

#68-F-69

W.P. #130-63

Hwy #7

FISH CREEK  
BRIDGE



## MEMORANDUM

TO: Mr. B. R. Davis,  
Bridge Engineer,  
Bridge Division,  
Admin. Bldg.

FROM: Foundation Section,  
Materials & Testing Div.,  
Room 107, Lab. Bldg.

ATTENTION: Mr. S. McCombie

DATE: November 18, 1968

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For  
Proposed New Structure at the  
Crossing of Hwy. #7 and Fish Creek  
Twp. of Blanshard -- County of Perth  
District No. 3 (Stratford)  
W.J. 68-P-69 -- W.P. 130-63

Attached, we are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above structure 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.

AGS/MdeF  
Attach.

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
W. Zonnenberg  
J. G. Tillcock  
A. Watt  
J. Roy  
B. A. Singh  
Foundations Files  
Gen. Files

*Alsterman*  
A. G. Stermac  
PRINCIPAL FOUNDATION ENGINEER

## TABLE OF CONTENTS

1. INTRODUCTION.
2. DESCRIPTION OF SITE AND GEOLOGY.
3. FIELD AND LABORATORY WORK.
4. SUBSOIL CONDITIONS:
  - 4.1) General.
  - 4.2) Organic Clayey Silt.
  - 4.3) Fill Material (Clayey Silt with Sand and Gravel).
  - 4.4) Mixture of Gravel and Silty Sand.
  - 4.5) Clayey Silt with some Sand and Gravel.

FOUNDATION INVESTIGATION REPORT  
For

Proposed New Structure at the  
Crossing of Hwy. #7 and Fish Creek  
Twp. of Blanshard -- County of Perth  
District No. 3 (Stratford)

W.J. 68-P-69 -- W.P. 130-63

---

1. INTRODUCTION:

The Foundation Section was requested to carry out a foundation investigation at the crossing of Hwy. #7 and Fish Creek, in the Twp. of Blanshard, County of Perth. The request was contained in a memo from the Bridge Location Section (Mr. A. P. Watt, Regional Bridge Location Engineer, London), dated August 21, 1968. Subsequently, an investigation was carried out by this Section to determine the subsoil conditions existing at the site.

This report contains the results of the investigation, together with recommendations pertaining to the foundations of the proposed structure, as well as the stability of the approach embankments.

2. DESCRIPTION OF SITE AND GEOLOGY:

The proposed structure will be at the same location as the existing bridge which carries Hwy. #7 over Fish Creek, about 5 miles west of the Town of St. Mary's. Fish Creek is about 50 ft. wide and 4 to 6 feet deep at the crossing; it flows North to South. The topography at the site is hilly with patches of wooded land; the remainder is being utilized for farming purposes.

Physiographically, the area is situated in the "Stratford Till Plain" region. This area is characterized by extensive ground moraines composed basically of clayey soil. The morainal valleys formed south of St. Mary's are often filled in with sand and gravel deposits.

cont'd. /2 ...

3. FIELD AND LABORATORY WORK:

The field work consisted of four sampled boreholes, each accompanied by a dynamic cone penetration test. The borings were advanced by a conventional diamond drill rig adapted for soil sampling purposes.

Samples were recovered at required depths in a 2" O.D. split-spoon sampler. The method of driving the split-spoon sampler conformed to the specifications for the Standard Penetration Test; the same method was used to advance the dynamic cone penetration tests. In all four borings bedrock was proven by obtaining AXT rock core samples.

The locations and elevations of all boreholes are shown on Drawing 68-F-69A, together with the estimated stratigraphical profile.

All samples were subjected to visual inspection in the field and subsequently in the laboratory prior to any tests. Following this inspection, tests were carried out on certain selected samples to determine the physical properties of the various soil types:

- Organic Contents
- Natural Moisture Contents
- Bulk Densities
- Grain-Size Distributions
- Atterberg Limits

The results of these tests are summarized and plotted on the Record of Borelog sheets contained in the Appendix of the report.

On completion of laboratory testing, the various soil types were classified as to type and consistency, or relative density, in general according to the Unified Soil Classification System (Oct. 1963).

cont'd. /3 ...

