

G.I.-30 SEPT. 1976

GEOCRES No. 30M5-115DIST. 4 REGION W.P. No. 125-66-23CONT. No. 79-80W. O. No. STR. SITE No. 10-140CHWY. No. Q.E.W.LOCATION W-N Ramp over
Joshua CreekNo. of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

Cont

79-80



Ontario

Ministry of
Transportation and
Communications

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

WP 125-66-23

DIST 4

HWY QEW

STR SITE 10-140C

W-N and W-S Ramp Over Joshua Creek

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SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	78 01 18	M.L.
TUBES	—	—
ROCK CORES	After 75' depth	M.L.

FOUNDATION INVESTIGATION REPORT

For

W-N and W-S Ramp Over Joshua Creek
W.P. 125-66-23, Site 10-140C
Hwy. QEW, District 4, Hamilton

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project during the period of November 14 and 15, 1977. The fieldwork consisted of four sampled boreholes advanced by means of a continuous flight auger machine equipped with 3¼" I.D. hollow stem augers. In addition, diamond drilling techniques were employed to obtain BXL size core samples of the bedrock. The boreholes ranged in depth from 6 to 11 feet below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located approximately half a mile east of Q.E.W. and Joshua Creek crossing in the Town of Oakville, Regional Municipality of Halton. The land immediately adjacent to the site has a gentle rolling topography sloping down to the south. The creek bed has exposed the underlying red Queenston shale.

The land forms part of the green park area surrounding the Ford Motor Co. of Oakville office building.

Physiographically the site lies on the southern edge of the region referred to as the "South Slope". This region is a strip of land bounded by the Iroquois Plain on the south and Peel Plain on the north. The region is characterized by glacial till overburden underlain by shale bedrock of Queenston and Dundas Formation of the Upper Ordovician Age.

SUBSURFACE CONDITIONS

The subsurface conditions at the site were found to be quite uniform. A 3 to 5 foot layer of clayey silt is underlain by shale bedrock. Detailed descriptions of the various soil and rock types encountered in each borehole are given in the Record of Borehole Sheets. The estimated stratigraphical profile and sections shown on Drawing No. 1256623-A are based upon this information. From ground level downwards the various types encountered are as follows.

Clayey Silt With Some Sand and Occasional Gravel

Under a one foot layer of topsoil a cohesive stratum 3 to 6 feet thick consisting of clayey silt with some sand and occasional gravel was encountered. The Standard Penetration Tests gave an 'N' value range of 15 to 51 blows per foot indicating that the consistency of the layer is very stiff to hard.

The physical properties of the clayey silt as determined from laboratory testing are summarized below:

		<u>Range</u>
Liquid Limit	(W _L) %	30-32
Plastic Limit	(W _p) %	20-22
Moisture Content	(W) %	10-12

The results of the Atterberg Limit Tests indicate that the cohesive layer is inorganic and of low plasticity.

Bedrock

Underlying the cohesive clayey silt layer is the bedrock which was proven to a maximum depth of 5 feet. The bedrock consists of interbedded layers of shale and limestone. The shale is soft, red in colour and fissile, having thin horizontal bedding planes with seams of limestone up to one foot thick. In B.H. #2 the upper one foot of the bedrock is weathered and below this the bedrock is moderately fractured. A detailed description of the bedrock is given on the Record of Borehole Sheets. The Rock Quality Designation (RQD) for the cored samples of the bedrock is about 15% to 30% indicating that the rock quality is generally poor.

Groundwater

The groundwater level 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 386.0 and elevation 386.5 which corresponds to 2 to 3.5 feet below the existing ground surface. The water level in the creek during the time of investigation was at elevation 385.0. The groundwater levels are shown on the Record of Borehole Sheets, as well as on Drawing No. 1256623-A.

DISCUSSION AND RECOMMENDATIONS

As part of the proposed new complex interchange connecting Q.E.W. to Hwy. 403 a structure will be required to carry W-N and W-S Ramp over Joshua Creek.

In the vicinity of the proposed structure the existing ground elevation varies from elevation 388 to elevation 389.5. The proposed grade of the W-N and W-S Ramp elevation is at elevation 406.0. This will necessitate embankment fills of maximum 16.5 feet.

