

DOCUMENT MICROFILMING IDENTIFICATION

6-1-76 SEP 1976  
GEOCRES No. 41K-34

DIST. 18 REGION NORTHWESTERN

W.P. No. 903-72-06

CONT. No. 75-113

W. O. No.

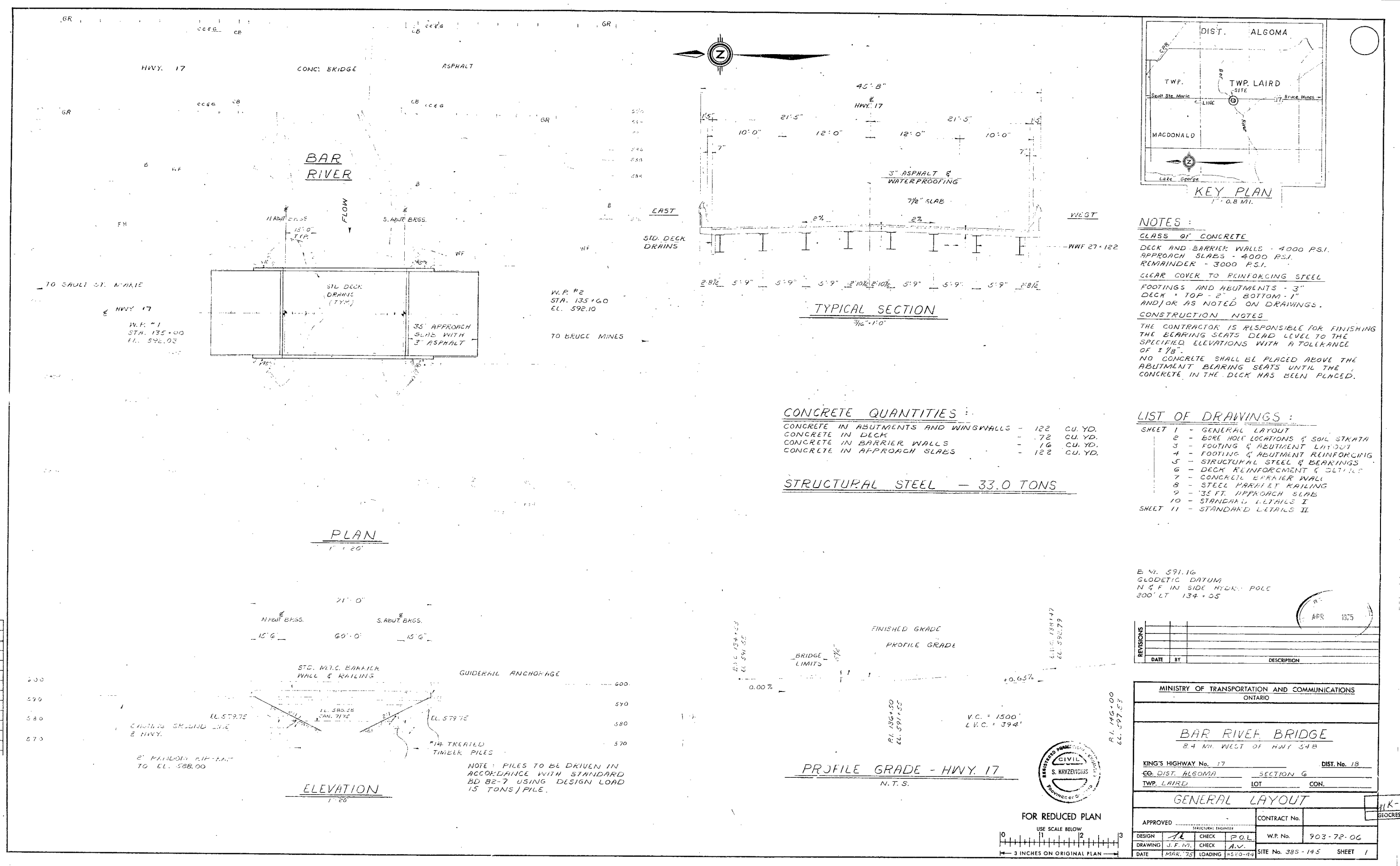
STR. SITE No. 385-145

HWY. No. 17

LOCATION 1-ING AT BAR R. AND  
HWY. 17

ATTACHE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 2

REMARKS: DRAWINGS TO BE UNFOLDED  
BEFORE MICROFILMED



**NOTES:**

**CLASS OF CONCRETE**  
DECK AND BARRIER WALLS - 4000 P.S.I.  
APPROACH SLABS - 4000 P.S.I.  
REMAINDER - 3000 P.S.I.

**CLEAR COVER TO REINFORCING STEEL**  
FOOTINGS AND ABUTMENTS - 3"  
DECK - TOP - 2", BOTTOM - 1"  
AND/OR AS NOTED ON DRAWINGS.

**CONSTRUCTION NOTES**  
THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF  $\pm 1/8"$ .  
NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

**CONCRETE QUANTITIES:**

CONCRETE IN ABUTMENTS AND WINGWALLS	-	122	CU. YD.
CONCRETE IN DECK	-	72	CU. YD.
CONCRETE IN BARRIER WALLS	-	16	CU. YD.
CONCRETE IN APPROACH SLABS	-	122	CU. YD.

**STRUCTURAL STEEL - 33.0 TONS**

**LIST OF DRAWINGS:**

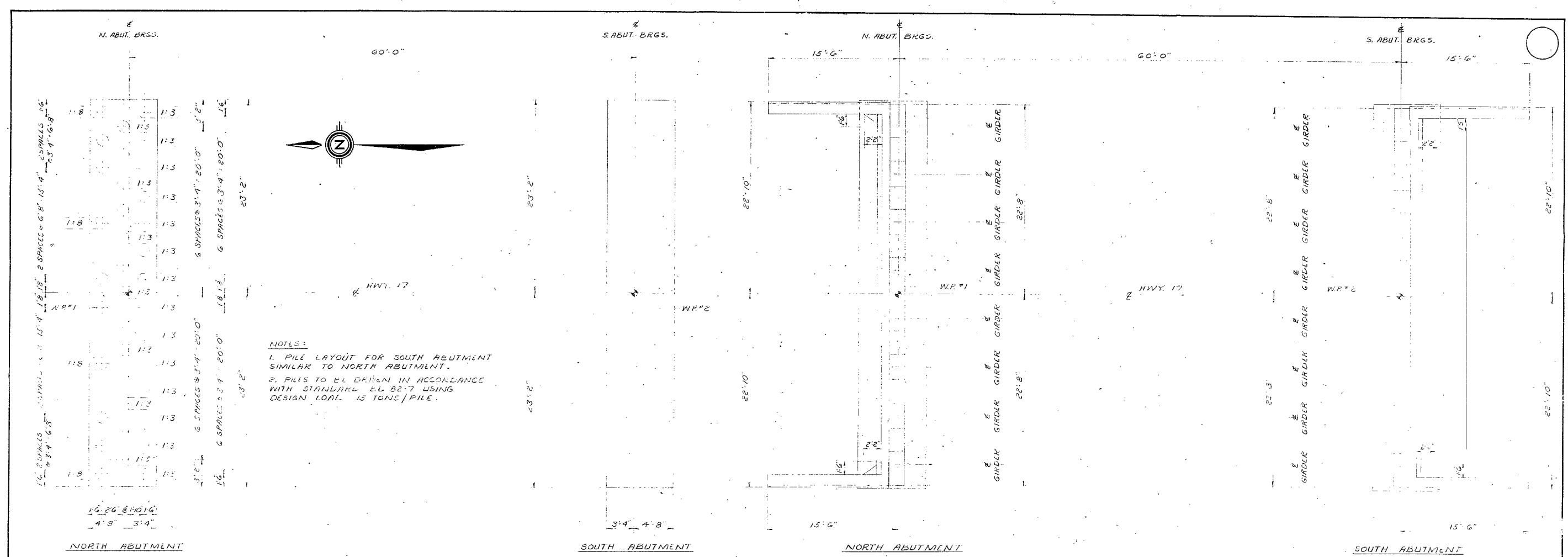
SHEET 1	-	GENERAL LAYOUT
2	-	BORE HOLE LOCATIONS & SOIL STRATA
3	-	FOOTING & ABUTMENT LAYOUT
4	-	FOOTING & ABUTMENT REINFORCING
5	-	STRUCTURAL STEEL & BEARINGS
6	-	DECK REINFORCEMENT & DETAILS
7	-	CONCRETE BARRIER WALL
8	-	STEEL BARRIER RAILING
9	-	35 FT. APPROACH SLAB
10	-	STANDARD DETAILS I
SHEET 11	-	STANDARD DETAILS II