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

4.1) General:

Subsoil at the site consists of a surficial layer of organic clayey silt or roadway fill (mixture of clayey silt with sand and gravel) underlain by a deposit of gravel and silty sand with layers of clayey silt. Underlying these deposits is dolomitic limestone bedrock some 19 to 28 ft. below the existing ground surface, or at about elev. 924 - 926. The boundaries between the various soil strata are shown on the Record of Borelog sheets contained in the Appendix of the report. The estimated stratigraphical profile shown on Dwg. 68-F-69A is based upon this information. From the ground surface downwards, the different soil types are described in detail, as follows:

4.2) Organic Clayey Silt:

This surficial deposit was encountered only in B.E.'s #2 and 4 located on the south side of the outer limits of the existing approach embankments, having a total thickness of about 5 ft. The material in this layer essentially consists of a mixture of organics and clayey silt with some sand and gravel. The organic content ranges anywhere from 3% to 13% by dry weight. The Atterberg Limit tests, carried out on samples from this deposit, are summarized on the Plasticity Chart in the Appendix of this report. These results are indicative of an organic material, with a plasticity ranging from low to high. 'N' values ranged from 7 to 11 blows/ft., indicating a firm consistency.

4.3) Fill Material (Clayey Silt with Sand and Gravel):

The fill material was encountered only in B.E. #3 located on the north shoulder of the existing Hwy. #7 west approach embankment, and extends to a depth of 11 ft. below the roadway surface. This embankment fill is mainly composed of clayey silt with sand and gravel with occasional traces of organic material. Standard Penetration 'N' values ranged from 7 to 30 blows/ft., indicating the consistency of the fill material to vary from firm to stiff.

cont'd. /4 ...

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

4.4) Mixture of Gravel and Silty Sand:

This stratum was encountered in all boreholes, either immediately below the surficial layer of organic clayey silt in B.H.'s #2 and #4, and fill material in B.H. #4, or from the ground surface in B.H. #1. The upper and lower limits of this deposit varied somewhat due to the presence of clayey silt layers described elsewhere, but generally extends down to bedrock. In B.H. #4 this stratum is overlain by a distinct layer of clayey silt with some sand and gravel, whereas in B.H. #3, it is underlain by a clayey silt layer.

Grain-size distribution curves obtained from typical samples of the granular deposit are shown on a figure in the Appendix of this report. The percentage of silt, sand and gravel varied somewhat throughout the stratum, but the deposit may be described as a gravel and silty sand mixture with traces of clay. Standard Penetration 'N' values ranged from 16 to 98 blows/ft., indicating a relative density of compact to very dense.

4.5) Clayey Silt with some Sand and Gravel:

A distinct cohesive layer of clayey silt with some sand was encountered in B.H.'s #3 and #4; the thickness at these locations was 10 ft. and 7 ft., respectively. In addition, thin layers of clayey silt were also observed between elev. 935 and elev. 932 in B.H.'s #1 and #2. The physical properties of the cohesive stratum, as determined from field and laboratory testing, are summarized as follows:

Liquid Limit	( $W_L\%$ )	:	16% - 25%
Plastic Limit	( $W_P\%$ )	:	14% - 18%
Moisture Content	( $W\%$ )	:	16% - 20%
Plasticity Index	( $I_p$ )	:	2 - 9
Standard Penetration ('N') Values		:	18 - 38 Blows/ft.

Based on the above mentioned results, it is estimated that the cohesive soil is inorganic and of low plasticity (CL) with a consistency in the very stiff to hard range.

cont'd. /5 ...

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

4.5) Dolomitic Limestone Bedrock:

Bedrock was found to consist of layered grey dolomitic limestone. The surface of the bedrock was found to be fairly horizontal, and varied from elev. 926.5 to elev. 924.5. In all the borings bedrock was proven by obtaining AXT size rock core samples to a depth of 2 to 6 ft. Recovery ranged from 70% to 100%, indicating that the rock is generally sound right from the surface.

5. GROUNDWATER CONDITIONS:

Observations carried out in the open boreholes during the time of the field investigation, indicated that the groundwater level was approximately between elev. 946.0 and elev. 942.5. The exact water levels observed at the time of the field investigation are shown on Borehole Logs (Appendix I).

The water level in Fish Creek, at the time of the investigation, was at elev. 942.5.

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to replace the existing single-span bridge at the crossing of Hwy. #7 and Fish Creek. Present proposals call for a new 75-ft. single-span structure having a width of some 40 ft. The new centre-line will be the same as the existing one, without any change in the profile grade for Hwy. #7 at this crossing.

