

23-6237

MEMORANDUM

To: Mr. B. R. Davis
Bridge Engineer
Bridge Division
Admin. Bldg.

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

Attn: Mr. S. McComble

DATE: September 20, 1967

OUR FILE REF.

IN REPLY TO SEP 23 1967

SUBJECT:

FOUNDATION INVESTIGATION REPORT
for
Proposed Gentleman Creek Bridge
Hwy. #2, 1 Mile West of Melbourne
District #2 (London)
W.J. 67-F-66 -- W.P. 126-65

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

We believe that you will find the factual data and recommendations contained therein, adequate for your design requirements. Should additional information be required, please feel free to contact our office.

AGS:mt
Attach.

A. G. Stermac
A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs: B.R.Davis(2)
H. A. Tregaskes
D. W. Farren
W. Zonnenberg
H. C. Dernier
A. P. Watt
J. Roy
B. A. Singh
Foundation File
General Files

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FOUNDATION INVESTIGATION REPORT
for
Proposed Gentleman Creek Bridge
Hwy. #2 1 Mile West of Melbourne
District #2 (London)
W.J. 67-F-66 -- W.P. 126-65

1. INTRODUCTION:

In a memo dated July 7, 1967, a request to carry out a foundation investigation at the crossing of Gentleman Creek by Hwy. #2 was received by this Section from the Regional Bridge Location Engineer, Mr. A. P. Watt.

Subsequently an investigation was carried out at the proposed site to determine the subsoil conditions.

Presented in this report are the results of the field and laboratory work, together with discussion and recommendations pertaining to the design of the bridge foundations and stability of the approach embankments.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located in the Township of Ekfird, County of Middlesex, approximately one mile west of Melbourne, in the physiographic region known as the Ekfird clay plains. The terrain at the site is greatly undulating with the surrounding land being used for general farming.

The existing bridge is a single span, steel beamed structure, having a clear span of 24 ft. and a width of 31 ft.

3. DESCRIPTION OF FIELD AND LABORATORY WORK:

A total of 3 sampled boreholes and 5 dynamic cone penetration tests were carried out during the investigation. Undisturbed samples were recovered by means of 2 in. I.D. Shelby tubes advanced manually and disturbed samples were recovered by a standard split-spoon sampler driven according to the specifications of the Standard Penetration Test.

3. DESCRIPTION OF FIELD AND LABORATORY WORK: (cont'd)

The field work was carried out by means of a conventional diamond drill adopted for soil sampling purposes.

The samples were visually examined in the field and subsequently identified in the laboratory. Laboratory tests were carried out on selected representative samples to determine where applicable, Attenberg Limits, Grain Size Distribution, Natural Moisture Content and Shear Strength.

Results of the laboratory and field tests, together with locations and elevations of the boreholes are presented in the appendix of the report.

4. SUBSOIL CONDITIONS:

4.1) General:

The subsoil at the site consisted of an extensive deposit of clayey silt with traces of sand and gravel (glacial till). The upper 5 ft. in Borehole #2 and 7.5 ft. in Borehole #3 appeared to be fill material of the same composition as the glacial till stratum. In Borehole #1, 3 ft. deep granular fill deposit overlay the deposit of glacial till.

4.2) Clayey Silt with traces of sand and gravel
(Glacial Till):

This deposit was intersected in all boreholes and sampled to a depth of 61.5 ft. in Borehole #1 and Borehole #2, and to 51.5 ft. in Borehole #3.

The deposit consisted of a cohesive composition of clayey silt, sand and gravel in the following average proportions:

Clay	-	42%
Silt	-	50%
Sand	-	6%
Gravel	-	2%

4. SUBSOIL CONDITIONS: (cont'd)

4.2) cont'd.

The "N" values (No. of blows/ft. obtained in the Standard Penetration Test) in general ranged from 14 blows/ft. to 31 blows/ft. and the undrained shear strength ranged from 1850 p.s.f. to 2700 p.s.f., indicating a stiff to hard consistency. The "N" values in the upper 7.5 ft. in Boreholes #1 and #3 were observed to be in the order of 7 blows/ft.

In general the "N" values increased with depth.

Physical properties are summarized as follows:

Liquid Limit	28% - 40%
Plastic Limit	15% - 24%
Moisture Content	19% - 22%
Undrained Shear Strength	1850 - 2700 p.s.f.

