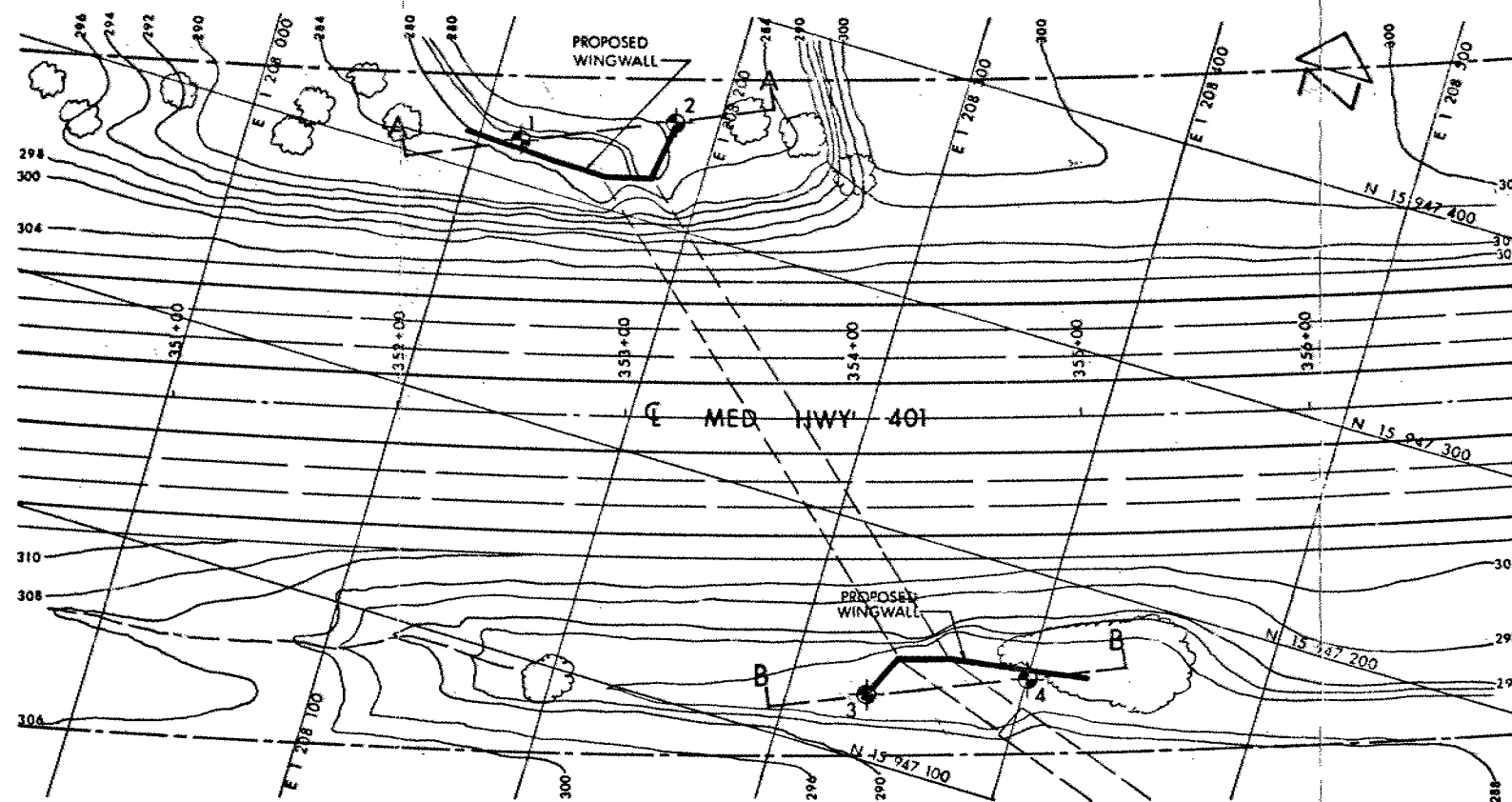
CULVERT No 10
WEST OF WAVERLY RD
BORE HOLE LOCATIONS & SOIL STRATA



SHEET

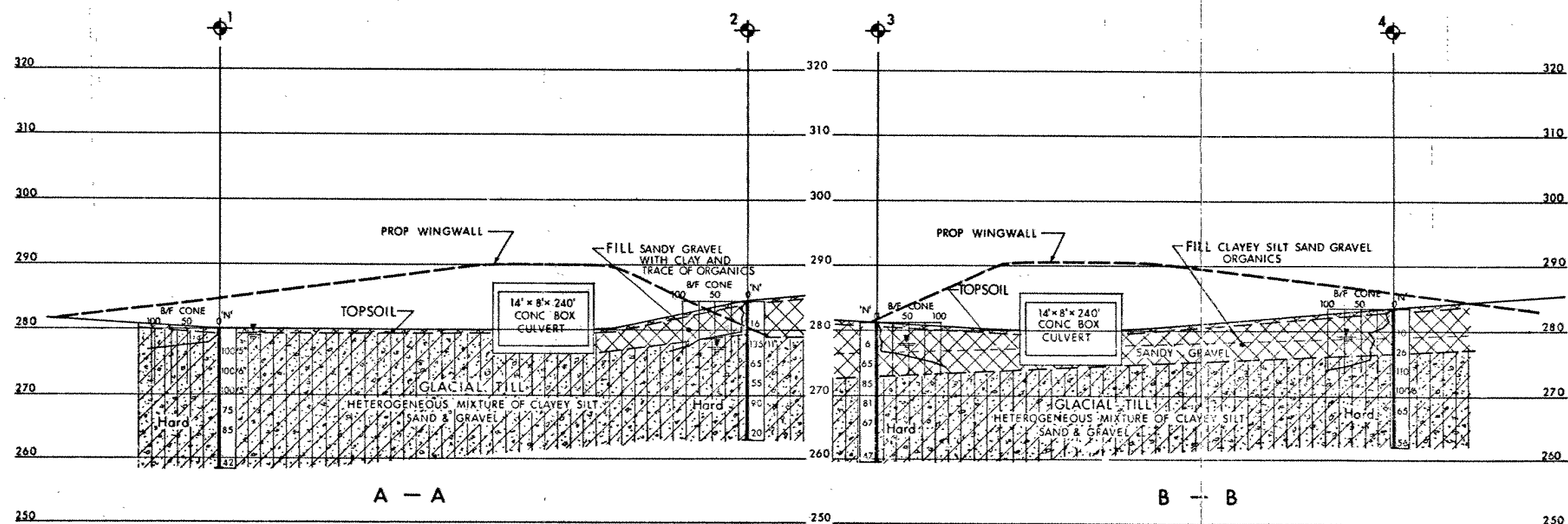


KEY PLAN
0.5 0 1 MI



PLAN

SCALE
40 20 0 20 40 FT



A - A

B - B

SECTIONS

SCALE
10 5 0 5 10 FT

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone, 350ft lbs energy)
- W/L at time of investigation DEC 1978

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	280.0	15 947 317	1 208 118
2	284.8	15 947 344	1 208 180
3	281.2	15 947 127	1 208 334
4	283.5	15 947 143	1 208 400

-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

HWY No 401
SUBMITTAL CHECKED DATE 79-01-03
DRAWN BY CHECKED DATE 79-01-03
SITE
DWG 597501-A

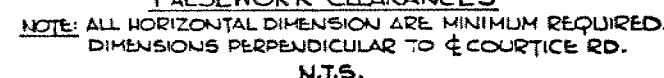


- 21-158-1. GENERAL PLAN.
2. BOREHOLE LOCATIONS & SOIL STRATA.
3. REMOVAL OF CONCRETE IN STRUCTURE.
4. FOOTING WIDENING & RETAINING WALL DETAILS.
