

G.I.-30 SEPT. 1976

GEOCRES No. 30M5-118DIST. 4 REGION W.P. No. 159-75-10CONT. No. 79-80W. O. No. STR. SITE No. 10-120HWY. No. Q.E.W.LOCATION ~~Q~~ Upper Middle Rd of
Joshua CreekNo of PAGES - =====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:



NOTES:

CLASS OF CONCRETE

FOOTINGS - 3000 P.S.I.
REMAINDER - 4000 P.S.I.

CLEAR COVER TO REINFORCING STEEL

FOOTINGS & ABUTMENTS - 3"
DECK - 2" TOP ; 1 1/2" BOT.
OR AS NOTED ON THE DRAWINGS.

REINFORCING STEEL GRADE

ALL STEEL - GRADE 400

CONSTRUCTION NOTES

FALSEWORK SUPPORTING WINGWALLS SHALL NOT BE REMOVED UNTIL CONCRETE IN THE DECK SLAB HAS ATTAINED A MINIMUM STRENGTH OF 3000 P.S.I.

BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH ABUTMENTS KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATIONS BE GREATER THAN 2 FEET.

FALSEWORK SUPPORTING THE DECK SHALL NOT BE REMOVED UNTIL AFTER THE BACKFILL HAS BEEN PLACED BEHIND THE ABUTMENTS TO AT LEAST EL. 428.00.

REINFORCING BARS WITH DESIGNATION 'C' AT END OF BAR MARK SHALL BE COATED BARS.

TO ACHIEVE THE MINIMUM CLEAR COVER OF 2" SPECIFIED, THE TOP LAYER OF REINFORCING SHALL BE PLACED, PRIOR TO CONCRETING, WITH A CLEAR COVER OF 2 1/2" ± 1/2" TOLERANCE.

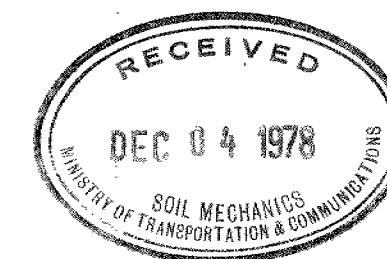
CONCRETE QUANTITIES:

CONCRETE QUANTITIES ARE LISTED BELOW FOR THE APPROPRIATE CONCRETE LUMP SUM TENDER ITEM:

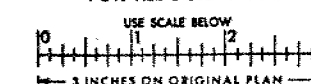
CONCRETE IN BRIDGE — 377 CU.YD.
CONCRETE IN BARRIER WALLS — 14 CU.YD.

LIST OF DRAWINGS:

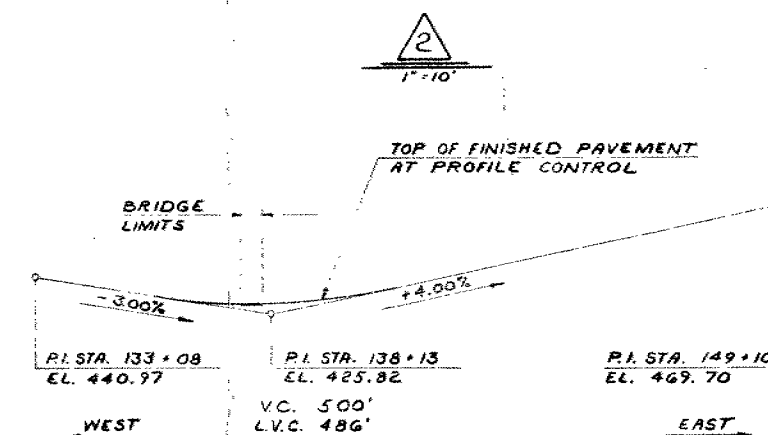
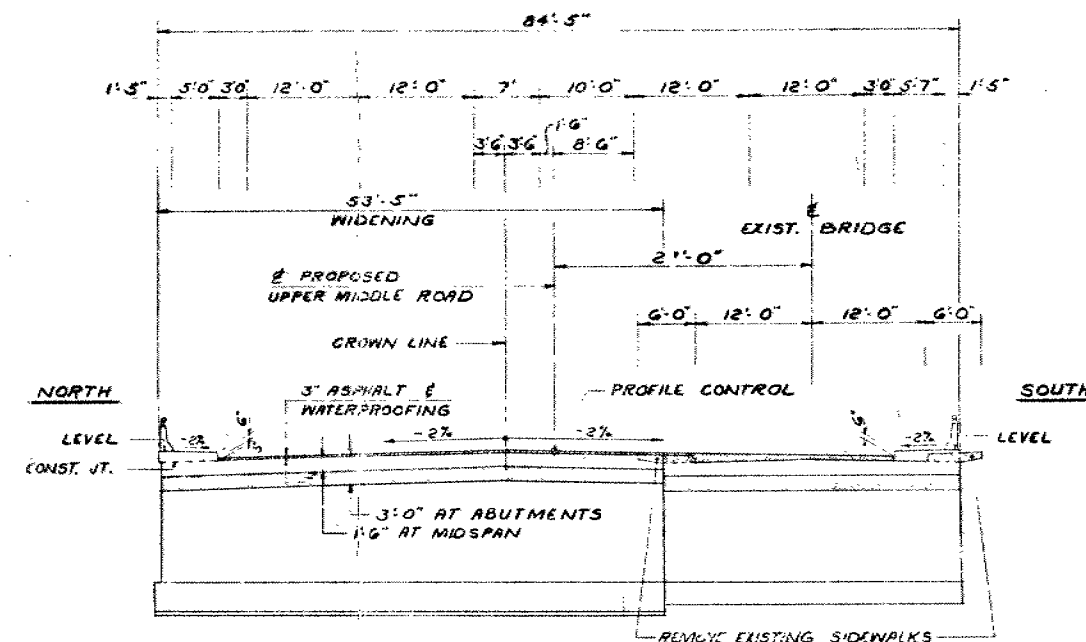
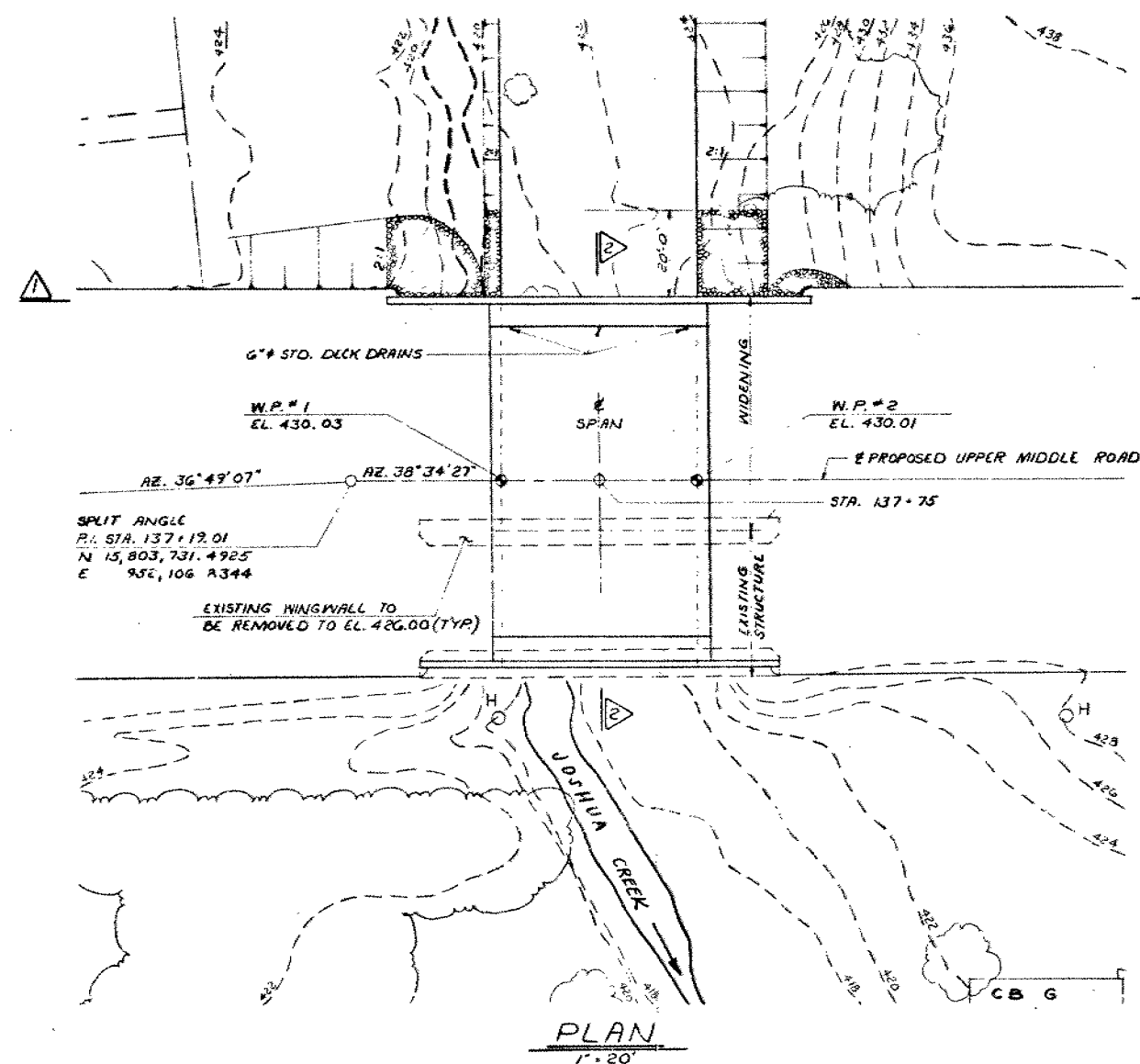
- 10-120-1 GENERAL LAYOUT
- 2 BORE HOLE LOCATIONS & SOIL STRATA
- 3 FOOTINGS
- 4 RIGID FRAME
- 5 WINGWALLS
- 6 BARRIER WALL WITH SIDEWALK
- 7 STEEL RAILING
- 8 AS CONSTRUCTED ELEV. & DIM.
- 9 STANDARD DETAILS I
- 10 STANDARD DETAILS II