B.M. 591.16  
GLOTTIC DATUM  
N & F IN SIDE HYDRA. POLE  
200' LT 134+05

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO			
BAR RIVER BRIDGE 8.4 MI. WEST OF HWY 348			
KING'S HIGHWAY No. 17		DIST. No. 18	
CO. DIST. ALGOMA		SECTION G	
TWP. LAIRD		CON.	
GENERAL LAYOUT			
APPROVED _____ STRUCTURAL ENGINEER		CONTRACT No. _____	
DESIGN J.F.M. CHECK P.O.L.		W.P. No. 903-72-06	
DRAWING J.F.M. CHECK A.V.		SITE No. 385-145 SHEET 1	
DATE MAR. 75		LOADING 4520-44	

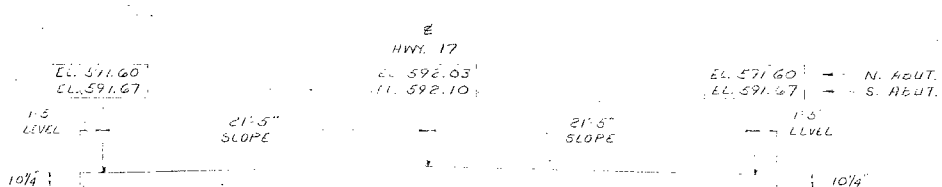
PRINT RECORD	No.	FOR	DATE



**PILE & FOOTING LAYOUT**

LOCATION	PILE TYPE	NO. REQ'D	PILE LENGTH	DESIGN LOAD
NORTH ABUTMENT	"14 TREATED TIMBER	37	55'-0"	15 TONS/PILE
SOUTH ABUTMENT	"14 TREATED TIMBER	37	55'-0"	15 TONS/PILE

**ABUTMENT LAYOUT**



**W.W. SECTION**

**W.W. ELEVATION**

**ABUT. SECTION**

SCALE: 3/16" = 1'-0" UNLESS NOTED OTHERWISE

PRINT RECORD	No.	FOR	DATE

REVISIONS	DATE	BY	DESCRIPTION

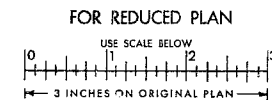
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS  
ONTARIO

**BAR RIVER BRIDGE** 41K-39  
8.4 MI. WEST OF HWY. 548

KING'S HIGHWAY No. 17 DIST. No. 18  
EQ. DIST. ALGOMA SECTION 2  
TWP. LAIRD LOT CON.

**FOOTING & ABUTMENT LAYOUT**

APPROVED	STRUCTURAL ENGINEER	CONTRACT No.
DESIGN	CHECK	W.P. No.
DRAWING	CHECK	903-72-06
DATE	LOADING	SITE No. 385-145 SHEET 3



W.O.

V.P.

LOCATION

GEOCRES NO.

● DATA ON FILE IN SOIL MECHANICS SECTION

REFER TO: CONTINENT 74 113

REMARKS

GEOCRES

INDEXING CARD FOR REPORTS NOT MICROFILMED

GI-20

AUG. 74



Memorandum

W P 903-72-06

To: Mr. C. Mirza  
Principal Foundation Engineer  
Geotechnical Office  
Downsview, Ontario

From: Structural Planning Section  
Northwestern Region

Attention: Mr. M. Doyt

Date: February 26, 1975

Our File Ref.

In Reply to

Subject: Shewfelt Creek Bridge, W.P. 903-72-07, Site No. 38S-285  
Bar River Bridge, W.P. 903-72-06, Site No. 38S-145  
Hwy. 17, District 18, Sault Ste. Marie

This is to request a foundation investigation and reports to be carried out for the above sites, as soon as possible.

Enclosed please find E-plan with proposed footing locations indicated in pencil.

Due to difficulties with plane travel, we have not been able to carry out a field reconnaissance, or take photographs of the site. We suggest that they be forwarded when available, or that the necessary data be obtained by your representative, Mr. Shah in Echo Bay.

The projects have already been discussed with Mr. A. Radkowski, who will undertake to draw a preliminary plan for Bar River based on data already available. Please verify footing locations with him.

H. J. Doyt

H. J. Doyt  
REGIONAL STRUCTURAL  
PLANNING SUPERVISOR

HJD/em  
Attach.

cc: Mr. I. G. Maluzynsky  
Mr. A. Radkowski





## Memorandum

To: Mr. B. J. McKenna,  
Reg. Structural Planning Eng.,  
Northwestern Region,  
Thunder Bay, Ontario.

From: Structural Office,  
West Building, Downsview.

Attention:

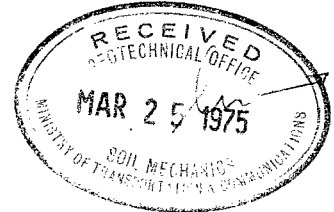
Date: March 24, 1975.

Our File Ref.

In Reply to

Subject:

Bar River Bridge,  
W.P. 903-72-06, Site 38S-145,  
Highway 17, District 18.



Attached herewith are prints of the Preliminary Bridge Plan Drawing 38S-145-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$115,000.00 which includes tender, materials, engineering and sundry construction.

Any comments or revisions you may have should be submitted at your earliest convenience.

We have also sent a copy of the Preliminary Plan to the Hydrology Office for their comments.

CSG/cf  
Encl.

C. S. Grebski,  
Structural Design Engineer.

c.c. B. R. Davis  
W. D. Birch  
A. E. McKim  
A. Radkowski  
M. Stoyanoff  
C. Mirza  
J. Harris  
J. Anderson  
N. Maluzynsky  
S. Edwards

*Replied in a memo on April 1, 1975*

*H. Shah*

*Preliminary drawing discarded after  
reviewing final*

*April 15/75*



## Memorandum

To: Mr. C. Mirza,  
Head, Soils Mechanics Section,  
West Building, Downsview.

