

BA 1941  
19-205  
file

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. B. R. Davis,  
Bridge Design Engr.,  
Bridge Division.

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

Attention: Mr. C. Grebski

DATE: February 19, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT:

-- Piled Foundations --  
Sydenham River Bridge at Strathroy  
Bridge Site: 19-205, Hwy. 81, Dist. 2  
W.P. 326-61 -- W.J. 64-F-86

We have reviewed your Preliminary Plan No. D-5605-P2 for the above proposed structure.

As you requested, we have investigated the possibility of using 12" diameter steel tube piles instead of the recommended timber piles.

The calculations seem to indicate that 12" diameter steel piles may be used with an embedded length of 40 ft. The lip of these piles should be around El. 682.00'. At that elevation the allowable bearing capacity of such a pile may be taken as 50 T.S.F.

We trust that the above comments are satisfactory to you.

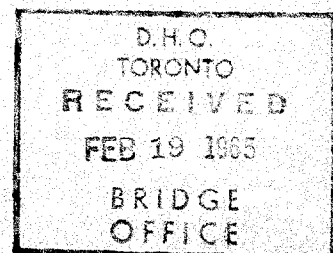
*A. G. Stermac*

KGS/MdeF

A. G. Stermac,  
PRINCIPAL FOUNDATION ENGINEER

cc: Mr. N. Zoltay

Foundations Office  
Gen. Files



## MEMORANDUM

BA 1941

To: Mr. A. M. Toye,  
Bridge Engineer,  
Bridge Division.

FROM: Foundation Section,  
Materials and Research Div.,  
Room 107. Lab. Bldg.

Attention: Mr. S. McCombie

DATE: October 27, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Hwy #81 and Sydenham River  
County of Middlesex Town of Strathroy  
District #2  
W.J. 64-F-86 -- W.P. 326-61

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

We believe that you will find the factual data and recommendations contained therein, adequate for your future design work. Should you require additional information, please do not hesitate to contact our Office.

AGS/PB  
Attach.

cc: Messrs.

A. M. Toye (2) ✓  
H. A. Tregaskes  
H. D. McMillan  
A. Gater  
H. C. Dernier  
J. E. Roy  
A. Watt

*for* A. G. Stermac  
PRINCIPAL FOUNDATION ENGINEER.

Foundations Office  
General Files

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# FOUNDATION INVESTIGATION REPORT

For

Hwy #81 and Sydenham River  
County of Middlesex. Town of Strathroy  
District #2  
W.J. 64-F-86 -- W.P. 326-61

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## 1. INTRODUCTION:

A request to carry out a Foundation Investigation at Hwy #81 and Sydenham River, was received from the Regional Bridge Location Engineer, Mr. G. Scott, dated September 16, 1964.

It is proposed to erect a new bridge to carry Hwy #81 over the Sydenham River. The site of the proposed bridge is located in the Town of Strathroy, County of Middlesex. At this location the chainage of Hwy #81 is from 15+50 to 16+70.

In order to determine the soil properties and decide on the type of foundation, an investigation was carried out by this section. Results and the discussion of the field and laboratory investigations, as well as conclusions and recommendations for the future design work, are contained in the following paragraphs of this report.

## 2. DESCRIPTION OF SITE:

The site of the proposed bridge is located in the town of Strathroy. The surrounding area is generally flat terrain.

Physiographically, the site is located in the so-called Caradoc Sand Plains.



2. DESCRIPTION OF SITE: (cont'd) ...

The deck and abutments of the existing Warren type bridge, which was erected in 1922, are in a poor condition - badly damaged by weather and traffic. A considerable settlement of the north abutment can be observed, and the deck is supported by six adjustable jacks. From the information gathered at the site it seems that the bridge was constructed on spread footings placed 5 feet below the creek bed.

Approximately 1.5 miles west of the investigated site is another bridge of the same size and type erected in 1927 on piled footings. Wooden piles of 12" butt diameter were driven 30 to 32 feet below the creek bed. No settlements of any kind can be observed on this bridge.