FOR REDUCED PLAN

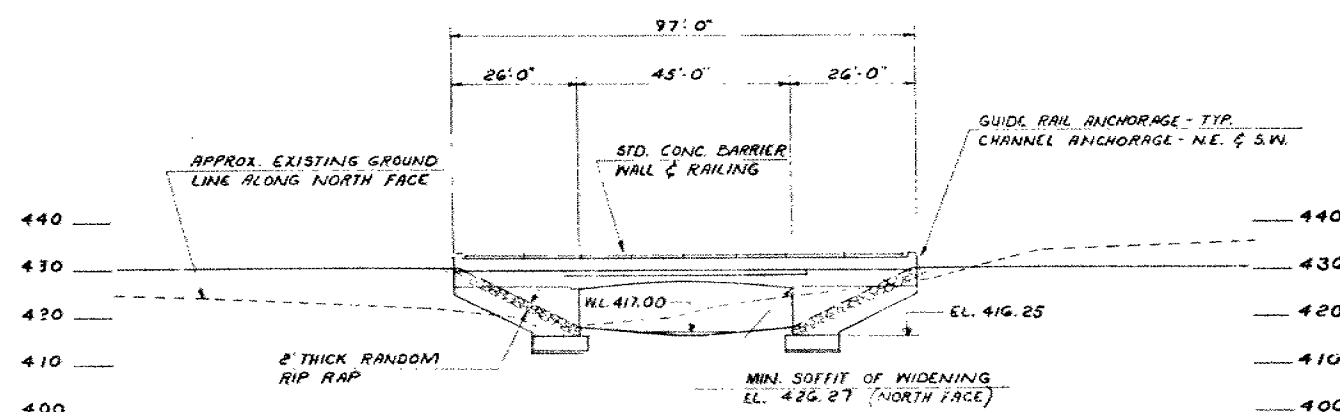


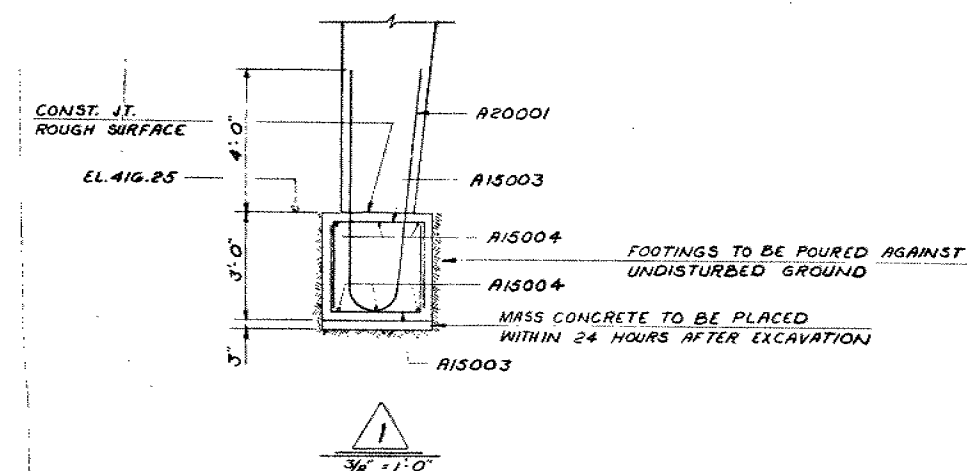
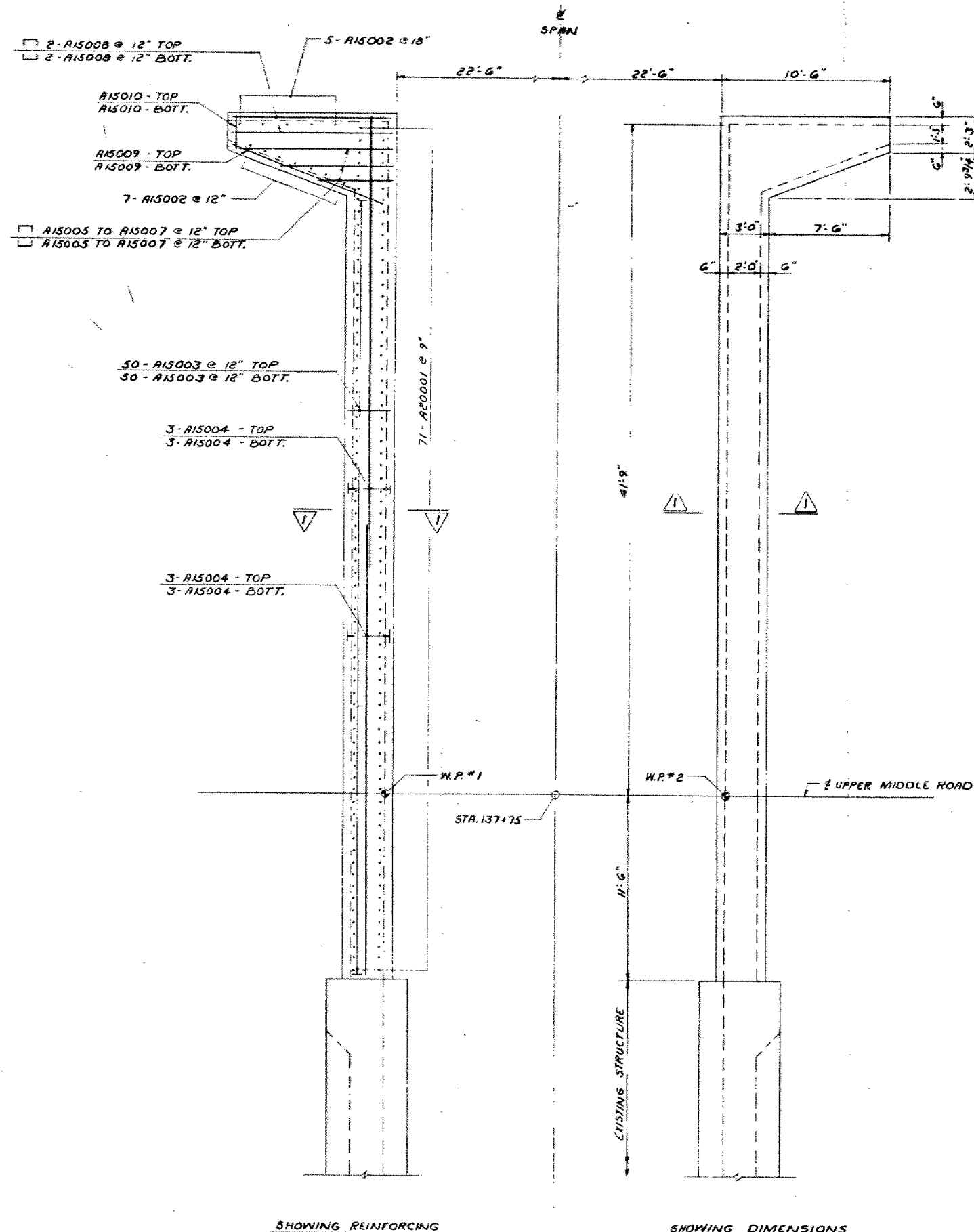
REVISIONS	DATE	BY	DESCRIPTION



