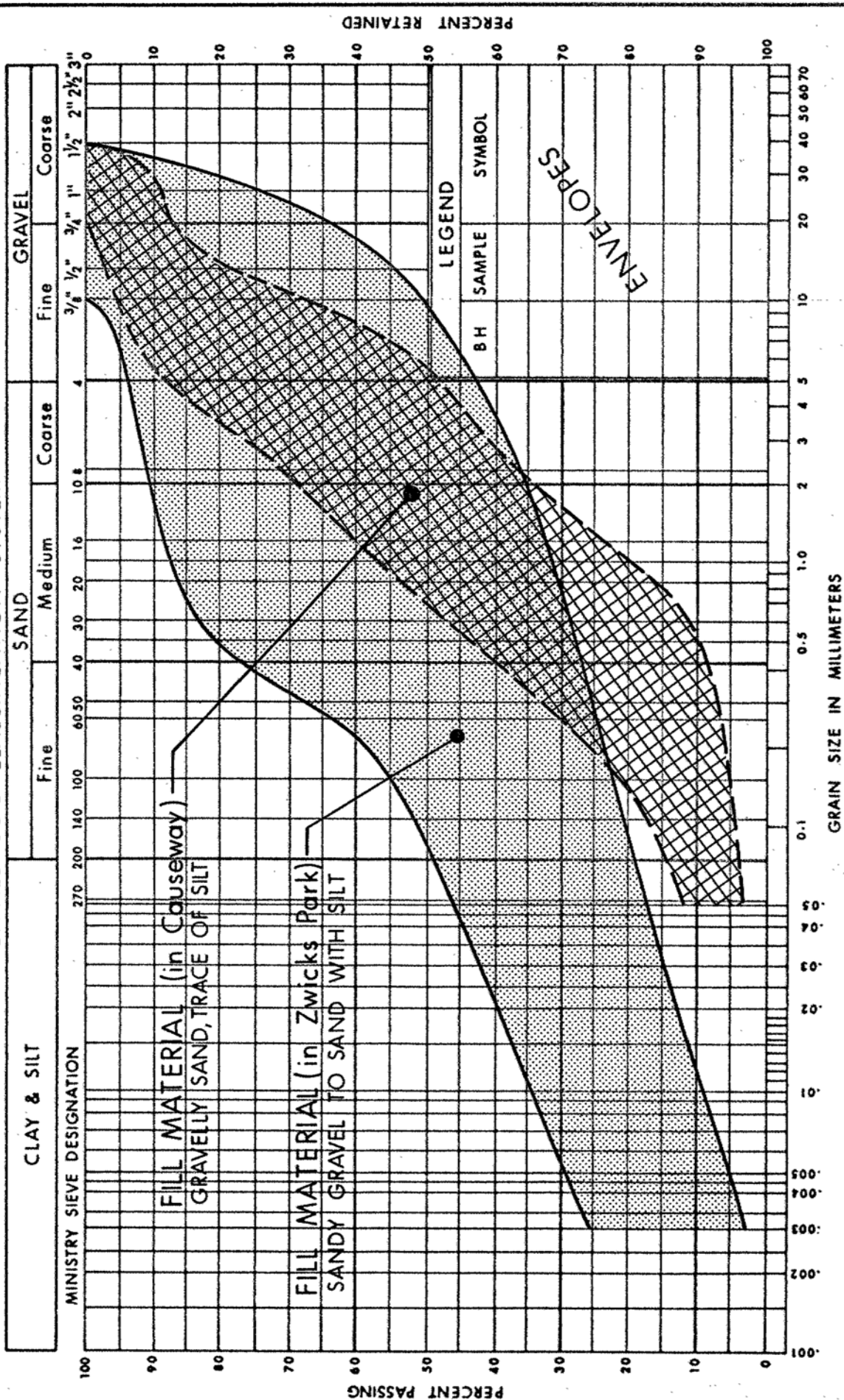


# UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation and  
Communications

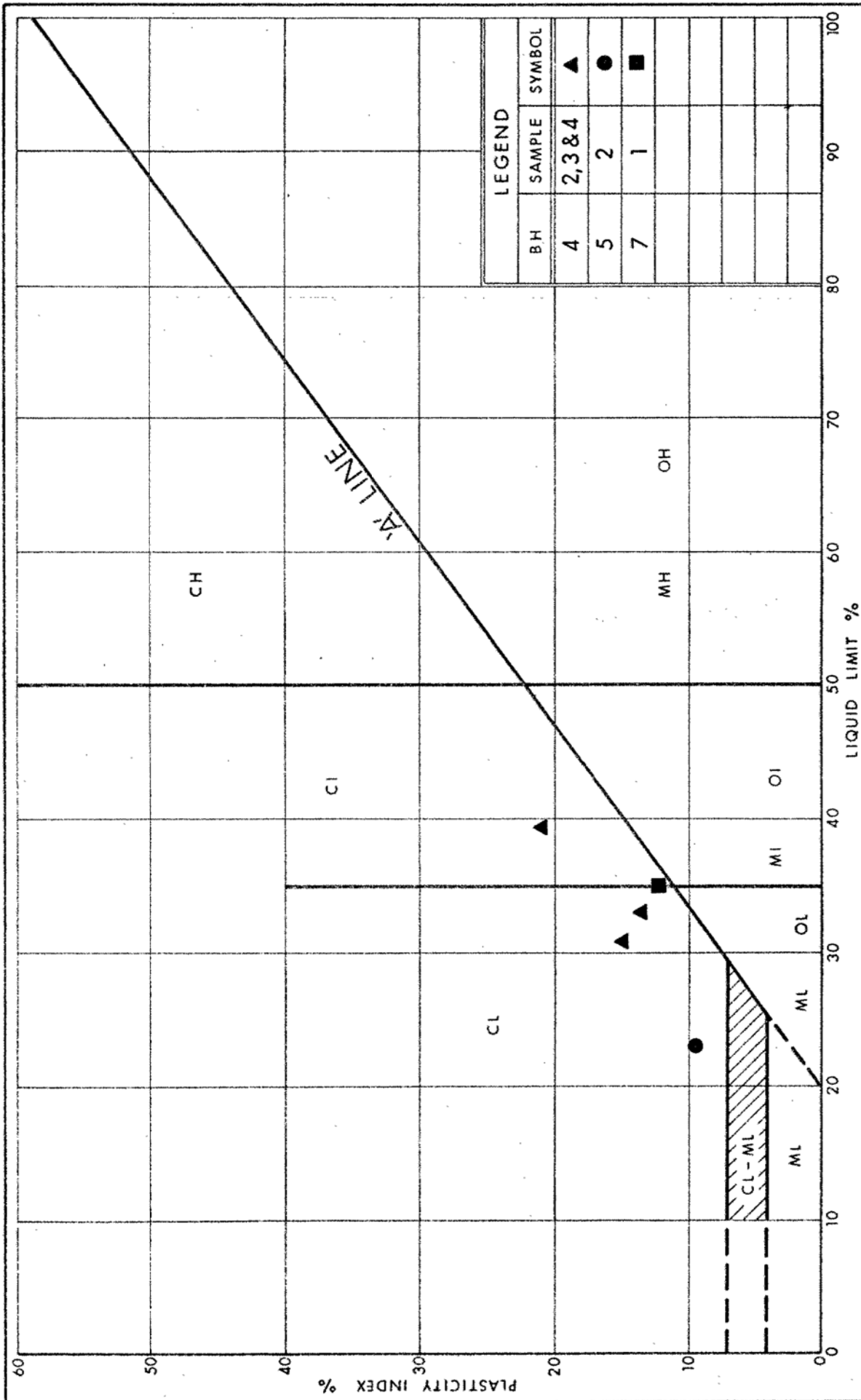


## GRAIN SIZE DISTRIBUTION FILL MATERIAL

FIG No 1

W P 134-74-01

Oct 75, FF-S-21



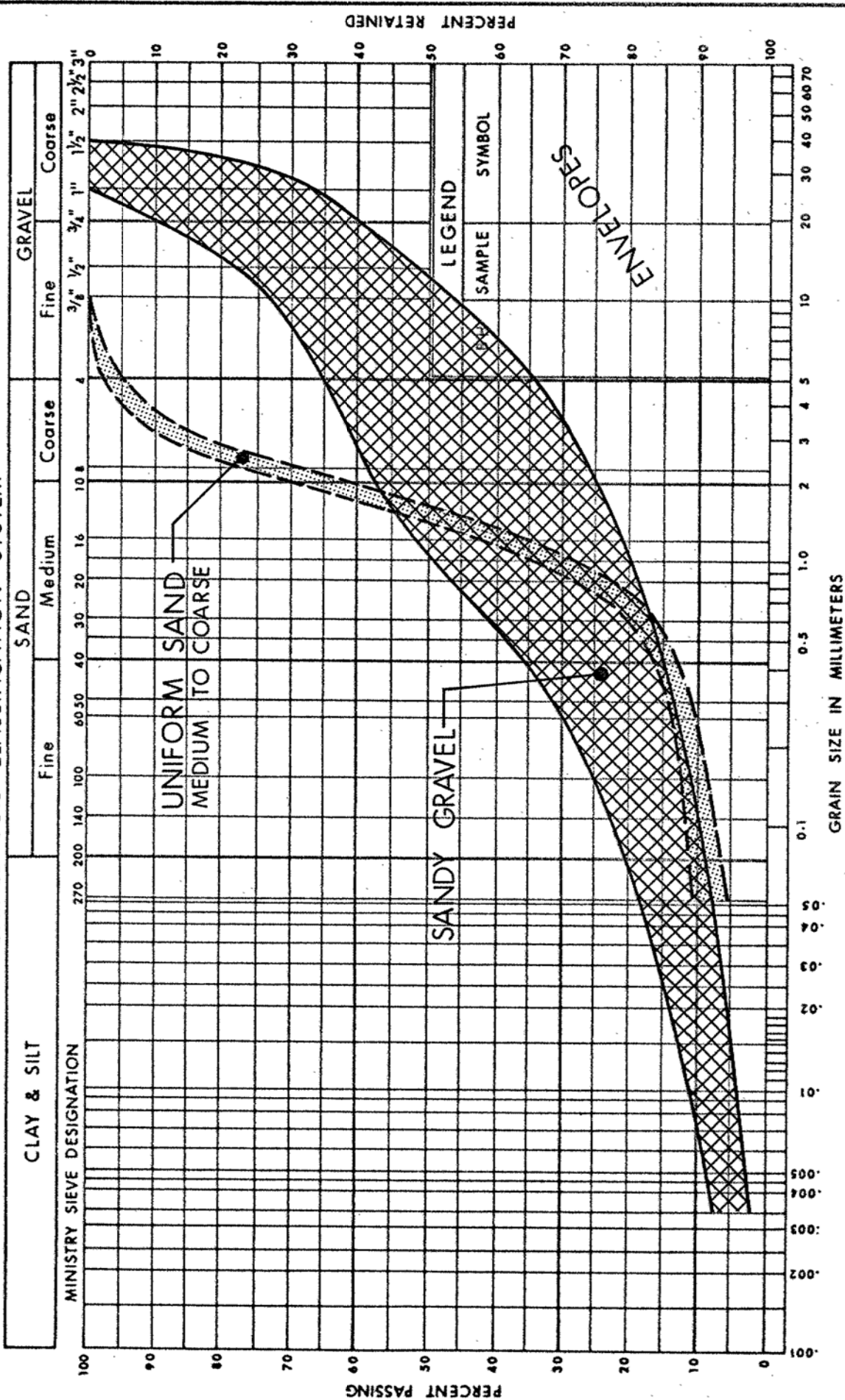
PLASTICITY CHART

FILL MATERIAL (in Zwicks Park)  
COHESIVE POCKETS OF CLAYEY SILT

FIG No 2

W P 134-74-01

# UNIFIED SOIL CLASSIFICATION SYSTEM

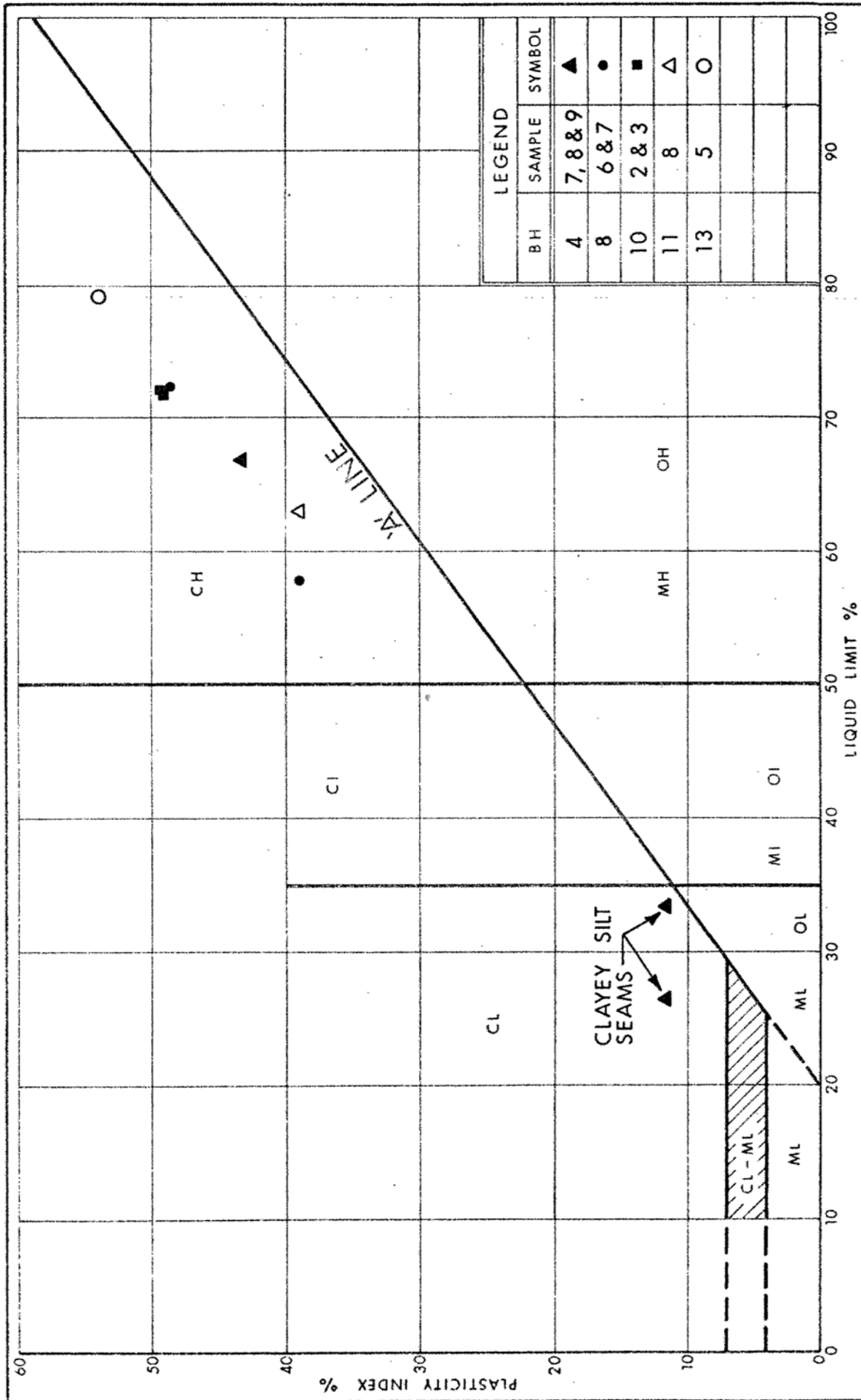


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Communications



FIG No 3  
W P 134 - 74 - 01

Oct 75, FF-S-21



# PLASTICITY CHART

CLAY  
WITH LAYERS OR SEAMS OF CLAYEY SILT

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Transportation and  
Communications

