

*21-P 83-61*

*22-67-115*

Mr. A. M. Toye,  
Bridge Engineer,  
Materials & Research Division,  
(Foundation Section)  
Attention: Mr. S. McCombie.

March 20, 1962.

D.H.O. FOUNDATION INVESTIGATION  
REPORT.  
W.J. 62-F-16 -- W.P. 83-61.

Re: Proposed New Bridge at Hwy. #10 and  
Etobicoke Creek, Town of Brampton,  
4.0 Miles North of Hwy. 401, Toronto.  
District #6.

Attached, we are forwarding to you, our detailed foundation report dealing with existing subsoil conditions at the above structure location.

We believe the factual data and recommendations contained therein, should prove adequate for your future design work. If further assistance is required in connection with this project, please do not hesitate to contact our Office.

AGS/MdeF  
Attach.

cc: Messrs. A. M. Toye (2)  
H. A. Tregaskes  
H. D. McMillan  
I. C. Campbell  
C. Fraser  
T. J. Kovich  
J. Roy  
J. E. Gruspier  
E. R. Saint  
F. Norman  
A. Watt  
Foundations Office  
Gen. Files.

*A. G. Stermac*  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGINEER

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# FOUNDATION INVESTIGATION

For

Proposed New Bridge at Hwy. #10 and  
Etobicoke Creek, Town of Brampton,  
4.0 Miles North of Hwy. 401, Toronto.  
District #6

W.J. 62-F-16      --      W.P. 83-61.

## 1. INTRODUCTION:

It is proposed to construct a new single span structure to replace a 54' concrete and steel structure at Etobicoke Creek on Hwy. No. 10, approximately 4.0 miles North of Hwy. No. 401, at Peel Village.

A request for a foundation investigation to be carried out at the above site was received from the Bridge Location Section in a memo dated February 5th, 1962.

The Foundation Section carried out the requested investigation during the month of February and this report contains the results, together with the discussion and recommendations pertaining to the foundations of the proposed structure.

## 2. DESCRIPTION OF SITE:

The structure is located in a shallow valley through which Etobicoke Creek winds its way. The creek at the site is about 15' wide, on the average, with water ranging from 6 inches to 2 feet in depth and flowing rapidly.

cont'd. /2 ...

### 3. FIELD INVESTIGATION PROCEDURE:

Five boreholes were drilled at the site, utilizing a conventional diamond drill rig. Disturbed samples were recovered, using a 2-inch O.D. split-spoon sampler, driven into the soil with an energy of 350 ft.-lbs. per blow. The detailed description of each sample recovered is contained in the Appendix of this report.

Bedrock was established in all five boreholes; in boreholes #1 & #3, rock samples were recovered using an AX core barrel; in the other boreholes the bedrock contact was established by driving the BX casing to refusal. Borehole #4 was carried out in the stream bed in order to provide information for accurate depth determination.

The locations and elevations of all boreholes are shown on the attached Plan No. 62-F-16A. All elevations are referred to a D.H.C. B.M. located on the South-East corner of the existing structure and were set by a D.H.C. survey crew in the vicinity at that time. The B.M. elevation is 668.16 and is of geodetic origin.

Each sample of the subsoil was visually classified in the field at the time it was recovered.

### 4. LABORATORY PROCEDURE:

Each sample, taken in the field, was again classified visually in the laboratory. Liquid limit, plastic limit, moisture content and grain size distribution analyses were carried out on selected representative samples. The results of these tests accompany this report.

5. SUBSOIL CONDITIONS:

5.1) General:

The stratigraphy established in boreholes #1 and #3 on the N. & S. corners of the creek, and in boreholes #2 and #5 on the E. & W. corners, respectively, was found to be quite regular and the estimated stratigraphical profile shown on Drawing No. 62-F-16A, is based on this information.

From ground level downwards, the various soil types encountered are as follows:-

5.2) Clayey-Silt & Organic Matter:

This brown oxidized deposit was found in boreholes #1 and #3 to a depth of 8' and 6', respectively (elev. 654.0). This deposit contains seams of silty-fine sand and some fine gravel. Standard Penetration values obtained in this material varied from 4 to 6 blows/ft., indicating a soft to medium stiff consistency.