PROFILE OF UPPER MIDDLE ROAD

N.T.S.





SHOWING REINFORCING

SHOWING DIMENSIONS

FOOTING LAYOUT
1/4" = 1'-0"

FOR REDUCED PLAN



REVISIONS				
	DATE BY	DESCRIPTION		
DESIGN JEM CHECK	LOADING - 320-44	DATE 78		
DRAWING JEM CHECK	SITE No 10-120	DWG 3		

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

WP 159-75-10

DIST 4

HWY QEW/403

STR SITE 10-120

Upper Middle Road Bridge
Over Joshua Creek

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

Files J

SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	78-10-20	KJS
TUBES	—	—
ROCK CORES	CONTRACT AWARD	KJS

FOUNDATION INVESTIGATION REPORT

For

Upper Middle Road Bridge Over Joshua Creek

W.P. 159-75-10, Site 10-120

QEW/403, District 4, Hamilton

INTRODUCTION

This report contains the results of a foundation investigation carried out for the above project. The fieldwork consisted of 2 boreholes advanced on August 14, 1978 employing a CME auger mounted on a tracked vehicle. Hollow stem augers were employed to auger through the overburden after which BX diamonds and core-barrel were used to obtain samples of the underlying bedrock. At the time of the investigation there was no apparent flow in the stream with only isolated pools of water in the channel.

SITE DESCRIPTION

The site is located on Upper Middle Road half a mile west of the existing Ford Drive-QEW interchange. Here Upper Middle Road crosses Joshua Creek on a two lane rigid frame structure having a span of 45 feet. The channel bed consists of loose slabs of limestone and shale alternating with areas of exposed bedrock. The valley slopes are relatively gentle and are covered with patches of trees and undergrowth. Land use in the general area is undergoing a change from agricultural to urban and industrial.

SUBSURFACE CONDITIONS

The overburden on the valley slopes consists of a shallow deposit of clayey silt containing some sand and gravel, as well as larger fragments of the underlying bedrock. It has a hard consistency as shown by a Standard Penetration 'N' value of 41.

The bedrock is part of the Meaford-Dundas formation and consists of interbedded layers of limestone and shale with occasional thin seams of clay. The percent of the rock core recovered was

low but may at least partly be explained by the use of a BX corebit. The core recovered did show that the limestone beds occasionally exceed 1 foot in thickness.

Groundwater was encountered in the bedrock at levels approximately equal to the stream bed.

DESIGN CONSIDERATIONS

Proposal

It is proposed to widen the existing structure to the north to allow for 4 lanes of traffic and a center median.

Recommendations

It is recommended that the structure extension be supported on spread footings in the bedrock with a design load of 10 tons per square foot. Since the shale layers in the bedrock are susceptible to frost action, the underside of the footings should be protected by 4 feet of cover. The present streambed is at 417 requiring the footings to be placed at or below 413. To prevent deterioration of the shale on exposure to air and water the base of the footing should be covered by 3 inches of mass concrete within 4 hours of the excavation reaching grade. Any soft rock encountered at the footing grade should be excavated and replaced by mass concrete. The coefficient of friction between the footing base and the bedrock may be taken as .45.

Earth Pressure

It should be assumed that the abutments are rigid and the following parameters used to calculate earth pressures.

