

REMARKS: \_\_\_\_\_



DIST. 6 HWY. 403  
CONT No  
WP No 157-75-05



MULLET CREEK BRIDGE  
GENERAL LAYOUT

SHEET

COLE  
SHERMAN

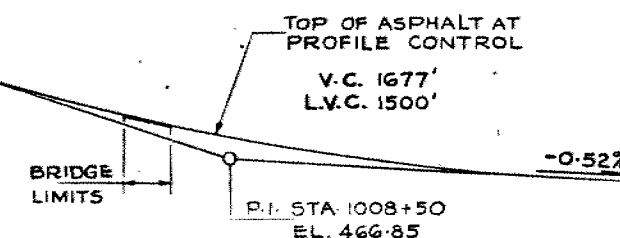
# NOTES

- CLASS OF CONCRETE**  
DECK & BARRIER WALLS ..... 4,000 P.S.I.  
REMAINDER ..... 3,000 P.S.I.  
OR AS NOTED ON THE DRAWINGS
- REINFORCING STEEL**  
GRADE 400 - REIN. BARS WITH THE DESIGNATION  
'C' SHALL BE COATED BARS.
- CONSTRUCTION NOTES**  
THE CONTRACTOR IS RESPONSIBLE FOR  
FINISHING THE BEARING SEATS DEAD LEVEL  
TO THE SPECIFIED ELEVATIONS WITH A  
TOLERANCE OF  $\pm 1/8"$ .  
TO ACHIEVE THE MINIMUM CLEAR COVER OF 2"  
AS SPECIFIED, THE TOP LAYER OF REIN. STEEL  
SHALL BE PLACED PRIOR TO CONCRETING WITH A  
CLEAR COVER OF  $2 1/2 \pm 1/2$  TOLERANCE.  
NO CONCRETE SHALL BE PLACED ABOVE THE  
ABUTMENT BEARING SEATS UNTIL THE CONC.  
IN THE DECK HAS BEEN PLACED.
- CONCRETE QUANTITIES**  
CONCRETE QUANTITIES ARE LISTED BELOW  
FOR THE APPROPRIATE CONCRETE LUMP SUM  
TENDER ITEMS.  
1. CONCRETE IN ABUTMENTS  
AND WING WALLS ..... 472 CU. YDS  
2. CONCRETE IN DECK ..... 336 CU. YDS  
3. CONCRETE IN BARRIER WALLS ..... 34 CU. YDS  
4. CONCRETE IN APPROACH SLABS ..... 138 CU. YDS

PROFILE  
CONTROL (M.E.P.)

10°00'00" SKEW  
SIN. 0.1736481  
COS. 0.9848077  
TAN. 0.1763769

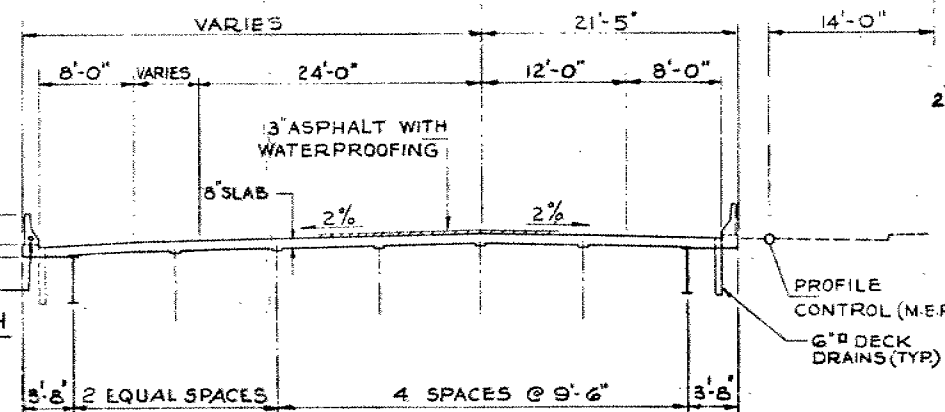
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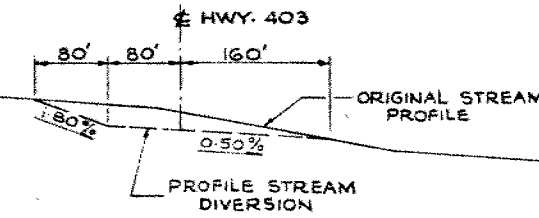
## PROFILE OF HWY. 403

N.T.S.

CONTROL LINE  
W.B.L. HWY. 403



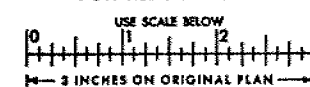
SCALE:  $1/8" = 1'-0"$



## PROFILE OF MULLET CREEK

N.T.S.

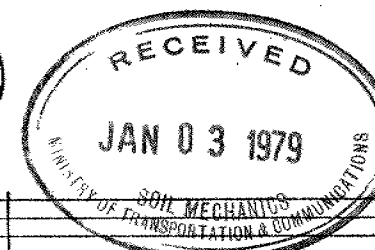
FOR REDUCED PLAN



## LIST OF DRAWINGS

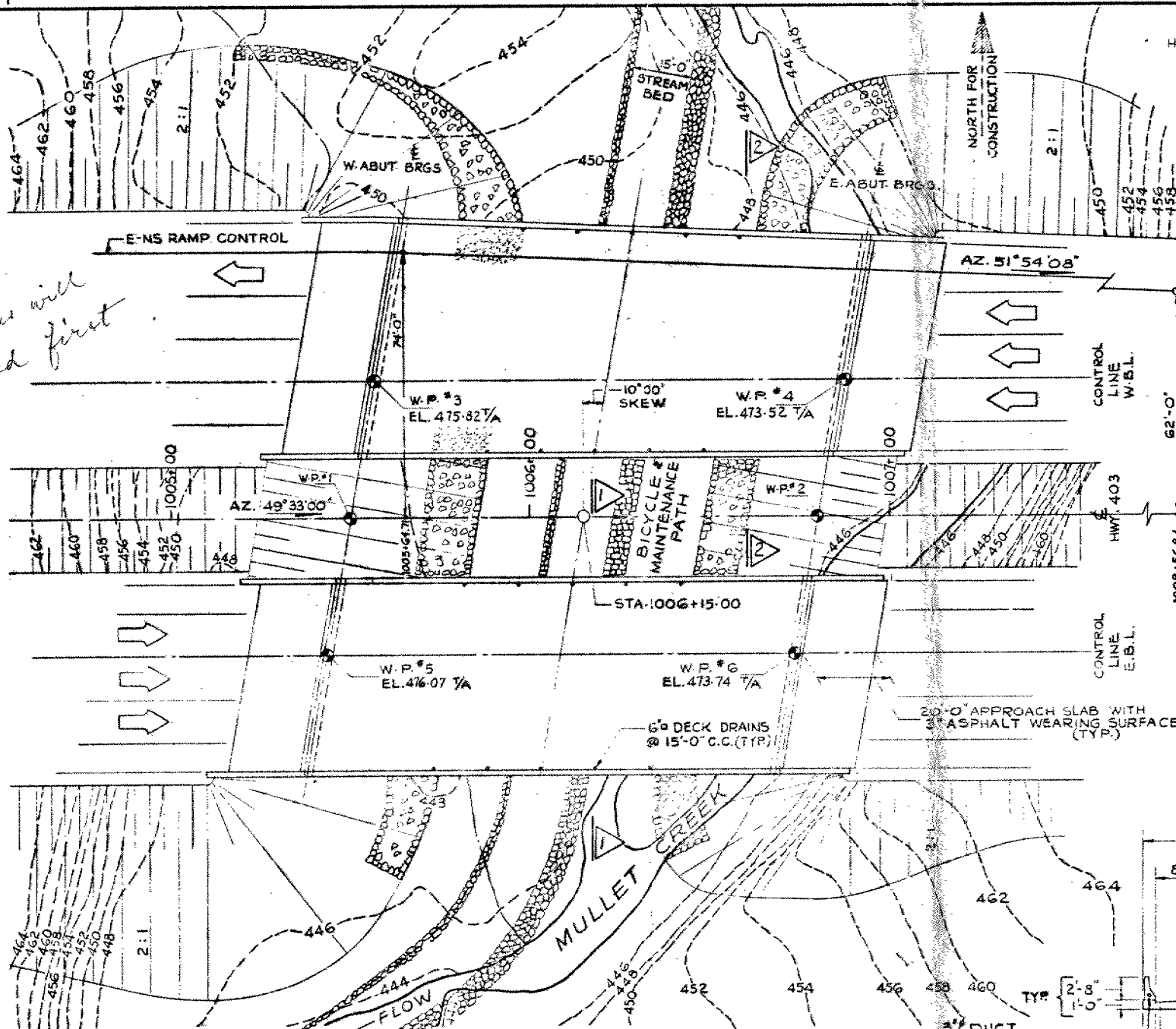
- 24-386
1. GENERAL LAYOUT
  2. BOREHOLE LOCATIONS & SOIL STRATA
  3. FOOTING LAYOUT
  4. FOOTING REINFORCING
  5. WEST ABUTMENT - SOUTH BRIDGE
  6. EAST ABUTMENT - SOUTH BRIDGE
  7. WEST ABUTMENT - NORTH BRIDGE
  8. EAST ABUTMENT - NORTH BRIDGE
  9. GIRDER LAYOUT
  10. GIRDER DETAILS
  11. DECK REINFORCEMENT
  12. DECK SECTIONS
  13. BARRIER WALL - SOUTH BRIDGE
  14. BARRIER WALL - NORTH BRIDGE
  15. STEEL RAILING (SINGLE TUBE)
  16. 20 FT. APPROACH SLAB
  17. STANDARD DETAILS I
  18. STANDARD DETAILS II
  19. SOUND BARRIER
  20. AS CONSTRUCTED ELEV. & DIM.

STRUCTURAL STEEL 245 TONS



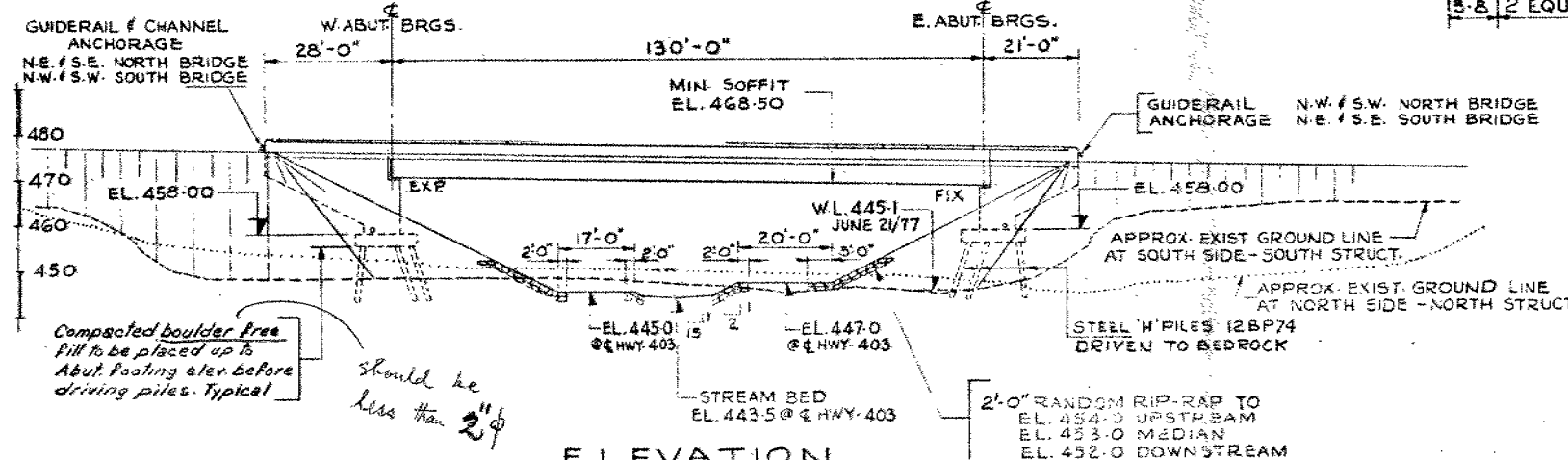
REVISIONS	DATE BY	DESCRIPTION
DESIGN	CSL	CHECK 2/2/81 LOADING - 5 20-41 DATE AUG. 78
DRAWING	CSL	CHECK 2/2/81 SITE No 24-336 DWG 1

oil pipelines will  
be relocated first



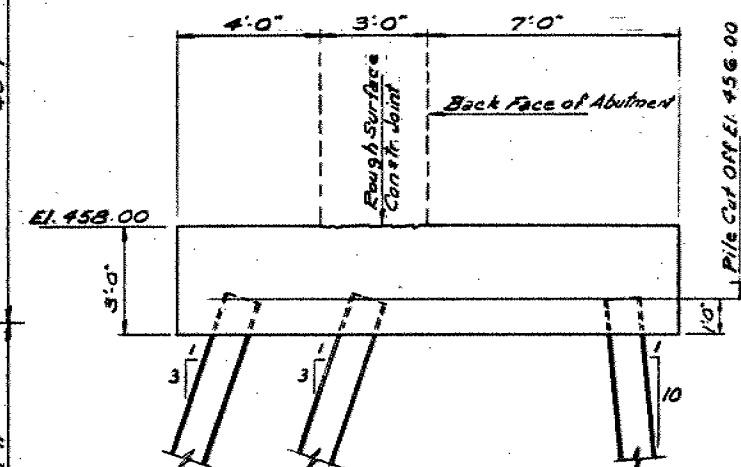
PLAN  
SCALE:  $1" = 20'-0"$

NOTE:  
FOR COMPLETE EXTENT OF GRADING  
AND RIP-RAP REFER TO GRADING DWGS.



