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BRIDGE # 23

LOT 24, CONS. 7-8

CARADOC TWP.

A.M. SPRIET & ASSOCIATES LTD.
CONSULTING ENGINEERS
LONDON ONTARIO

67-F-24411

Report on
SOIL INVESTIGATION
FOR
BRIDGE NO 23
LOT 24 CONCESSIONS 7-8
TOWNSHIP OF CARleton

by
DOMINION SOIL INVESTIGATION LIMITED
369 Queens Avenue,
LONDON ONTARIO
Reference No. 7-12-L4

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SUMMARY.

The two boreholes revealed the following general ground succession: silt fill (6 to 7 feet thick), loose to dense silt and fine sand (21 to 22 feet thick), and very stiff to hard silty clay till (penetrated 13.5 feet).

It is recommended that the structure be supported on a timber pile foundation driven 12 feet into the silty clay till stratum and mobilizing a working load of 20 tons per pile.

1. INTRODUCTION.

In accordance with verbal authorization from A.M. Spriet & Associates Limited, Consulting Engineers, a soil investigation has been carried out in the Township of Caradoc where it is proposed to replace an existing road bridge with a new structure.

The existing 32 foot span steel beam structure is located at Lot 24 Concessions 7-8 of the Township where the road crosses a tributary of the Sydenham River.

It is understood that the proposed structure is a concrete rigid frame and that it will be centered on the existing bridge. The requirements of the project were discussed with Mr. W.E. Kelley, P.Eng., who supplied the foregoing information.

The purpose of the investigation was to reveal the subsurface conditions at the site and to determine the relevant soil properties for the design and construction of the new foundations.

11. FIELD WORK.

The field work, consisting of 2 boreholes was carried out on December 21, 27 and 28, 1967 at the locations indicated on Enclosure 1. The holes were advanced to the sampling depths by washboring methods and were lined with Bx size casing.

Standard penetration tests were performed at frequent intervals of depth, as detailed in Appendix 'A', and the results are recorded on the borehole logs as 'N' values.

Dynamic cone penetration tests were performed adjacent to each borehole location to obtain an indication of soil density and strata changes with depth.

Elevations were referred to a benchmark which was established by the client (Spike in hydro pole, 120 feet north and 30 feet west of the bridge centre line).

111. SUBSURFACE CONDITIONS.

Detailed descriptions of the strata encountered in each borehole are given on the borehole logs, comprising Enclosures 2 and 3, and a general picture of the soil stratigraphy is presented in the form of a Subsurface Profile on Enclosure 1. The following notes are intended only to amplify this data.

Grey silt and fine sand with pieces of decomposed wood.

This material is an alluvial deposit which was probably deposited under swampy conditions.

The relative density of the material differs considerably between boreholes, and is described as 'compact' to 'dense' in borehole 1, whereas in borehole 2 it is generally in a 'loose' condition. The difference in relative density, as indicated by the 'N' values, is also confirmed by the dynamic cone penetration test results.

Grey silty clay (Glacial Till).

This material is of glacial origin and contains no sand or gravel

size particles, which is usually the case in till deposits.

The consistency of the silty clay is described as 'very stiff' to 'hard' as indicated by 'N' values ranging from 20 to 65 blows per foot.

IV. GROUNDWATER CONDITIONS.

The water levels in the boreholes reached equilibrium at an average El.96.8, which was 4.8 feet above the water in the adjacent creek at the time the field work was carried out.

V. DISCUSSION & RECOMMENDATIONS.

The loose silt stratum extends to a depth of about 17 feet below the creek bed at borehole 2 location therefore it is apparent that the structure must be supported on a piled foundation to minimise settlement and construction problems. The piles should be driven into the silty clay till stratum, and will develop most of their working load by adhesion along the pile shaft. Under these circumstances it is recommended that the structure be supported by timber piles which develop a greater adhesion to the clay than steel piles of the same size.

Timber Piles.

On the basis of the soil profile encountered in borehole 2 it is estimated that nominal 12-inch diameter piles will reach a satisfactory set, corresponding to a safe working load of 20 tons per pile when driven 12 feet into the clay till stratum. The piles will therefore require to be about 27 feet in length to accommodate a pile cap placed at El.87.

Due to the denser nature of the silt stratum at borehole 1 location it is anticipated that the piles will not require as deep a penetration to mobilize the 20 ton working load. In this case the piles will require jetting to achieve the same penetration as at borehole 2 location, or alternatively the pile tops may be cut off when a suitable set has been achieved.

