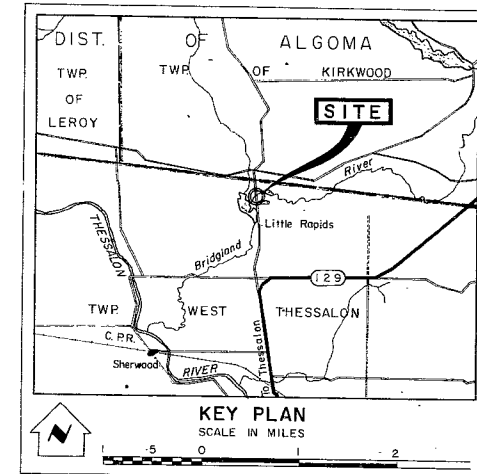
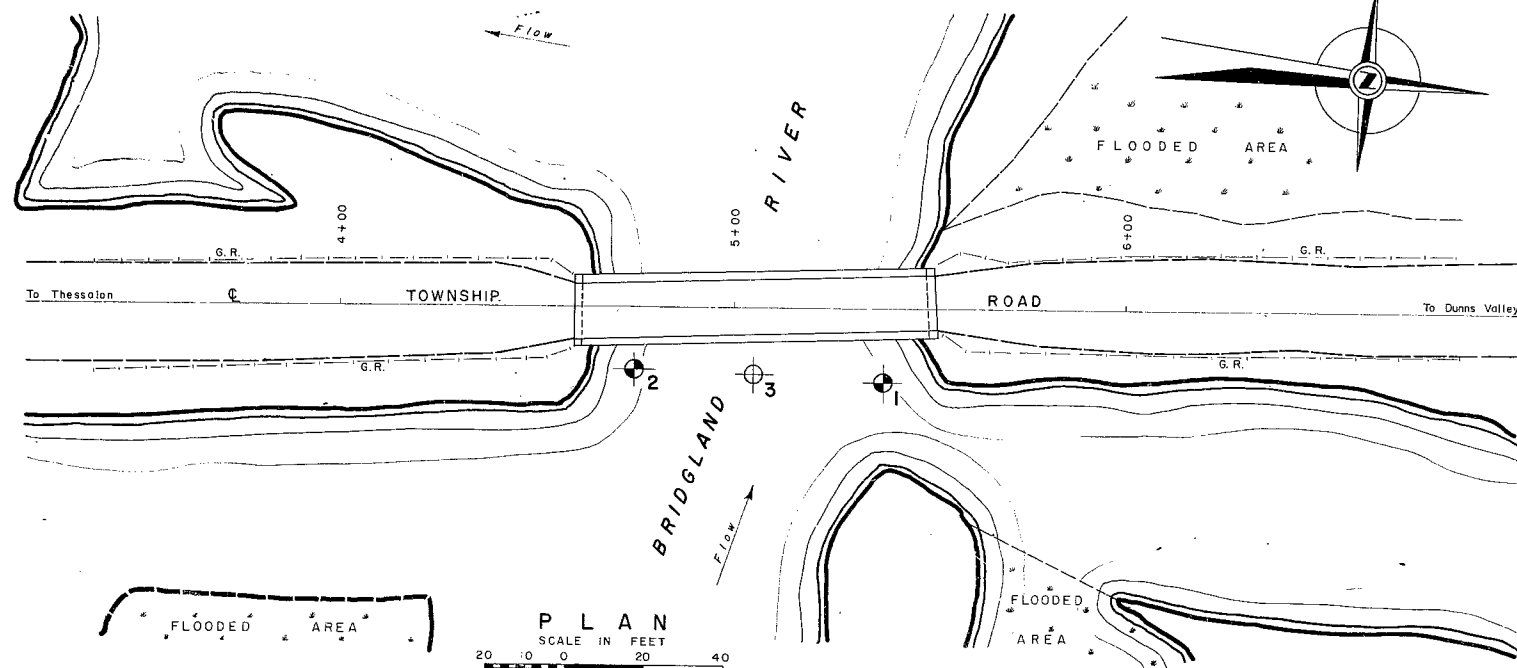