The subsoil at the site consists of a deposit of a compact to very dense mixture of gravel and silty sand which underlies, in certain areas, a surficial cover of organic clayey silt or roadway fill material. The granular deposit (mixture of gravel and silty sand) contains distinct cohesive layers of clayey silt. Underlying the overburden is dolomitic limestone bedrock at elev. 926 - elev. 924, or some 19 to 28 ft. below the existing ground surface.

cont'd. /6 ...

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

In view of the presence of competent subsoil, it is recommended that the proposed abutments be founded on spread footings at or below elev. 937.0 with an allowable net pressure of 2.5 t.s.f. The depth of the footings should be sufficient so as to ensure at least 4 ft. of cover for frost protection. If any local pockets of organic material are encountered at the footing formation level, such compressible deposits should be sub-excavated and backfilled with well compacted granular material. The differential settlements between the two abutment footings will be negligible and well within tolerable limits. As it will be necessary to carry out the excavations for the spread footings below the creek or groundwater level, a dewatering scheme may be required. The subsoil consists mainly of a granular type material and is susceptible to 'boiling' under conditions of an unbalanced hydrostatic head. If steel sheeting is incorporated in a dewatering scheme, or as a means of scour protection, this should be driven to a minimum depth below the excavation bottoms equal to the height of the prevailing water above them in order to prevent boiling.

As an alternative, perched abutments may be constructed within the approaches supported on end-bearing steel H-piles driven to bedrock. Allowable loads will depend upon the pile chosen. For example, a 12 BP 74 steel H-pile driven to bedrock, may be designed for 90 tons per pile. The forward and side slopes of the approaches and the river banks should be rip-rapped to high water level to protect against erosion by scour. In this case, the footings can be placed above groundwater level and will, therefore, not require a dewatering scheme. The structure, however, will have a longer span than in the former case.

cont'd. /7 ...

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

Approach Embankments: The proposed grade for Hwy. #7 at this crossing will have the same grade as the existing highway; however, the new roadway will be wider. No stability problems are anticipated for the proposed widening with standard 2:1 slopes, provided that all organic material is sub-excavated and backfilled with suitable granular material as per current D.H.O. Standards, prior to the construction of the approach embankments.

7. MISCELLANEOUS:

The field work, performed between September 6 and September 13, 1968, was supervised by Mr. V. Korlu, Project Foundation Engineer, who also prepared this report.

The investigation was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.

The equipment used in the field was provided and operated by P.V.K. & Sons Company of Burford, Ontario.

November 1968

APPENDIX I

---

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO 1

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 68-1-69 LOCATION Hwy. 7 & Fish Cr. 270 + 19 31' Rt. DESIGNATED BY VE  
 W P 130-12 BORING DATE Sept. 6, 1969 COMPILED BY VE  
 DATUM Geodetic BOREHOLE TYPE Drive By Casing & Wash CHECKED BY

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
			NUMBER	TYPE		BLOWS / FOOT	20	40	60	80	100	WP	WL		
913.5	Ground Level														
930.0	Mixture gravel & silty sand with trace of clay		1	SS	16	930									Gr. 67 Sa. 28 Si. 5 Cl. 0
935.0	Compact to dense. Clayey silt & some sand		2	SS	34										Gr. 42 Sa. 20 Si. 29 Cl. 9
932.5	Very stiff.		3	SS	16										
924.5	Mixture gravel & silty sand with trace of clay		4	SS	38	930									
19.0	Bedrock - Sound.		5	SS	45										
918.5	Layered Limestone.		6	AKT	100% Rec.	920									
25.0	End of Borehole					910									

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

RECORD OF BOREHOLE NO 2

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 68-J-69 LOCATION Hay. 7 & Fish Cr. 270 + 91 40 Lt. ORIGINATED BY WK  
 W.P. 100-63 BORING DATE Sept. 10, 1968 COMPILED BY VA  
 DATUM Geodetic BOREHOLE TYPE Drive BX Casing & Wash CHECKED BY VA

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
			NUMBER	TYPE		20	40	60	80	100	WL	WP	W		
944.5	Ground Level														
939.5	0.0 Organic clayey silt with sand & gravel. Stiff		1	SS	11										Gr. Sa. Si. Cl
934.5	5.0 Mixture of gravel & silty sand with		2	SS	37										28 57 15
932.5	10.0 Clayey silt with some sand & gravel.		3	SS	32										
925.0	12.0 A trace of clay  Dense to very dense.		4	SS	91										
920.0	19.5 Bedrock - Sound		5	SS	51										
920.0	24.5 Layered limestone. End of Borehole		6	SS	100/6"										
			7	AXT	100% Rec.										