The width of the Sydenham River at the proposed crossing is about 45 feet, and the depth of the water, approximately 2'-0" to 2'-6".

3. FIELD AND LABORATORY WORK:

In order to obtain sufficient information on the type and properties of the subsoil four sampled Boreholes and four Dynamic Cone Penetration Tests, were carried out at this site.

Split spoon samples were taken at various depth intervals. Samples recovered in the split-spoon sampler were used to determine the following physical properties:

1. Natural Moisture Content.
2. Grain Size Distribution.

cont'd /3...

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

Results of these laboratory tests are summarized in Appendix I of this report.

4. SUBSOIL CONDITIONS:

4.1 General

The stratigraphy of the soil at the site was found to be generally uniform. A detailed description of various soil types encountered during the investigation, is shown in Appendix I of this report, and is also given in subsequent paragraphs. The estimated Stratigraphical Profile shown on Dwg. No. 64-F-86A, is based upon this information.

4.2 Sand- Loose (Hwy Fill)

This layer, which extends for a depth of 5'-0" to 7'-0" was found in BH #1 & BH #4, just below the topsoil.

It may be classified as loose with an average "N" value of 6 blows/foot.

4.3 Silty sand to Sandy Silt Very Loose to Very Dense.

Following the Hwy fill in BH #1 & 4 and immediately below the topsoil in BH #2 & BH #3 is a stratum of silty sand to sandy silt. This deposit extends to the maximum depth tested, which was 56.7 feet in BH #3.

The overall stratum is in a very loose to very dense condition with an average "N" value of 45 blows/foot. The "N" values varied from 2 blows/foot to over 100 blows/foot.

cont'd /4...

4.3 Silty Sand to Sandy Silt Very Loose to Very Dense: (cont'd)..

Grain size distribution curves indicated that this stratum is composed of 55% sand, 43.5% silt and 1.5% gravel. The average moisture content in this stratum was found to be 21.8%, ranging from 16.2% to 28.1%.

5. GROUND WATER CONDITIONS:

The ground water level at the time of the investigation was found to be at elevation 726.2, which corresponded with the water level elevation of the creek. It may be assumed that the water level will vary with the seasons of the year. No Artesian water conditions were encountered.

6. DISCUSSION AND RECOMMENDATIONS:

As was described in previous paragraphs the subsoil is basically a silty sand, whose relative density increases with depth, from very loose to very dense. The investigation has revealed that within the upper 20 feet of the deposit the properties are such that adequate support for spread footings could not be obtained. It is therefore suggested that the structure be founded on displacement friction piles driven some 40 feet into the ground. Treated timber piles would be best suited for this purpose and an allowable load of 20 tons per pile could be obtained. Pier pile caps should be placed 5 feet below Creek bed at approximate elevation 720.5 (bottom of cap), if perched abutments are used the pile caps for the abutments should be placed 5 feet below finished grade elevations.

cont'd /5...

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

The Hydrological section of the D.H.C. indicated that some scour may be expected in the Sydenham River Channel. The depth of the scour should be checked with the Hydrology Section when their study is completed. A Dewatering scheme will be necessary and should be carried out so as to prevent "boiling" of the excavations. If steel sheeting is used for this, it should be driven to a depth below the footing base equal to the height of the prevailing water level above it. The sheeting, if found necessary, may be left in for scour protection.

No stability problems are anticipated with regard to the proposed approach embankments, either during or after construction.

7. SUMMARY:

1. The Stratification of the soil is quite uniform. The relative density of the material encountered varies from very loose to very dense.

2. Because of the loose density of the upper layers, a structure supported on piles is recommended.

3. Treated timber piles driven some 40 feet into the ground and loaded with 20 tons/pile are recommended for pier and abutment footings.

4. Bottom of pier pile caps should be 5 feet below creek bed at approximate elevation 720.5. Abutment pile caps should be placed 5 feet below finished grade levels.