5.3) Organic Silty Fine Sand:

This material was found in boreholes #2 and #5, to a depth of 9' and extended from ground level to the weathered shale bedrock. Standard penetration resistance of this material was 10 blows/foot in borehole #5, but the material was in a very loose state in borehole #2 where the split-spoon sampler sank 4.0' with only one blow of the hammer. It was also noted that this silty-fine sand in borehole #2 was black, rather than brown as in borehole #5 and had more organic content.

cont'd. /4 ...

5. SUBSOIL CONDITIONS: (cont'd.) ...

5.4) Bedrock:

Sound shale bedrock was established in all boreholes as described under "Field Investigation Procedure". This bedrock consists of brown to reddish-brown shale with seams of green shale.

The depth of sound bedrock is generally uniform throughout the area and varies from Elev. 652.5 to Elev. 648.5. Above these elevations, however, a badly weathered zone was observed, varying from one to three feet in thickness.

6. GROUND WATER CONDITIONS:

The water table was found to coincide with the stream elevation (657.5) in all cases. This elevation was determined by measuring the water level in each borehole, either at the end of each day, the start of the following day, or both.

7. DISCUSSION AND RECOMMENDATIONS:

A single span structure of approximate length of 70 ft. is proposed for this location. Subsoil at the site consists of 6 to 8 ft. of soft to firm clayey silt with organic matter on the N. & S. corners, whereas on the E. & W. corners, the deposit mainly consists of loose silty sand with organic matter. Underlying these deposits, the shale bedrock was established at Elev. 654.0 and Elev. 651.0, respectively, on the south side and the north side of the stream. The upper one to three feet of shale is badly weathered.

cont'd. /5 ...



7. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

It is understood that hydrological conditions are such that footings should be placed 5.0 ft. below the existing stream bed. The elevation of the stream bed is approximately Elev. 656.0. Hence, it will be necessary to found the structure at Elev. 651.0 or below, which is already bedrock elevation. A safe design load of 10 t.s.f. for spread footing support can be used, provided all weathered shale is removed prior to placing the footings.

Excavations for the footings will be some 6 to 8 ft. below the water level. Because of the permeable nature of the subsoil, excessive seepage may be anticipated from the side slopes of the footing excavations. However, this could be readily controlled by ordinary pumping methods.

No stability problems are anticipated with regard to the bridge approaches.

8. SUMMARY:

Subsoil at the site consists of 6 to 8 ft. of soft to firm clayey silt with organic matter followed by shale bedrock on the N. & S. corners, whereas the E. & W. corners consist of 9 ft. of loose silty sand with organic matter followed by shale bedrock. Bedrock elevation varies from 654.0 to 651.0.

Spread footings with a safe design load of 10 t.s.f. are recommended on sound bedrock. All weathered shale should be removed prior to placing the footings.

8. SUMMARY: (cont'd.) ...

Footing excavations will be some 6 to 8 ft. below the existing water level. Excessive seepage may be anticipated from the side slopes of the excavations. However, this could be readily controlled by ordinary pumping methods.

No stability problems are anticipated for the proposed approach fills.

9. MISCELLANEOUS:

The field investigation was carried out during the period February 21 - 23, 1962, under the supervision of Mr. G. Mierzynski.

Equipment was owned and operated by the Johnston Drilling Co. of Ottawa.

March 1962

REPORT PREPARED BY:

*G. Mierzynski*  
.....  
for G. Mierzynski,  
PROJECT FOUNDATION ENGINEER.

REPORT APPROVED BY:

*M. Devata*  
.....  
M. Devata,  
SR. PROJECT FOUNDATION ENGINEER.



APPENDIX I.

## ABBREVIATIONS USED IN THIS REPORT

### PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - 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>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

### TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

### SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

## ABBREVIATIONS 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
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
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a 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

# RECORD OF BOREHOLE NO. 1.

FOUNDATION SECTION

JOB 62-F-16 LOCATION Sta. 594+00 - 33' Lt. of E ORIGINATED BY G.M.  
W.P. 83-61 BORING DATE Feb. 21, 1962 COMPILED BY G.M.  
DATUM Geodetic BOREHOLE TYPE Washboring - BX Casing CHECKED BY H.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	SHEAR STRENGTH P.S.F.			WATER CONTENT % 20 40 60			
662.0 0.0	Groundlevel		1	S.S.	6	660							0.48% Organic  V 657.5  W.L. from observa- tion in borehole.
	Brown clayey-silt with organic matter and seams of greyish green sand.		2	S.S.	12								
654.0 8.0	Brown shale with seams of green shale Upper 2.0' weathered		3	S.S.	80 For 6"		650						
647.5 14.5	End of borehole.				640								