ELEVATION  
SCALE:  $1" = 20'-0"$



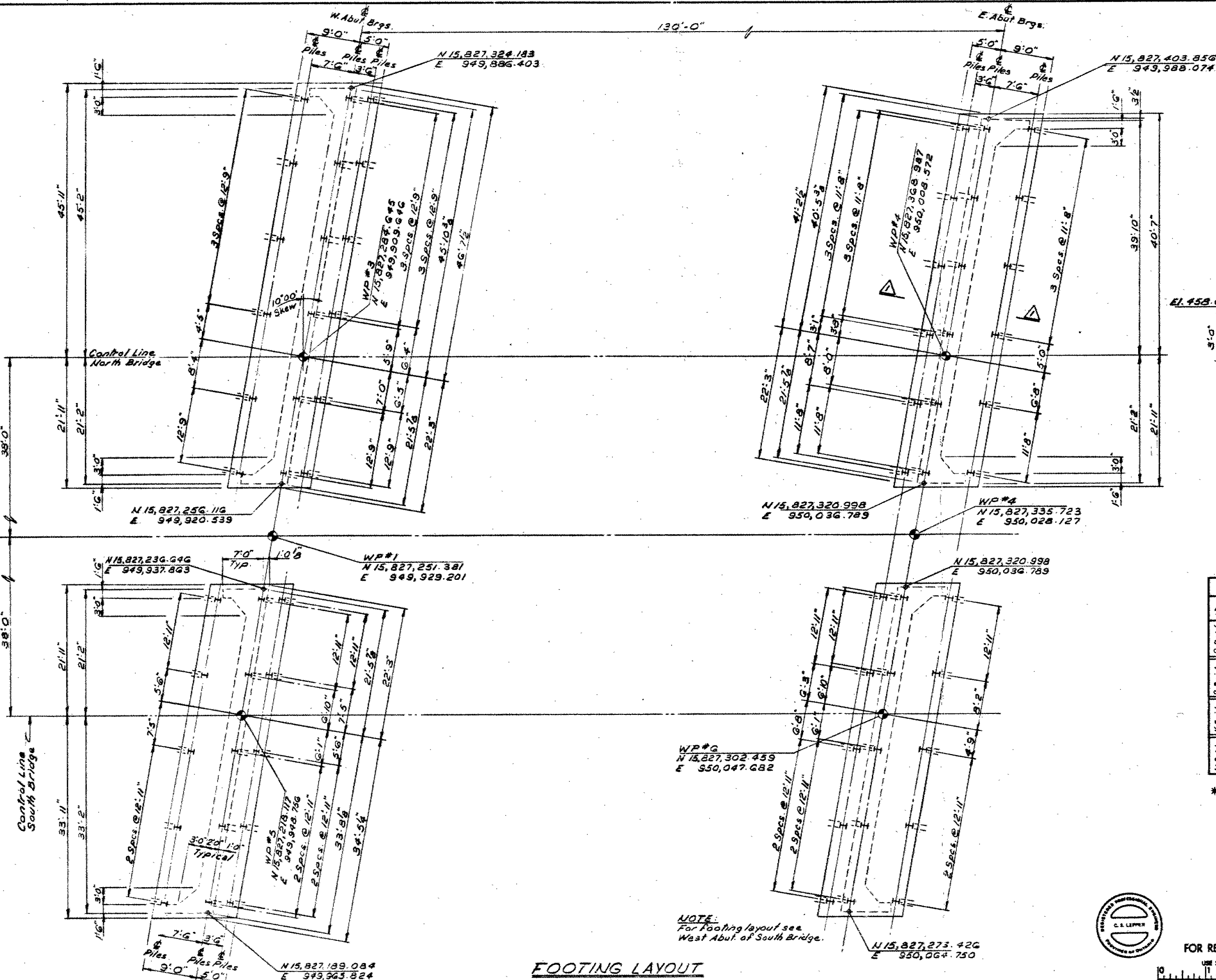


Scale: 1/2" = 1'-0"

PILE DATA					
Location	No.	Length	Batter	Type	Design Load
S Bridge W Abut	Front	5	17'-0"	3:1	100 Tons Per Pile
	Middle	5	17'-0"	3:1	
	Rear	5	16'-0"	10:1	
S Bridge E Abut	Front	5	17'-0"	3:1	100 Tons Per Pile
	Middle	5	17'-0"	3:1	
	Rear	5	16'-0"	10:1	
N Bridge W Abut	Front	6	17'-0"	3:1	100 Tons Per Pile
	Middle	6	17'-0"	3:1	
	Rear	6	16'-0"	10:1	
N Bridge E Abut	Front	6	17'-0"	3:1	100 Tons Per Pile
	Middle	6	17'-0"	3:1	
	Rear	6	16'-0"	10:1	

\* 12 BP74 Steel H Pile

Pile spacing is measured at 1/2 of footing.



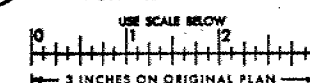
NOTE:  
For footing layout see  
West Abut. of South Bridge.

FOOTING LAYOUT

Scale: 1/8" = 1'-0"