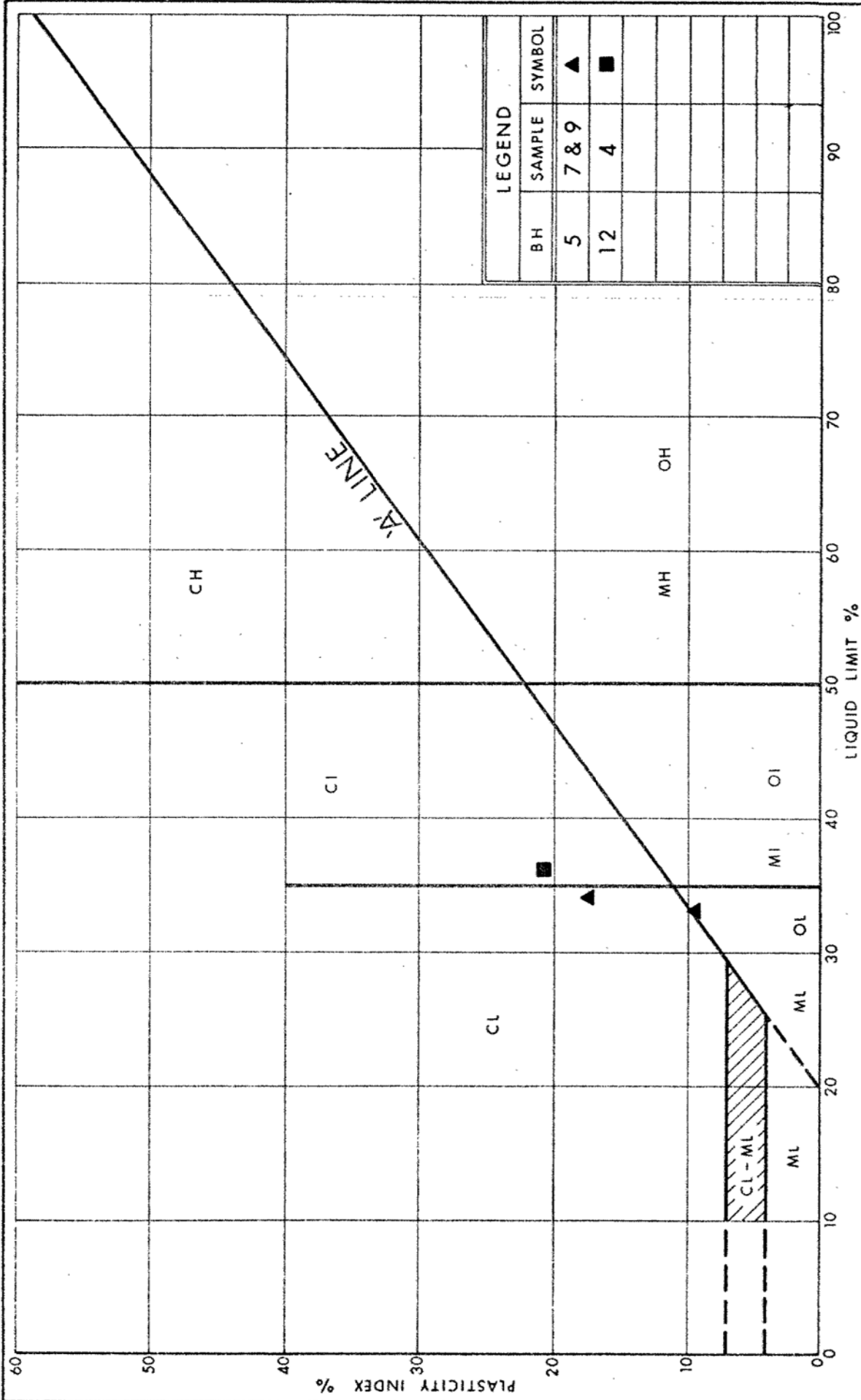


FIG No 4

W P 134-74-01



Oct 75, FF-S-21



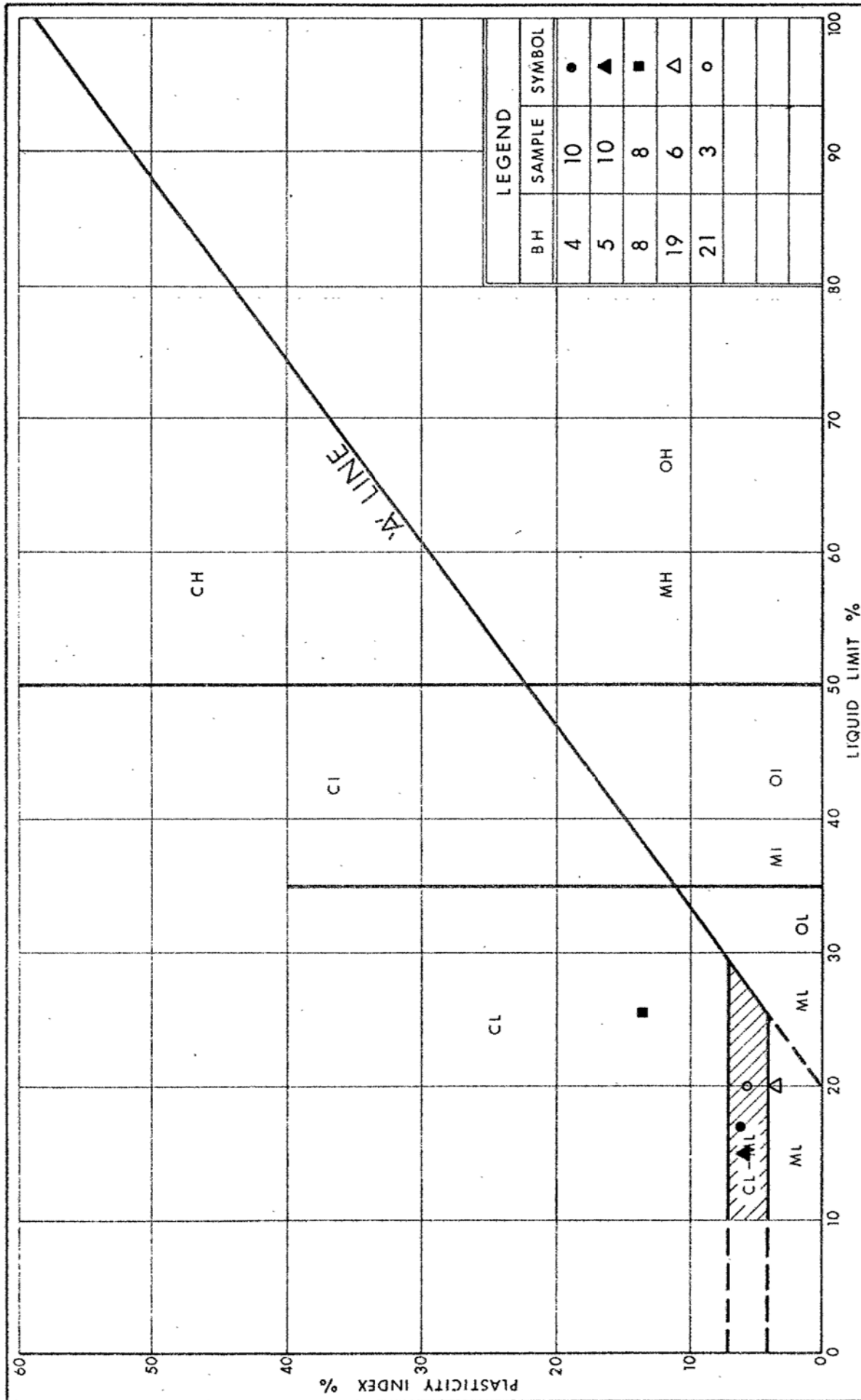
LEGEND

BH	SAMPLE	SYMBOL
5	7 & 9	▲
12	4	■

PLASTICITY CHART  
CLAYEY SILT

FIG No 5

W P 134 - 74 - 01



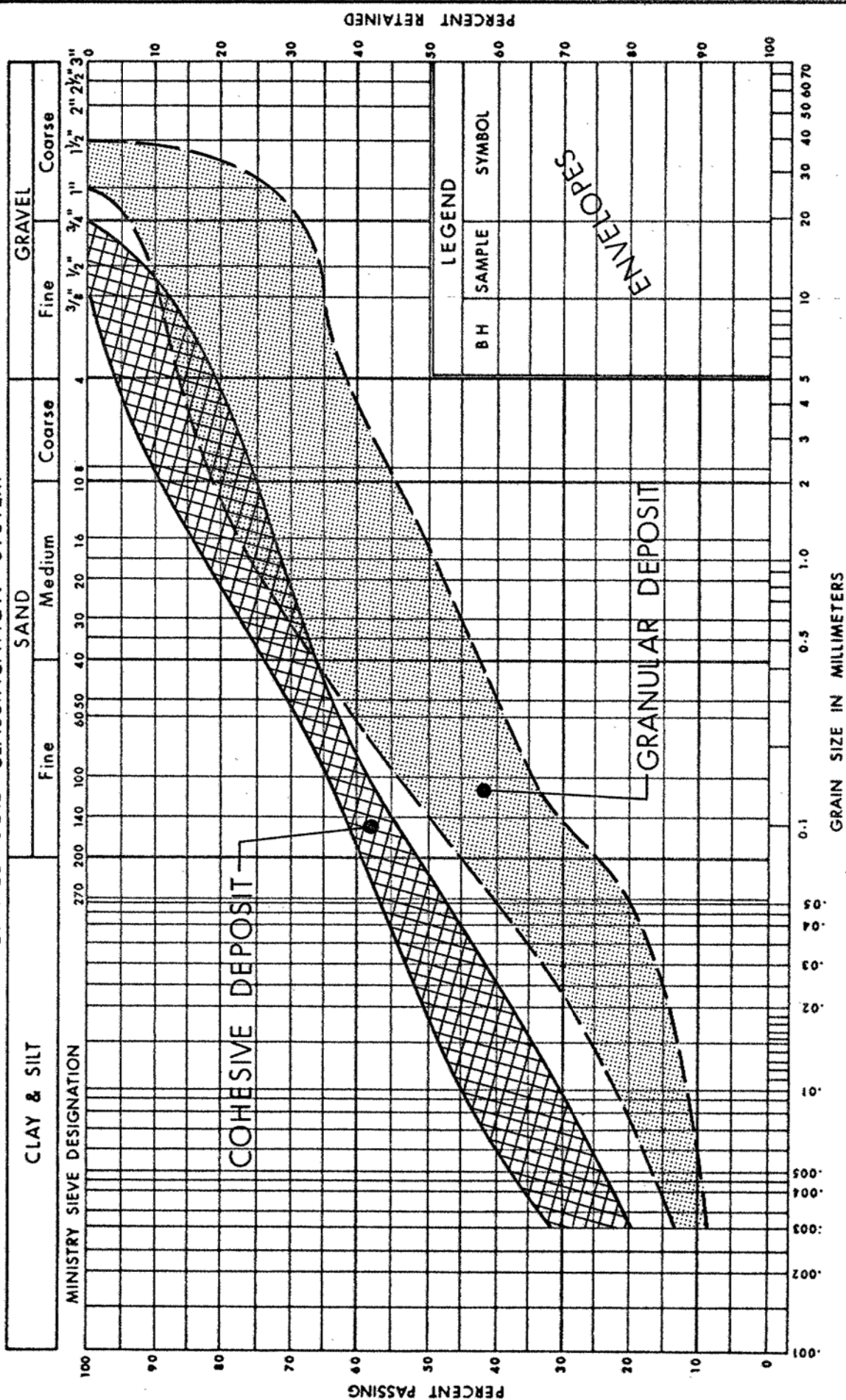
PLASTICITY CHART  
GLACIAL TILL (cohesive portion)

FIG No 6

W P 134-74-01

Ministry of  
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Communications