#64-F-3
W.P. MUNIC.
BRIDGELAND
RIVER & TWP.
RD. APPROX.
3 MI. N. OF
THESSALON

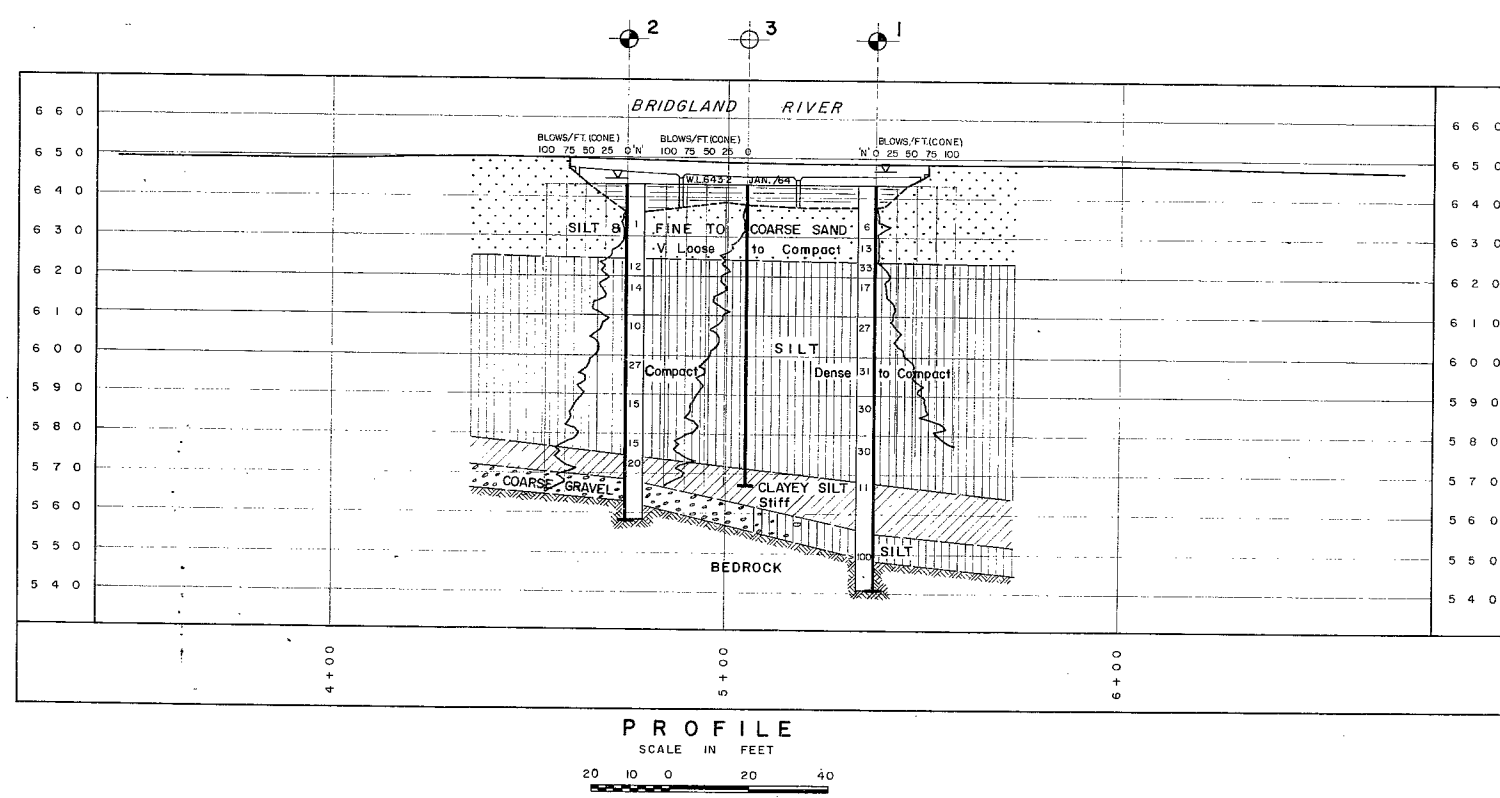


| LEGEND | | | |
|--------|--|--|--|
| | Bore Hole | | |
| | Cone Penetration Hole | | |
| | Bore & Cone Penetration Hole | | |
| | Water Levels established at time of field investigation. | | |
| | Artesian Head | | |

| NO. | ELEVATION | STATION | OFFSET |
|-----|-----------|---------|---------|
| 1 | 643.1 | 5+38 | 19' RT. |
| 2 | 643.3 | 4+75 | 16' RT. |
| 3 | 643.2 | 5+05 | 17' RT. |

- 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.



| | | | |
|---|----------------------------|---------------|--------|
| DEPARTMENT OF HIGHWAYS - ONTARIO | | | |
| MATERIALS & RESEARCH SECTION | | | |
| BRIDGLAND RIVER | | | |
| SHOWING POSITIONS & ELEVATIONS OF HOLES | | | |
| HWY. | DISTRICT NO. 18 | DISTRICT | ALGOMA |
| TOWNSHIP | WEST THESSALON | LOT | CON. |
| LOCATION | 3 MILES NORTH OF THESSALON | | |
| DRAWN BY: D. MUMFORD | CHECKED BY: T.L. | W.D. 63-33224 | |
| DATE 20 FEB. 1964 | APPROVED BY: | DRAWING NO. | |
| SCALE AS SHOWN | | 64-F-3A | |

