

DOCUMENT MICROFILMING IDENTIFICATION.

GEOCRES No. 40P9-26

DIST. 3 REGION Southwestern

W.P. No. \_\_\_\_\_

CONT. No. \_\_\_\_\_

W. O. No. \_\_\_\_\_

STR. SITE No. \_\_\_\_\_

HWY. No. \_\_\_\_\_

LOCATION COX CREEK (NORTH OF

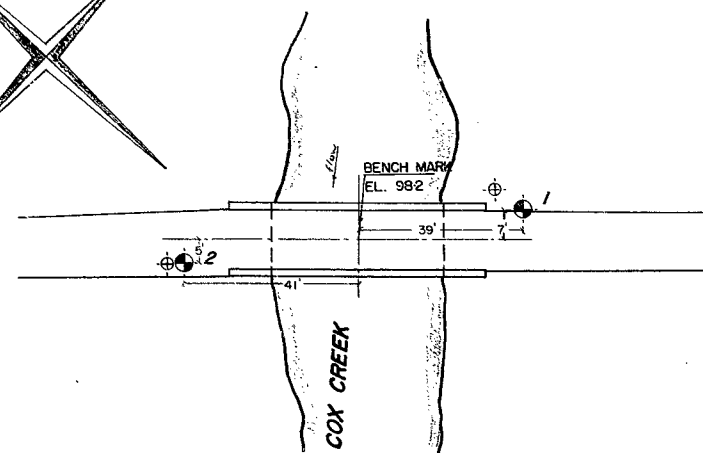
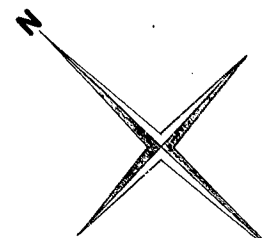
HWY 86) WELLINGTON CO.

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 1

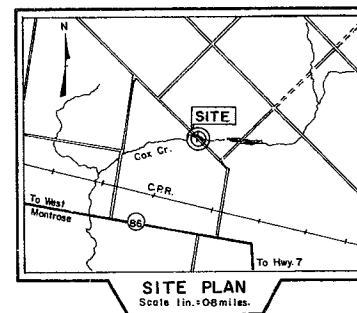
REMARKS: DOCUMENTS TO BE UNFOLDED

BEFORE MICROFILM

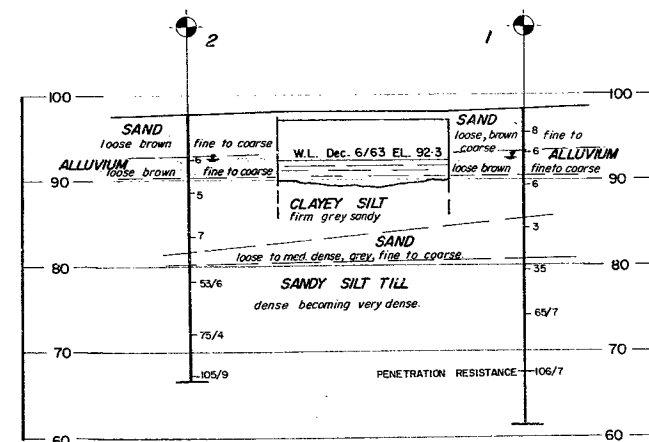
G.I.-30 SEPT. 1975



40P9 map



**PLAN**  
SCALE: 1 IN. = 20 FT.



**LEGEND**

- BOREHOLE
- CONE

**INTERPRETED SUBSOIL STRATIGRAPHY**  
SCALE: HOR. 1 IN. = 20 FT. VERT. 1 IN. = 10 FT.

40P9-26  
GEOCRES No.

WILLIAM A. TROW AND ASSOCIATES LIMITED  
FOUNDATION INVESTIGATION

**GOODWIN BRIDGE  
OVER COX CREEK**

TWP. PILKINGTON & WOOLWICH ONTARIO

PROJ. 1334 DATE FEB. 1964 DWG. No. 1

Plot on 40P9

WILLIAM A. TROW AND ASSOCIATES LTD.

SITE INVESTIGATIONS  
LABORATORY TESTING  
SOIL MECHANICS CONSULTATION

BA 1847

W. A. TROW, M.A.Sc., M.E.I.C., P.ENG.

Project: J1334

March 5, 1964

1850 JANE ST.,  
WESTON, ONT.  
CH. 1-4644

Mr. V.R. Astrop, P. Eng.,  
Consulting Engineer,  
4 Hughson Street South,  
Hamilton, Ontario.