Ministry of  
Transportation and  
Communications

# GRAIN SIZE DISTRIBUTION GLACIAL TILL

**FIG No 7**

WP 134-74-01

# VOID RATIO - PRESSURE CURVES

WP 134-74-01

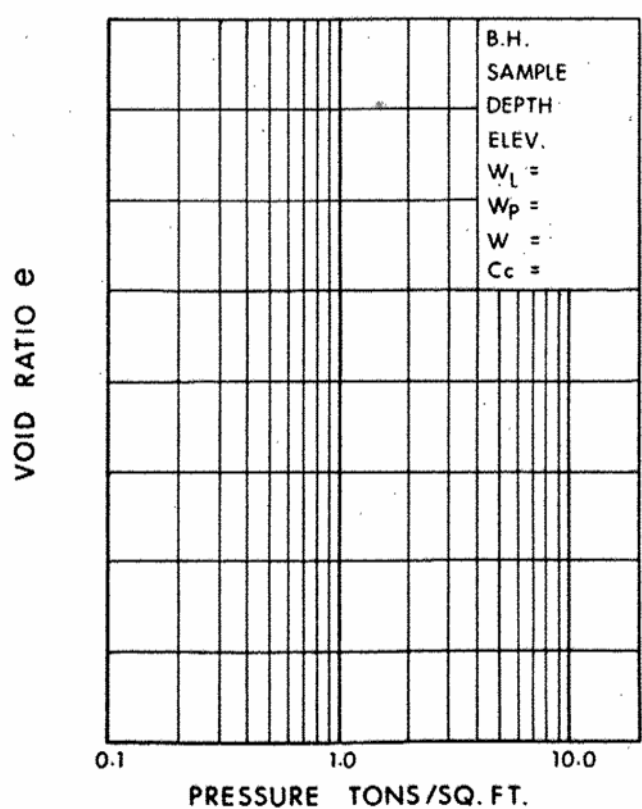
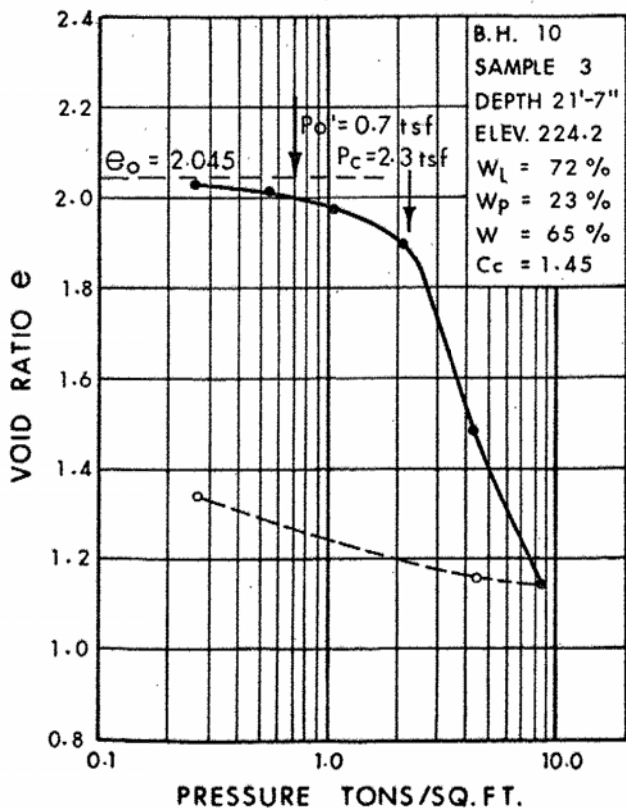
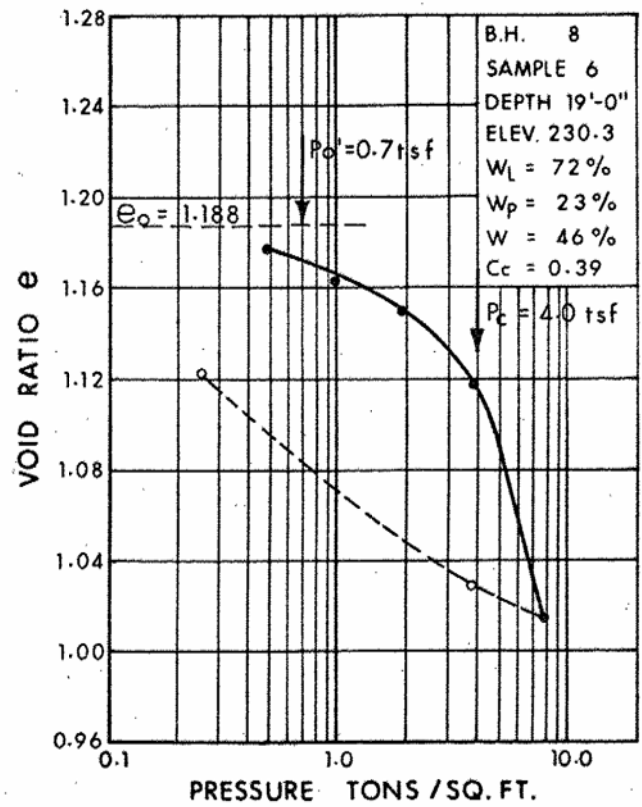
