

66-F-85

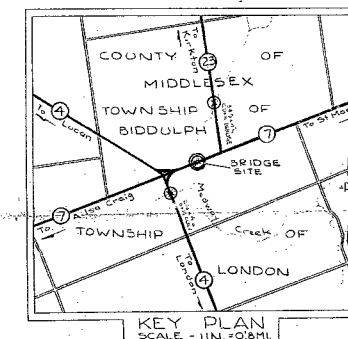
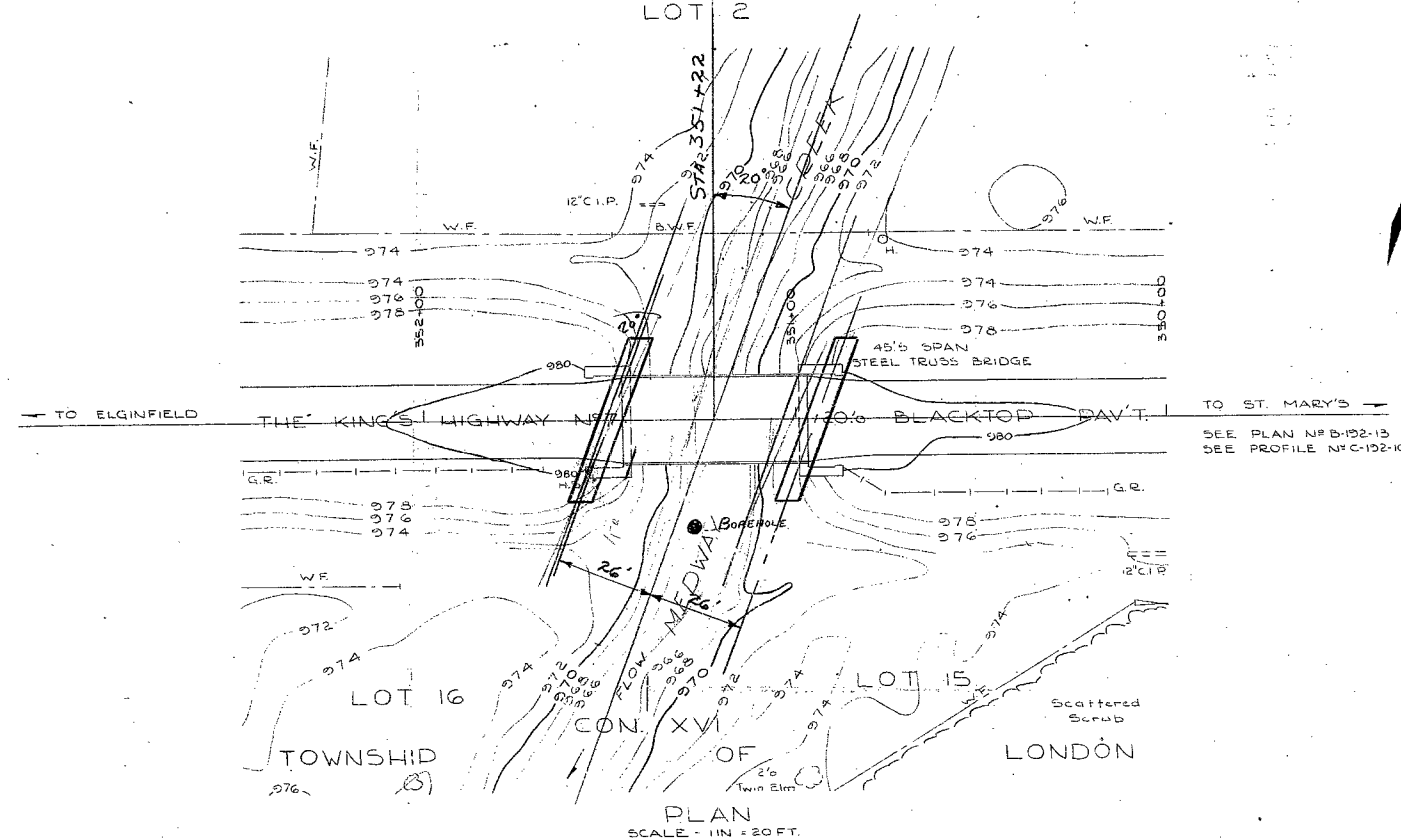
W.P. #132-63