A single span structure is presently being considered.

Structure Foundations

In case a single span closed type structure is considered, the abutment footings can be founded on spread footings. The footings can be placed at or below elevation 383.0 and designed for an allowable load up to 10 t.s.f. Since the shale is frost susceptible the underside of the footings should be provided with a minimum of 4 feet of earth cover for frost protection purposes.

Other Considerations

To prevent softening of the shale bedrock due to weathering, the excavated base should be covered with a minimum of 3 inches of mass concrete immediately after the excavation.

No dewatering problems are anticipated for the construction of the foundations. Any minor seepage or surface runoff into the excavations can be handled by pumping from sumps.

Approaches

The approach fills will have a maximum height of 16.5 feet. No stability problems are anticipated for the proposed approach fills constructed with standard 2:1 slopes.

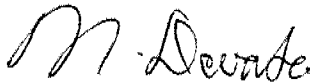
MISCELLANEOUS

The fieldwork was carried out during November 14 and 15, 1977 under the supervision of Mr. V. Korlu, Project Engineer, who also prepared this report.

The drilling equipment was owned and operated by D.S.I.L. Drilling Inc. of Toronto.

This report was reviewed by Mr. M. Devata, Supervising Engineer.


V. Korlu, P. Eng.
Project Engineer





M. Devata, P. Eng.
Supervising Engineer

MD/VK/gs
January, 1978

APPENDIX

RECORD OF BOREHOLE No 1

W P 125-66-23 LOCATION Co-ords N 15,803,181; E 954,335 ORIGINATED BY V.K.
 DIST 4 HWY 403 BOREHOLE TYPE 3 1/2" Hollow Stem Auger; BXL Core and Cone Test COMPILED BY V.K.
 DATUM Geodetic DATE November 14, 1977 CHECKED BY RS

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					
389.6	Ground Level												GR SA SI CL
0.0	Topsoil												
384.6	Clayey Silt, Sand & Gravel Hard		1	SS	51								28 7 39 26
5.0	Shale Bedrock*												
379.6							380						
10.0	End of Borehole * <u>Bedrock</u> : Shale, grey, soft, fissile, 2" limestone seams R.Q.D. 15%												

RECORD OF BOREHOLE No 2

W P 125-66-23 LOCATION Co-ords N 15,803,193; E 954,297 ORIGINATED BY V.K.
 DIST 4 HWY 403 BOREHOLE TYPE 3 1/2" Hollow Stem Auger; BXL Core and Cone Test COMPILED BY V.K.
 DATUM Geodetic DATE November 14, 1977 CHECKED BY RS

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 (%)
								10 20 30						
								SHEAR STRENGTH						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL x LAB VANE						
389.6	Ground Level													
0.0	Topsoil													
383.6	Clayey Silt, Sand and Gravel Very Stiff		1	SS	15								50 22 14 5	
6.0	Weathered							100/6"						
378.6	Shale Bedrock*						380							
11.0	End of Borehole													
	* Bedrock: Shale, grey, soft, fissile. 4" limestone seams R.Q.D. 20%													

RECORD OF BOREHOLE No 3

W P 125-66-23 LOCATION Co-ords N 15,803,229; E 954,333 ORIGINATED BY V.K.
 DIST 4 HWY 403 BOREHOLE TYPE 3½" Hollow Stem Auger; BXL Core COMPILED BY V.K.
 DATUM Geodetic DATE November 14, 1977 CHECKED BY RS

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					
388.1	Ground Level																
0.0	Topsoil																
384.1	Clayey Silt, sand and Gravel																
4.0																	
379.1	A Bedrock*																
9.0	End of Borehole																
	* Bedrock:																
	A. Shale, grey, soft fissile with 1" seams of limestone																
	B. Limestone, light grey, fine to med. grained, hard. Fossiliferous																
	R.Q.D. 30%																

RECORD OF BOREHOLE No 4

W P 125-66-23 LOCATION Co-ords: N 15,803,217; E 954,368 ORIGINATED BY V.K.
 DIST 4 HWY 403 BOREHOLE TYPE 3½" Hollow Stem Auger; BXL Core COMPILED BY V.K.
 DATUM Geodetic DATE November 15, 1977 CHECKED BY RS