7. SUMMARY: (cont'd)...

5. Dewatering may present a problem and recommendations contained in the body of the report should be followed.

6. No stability problems for approach fills are anticipated.

8. MISCELLANEOUS:

The field work, performed during the period from September 21 to September 25, 1964, together with the preparation of this report, was undertaken by Mr. W. W. Kulmatickas, Proj. Foundation Engineer. The investigation was carried out under the general supervision of Mr. K. G. Selby, Sen. Foundation Engineer, who reviewed this report.

The information about the existing bridges was obtained from Mr. W. Conkey, Caradoc Street, Strathroy, who acted as a foreman during the erection in 1922 and 1927.

October 27, 1964.

APPENDIX I.

# RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

64-F-86

LOCATION Sydenham River & Hwy. #81 Ch. 15/21 - 21'-0" Bl.

ORIGINATED BY W.W.K.

326-61

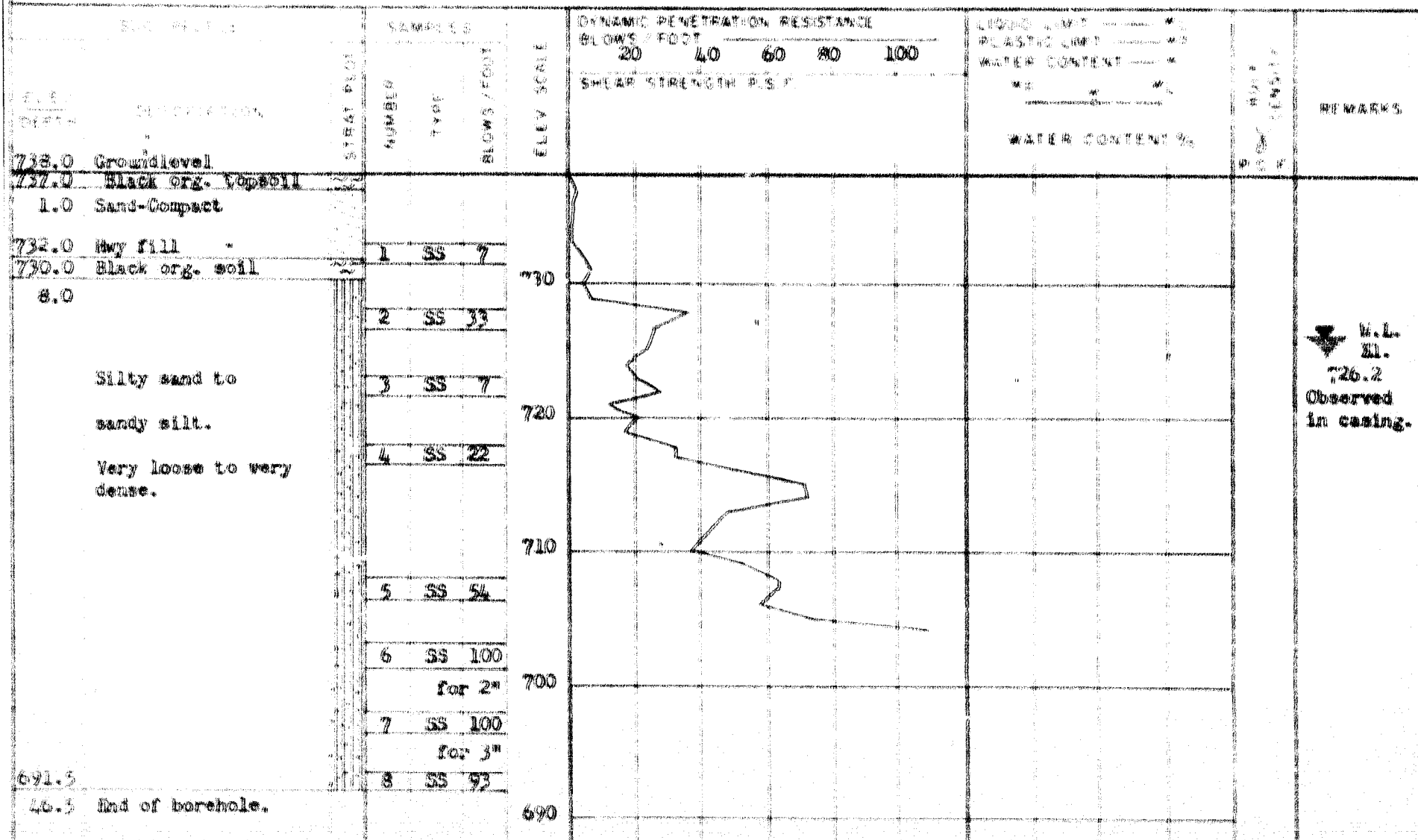
DATE OF TEST Sept. 21, 1964.