DEFECTS IN NEGATIVE DUE TO  
CONDITION OF ORIGINAL DOCUMENT

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 68-F-69 LOCATION Hwy. 7 & Fish Cr. 270 + 99 20' Rt. ORIGINATED BY VK  
 W P 130-63 BORING DATE Sept. 11, 1968 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Drive BX Casing & Wash CHECKED BY [Signature]

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W	WATER CONTENT % 15 30 45	BULK DENSITY PCF	REMARKS		
			NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT					BLOWS / FOOT	
954.5	Ground Level																
0.0	Clayey silt with sand and gravel - trace of organics. Fill material.	[Hatched]	1	SS	7	950											
	Firm to stiff		2	SS	9												
944.5	Mixture of gravel & silty sand & trace of clay		3	SS	30												
10.0	Dense to very dense.	[Dotted]	4	SS	70	940											
936.5	Clayey silt with some sand & gravel.		5	SS	52												
18.0	Hard.	[Diagonal]	6	SS	38	930											
926.5	Bedrock - Sound		7	SS	100/3"												
28.0	Layered limestone	[Wavy]	8	AXT	70% Rec.	920											
923.5	End of Borehole																

Gr. Sa. Si. Cl

946.0  
48 36 16

DEPARTMENT OF HIGHWAYS - ONTARIO

**RECORD OF BOREHOLE NO. 4**

FOUNDATION SECTION

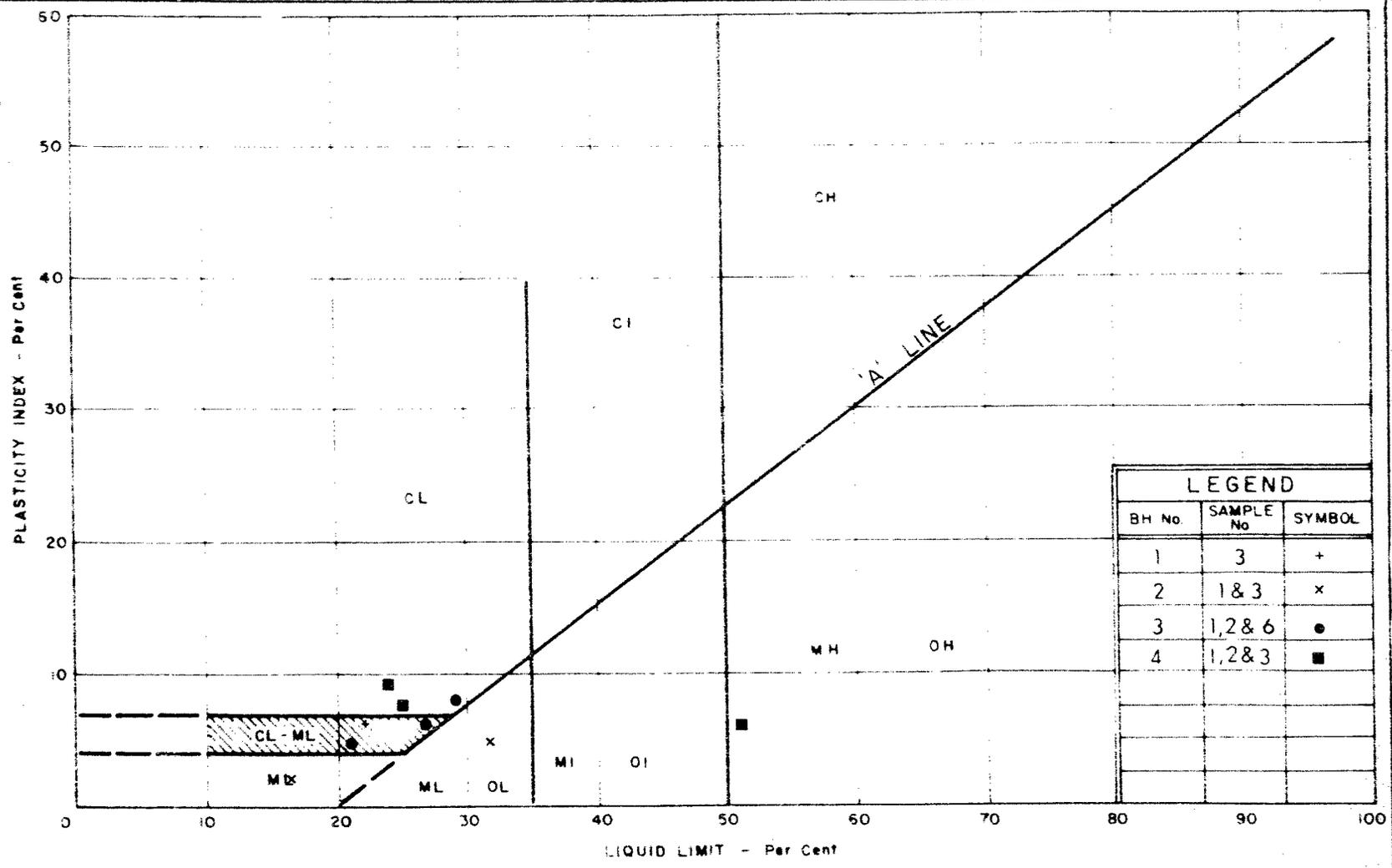
MATERIALS & TESTING DIVISION

JOB 68-F-69 LOCATION Hwy. 7 & Fish Cr. Sta. 269+86 39' Lt. E ORIGINATED BY VK

W P 130-63 BORING DATE Sept. 19, 1968 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Drive RX Casing & Wash CHECKED BY \_\_\_\_\_

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W	BULK DENSITY PCF	REMARKS
			NUMBER	TYPE	BLOWS / FOOT		20	40	60	80			
944.0	Ground Level												
0.0	Organic clayey silt with some sand & gravel. Firm.		1	SS	7	940							942.5
4.5	Clayey silt with some sand & traces of gravel.		2	SS	22								
932.0	Very stiff.		3	SS	30								
12.0	Mixture of gravel & silty sand & trace of clay		4	SS	54	930							
925.1	Dense to very dense.		5	SS	142								
18.9	Bedrock - sound		6	AXT	100%								
920.1	Layered limestone.				Rec								
23.9	End of Borehole					920							