From: Structural Office,  
West Building, Downsview.

Attention:

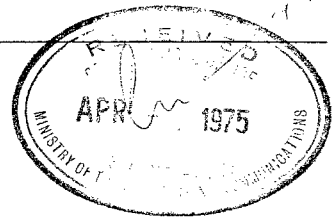
Date: March 27th, 1975.

Our File Ref.

In Reply to

Subject:

Bar River Bridge,  
W. P. 903-72-06, Site 38S-145,  
Highway 17, District #18.



Attached herewith we are submitting the final bridge drawings  
which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

CSG/cf  
Atch.

C. S. Grebski,  
Structural Design Engineer.

*Replied in a memo dated April 17/75*

Mr. C. S. Grebski  
Structural Design Engineer  
West Building, Downsview

Soil Mechanics Section  
Geotechnical Office

April 1, 1975

W.P. 903-72-06

BAR RIVER BRIDGE  
W.P. 903-72-06, Site 38S-145  
Hwy. 17, Dist. 18


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The preliminary drawing sheet PP1 for the above-mentioned site indicates a revised profile grade from the one shown on pre-preliminary drawing sheet PP1. Since there is a slight increase in the profile grade, additional analyses are being carried out to determine the stability of the proposed 2:1 slopes in the longitudinal direction. We will forward to you our comments with regards to this aspect as soon as possible.

#14 treated timber piles driven to a tip elevation of 525 (approx. 55 ft. long) can be designed for a safe load of 15 tons/pile. Since these piles are friction piles driven into the cohesive clay stratum, pile driving during construction need not be controlled by the Standard BD 82-7, but should be driven to the above-mentioned tip elevation.

H. SHAH  
Project Engineer.

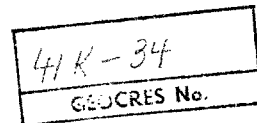
for: M. DEVATA  
Supervising Engineer.

c.c. D. Aspinwall  
Files   
Record Services





## Memorandum



To: Mr. B. J. McKenna (2)  
Regional Structural Planning Engr.  
Northwestern Region  
Thunder Bay

From: Soil Mechanics Section  
Geotechnical Office  
West Building, Downsview

Attention:

Date: April 11, 1975

Our File Ref. W.P. 903-72-06

In Reply to

APR 14 1975

Subject:

### FOUNDATION INVESTIGATION REPORT

for

Proposed Structure Crossing  
at Bar River & King's Hwy. 17 (E.B.L.)  
Twp. of Laird, District #18, Sault Ste. Marie  
Site 38S-145, W.P. 903-72-06  
*C.ONT. 75-113*

Attached we are forwarding to you our detailed Foundation Investigation Report on the subsoil conditions existing at the above-mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

M. DEVATA  
Supervising Engineer.

c.c. E. J. Orr  
B. R. Davis  
W. L. Lees  
G. E. French  
B. J. Giroux  
R. Morgenroth  
G. A. Wrong  
P. Lewycky  
McCormick, Rankin & Assoc. Ltd., Attn: J. Sutherns

Files  
Record Services

J. Anderson )  
N. G. Maluzinsky ) memo only

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the Approaches
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7. MISCELLANEOUS

# FOUNDATION INVESTIGATION REPORT

for

Proposed Structure Crossing  
at Bar River & King's Hwy. 17 (E.B.L.)  
Twp. of Laird, District #18, Sault Ste. Marie  
Site 38S-145, W.P. 903-72-06

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## 1. INTRODUCTION

It is proposed that the present two-lane Hwy. 17 between Desbarats and Sault Ste. Marie be widened to four lanes. Another structure over Bar River, about 125 ft. west of the present bridge, will be required to accommodate the future Hwy. 17 (E.B.L.) in this area. Mr. H. Dost, Regional Structural Planning Supervisor, Northwestern Region, requested the Soil Mechanics Section, in his memorandum dated February 26, 1975, to carry out a foundation investigation. Presented here are our findings from the field investigations, laboratory testing, and our recommendations pertaining to the foundation of the proposed structure and immediate approaches.

## 2. SITE AND GEOLOGY

The site is located just south of Echo Bay in the Twp. of Laird, approximately 3.2 miles south of the junction of Hwy. 17 & Hwy. 638. The surrounding area is generally flat and is utilized for agricultural purposes. Bar River meanders in this area, and flows in an east-west direction draining into Lake George. At the proposed structure location, the river is about 40 ft. wide and, at the time of the investigation, the ice level surface was found to be at elev. 581.0. The river banks above the ice level were observed to be 6 to 7 ft. high with natural slopes of about 4 to 1.

Artesian wells located at Sta. 134+45 (31' lt.) and at Sta. 136+05± (32' rt.) are, according to a local resident, encountered at elev. 409± and elev. 416± respectively. Artesian flow from each well is about 500 gallons per day and is used for domestic purposes.

The existing single span structure where Hwy. 17 crosses over Bar River is supported on wooden piles. The profile grade at the structure location is about 590.4. Overall, the existing structure appears to be in sound condition.

The area geologically is located in the Canadian Shield. The overburden consists of highly compressible lacustrine clay of variable thickness. The bedrock in this area was originally of a lacustrine nature, folded and faulted by earth forces, and eventually worn down by glacial action to a moderate relief. Bedrock does not outcrop within the site locality and, according to a local well driller, bedrock could be as deep as 300 ft. in this general area.

### 3. FIELD AND LABORATORY WORK

Two sampled boreholes and one dynamic cone penetration test were put down during the course of the investigation. Disturbed samples were obtained with a 2-inch O.D. split-spoon sampler driven according to the specifications of the Standard Penetration Test with a driving energy of 350 ft. lbs. per blow. The same method was used for the dynamic cone penetration test. "Undisturbed" samples were obtained by using 2-inch I.D. Shelby tubes pushed hydraulically into the soil.

The locations of the boreholes and the dynamic cone penetration test are shown on Drawing No.9037206-A. Also shown on this Drawing is the inferred soil profile along the centerline of the proposed alignment. A detailed log for each boring is given on the Record of Borehole Sheets following the text of this report.

The samples were examined visually in the field and in the laboratory. Selected samples were analysed in the laboratory to determine the following soil properties:

- Liquid Limit
- Plastic Limit
- Moisture Content
- Grain-size Distribution
- Organic Content
- Unconfined Shear Strength
- Bulk Density
- Consolidation Characteristics

The results of the field and laboratory investigations are summarized on the Record of Borehole Sheets, Plasticity Chart (Fig. 1), Grain-size Distribution envelope for the clay deposit (Fig. 2) and, a Shear Strength vs. Elevation graph (Fig. 3).

The borehole locations were surveyed by the personnel from District Construction Surveys, Sault Ste. Marie. The elevations are referenced to the Geodetic Datum.

Our subsoil sampling was terminated well above the possible artesian conditions so as not to disturb the artesian flow which is used by the local residents for their water supply.

#### 4. SUBSOIL CONDITIONS

##### (4.1) General

The subsoil at the site on either side of the river bank consists of a thin layer (6" to 8") of sandy or silty topsoil, followed by 4.5 to 7 ft. of very loose to loose non-cohesive stratum of sandy silt with traces of organics extending down to approximately elev. 578.0. This granular stratum is underlain by an extensive deposit of soft to stiff clay with occasional seams or pockets of silt. The clay deposit extends at least to a maximum depth of 140 ft. and 100 ft. below the north and south banks of the river respectively.