COMPILED BY W.W.K.

738.0

BOREHOLE TYPE Washboring - BK Casing.

CHECKED BY K.C.S.



# RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

64-F-86

LOCATION Sydenham River &amp; Hwy. #61 Ch. 15472-23'-0" LA.

OBSERVED BY W.W.K.

126-61

DATE Sept. 23, 1964.

CORRECTED BY W.W.K.

729.0

METHOD Washboring - BK Casing.

CHECKED BY H.H.S.

729.0 Groundlevel

726.2 Black org. topsoil

0.8

 Silty sand to  
sandy silt.

 Very loose to  
very dense.

1	SS	2
2	SS	12
3	SS	7
4	SS	34
5	SS	33
6	SS	20
7	SS	112
8	SS	37
9	SS	31

 DYNAMIC PENETRATION RESISTANCE  
BLOWS / FOOT

30 40 60 80 100

60 120 180 240 300

360 420 480 540 600

660 720 780 840 900

960 1020 1080 1140 1200

1260 1320 1380 1440 1500

1560 1620 1680 1740 1800

1860 1920 1980 2040 2100

2160 2220 2280 2340 2400

2460 2520 2580 2640 2700

2760 2820 2880 2940 3000

3060 3120 3180 3240 3300

3360 3420 3480 3540 3600

3660 3720 3780 3840 3900

3960 4020 4080 4140 4200

4260 4320 4380 4440 4500

4560 4620 4680 4740 4800

4860 4920 4980 5040 5100

5160 5220 5280 5340 5400

5460 5520 5580 5640 5700

5760 5820 5880 5940 6000

6060 6120 6180 6240 6300

6360 6420 6480 6540 6600

6660 6720 6780 6840 6900

6960 7020 7080 7140 7200

7260 7320 7380 7440 7500

7560 7620 7680 7740 7800

7860 7920 7980 8040 8100

8160 8220 8280 8340 8400

8460 8520 8580 8640 8700

8760 8820 8880 8940 9000

9060 9120 9180 9240 9300

9360 9420 9480 9540 9600

9660 9720 9780 9840 9900

9960 10020 10080 10140 10200

10260 10320 10380 10440 10500

10560 10620 10680 10740 10800

10860 10920 10980 11040 11100

11160 11220 11280 11340 11400

11460 11520 11580 11640 11700

11760 11820 11880 11940 12000

Per 6"

 W.L.  
H.L.  
726.2  
Observed  
in casing.

672.5

56.5 End of borehole.

670





CONFIDENTIAL K.S.S.

W. L.  
El.  
726.2  
Observed  
in Casing.

## 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 DENSITIES OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS:-

<u>CONSISTENCY</u>	<u>"N" BLOWS / FT.</u>	<u>γ LB. / CU. FT.</u>	<u>DENSITIES</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

CU	UNCONFINED COMPRESSION	LV	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	FW	FIELD VANE
Q <sub>cu</sub>	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q <sub>d</sub>	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 $= \frac{-\Delta e}{(1+e)\Delta\sigma}$
$C_u$	COEFFICIENT OF CONSOLIDATION
$C_c$	COMPRESSION INDEX $= \frac{\Delta e}{\Delta \log_{10} \sigma}$
$T_v$	TIME FACTOR $= \frac{C_u t}{d^2}$ ( $d$ , DRAINAGE PATH)
$U$	DEGREE OF CONSOLIDATION
$\tau_h$	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
$S_t$	SENSITIVITY