LEGEND		
BH No.	SAMPLE No	SYMBOL
1	3	+
2	1&3	x
3	1,2&6	●
4	1,2&3	■



DEPARTMENT OF HIGHWAYS  
**MATERIALS and  
 TESTING  
 DIVISION**

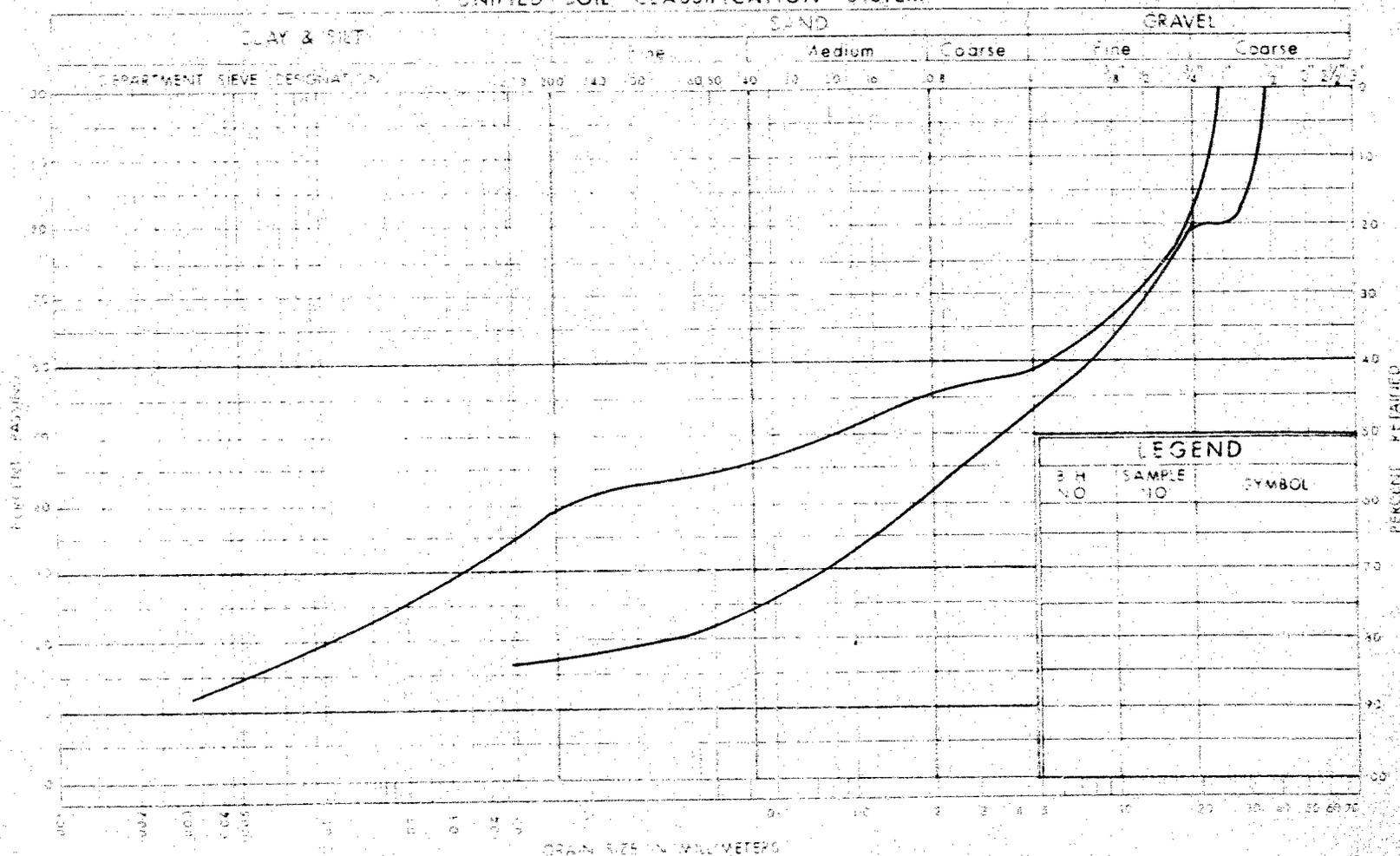
## PLASTICITY CHART

DEFECTS IN NEGATIVE DUE TO  
 CONDITION OF ORIGINAL DOCUMENT

WP No. 130 - 63  
 JOB No. 68 - F - 69

DEFECTS IN NEGATIVE DUE TO  
CONDITION OF ORIGINAL DOCUMENT

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

GRAIN SIZE DISTRIBUTION  
MIXTURE OF GRAVEL AND SAND WITH A TRACE  
OF CLAY AND SILT

WP No. 130 - 63  
JCB No. 68 - F - 69

## 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

SS	SPLIT SPOON	TW	THINWALL OPEN
WS	WASHED SAMPLE	TP	THINWALL PISTON
SB	SCRAPER BUCKET SAMPLE	OS	OESTERBERG SAMPLE
AS	AUGER SAMPLE	FS	FOIL SAMPLE
CS	CHUNK SAMPLE	RC	ROCK CORE
ST	SLOTTED TUBE SAMPLE		
	PH	SAMPLE ADVANCED HYDRAULICALLY	
	PM	SAMPLE ADVANCED MANUALLY	

### SOIL TESTS

Qu	UNCONFINED COMPRESSION	LV	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	FV	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
$S_r$	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
$\sigma'$	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