The length of piles required has been estimated by theoretical means only, and in practice the pile capacity should be determined in accordance with the Hiley formula. If the required set is not obtained, the working load should be reduced and additional piles driven.

Dewatering of the excavations for pile caps can probably be done by pumping from filtered sumps. However if this proves inadequate the excavation should be carried out inside temporary wooden or steel sheeting enclosures.



Yours very truly,

DOMINION SOIL INVESTIGATION LIMITED.

A handwritten signature in dark ink, appearing to read 'C.J.W. Atkinson', written over the typed name.

C.J.W. Atkinson, M.Sc., P.Eng.,
Branch Manager.,

CJWA/jb.,

APPENDIX A.

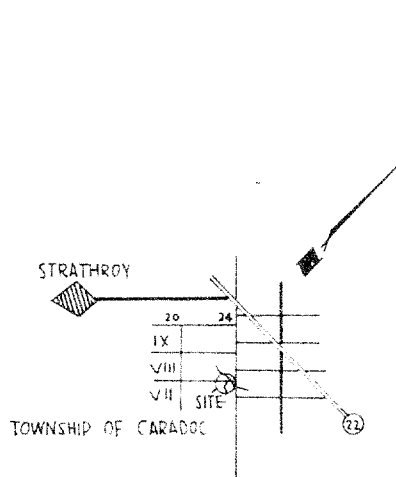
THE STANDARD PENETRATION TEST.

In order to determine the relative density of non-cohesive soils, such as sands and gravels, the standard penetration test has been adopted. The test also gives an indication of the consistency of cohesive soils.

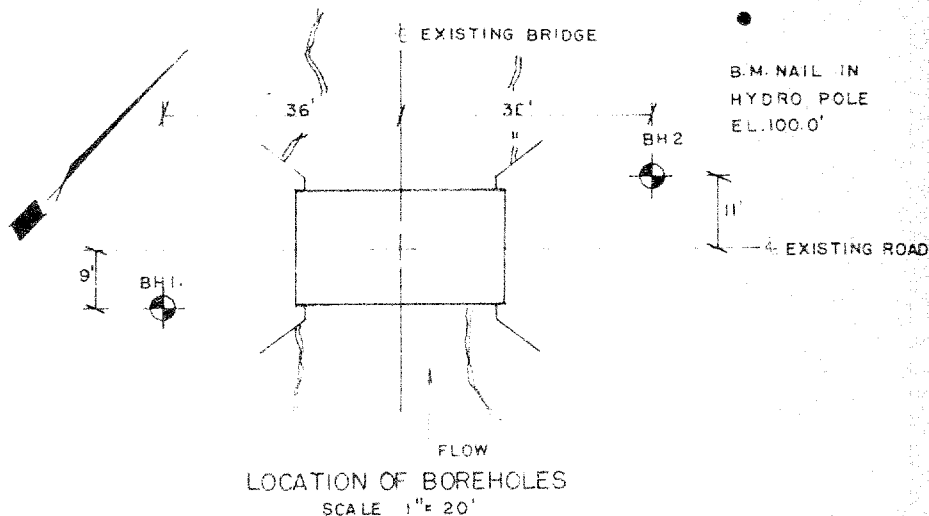
A two inch external diameter thick-walled sample tube is driven into the ground at the bottom of the borehole by means of a 140 lb. hammer falling freely through 30 in. The tube is first driven an initial 6-inches to allow for the presence of disturbed material at the bottom of the borehole. The number of standard blows (N) required to drive the sampler a further 12 in. is recorded. The sample tube is one originally developed by Raymond Concrete Pile Company in the United States, where a sufficient number of tests have been made in conjunction with field investigations to show that the results, although essentially empirical, may be applied to foundation design.