## GENERAL

$\pi$	$= 3.1416$
$e$	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF $\sigma$
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF $\sigma$ TO BASE 10
$t$	TIME
$g$	ACCELERATION DUE TO GRAVITY
$V$	VOLUME
$W$	WEIGHT
$M$	MOMENT
$F$	FACTOR OF SAFETY

## STRESS AND STRAIN

$\sigma$	PORIE PRESSURE
$\sigma_n$	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

$z$	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
$K$	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SURFACES 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

## MEMORANDUM

To: Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107,  
Laboratory Building.

FROM: Bridge Division,  
Downsview, Ontario.

DATE: March 12th., 1965.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 326-61, Bridge Site 19-205,  
Sydenham River Bridge,  
Highway #81, District #2.

64-F-86

We are sending to you herewith one print of the revised Preliminary Plan D-5605 - P4 for the above structure.

Preliminary Plan D-5605-P2 has already been approved by you on February 19th., 1965. The present revision does not change the foundation condition therefore we assume your approval will remain unaffected.

*N. Zoltay*

NZ/lg.  
cc. S. McCombie,  
G. Scott,  
N.D. Smith,  
R. Fitzgibbon,  
Designer.

N. Zoltay,  
for: G. Scott,  
Regional Bridge Location Engineer.

MEMORANDUM

TO: Mr. A. Sternac,  
Principal Foundation Engineer,  
Room 107,  
Lab. Building.

FROM: Bridge Division,  
Downsview, Ontario.

DATE: September 16, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 326-61 Bridge Site # 20-205  
Sydenham River Bridge at Strathroy  
Highway # 81 District # 2.

Attached herewith please find two prints of Bridge Site Plan E 4318-1 showing the proposed location of the above structure marked in red.

Please make the necessary arrangements for a Foundation Soils Investigation. We will be pleased to have your report in due course.



GS/kd

G. Scott,  
Regional Bridge Location Engineer.

c.c. S. McCombie  
N.D. Smith  
R. Fitzgibbon



MEMORANDUM

From: Bridge Division,  
Tottenham, Ontario.  
Date: September 12, 1904.

Mr. A. Stewart,  
Principal Foundation Engineer,  
Room 107,  
East Building.

IN REPLY TO

ON FILE FILE

W.P. 320-01 bridge site & 20-205  
Sydenham River bridge at Strachan  
Highway # 81 District # 2.

Attached herewith please find two prints of bridge  
site plan & 431-1 showing the proposed location of the  
above structure marked in red.

Please make the necessary arrangements for a foundation  
Soils Investigation. We will be glad to have your  
report in due course.

640-1290

15-16

Regional Bridge Location Engineer.

W.D. Smith  
R. Fitzgibbon  
J. McCormick

## MEMORANDUM

To: Mr. A. Stermac, Principal Foundation Engineer, Room 107, Lab. Bldg.

FROM:

Bridge Division,  
Downsview, Ontario.Att.: Mr. K. Selby

DATE:

February 10, 1965.

OUR FILE REF.

IN REPLY TO

## Subject:

Sydenham River Bridge at Strathroy,  
H.P. 326-61,  
Highway No. 81 District No. 2.

Some time ago I discussed this bridge foundation piling with you. We have now completed the preliminary plan a copy of which is attached.

The soil report suggests timber piles with 20 ton capacity. We wish to use steel tube piles 12" diameter with a capacity 40 - 50 tons; preferably 50 tons.

We would like to have your recommendations regarding allowable load and probable tip elevation for the steel tube piles.

CSG:go  
c.c. G. Scott

*C. S. Grebski*  
C. S. Grebski,  
Sr. Bridge Project Engineer.