28-18

MEMORANDUM

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

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

Description: Mr. S. McCordie

DATE: March 10, 1964

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Bridge Crossing at Bridgeland
River and Twp. Road, approx. 3
miles North of Thessalon, Ont.
District #18

W.J. 64-F-3 - Mun. W.O. 63-33224

As requested by the Bridge Office in a memo dated December 12, 1963, this Section has recently completed a foundation investigation at the above-noted site.

The existing bridge is located in a flat swampy backwater area of the Bridgeland River. Earth fill causeways run North and South from the bridge to higher ground.

The results of two sampled boreholes and a dynamic cone penetration test indicate that the upper material consists of 10 to 15 ft. of a very loose irregularly layered granular mixture ranging from silt to coarse sand. Underlying the loose surface deposit is a thick layer of dense to compact silt varying between 50 and 55 feet in thickness.

This material is in turn, underlain by a layer of stiff clayey silt varying between 5 and 13 feet in thickness in the two sampled boreholes.

cont'd. /2 ...

March 10, 1964

In B.H. #2 there is approx. 6 ft. of gravel and cobbles between the bottom of the clayey silt and the underlying bedrock while in B.H. #1 there is a 6-ft. layer of silt between the clayey silt and the bedrock. The bedrock was found to dip to the North varying between el. 563.1 at B.H. #2 to el. 548.5 at B.H. #1.

Artesian water was encountered at and just above the rock in both boreholes. The artesian head was approx. 4 ft. in B.H. #1 and approx. 1 ft. in B.H. #2.

Since the bedrock is covered by a thick mantle of granular material, it is recommended that the structure be founded on 1-ft. dia. timber piles driven into the silt to a tip elevation of approx. el. 600, or on end-bearing steel H-piles driven to the bedrock. Timber piles could carry a design load of 15 T/pile, while 12 BP 7 $\frac{1}{2}$ H-piles driven to rock could carry up to 70 T/pile. If wooden piles are used, they should be treated against deterioration if the cut-off elevation is above the water level.

Due to the loose nature of the upper part of the granular deposit, serious dewatering problems may be encountered in any excavation below the water table. Steel sheet cofferdams can be used to overcome this problem. To prevent piping of the bottom of the excavation, it will be necessary to drive the sheet piling to at least twice the depth of the excavation below the water level.

The field work was carried out between January 25 and February 1, by Mr. G. Cherrington, Project Foundation Engineer. This report was written by Mr. Cherrington under the general supervision of Mr. K. G. Selby, Senior Foundation Engineer.

cont'd. /3 ...

Mr. A. M. Toye,
Attn: Mr. S. McCombie

- 3 -

March 10, 1964

Equipment used was owned and operated by Canadian Longyear Drilling Co.

We believe that this report contains the necessary information for your design requirements. However, should there be any queries in connection with this project, please feel free to contact our Office.

GGC/MdeF

Attach.

cc: Messrs. A. M. Toye (3)
J. P. Howard
W. H. Shiells
E. R. Saint

Foundations Office
Gen. Files

K. Y. Lo,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

| SOIL PROFILE | | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | | | PLASTIC LIMIT --- W WATER CONTENT --- W | | | BULK DENSITY P.C.F. | REMARKS |
|---------------|--|--------------|---------|------|--|------|------|------|------|-----------------------------|--|--|---|---|---------|
| ELEV DEPTH | DESCRIPTION | STRAT. PLLOT | NUMBER | TYPE | 20 | 40 | 60 | 80 | 100 | WATER CONTENT % 20 40 60 | | | | | |
| 643.3 | Ice Level | | | | 500 | 1000 | 1500 | 2000 | 2500 | | | | X | ▽ 644.4 | |
| 0 | Water | | | | | | | | | | | | | Artesian Head encountered at El. 563.1 and below. | |
| 636.3 | <u>Fine to co. sand very loose.</u> | | 1 | SS | 1 | | | | | | | | | | |
| 7.0 | | | 2 | SS | | | | | | | | | | | |
| 624.8 | | | 3 | SS | 12 | | | | | | | | | | |
| 18.5 | | | 4 | SS | 14 | | | | | | | | | | |
| | <u>Silt,</u> | | | | | | | | | | | | | | |
| | <u>Compact.</u> | | 5 | SS | 10 | | | | | | | | | | |
| | | | 6 | SS | 27 | | | | | | | | | | |
| | | | 7 | SS | 15 | | | | | | | | | | |
| | | | 8 | SS | 15 | | | | | | | | | | |
| 574.3 | | | 9 | SS | 20 | | | | | | | | | | |
| 69 | <u>Clayey silt, stiff, with 1/16" thick clay layers.</u> | | 10 | TW | PM | | | | | | | | | | |
| 568.3 | | | 11 | TW | PM | | | | | | | | | | |
| 75 | <u>Coarse gravel & cobbles (2" Ø-6"Ø).</u> | | | | | | | | | | | | | | |
| 563.1 | | | 12 | RC | - | | | | | | | | | | |
| 80.2 | <u>Bedrock.</u> | | 13 | RC | - | | | | | | | | | | |
| 558.2 | (Granite) | | | | | | | | | | | | | | |
| 85.1 | End of borehole. | | | | | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO 3

