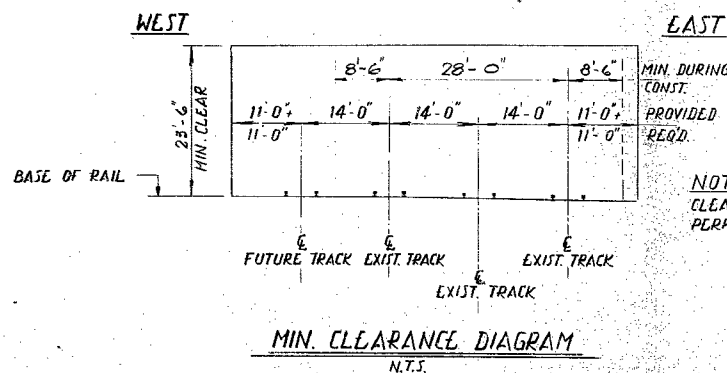
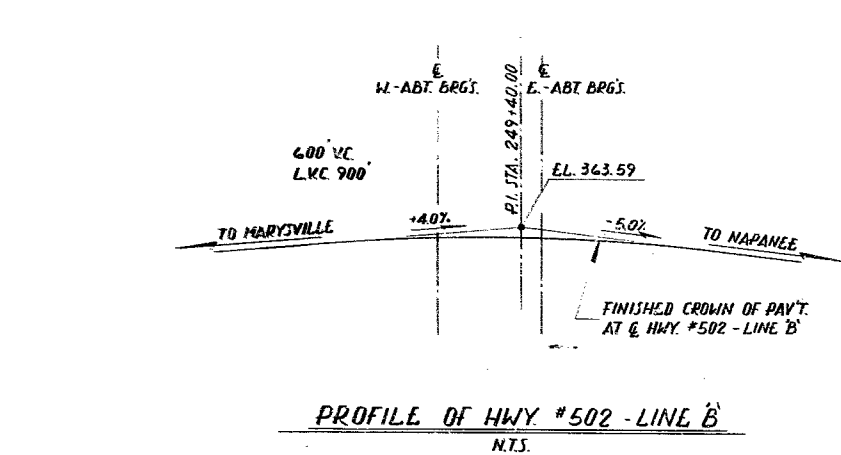
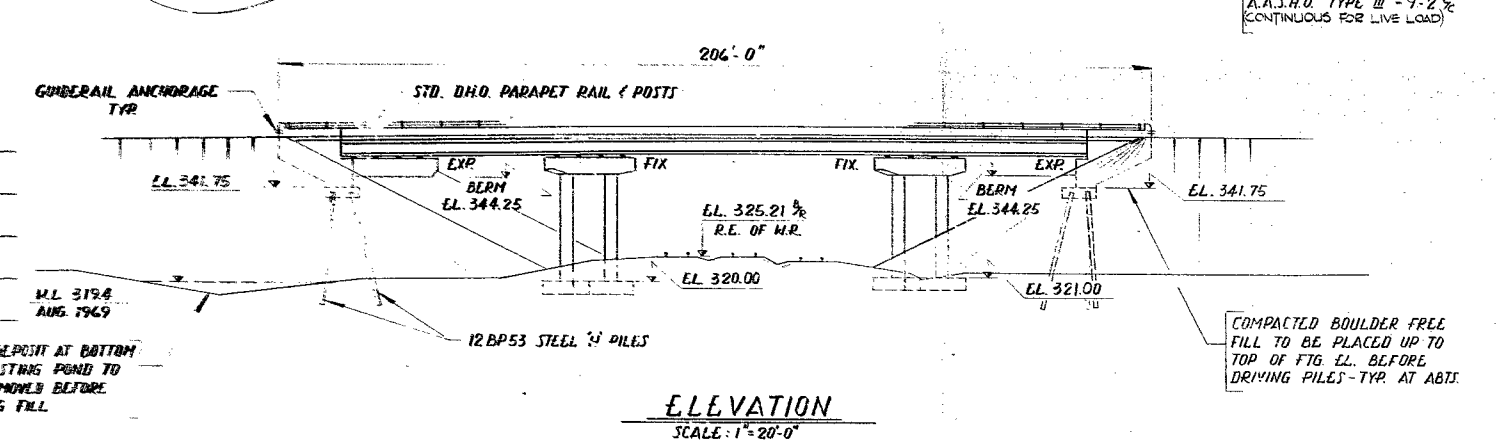
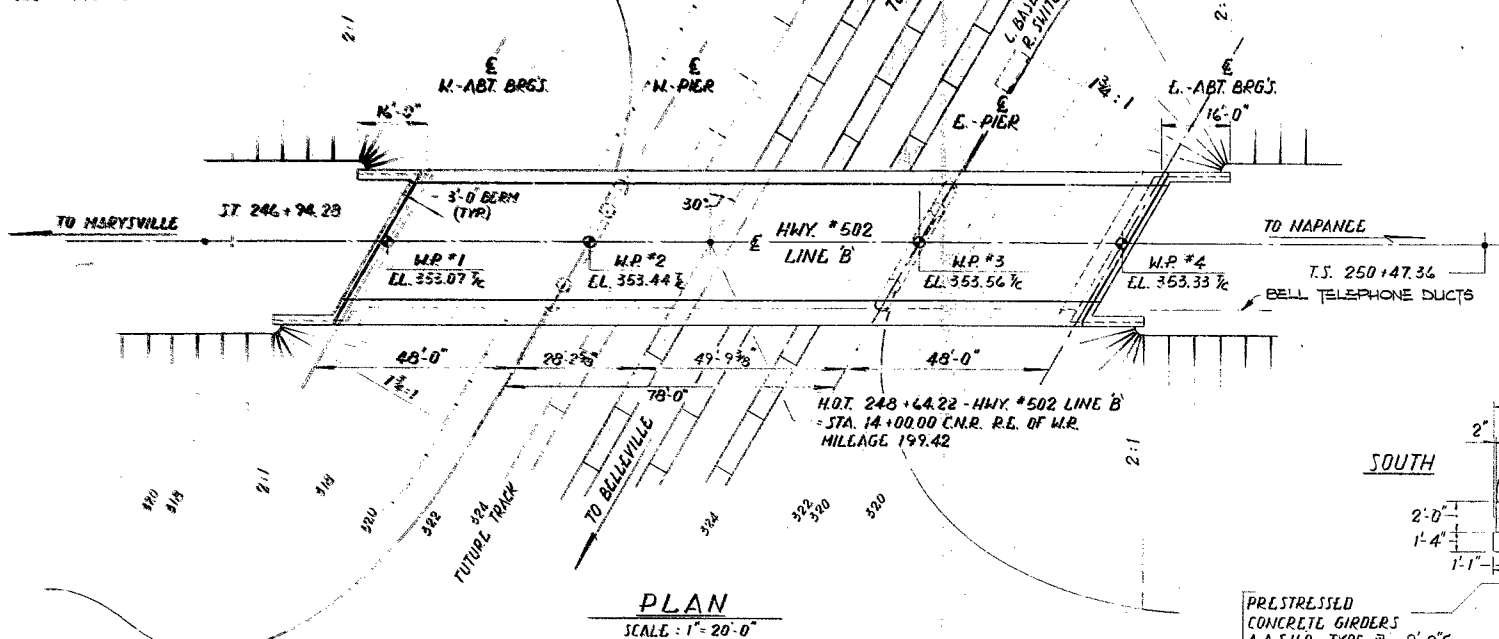