FOR REDUCED PLAN



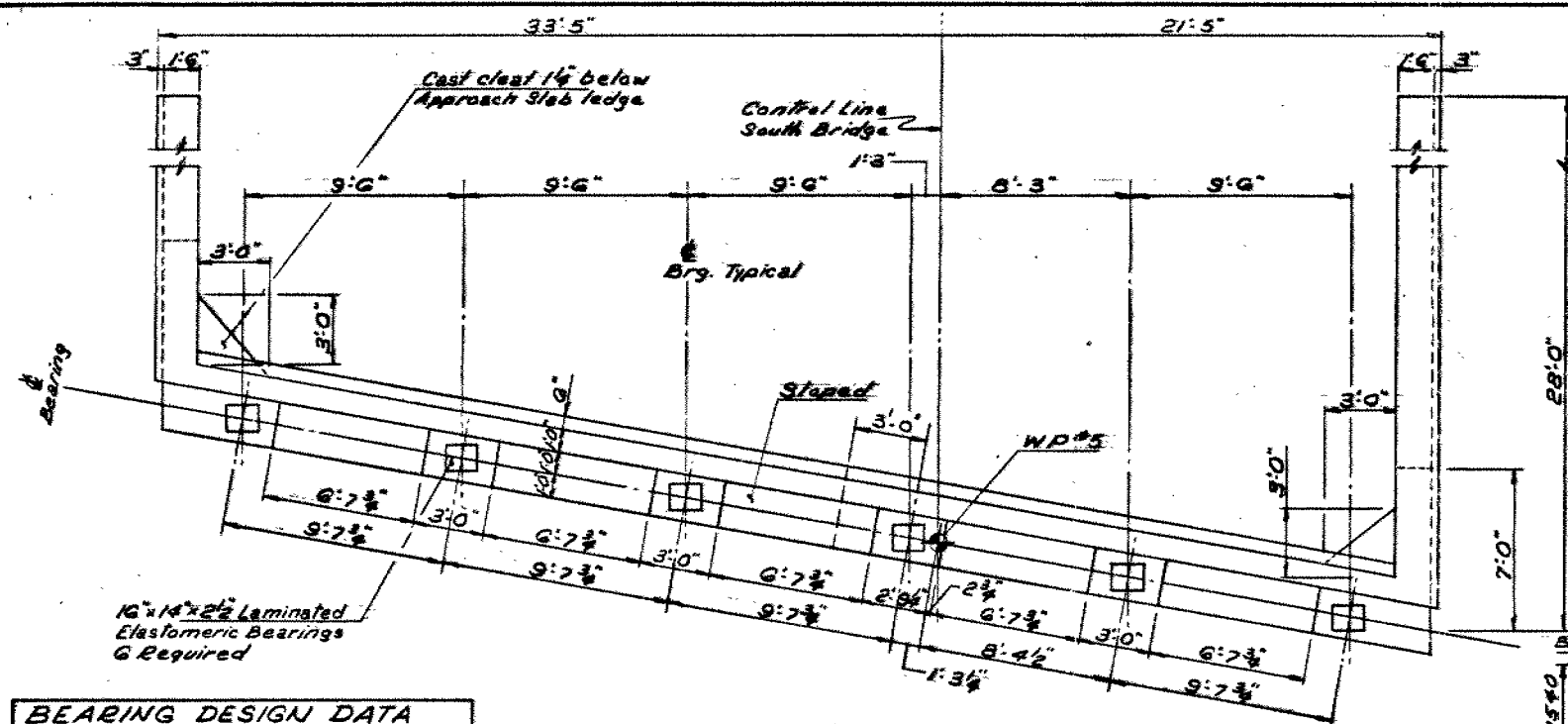
REVISIONS	DATE	BY	DESCRIPTION

DESIGN: C.S.L. CHECK: C.S.L. LOADING: 4320 x 4 DATE: NOV 75  
DRAWING: C.S.L. CHECK: C.S.L. SITE: No 24-533 DWG: 3



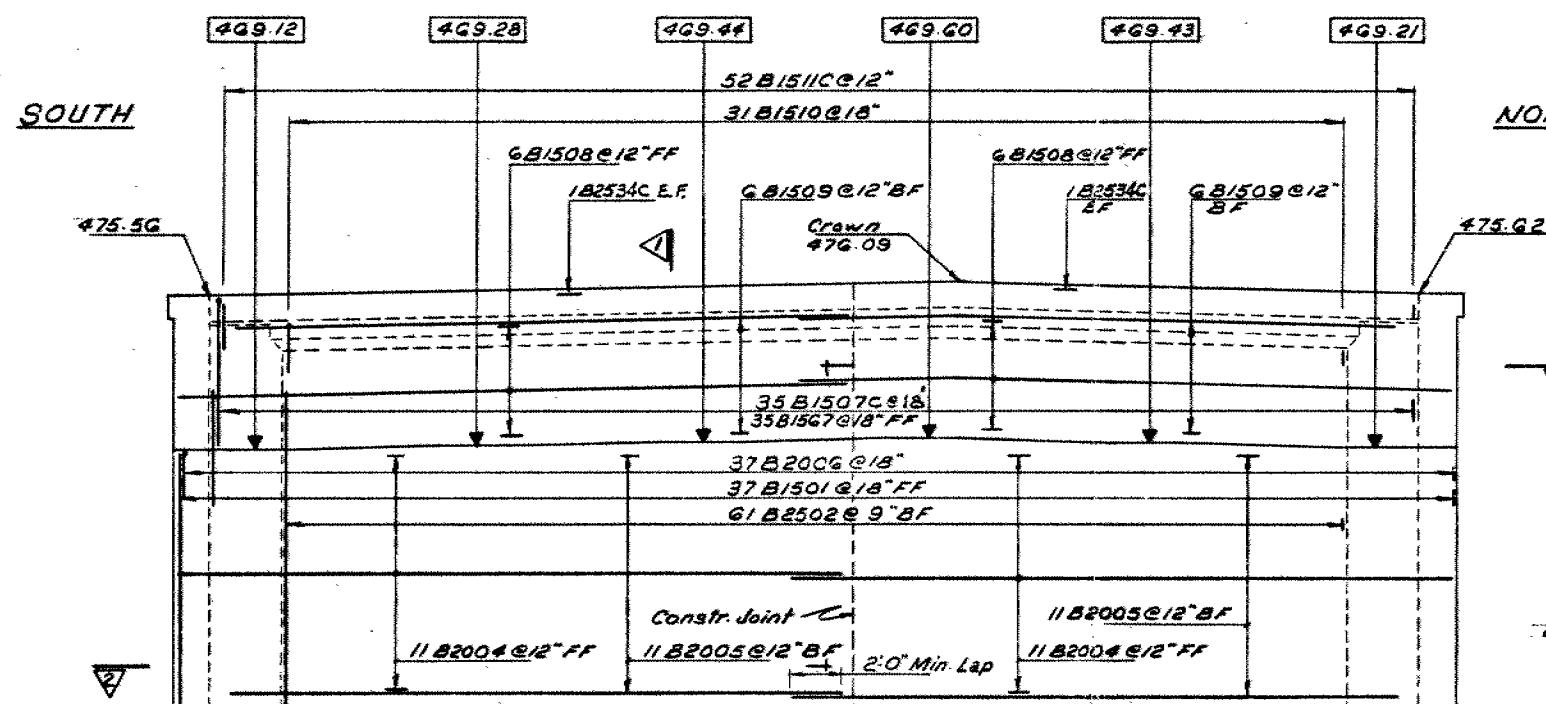




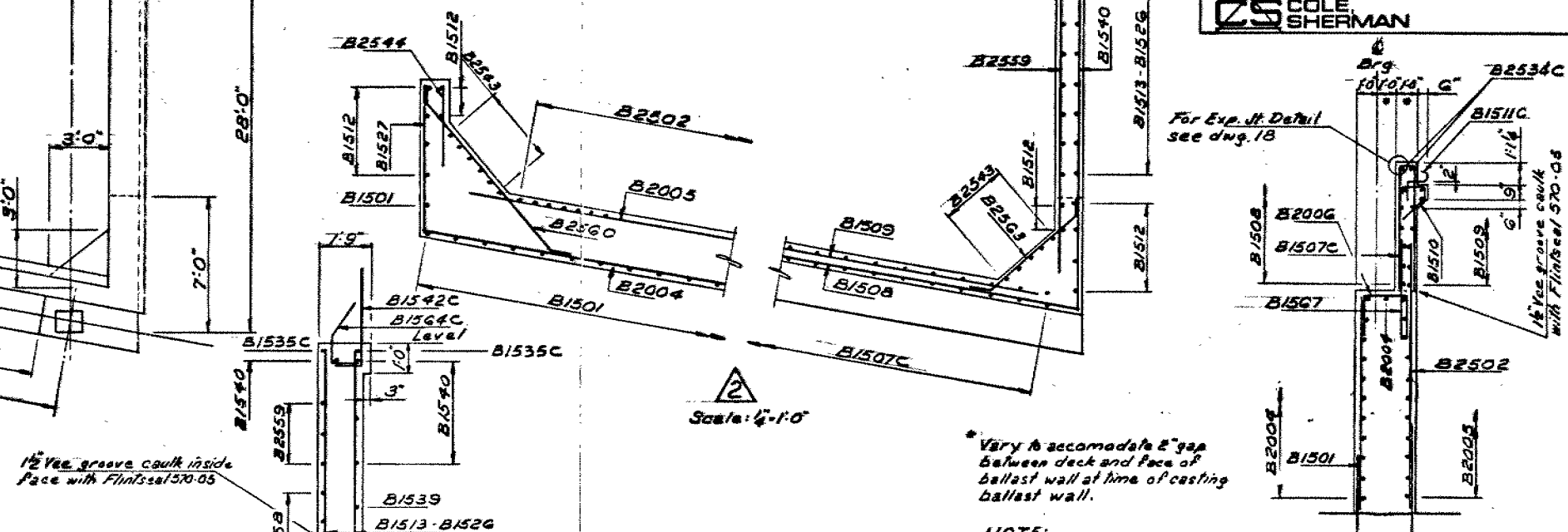


**PLAN of ABUTMENT**

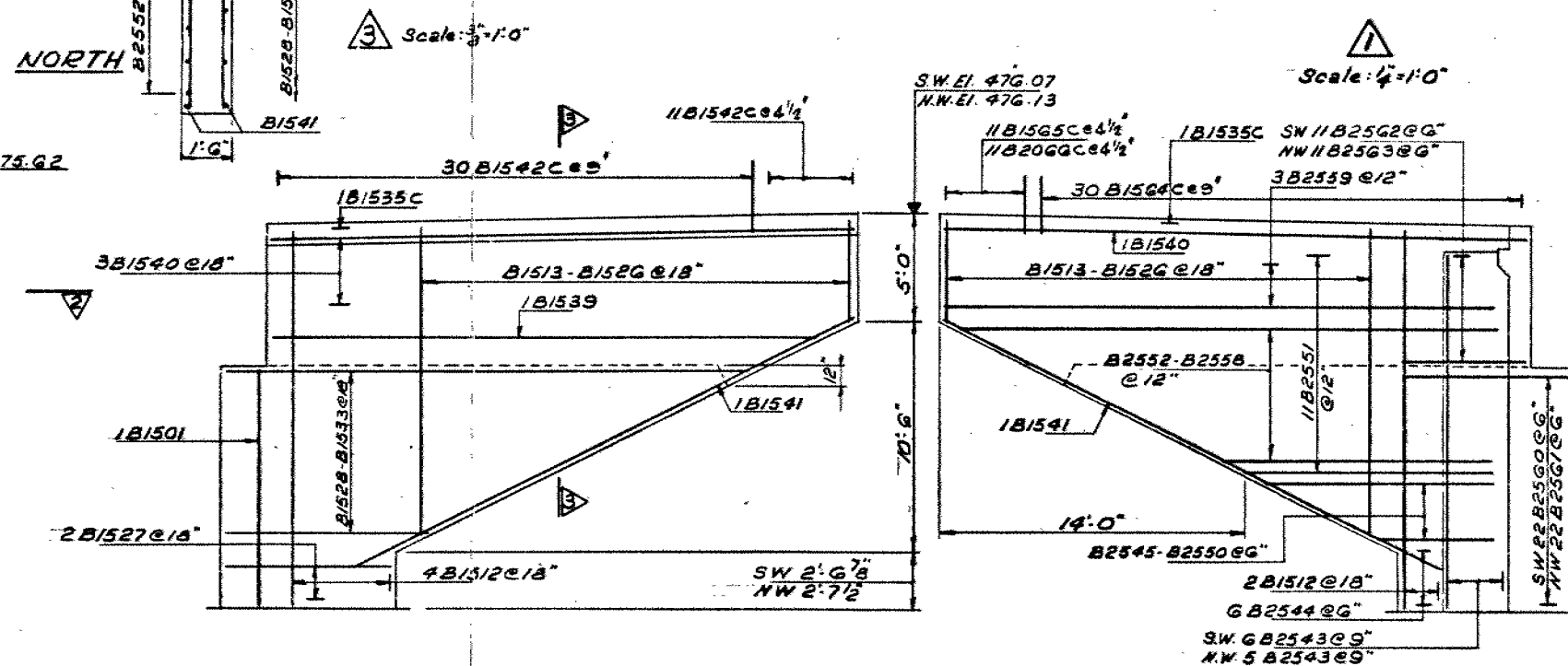
BEARING DESIGN DATA	
D.L.	= 108 k
D.L. + LL + I	= 176 k
Maximum Movement	= 2"
Maximum Allowable Shear Rate	= 14 k/in.



ELEVATION  
Scale: 1"=10'



*NORTH*

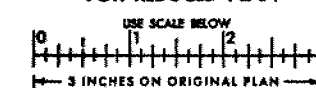


OUTSIDE FACE OF WING WALL

INSIDE FACE OF WING WALL



FOR REDUCED PLAN



3	REVISIONS				
	DATE	BY	DESCRIPTION		
	DESIGN	CSL	CHECK	SLR	LOADING H3 20-44 DATE AUG.
	DRAWING	44	CHECK	SLR	SITE N- 24-220 DWS



Note  
changes



ENGINEERING MATERIALS OFFICE  
SOIL MECHANICS SECTION

WP 157-75-05

DIST 6

*CONT 80-71*

HWY 403

STR SITE 24-386

Proposed Structure Over Relocated  
Mullet Creek and New Hwy. 403

DISTRIBUTION

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J. Anderson } cover only  
G. Sloan }

Files ✓

SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	75 08 09	M.D.
TUBES	-	-
ROCK CORES	<i>After completion of Bridge Cont</i>	M.D.



# FOUNDATION INVESTIGATION REPORT

for

Proposed Structure Over Relocated  
Mullet Creek and New Hwy. 403  
Site 24-386, W.P. 157-75-05  
District 6, Toronto

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803-93-01

## INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project during the period of June 21 and 22, 1977.

The fieldwork consisted of 12 sampled boreholes advanced by means of a continuous flight auger machine equipped with solid and hollow stem (3½" I.D.) augers. In addition, diamond drilling techniques were employed to obtain BXL size rockcore samples of bedrock. The boreholes ranged in depths from 6.5 to 11 feet below the ground surface.

## SITE DESCRIPTION AND GEOLOGY

The site is located about half mile west of Credit River or immediately west of Mississauga Road and one mile south of Eglinton Avenue, in the City of Mississauga, Regional Municipality of Peel.

The topography of the general area is gently sloping in a southerly direction. The site is located in the Mullet Creek Valley whose width is approximately 250 feet. The valley floor is at approximate elevation 448 and the valley banks are at elevation 465. The creek meanders in a southerly direction. The clear width of the creek is about 20 feet and the water level in the creek is about elevation 445. The land is developed for farming purposes. Physiographically the site is situated in the border regions of "Peel Plains" and "South Slope". The characteristic deposit in the vicinity of the area under investigation is composed of cohesive glacial till and granular deposits. The overburden is underlain by shale bedrock of Meaford, Dundas formation, Ordovician Period.

This physiographic region is well drained by the Credit, Oakville and Etobicoke Creeks, which have cut deep valleys into the overburden, although in many of the interstream areas drainage is still imperfect.



## SUBSURFACE CONDITIONS

### General

The subsurface conditions were found to be quite uniform over the site. Under a thin layer of topsoil is a stratum of cohesive glacial till, a heterogeneous mixture of clayey silt, sand and gravel which was explored to its full depth in all the boreholes except B.H. No's 8, 9 and 11, which were put in the creek floor with water depth about 6". The overburden is underlain by shaley limestone bedrock which was proven in all the boreholes. Detailed descriptions of the 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. 1577505A are based upon this information.

### Glacial Till (Heterogeneous Mixture of Clayey Silt, Sand and Gravel)

Underlying a thin layer up to 12 inches of topsoil, is a deposit of cohesive glacial till comprised of a heterogeneous mixture of clayey silt, sand and gravel. The cohesive glacial till material was encountered at all locations except in B.H. No's 8, 9 and 11. The glacial till varied in thickness from 3.5 to 6.0 feet. The Standard Penetration Tests gave 'N' values ranging from 13 to over 100 blows per foot indicating that the cohesive stratum has stiff to hard consistency.

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

	<u>Range</u>
Liquid Limit ( $W_L$ )      %	25-34
Plastic Limit ( $W_p$ )      %	16-20
Moisture Content ( $W$ )    %	7-21

The results of the Atterberg Limit Tests are shown on Plasticity Chart (Fig. 1) and the typical grain size distribution curves are presented in an envelope form in Fig. 2 which are included in the Appendix of this report.

The Atterberg Limits indicate that the cohesive stratum is inorganic and of low plasticity.

The boreholes No. 8, 9 and 11 were put in the creek through 6 inches of water. Under the water a deposit of 1.5 to 2.5 ft. thick alluvial silty sand and gravel was found overlying the bedrock.



### Bedrock (Shale to Shaley Limestone)

Bedrock was encountered immediately below the cohesive glacial till overburden, or immediately beneath the alluvial deposit in the creek floor.