Granular A

$$\gamma = 145 \text{ pcf}$$

$$K_o = 0.35$$


Granular B and C

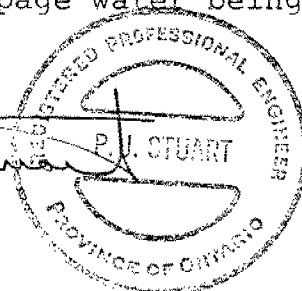
$$\gamma = 135 \text{ pcf}$$


$$K_o = 0.50$$

Dewatering

No dewatering problems are anticipated with seepage water being pumped from sumps outside the footing areas.


P. Stuart, P. Eng.
Project Engineer




P. Payer, P. Eng.
Senior Engineer

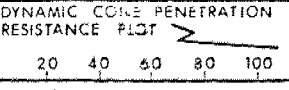


October, 1978

APPENDIX



RECORD OF BOREHOLE No 1

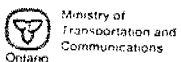
W P 159-75-10 LOCATION Coords. N 15,803.811; E 352.131 ORIGINATED BY P.J.S.
DIST 4 HWY QEW/403 BOREHOLE TYPE Hollow Stem Auger and BX Core COMPILED BY P.J.S.
DATUM Geodetic DATE August 14, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH					WATER CONTENT (%)				
								O UNCONFINED + FIELD VANE * QUICK TRIAXIAL x LAB VANE					W _p	W	W _L		
423.3	Ground Level																
0.0	Clayey Silt, Some Sand and Gravel		1	SS	41	*	420										
417.6	Hard		2	SS													
5.7	Bedrock Interbedded Layers of Shale and Limestone		3	BX RC	35% Rec												
408.4			4	BX RC	50% Rec		410										
14.9	End of Borehole																
	*Note: Water Level Not Established																

+3, x5: Numbers refer to
Sensitivity

20
15 \pm 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

W P 159-75-10 LOCATION Coords. N 15,803,774; E 952,111 ORIGINATED BY P.J.S.
DIST 4 HWY QEW/403 BOREHOLE TYPE BX Core COMPILED BY P.J.S.
DATUM Geodetic DATE August 14, 1978 CHECKED BY RS

[illegible]

*3, *5: Numbers refer to Sensitivity

15 ϕ 5 (%) STRAIN AT FAILURE

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 (FSF)	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. CUU = 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 OSTENBERG SAMPLE
F S FOIL SAMPLE
R C ROCK CORE
F H T.W. ADVANCED HYDRAULICALLY
F 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
 ω SLOPE ANGLE-BACKFACE OF WALL
 β ANGLE OF SLOPE
 N_1, N_2, N_3 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 = $\frac{w - w_p}{w_p - w_L}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{w_p - w_L}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{2.4 \text{ of } \text{clay fraction}}$
 Om ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u(\text{undisturbed})}{S_u(\text{remoulded})}$