5. STRUCTURE WIDENING I.
6. STRUCTURE WIDENING II.
7. BARRIER WALL.
8. STEEL RAILING (SINGLE TUBE).
9. APPROACH SLAB WIDENING.
10. STANDARD DETAILS.
11. ROADWAY PROTECTION.



QUANTITY OF DOWELS INTO CONCRETE 405 each
QUANTITY OF ANCHORS INTO CONCRETE 74 each

1. INSTALL TEMPORARY TRAFFIC BARRIER (SOUTH).
2. REMOVE EXISTING CURB, POSTS & RAILING (SOUTH).
3. REMOVE PART APPROACH SLAB (SOUTH).
4. REMOVE TOP PART EXISTING WINGWALLS (SOUTH).
5. CONSTRUCT ROADWAY PROTECTION.
6. REMOVE PART OF EXISTING RETAINING WALLS (SOUTH).
7. CONSTRUCT WIDENING (SOUTH).
8. CONSTRUCT BARRIER WALL (SOUTH).
9. INSTALL TEMPORARY TRAFFIC BARRIER (NORTH).
10. REMOVE EXISTING CURB, POSTS & RAILING (NORTH).
11. CONSTRUCT BARRIER WALL (NORTH).
12. REMOVE ASPHALT FROM EXISTING DECK.
13. EXISTING BRIDGE DECK REPAIRS.
14. WATERPROOF EXISTING & NEW DECK.
15. PAVE EXISTING & NEW DECK & APPROACH SLAB WIDENING