##### (4.2) Sandy Silt, Traces of Organics

Immediately beneath a thin layer of topsoil is a non-cohesive stratum of sandy silt with traces of organics. Occasional gravel is also found within this material encountered in B.H. 2. The thickness of this zone ranges from 4.5 ft. (B.H. 2) to 7.0 ft. (B.H. 3) and extends to elev. 578.3 and 578.5 respectively. Based on the standard penetration tests, the relative density of this material is estimated to be loose to very loose.

##### (4.3) Clay, Occasional Seams or Pockets of Silt

The granular stratum is underlain by the clay deposit. The lower boundary of this stratum was not established since the borings were terminated at a depth of 140 ft. (B.H. 2) and 100 ft. (B.H. 3)

below the ground surface. Within this deposit, random seams up to 1/8 inch thick or pockets of silt were also encountered. Grain-size distribution in an envelope form is shown on Fig. 2.

The engineering properties of this stratum as determined by the field and laboratory testing are as follows:

	<u>Range</u>	<u>Average</u>	
Bulk Density ( $\gamma$ p.c.f.)	92 - 108	96	
Liquid Limit ( $W_L$ %)	71 - 90	84	
Plastic Limit ( $W_p$ %)	25 - 33	29	
Natural Moisture Content (W %)	51 - 88	82	
Undrained Shear Strength (p.s.f.)			<u>Sensitivity</u>
- Field Vanes	320 - 2000+	600	2.2 - 8.3 (Avg 4.9)
- Lab Tests	130 - 415	240	-

The Atterberg Limit tests, summarized above, are also plotted on the Plasticity Chart, Fig. 1. These results indicate that the clay is of high plasticity and in general inorganic. The undrained shear strengths obtained from the laboratory testing gave consistently lower values than those obtained from the field vane tests. It is considered that this is primarily due to unavoidable sample disturbance caused by the shipping of the samples, field and laboratory handling and subsequent testing. In view of this, in our opinion, the results from the field vane tests are more reliable. A plot of Shear Strength vs. Elevation is shown on Fig. 3. The inferred stratigraphical profile, along the centerline of the proposed alignment, is plotted on Drawing No.9037206-A.

## 5. GROUNDWATER CONDITIONS

Groundwater level observations were carried out during the time of the field investigation. The water levels noted were about 1 to 1.5 ft. below ground surface at elev. 582.0 and 584.0 for B.H.s 2 & 3 respectively. The ice level in the river was at elev. 581.0. The locations of the artesian wells constructed by the local residents in the general vicinity of the proposed structure and, the depths at which artesian conditions are believed to exist, are also shown on Drawing No.9037206-A.

## 6. DISCUSSION AND RECOMMENDATIONS

### (6.1) General

At this location the proposed Hwy. 17 E.B.L. will run in a north-south direction parallel to and about 125 ft. west of  $\frac{1}{2}$  of the existing Hwy. 17 which will be designated as W.B.L. According to present proposals, the new E.B.L. structure over Bar River will be a single span structure with a clear span of about 60 ft. The profile grade for the E.B.L. Hwy. 17 at the structure location will be at about elev. 592. This indicates that the approaches will have a maximum height of about 17 ft. above the river bed (approximately elev. 575) in the longitudinal direction, and embankments up to 8 ft. high in the transverse direction.

Subsoil at the site consists of about a 6" layer of topsoil, followed by very loose to loose deposit of sandy silt with traces of organics. Below the granular stratum (approximately elev. 578), the predominant deposit of soft to stiff clay is encountered, extending to at least a depth of 140 ft. below the ground surface.

### (6.2) Stability and Settlement Considerations of the Approaches

Stability analyses, in terms of total stresses have been carried out, both in the longitudinal and transverse directions with the following assumptions for the fill material: Granular type,  $\phi = 30^{\circ}$ ,  $\gamma = 130$  p.c.f. The shear strengths for the clay stratum used were obtained from Fig. 3. Based on the stability analyses, it is concluded that the fills constructed to profile grade (approximately elev. 592) with 2 horizontal to 1 vertical slopes will be stable, both in the longitudinal and transverse directions. It should be noted that any raise in the profile grade may result in unstable conditions and berms may be required, especially in the longitudinal direction, to ensure the stability. Thus, further stability analyses should be carried out if any grade revisions are proposed.

The underlying highly compressible clay stratum will undergo settlement due to consolidation over a long term period under the weight of the approach embankments. The maximum consolidation settlement will be where the height of the fill is about 8 ft. above the

ground surface in the transverse direction. It is estimated that this settlement could be as much as 12 to 15 inches under the centerline of the embankment. About 40% of this settlement will occur in the first 1 to 2 years. It would be advantageous therefore to construct the embankments first and leave them in place for as long as possible prior to the construction of the structure. In any event, the final paving should be delayed for as long a period as possible.

### (6.3) Structure Foundations

The presence of soft to stiff stratum of clay precludes the possibility of spread footing type foundations. It is therefore recommended that the foundations for the proposed single span structure abutments be supported on friction piles. No.14 timber piles driven to tip elev. 525 (approximately 55 ft. long) will provide an allowable load of 15 tons per pile. The pile driving during construction should not be controlled by means of the Hiley Formula, and should be driven to the predetermined tip elev. (elev. 525), since these are friction piles driven into the clayey subsoil.

Due to settlement of the proposed roadway embankments, some negative skin friction forces can be imposed on the timber piles supporting the abutments. These forces, combined with movement of the subsoil due to strains imposed by the embankment loading, will generally tend to displace the piles and can cause rotation of the abutments. In view of this, we recommend that consideration be given to supporting the extreme ends of the wing walls on friction piles, founded as aforementioned. It is considered that this will improve the stability of the embankments in the longitudinal direction. In addition, no bouldery or rock fill should be placed in areas where piles are to be driven. Pile caps for the abutments should be founded at sufficient depth below finished grade so as to ensure adequate frost protection.

An earth pressure coefficient of  $K_a = 0.35$  is to be used in calculating the active earth pressure acting on the abutment walls due to the placing of backfill material consisting of free-draining



granular material as per current M.T.C. Standards. Provisions for drainage from this material should be made to ensure that no excess hydrostatic or ice pressures are built up behind the walls.

Any inflow of water which may enter the pile cap excavations may be controlled by pumping from sumps. It may be necessary to construct a temporary earth dyke to prevent the river water from entering the pile excavation area.

Protective measures against scour, due to river erosion, should be provided. Recommendations pertaining to this aspect should be obtained from the Hydrology Section.

## 7. MISCELLANEOUS

The field work, performed between March 11 and March 15, 1975, was supervised by Mr. H. Shah, Project Engineer.

The equipment used was owned and operated by Master Soil Investigations Ltd.

This report was written by Mr. M. MacLean and Mr. H. Shah, Project Engineers, and was reviewed by Mr. M. Devata, Supervising Engineer.