Re: Soil Conditions  
Goodwin Bridge, Cox Creek  
Wellington County, Ontario

Dear Sir:

In conformance with your authorization of January 17th, 1964, we have carried out a soil investigation at Goodwin Bridge over Cox Creek in Wellington County, Ontario. This work consisted of 2 borings taken to a maximum depth of 37 feet.

Briefly the findings of the investigation are as follows:

- (1) A dense becoming very dense grey sandy silt till was encountered by both borings about 10 feet below stream bed at approximate El 80. Layers of fill, sandy alluvium, clayey silt and sand extend from ground surface and overlie the till. These overlying soils are in a loose condition as revealed by the results of the standard penetration tests performed as part of the field investigation.
- (2) It is recommended that the abutment and wing walls be supported by timber piles driven through the overlying alluvial, silt and fill deposits to a set or refusal in the very dense sandy silt till.
- (3) The abutment and wing walls should be designed to resist an earth pressure given by the coefficient  $K = 0.35$ , allowance being made for surcharge loading.

Descriptions of the site, field work carried out and brief comments on the soil and site conditions as they affect foundation design and construction are given in the following sections.

#### THE SITE

The bridge site is located to the west of Ariss, north of Highway 86, and spans a township road which runs north west to south east (See Key Plan, Dwg. 1). Near to the bridge, the creek meanders across flat marshy ground which is about 1 - 2 feet above stream level. There are a number of large trees with willows, and tall grass cover. The stream bed is about 7.5 feet below the top of the bridge deck. The ground on either side of the bridge is from 2.5 to 5 feet below present road level. At the bridge crossing the water was up to 2.5 feet deep and the surface was frozen during the period of the investigation.

The bridge is a single reinforced concrete structure supported on mass concrete piers. The depth and method of founding these piers was not ascertained during the investigation.

#### FIELD WORK

Two boreholes were put down at the positions indicated on the site plan, Dwg. 1. These borings were preceded by dynamic cone penetration tests. The cones were driven to refusal under an energy of 350 ft. lbs. per blow. The number of blows per foot penetration was recorded.

Borehole records which include the drilling methods used, depths drilled, soils encountered, samples taken and field penetration tests made are compiled in Dwg. 2 and 3.

Representative samples of the soil were recovered in a partially disturbed state using the conventional 2 inch O.D. split spoon sampler. The number of hammer blows of 350 ft.lb. energy required to drive the split spoon from 6 to 18 inches below the bottom of the boring was taken as the standard penetration resistance of the soil. Below 25.5 ft. in borehole 1 limestone boulders were encountered which were drilled through using rotary core drilling methods. These boulders were not encountered in borehole 2.

The elevations of the boreholes are referred to the centre line of the top of the existing bridge deck which was taken to be 98.2 ft., (See Dwg. 1.)

#### LABORATORY TESTING

Natural moisture contents determined on all samples from the sandy silt till stratum and two of the clayey silt samples are given on the borehole logs. Two natural bulk densities of the till, determined by weight and volume measurement, are also given.

From these measurements it can be seen that the till is in a very dense condition.

#### FOUNDATION CONSIDERATIONS

Due to the poor bearing ability of the clayey silt and sand strata, overlying the dense till, it will be necessary to transfer the structural loads to the dense sandy silt till stratum. Either end-bearing piles driven into the till to refusal or to a satisfactory set or strip footings taken down to the till may be used. The former means of support is considered to be more satisfactory, however, since

the deep footing proposal would require a sheeted excavation to be made about 12 feet below river level. For this reason the pile foundation only is considered. It is expected that refusal to timber or cylindrical steel piles will occur after shallow penetration into the till. The permissible loading of a pile driven to refusal in the dense till will be determined by its safe structural capacity when considered as a short column.

Refusal to penetration for timber piles should be taken as 6 blows per inch under a driving energy of 8750 ft.lb. per blow. Overdriving or the use of a heavy hammer should be avoided since the piles may be damaged.

Since the soils are in a fairly uniform state at the proposed founding level, differential settlements will be of a small order and well within the capacity of the proposed structure.