5. GROUNDWATER:

Groundwater level was observed to range between 9.0 ft. in Borehole #1 and 10.5 ft. in Borehole #2.

The observed groundwater levels are shown on the record of Borehole Sheets on Dwg. 67-F-66A, which are included in the appendix of the report.

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to demolish the existing structure and construct a new bridge for the crossing of Hwy. #2 over Gentleman Creek.

Present proposals call for a single span structure (27') with a width of 46 ft. and a new grade approximately 5 ft. above the existing Hwy. #2 grade at the abutments.

Subsoil at the site consists of a deep deposit of clayey silt with traces of sand and gravel extending at least 62 ft. below the ground surface.

6. DISCUSSION AND RECOMMENDATIONS: (cont'd)

6.1) Structure Foundations:

The proposed abutments may be constructed on spread footing type of foundations within the hard clayey silt stratum some 4 ft. below the creek bed.

As the creek bed is at approximate elev. 692.0, it is recommended that the spread footings be located at or below elev. 688.0, with a safe bearing pressure of 2 t.s.f.

No differential settlements between the abutments are expected since the footings will settle uniformly for the proposed single span structure.

Because of the relative impermeable nature of the subsoil, no major dewatering problems are anticipated.

Care should be taken to prevent softening of the bottom of the excavation by surface runoff. A 12 in. thick granular pad or a concrete working slab should be placed immediately after the completion of the footing excavation.

6.2) Approach Fills:

The approach fills will be in the order of 10 ft. above the ground surface. No stability problems are anticipated for embankments with 2:1 side slopes.

7. SUMMARY:

It is proposed to construct a single span over Gentleman Creek on Hwy. #2.

Subsoil at the site consists of an extensive deposit of clayey silt with traces of sand and gravel.

It is recommended that the abutments be supported on spread footings at or below elev. 688.0 with a safe bearing pressure of 2 t.s.f. No differential settlements are anticipated for the proposed single span structure.

No major dewatering problems are anticipated.

7. SUMMARY: (cont'd)

Care should be taken to prevent softening of the foundation material by surface run off.

No embankment stability problems are anticipated for standard 2:1 slopes.

8. MISCELLANEOUS:

The field investigation was carried out by Mr. A. Seppala and Mr. D. Katauskas, Project Foundation Engineers, during the period July 26th to 31st inclusive. The equipment was owned and operated by Dominion Soil Investigation Co. The report was prepared by Mr. D. Katauskas under the general supervision of Mr. M. Devata, Supervising Foundation Engineer.