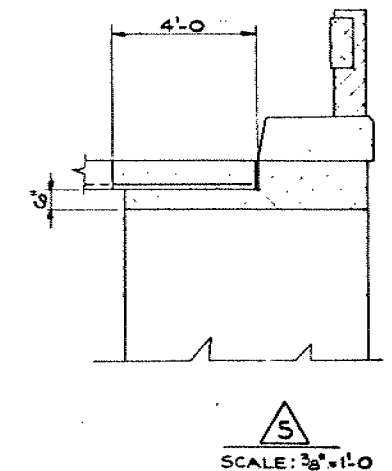
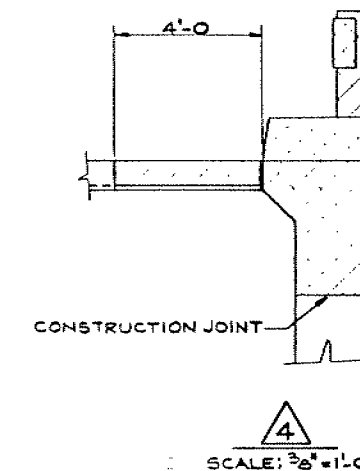
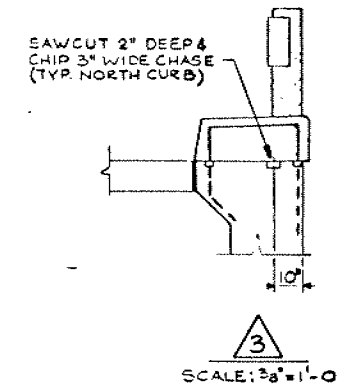
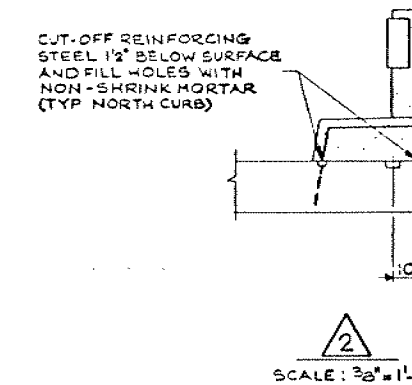
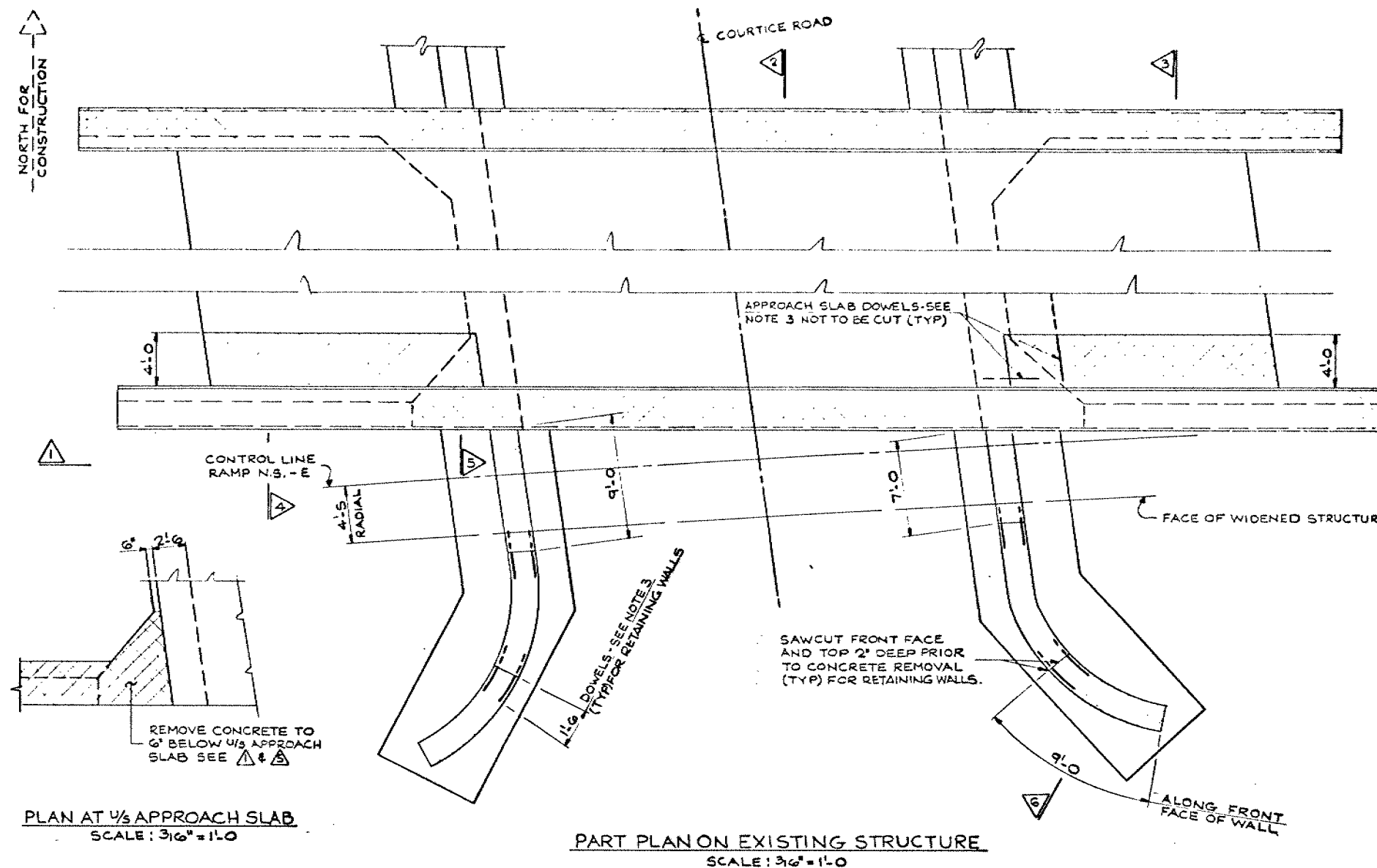
N.T.S.