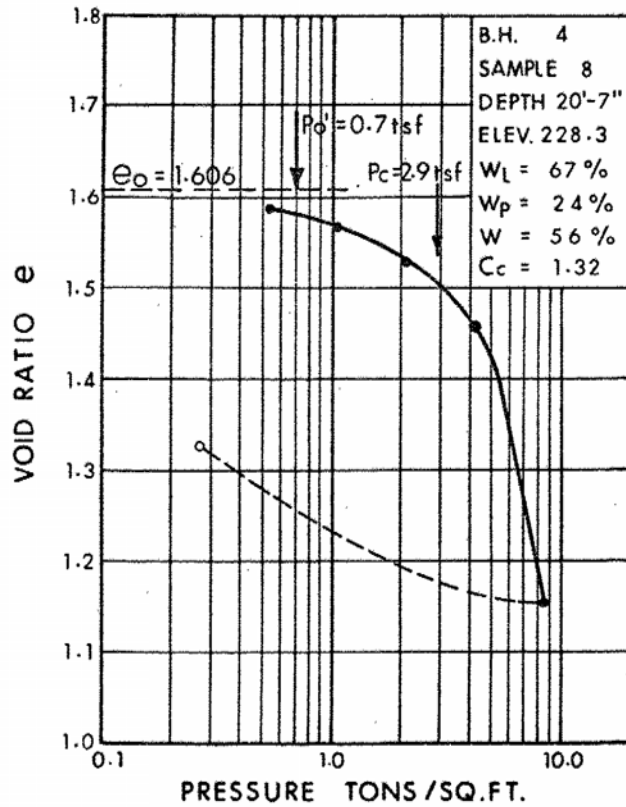
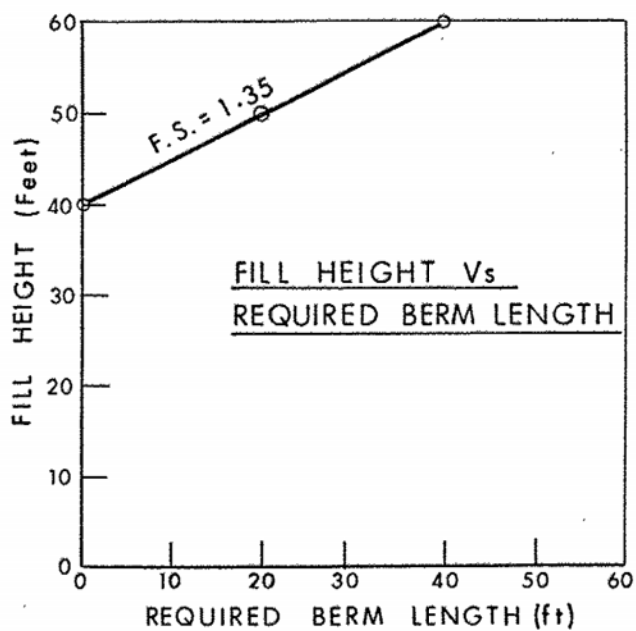
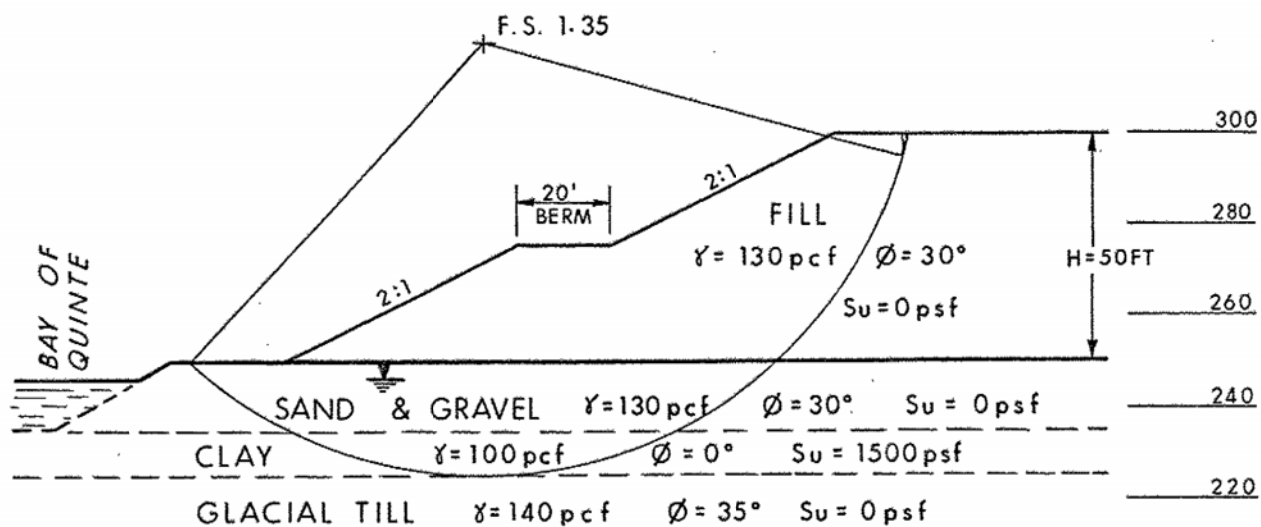
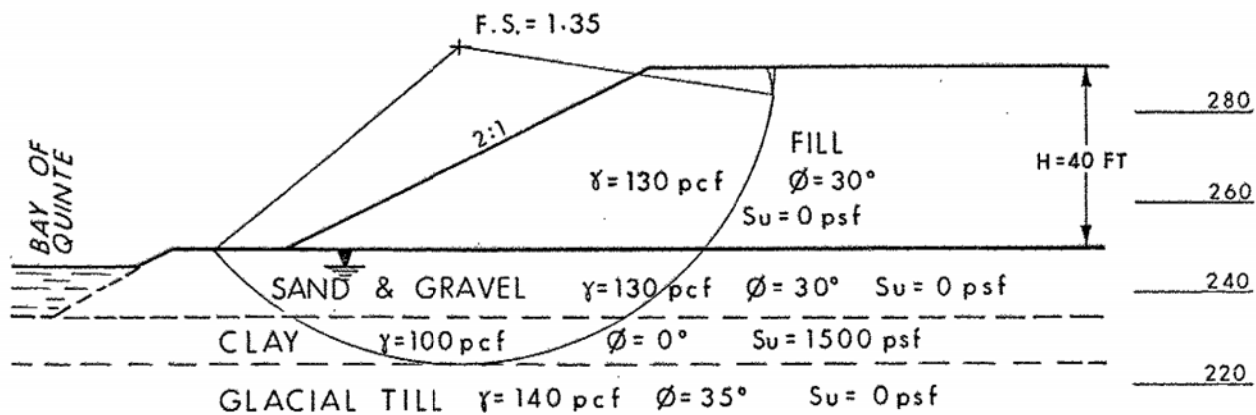
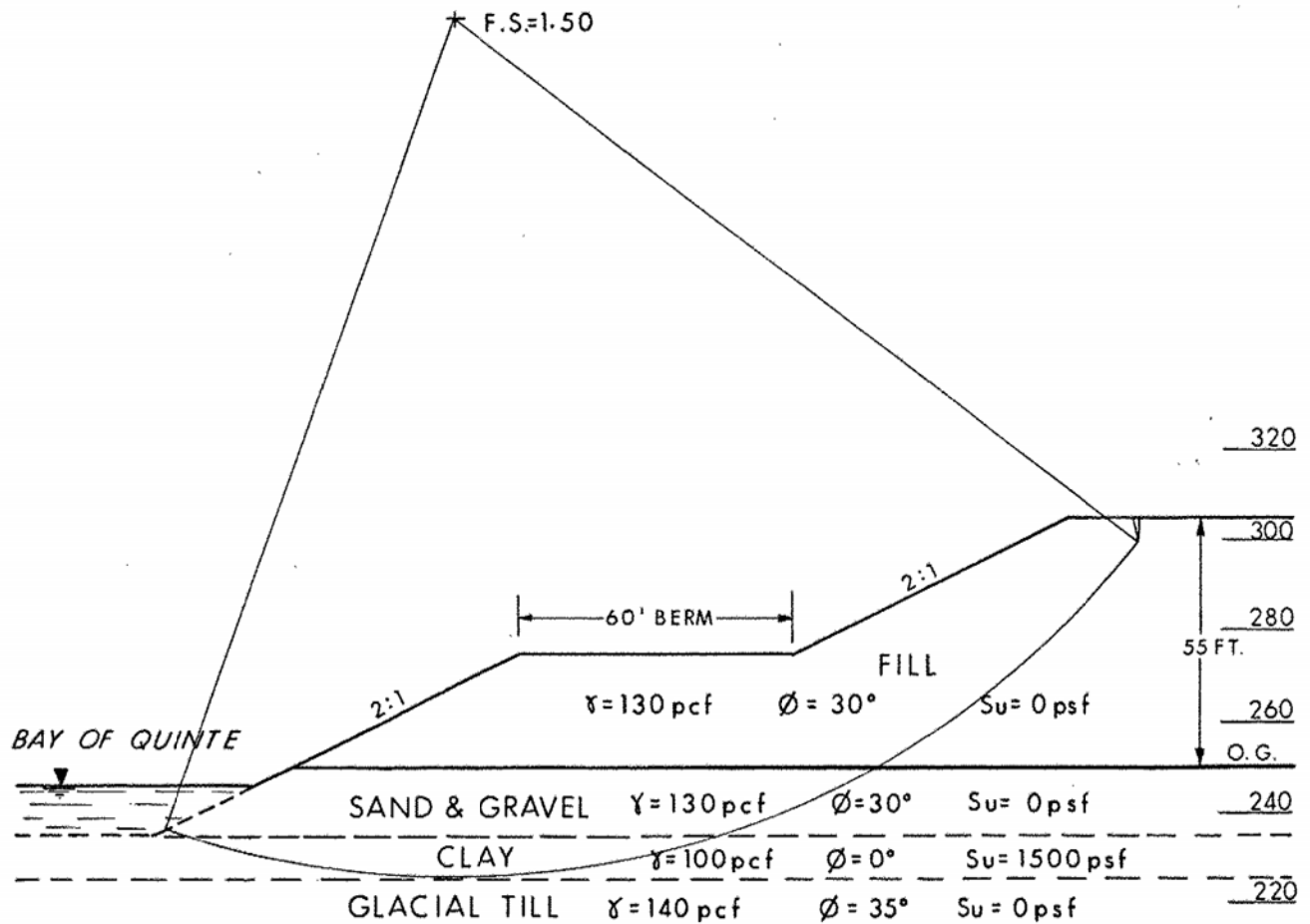
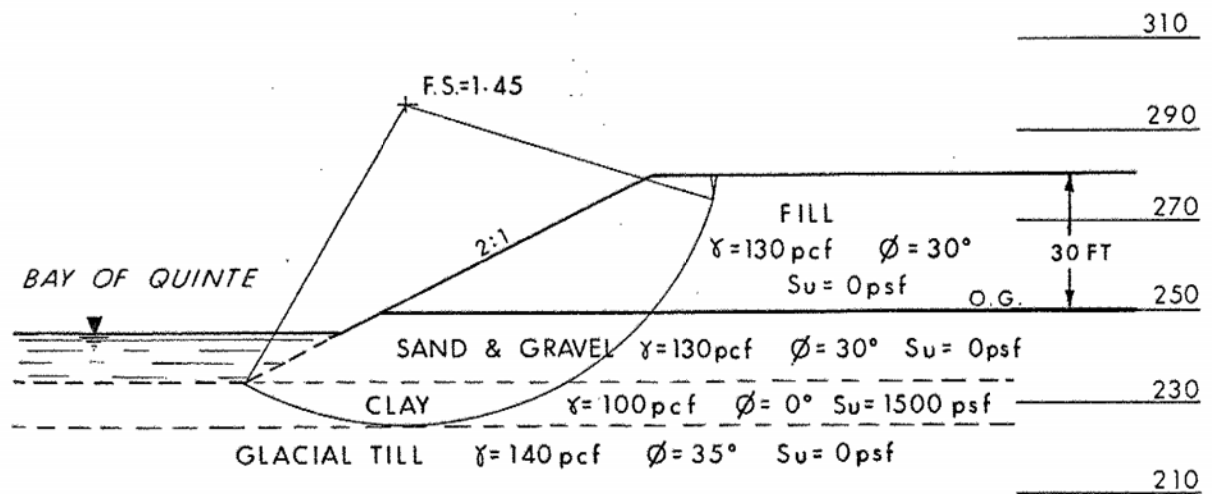