The dominant type of bedrock encountered across the site is shale to shaley limestone. The surface of the bedrock in the area investigated varies from elevation 442.0 to 445.0 and appears to be dipping slightly in a westerly direction. The bedrock was found to be generally sound. However, in certain locations, the upper 6" to 18" of the bedrock appeared to be slightly weathered.

### Groundwater

The groundwater levels were observed by measuring in the open boreholes during and after the completion of the foundation investigation. The groundwater levels were found to vary between elevations 445.8 and 444.1 which corresponds to depths of 3.0 to 3.5 feet below the existing ground surface. The water level in the Mullet Creek during the time of investigations (June 22, 1977) was 445.0.

The groundwater levels are shown on the Record of Borehole Sheets, as well as on Drawing No. 1577505A.

803 9301-A



## DISCUSSIONS AND RECOMMENDATIONS

As part of the new Hwy. 403 construction, a bridge structure has been proposed at the crossing of the proposed Hwy. 403 and the relocation of Mullet Creek, in Mississauga.

The type of structure to be utilized at this site has not yet been determined. However, three alternate schemes are being contemplated at this stage for this crossing:

1. Single span closed abutment structure
2. Three span with perched abutment type structure
3. Two span rigid frame open concrete culvert type structure.

In the vicinity of the proposed crossing the existing ground elevation varies from 450.0 (west) to 445.5 (east). The proposed grade of the new Hwy. 403 will be at elevation 476.0 (west side) and 472.0 (east side). This will necessitate fills up to 26.5 feet.

### Single Span Closed Type Abutment Structure

The proposed rechannelled Mullet Creek can be spanned with a 50 feet single span bridge with closed type abutments. The abutments could be founded on spread footings supported in the sound shaly limestone bedrock at or below elevation 441.0. Spread footings founded on sound shale bedrock may be designed using an allowable pressure up to 10 t.s.f. In any event, a minimum of 4 feet of earth cover should be provided to the underside of the footings for frost protection purposes, since shale is susceptible to frost action.

The footing excavations will extend below the groundwater level. The overburden material is cohesive and relatively impervious. Any minor seepage or surface run-off into the excavations could be controlled by pumping from the sumps. It should be noted that foundation excavation base should be kept dry at all times prior to the placing of concrete. In order to prevent softening of the exposed bedrock surface due to weathering, because of delays in construction of the footings, the bedrock surface should be covered and protected by means of a thin layer (minimum 3") of mass concrete immediately following the excavations.

If the structure is designed as a rigid frame, then a coefficient of earth pressure at rest ( $K_0$ ) of 0.5 should be assumed for the granular material



placed behind the wall when designing the abutment wall structure. If some movement of the top of the wall is permitted, then a coefficient of active earth pressure ( $K_a$ ) of 0.35 can be used. To compute the sliding resistance between the rough concrete footing base and bedrock a coefficient of friction value of 0.7 can be used.

#### Three-Span Perched Abutment Type Structure

If it is planned to construct a three span structure with perched abutments the recommendations outlined for closed type abutments of the single span structure will be applicable for the pier foundations.

The abutments, however, can be supported on spread footings perched within the approach fills. In such a case they should be supported on a core of well compacted granular "A" material placed above the natural subsoil as per our current M.T.C. practices. As such an allowable load of 2.5 t.s.f. may be used for footing design. Alternatively, these perched abutments can be supported on end bearing steel 'H' piles driven to bedrock surface, using maximum allowable capacity of the pile section chosen.

Other related considerations for dewatering and lateral earth pressure exerted by the backfill will be similar to those discussed for a single span structure concept.

#### Two Span Rigid Frame Open Concrete Culvert

In case a two span concrete culvert type structure is contemplated all three footings can be founded on spread footings supported on bedrock in accordance with the same recommendations like the single span structure.

The related considerations for dewatering and lateral earth pressure exerted by the backfill will be similar to those discussed for single span bridge.

#### APPROACHES

The contemplated structures at this site will necessitate approach fills up to maximum height of 27 feet in the longitudinal and transverse direction. Fills of this height will be inherently stable with respect to a deep seated failure within the foundation's subsoil, provided that:

- a. The fill should be placed after removing any surficial organic topsoil to its full depth and replaced with properly compacted earth material.

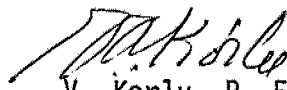


- b. The fills should be constructed with 2:1 side slopes and compacted according to M.T.C. standards.
- c. The creek approaches within the structure area should be rip-rapped to the height of the high water level.
- d. The proposed Mullet Creek rechanneling can be carried without any anticipated stability problems with 2:1 slopes.


#### MISCELLANEOUS

The fieldwork was carried out during June 21 and 22, 1977 under the supervision of Mr. V. Korlu, Project Engineer, who also prepared this report.

The drilling equipment was owned and operated by Dominion Soil 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

VK/MD/kr  
July, 1977



## APPENDIX



## FIELD AND LABORATORY WORK

At this site twelve sampled short boreholes were carried out. The borings were advanced by a continuous flight auger machine (commercially known as C.M.E. 75, H.S. M.V) adapted for soil sampling purposes.

Samples of the overburden were obtained by means of a 2" O.D. split-spoon sampler at required depths. The samples were hammered into the soil according to the specifications of Standard Penetration Tests. Bedrock was proven in boreholes by obtaining BXL size rock core samples.

Groundwater level observations were carried out during the time of investigation in the open boreholes. The soil, bedrock and groundwater conditions encountered at the boring locations are presented in the Record of Borehole Sheets. The locations and elevations of the various boreholes were provided by personnel from Construction Office, Central Region. The elevations in this report are referred to a Geodetic datum. Boring locations and elevations are shown on Drawing No. 1577505A.

All samples were subjected to careful visual examination in the field and subsequently in the laboratory. Following this examination laboratory tests were carried out on selected representative samples to determine the physical properties of the various soil types encountered, namely:

- Natural Moisture Content

- Atterberg Limit

- Grain Size Distribution

The results of this testing are plotted on the Record of Borehole Sheets and summarized on Figs. 1 and 2, all contained in Appendix 1 of this report.



## ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

### PENETRATION RESISTANCE

'N' STANDARD PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW

### DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>c LB/SQ. FT</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 250	VERY LOOSE	0 - 4
SOFT	250 - 500	LOOSE	4 - 10
FIRM	500 - 1000	COMPACT	10 - 30
STIFF	1000 - 2000	DENSE	30 - 50
VERY STIFF	2000 - 4000	VERY DENSE	> 50
HARD	> 4000		

TERMS TO BE USED IN DESCRIBING SOILS :-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

### TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

### SOIL TESTS

U	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" " ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		



## ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

### SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
$S_r$	DEGREE OF SATURATION
$w_L$	LIQUID LIMIT
$w_p$	PLASTIC LIMIT
$I_p$	PLASTICITY INDEX
$w_s$	SHRINKAGE LIMIT
$I_L$	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
$I_c$	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
$e_{max}$	VOID RATIO IN LOOSEST STATE
$e_{min}$	VOID RATIO IN DENSEST STATE
$I_D$	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY $D_r$ IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
$m_v$	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
$c_v$	COEFFICIENT OF CONSOLIDATION
$C_c$	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
$T_v$	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

### GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF $\sigma$
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF $\sigma$ TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

### STRESS AND STRAIN

u	PORE PRESSURE
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

### EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

### FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC IN THE FORMULA FOR BEARING CAPACITY
$k_s$	MODULUS OF SUBGRADE REACTION

### SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WP 157-75-05 LOCATION Co-ords. N 15,827,211; E 950,002 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 22, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
447.6	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, sand & gravel (Glacial till) Stiff		1	SS	28											31 33 24 12
442.1	Weathered															
5.5	Sound Shaly limestone Bedrock		2	BXL	Rec 70%	440										RQD 9%
437.1	End of Borehole															
10.5	Bedrock Description															
	From 5'5" to 5'11" Limestone, grey, medium textured, medium hard, fossiliferous with sandy sections.															
	From 5'11" to 10'5" Shale, grey, soft fissile with shaly sections.															

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

WP 157-75-05 LOCATION Co-ords. N 15,827,282; E 949,964 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 22, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$W_P$	$W$	$W_L$		
448.3	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, sand, gravel.															
444.3	(Glacial till) Stiff		1	SS	13											11 36 37 16
4.0	Shaly Limestone		2	BXL	Rec											RQD 40%
439.3	Bedrock Sound				100	% 440										
9.0	End of Borehole															
	<u>Bedrock Description</u>															
	From 4'0" to 6'0" Limestone, grey, medium textured, medium hard to hard, fossiliferous.															
	From 6'0" to 10'5" Shale, grey, soft, fissile with shaly sections.															

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

WP 157-75-05 LOCATION Co-ords. N 15,827,355; E 949,932 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 21, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$ — $w$ — $w_L$				
448.4	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, sand, & gravel. (Glacial Till) Hard		1	SS	45										7 28 51 14	
442.4	Weathered		2	SS	100	5"										
6.0	Sound Shaly Limestone Bedrock		3	BXL	Rec 90%	440									RQD 7%	
437.4																
11.0	End of Borehole															
	<u>Bedrock Description</u>															
	From 6' to 7' Limestone, grey, medium textured, hard.															
	From 7' to 9'3" Shale, grey, soft, fissile with shaly sections.															
	From 9'3" to 9'9" Limestone, light grey, medium textured, hard, fossiliferous.															
	From 9'9" to 11' Shale, grey, soft, fissile with shaly sections.															

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4

WP 157-75-05 LOCATION Co-ords. N 15,827,230; E 950,025 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 22, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
446.9	Ground Level															
0.0	Topsoil															
1.0	Het. mix. of cl. si. sa. & gr. (Gl. Till) Hard		1	SS	38											28 31 31 10
3.5	Shaly Limestone		2	BXL	Rec 100%	440										RQD 38%
438.4	Sound Bedrock															
8.5	End of Borehole															
	Bedrock Description															
	From 3'5" to 5'5" Limestone, grey, medium textured, medium hard to hard, fossiliferous.															
	From 5'5" to 7'5" Shale, grey, soft, fissile with shaly sections.															
	From 7'5" to 8'5" Limestone, light grey, medium to coarse textured, medium hard, fossiliferous.															



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5

WP 157-75-05 LOCATION Co-ords. N 15,827,301; E 949,986 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 22, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$W_P$	$W$	$W_L$		
447.7	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, ss. & gr.															
443.7	(Glacial Till) Hard		1	SS	45											13 15 55 17
4.0	Shaly Limestone		2	BXL	Rec 100%	440										RQD 45%
438.7	Bedrock Sound															
9.0	End of Borehole															
	Bedrock Description															
	From 4'0" to 6'4" Limestone, grey, medium textured, medium hard, fossiliferous.															
	From 6'4" to 8'5" Shale, grey, soft, fissile with shaly sections.															
	From 8'5" to 9' Limestone, grey, medium textured, medium hard, fossiliferous.															

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 6

WP 157-75-05 LOCATION Co-ords. N 15,827,376; E 949,961 ORIGINATED BY VK  
DIST 6 HWY 403 BORING DATE June 21, 1977 COMPILED BY VK  
DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
448.0	Ground Level															
0.0	Topsoil															
1.0	Het. mix. of cl. si. sa. & s. l.		1	SS	16											
444.0	gr. (Gl. Till) V. Stiff. 7.5															7 50 35 8
4.0	Shaly Limestone		2	BXL	Rec 100											RQD 28%
439.0	Bedrock Sound					440										
9.0	End of Borehole															
	<u>Bedrock Description</u>															
	From 4' to 6'3"															
	Limestone, grey,															
	medium textured,															
	hard, fossiliferous.															
	From 6'3" to 9'															
	Shale, grey, soft,															
	fissile, with shaly															
	sections.															

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 7

WP 157-75-05 LOCATION Co-ords. N 15,827,333; E 950,024 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 22, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$W_P$	$W$	$W_L$		
447.9	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, sa. & gr.		1	SS	22											
443.4	(Glacial till) V. Stiff															
4.5	Shaly Limestone		2	BXL	Rec											
438.4	Bedrock Sound				100	440										
9.5	End of Borehole															
	<u>Bedrock Description</u>															
	From 4'5" to 6'6" Limestone, grey, medium textured, medium hard, fossiliferous.															
	From 6'6" to 8'7" Shale, grey, soft, fissile with shaly sections.															
	From 8'7" to 9'2" Limestone, grey, medium textured, medium hard, fossiliferous															
	From 9'2" to 9'5" Shale, grey, soft, fissile.															