CONT No
WP No 59-75-04

COURTICE ROAD OVERPASS
REMOVAL OF CONCRETE
IN STRUCTURE

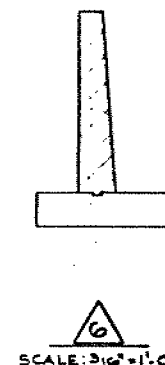
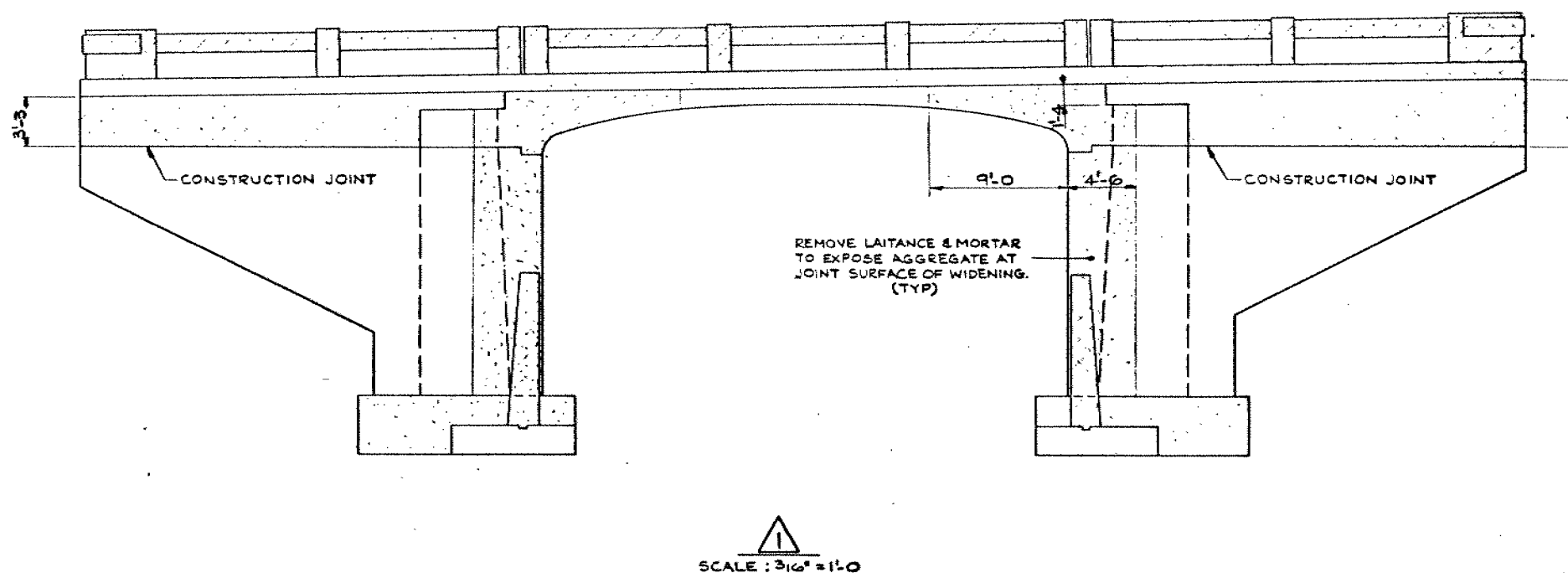
SHEET

DeLuw Cather

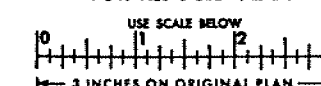


NOTES

- REMOVAL OF CONCRETE IN STRUCTURE IS SHOWN BY THE SYMBOL
- REINFORCING STEEL TO BE CUT-OFF FLUSH WITH CONCRETE TO BE LEFT IN PLACE, UNLESS NOTED OTHERWISE.
- WHERE DOWEL PROJECTIONS ARE SHOWN FROM CONCRETE TO BE LEFT IN PLACE, THE REINFORCING STEEL IS TO BE EXPOSED, STRAIGHTENED AND CUT-OFF TO SPECIFIED LENGTH.
- REFER TO ORIGINAL DRAWINGS FOR COURTICE SIDE ROAD OVERPASS FOR DETAILS OF EXISTING STRUCTURE. THE CONTRACTOR SHALL FIELD CHECK ALL DIMENSIONS REQUIRED FOR THE REMOVAL OF CONCRETE.