STRENGTH PARAMETERS

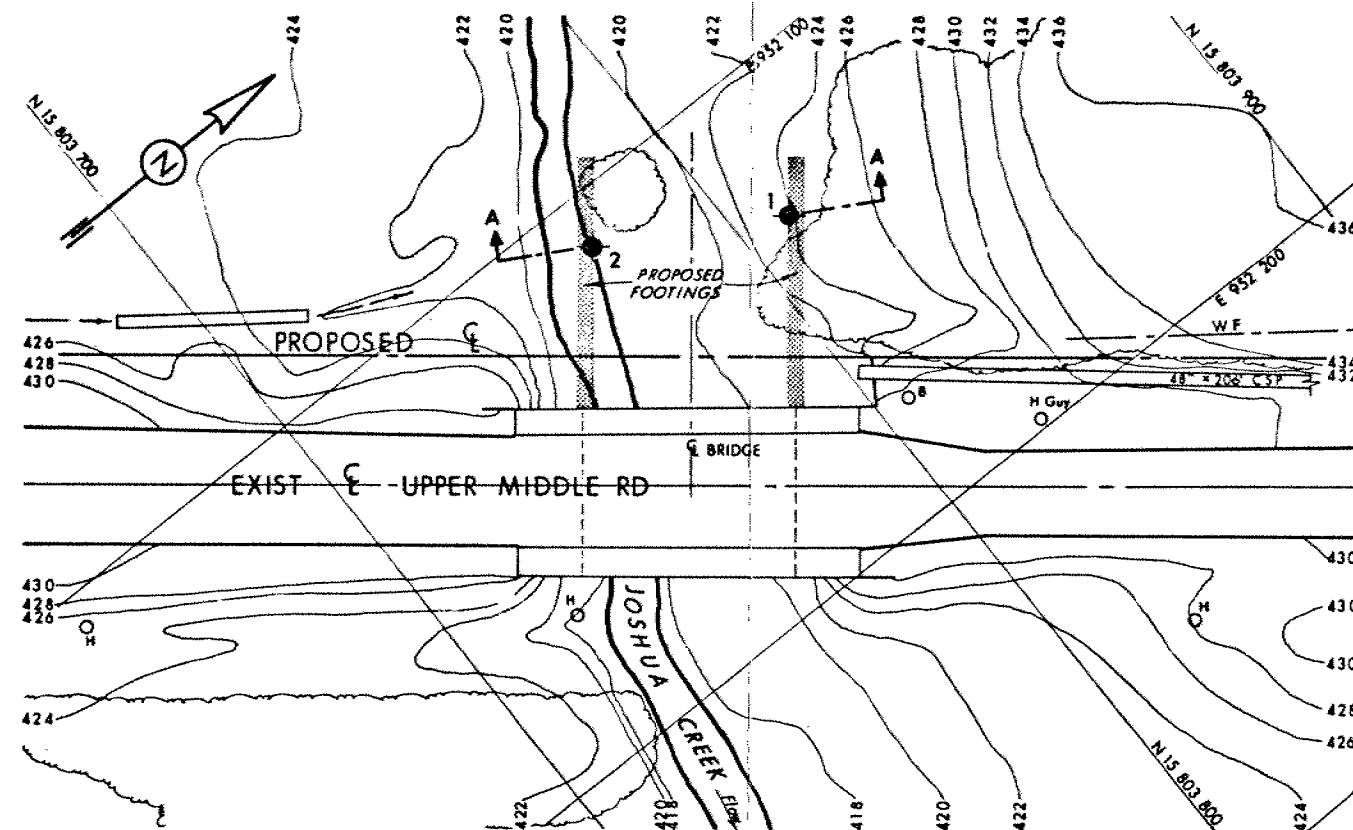
ϕ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_R RESIDUAL SHEAR STRENGTH
 c COHESION INTERCEPT
 $\sigma_1, \sigma_2, \sigma_3$ NORMAL PRINCIPAL STRESSES
 u PORE WATER PRESSURE
 u_e EXCESS u
 r_u PORE PRESSURE RATIO
 q_u UNCONFINED COMPRESSIVE STRENGTH
 s_u UNDRAINED SHEAR STRENGTH
 ϵ LINEAR STRAIN
 γ SHEAR STRAIN
 ν POISSON'S RATIO
 E MODULUS OF ELASTICITY
 G MODULUS OF SHEAR DEFORMATION
 k_a 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:
 σ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ'_1 = EFFECTIVE NORMAL STRESS

HYDRAULIC TERMS

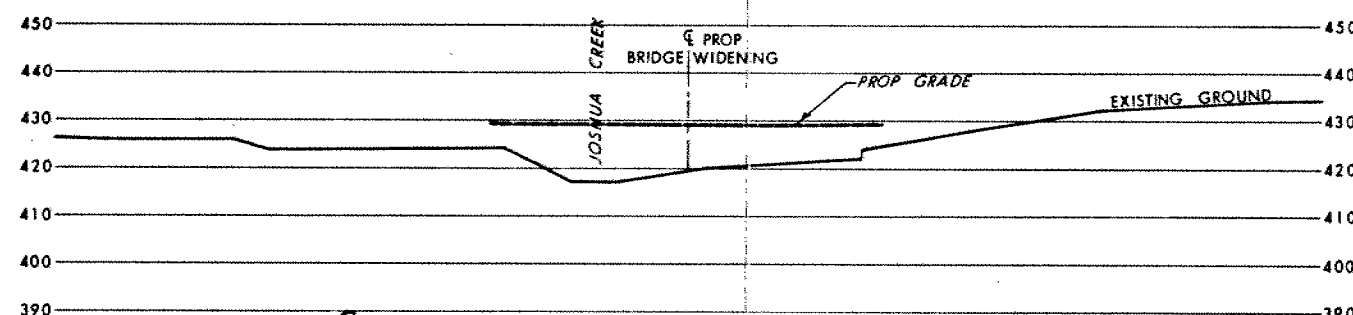
h HYDRAULIC HEAD OR POTENTIAL
 q RATE OF DISCHARGE
 v VELOCITY OF FLOW
 i HYDRAULIC GRADIENT
 j SEEPAGE FORCE PER UNIT VOLUME
 η COEFFICIENT OF VISCOSITY
 k COEFFICIENT OF HYDRAULIC CONDUCTIVITY
 k_h k IN HORIZONTAL DIRECTION
 k_v k IN VERTICAL DIRECTION
 m_v COEFFICIENT OF VOLUME CHANGE
 c_v COEFFICIENT OF CONSOLIDATION
 C_c COMPRESSION INDEX
 C_L RECOMPRESSION INDEX
 d DRAINAGE PATH DISTANCE
 T_v TIME FACTOR
 U DEGREE OF CONSOLIDATION
 σ'_1 OVERCONSOLIDATION RATIO (OCR)