The bridge abutments should be taken down to stream bed level. Sheet piling should be driven around the abutment to below the depth of maximum scour. Referring to the borehole records it can be seen that the alluvium is loose and the underlying clayey silt is in a firm state only. The sheet piling should therefore be driven to El 80 which is the upper horizon of the dense sandy silt till.

#### EARTH RETAINING WALLS

Well compacted granular fill should be placed behind the abutment and wing walls. In order to account for the rigidity of the walls it is recommended that an earth pressure coefficient  $K = 0.35$  be assumed for design purposes. The earth pressure acting at any depth,  $h$ , below the top of the fill may be expressed by:

$$P = K \{ \gamma (h - h_1) + \gamma^1 h_1 + q \}$$

where:  $\gamma$  and  $\gamma^1$  are the bulk and submerged densities of the backfill soil (assumed = 130 and 70 pcf.)

$h_1$  is the height of the water table above the point being considered

$q$  is the surcharge, if any, acting at the top of the fill.

In the above expression no allowance has been made for water collecting behind the wall above the water level in the stream. Provision must be made by weepers drains to draw off any water which collects behind the wall.

#### EMBANKMENTS

Since the bridge is to be widened, additional fill will be required on each side of the road. It is expected that the road grade will be raised only very slightly. The sandy alluvium overlying the firm clayey silt will spread the loads from the fill to the clayey silt stratum and therefore no stability problem is expected.

Some settlement of the newly placed fill will occur. It is suggested that paving of the road surface should not be carried out until the fill was settled.

If you have any queries after you have examined the results of this investigation we shall be pleased to discuss them with you.

Yours very truly,

*T.H. Hanna.*

T.H. Hanna, P. Eng.

THH/bs.  
Encls.  
J1334.



View Looking North East



View Looking North East From Bridge





View Looking North West



View Looking South East

# WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

**40P9-26**  
PROJECT No.

## LEGEND

### PENETRATION RESISTANCE

2" O.D. SPLIT TUBE —○—○—○—  
2" I.D. SHELBY TUBE \* \* \* \* \*  
2" DIA. CONE —————

### SHEAR STRENGTH

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE ⊕  
UNCONFINED COMPRESSION ⊗  
VANE TEST AND SENSITIVITY (S) +<sup>s</sup>

### NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

### ATTERBERG LIMITS

LIQUID LIMIT —○—

PLASTIC LIMIT —|—

### SAMPLE TYPE

2" O.D. SPLIT TUBE ■  
2" I.D. SHELBY TUBE ■  
3" O.D. SHELBY TUBE ■

DRAWING No. 2  
PROJECT No. JL334

BOREHOLE No. 1  
PROJECT Goodwin Bridge.  
LOCATION Cox Creek, Wellington County, Ontario.  
HOLE LOCATION See Dwg. 1.  
HOLE ELEVATION 98.2 ft.  
DATUM See Dwg. 1.

| SYMBOL | SOIL DESCRIPTION   | ELEV. FEET | DEPTH FEET | PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT |    |    |    | NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT |    |    | SAMPLE TYPE AND NO | NATURAL UNIT WEIGHT P.C.F. |
|--------|--|------------|------------|---|----|----|----|--|----|----|--------------------|----------------------------|
|        |  |            |            | 20  | 40 | 60 | 80 | 10   | 20 | 30 |                    |                            |
|        |  | 98.2       | 0          | SHEAR STRENGTH PSF                          |    |    |    |  |    |    | Recovery           |                            |
|        | —loose brown fine to coarse sand with a few gravel sizes.  | 98.2       | 0          |   |    |    |    |  |    |    | SS1                |                            |
|        | ALUVIUM—loose brown fine to coarse organic sand with gravel sizes.   | 92.5       | 6.7        |   |    |    |    |  |    |    | SS2                |                            |
|        | CLAYEY SILT—firm light grey, slightly organic.   | 90.2       | 8.0        |   |    |    |    |  |    |    | SS3                |                            |
|        | SAND—loose to medium dense grey fine to coarse.  | 85.2       | 13.0       |   |    |    |    |  |    |    | SS4                |                            |
|        | SANDY SILT TILL—dense becoming very dense grey, clayey in parts with occasional pebbles. Grey fine grained limestone boulders and cobbles below 25.5 ft. | 80.7       | 18.5       |   |    |    |    |  |    |    | SS5                |                            |
|        |  |            | 20         |   |    |    |    |  |    |    | SS6                | 146                        |
|        |  |            | 30         |   |    |    |    |  |    |    | AX Core 10%        |                            |
|        |  |            | 40         |   |    |    |    |  |    |    | SS7                |                            |
|        |  |            | 50         |   |    |    |    |  |    |    | AX Core 15%        |                            |
|        | End of Bore  | 61.2       | 37.0       |   |    |    |    |  |    |    |                    |                            |
| Notes: | 1) Hole augered by continuous flight methods to 25.5 ft. BX casing installed and hole completed using wash boring and rotary core drilling methods.      |            | 25.5       |   |    |    |    |  |    |    |                    |                            |
|        | 2) Dynamic cone driven about 8 ft. north of borehole.  |            | 33.5       |   |    |    |    |  |    |    |                    |                            |
|        |  |            | 50         |   |    |    |    |  |    |    |                    |                            |
|        |  |            | 60         |   |    |    |    |  |    |    |                    |                            |
|        |  |            | 70         |   |    |    |    |  |    |    |                    |                            |