*H. Shah*

H. SHAH  
Project Engineer.

*M. Devata*

M. DEVATA  
Supervising Engineer.

April 1975

## APPENDIX





## RECORD OF BOREHOLE No 2 SHEET 1 of 2

W.P. 903-72-06

LOCATION STA: 134+98.5 25' LT of Q E.B.L. (BAR RIVER)

ORIGINATED BY HS

DIST. 18 HWY. 17

BORING DATE MARCH 12, 1975

COMPILED BY MM

DATUM GEODETIC

BOREHOLE TYPE HOLLOW STEM AUGER

CHECKED BY C.M.C. *B*

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	$w_p$	$w$	$w_L$		
582.8	GROUND LEVEL															
0.0	TOPSOIL															
578.3	Sandy silt, trace of org. V. Loose		1	SS	3	582.0										2.51% org.
4.5	Silty Clay		2	SS	2	580										0.5% org.
	Clay, Occasional seams or pockets of silt Soft to Firm Reddish Brown		3	TW	PH										107.5	0 0 14 86
			4	SS	1/18"	570									93	0 0 17 83
			5	TW	PH											
			6	SS	1/18"	560										
			7	TW	PH										97	
			8	SS	2	550										
			9	TW	PH										97	0 0 10 90
			10	SS	2	540										
			11	TW	PH	530										
						520										
						510										
						500										
						490										
						480										
482.8																
100.0	Continued on following page															

RECORD OF BOREHOLE No 2 (Continued) SHEET 2 of 2

W.P. 903-72-06

LOCATION STA: 134+98.5 25' LT. of Q.E.B.L. (BAR RIVER)

ORIGINATED BY HS

DIST. 18 HWY. 17

BORING DATE MARCH 12, 1975

COMPILED BY NM

DATUM GEODETIC

BOREHOLE TYPE HOLLOW STEM AUGER

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER	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	$w_p$	$w$	$w_L$		
482.8						ELEV.	400	800	1200	1600	2000					GR. S.A. SI. CL.
100.0	Clay - Firm Reddish Brown to Grey					480			+S=2.2	+S=2.8						
						470										
						460			+S=3.3	S=2.7						
						450										
442.8																
140.0	End of Borehole					440										
	NOTE: Borehole was terminated to avoid the Artesian conditions existing at Elev. 409 $\frac{1}{2}$ . The conditions were encountered in well adjacent to the borehole.															

W.P. 903-72-06

LOCATION STA: 135 + 72 Q E.B.L. (BAR RIVER)

ORIGINATED BY H.S.

DIST. 18 HWY. 17

BORING DATE MARCH 14, 1975

COMPILED BY M.M.