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					
388.0	Ground Level																
0.0	Topsoil																
383.0	Clayey Silt, Sand and Gravel, Very Stiff		1	SS	18												56 21 18 5
5.0																	
378.0	A Bedrock*																
10.0	End of Borehole																
	* Bedrock:																
	A. Shale, grey, soft fissile, thin seams of limestone.																
	B. Limestone, light grey, med. grained, hard, fossiliferous																
	R.Q.D. 30%																

+3, x5: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

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. $\bar{C}\bar{U}$ = 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
E 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
 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 = $w_L - w_p$
 I_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

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_r OVERCONSOLIDATION RATIO (OCR)

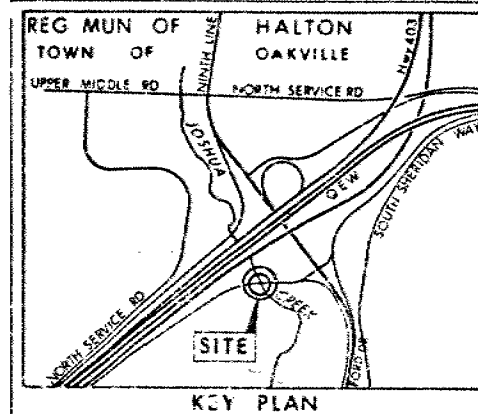
NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS

CONT No
WP No 125-66-23



W-N & W-S RAMP OVER JOSHUA CR
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- W' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60" Cone, 350 ft lbs energy)
- W.L. at time of investigation Nov 1977

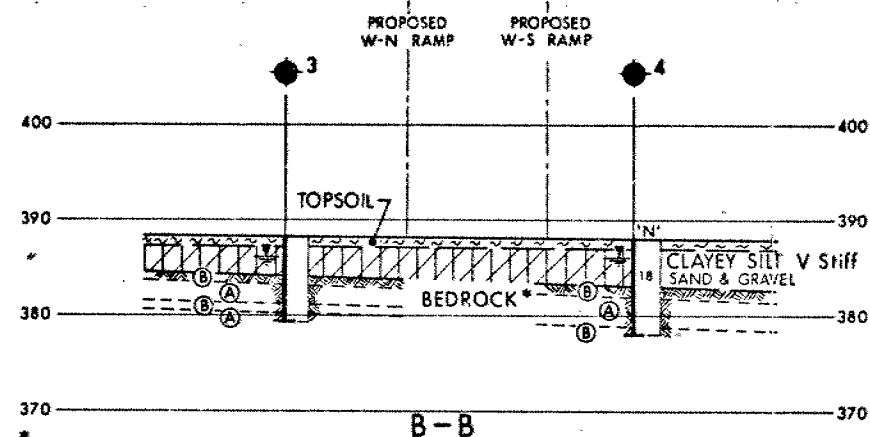
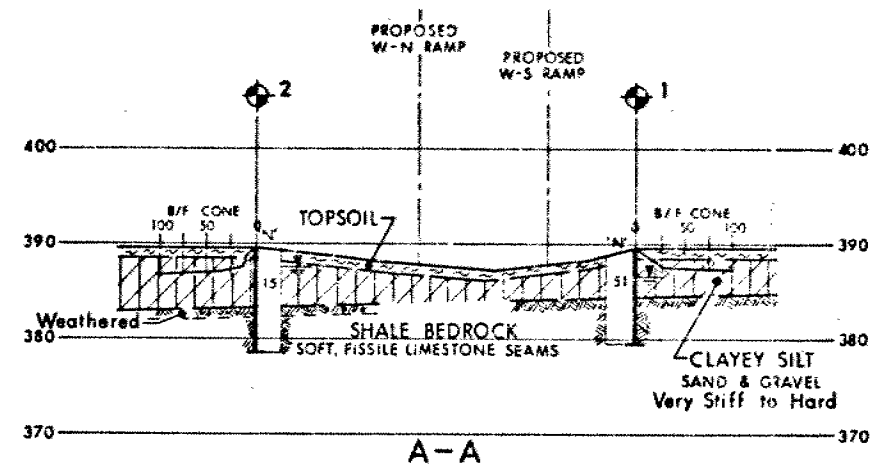
No	ELEVATION	CO ORDINATES	
		NORTH	EAST
1	389.6	15 803 181	954 335
2	389.6	15 803 193	954 297
3	388.1	15 803 229	954 333
4	388.0	15 803 217	954 368