Hwy. # 7 E

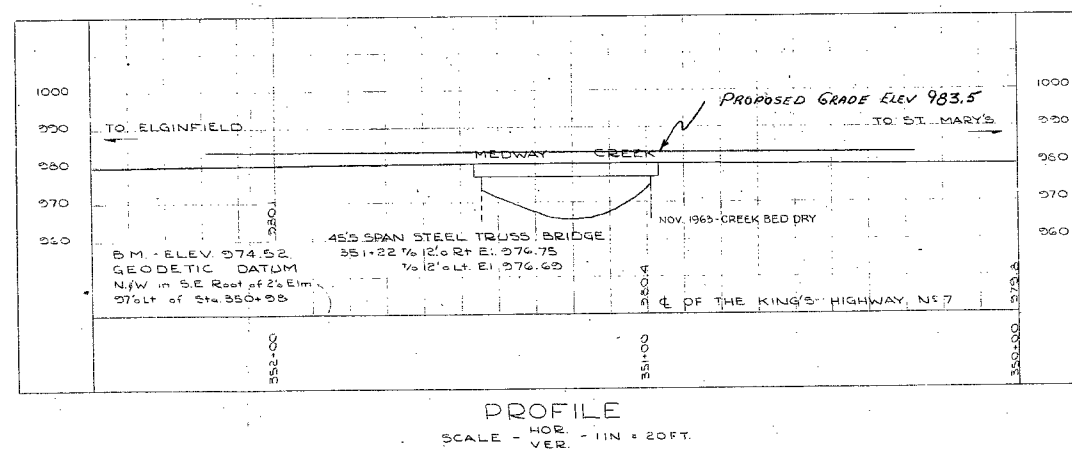
MEDWAY CR.

COUNTY OF MIDDLESEX
TOWNSHIP OF BIDDULPH
SOUTH BOUNDARY CONCESSION
LOT 2

PROBABLE FOOTING LOCATIONS



G.B.M. N° 114-F Elev. 997.353.
Double Stone Box Culvert under C.N.R.
1 m. east of station and at milepost 45
from St. Mary's Junction East end of 4th
Face, first course below coping. Built sub-
horizontally. Publication 19 'LUCAN'.



PROFILE
SCALE - HOR. - 1 IN. = 20 FT.
SCALE - VER. - 1 IN. = 20 FT.

DATE	REVISIONS & ADDITIONS	BY	CHKD.
DEPARTMENT OF HIGHWAYS - ONTARIO			
DESIGN BRANCH SOUTH-WESTERN REGION			
DISTRICT N° 3			
CROSSING WP 132-63			
AT			
MEDWAY CREEK			
AND			
THE KING'S HIGHWAY N° 7			
LOT 2, 15 & 16 S.B. CON. of CON. XVI			
TOWNSHIPS of BIDDULPH & LONDON COUNTY of MIDDLESEX			
BRIDGE SITE			
SURVEY BY Chief of Party - W.R. AGNEW Supervisor - W.L. SMYTH		APPROVED <i>John Walter</i> Director of Design	
DRAWN BY Draftsman - J.C. ANDERSON Supervisor - J. CAMILLERI		SCALE - AS SHOWN	
CHECKED BY Draftsman - I. DROZD Supervisor - J. CAMILLERI		DATE OF SURVEY - OCT. NOV '63	
		DATE OF PLAN - JAN. '64	
		W.O.N° 2012-63-85 X-11113 N1	
		PLAN E-4313-1	

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

23-68-12

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

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

Attention: Mr. S. McCombie

DATE: November 8, 1966.

NOV - 8 1966

OUR FILE REF.

IN REPLY TO:

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Proposed New Structure at Medway Creek
and King's Hwy. #7, Lots 2, 15 & 16;
S. B. Con. & Con. XVI, Townships of
Biddulph & London; Co. of Middlesex,
District #8 (Stratford)
W.J. 66-F-85 2 London W.P. 132-63

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

We believe that 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:sm
Attach.