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO
ON-MT-308 (10-75)



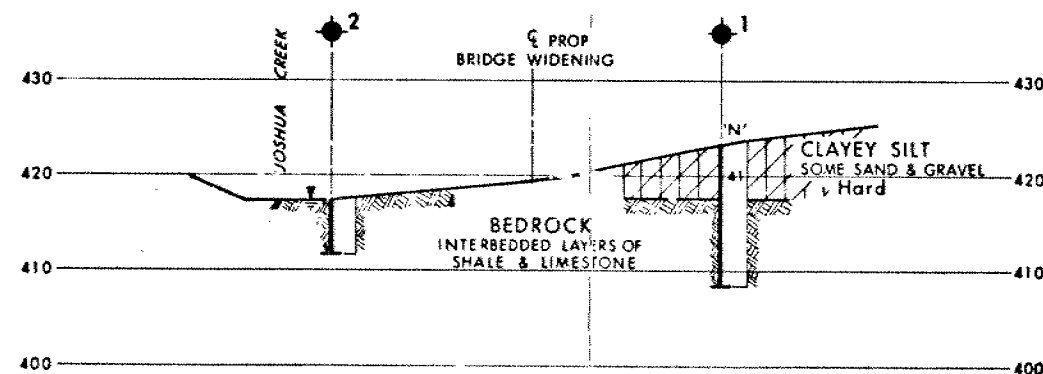
PLAN

SCALE
20 10 0 20 FT



PROFILE - PROPOSED UPPER MIDDLE ROAD

SCALE
20 10 0 20 FT



SECTION A-A

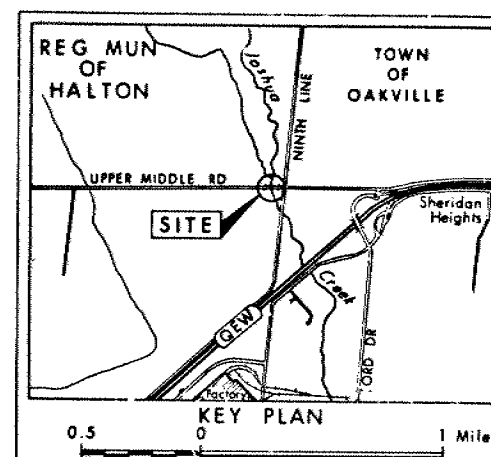
SCALE
10 5 0 10 FT

CONT No
WP No 159-75-10



UPPER MIDDLE RD OVER JOSHUA CR
(Bridge Widening, Just W of Ninth Line)
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



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)
- WL at time of investigation Aug 1978
- Water Level Not Established for Bore Hole No 1

No	ELEVATION	CO - ORDINATES	
		NORTH	EAST
1	423.3	15 803 811	952 131
2	417.4	15 803 774	952 111

-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 30 M5 - 118

HWY No QEW/403
SHEET PJ 5 OF 5
DATE Oct 11, 1978
SITE 10-120
DRAWN RS
CHECKED JG
APPROVED JG
REF PLAN GIFFELS DAVIS & JORGENSEN July 10/78
NO 1597510-A