*Comments: Use 12" steel tubes with an embedded length  
of 40'. Tip elevation around EL. 692'  
Should bearing pressure per pile: 56 Tons*

## MEMORANDUM

To: Mr. A. Stermack,  
Principal Foundation Engineer,  
Room 107, Lab. Bldg.

From: Bridge Division,  
Downsview, Ontario.

Date: February 17 1965

Our File Ref.

In Reply To

Subject: W.F. 326-61  
Bridge Site: 19-205  
Sydenham River Bridge  
Hwy. 81 - Dist. 2

We are sending to you herewith two prints of Preliminary Plan D-5605-P2 of the above structure.

Would you please let us have your written comments.



NZ/sp

N. Zoltay,  
for G. Scott,  
Regional Bridge Location Engineer.

cc. S. McCombie  
G. Scott  
R. Smith

Mr. B. R. Davis,  
Bridge Design Engr.,  
Bridge Division.

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

Attention: Mr. C. Grebski

February 19, 1965

-- Piled Foundations --  
Sydenham River Bridge at Strathroy  
Bridge Site: 19-205, Hwy. 81, Dist. 2  
W.P. 326-61 -- W.J. 64-F-86

We have reviewed your Preliminary Plan No. D-5605-P2  
for the above proposed structure.

As you requested, we have investigated the possibility  
of using 12" diameter steel tube piles instead of the recommended  
timber piles.

The calculations seem to indicate that 12" diameter  
steel piles may be used with an embedded length of 40 ft. The  
tip of these piles should be around El. 682.00'. At that elevation  
the allowable bearing capacity of such a pile may be taken as  
50 T.S.F.

We trust that the above comments are satisfactory to  
you.

KGS/MdeF

cc: Mr. N. Zoltay

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

Foundations Office ✓  
Gen. Files

JOENJAM RIV.

64-7-16

ALCULATIONS OF BEARING CAPACITIES OF 12"  $\phi$  STEEL

TOBE PILES :

ASSUME EMBEDDED LENGTH = 30'

TIP ELEV. APPROX. EL. 692'

$$Q_u = 4 \times 1.5 \times A_p \times \frac{1.5 \times 4.5}{50}$$

$$A_p = 0.5^2 \pi = 0.785 \text{ SQFT}$$

$$A_s = 0.5^2 \pi \times 2 \times 30 = 93.30 \text{ SQFT}$$

$$N \text{ (average at tip)} = 30$$

$$N \text{ (average along embedded length)} = 27$$

$$Q_u = 4 \times 1.5 \times 0.785 + \frac{27 \times 93}{50} = 113 \text{ 70N/150FT}$$

$$Q_{\text{Permissible}} = \frac{113}{3} = 38 \text{ TSF}$$

ASSUME EMBEDDED LENGTH = 40'

TIP ELEV. APPROX. EL. 692'

$$N \text{ (at tip)} = 33$$

$$N \text{ (along shaft)} = 27$$

$$A_p = 1.2 \times 1.5 \times \pi \times 40 = 185 \text{ SQFT}$$

$$Q_u = 4 \times 33 \times 0.785 + \frac{27 \times 185}{50} = 170 \text{ TSF}$$

$$Q_{\text{Permissible}} = \frac{170}{3} = 56 \text{ TSF}$$

OK.