GEORGE No.

DATUM See Dwg. 1.

## PENETRATION RESISTANCE

2" DIA. CONE

## SHEAR STRENGTH

UNCONFINED COMPRESSION VANE TEST AND SENSITIVITY (S)  $\pm$ 

X<sup>L</sup>

### ATTERBERG LIMITS

LIQUID LIMIT \_\_\_\_\_

PLASTIC LIMIT

**SAMPLE TYPE**

2" O.D. SPLIT TUBE \_\_\_\_\_

2" I.D. SHELBY TUBE \_\_\_\_\_

3" O.D. SHELBY TUBE \_\_\_\_\_

| SYMBOL | SOIL DESCRIPTION   | ELEV.<br>FEET | DEPTH<br>FEET | PENETRATION RESISTANCE |    | 350 FT. LB.<br>BLOWS/FT.<br>80 | NATURAL MOISTURE CONTENT<br>AND<br>ATTERBERG LIMITS<br>% DRY WEIGHT | SAMPLE<br>TYPE<br>AND<br>NO | NATURAL<br>UNIT<br>WEIGHT<br>P.C.F. |        |  |  |     |     |
|--------|--|---------------|---------------|------------------------|----|--------------------------------|---|-----------------------------|-------------------------------------|--------|--|--|-----|-----|
|        |  |               |               | 20                     | 40 |                                |   |                             |                                     | 60     |  |  |     |     |
|        |  |               |               | SHEAR STRENGTH         |    |                                |   |                             |                                     | P.S.F. |  |  |     |     |
|        |  |               |               |                        |    |                                | 10  | 20                          | 30                                  |        |  |  |     |     |
|        | FILL-loose brown fine to coarse sand.  | 97.7          | 0             |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        | ALUVIUM-loose brown fine to coarse organic sand.   | 92.7          |               |                        |    |                                |   |                             |                                     |        |  |  | SS1 |     |
|        | CLAYEY SILT-firm grey, in parts sandy.   | 90.2          | 10            |                        |    |                                |   |                             |                                     |        |  |  | SS2 |     |
|        |  |               |               |                        |    |                                |   |                             |                                     |        |  |  | SS3 |     |
|        | SAND-medium dense, grey coarse.  | 81.7          |               |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        | SANDY SILT TILL-dense becoming very dense grey with occasional sand partings, in parts clayey. Occasional pebbles.       | 80.2          | 20            |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        |  |               |               |                        |    |                                |   |                             |                                     |        |  |  | SS4 | 146 |
|        |  |               |               |                        |    |                                |   |                             |                                     |        |  |  | SS5 |     |
|        |  |               |               |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        |  |               |               |                        |    |                                |   |                             |                                     |        |  |  | SS6 |     |
|        | End of Bore  | 66.5          | 30            |                        |    |                                |   |                             |                                     |        |  |  |     |     |
| Notes: | 1) Hole augered by continuous flight methods to 18 ft. BX casing installed and hole completed using wash boring methods. |               | 40            |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        | 2) Dynamic cone driven before boring was started and about 5 ft. N.W. of borehole.                                       |               |               |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        | 3) Sample 3 was not recovered.   |               |               |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        |  |               | 50            |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        |  |               | 60            |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        |  |               | 70            |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        |  |               |               |                        |    |                                |   |                             |                                     |        |  |  |     |     |
|        |  |               |               |                        |    |                                |   |                             |                                     |        |  |  |     |     |