-NOTE-

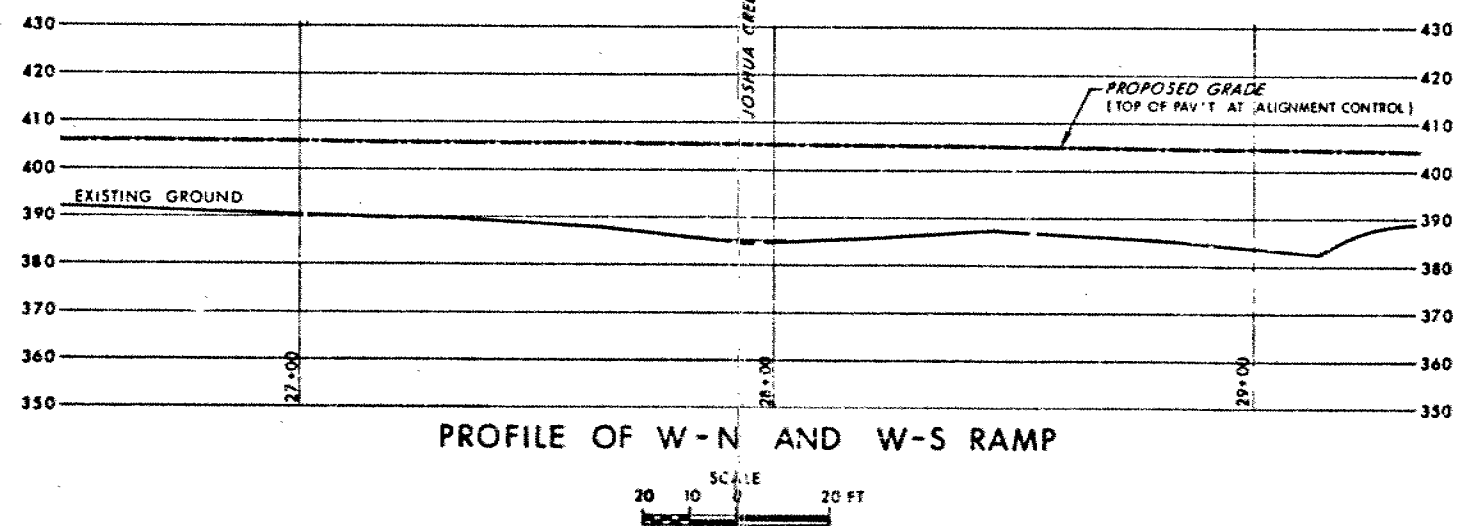
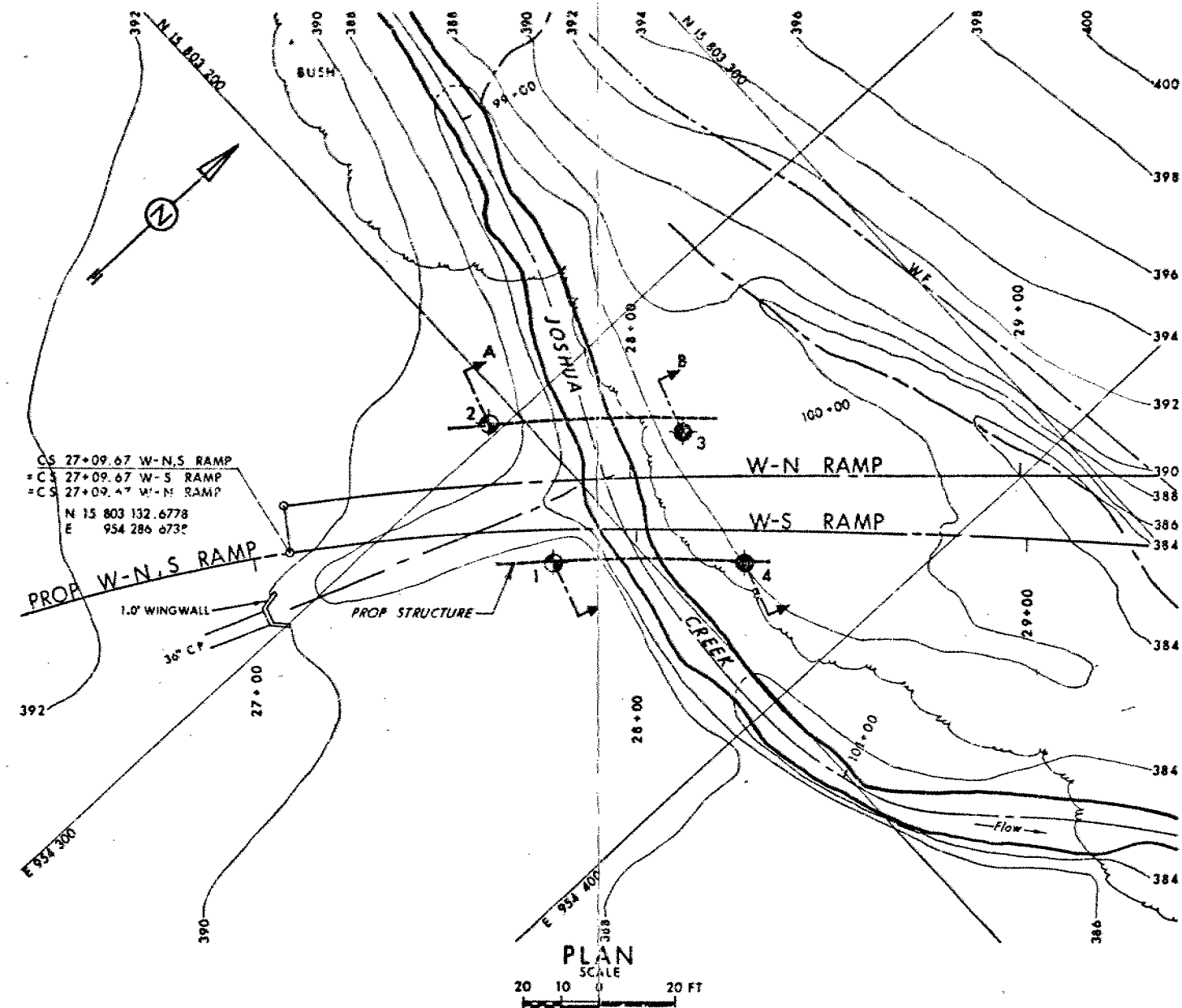
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