Sept. 1967

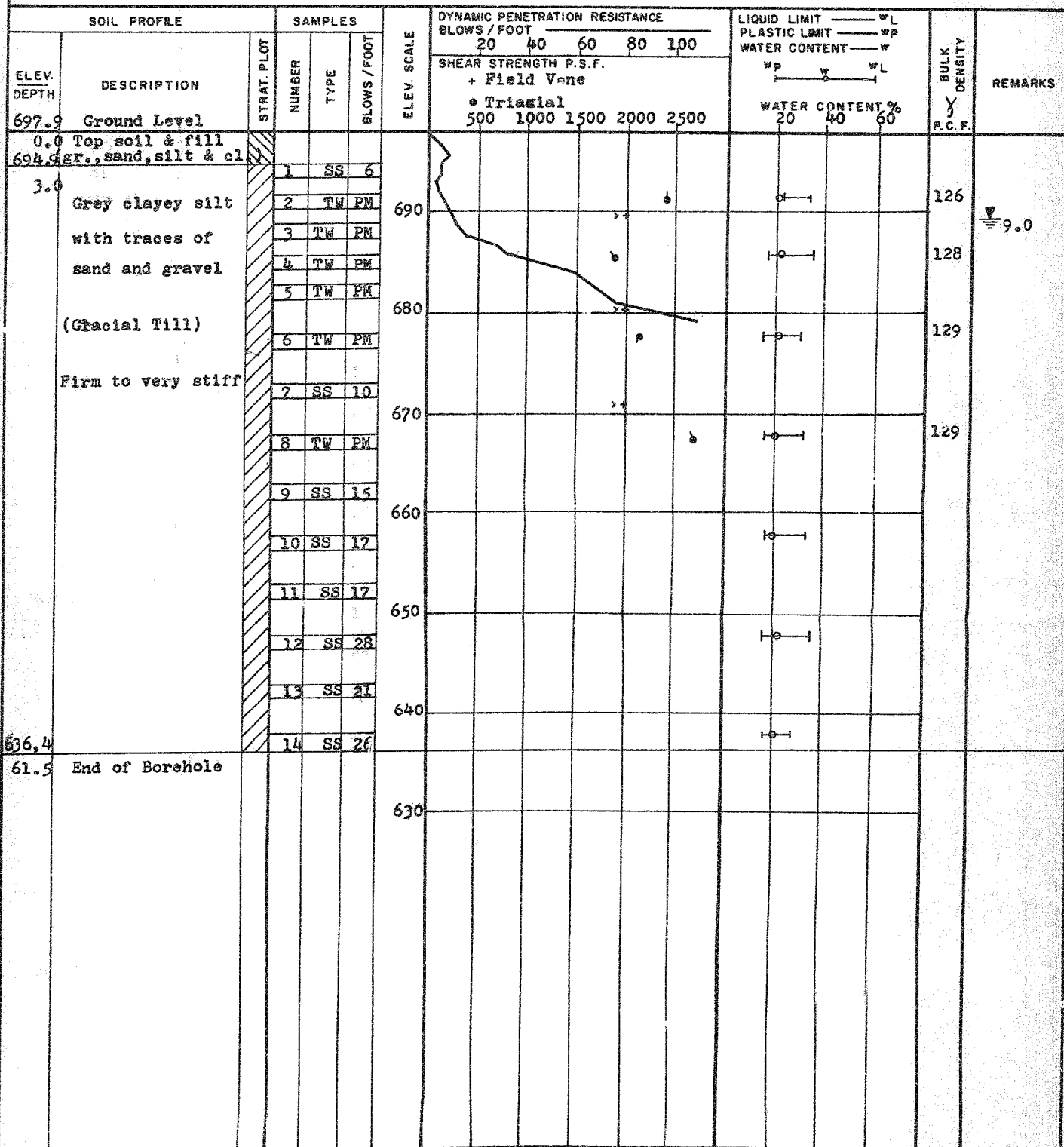
APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO.1

FOUNDATION SECTION

JOB 67-F-66LOCATION 78 + 03 o/s 35th Rt.ORIGINATED BY DKW.P. 126-65BORING DATE July 26, 1967COMPILED BY DKDATUM GeodeticBOREHOLE TYPE WashboringCHECKED BY SK