For Sands:-

| Values of N | Density |
|-------------------|-------------|
| Less than 10 | Loose |
| Between 10 and 30 | Compact |
| Between 30 and 50 | Dense |
| Greater than 50 | Very dense. |



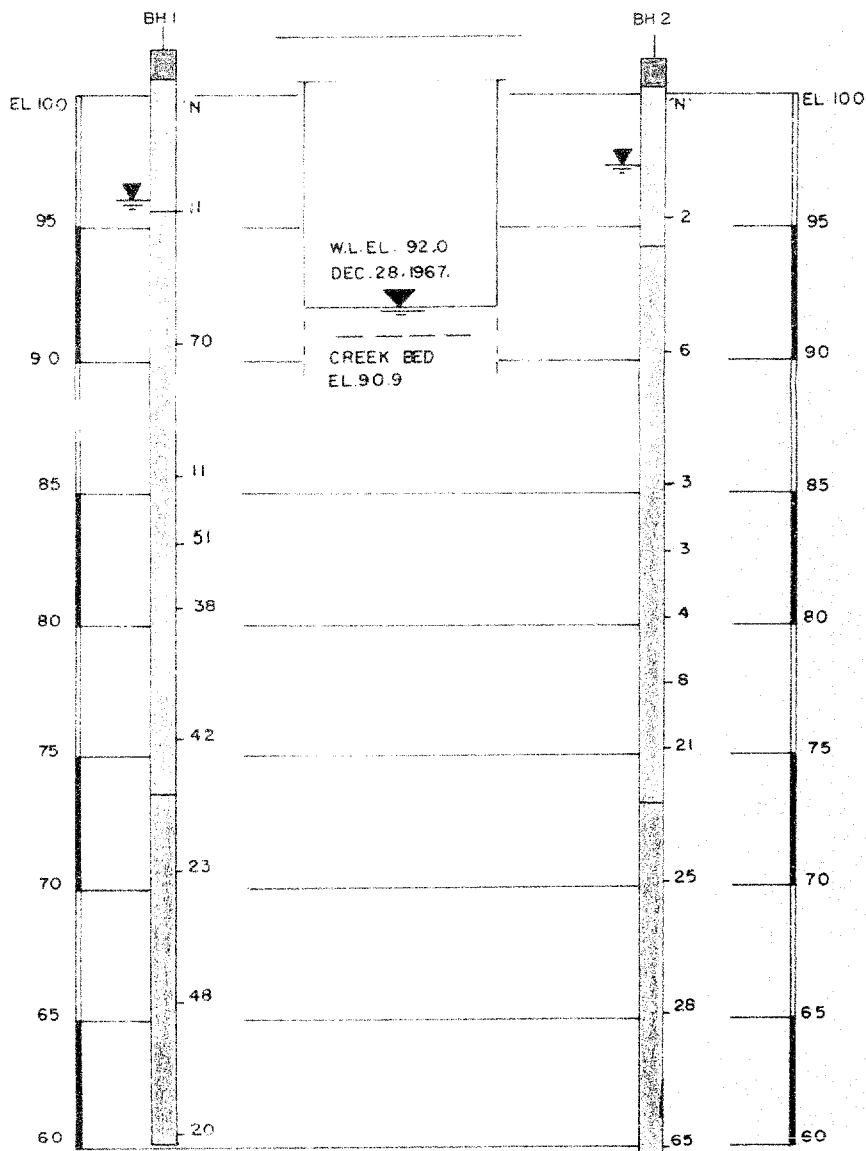
KEYPLAN



LOCATION OF BOREHOLES
SCALE 1" = 20'

LEGEND

- SAND & GRAVEL
- SILT, FILL
- LOOSE TO DENSE SILT
- VERY STIFF TO HARD SILTY CLAY, TILL



SUBSURFACE PROFILE
VERT SCALE 1" = 5'

LOG OF BOREHOLE 1

Our Reference No. 7-12 L4

Enclosure No. 2

CLIENT: A.M. Spriet & Assoc. Ltd.