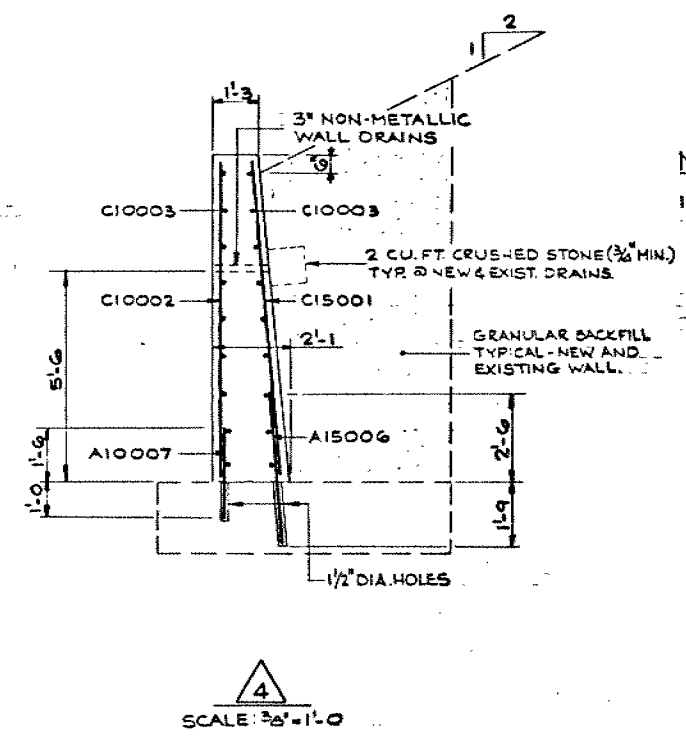
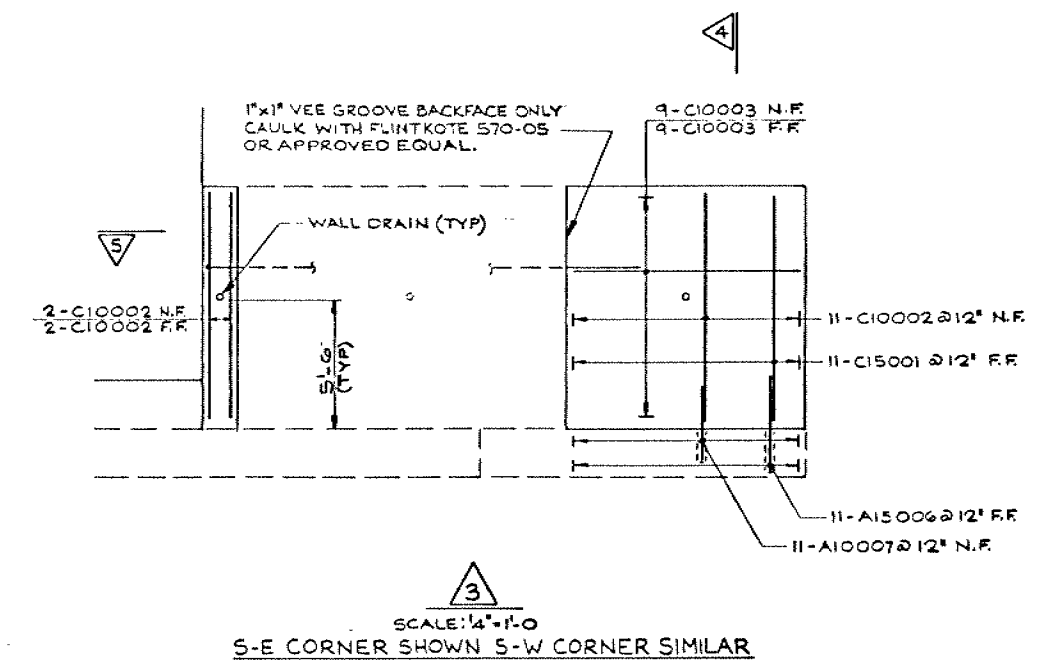
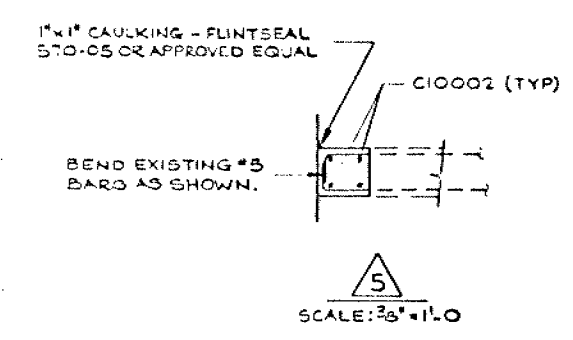