FIG. 8



CASE A: Toe of Fill Slopes Not Closer than 20 ft. from Shoreline





CASE B: Toe of Fill Slopes at Edge of Shoreline



PHOTO 1 (LOOKING SOUTHWEST FROM ZWICK'S PARK)  
OVERALL VIEW OF EXISTING HWY. 14  
CROSSING OF BAY OF QUINTE



PHOTO 2 (LOOKING NORTH FROM ZWICK'S PARK PUMP HOUSE)  
PROPOSED HWY. 14 APPROACH ON ZWICK'S PARK

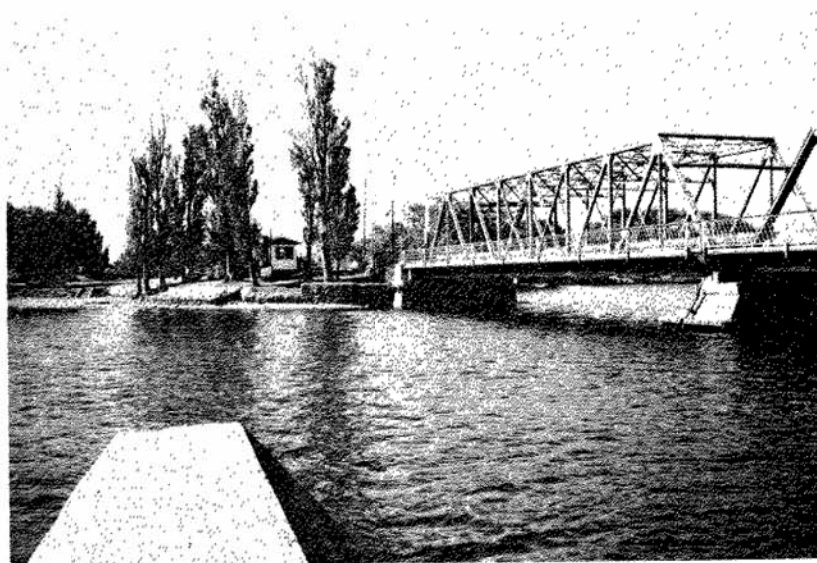


PHOTO 3 (LOOKING SOUTH FROM EAST SWING STOP PIER)  
PROPOSED HWY. 14 APPROACH ON ROSSMORE

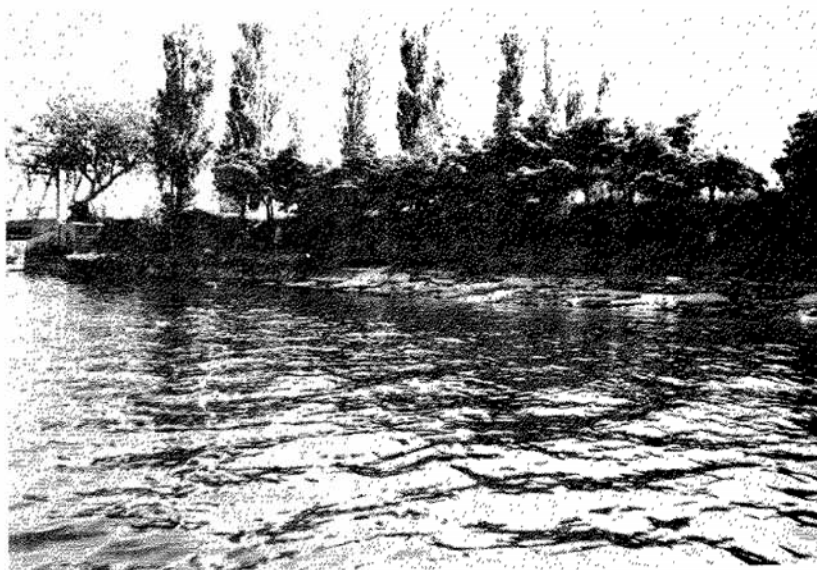


PHOTO 4 (LOOKING EAST AT PRINCE EDWARD COUNTY SHORELINE)  
BEDROCK OUTCROPS

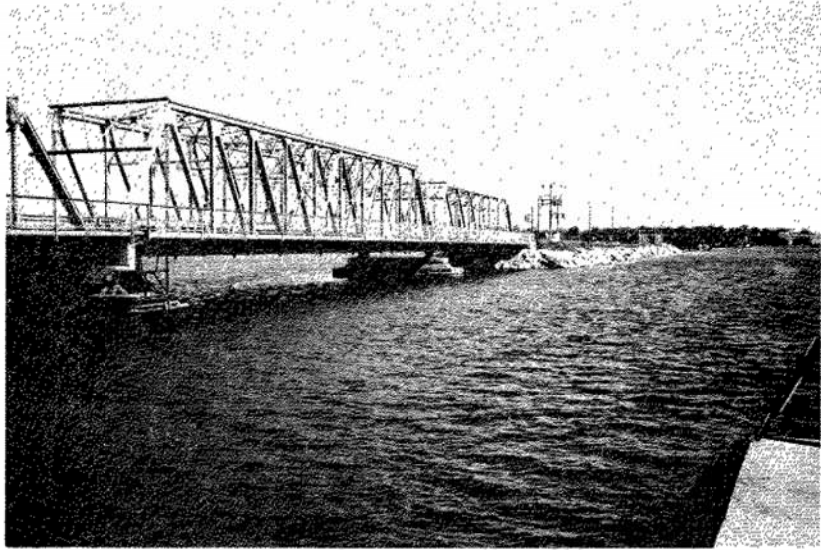


PHOTO 5 (LOOKING NORTHWEST)

NOTE: ROCK ARMOUR SLOPE PROTECTION

# EXPLANATION OF TERMS USED IN REPORT

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

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

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

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

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

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

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

**ROCK QUALITY:** ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

**RECOVERY:** SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH DRILLED IN THAT CORING RUN.

**MODIFIED RECOVERY:** SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4"+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

**JOINTING AND BEDDING:**

SPACING	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

## ABBREVIATIONS & SYMBOLS

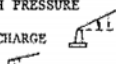

### LABORATORY TESTING

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

### FIELD SAMPLING

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

### EARTH PRESSURE TERMS

$\mu$  COEFFICIENT OF FRICTION  
 $\delta$  ANGLE OF WALL FRICTION  
 $k_o$  COEFFICIENT OF EARTH PRESSURE AT REST  
 $k_A$  COEFFICIENT OF ACTIVE EARTH PRESSURE  
 $k_P$  COEFFICIENT OF PASSIVE EARTH PRESSURE  
 $i$  ANGLE OF INCLINATION OF SURCHARGE  
 $w$  SLOPE ANGLE-BACKFACE OF WALL   
 $\beta$  ANGLE OF SLOPE   
 $N, N_q, N_c$  BEARING CAPACITY FACTORS  
 $D_f$  DEPTH OF FOOTING  
 $B, L$  FOOTING DIMENSIONS

### INDEX PROPERTIES

$\gamma$  UNIT WEIGHT OF SOIL (BULK DENSITY)  
 $\gamma_w$  UNIT WEIGHT OF WATER  
 $\gamma_d$  UNIT DRY WEIGHT OF SOIL (DRY DENSITY)  
 $\gamma'$  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 =  $w - w_p$   
 $I_L$  LIQUIDITY INDEX =  $\frac{w - w_p}{w_L - w_p}$   
 $I_c$  CONSISTENCY INDEX =  $\frac{w_p - w_s}{w_L - w_s}$   
 $A_c$  ACTIVITY =  $\frac{I_p \text{ of soil}}{2.45 \text{ } \mu\text{m Soil Fraction}}$   
 $Om$  ORGANIC MATTER CONTENT  
 $S_r$  DEGREE OF SATURATION  
 $S$  SENSITIVITY =  $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

### STRENGTH PARAMETERS

$\phi$  ANGLE OF SHEARING RESISTANCE  
 $\tau_f$  PEAK SHEAR STRENGTH  
 $\tau_R$  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  
 $\epsilon$  LINEAR STRAIN  
 $\gamma$  SHEAR STRAIN  
 $\nu$  POISSON'S RATIO  
 $E$  MODULUS OF ELASTICITY  
 $G$  MODULUS OF SHEAR DEFORMATION  
 $k_s$  MODULUS OF SUBGRADE REACTION  
 $m, n$  STABILITY COEFFICIENTS  
 $A, B$  PORE PRESSURE COEFFICIENTS

**NOTE:** EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:  
 $\phi'$  = EFFECTIVE ANGLE OF SHEARING RESISTANCE;  
 $\sigma'$  = EFFECTIVE NORMAL STRESS

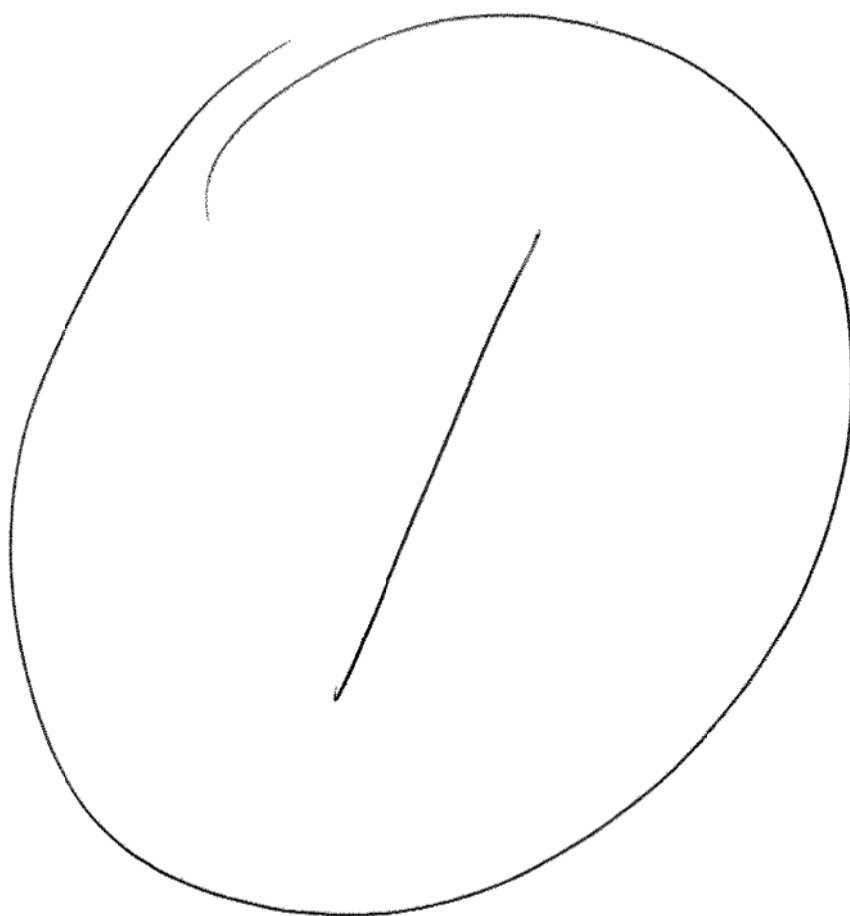
### HYDRAULIC TERMS

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

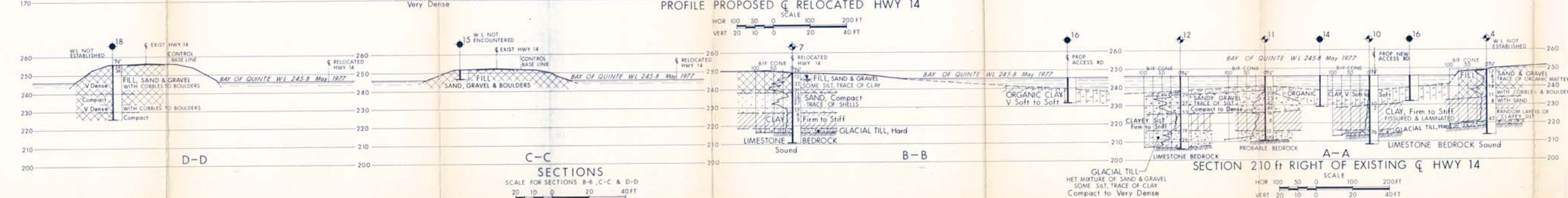
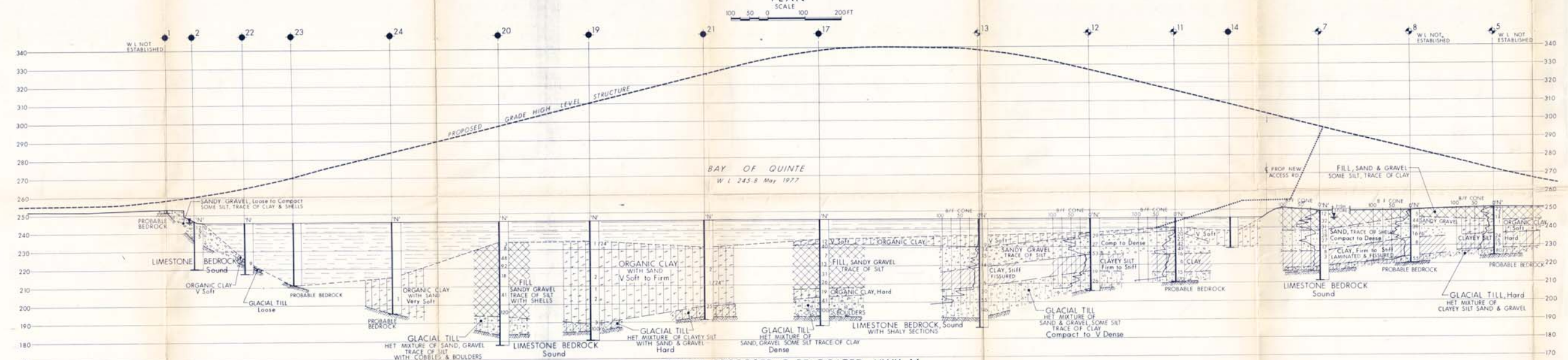
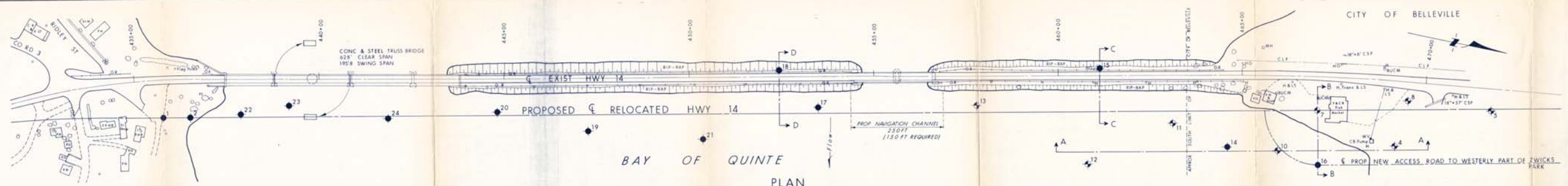


35MM

DRAWING



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO



CONT No 80-34  
WP No 134-74-01  
BAY OF QUINTE CROSSING  
PRELIMINARY INVESTIGATION  
BORE HOLE LOCATIONS & SOIL STRATA



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blowcount (Std. Pen. Test, 350 lb hammer)
- Cone Blowcount (60° Cone, 350 lb hammer)
- W.L. at time of investigation May & June, 1977
- W.L. Not Established in BH 1, 4, 5, 8 & 18
- W.L. Not Encountered in BH 15

No.	ELEVATION	STATION	OFFSET
1	253.1	435+83	104' RT
2	246.5	436+56	105' RT
3	248.9	469+29	178' RT
4	250.7	471+83	60' RT
5	249.1	467+06	92' RT
6	249.3	469+56	52' RT
7	245.8	466+00	205' RT
8	245.8	463+10	130' RT
9	245.8	460+79	243' RT
10	245.8	457+81	80' RT
11	245.8	464+58	194' RT
12	252.0	461+14	20' LT
13	245.8	467+10	242' RT
14	245.8	453+52	84' RT
15	256.0	452+48	18' LT
16	245.8	447+28	145' RT
17	245.6	444+84	90' RT
18	245.6	450+20	170' RT
19	245.6	437+92	96' RT
20	245.6	439+24	73' RT
21	245.6	441+92	108' 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.