## MEMORANDUM

**TO:** Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107, Lab. Bldg.

**FROM:** Bridge Division,  
Downsview, Ontario.

**DATE:** October 13, 1965.

**OUR FILE REF.**

**IN REPLY TO**

**SUBJECT:** W.P. 83-61, Site 24-136,  
Etobicoke Creek Bridge,  
Hwy. 10, District No. 6.

Herewith one print of the preliminary drawing D 5793-P2 for the above structure. This drawing supersedes drawing D 5192-P1, which was sent to you on January 29, 1963.

The designer appears to have followed the recommendations of the Foundation Report. Your comments would be appreciated.

JFW/ag

*Joseph F. Walshe*  
J. F. Walshe,  
for J. B. Curtis,  
Regional Bridge Location Engineer.

*no comments. This drawing  
is in agreement with  
previous drawings which were  
approved Jan 31, 1963*

*WBS*

MEMORANDUM

To: Mr. A. G. Stermac,  
Principal Foundation Eng.  
Room 107, Lab. Bldg.

FROM: F. DeVisser

DATE: January 29, 1963.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 83-61  
Site #25-136  
Etobicoke Creek Bridge  
4.1 Miles North of Hwy. 401  
Hwy. 10 District 6

Enclosed please find one print of preliminary  
plan D 5192-P1 for the subject structure.

If you have any comments please let me know.

FDeV/et

*F. DeVisser*

F. DeVisser,  
Bridge Location Engineer.

NO COMMENT

JAN 31 1963.

AGS.

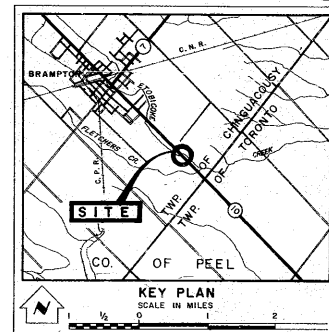
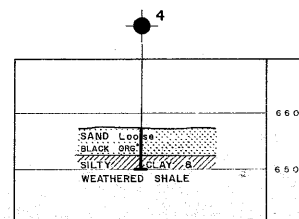
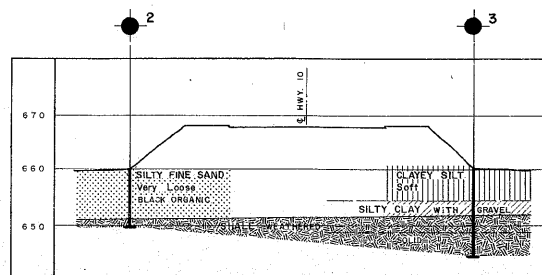
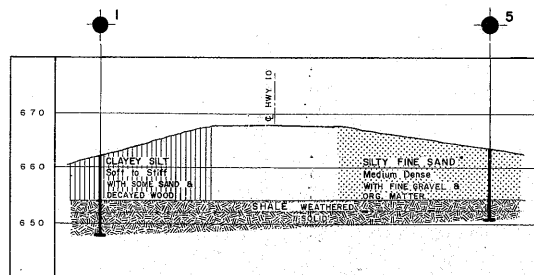
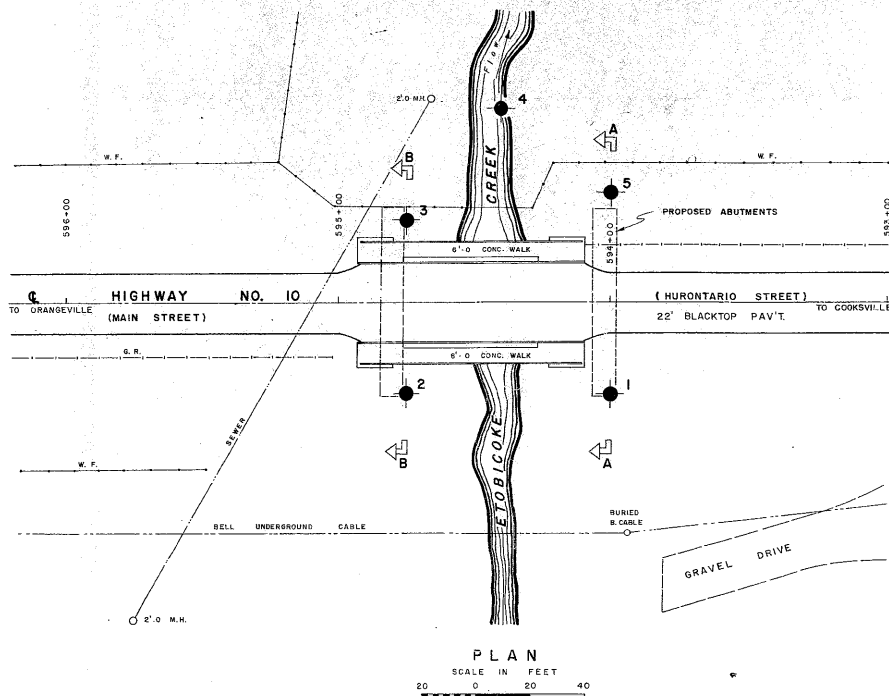