PROJECT: Bridge #23

LOCATION: Lot 24 Con. 7-8, Township of Caradoc

DATUM ELEVATION: Nail in telephone pole, El. 100 feet

DRILLING DATA

Method: Washboring

Diameter: 4 1/2-inch

Date: December 21, 1967

| SUBSURFACE PROFILE | | | | SAMPLES | | PENETRATION RESISTANCE | | | | | WATER CONTENT % | | | REMARKS | | | |
|--------------------|--------------|--|--------|-----------------|--------|------------------------|---------------------|--------------------------|----|----|-----------------|-----|------------------|---------|---------|-----------------|------------------|
| ELEVATION Ft. | DEPTH Ft. | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | 'N' Blows / Foot | Blows / Foot | | | | | PLASTIC LIMIT | | NATURAL | LIQUID LIMIT | |
| | | | | | | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| | | | | | | | | UNDRAINED SHEAR STRENGTH | | | | | | | | | COMPRESSION TEST |
| | | | | | | | | + FIELD VANE TEST | | | | | lbs./sq. ft. | | | | |
| Ground Surface | | | | | | | | | | | | | | | | | |
| 101.3 | 0.0 | Sand and gravel | | | | | | | | | | | | | | | |
| | 1.0 | | | | | | | | | | | | | | | | |
| | | Brown silt (Fill) | | | 1 | SS | 11 | | | | | | | | | | |
| 95 | 6.0 | | | | | | | | | | | | | | | | |
| | | Compact to dense grey silt, with a trace to some sand and containing pieces of decomposed wood | | | 2 | SS | 70 | | | | | | | | | | |
| 90 | | | | | | | | | | | | | | | | | |
| | | | | | 3 | SS | 11 | | | | | | | | | | |
| 85 | | | | | 4 | SS | 51 | | | | | | | | | | |
| | | | | | 5 | SS | 38 | | | | | | | | | | |
| 80 | | | | | 6 | SS | 42 | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | | | | |
| 28.0 | | Very stiff to hard grey silty clay (Glacial Till) | | | 7 | SS | 23 | | | | | | | | | | |
| 70 | | | | | 8 | SS | 48 | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | | | | |
| 60 | 41.5 | End of Borehole | | | 9 | SS | 20 | | | | | | | | | | |

VERTICAL SCALE: 1 inch to 5 feet

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MADE:

CHECKED:

LOG OF BOREHOLE...2.....

Our Reference No 7-12-14

Enclosure No 3

CLIENT: A.H. Spry & Assoc. Ltd.

PROJECT: Bridge #23

LOCATION: Lot 24 Con. 7-8, Township of Caradoc

DATUM ELEVATION: Nail in telephone pole, El. 100 feet.

DRILLING DATA

Method: Washboring

Diameter: 8 1/2 inch

Date: December 27 & 28, 1967

| SUBSURFACE PROFILE | | | | SAMPLES | | | PENETRATION RESISTANCE | | | | WATER CONTENT % | | | REMARKS | | | |
|--------------------|--------------|--|--------|-----------------|--------|------|------------------------|--------------|--------------------------|----|-----------------|----|-----|---------|--------------------------------------|---------|-----------------|
| ELEVATION Ft. | DEPTH Ft. | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | N° | Blows / Foot | 20 | 40 | 60 | 80 | 100 | | PLASTIC LIMIT | NATURAL | LIQUID LIMIT |
| | | | | | | | | | UNDRAINED SHEAR STRENGTH | | | | | | 100% Wt. | | |
| | | | | | | | | | + FIELD VANE TEST | | | | | | W _p W W _L | | |
| | | | | | | | | | | | | | | | | | |
| 101.7 | 0.0 | Ground Surface | | | | | | | | | | | | | | | |
| 101.0 | 1.0 | Sand and gravel | | | | | | | | | | | | | | | |
| | | Brown silt (Fill) | | | 1 | SS | 2 | | | | | | | | | | |
| 95.0 | 7.0 | | | | | | | | | | | | | | | | |
| | | Loose grey silt, with a trace to some fine sand and containing pieces of decomposed wood | | | 2 | SS | 6 | | | | | | | | | | |
| 90.0 | | | | | | | | | | | | | | | | | |
| | | | | | 3 | SS | 5 | | | | | | | | | | |
| 85.0 | | | | | | | | | | | | | | | | | |
| | | | | | 4 | SS | 3 | | | | | | | | | | |
| 80.0 | | | | | | | | | | | | | | | | | |
| | | | | | 5 | SS | 4 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | 6 | SS | 8 | | | | | | | | | | |
| 75.0 | | | | | | | | | | | | | | | | | |
| | | | | | 7 | SS | 21 | | | | | | | | | | |
| 28.0 | | | | | | | | | | | | | | | | | |
| | | Very stiff to hard grey silty clay (Glacial Till) | | | | | | | | | | | | | | | |
| 70.0 | | | | | 8 | SS | 25 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | 9 | SS | 28 | | | | | | | | | | |
| 65.0 | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | 10 | SS | 63 | | | | | | | | | | |
| 60.0 | 4.5 | End of Borehole | | | | | | | | | | | | | | | |

VERTICAL SCALE 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE

CHECKED