DATUM      GEODETIC

BOREHOLE TYPE HOLLOW STEM AUGER

CHECKED BY C. Mc

15  $\phi$  5 % STRAIN AT FAILURE

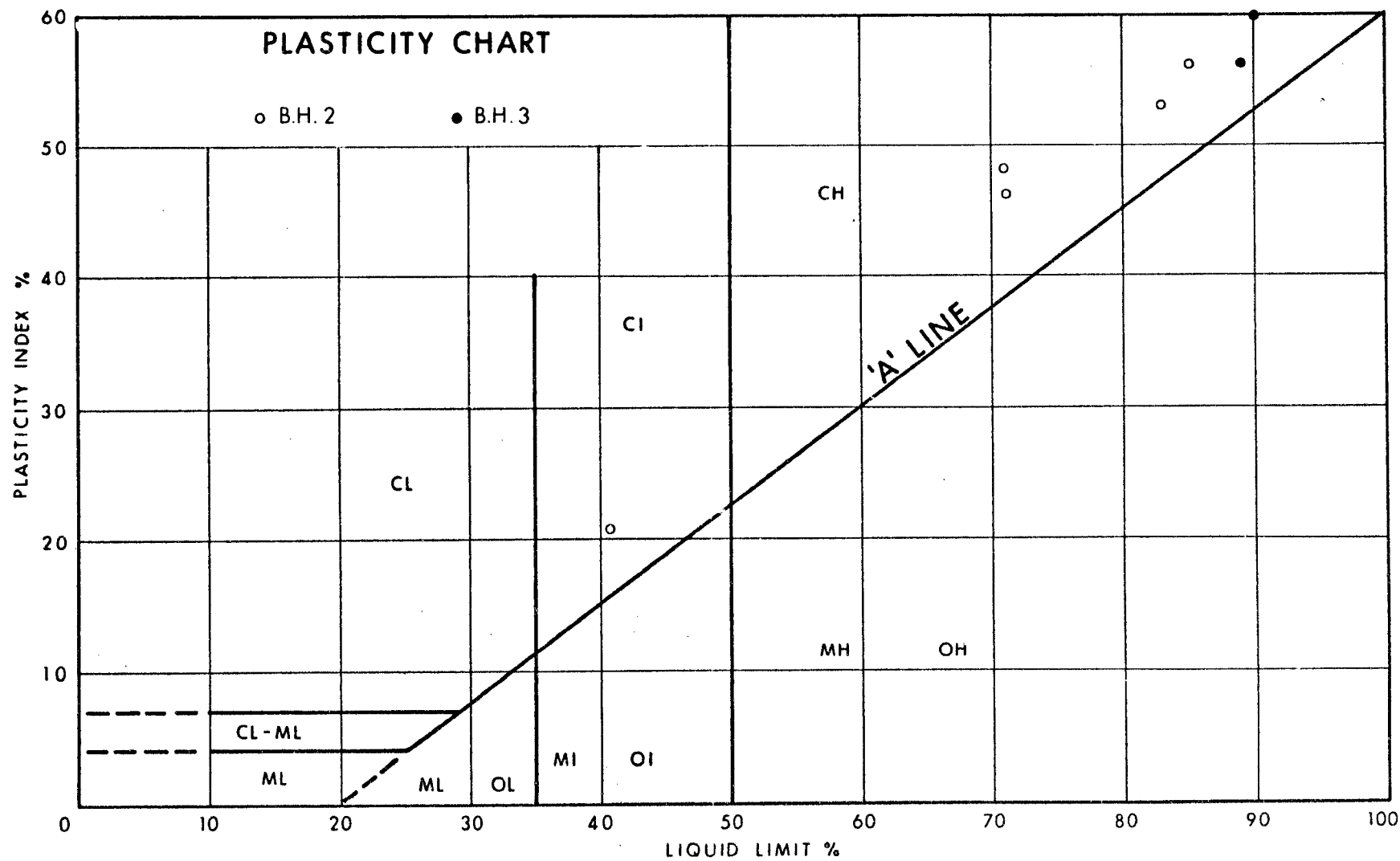


FIG. 1



# GRAIN SIZE DISTRIBUTION

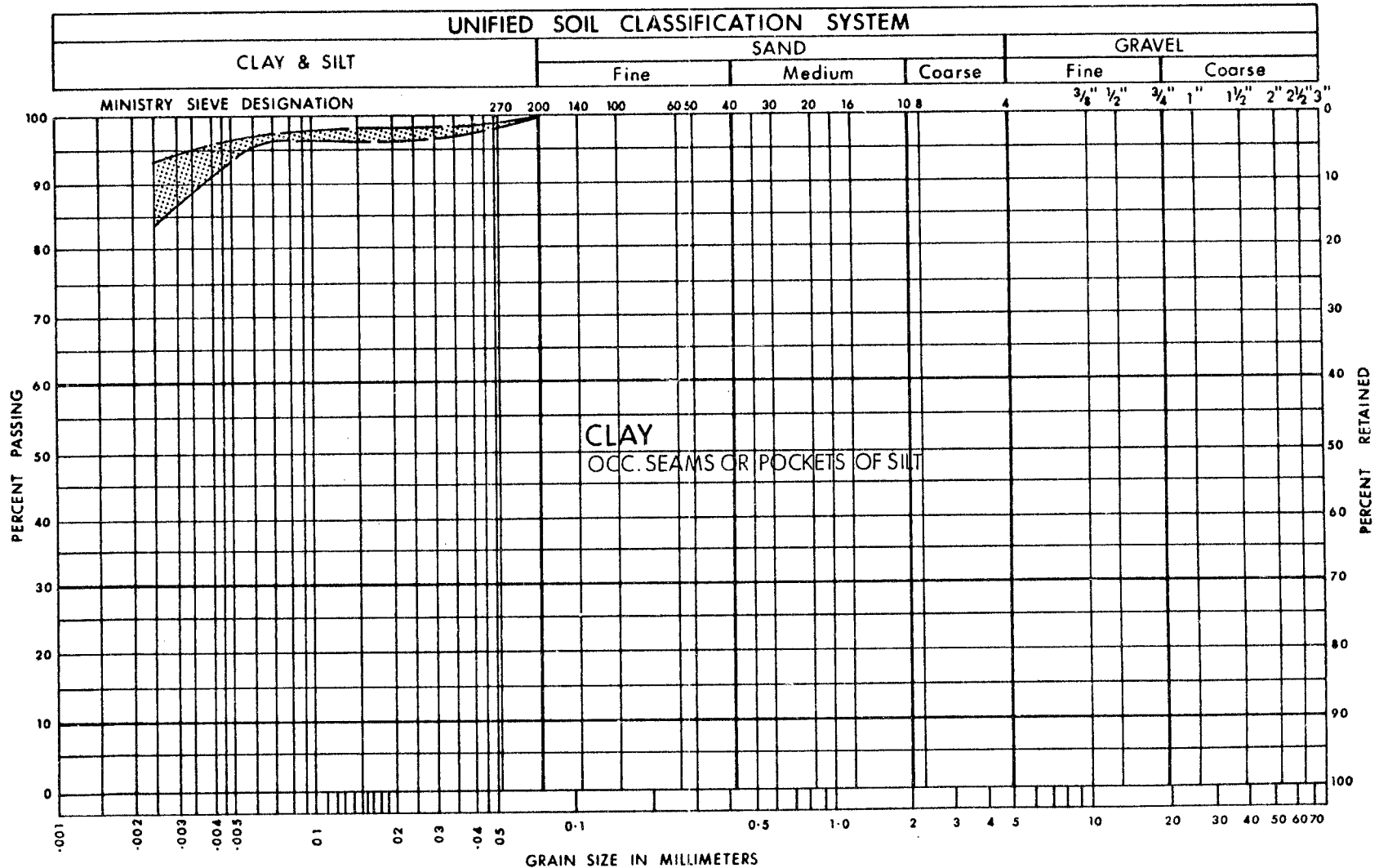


FIG. 2

# SHEAR STRENGTH Vs ELEVATION

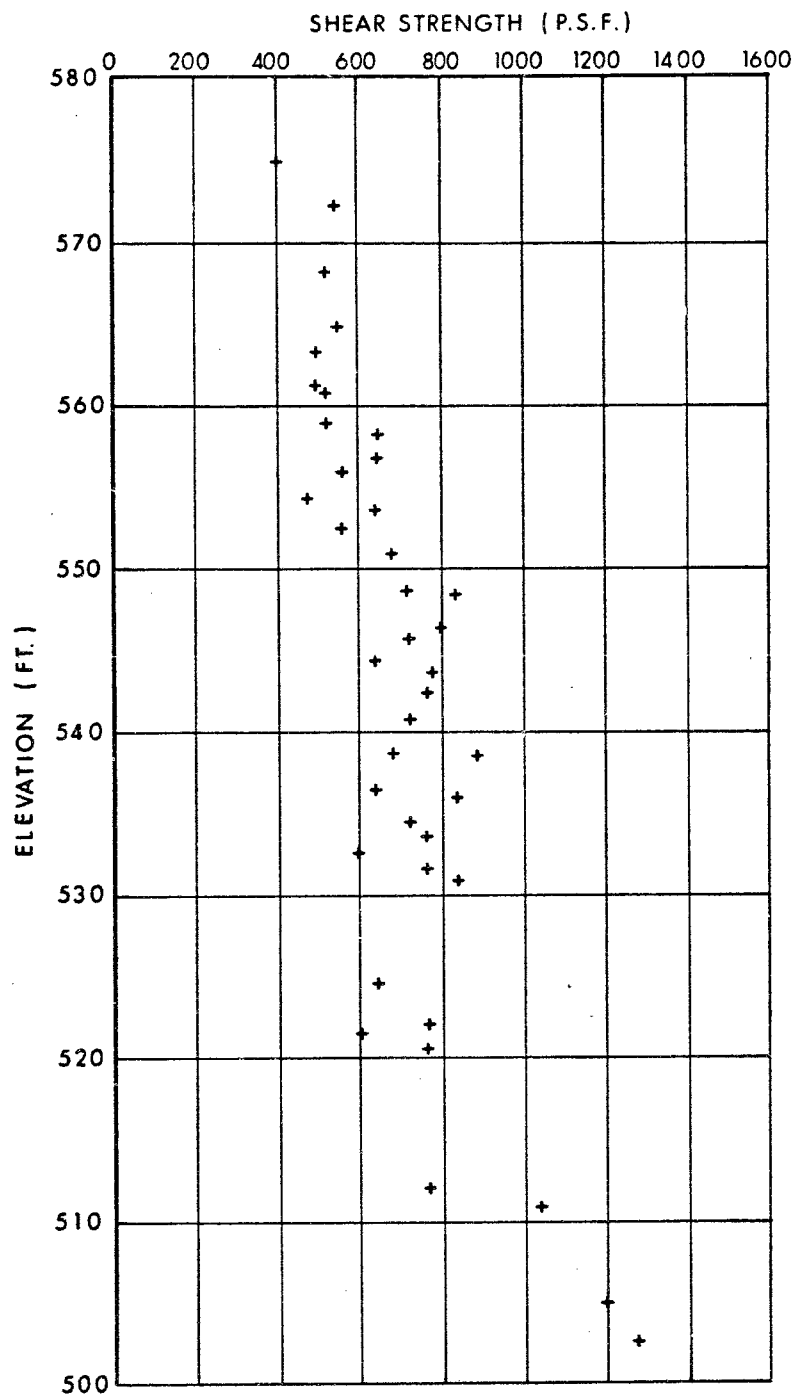


FIG. 3

WP. 903-72-06

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTPENETRATION 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 COMESIONLESS 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
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_r$	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
$\bar{\sigma}$	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