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

c. c. Messrs: B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
A. Gater
J. G. Tillcock
J. Roy
A. P. Watt
A. Watt
Foundations Office
Gen. Files ✓

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2. Soil Types and Soil Conditions
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 - 2.5) Silty Clay to Clay
 - 2.6) Sandy Silt
 - 2.7) Gravelly Sand
3. Discussion and Recommendation
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FOUNDATION INVESTIGATION REPORT

For

Proposed New Structure at Medway Creek
and King's Hwy. #7, Lots 2, 15 & 16;
S. B. Con. & Con. XVI, Townships of
Biddulph & London; Co. of Middlesex,
District #3 (Stratford)

W.J. 66-F-85 -- W.P. 132-63

1. INTRODUCTION:

A foundation investigation was carried out by the Foundation Section to determine the subsoil conditions existing at the site of a proposed new bridge. The bridge site is located some 0.4 miles East of the interchange of Highway #7 and Highway #4, on Highway #7 at Medway Creek.

The field work consisted of two sampled boreholes and three dynamic cone penetration tests.

The locations and elevations of these test holes are shown on Drawing 66-F-85A, which accompanies this report.

2. SOIL TYPES AND SOIL CONDITIONS:

2.1) General:

The subsoil, at the site investigated, was found to consist of stratified cohesive and granular type material.

The detailed stratigraphy encountered in each boring is shown on the Record of Boreholes in the Appendix.

From groundlevel downwards, the following soil types were observed:

2.2) Fill Material:

This stratum extends from groundlevel in Borehole #3 to elevation 969. The material in the deposit consists of brown coloured clayey silt

cont'd /2.....

with some sand and organic substances. The consistency is estimated to be soft.

2.3) Silty Clay to Clayey Silt:

This deposit was encountered between elevation 969 and elevation 953.7 in Borehole #3 and between groundlevel (elevation 973.8) and elevation 956.3 in Borehole #1.

The material consists of numerous thin layers of silty clay, clayey silt and silt.

Unconfined compression tests, carried out on "undisturbed" samples, gave shear strength values ranging from 584 to 1145 pounds per sq. ft., which indicate firm to stiff consistency.

Physical properties determined in the laboratory are as follows:

Liquid Limit	25.3 to 36.0%
Plastic Limit	16.3 to 19.9%
Natural Moisture Content	21.1 to 32.5%
Bulk Density	118 to 124 lbs. per cu. ft.

In-situ vane test results were found to vary from 640 to 1920 p. s. f.

2.4) Sandy Silt:

A 2 to 4 ft. thick of sandy silt layer was found to underlie the silty clay to clayey silt deposit. The material consists of predominantly silt (83%) and sand (15%) with traces of clay (2%). The relative density is estimated to range from compact to dense.

2.5) Silty Clay to Clay:

This deposit underlies the sandy silt stratum and extends to elevation 937.5 and elevation 932.5 in Borehole #1 and Borehole #2 respectively.

The visual examination of samples revealed that the material is basically silty clay to clay with occasional layers of sandy silt.

cont'd /3.....

Standard penetration tests carried out in this zone gave "N" values ranging from 9 to 30, which indicate firm to hard consistency.

2.6) Sandy Silt:

In Borehole #3, a sandy silt with traces of clay deposit was observed beneath silty clay to clay stratum. The thickness of the material is in the order of 11 ft. The relative density may be described as dense to very dense.

2.7) Gravelly Sand:

This deposit was encountered at elevation 937.5 and elevation 921.5 in Borehole #1 and #3, respectively. The lower boundaries were not determined since the borings were terminated in this layer. The material in the borings, was found to consist of sand and gravel, with layers of clayey silt. "N" values varied from 27 to over 100 blows per feet. Which indicates that the relative density of the material ranges from compact to very dense. The groundwater level was found to be at elevation 969.3.

3. DISCUSSION AND RECOMMENDATION:

It is proposed to construct a new single span bridge at the crossing of Medway Creek and Highway #7. The creek is some 25 ft. wide.

It was observed from the bridge site plan, that the present grade line of Highway #7 will be raised by 5 ft. above the existing level. The proposed footing elevation is 960.

The investigation has revealed that, in general, the shear strength for the upper layers is inadequate to provide suitable support for spread footing type foundation.

In view of the foregoing, it appears that a piled foundation is the most suitable type.

It is recommended that large displacement piles should be driven into the granular strata which occurs around elevation 931.0 and elevation 937, where a safe design load of 40 tons per pile may be achieved.

No stability problems are anticipated for the proposed embankment on Highway #7, provided standard 2:1 slopes are constructed.