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 8

WP 157-75-05 LOCATION Co-ords. N 15,827,263; E 950,063 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 22, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS  % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$W_P$	$W$	$W_L$		
444.8	Water Level															
442.8	Si. sa. & gr. (alluvial)															
2.0	Shaly Limestone		1	BXL	Rec	440										RQD 51%
437.8	Bedrock Sound				100 %											
7.0	End of Borehole															
	<u>Bedrock Description</u>															
	From 2' to 3' Limestone, grey, medium to coarse textured, medium hard, fossiliferous.															
	From 3' to 5' Shale, grey, soft, fissile with shaly sections.															
	From 5' to 5'10" Limestone, grey, medium to coarse textured, medium hard, fossiliferous.															
	From 5'10" to 6'4" Shale, grey, soft, fissile.															
	From 6'4" to 6'7" Limestone, grey, medium to coarse textured, medium hard, fossiliferous.															
	From 6'7" to 7' Shale, grey, soft, fissile.															

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 9

WP 157-75-05 LOCATION Co-ords. N 15,827,404; E 949,986 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 21, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS  % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20 40 60 80 100					$w_p$ $w$ $w_L$				
							SHEAR STRENGTH									
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT %				
445.0	Water Level															
442.0	Silty sand & gravel (alluvial)															
3.0	Weathered															
437.0	Sound Shaly Limestone Bedrock		1	BXL	Rec 96%	440									RQD 53%	
8.0	End of Borehole															
	<u>Bedrock Description</u>															
	From 3' to 3'6" Limestone, grey, fine to medium textured, hard.															
	From 3'6" to 6'2" Shale, grey, soft, fissile.															
	From 6'2" to 6'9" Limestone, grey, fine textured, hard, fossiliferous with thin seams of shale.															
	From 6'9" to 8' Shale, grey, soft, fissile, interbedded with shaly sections.															

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 10

WP 157-75-05 LOCATION Co-ords. N 15,827,281; E 950,084 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 21, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
448.5	Ground Level															
0.0	Topsoil															
445.0	Het. mix. of cl. si. sa. & gr. (Cl. Till) Hard		1	SS	55											34 7 47 12
3.5	Shaly Limestone		2	BXL	Rec											RQD 40%
440.0	Bedrock Sound				100 %											
8.5	End of Borehole															
	<u>Bedrock Description</u>															
	From 3'5" to 5'1" Limestone, grey, medium textured, medium hard, fossiliferous.															
	From 5'1" to 7'3" Shale, grey, soft, fissile, with shaly sections.															
	From 7'3" to 8'5" Limestone, grey, medium textured, medium hard, inter- bedded with grey shale. Fossiliferous.															

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 11

WP 157-75-05 LOCATION Co-ords. N 15,827,353; E 950,047 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 21, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT —WL PLASTIC LIMIT —WP WATER CONTENT —W			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	WP	W	WL		
445.1	Water Level															
443.6	Si. Sa. Sgr. (Alluvial)		1	Wash												GR SA SI CL
1.5	Shaly Limestone		2	BXL	Rec											RQD 49%
438.6	Bedrock Sound				100	% 440										
6.5	End of Borehole															
	Bedrock Description															
	From 1'5" to 2'11" Limestone, grey, medium textured, medium hard, fossiliferous.															
	From 2'11" to 5'0" Shale, grey, reddish, soft, fissile with shaly sections.															
	From 5'0" to 5'11" Limestone, light grey, medium textured, medium hard, fossiliferous.															
	From 5'11" to 6'5" Shale, grey, reddish, soft, fissile.															

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 12

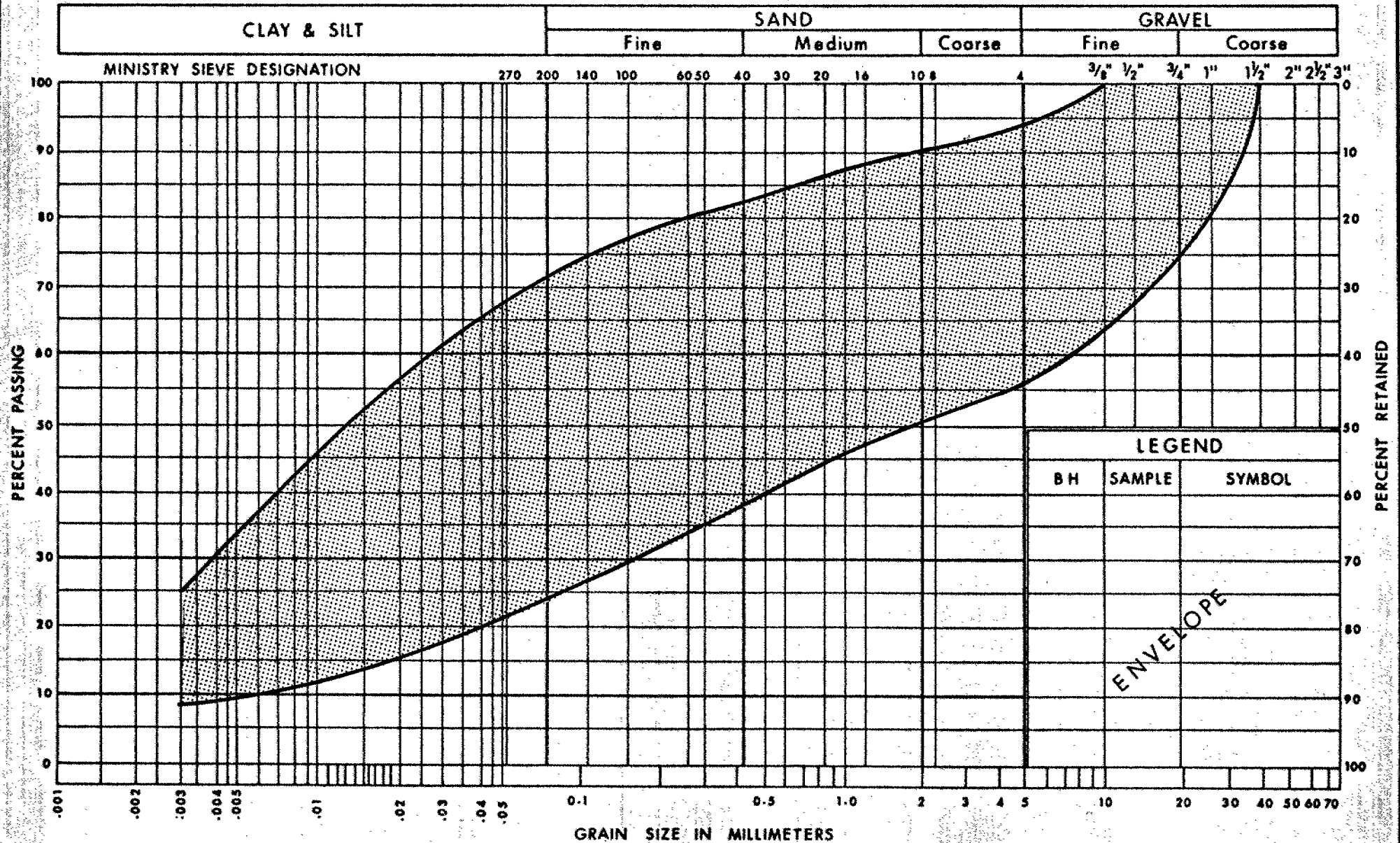
WP 157-75-05 LOCATION Co-ords. N 15,827,422; E 950,008 ORIGINATED BY VK  
 DIST 6 HWY 403 BORING DATE June 21, 1977 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY KS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
447.4	Ground Level															
0.0	Topsoil															
1.0	Het. mix. of cl. si. sa. & gr. (Gl. Till) Hard		1	SS	118, 9											43 22 25 10
443.4																
4.0	Shaly Limestone		2	BXL	Rec 100%	440										RQD 16%
438.4	Bedrock Sound															
9.0	End of Borehole															
	<p><u>Bedrock Description</u></p> <p>From 4' to 6' Limestone, grey, med. textured, med. hard, fossiliferous.</p> <p>From 6' to 6'7" Shaly limestone.</p> <p>From 6'7" to 7'3" Limestone, grey, medium textured, medium hard, fossiliferous.</p> <p>From 7'3" to 7'10" Shale with thin seams of limestone.</p> <p>From 7'10" to 9' Limestone, grey to pink, medium textured, medium hard, fossiliferous.</p>															

OFFICE REPORT ON SOIL EXPLORATION



## UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

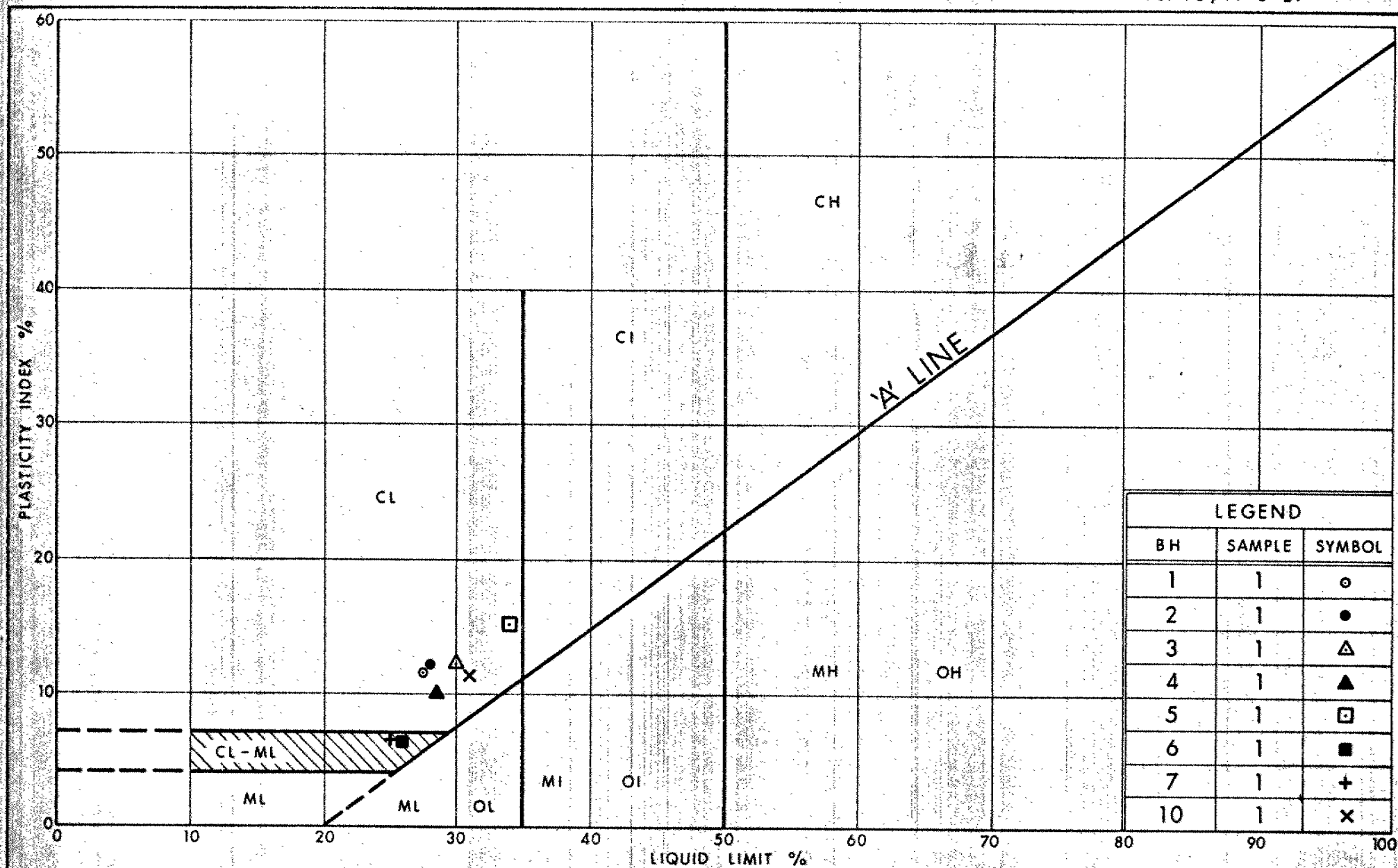
 Ministry of  
Transportation and  
Communications