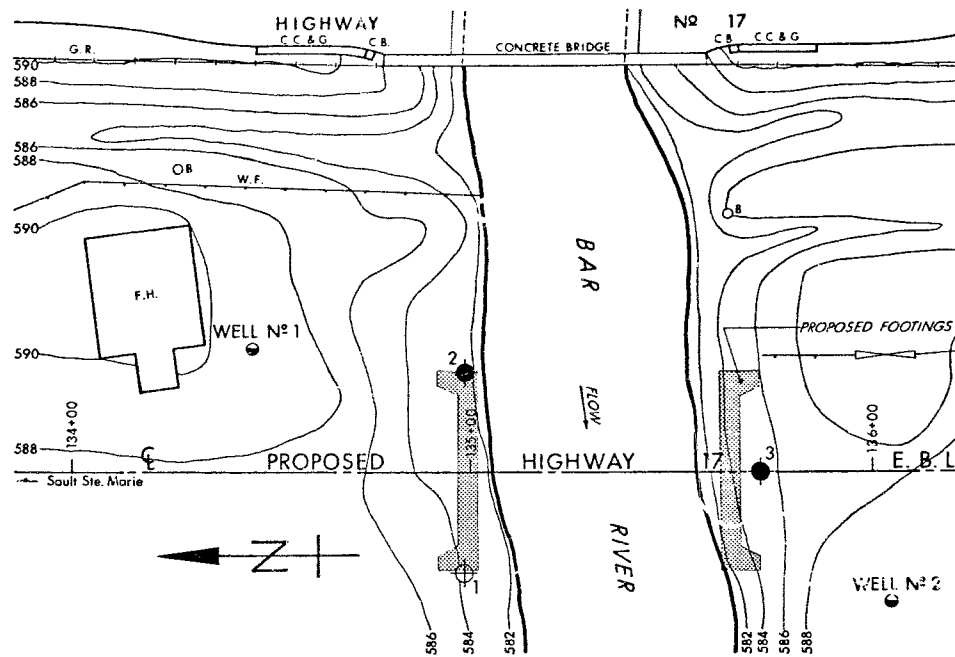
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

## 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

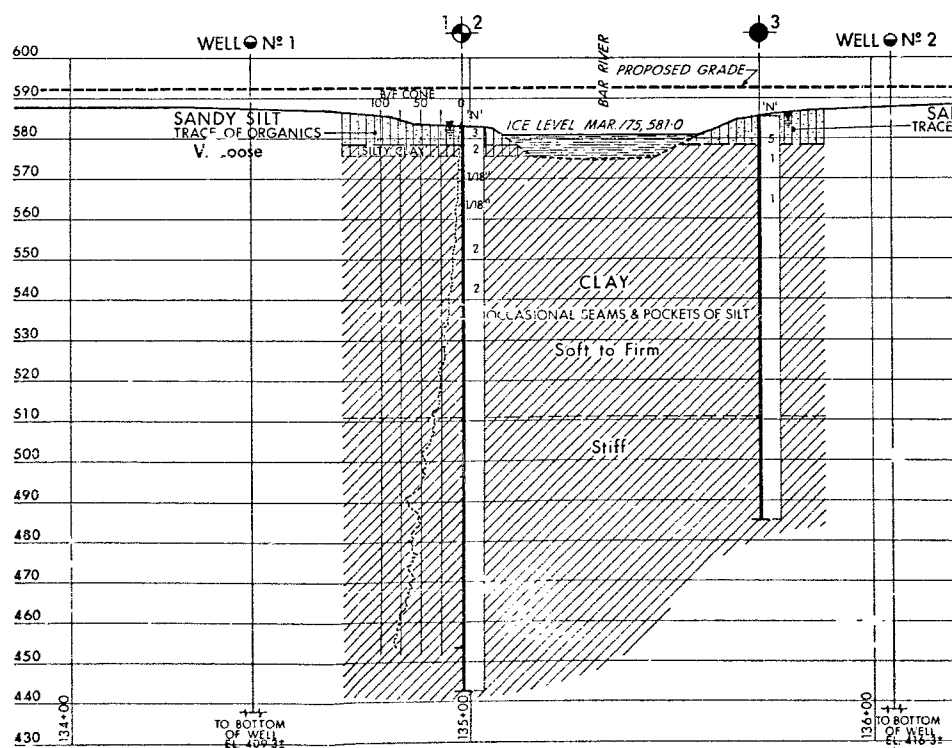
## SLOPES

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



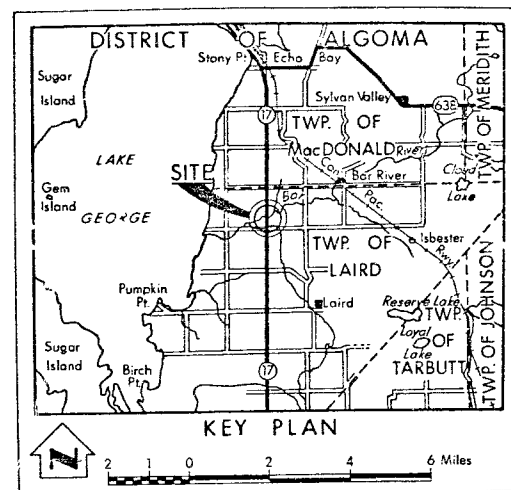
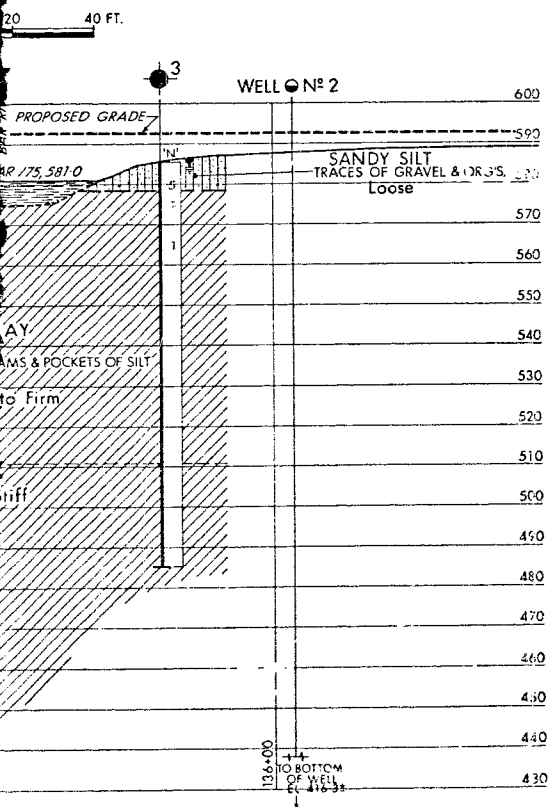
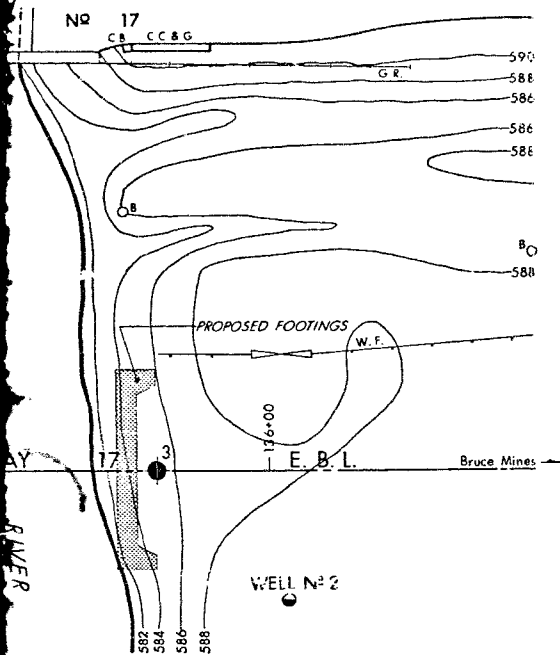
PLAN

20 10 0 SCALE 20 40 FT.