# 62-F-16

W.P. # 83-61

Hwy. # 10 E

ETOBICOKE CR.

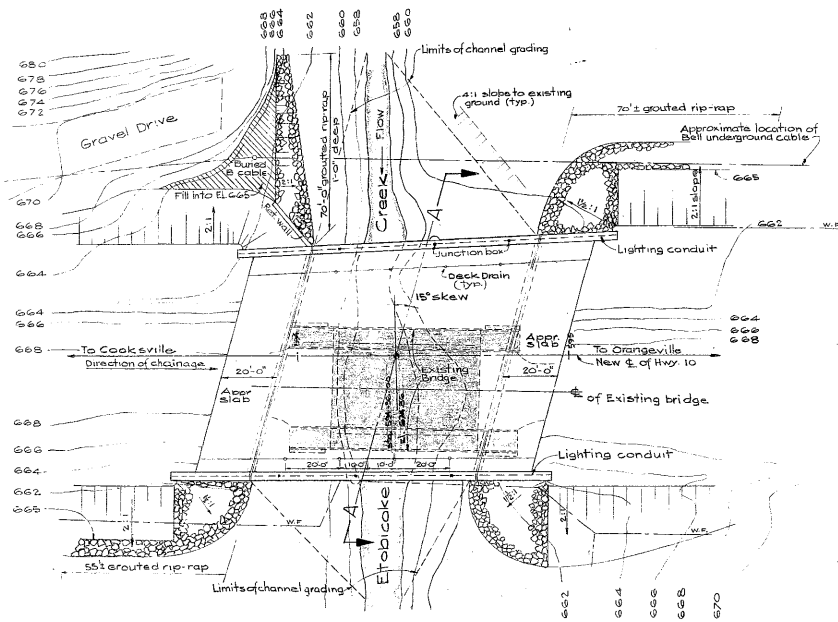


LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation		
NO.	ELEVATION	STATION	OFFSET
1	662.0	594+00	33' LT.
2	660.0	594+75	33' LT.
3	660.3	594+75	30' RT.
4	657.5	594+40	70' RT.
5	663.3	594+00	40' RT.

- NOTE -  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

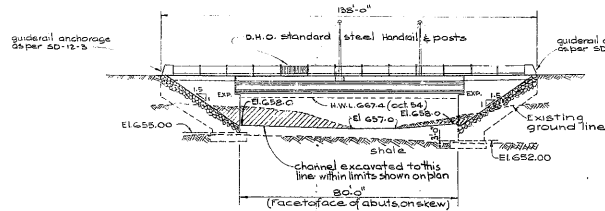
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION		
<b>ETOBICOKE CREEK</b> AND <b>HIGHWAY NO. 10</b> IN THE TOWN OF BRAMPTON		
ORIGINATED G. MERZYNSKI	DISTRICT NO. 6	DATE 29 MARCH 1962
DRAWN D. MUMFORD	W.P. NO. 83-61	JOB NO. 62-F-16
CHECKED <i>[Signature]</i>	CONTRACT NO.	DRAWING NO.
APPROVED <i>[Signature]</i>		<b>62-F-16A</b>