**GRAIN SIZE DISTRIBUTION**  
**GLACIAL TILL**  
 HET MIX OF CLAYEY SILT WITH SAND & GRAVEL

FIG No 2

WP 157-75-05





Ontario

 Ministry of  
Transportation and  
Communications

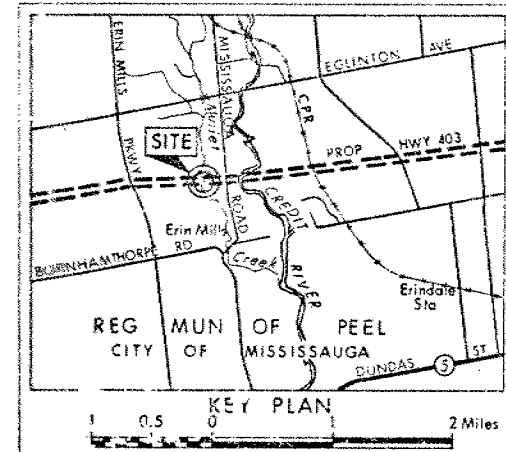
# PLASTICITY CHART GLACIAL TILL

HET MIX OF CLAYEY SILT WITH SAND &amp; GRAVEL

FIG No 1

W P 157-75-05





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)
- Wt at time of investigation June 1977

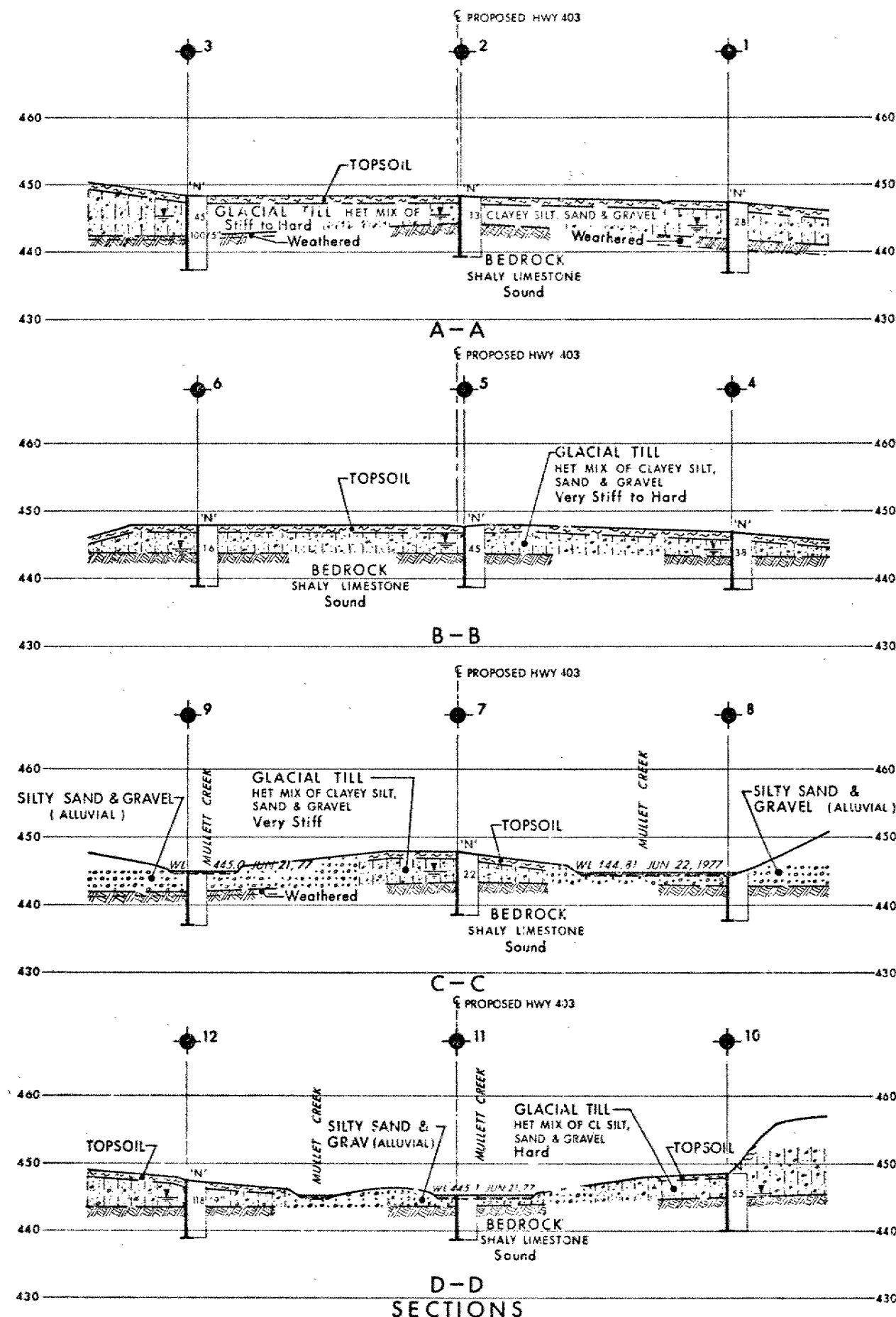
No.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	447.6	15 827 211	950 002
2	448.3	15 827 282	949 964
3	448.4	15 827 355	949 932
4	446.9	15 827 230	950 025
5	447.7	15 827 301	949 980
6	448.0	15 827 376	949 961
7	447.9	15 827 333	950 024
8	444.8	15 827 263	950 063
9	445.0	15 827 404	949 986
10	448.5	15 827 281	950 084
11	445.1	15 827 353	950 047
12	447.4	15 827 422	950 008

-NOTE-

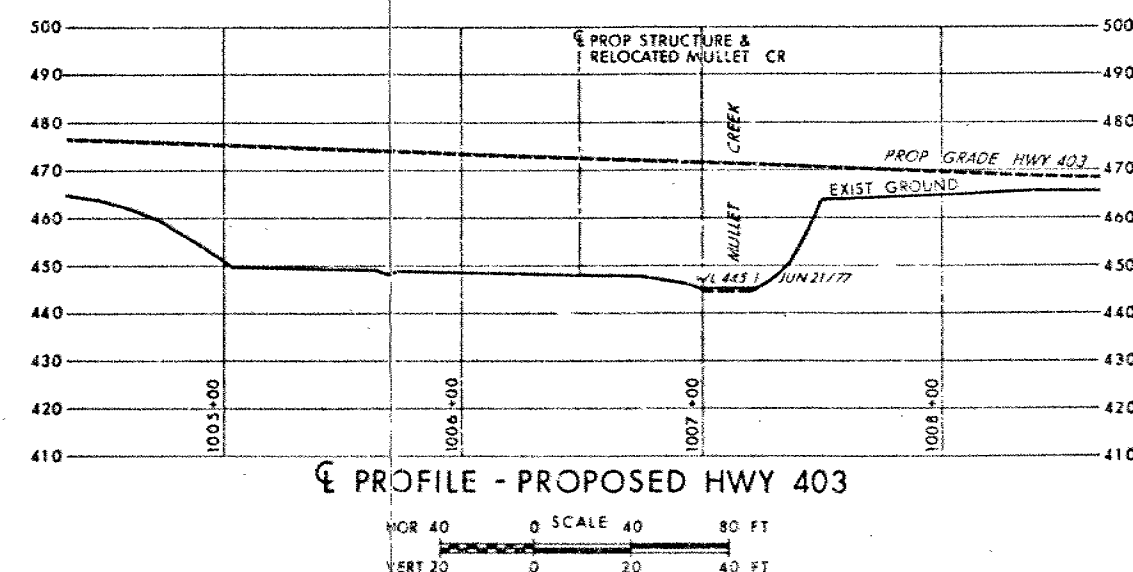
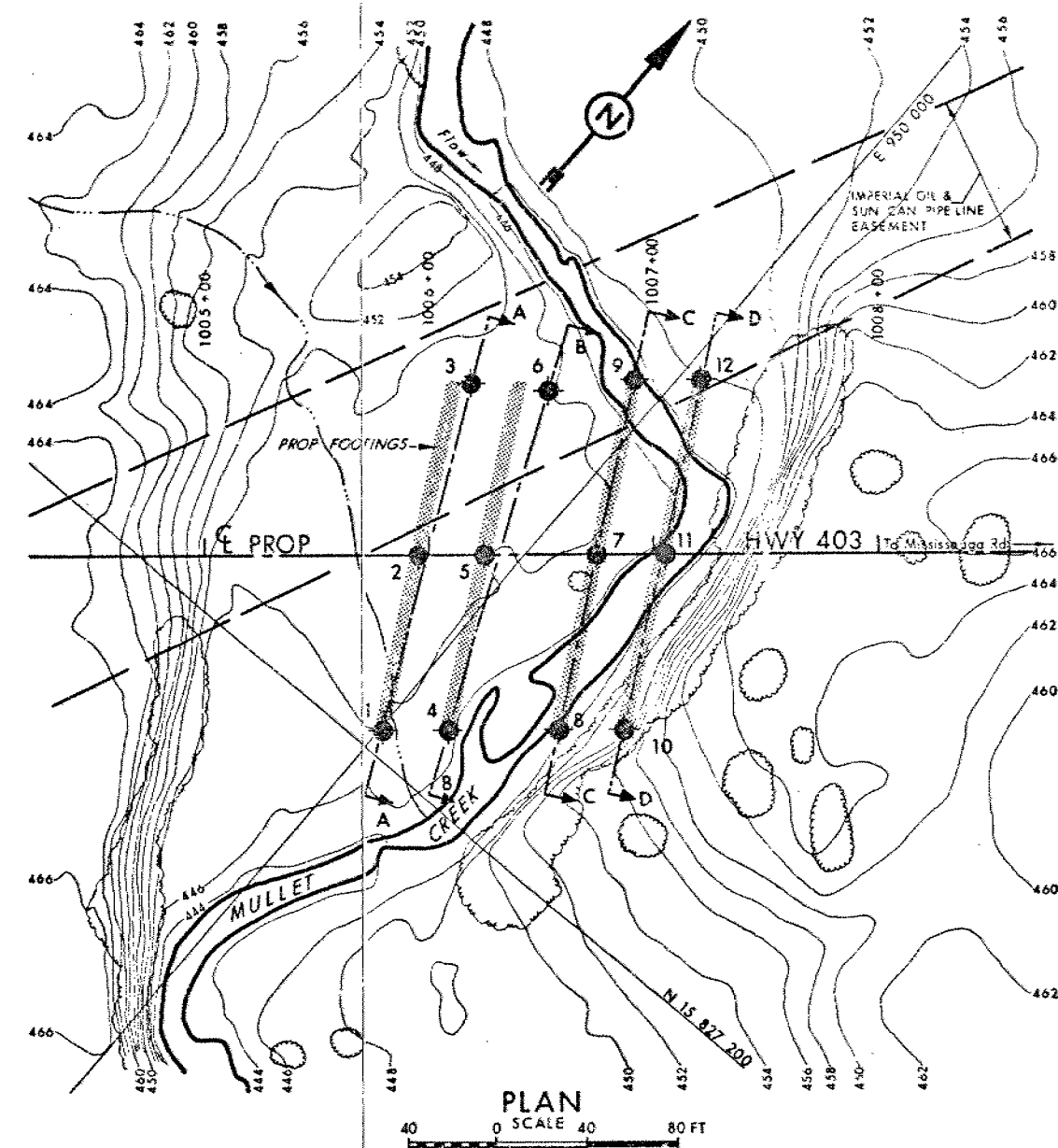
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

WORK No PROP 403  
DESIGNED BY: [Signature] DATE: July 29, 1977  
CHECKED BY: [Signature] DATE: [Blank]  
REF: COLE SHERMAN ASSOC LTD



HOR 20 0 SCALE 20 40 FT  
VERT 10 0 10 20 FT



HOR 40 0 SCALE 40 80 FT  
VERT 20 0 20 40 FT



# memorandum



Telephone 248-3282

To: File

Date: 86 08 07

FROM: Engineering Materials Office  
Foundation Design Section  
Central Building, Room 315

RE: Mullet Creek Bridge  
W.P. 157-75-05, Site 24-386  
Hwy. 403, District 6, Toronto  
Contract 80-71

Further to the telephone conversation between M. Devata and G.C.E. Burkhardt of 86 08 07, it was agreed that no further action would be taken to investigate the foundations of this structure, pending the evaluation of a program to monitor movements of the bridge. The Regional Structural Section will advise if a Foundation Investigation is requested.