# 64-F-86

W.P. # 326-61

Hwy. # 81

SYDENHAM

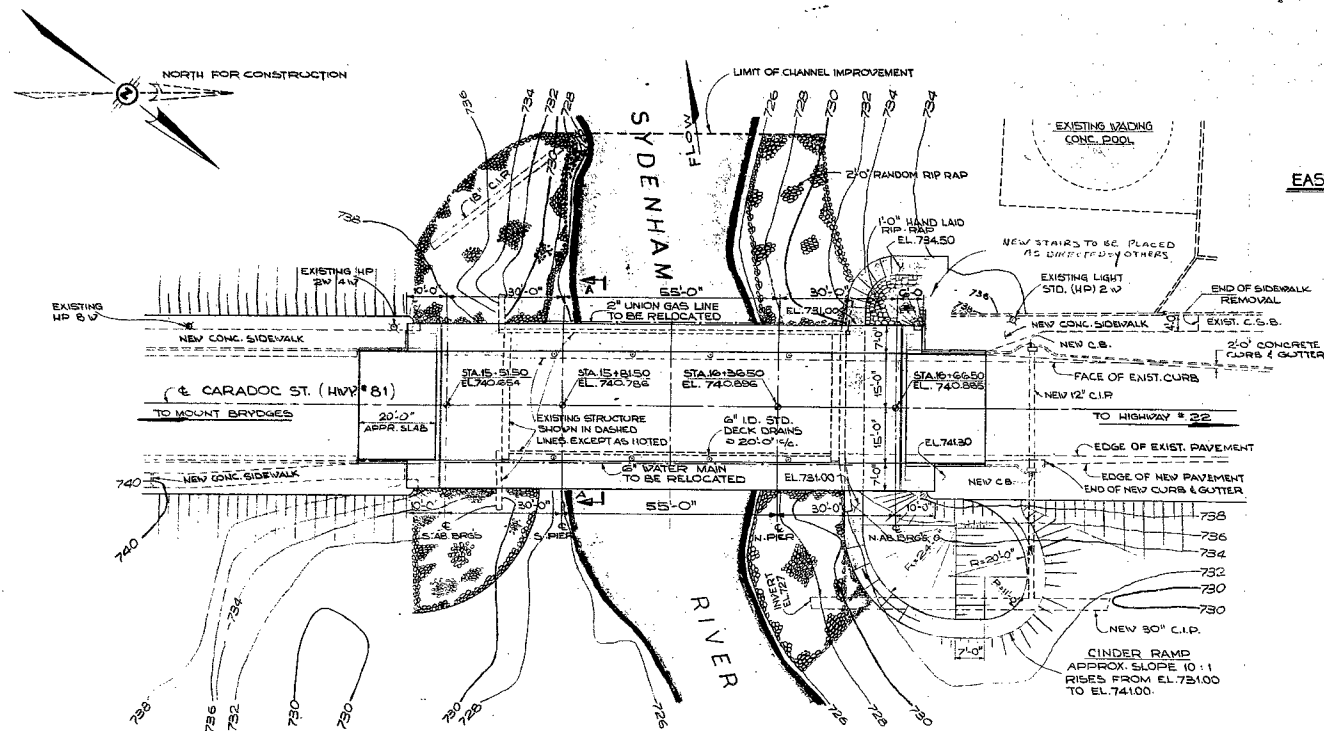
RIVER BRIDGE

AT STRATHROY

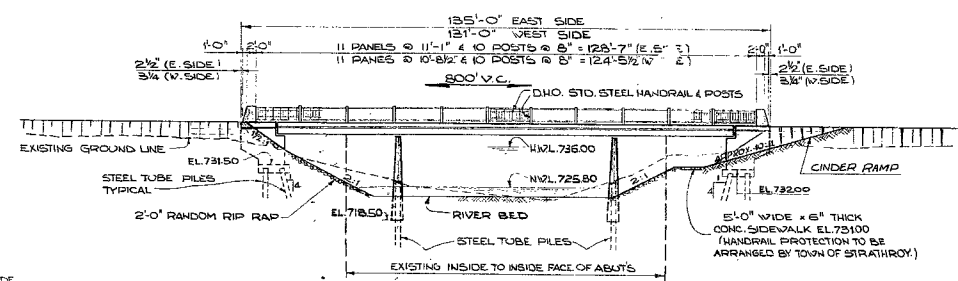
BRIDGE SITE

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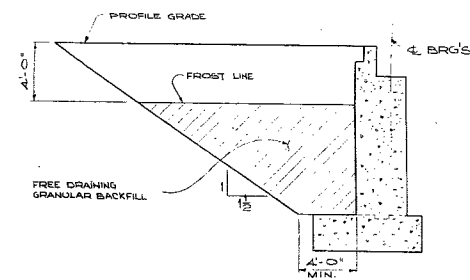