Geocres No: 31C-135  
HWY 14 RELOCATED Hwy 14 DIST 8  
SUBMITTAL CHECKED DATE Oct 14, 1977 SHT 28-28  
DRAWN BY DATE 11/1/77 DWG 1347401-A

# memorandum



To: Mr. L.G. Timson  
Sr. Project Manager  
Planning and Design Section  
Kingston Region

Date: 1980-12-04

From: Pavement & Foundation Design Section  
Room 313, Central Building  
Downsview

Re: The Norris Whitney Bridge (Bay of Quinte)  
W.P. 134-74-01, Contract 80-34, Hwy. 14

---

Further to your recent memo, we have reviewed the revised geometry incorporating a modified upper berm width ranging from 6 m to 8 m between Sta. 21+170 and Sta. 21+185 for the north approach. This memo confirms our telephone conversation with you indicating that the proposed modification will be satisfactory from the stability point of view.

A handwritten signature in cursive script, appearing to read "M. Devata".

M. Devata  
Senior Foundations Engineer

MD:ea

cc: R.W. Franks

# memorandum



To: M. Devata  
Pavement and Foundation Design Section  
Central Building  
Downsview

Date: 1980 11 14

FROM: Planning and Design Section  
Kingston, Ontario

RE: W.P. 134-74-01, Contract 80-34  
Highway 14, The Norris Whitney Bridge

---

Further to our telephone conversation on Thursday, November 13th, we enclose a sketch showing proposed modifications to the upper berm of the north approach. Considering the fact that there must be a sufficient depth of earth on the approach to support tree and shrub growth, the side slope should be constructed at a 2:1 slope rather than at the  $1\frac{1}{2}$ :1 slope recommended by the Construction Office.

It would be appreciated if you provide us with comments on this proposal at your earliest convenience.

A handwritten signature in dark ink, appearing to read "L. G. Timson".

L. G. Timson  
Sr. Project Manager

LFT/eb

c.c. R. W. Franks

Enclosure





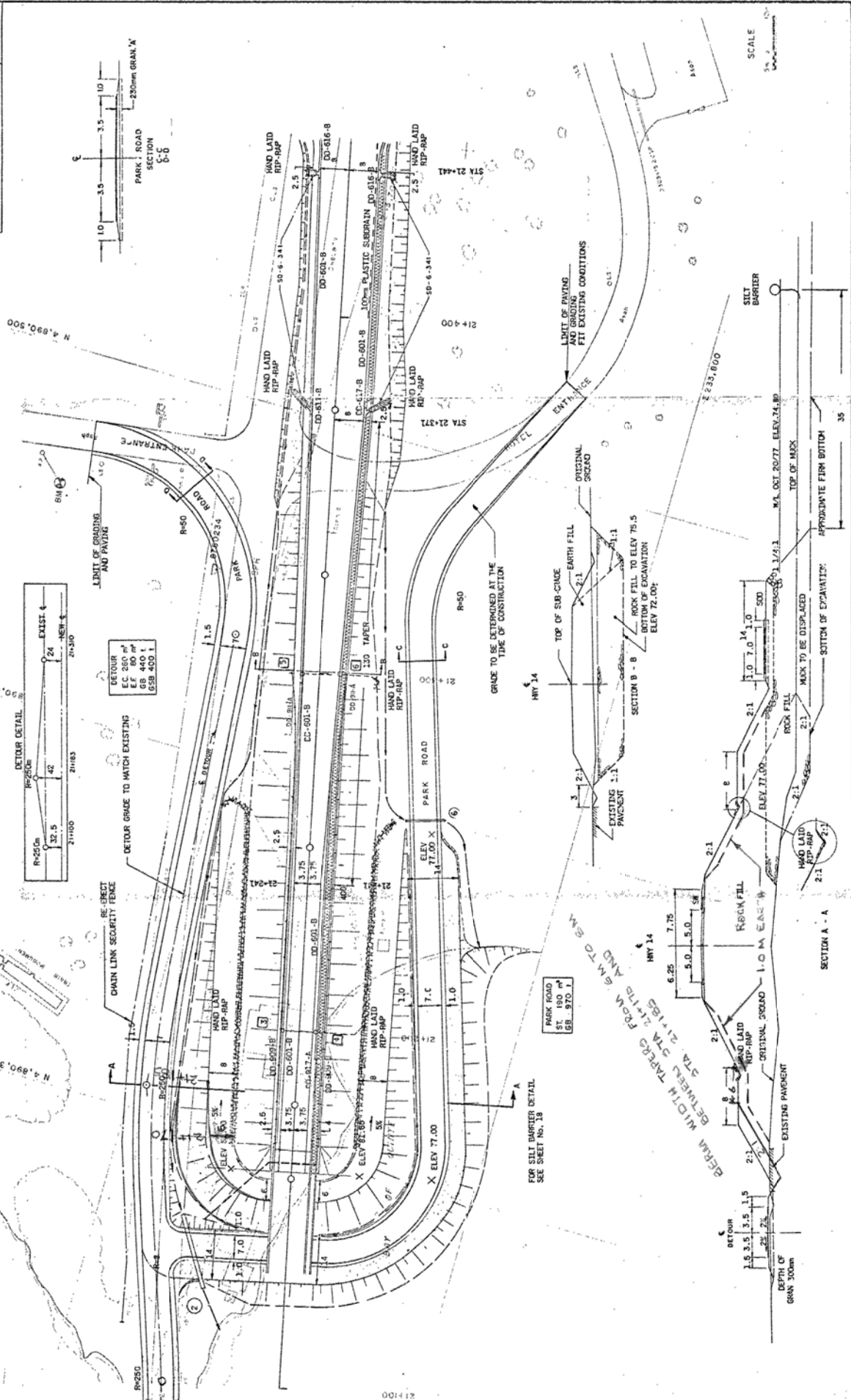


SHEET 10

METRIC

"ZWICK ISLAND PARK"

BAY OF QUINTE



SCALE

SILT BARRIER

TOP OF MEX

APPROXIMATE FIRM BOTTOM

MUX TO BE DISPLACED

ROCK FILL

EXISTING PAVEMENT

ORIGINAL GRADE

ROCK FILL

EXISTING PAVEMENT

DEPTH OF GRAN 300m

SECTION A - A

SECTION B - B

FOR SILT BARRIER DETAIL SEE SHEET NO. 18

GRADE TO BE DETERMINED AT THE TIME OF CONSTRUCTION

LIMIT OF PAVING AND GRADING FIT EXISTING CONDITIONS

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L. Timson

## MINUTES OF DESIGN PACKAGE REVIEW MEETING

Held 1980-11-05 at Field Office for Contract 80-34

---

### In Attendance

L. Timson - Project Manager, Planning and Design  
J. Drope - Technician, Planning and Design  
A. J. Yorke - Project Supervisor, Construction Office  
C. H. Quick - Construction Supervisor, Construction Office  
(unable to attend)

The following items were discussed and appropriate action will result.

### Drainage - North Approach

Due to restricted area on the left side at Stations 21+160 and 21+175 the theoretical cross-section as shown on Sheet #10 requires revision.

These revisions are as follows.

1. Replace Culvert 2 with 600 mm CSP instead of 900 mm.
2. Place 20 m of 600 mm CSP under new entrance to West Zwick's Park.
3. Because of 1 and 2 above the drainage pattern will be split at Station 21+360.
4. Because of 1, 2 and 3 the low invert of culvert can be raised .3 m and the ditch to the north by corresponding depths.
5. Steepening of Berm side slopes Station 21+160 and 21+175 to  $1\frac{1}{2}:1$  are still a requirement.

Mr. Timson will be contacting the Foundation and Landscaping Sections for comments re Item #5. On receipt of this information the necessary arrangements with the contractor will be made.

### Construction North Approach

The approach fill is being changed to all rock borrow with a one metre cap of earth on the side slopes and berms. This cap depth will not be attainable at subgrade limits and will be somewhat less due to the need for consistent grade under curbs and sidewalks. Therefore, cap on fill slopes will vary for one metre at the bottom to one-third of a metre at subgrade. Mr. Timson felt that this depth would be sufficient to maintain vegetation.

### Superelevation Control Data

Requested that this information be forwarded for alignment on Rossmore end.

### Construction Operations

Mr. Timson queried what operations the contractor was going to proceed with this fall. This item was broached due to the sign advertising the Four Seasons Hotel not being lighted for sometime. The hotel management is agreeable to live with the sign not being lighted for a short time, but felt that the sign should be lighted for the winter season at whatever access was being used. This follows the conversations that I have had with the hotel maintenance supervisor - Mr. Milton McTaggart.

### Silt Barrier Installation

Item was discussed re installation time and method. Mr. Timson stated that barrier should be anchored and set in place before barrier is dropped in water.

### Standard DD917A

This standard was shown on Sheet #'s 7 and 10, but was not included in contract standards. Necessity of this could not be ascertained at this line.

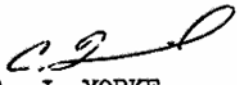
### Detour Construction

The discussion on this item was limited to the completion of the contract. Mr. Timson felt it would not be out of order to resurface with a 40 mm lift of HL4 prior to acceptance by the City of Belleville.

### Special Provision - Clay Seal

The requirements for this item were discussed. The Ministry specification for clay seal would cause an unrealistic cost for the intent of the material required to line the pit. A good impermeable material would be satisfactory for this operation.

As the contract progresses, further meetings on the Design Package may be necessary.

  
for A. J. YORKE  
Project Supervisor

AJY/dj

c.c. R. W. Franks	G. A. Wrong
L. Timson	D. McFarlane
J. Drope	A. G. Kelly
A. J. Yorke	R. M. Dell
C. H. Quick	W. G. Wigle
E. J. Orr	S. C. J. Radbone
P. J. Harvey	J. W. Reid
B. J. Giroux	G.. Luyt

# memorandum



To: Mr. K. Bassi  
Head, Structural Design Office  
Eastern Region

Date: 1980-03-03

Attention: Mr. C. Farrel

From: Pavement & Foundation Design Section  
Room 313, Central Building  
Downsview

Re: Bay of Quinte Crossing  
at Belleville  
W.P. 134-74-01, Site 28-28  
Hwy. 14, District 8, Kingston

Further to our discussion of 80 02 14 we hereby confirm our verbal recommendations made to you at that time.

The extreme ends of the north abutment wing wall should be provided with additional support comprised of steel 'H' piles driven to the bedrock surface. These piles are intended to prevent rotation of the abutment due to lateral forces on the abutment piles resulting from shear flow of the underlying clay deposits.

If you have any further queries please do not hesitate to contact us.

*M MacLean*

MM:MD:ea

M. MacLean  
For:  
M. Devata  
Senior Foundations Engineer

cc: T.C. Kingsland

# memorandum



To: Mr. G. Wrong,  
Head,  
Pavement Design & Foundations Section,  
Central Building, Downsview.

Date: 79 08 31

Attention: Mr. M. MacLean.

Subject: Bay of Quinte Crossing at Belleville,  
W.P. 134-74-01, Site 28-28,  
District #8.