FOUNDATION SECTION

JUL 64-F-3 LOCATION Sta. 5/05 17' Rt. of E ORIGINATED BY G.C.
W F Mun. WO 63-33224 BORING DATE Feb. 4, 1964. COMPILED BY G.C.
OAT IM Good. 643.2 BOREHOLE TYPE Dynamic Cone Penetration. CHECKED BY K.S.

| SOIL PROFILE | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT --- % PLASTIC LIMIT --- % WATER CONTENT --- % | | BULK DENSITY P.C.F. | REMARKS |
|---------------|-------------|---------------|----------------|--------------------------------|---------------|----|----|----|--|-----|-------------------------------|---------|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER TYPE | BLOWS / FOOT | ELEV SCALE | 20 | 40 | 60 | 80 | 100 | | |
| 643.2 | Ice Level | | | | | | | | | | | |
| 0 | | | | | | | | | | | | |
| | | | | | 640 | | | | | | | |
| | | | | | 630 | | | | | | | |
| | | | | | 620 | | | | | | | |
| | | | | | 610 | | | | | | | |
| | | | | | 600 | | | | | | | |
| | | | | | 590 | | | | | | | |
| | | | | | 580 | | | | | | | |
| | | | | | 570 | | | | | | | |
| 567.2 | | | | | | | | | | | | |
| 76.0 | Refusal | | | | | | | | | | | |
| | | | | | 560 | | | | | | | |

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_e | 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_o | 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. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Bldg.

FROM: J. C. McAllister

DATE: December 12, 1963.

OUR FILE REF.

IN REPLY TO

SUBJECT: Municipal W.O. No. 63-33224
Bridgeland River
Twp. Road 3.0+ miles N. of Thessalon
District #18

64-F-3

The above crossing requires a foundation investigation, the cost of which is recoverable under the above W.O. number. I understand you intend to do some work at Blind River in the near future and suggest that this be done at the same time.

Attached are two prints of site plan E 4239-1 and composite plan and profile B-339-10. Preliminary hydrology investigation indicates that a 60' clear span will be used here, with a possible raise in grade of about 1 foot.

J. C. McAllister

JCMca/es

J. C. McAllister,
for S. McCombie,
Bridge Planning Engineer

cc. N. D. Smith
cc. R. Fitzgibbon
cc. J. Walter

Estimate

\$1800.00 (Foundation Investigation)

K. L. Smith

Dec. 20th 1963

OVER

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

FROM: Bridge Division,
Downsview, Ontario.

DATE: May 11, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT: Project No. 63-33224 Bridgeland River,
Thessalon Township,
District # 18.