HWY No. QEW
DRAWN BY: [Signature] CHECKED BY: [Signature] DATE: Jan 5, 1978
SITE 10-140 C
NO 1256623-A



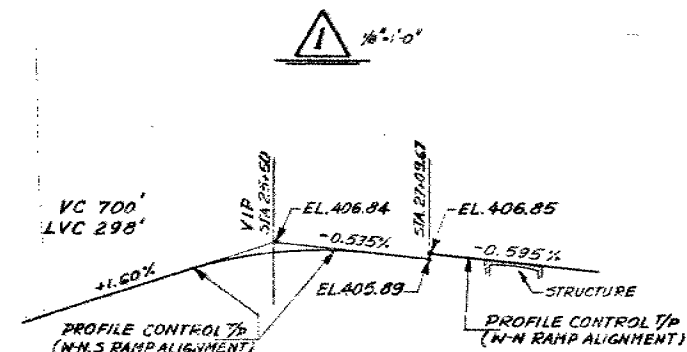
- * BEDROCK
- Ⓐ - SHALE, SOFT FISSILE, THIN SEAMS OF LIMESTONE.
- Ⓑ - LIMESTONE, FINE TO MEDIUM GRAINED, HARD, FOSSILIFEROUS.



REF: Giffels, Davis & Jorgensen
Consulting Engineers, Date: 7/7/10/18



NOTES
MR DENOTES WORKING POINT
T/P DENOTES TOP OF FINISHED PAVEMENT



PROFILE OF W-N, S AND W-N RAMP
N. T. S.



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

1. CONCRETE IN BRIDGE	271 cu yd
2. CONCRETE IN RETAINING WALLS	116 cu yd
3. CONCRETE IN BARRIER WALLS	16 cu yd
4. CONCRETE IN APPROACH SLABS	41 cu yd

Mass Concrete to be placed immediately after excavation

10-140C-1 GENERAL LAYOUT

- 1- -2 BORE HOLE LOCATIONS & SOILS STRATA
- 2- -3 FOOTINGS
- 3- -4 FRAME AND STUB WALLS
- 4- -5 RETAINING WALLS
- 5- -6 BARRIER WALL
- 6- -7 20 FT. APPROACH SLAB
- 7- -8 STEEL RAILING (SINGLE TUBE)
- 8- -9 STANDARD DETAILS I
- 9- -10 STANDARD DETAILS II
- 10- -11 AS CONSTRUCTED ELEV. & DIM.