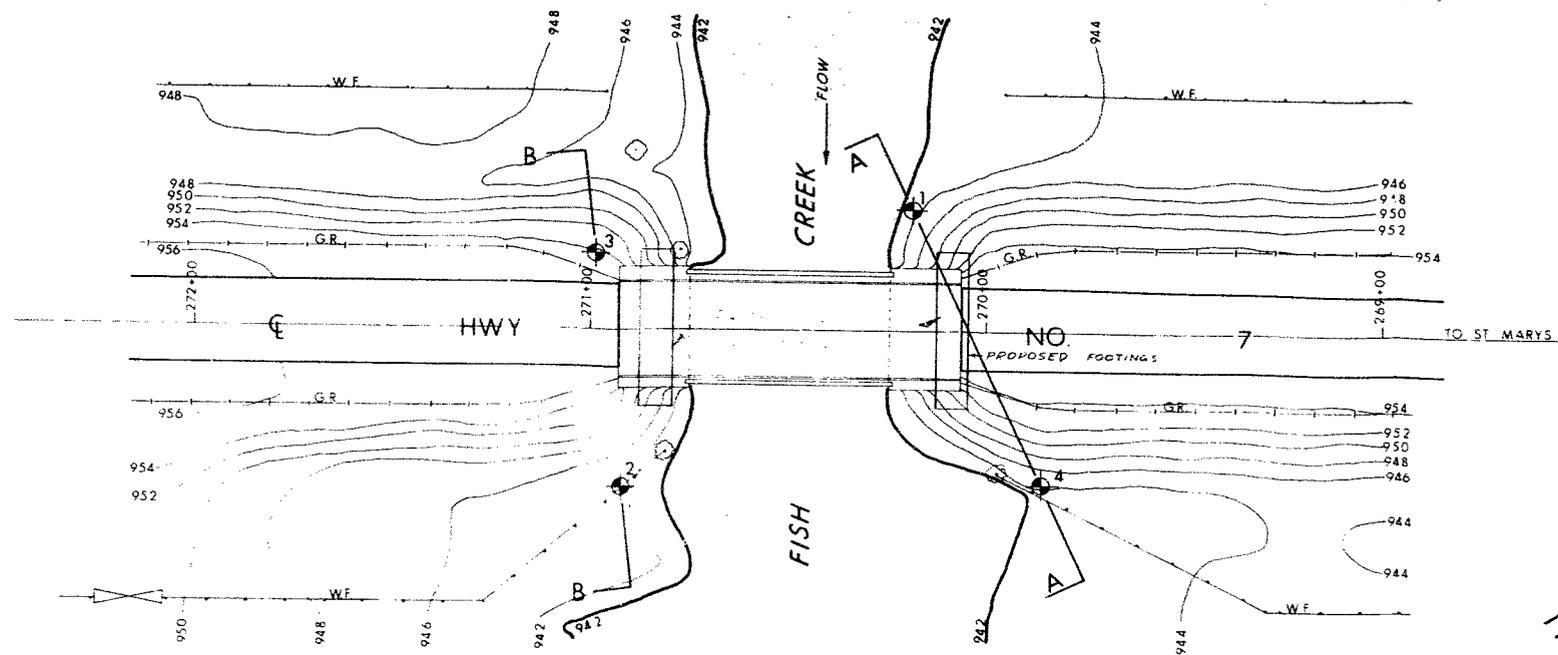
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

### FOUNDATIONS

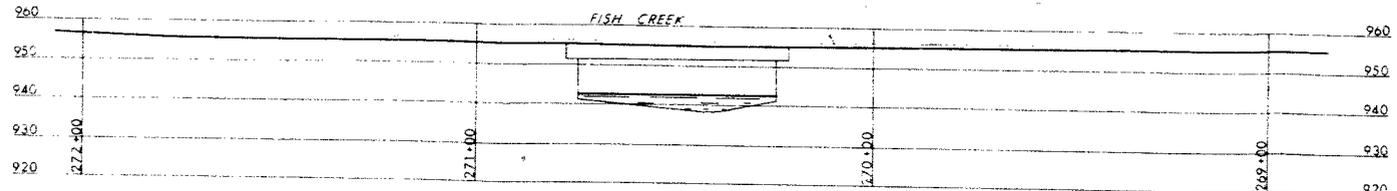
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC IN THE FORMULA FOR BEARING CAPACITY
$k_s$	MODULUS OF SUBGRADE REACTION

### SLOPES

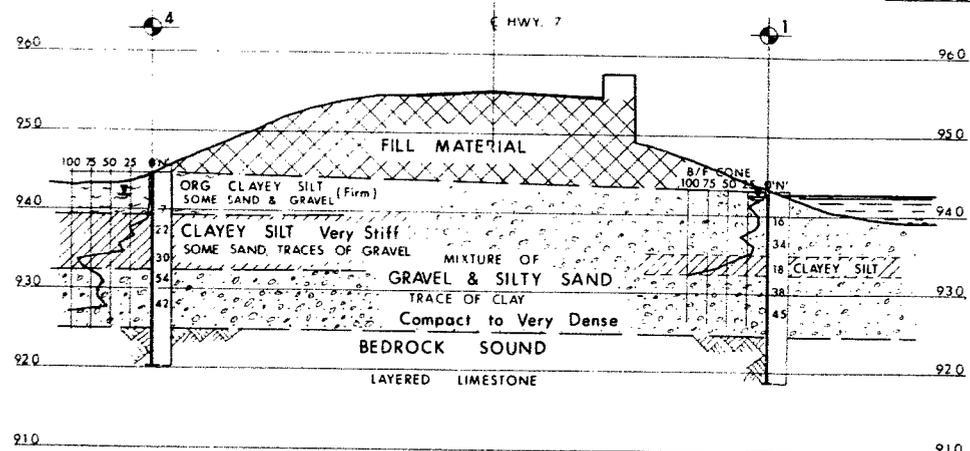
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL