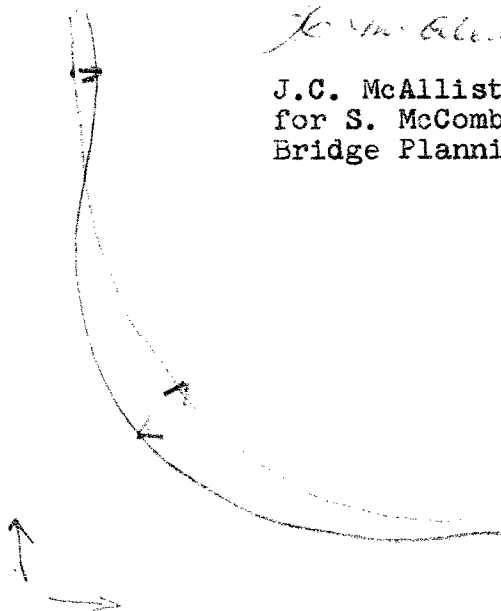
63-33224

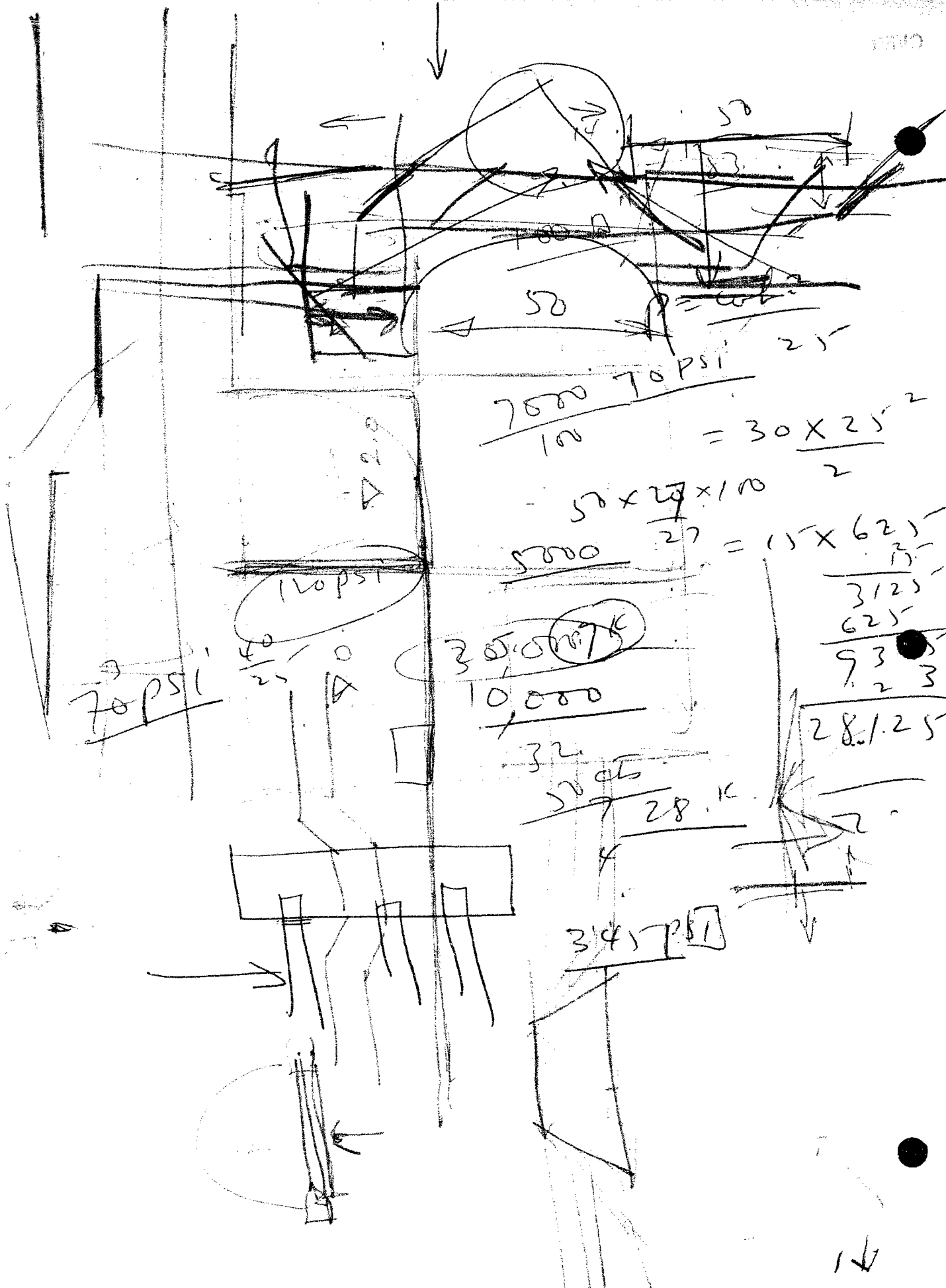
Attached please find one print of the
preliminary plan D-5482-1 for the above crossing.

The structure has been designed in accordance
with the recommendations contained in the Foundation
Report.

JCMcA/kd

J.C. McAllister
J.C. McAllister,
for S. McCombie,
Bridge Planning Engineer.





$$\frac{7000}{100} = \frac{70 \text{ PSI}}{25}$$

$$= \frac{30 \times 25^2}{2}$$

$$\frac{5000}{27} = \frac{15 \times 625}{27}$$

$$\begin{array}{r} 3125 \\ 625 \\ \hline 935 \\ 123 \\ \hline 28.125 \end{array}$$

$$\frac{50 \text{ K}}{32} = 28.1 \text{ K}$$

$$345 \text{ PSI}$$

14