USE SCALE BELOW

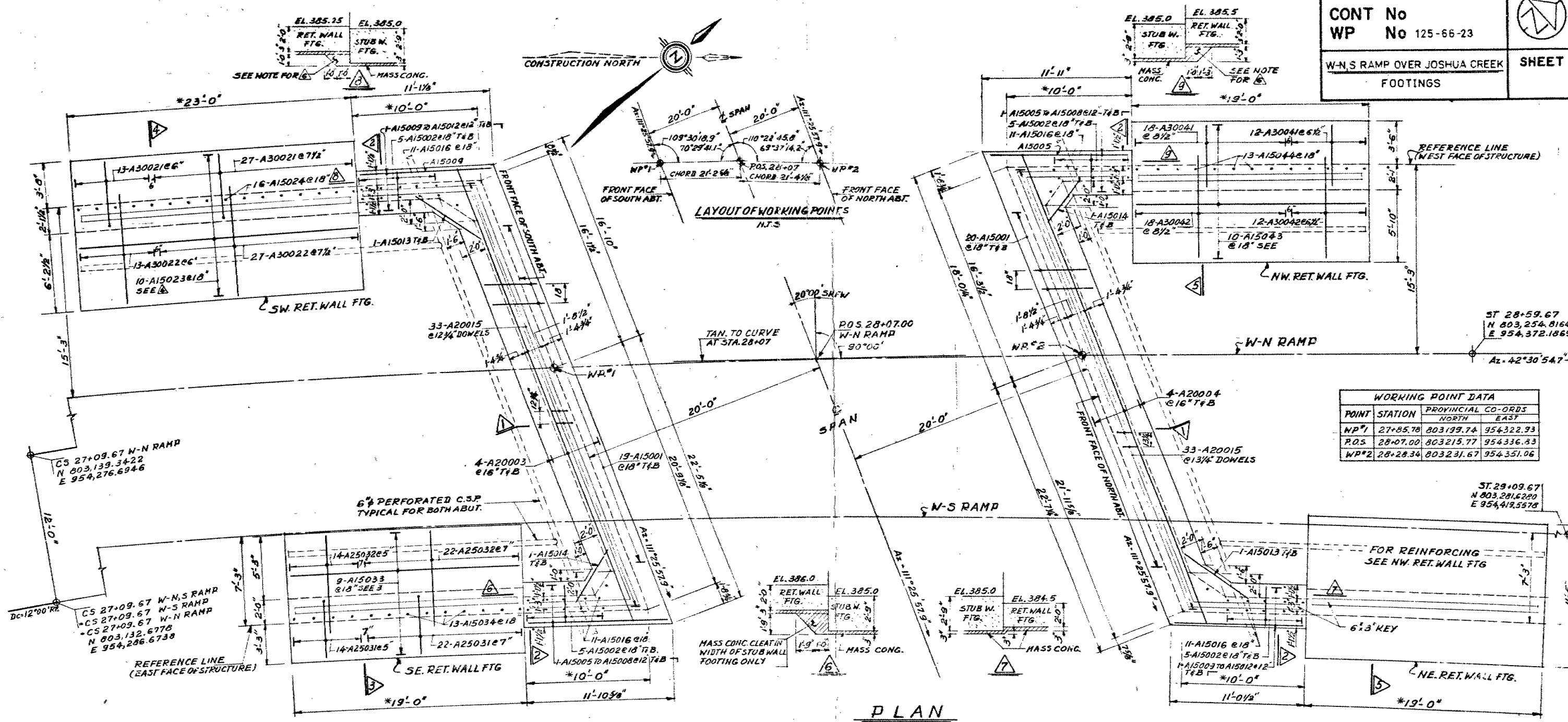
0 1 2 3

3 INCHES ON ORIGINAL PLAN

REVISE						
	DATE	BY	DESCRIPTION			
DESIGN	10-28-40		CHECK	OK	LOADING	10-28-40
DRAWING	10-28-40		CHECK	OK	SITE No	10-28-40
						DWG-1

CONT No
WP No 125-66-23

W-N S RAMP OVER JOSHUA CREEK
FOOTINGS



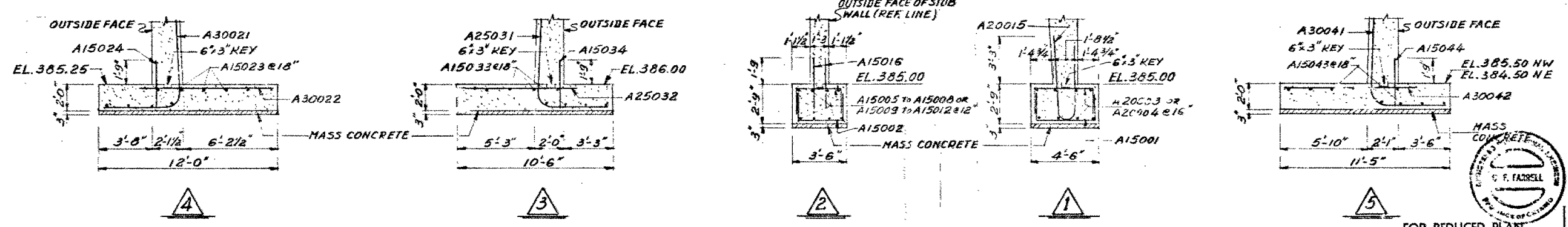
WORKING POINT DATA			
POINT	STATION	PROVINCIAL CO-ORDS NORTH	EAST
WP1	27+85.78	803199.74	954322.93
P.O.S.	28+07.00	803215.77	954336.83
WP2	28+28.34	803231.67	954351.06

PLAN

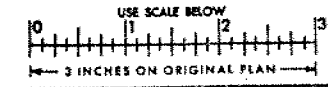
* DIMENSIONS MEASURED ALONG
REFERENCE LINE (EAST OR WEST
FACES OF STRUCTURE)

NOTES

- 3" THICK MASS CONCRETE TO BE PLACED IMMEDIATELY AFTER COMPLETION OF FOOTING EXCAVATIONS
- WP DENOTES WORKING POINT
- T&B DENOTES TOP AND BOTTOM



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



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

Mr. C.S. Grebski
Head, Central Section
Structural Office
2nd Floor, West Building

Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building

78 09 21

Re: W-NS Ramp Over Joshua Creek
W.P. 125-66-23, Site 10-140C
District 4, Hamilton

It was recently brought to our attention that the design of the above mentioned structure has been modified. In the revised scheme as shown on Drawing No. 10-140-1 and 10-140-3, the long wingwalls previously contemplated have been replaced by retaining walls which are isolated from the main structure. Also, the founding elevations of the various footing elements have been raised somewhat. Since the footings of the main structure and the retaining walls are still founded in the bedrock in compliance with our recommendations contained in the foundation report, the modified design is acceptable.

B. Ly
Senior Engineer

For: M. Devata
Supervising Engineer

BL/MD/gs

cc: G.C.E. Burkhardt
Files ✓