PROFILE

20 10 0 SCALE 20 40 FT.



### LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Resistance Test
- ⊙ Bore Hole & Cone Test
- ≡ Water Levels established at time of field investigation, March 1975.
- Well

NO.	ELEVATION	STATION	OFFSET
1	583.8	134+98.5	25' RT.
2	582.8	134+98.5	25' LT.
3	585.5	135+72.0	℄

### — NOTE —

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

### NOTE FOR CONTRACT DOCUMENT

The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the Sault Ste. Marie District Office.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO  
ENGINEERING SERVICES BRANCH—GEOTECHNICAL OFFICE—SOIL MECHANICS SECTION

### BAR RIVER

HIGHWAY NO 17 E.B.L. DIST NO 18  
DIST. ALGOMA  
TWP. LAIRD LOT. CON.

### BORE HOLE LOCATIONS & SOIL STRATA

SUBMD H.S.	CHECKED	W.F. NO 903-72-06	DRAWING NO.
DRAWN N.T.	CHECKED	W.F. NO	9037206-A
DATE April 8, 1975	CHECKED	S.F. NO 385-145	BRIDGE DRAWING NO.
APPROVED		CONT. NO.	

Mr. C. S. Grebski  
Structural Design Engineer  
West Building, Downsview

Soil Mechanics Section  
Geotechnical Office  
West Building, Downsview

April 17, 1975

W.P. 903-72-06

BAR RIVER BRIDGE

W.P. 903-72-06, Site 38S-145  
Highway 17, District 18

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The final bridge drawing shows the profile grade to be 592.1. The proposed 2:1 slopes will be stable in the longitudinal and transverse directions for both granular type of fill material ( $\gamma = 130$  pcf), and for light weight fill ( $\gamma = 90$  pcf - Slag which is locally available from Algoma Steel). The slag material would be better than the granular fill, since the stresses induced by the embankment loading would be lesser, and thus resulting in lesser settlements for the approaches.

The pile driving during construction should not be controlled by means of the Hiley Formula, and should be driven to the predetermined tip elevation (elev. 525), since these are friction piles driven into the clayey subsoil.

Due to the settlement of the proposed roadway embankments, some negative skin friction forces can be imposed on the timber piles supporting the abutments. These forces tend to displace the piles and can cause rotation of the abutments. Therefore, consideration should be given to supporting the extreme ends of the wing walls on timber piles, similar to the abutment piles.

Since the pile caps will be located below the river water level, a temporary earth dyke should be constructed to prevent any water entering the excavation areas from the Bar River. Any minor inflow can be removed by using conventional means, such as pumping from sumps.

H. SHAH  
Project Engineer

for: M. DEVATA  
Supervising Engineer.

c.c. D. Aspinwall  
Files  
Record Services

903 - 72 - 07 ✓

FORM OB-CC-7



Ministry of  
Transportation and  
Communications

LISTING OF VERIFIED BIDS - NOTICE OF AWARD OF CONTRACT

TENDER OPENING NO. 29

DATE October 15th 1975

CONTRACT NO. 75-113 ✓

DESCRIPTION

STRUCTURE

NECESSARY AVAILABLE RATING IS (2) IN (S)

Bar River Bridge, 9.2 Miles West of Highway 548

HIGHWAY 17

SAULT STE. MARIE DISTRICT

MILEAGE: 0.05

W. G. Kelly Construction Limited	\$148,895.00
Looby Construction Limited	153,719.50
Bailey Construction Company Limited	153,937.30
Carrington Construction Company Limited	154,162.42
Arnott Construction Limited	176,454.75
O. J. Gaffney Limited	176,511.80
John Chisholm Limited	178,626.00
Dineen Roads & Bridges Limited )	209,677.35
Rule Contracting (Toronto) Limited)	

AWARDED TO:

W.G. KELLY CONSTRUCTION LIMITED  
R. R. #5,  
STRATFORD, ONT.

613

DATE October 24th, 1975.

Copy: H. Reed







Ontario

Ministry of  
Transportation and  
CommunicationsVISUAL CLASSIFICATION SHEET  
SOILS MECHANICS OFFICE

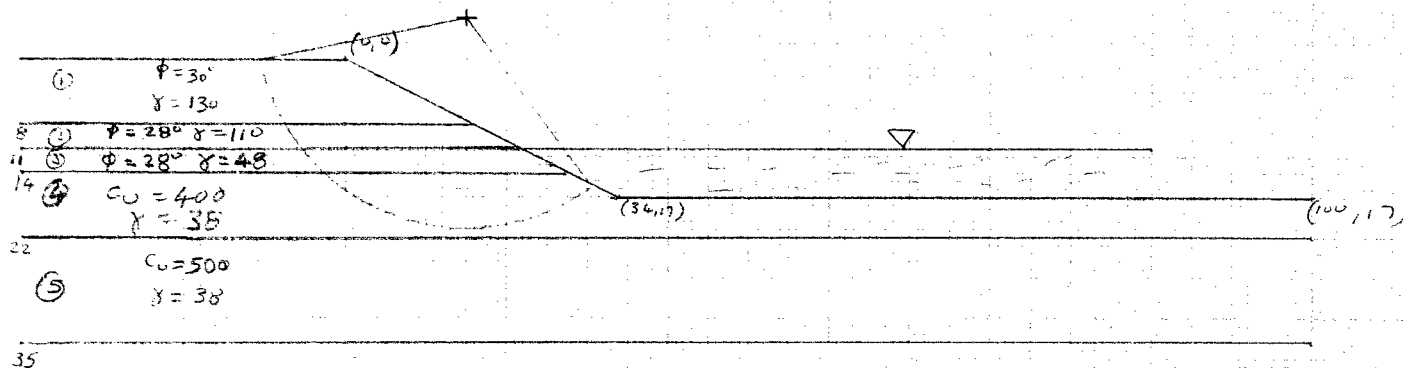
PROJECT <u>Roe Road</u>		SITE		BOREHOLE NO. <u>3</u>		GROUND ELEVATION											
SAMPLE NO.	DEPTH	GRAIN SIZE DISTRIBUTION			DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL			
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE													
				GRAVEL											SAND	SILT AND CLAY	
2	2-2 1/2	200			0	0	100	High	Dull	Nil	Slight	Earthy	Reddish Brown Grey Streaks	Strong	Very Soft	CLAY of Low PLASTICITY	CL
4	20-25	200			0	0	100	"	Shiny	Nil	Med	Earthy	"	Strong	"	"	CL
✓ 6	30-35	200			0	0	100	"	Shiny	Nil	Med	Earthy	"	"	"	"	CL
✓ 8	40-45	200			0	0	100	"	Shiny	Nil	Med	"	"	"	"	"	CL
✓ 10	50-55	200			0	0	100	"	"	"	"	"	"	"	"	"	"

NOTE:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.  
REMARKS:-

A.T. - 3

BAR RIVER  
2 TO 1 SLOPE  
SCALE: 1" = 20'

$$FS = 1.3$$



# Oversized Drawings

General Layout

Footings : Abutment Layout.