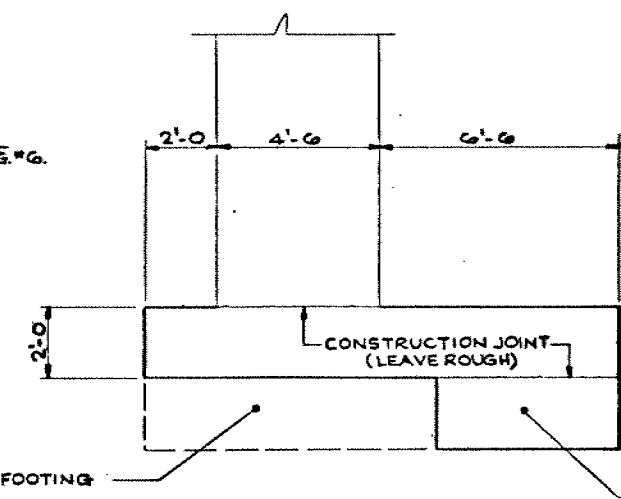
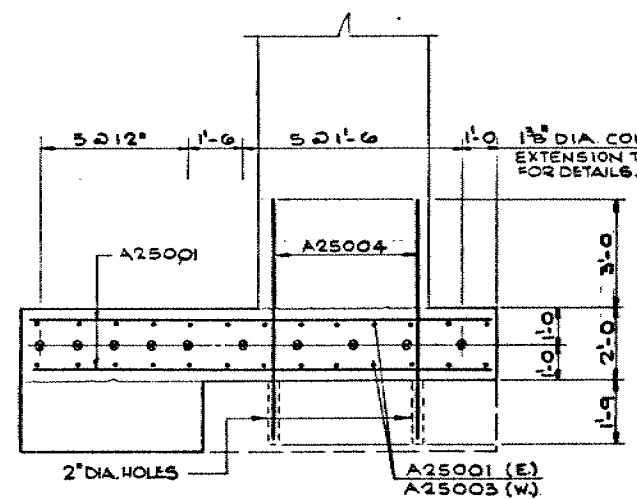
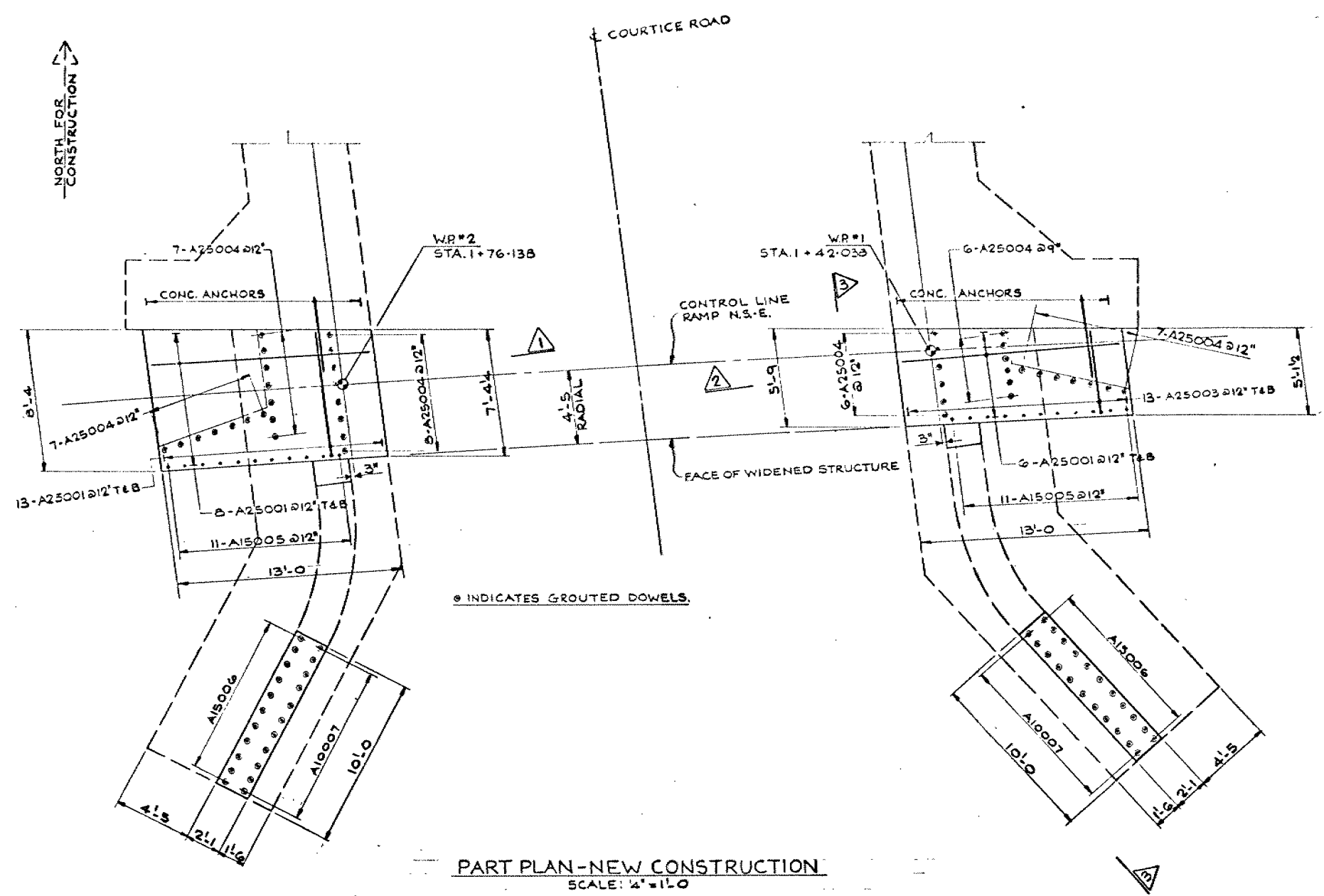