I refer to our recent discussion regarding allowable pile loads on the above structure.

It was agreed that using 3 - HP 310 x 110 piles per caisson, the maximum working load per caisson could be 3500 KN rather than the 2700 KN value shown on page 24 of the foundation report. This value represents a tip pressure of 82.74 MPa (12,000 psi).

This bridge is being designed to the requirements of the Ontario Highway Bridge Design Code using ultimate limit state considerations. According to Cl. 6.8.4.3.2, the factored capacity of a caisson =  $F_p R_s$ , where  $F_p = 0.4$  for steel H sections,  $R_s$  can be taken from Cl. 10.8.3 as  $\phi A F_y$  (the  $\lambda$  values for these installations relatively small). Using 260 MPa yield steel, we obtain a factored capacity =  $0.4 \times 0.9 \times 42.3 \times 260 = 3959$  KN. This represents a value of 1.13 x the working capacity. It is the thinking of this Section that this value is unduly conservative and would result in more piles than if the structure had been designed using working stress methods with an allowable tip pressure of 12,000 psi.

Using an  $F_p$  value of 0.45, we would obtain a factored capacity of 4454 KN which represents a value of 1.27 x the working capacity. This value more accurately represents the typical values of the applied load factors, and it was agreed that a factored capacity of 4454 KN should be used for the design of the caissons.

CFF/cf

*C. F. Farrell*  
C. F. Farrell,  
Design Engineer,  
Eastern Section.

*This in response  
to conversation  
with C. Farrell & M.M.  
I am in agreement  
with the structural  
offices conclusions  
M.M.*

c.c. K. Bassi  
W. McFarlane



*MM  
M.D.*

Mr. T.C. Kingsland  
Head, Structural Section  
Eastern Region

1979-11-27

From: Pavement & Foundation Design Section  
Room 313, Central Building  
Downsview

Re: Bay of Quinte Bridge at Belleville  
W.P. 134-74-01, Site 28-28  
Hwy. 14, District 8, Kingston

In response to your written request of 1979-11-14 concerning the foundations for the barrier wall for the above structure, we have the following comments to make.

We feel that adequate performance can be obtained from the barrier wall without supporting it on timber piles. The base width of the footing and depth below ground surface should be sized in view of the imposed loads according to the following soil parameters:

Maximum Allowable Bearing Capacity 100 kPA  
Coefficient of Passive Earth Pressure  $k_p = 3.0$

Because of anticipated settlements of the approach fill due to consolidation of the underlying subsoil as well as the settlements within the approach fill, the construction of the barrier wall should be delayed as long as possible after completion of the embankment.

MM:MD:ea

M. MacLean  
Project Foundations Engineer  
For: M. Devata  
Senior Foundations Engineer

cc: C. Bassi - Att: C. Farrel  
L. Timson



# memorandum



To: Mr. T.C. Kingsland  
Head, Structural Section  
Eastern Region

Date: 1979-11-27

From: Pavement & Foundation Design Section  
Room 313, Central Building  
Downsview

Re: Bay of Quinte Bridge at Belleville  
W.P. 134-74-01, Site 28-28  
Hwy. 14, District 8, Kingston

In response to your written request of 1979-11-14 concerning the foundations for the barrier wall for the above structure, we have the following comments to make.

We feel that adequate performance can be obtained from the barrier wall without supporting it on timber piles. The base width of the footing and depth below ground surface should be sized in view of the imposed loads according to the following soil parameters:

Maximum Allowable Bearing Capacity 100 kPA  
Coefficient of Passive Earth Pressure  $k_p = 3.0$

Because of anticipated settlements of the approach fill due to consolidation of the underlying subsoil as well as the settlements within the approach fill, the construction of the barrier wall should be delayed as long as possible after completion of the embankment.

*M MacLean*

MM:MD:ea

For: M. MacLean  
Project Foundations Engineer  
M. Devata  
Senior Foundations Engineer

cc: C. Bassi  
Att: C. Farrel  
L. Timson



## Memorandum

To: Mr. L. G. Timson,  
Planning & Design Office,  
Eastern Region.

From: Pav't. & Foundation Design Section,  
Engineering Materials Office,  
Room 315, Central Building,  
Downsview, Ontario.

Attention:

Date: 79 11 09

Our File Ref.

In Reply to

Subject:

Re: Bay of Quinte Crossing at Belleville,  
Hwy. 14, District 8, Kingston,  
W.P. 134-74-01, Site 28-28.

It is understood from recent discussions with you that the City of Belleville requires that the lower berm for the north approach fill be 16 metres wide to accommodate their needs. As discussed in our Foundation Investigation Report, an 8 metre wide upper berm and 12 metre wide lower berm is required for stability purposes. As you requested, we have reassessed the stability of the approaches based on the new requirements for the City of Belleville. Our recommendations are as follows.

Behind the centreline of the north abutment bearings, in the transverse direction, an 8 metre wide upper berm and a 12 metre wide lower berm are required for stability purposes. Further, our analysis indicates that an 8 metre wide upper berm with a lower berm of 16 metres wide would also be stable.

Ahead of the north abutment bearings, in the direction of the forward slope, a 6 metre wide upper berm and a minimum of 14 metre wide lower berm are required for stability purposes. Hence, a 6 metre wide upper berm and a 16 metre wide lower berm as required by the city would be stable also in the longitudinal direction.

A smooth transition should be incorporated between the transverse and longitudinal geometry.

If you have any further questions, please do not hesitate to call this office.

MM/MD/cy

c.c. T. C. Kingsland  
K. Bassi  
W. Blum  
Files ✓

*M MacLean*

M. MacLean,  
Project Foundations Engineer.  
For: M. Devata,  
Senior Foundations Engineer.

DISTRICT No 8  
CONT No 80-34  
WP No 134-74-01

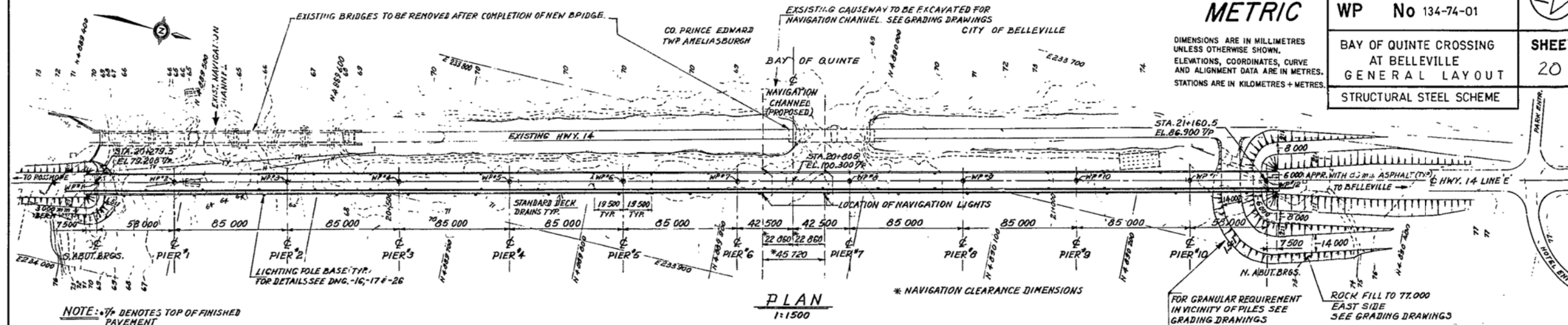


BAY OF QUINTE CROSSING  
AT BELLEVILLE  
GENERAL LAYOUT  
STRUCTURAL STEEL SCHEME

SHEET  
20

METRIC

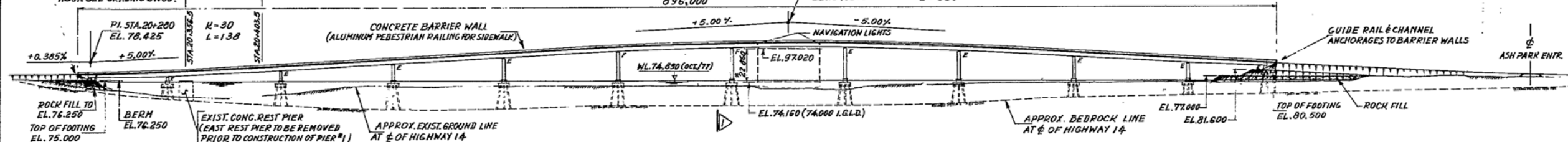
DIMENSIONS ARE IN MILLIMETRES  
UNLESS OTHERWISE SHOWN.  
ELEVATIONS, COORDINATES, CURVE  
AND ALIGNMENT DATA ARE IN METRES.  
STATIONS ARE IN KILOMETRES + METRES.



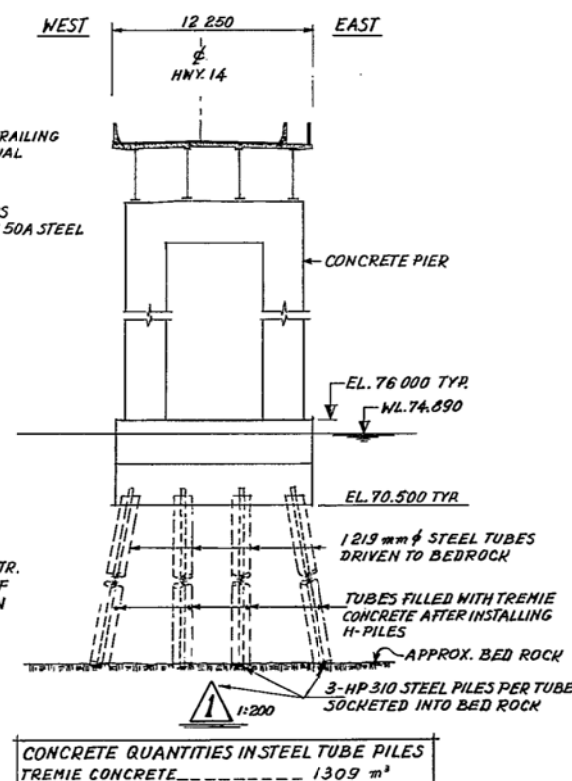
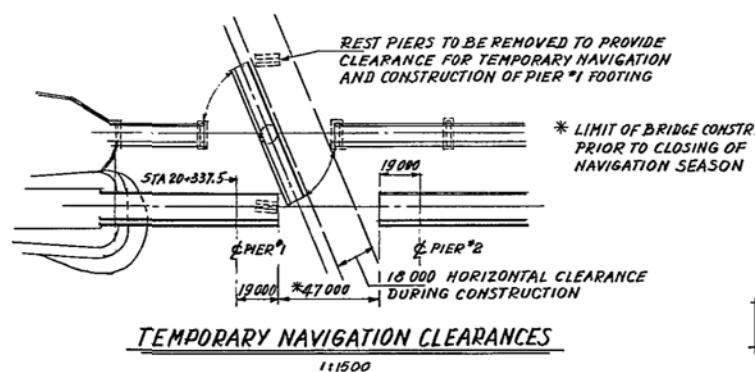
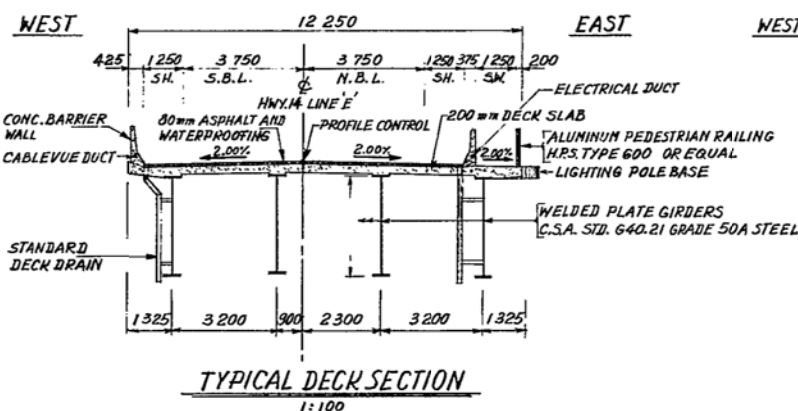
NOTE: \*TP DENOTES TOP OF FINISHED  
PAVEMENT  
\*WP DENOTES WORKING POINT

FOR GRANULAR CORE AT  
ABUT. SEE GRADING DWGS.