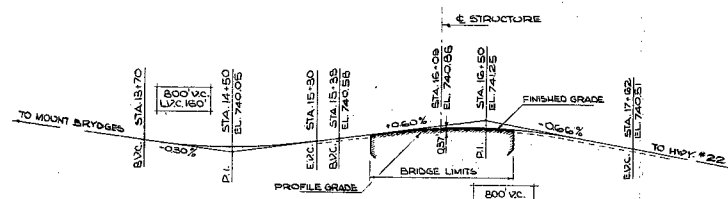
**PLAN**  
SCALE: 1" = 20' FT.



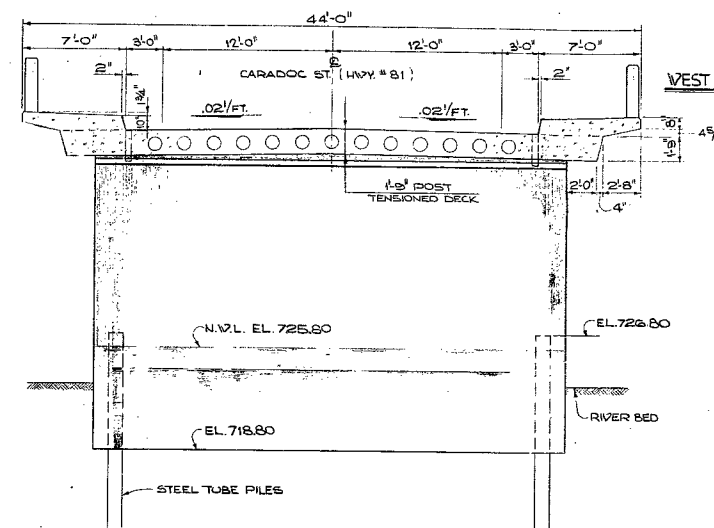
**ELEVATION**  
SCALE: 1" = 20' FT.



**GRANULAR BACKFILL**  
SECTION TAKEN NORMAL TO FACE OF ABUT.  
INSIDE FACE TO INSIDE FACE OF VINGUARDS  
SCALE: 3/32" = 1'-0"



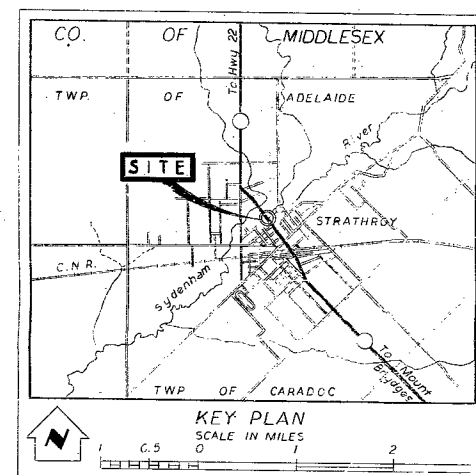
**PROFILE GRADE OF KING'S HWY. #81**  
NOT TO SCALE



**SECTION A-A**  
SCALE: 3/16" = 1'-0"

- REFERENCE DRAWINGS**
- BRIDGE SITE PLAN E - 4318-1
  - LOCATION PLAN B - 213-2
  - LOCATION PROFILE C - 213-8
  - SOILS REPORT BA 1941

FOR CHANNEL IMPROVEMENT SEE  
ROADWAY DRAWINGS.



REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION			
SYDENHAM RIVER BRIDGE AT STRATHROY			
KING'S HIGHWAY No. 81		DIST. No. 2	
CO. MIDDLESEX		TOWN OF STRATHROY	
TWP. OF CARADOC		LOT CON.	
PRELIMINARY			
APPROVED	BRIDGE ENGINEER	SITE No. 18-205	W.P. No. 326-61
DESIGN 9.5	CHECK	CONTRACT No.	
DRAWING N.T.	CHECK 9.5	DRAWING No.	D-5605-P1
DATE MAR 1985	LOADING 1420-512		