*D.H. Dundas*

D.H. Dundas  
Senior Foundations Engineer

DHD: jm



Structural Office  
4th Floor  
3501 Dufferin St.  
Downsview  
248-3506

July 18th, 1986

G. C. E. Burkhardt, Head Regional Structural Section  
Central Region

Attention: Mr. Almer

Hwy 403 - Mullet Greek Bridge  
Site 24-386  
Dist. 6, Toronto

*Contract 80-71*

With reference to your memo of 1986-06-09 we have carried out a design check of the piles on the above structure and have found that there were no deficiencies in the pile design.

Since you had sent a copy of your memo to M. Devata I asked him if he had inspected the site. He said he was going to send D. Dundas to look at it.

Please let me know if you agree with the recommendations from the Foundation Office and if you want me to carry out any further investigation on it.

*Ranjit Reel*

RR:mg

Ranjit Reel  
Head  
Bridge Management Section

c.c. M. Devata





# memorandum



Telephone 248-3282

To: R. Reel  
Head, Structural Management Office  
3501 Dufferin Street

Date: 86 07 15

FROM: Engineering Materials Office  
Foundation Design Section  
Room 315, Central Building

RE: Mullet Creek Bridge  
W.P. 157-75-05, Site 24-386  
Hwy. 403, District 6, Toronto  
Contract 80-71

Further to your telephone request of 86 07 14, this Section inspected the above-noted structure on 86 07 15. It is our understanding that there has been some distortions of the west abutment bearings from which it has been inferred that the abutments are moving.

We have reviewed the contract documents for this structure and determined that the abutments are founded on 5± m long end-bearing steel H-piles. During our site visit we could detect no evidence of foundation distress.

Based on these observations, we do not anticipate any foundation failure. However, we recommend that the positions of the abutments should be monitored by survey techniques so that the magnitude of vertical and horizontal movements can be determined. Also this office will undertake a subsurface investigation at this site to ascertain the properties of the backfill material and to determine whether any soft or loose native material has been trapped below the approach embankment as these conditions could contribute to increased earth pressures, consolidation or bending of the H-piles. The results of this investigation will be provided to you when they are available.

If there are any questions, please contact this office.

A handwritten signature in dark ink, reading "D.H. Dundas".

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

For

M. Devata, P.Eng.  
Chief Foundations Engineer  
(East)

DHD: jm  
cc: G.C.E. Burkhardt



# memorandum



To: Mr. R. Reel,  
Acting Head,  
Structural Management Office,  
3501 Dufferin Street,  
Downsview.

Date: 1986-06-09


Central Region

RE: Hwy. 403 - Mullet Creek Bridge,  
Site 24-386,  
District 6, Toronto

The above structure showed distortion of bearings on the west abutment, tilting to the west, during the last winter inspections. Taking the seasonal condition into account, it should have been the other way. The tilt was about  $1\frac{1}{2}$ " on a  $2\frac{1}{2}$ " high laminated pad. Since it was more than the  $1"$  max. movement on the bearing, we recommended the relief of bearings by jacking up procedure. That was done last month and the situation was corrected although the bearings did not recover completely into a true vertical position. However, it is reported now that the tilting occurred again, and the gap between the steel and ballast wall is closing, especially on the south structure. It is suggested that some abutment movement is taking place which should be further studied.

Please provide us with recommendations for remedy.

MA:gc

  
M. Almer,  
Area Engineer-Structures,  
for:  
G.C.E. Burkhardt,  
Head, Structural Section.

c.c. ✓ M. Devata







## Memorandum

To: Mr. C.S. Grebski,  
Head, Central Section,  
Structural Office,  
West Building, Downsview.

From: G.C.E. Burkhardt,  
Structural Section,  
Central Region.

Attention:

Date: 1978-11-01

Our File Ref.

In Reply to

Subject: RE: Mullet Creek Bridge,  
Site 24-386, W.P. 157-75-05,  
Highway 403, District 6

This is to confirm a decision that was reached at the meeting of 1978-10-31 held in your office regarding the design of the foundations for the above mentioned structure. This meeting was attended by W. Lin of your office, M. Devata and B. Ly of the Soil Mechanics Section and V. Boehnke and D. Bye of the Regional Structural Section.

Due to hydrological concerns regarding the stability of the structure in the event of a Regional Flood, it was decided at this meeting that the structure foundations should be supported on end bearing H Piles. The extent of the random rip-rap will remain as detailed, but the depth of the rip-rap should be revised to 2'-0" nominal throughout.

This decision will necessitate the redesign of the sub-structure. The completion date of 1978-12-15 for D4 and drawings should be maintained.

DHB:gj

D.H. Bye,  
Structural Supervisor,  
for:  
G.C.E. Burkhardt,  
Head, Structural Section.

c.c. W. Lin  
M. Devata ✓  
B. Ly  
R. Fitzgibbon  
J.D. Harris  
N. Sen  
B. Hurd (Cole Sherman Assoc.)





Mr. C.S. Grebski,  
Head, Central Section,  
Structural Office,  
West Bldg., Downsview.

G.C.E. Burkhardt,  
Structural Section,  
Central Region.

1978-10-26

RE: Mullet Creek Bridge  
Site 24-386, W.P. 157-75-05  
Highway 403, District 6, Toronto

In response to a memo by J.D. Harris of the Hydrology Section dated 1978-10-04, we have reviewed the above project with respect to its safety from scour during a Regional flood.

During a meeting on 1978-03-28 we somewhat reluctantly agreed with the Structural Office and the Soil Mechanics Section to place abutment footings on compacted granular. We were rather reluctant to go to a spread footing design on granular fill, on account of the possibility that the granular material in front of, and below the spread footings could fail during a Regional flood in spite of extra heavy rip-rap. However, we felt that the probability of a Regional flood occurring during the lifetime of a structure, and also causing a large washout of granular material would be rather low. Our feeling at that time was that, such a footing design would not create undue and sizeable risks to the structures involved.

We now believe that we should not jeopardise Highway 403 with a possible structural failure during a Regional flood, and are unwilling to take any such risks, however remote the possibility of failure may be. We therefore recommend to go to a completely scour resistant footing design for all abutments (oil pipelines will be relocated), i.e., abutments on short piles, or an abutment design to bedrock. All rip-rap slope protection should be reduced to 2' nominal.

A bridge plan completion and D4 by 1978-12-15 should allow the present schedule of expediting the project to be maintained.

VFB:pp

V.F. Boehnke,  
Area Engineer-Structures,  
for:  
G.C.E. Burkhardt,  
Head, Structural Section.

c.c. J.D. Harris  
M.S. Devata✓  
R. Fitzgibbon  
N. Sen







## Memorandum

To: G. Burkhardt,  
Head, Structural Section,  
Central Region.

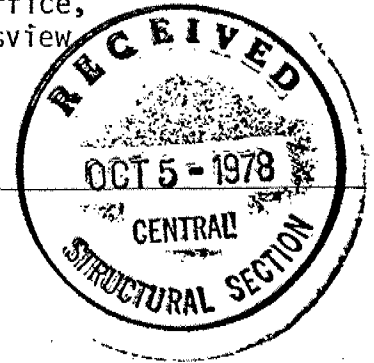
From: Hydrology Section,  
Highway Design Office,  
West Bldg., Downsview

Attention:

Date: 1978 10 04

Our File Ref.

In Reply to



Subject: Mullet Creek Bridge - Hwy. 403 - Site #24-386

W.P. 157-75-07

Mr. W. McFarlane has indicated to us that the bridge foundation design has been changed significantly from that shown on the preliminary drawing which was approved by this Section on 1978 03 29.

On the preliminary drawing all abutments except the north-west were founded on piles driven into bedrock; the north-west abutment was founded on spread footings so as to avoid interference with oil pipe lines.

On the latest drawing all abutments are founded on spread footings supported on compacted granular, i.e. on predominantly sand material. The east abutments in particular will be on 6 to 8 ft. of granular, and will be located approximately on the line of the existing channel.

My concern is that if the 4 ft. layer of random riprap were to fail during a severe flood, there would be a significant risk that the fill under and in front of the east abutments would be washed out, in which case the bridge or bridges would fail.

A hydraulically acceptable alternative would be to provide open abutments taken down into the bedrock, which is approximately at stream bed level. The bridge would then be virtually flood-proof, and the riprap could be reduced to 2 ft.

If this alternative is unacceptable, a conservative size and grading of the riprap material should be determined by the latest methods.

J.D. Harris,  
Head, Hydrology Section.

JDH/jk

c.c. Messrs. R.A. Dorton  
R.S. Pillar  
W. McFarlane



Bin-ly

Please note this and see me.

Considering to use  
selected crushed stone to construct  
the pad. 78 10 25.





## Memorandum

To: Mr. C.S. Grebski,  
Head, Central Section  
Structural Office,  
West Building, Downsview.

From: G.C.E. Burkhardt,  
Structural Section,  
Central Region.

Attention:

Date: 1978-07-04

Mr. W. Lin

Our File Ref.

In Reply to

Subject: RE: Mullet Creek Bridge,  
Site 24-386, W.P. 157-75-05,  
Highway 403, District 6

This is to confirm, as discussed by phone that a decision has been made to relocate the oil pipelines in the area of the Mullet Creek Bridge. A copy of a memo from Regional Planning and Design indicating this decision is attached.

The exact route that the relocated pipelines will follow has not been established as yet, but they will be relocated away from the area of the west abutment footings.

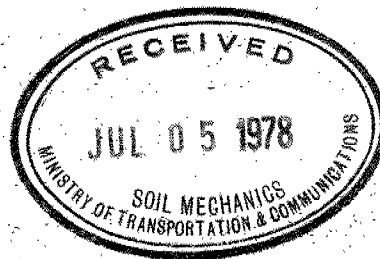
As soon as the exact location of the relocated pipelines is known, I will inform you.

DHB:gj  
Attach.

*D.H. Bye*

D.H. Bye,  
Structural Supervisor,  
for:  
G.C.E. Burkhardt,  
Head, Structural Section.

c.c. K. Cameron  
B. Hurd (Cole Sherman)  
M. Devata ✓







## Memorandum

To: Mr. D. Bye  
Structural Planner

From: Planning and Design

Attention:

Date: 1978-06-29

Our File Ref.

In Reply to

Subject:

Relocation of pipeline of Mullet Creek structure  
W.P. 157-75-01, Highway 403 from Winston  
Churchill Boulevard easterly to Mississauga Road



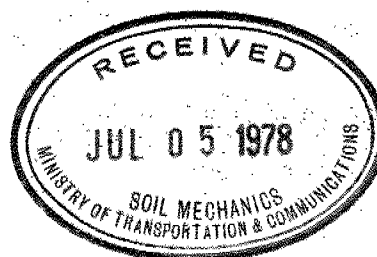
Please be advised that Planning and Design recommends that the Sun-Canadian and Sarnia Products pipelines should be relocated around the Mullet Creek structure footing. In view of the uncertainty as to whether the pipelines can be lowered without a draindown and addition of a section of pipe which would increase the cost significantly, it is felt that the pipelines should be relocated now.

Please advise the Bridge Office of this change.

K.A. Cameron,  
Project Manager.

KAC/n

cc's Messrs. B. Hurd (Cole, Sherman)  
N. Johnston





Mr. G.C.E. Burkhardt  
Head, Structural Section  
Central Region  
3501 Dufferin St., Downsview

Soil Mechanics Section  
Engineering Materials Office  
3rd Floor, Central Building

78 03 31

Re: Mullet Creek Bridge  
W.P. 157-75-05, Site 24-386  
Hwy. 403, District 6, Toronto

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Further to the meeting held in the Region's office on 78 03 21,  
we submit the following comments.

1. Since the structures are single span and bedrock exists at a shallow depth, we recommend that the perched abutment footings be founded on a well compacted granular 'A' pad constructed as per current M.T.C. Standards.
2. The pipelines located within the plan limits of the base of the granular pad should be lowered onto the bedrock surface and encased in concrete.
3. No specific comments can be made at this stage with regard to the treatments of the oil pipelines under the west approaches because of the lack of the precise location and construction information. It is understood that the oil pipeline companies will be contacted by the Regional Planning and Design Section and a meeting will be arranged to discuss this matter. We will submit our comments when the pertinent information is available.