FOR REDUCED PLAN



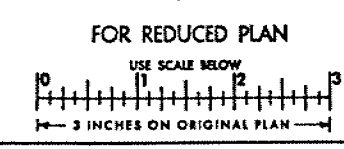
REVISIONS	DATE	BY	DESCRIPTION
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

DESIGN G.M. CHECK G.S. LOADING HS-20-44 DATE JAN '79
DRAWING D.C. CHECK SITE No 21-158 DWG 3



NOTES

1. METHOD OF EXCAVATION SHALL PREVENT ANY LOSS OF GROUND BENEATH EXISTING FOOTING DUE TO PIPING OR BOILING OF SUBSOIL.



REVISIONS	DATE	BY	DESCRIPTION
DESIGN G.M.	CHECK G.S.	LOADING HS-20-44	DATE JAN. 79
DRAWING D.C.	CHECK	SITE No 21-158	DWG 4

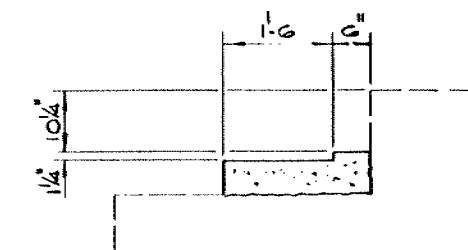
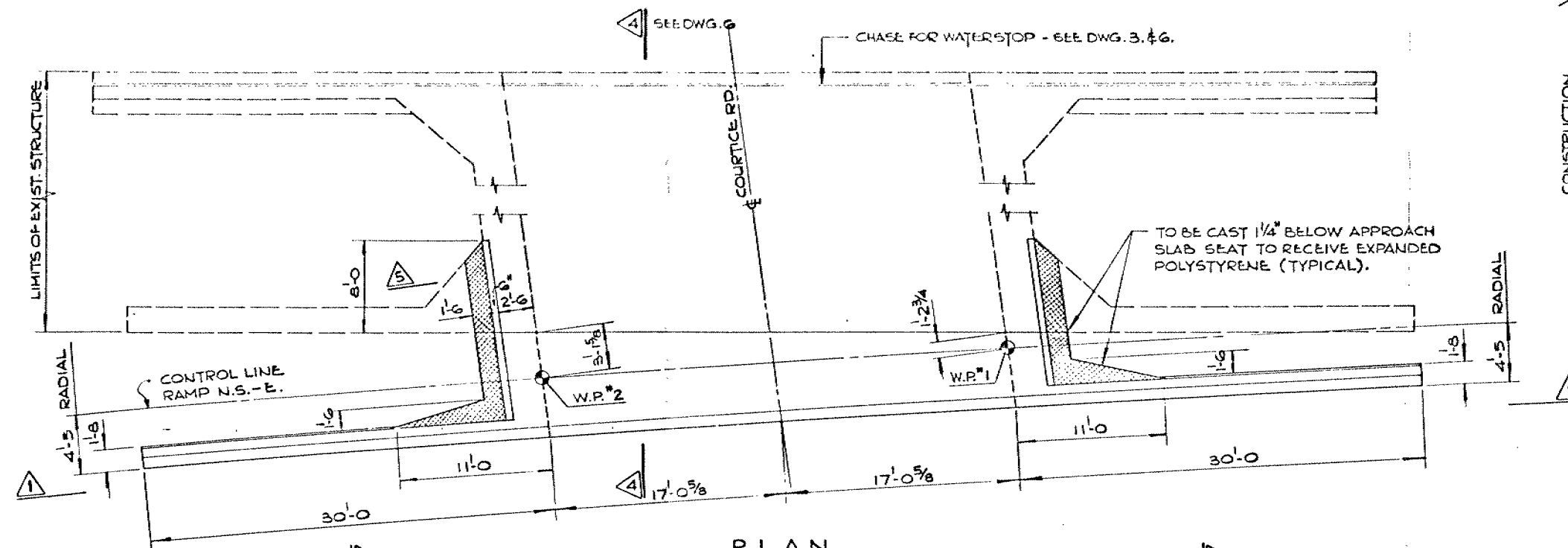
CONT No
WP No 59-75-04