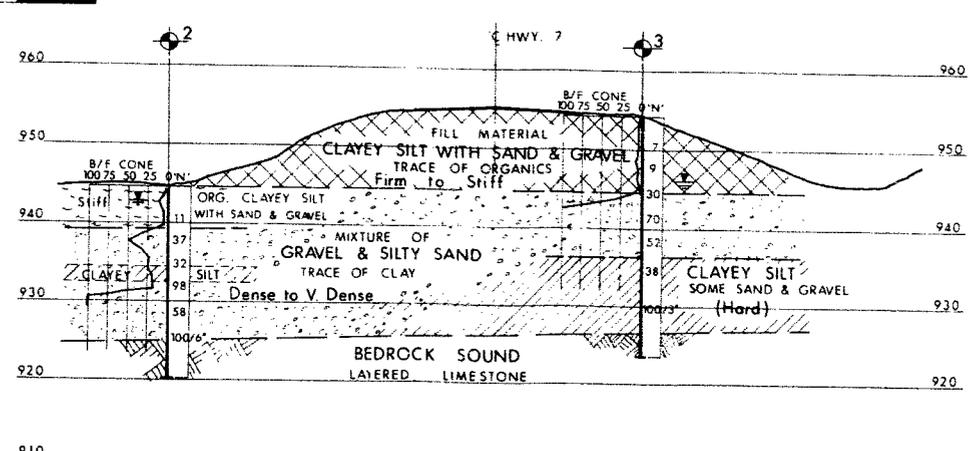
PLAN  
SCALE  
20 10 0 20 40 FT



PROFILE  
SCALE  
20 10 0 20 40 FT

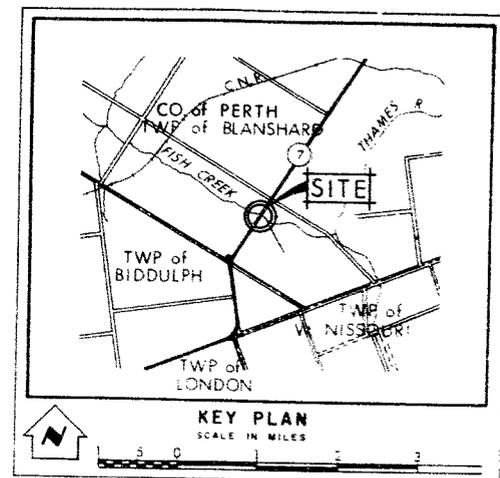


SECTION A-A



SECTION B-B

SECTIONS  
SCALE  
10 5 0 10 20 FT



KEY PLAN  
SCALE IN MILES

LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation - SEP. 1968		

NO.	ELEVATION	STATION	OFFSET
1	943.5	270+13	21 FT
2	944.5	270+97	41 FT
3	954.5	270+99	21 FT
4	944.0	269+86	39 FT

**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.

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION - FOUNDATION SECTION

**FISH CREEK**

KING'S HIGHWAY NO. 7 DIST. NO. 3  
CO. PERTH  
TWP. BLANSHARD LOT 26 CON. E. & W. MITCHELL RD.

**BORE HOLE LOCATIONS & SOIL STRATA**

SUBM'D. V.K. CHECKED <input checked="" type="checkbox"/>	W.P. NO. 130-63	W.B.T. DRAWING NO.
DRAWN D.M. CHECKED <input checked="" type="checkbox"/>	JOB NO. 68-F-69	68-F-69A
DATE OCT. 9/1968	SITE NO.	BRIDGE DRAWING NO.
APPROVED <i>[Signature]</i>	CONT. NO.	