4. MISCELLANEOUS:

The field work was carried out during the period September 27, 1966 to September 30, 1966. Equipment used was owned and operated by Canadian Longyear Limited. The field work was supervised directly by Project Foundation Engineers, Mr. A. C. Calder and Mr. P. Payer.

The preparation of this report was carried out by Mr. P. Payer, under the supervision of Mr. K. G. Selby, Supervising Foundation Engineer.

October, 1966.

APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-85

LOCATION 351401: 31'Lt

ORIGINATED BY PP

W. P. 132-63

BORING DATE September 27 & 28, 1966.

COMPILED BY _____ PP

DATUM Geodetic

BOREHOLE TYPE Washbore-Bx & Nx Casing

CHECKED BY AK

[illegible]

FOUNDATION SECTION

JOB 66-F-85

LOCATION Sta: 350+81; 20.5' Rt.

ORIGINATED BY P.P.

W.P. 132-63

BORING DATE September 28, 1966.

COMPILED BY P.P.

DATUM Geodetic

BOREHOLE TYPE Cone Test Only

CHECKED BY HK

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-85

LOCATION Sta: 351.459; 17.5' Lt.

ORIGINATED BY P.P.

W.P. 132-53

BORING DATE September 29 & 30, 1966

COMPILED BY P.P.