COURTICE ROAD OVERPASS

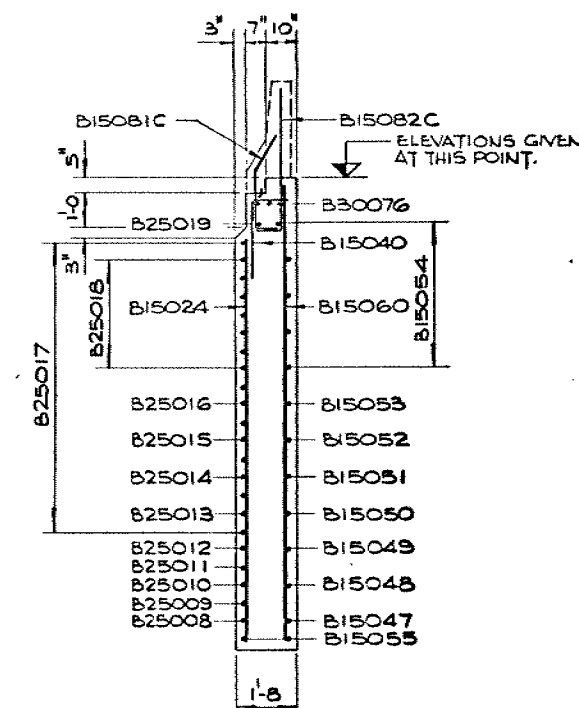
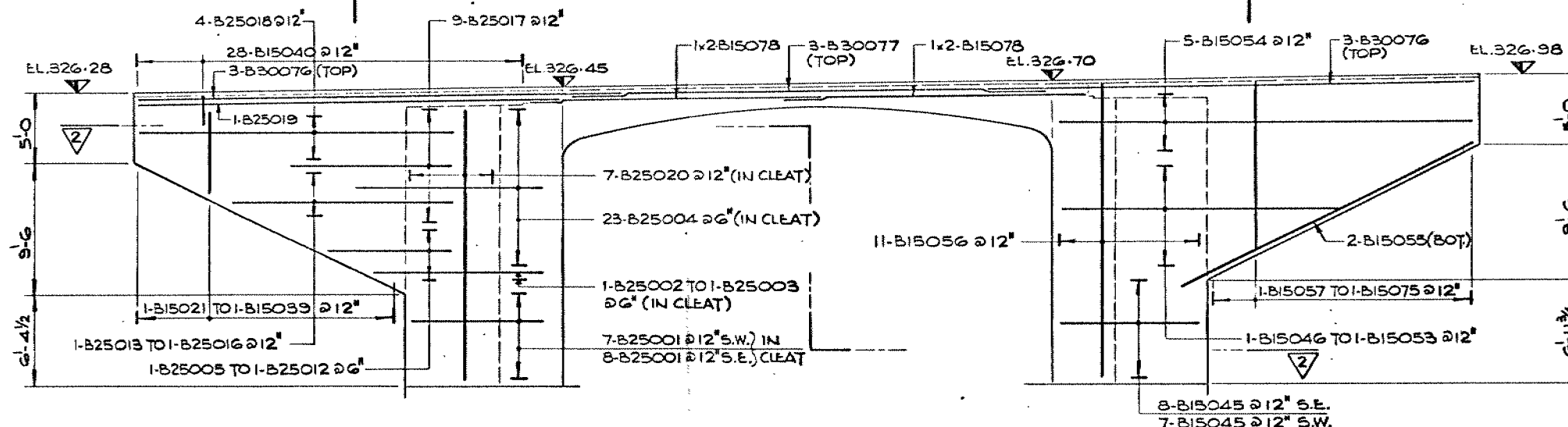
STRUCTURE WIDENING I

De Leuw Cather

SHEET



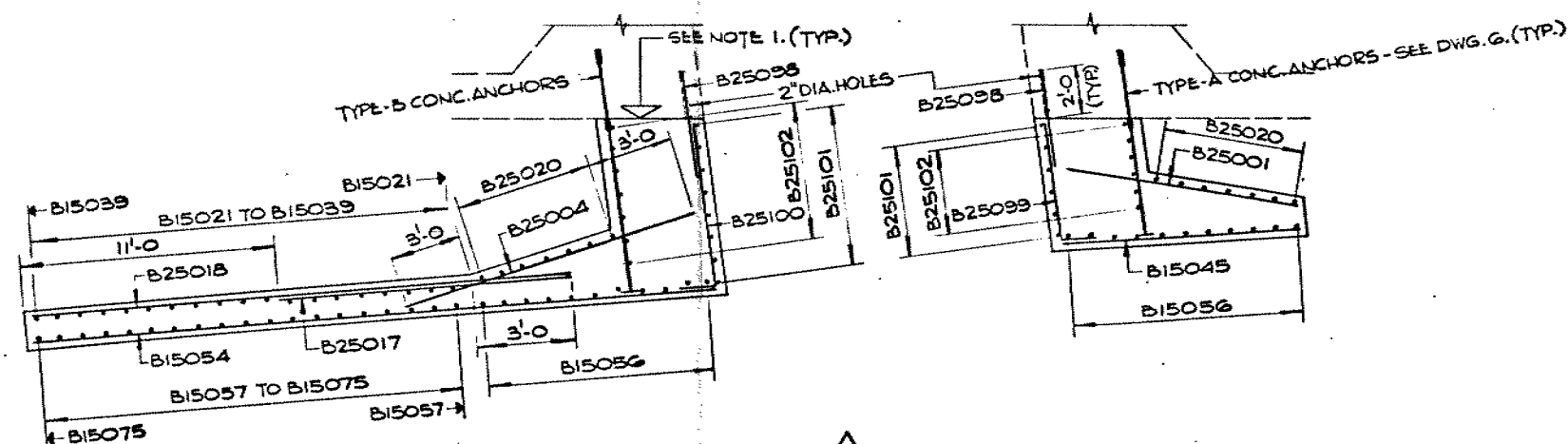
SCALE: 3/4" = 1'-0"



SCALE: 3/8" = 1'-0"

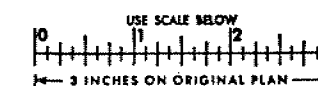
NOTES:

1. JOINT SURFACE OF EXISTING STRUCTURE TO BE COATED WITH CEMENT PASTE PRIOR TO PLACING CONCRETE IN WIDENING.



SCALE: 1/4" = 1'-0"

FOR REDUCED PLAN



REVISIONS	DATE	BY	DESCRIPTION
DESIGNING MFR	CHECKS S.	LOADING H520-44	DATE JAN/75
DRAWING RFR	CHECK	SITE No 21-128	DWG 5.