DEPARTMENT OF HIGHWAYS - ONTARIO

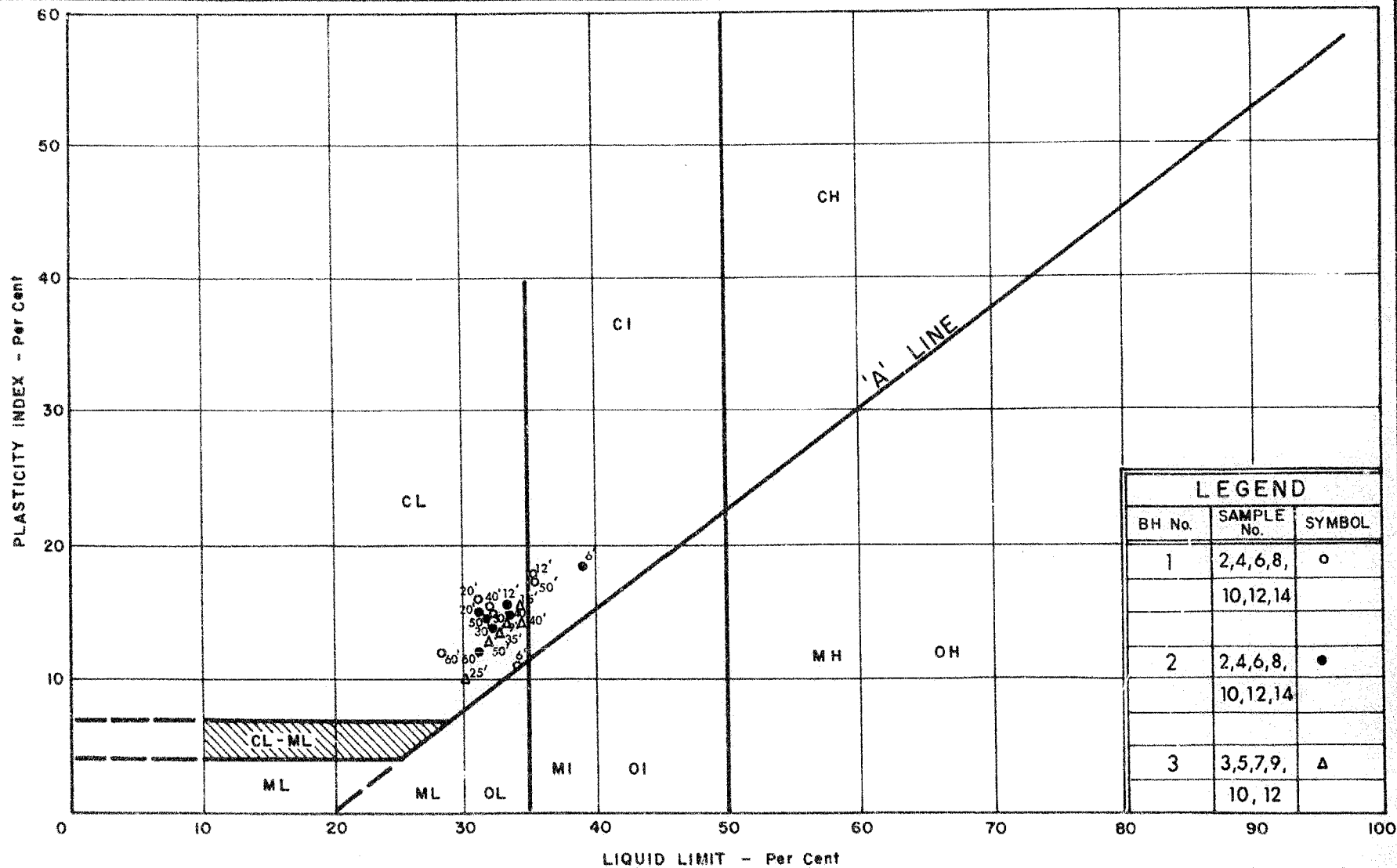
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO.2

FOUNDATION SECTION

JOB 67-F-66LOCATION 77 + 16 o/s 28th Lt.ORIGINATED BY DKW.P. 126-65BORING DATE July 27, 28, 1967COMPILED BY DKDATUM GeodeticBOREHOLE TYPE WashboringCHECKED BY SK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. + Field Vane • Triaxial 500 1000 1500 2000 2500	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W WP — W — WL WATER CONTENT % 20 40 60	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					
698.8	Ground Level									
0.0	Brown clayey silt with traces of sand		1	SS	25					
693.8			2	SS	28					
5.0	Grey clayey silt with traces of sand and gravel. (Glacial Till)		3	SS	23					
			4	SS	22					
			5	TW	PM					
			6	TW	PM					
			7	SS	23					
			8	SS	16					
			9	TW	PM					
			10	TW	PM					
			11	SS	27					
			12	SS	30					
			13	SS	31					
637.8			14	SS	22					
61.5	End of Borehole									



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

W.P. No. 126 - 65
JOB No. 67-F-66

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

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

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

DESCRIPTION OF SOIL

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

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

TYPE OF SAMPLE

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

SOIL TESTS

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

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	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
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 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
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	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
β	ANGLE OF SLOPE TO HORIZONTAL

MEMORANDUM

To: Mr. A. G. Stermac
Principal Foundation Engineer
Lab Building
D O W N S V I E W

From: A. P. Watt

Date: July 7, 1967

Our File Ref.

In Reply To

SUBJECT:

W.P. 126-65, Bridge Site 19-401,
Gentleman Creek Bridge,
12.1 miles west of Hwy. 81,
Highway 2,
District 2, London.

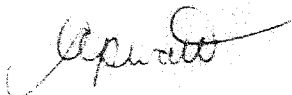
67-F-66

Would you please arrange to have a foundation investigation conducted at the above location.