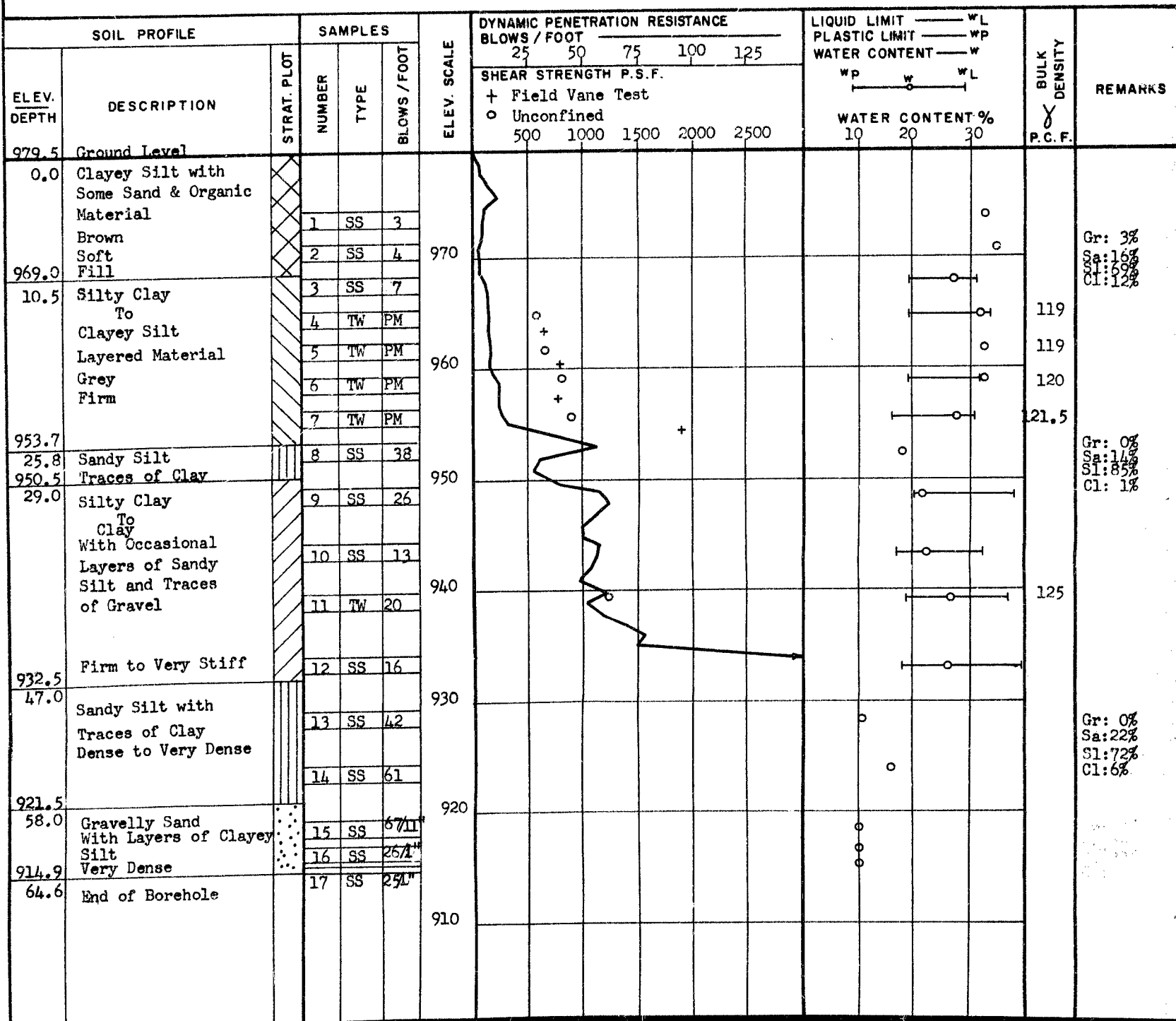
DATUM Geodetic

BOREHOLE TYPE Washbore-Bx Casing

CHECKED BY AK

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION



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 I.B. / 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

Q _u	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Q _{cu}	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q _d	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
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

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SLOPES

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PRELIMINARY STRUCTURE SITE REPORT

66-F-85

HWY. 7 W.P. 132-63 STATION 351+22 DISTRICT 3-STRATFORD
PLAN NO. B-192-13 PROFILE NO. C-192-10 SITE PLAN NO. E-4313-1

Purpose of Structure: River Crossing ☒ R.R.X
Grade Separation Other _____

Is Structure located on D.H.O. right-of-way? YES. If not, who owns property and was permission obtained to carry out necessary exploration work? _____

Describe Soil Conditions at Site. This is to be determined chiefly from a visual observation and possibly a limited amount of hand exploration and should include the general geological formation, anticipated soil conditions, bedrock if visible, etc.

CLAY

Is Structure Site readily accessible with Core Drill or Power Auger?

YES

Would preliminary borings by Power Auger be advantageous?

No

Is water available at the site? YES If not, where is closest source?

Should Approach Fills be investigated for stability?

YES

REMARKS: _____

DATE

July 28, 1966

ENGINEER

A. P. WATT

66-F-85

Mr. A. P. Watt,
Regional Bridge Location Engr.,
Bridge Section,
London Regional Office.

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

January 18, 1967

Your Memo -- Jan. 9/67

W.P. 132-63, Bridge Site 19-64,
Midway Creek Bridge,
0.4 miles east of Hwy. 4, Elginfield,
Highway 7,
District 2, London.

With reference to your memo of January 9, 1967,
and the attached preliminary plan D-6093-P1, we wish to
advise you that we have no comments to make at this stage
because the plan seems to incorporate the recommendations
contained in our report for this structure.

AGS/MdeF


A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

cc: Mr. S. McCombie

Foundations Files
Gen. Files

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: January 9, 1967

OUR FILE REF.

IN REPLY TO

SUBJECT:

W.P. 132-63, Bridge Site 19-64,
Medway Creek Bridge,
0.4 miles east of Hwy. 4, Elginfield,
Highway 7,
District 2, London.

Attached please find one copy of the preliminary
plan D-6093-P1 for the above noted structure.

Would you kindly review the bridge foundations
proposed and inform me if they are satisfactory.

A reply would be appreciated within the next two
weeks.



A. P. WATT
REGIONAL BRIDGE LOCATION ENGINEER

APW:gf
ATT'D

c.c. Mr. S. McCombie

*Review please and
see me.*

Thank you

Jan 12/67

APW

am

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division, Admin. Bldg.

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

Attention: Mr. L. Gvildys,
Sr. Bridge Project
Engr.

February 20, 1967

Redway Creek Bridge - Piled Foundation
Highway No. 2 - District No. 2 (London)
W.J. (66-P-35) -- W.P. 132-63

We have reviewed the soil conditions at the site of the above mentioned structure, following your verbal request of February 16, 1967. 12-3/4 x 1/4 steel tube piles driven to approximate elevation 920.0, should achieve a design capacity of 70/80 tons per pile. Pile driving should be controlled in the field by means of the Hiley Formula, according to D.H.O. Standards DD 1218 and DD 1219.

42. 11. 3-1

KGS/1.1eF

K. G. Selby,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Sternac,
PRINCIPAL FOUNDATION ENGR.

cc: Foundations Files ✓
Gen. Files