STRUCTURAL STEEL IN THIS SECTION OF  
BRIDGE TO BE ERECTED AFTER EXISTING  
CHANNEL HAS BEEN CLOSED FOR NAVIGATION



B.M. 77.438 (GEODETIC DATUM)  
CUT CROSS IN S COLLAR ON  
H&B POLE 76 200 LT 20+138



### LIST OF DRAWINGS

- 28-28-1 GENERAL LAYOUT
- 2A BOREHOLE LOCATIONS & SOIL STRATA
- 2B BOREHOLE LOCATIONS & SOIL STRATA
- 2C BOREHOLE LOCATIONS & SOIL STRATA
- 3 FOOTING LAYOUT
- 4 FOOTING REINFORCEMENT I
- 5 FOOTING REINFORCEMENT II
- 6 SOUTH ABUTMENT
- 7 NORTH ABUTMENT
- 8 PIERS I
- 9 PIERS II
- 10 BEARINGS
- 11 STRUCTURAL STEEL I
- 12 STRUCTURAL STEEL II
- 13 STRUCTURAL STEEL III
- 14 STRUCTURAL STEEL IV
- 15 STRUCTURAL STEEL V
- 16 DECK PLAN
- 17 DECK DETAILS
- 18 DECK SCREED ELEVATIONS
- 19 EXPANSION JOINTS
- 20 WEST BARRIER WALL
- 21 EAST BARRIER WALL
- 22 PEDESTRIAN RAILING
- 23 6 000 mm APPROACH SLAB
- 24 AS CONSTRUCTED ELEV. & DIM.
- 25 STANDARD DETAILS I
- 26 STANDARD DETAILS II
- 27 STANDARD DETAILS III
- 28 ELECTRICAL EMBEDDED WORK
- 29 ELECTRICAL EMBEDDED WORK
- 30 ELECTRICAL GROUNDING LAYOUT
- 31 ELECTRICAL STANDARDS
- 32 CABLEVUE EMBEDDED WORK

### NOTES

#### CLASS OF CONCRETE

DECK, BARRIER WALLS, PIERS & PIER FOOTINGS 30 MPa  
REMAINDER 20 MPa

#### REINFORCING STEEL GRADE

GRADE 400,  
COATED BARS HAVE A SUFFIX 'C'

#### CLEAR COVER TO REINFORCING STEEL

FOOTINGS 75 mm, ABUTMENTS 75 mm, PIERS 75 mm, DECK TOP 50 mm,  
DECK BOTTOM 40 mm, APPROACH SLABS 50 mm.  
UNLESS NOTED OTHERWISE ON DRAWINGS

#### CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE  
BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS  
WITH A TOLERANCE OF  $\pm 3$  mm.

NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT  
BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS  
BEEN PLACED.

TO ACHIEVE THE MINIMUM CLEAR COVER OF 50 mm SPECIFIED  
AT TOP OF DECK, THE TOP LAYER OF REINFORCEMENT  
SHALL BE PLACED PRIOR TO CONCRETING, WITH A CLEAR  
COVER OF  $65 \pm 15$  mm TOLERANCE

### CONCRETE QUANTITIES

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

CONCRETE IN PIERS, ABUTMENTS & WING WALLS 20 MPa	276 m <sup>3</sup>
30 MPa	2804 m <sup>3</sup>
CONCRETE IN DECK	2444 m <sup>3</sup>
CONCRETE IN BARRIER WALLS	416 m <sup>3</sup>
CONCRETE IN APPROACH SLABS	36 m <sup>3</sup>

STRUCTURAL STEEL QUANTITY 2573 TONNES



DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
1	2000	C.F.F.	LOADING 04/8/00-2-79 DATE SET 7/0
2	2000	C.F.F.	SITE No 28-28 DWG 1











LOCATION	BATTER	HP 310x110		STEEL TUBES	
		N <sup>o</sup>	LENGTH	N <sup>o</sup>	LENGTH
S. ABUTMENT	1:3-5	7	5.50	—	—
	1:8	2	5.50	—	—
PIER#1	VERT.	—	—	—	—
	1:4-5	30	7.25	4-25	10
PIER#2	VERT.	—	—	—	—
	1:4-5	30	15.50	12-50	10
PIER#3	VERT.	—	—	—	—
	1:4-5	30	16.00	13-00	10
PIER#4	VERT.	—	—	—	—
	1:4-5	30	14.75	11-75	2
PIER#5	VERT.	—	—	—	—
	1:4-5	30	15.0	12-0	10

LOCATION	BATTER	HP 310x110		STEEL TUBES	
		N <sup>o</sup>	LENGTH	N <sup>o</sup>	LENGTH
PIER#6	VERT.	6	12.75	9-75	2
	1:4-5	36	13.0	10-0	12
PIER#7	VERT.	6	12.50	9-50	2
	1:4-5	30	12.75	9-75	10
PIER#8	VERT.	6	13.50	10-50	2
	1:4-5	30	13.75	10-75	10
PIER#9	VERT.	6	10.25	7-25	2
	1:4-5	30	10.50	7-50	10
PIER#10	VERT.	—	—	—	—
	1:3	8	15.0	—	—
N. ABUTMENT	1:8	2	14.50	—	—
	VERT.	2	19.50	—	—

# NOTES:

- ALL PILES TO BE HP 310x110. ALL STEEL TUBES TO BE 1219 mm O.D. 12.7 mm THICK WALL.
- STEEL TUBE SPACING TO BE MEASURED AT UNDER SIDE OF FOOTING.
- H-PILES IN PIER FOOTINGS TO BE SOCKETED INTO SOUND BEDROCK AS SHOWN.
- LENGTHS OF H-PILES & STEEL TUBES GIVEN IN TABLE ARE THE THEORETICAL LENGTHS BELOW CUT-OFF.
- H-PILES IN ABUTMENT FOOTINGS TO BE DRIVEN TO SOUND BEDROCK.

# METRIC

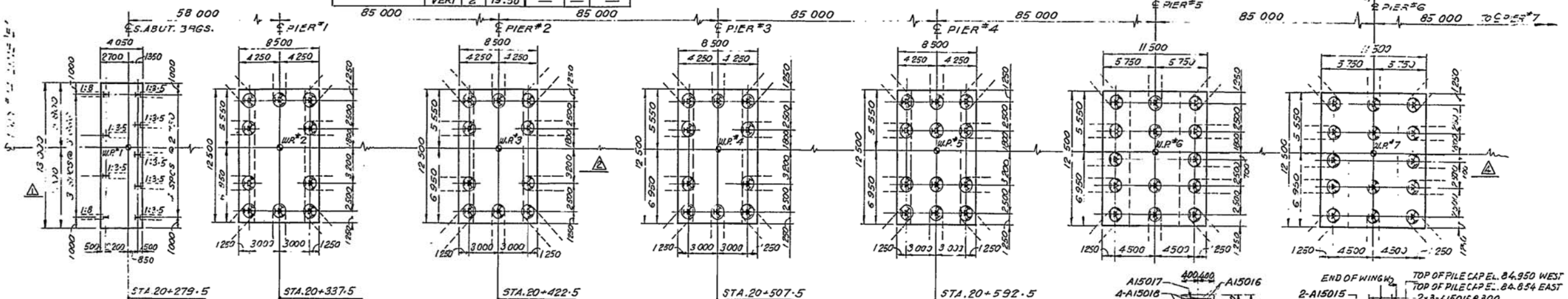
DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN. ELEVATIONS, COORDINATES, CURVE AND ALIGNMENT DATA ARE IN METRES. STATIONS ARE IN KILOMETRES+METRES.

DIST. No 8  
CONT No 80-34  
WP No 134-74-01

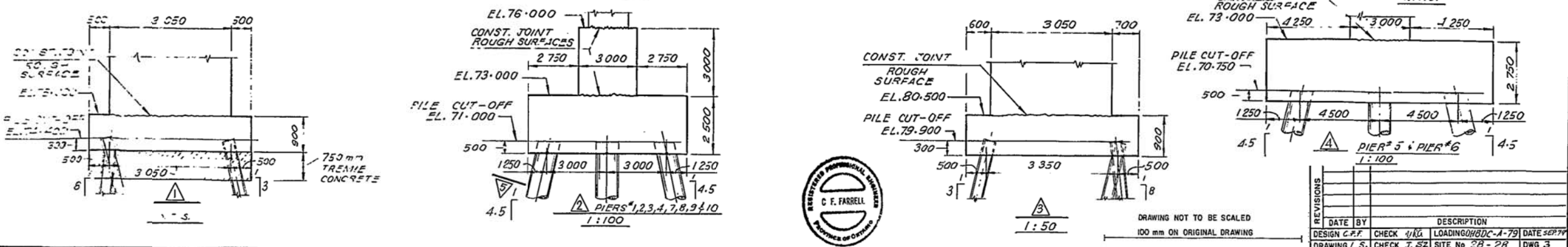
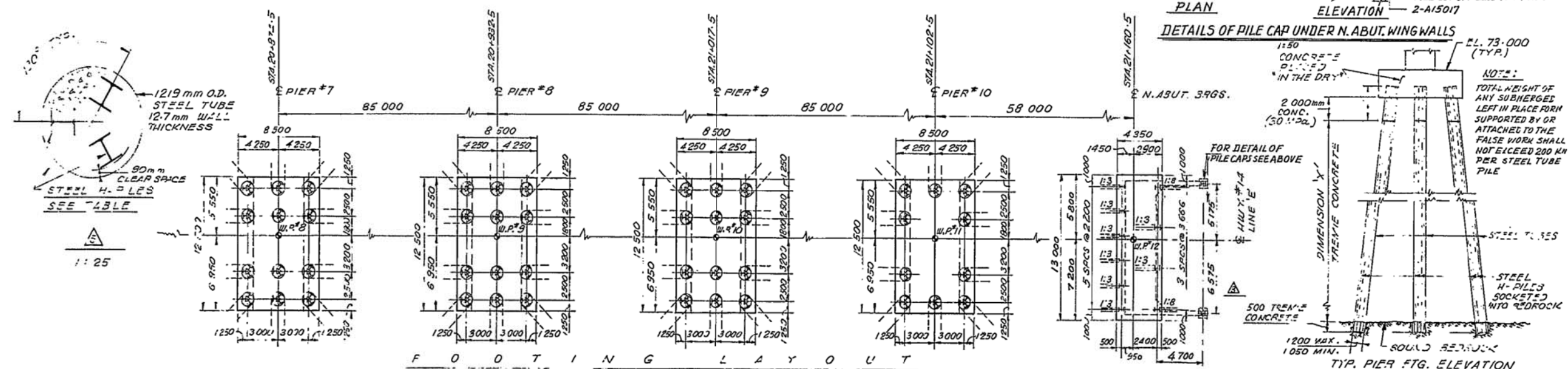
SAY OF QUOTE CROSSING  
AT BELLEVILLE  
FOOTING LAYOUT

SHEET  
21

STRUCTURAL STEEL SCHEMATIC



NOTE: ALL OUTSIDE STEEL TUBES BATTERED 1:4.5



DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN C.F.F.	CHECK J.S.	LOADING/HDC-A-79	DATE SEP 79
DRAWING L.S.	CHECK J.S.	SITE No 28-28	DWG 3



Appendix B

Site Photographs



**West Side of Norris Whitney Bridge looking north from south shore**



**West Side of Norris Whitney Bridge looking south from north abutment, showing the existing causeway (former crossing)**





**Looking north from north side of navigation channel**



**Looking south from north side of navigation channel**



**North approach embankment, east side, looking south**



**North approach embankment, east side, looking north**





**Drain outlet on east side of north embankment; possible minor erosion**



**North approach embankment, west side, looking south**





**North abutment**



**North approach looking north; possible approach settlement**



**Pier adjacent to north shore, showing rock protection along shoreline**



**South abutment, west side, showing rock protection along shoreline**





**South approach, west side, looking north**



**South abutment, east side, looking south**