*B. Ly*  
B. Ly  
Senior Engineer

For: M. Davata  
Supervising Engineer

BL/MD/gs

cc: C.S. Grebski  
W.L. Lin  
W. Roters  
Files ✓



Mr. C.S. Grebski,  
Head, Central Section,  
Structural Office,  
West Building, Downsview

G.C.E. Burkhardt,  
Structural Section,  
Central Region

1978-03-29

Mr. W. Lin

RE: Mullet Creek Bridge,  
Site 24-386, W.P. 157-75-05,  
Highway 403, District 6

This is further to the minutes of the meeting held on  
1978-03-21 re: the above project.

As noted in the "minutes" the decision as to whether you  
use a granular pad under all the abutment foundations  
rather than piles will be left to the Structural Design  
Office. If you decide to change the concept, would you  
please advise this office and issue new preliminary  
drawing.

Also as noted in the "minutes", if the change is made, it  
will be necessary to increase the depth of the random  
rip-rap to 4' in the areas directly in the area of the  
approach fills. The rip-rap lining the low flow channel  
can remain at 2'- 0" thick.

With regard to the treatment of the oil pipelines under the  
northwest abutment, a meeting will be set up in the near  
future with the pipeline companies, to discuss their  
requirements for this situation.

DHB:gj

*D H Bye*

D.H. Bye,  
Structural Supervisor,  
for:  
G.C.E. Burkhardt,  
Head, Structural Section

c.c. N. Sen  
M. Devata ✓





Mr. W. Lin, Design Engineer,  
Central Section,  
Structural Office  
West Building, Downsview

Soil Mechanics Section  
Engineering Materials Office  
3rd Floor, Central Building

78 03 21

Re: Mullet Creek Bridge  
W.P. 157-75-05 Site 24-386  
District 6, Toronto

We have reviewed the Preliminary Bridge Plan Drawing 24-386-P1 for the above mentioned structure. The drawing indicates that fills up to 20 feet high will be placed on four existing high pressure oil pipe lines. The compaction operation during construction and the weight of the fills may cause the pipelines to undergo differential settlements. Since we do not have information about the construction details of these pipelines, nor their tolerance to differential settlements, we cannot provide specific comments at this stage. In this regard, we have requested the Regional Structural Planning Section to provide us with all the necessary information. We have also suggested to the Regional Structural Planning Section that this matter be discussed in a meeting which is to be held in the Region on Thursday (78 03 23) at 9:00 a.m.

We will submit our comments when the pertinent information is available.

B. Ly  
Senior Engineer

For: M. Devata  
Supervising Engineer

BL/ig

cc: G.C.E. Burkhardt  
Files ✓





## Memorandum

To: Mr. C.S. Grebski,  
Head, Central Section,  
Structural Office,  
West Building, Downsview

From: G.C.E. Burkhardt,  
Structural Section,  
Central Region

Attention:

Date: 1977-12-13

Our File Ref.

In Reply to

Subject: RE: Mullet Creek Bridge,  
Site 24-386, W.P. 157-75-05,  
Highway 403, District 6

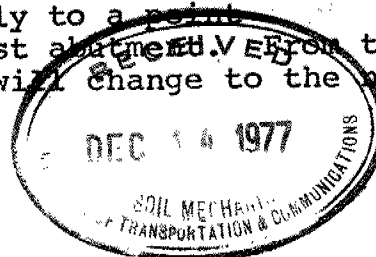
This is to confirm a number of decisions that were made at our meeting of 1977-12-08, regarding the above project. The meeting was held to discuss problems related to designing and constructing this structure and leaving the four high pressure oil pipelines in place. The main problem here was related to a recommendation contained in the Hydrology Report to support the abutment foundation on piles.

The following alternatives were discussed:

1. Design the three span type structure supported on piles as recommended, but move the location to the east to avoid any conflict between foundations and pipelines.
2. Design a three span type structure supported on spread footings at the recommended location.
3. Design a single span structure supported on spread footings at the recommended location.

The single span configuration seemed to be the most acceptable. The conflict area for this type of structure would only be at the west abutment of the north bridge. The decision was made to design the structures with the west abutment of the north bridge supported on a spread footing, and the east abutment supported on piles. The east and west abutments for the south bridge would be supported on piles. Additional rip-rap would be required to protect the one abutment that is supported on the spread footing.

I have enclosed a sketch indicating the extent of the rip-rap. The 2' random rip-rap will remain as indicated in the Hydrology Report except at the northwest corner of the structure, where 4' random rip-rap is to be used. The 4' rip-rap will extend southerly to a point approximately 10' past the northwest abutment. From there over a 10' transition the rip-rap will change to the normal 2' thickness.





A filter blanket will be required under the 4' random rip-rap.

In those areas where the 2' random rip-rap is recommended, a gabion mat can be substituted. If a gabion mat is used, it should be keyed into the bedrock at the toe of slopes.

I trust that this information will enable you to proceed with the preparation of a preliminary drawing of the structure. If problems arise during the preliminary design, that might affect the concept as described, please notify this office as soon as possible.

Should further information be required, please do not hesitate to contact this office.

DB:gj  
Encl.

*DH Bye*

D.H. Bye,  
Structural Supervisor,  
for:  
G.C.E. Burkhardt,  
Head, Structural Section

c.c. N. Sen  
B. Hurd (Cole Sherman Assoc.)  
J.D. Harris  
M. Devata ✓

P.S. →

Discussed with Deanean Bye in the phone expressed our concern with regard to foundation recommendation made by Structural Office and Regional Structural Section without the benefit of Soil Mechanics Section. Deanean is agreed with this.

M. Devata  
77 12 20



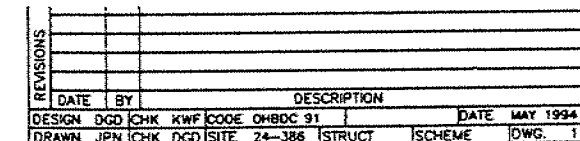
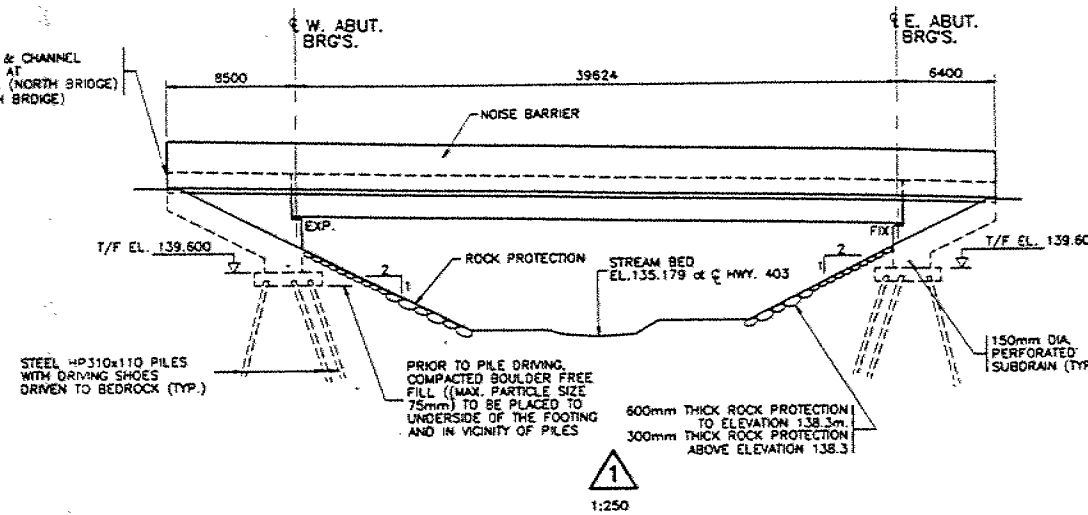
G.I.-30 SEPT. 1976

REMARKS: \_\_\_\_\_











**McCORMICK RANKIN**  
CONSULTING ENGINEERS

**MINUTES OF MEETING**

**PROJECT:** WP 803-93-01  
Contract 94-57  
Mullet Creek Bridge Widening  
At Highway 403

**MEETING NO.:** -  
**FILE NO.:** 2706

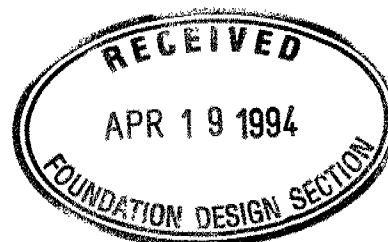
**DATE:** April 14, 1994

**PLACE:** Foundation Section  
Central Building  
Downsview

**TIME:** 10:00 a.m.

**PRESENT:** Betty Bennett, P. Eng.  
Dave Dundas, P. Eng.  
Bob Jeffries  
Doug Dixon, P. Eng.

MTO Foundation Section  
MTO Foundation Section  
MTO Structural Section  
McCormick Rankin



**PURPOSE:** To address any foundation related issues and to provide parameters for the design of the bridge foundation widening.



MINUTES OF MEETING

DATE: APRIL 14, 1994

PAGE 2

PROCEEDINGS:

ACTION BY:

1. Bob Jeffries reviewed the purpose of the widening of the Mullet Creek Bridge and the extent of the widening. Also, he identified the purpose for the meeting; that being to provide parameters to be used in the design of the bridge foundation upon widening. These parameters would be based on the foundation report prepared for WP 157-75-05 in 1977.
2. Dave Dundas indicated that further movement of the existing structure foundations (previously reported) was not anticipated.
3. Dave identified both piles and caissons as feasible foundation alternatives.

Piles should be steel H piles (HP310X110) fitted with driving shoes. Capacity at SLS could be taken as 1150 kN with factored capacity of ULS taken as 1650 kN.

Alternatively, caissons could be used to eliminate the need for a pile cap. McCormick Rankin could consider, for preliminary design and comparison with the steel H-pile alternative, the following criteria. Caisson should be socketed 2 to 3 diameters into the bedrock. Factored capacity can be estimated for preliminary design purposes on the basis of 5000 kPa on the end area of the caisson.

4. Recommendations for the calculation of lateral earth pressure on the abutments were provided to McCormick Rankin (see enclosed).
5. Shoring should be designed for the at rest condition. This criteria should be shown on the drawings. The water table can be assumed at the level of the excavation. Shoring pressure may be calculated using  $\phi = 30^\circ$  and  $\gamma = 22 \text{ kN/m}^3$ . Passive earth pressure on the toe of the soldier pile may be calculated using the same soil parameters.

A rectangular pressure diagram was recommended for the design of the shoring.

6. The other recommendations outlined in the 1977 foundation report will be followed for the design of the widening.



MINUTES OF MEETING

DATE: APRIL 14, 1994

PAGE 3

PROCEEDINGS:

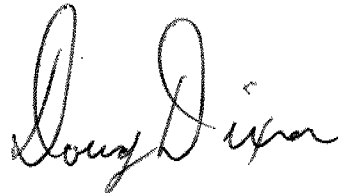
ACTION BY:

7. The original foundation report prepared under WP 157-75-05 will be provided for inclusion with the contract package in imperial units. The same will occur with the "Borehole Locations & Soil Strata" drawing which will be modified to suit the new WP number, etc. Notes will be added to both to identify that the chainage referred to in the original foundation investigation has no relationship to the chainage for Contract 94-57.

Please report all errors and omissions to the undersigned immediately.

Minutes Prepared By,

McCORMICK RANKIN

A handwritten signature in cursive script, appearing to read "Doug Dixon".

Doug Dixon, P. Eng.

DD/ss

Encl.

cc: all attending  
R.C. McCormick, P. Eng.



	<u>Gran. 'A'</u>	<u>Gran. 'B'</u>
Angle of Internal Friction: $\phi$	35°	30°
Unit Weight (kN/m <sup>3</sup> ): $\gamma$	22.8	21.2
Coefficient of Active Earth Pressure (Ka)	0.27	0.33
Coefficient of Earth Pressure at Rest (Ko)	0.43	0.5

The earth pressure coefficient at rest is to be used when the design of abutment walls are rigid and unyielding. All foundation elements should have a minimum of 1.2 m earth cover for frost protection.

#### Other Considerations

The granular 'A' or 'B' backfill should be in accordance with Special Provision No. 109F03 (dated March, 1988). The following parameters are recommended for the granular backfill"