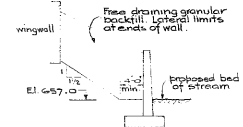
**PLAN**  
Scale: 1" = 20'-0"

Skew Angle: 15°
SIN: 0.2598190
COS: 0.9659258
TAN: 0.2679493
SEC: 1.0382762

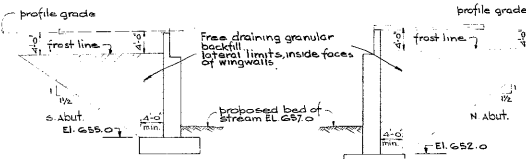


**EAST ELEVATION**  
Scale: 1" = 20'-0"

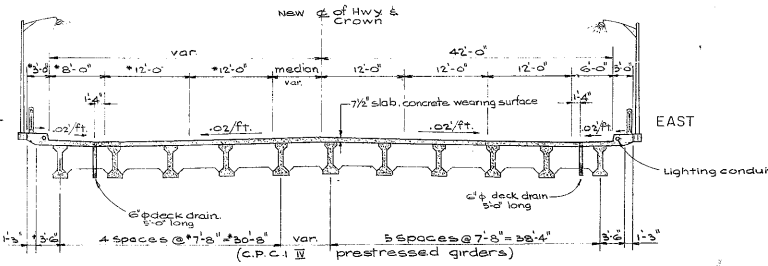
**GRANULAR BACKFILL AT RETAINING WALL**  
(section perp. to wall)



**GRANULAR BACKFILL AT ABUTMENTS**  
(sections perp. to abutment)

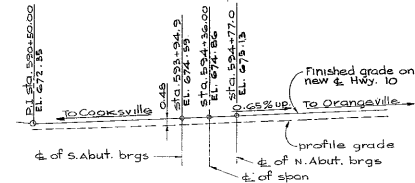


**LIST OF DRAWINGS**

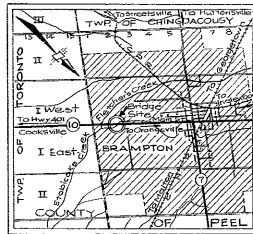
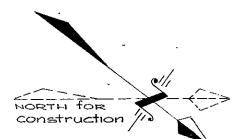


**A-A**  
Scale: 1/8" = 1'-0"

\* Measured perpendicular to west face of Bridge



**PROFILE OF HWY 10**



**KEY PLAN**  
Scale: 1 in = 1 mi

**NOTES**

- class of concrete**
- Pre-tensioned beams 5,000 p.s.i.
- Deck 4,000 p.s.i.
- Remainder 3,000 p.s.i.
- clear cover on reinforcing steel**
- surfaces in contact with earth 3"
- Top of deck 1 1/2"
- Bottom of deck and precast beams 2"
- construction notes**
- Existing bridge to be demolished prior to construction of new bridge.
- Barley bridge detour to be provided during construction.
- All weathered shale shall be removed prior to placing the footings. Top of footing elevations and footing thickness must be maintained.
- The general Contractor is responsible for finishing the bearing seats dead level to the specified elevations with a tolerance of ± 1/8 inch.
- No concrete shall be placed above the abutment bearing seats until the concrete in the deck has been placed.

B.M. EL 656.16 Geodetic Datum: Cut cross on S.E. corner of concrete abutment 213 ft of STA 524+09.00

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION			
Giffels ASSOCIATES LIMITED			
ETOBICOKE CREEK SOUTH CROSSING			
4.1 miles north of Hwy. 401			
KING'S HIGHWAY No. 10	DIST. No. 6		
CO. PEEL	CON. I.F. & I.W.		
TWP. CHINGACOUSY LOT 2			
GENERAL ARRANGEMENT			
APPROVED	BRIDGE DIVISION	SITE No. 24-136	W.P. No. 33-61
DESIGN	G.R.T.	CHECK	CON. I.F. & I.W.
DRAWING	P.C.	CHECK	G.R.T.
DATE	Sept. 2-68	LOADING	11-22-51
D.5793-P2			

PRINT RECORD	No.	FOR	DATE