I have enclosed two copies of the site plan number E-4801-1 with the probable footing locations marked in red.

Would you also have an additional boring made at the point indicated by a red circle so that the location of the structure could be moved northeast of its proposed location.

Attached please find a copy of the preliminary structure site report for your use.



A. P. WATT
REGIONAL BRIDGE LOCATION ENGINEER

APW:gf
ATT'D

c.c. Mr. S. McCombie
Mr. A. Crowley
Mr. B. Forrest

1967 JUL 20 PM 3:50

L

LOND DOWN 11 JULY 20/67 3.38 P

H C DERNIER DIST ENGR

ATT R A SHANNON MTCE ENGR

CC TO JOHN ROY REG MATLS ENGR

RE NO. 1 WP-126-65 BRIDGE SITE 19-401 (WJ-67-F-66) GENTLEMAN

CREEK BRIDGE 12.1 MILES WEST OF HWY 81 HWY 2 DIST 2 LONDON

NO. 2 WP-127-65 BRIDGE SITE 19-302 WJ-67-F-67 WAUBUNO

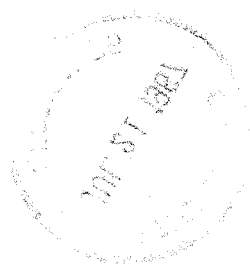
CREEK BRIDGE 7.2 MILES WEST OF HWY 19 HWY 2 DIST 2 LONDON

THE FIELD WORK FOR THE ABOVE MENTIONED PROJECTS WILL COMMENCE
ON JULY 26/67 THIS IS FOR YOUR INFORMATION.

M DEVATA SUPRVSG FOUNDATION ENGR FOR A G STERMACK PRINCIPAL

FOUNDATION ENGR MATLS AND TESTG DIV

RB



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401 & Keele Street
Downsview, Ontario

July 24, 1967

Dominion Soil Investigation Ltd.
77 Crockford Blvd.
Scarborough, Ontario

Dear Sirs:

This is to confirm our request of July 20, 1967 for the supply of a Diamond Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Melbourne, Ontario (Jct. of Hwy. 2 & County Rd. #9) on July 26, 1967.

These projects bear Job Numbers 67-F-66, and 67-F-67.

Yours truly,



MD:mt

M. Devata
Supervising Foundation Engineer
for: A. G. Sternac
Principal Foundation Engineer

cc: H. Konings
Foundation Files ✓ 110
General File

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

Mr. A.P. Watt,
Reg. Bridge Location Engineer,
London Regional Office,
London, Ontario

Bridge Division,
Downsview, Ontario

February 23, 1968

Gentlemen Creek Bridge
10.4 Miles West of Hwy. 81
W.P. 125-65, Site 19-401
Highway 2, District No. 2

Attached herewith are prints of the Preliminary Bridge Plan Drawing B-5332-21 for the above-mentioned structure.

The estimated cost of the proposed structure is \$42,000. This cost includes tender, materials, engineering and sundry construction.

Any comments or revisions you may have should be submitted within three weeks.

CSB:rd

C.S. Gotski,
Bridge Design Engineer

Attach.

c.c. S. McConbie
A. Stermac (2)
J. Anderson

No comments:
M. Devata

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Materials & Testing,
Room 107, Lab. Building

FROM: Bridge Division,
Downsview, Ontario

ATTENTION:

DATE: July 24, 1968

OUR FILE REF:

IN REPLY TO

SUBJECT: Gentleman Creek Bridge
10.4 Miles West of Hwy. 81
W.P. 126-65-00, Site 19-401
Highway 2, District No. 2

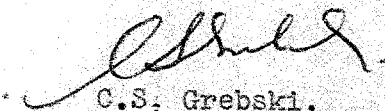
67-F-66

Attached herewith we are submitting the final bridge drawings (D-6332-1 to 3) which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

CSG:rd

Attach.


C.S. Grebski,
Bridge Design Engineer

*the proposed scheme shown on
Drawing D-6332-1 is acceptable
satisfies our requirements that*

- 1) footings be founded at or below elev.
688 they are founded at 686.5*
- 2) provided rip-rap*

BTD

No comments

*M. Levata
25th July/68*

67-F-66

W.P. # 126-65

Hwy. # 2

GENTLEMAN

CREEK BRIDGE