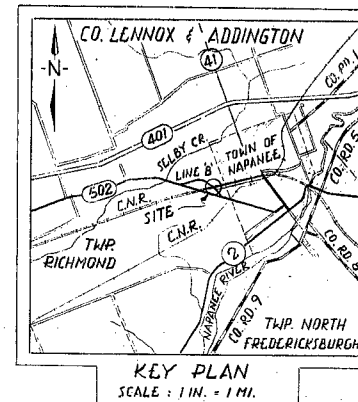
# **SKW DATA - 30°**

SM - 0.50000  
 COI - 0.84403  
 TAN - 0.57735  
 SEC - 1.15470



**NOTE:**  
 • W.P. DENOTES WORKING POINT  
 •  $\frac{1}{2}$  C DENOTES TOP OF CONCRETE WEARING SURFACE  
 •  $\frac{3}{4}$  R DENOTES TOP OF RAIL  
 •  $\frac{9}{8}$  R DENOTES BASE OF RAIL

- LIST OF DRAWINGS**
- D-6769-1 GENERAL LAYOUT
  - 2 BORE HOLE LOCATIONS & SOIL STRATA
  - 3 FOOTING LAYOUT & REINF
  - 4 ABUTMENTS
  - 5 PIERS
  - 6 PRESTRESSED GIRDERS & BEARINGS
  - 7 DECK
  - 8 PARAPET WALL DETAILS
  - 9 STANDARD STEEL PARAPET RAIL
  - 10 STANDARD DETAILS
  - D-6769-11 TRACK STRUCTURE PROTECTION.



## **REFERENCE BENCH MARK**

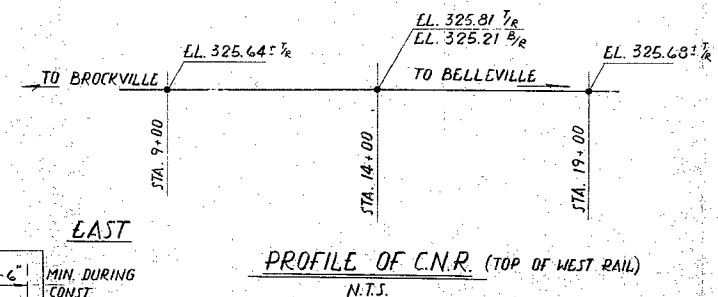
B.M. EL. 322.98 GEODETIC DATUM  
 TOP  $\frac{1}{2}$ " SQUARE STEEL BAR  
 IN OLD G.B.M. MONUMENT  
 415.0 RT. OF 246+98

## **NOTES**

**CLASS OF CONCRETE**  
 DECK & PARAPET WALLS & COLUMNS - 4000 P.S.I.  
 PREST. GIRDERS - 5000 P.S.I.  
 REMAINDER - 3000 P.S.I.

**CLEAR COVER ON REINF. STEEL**  
 FOOTINGS, ABUTMENTS & COLUMNS - 3"  
 PIER CAP - 2"  
 DECK: TOP & BOTT. -  $1\frac{1}{2}$ "  
 CURBS - 2"  
 PARAPET WALL -  $1\frac{1}{2}$ "

**CONSTRUCTION NOTES**  
 THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF  $\frac{1}{8}$ "  
 NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.



|           |      |    |             |
|-----------|------|----|-------------|
| REVISIONS | DATE | BY | DESCRIPTION |
|           |      |    |             |
|           |      |    |             |
|           |      |    |             |

DEPARTMENT OF HIGHWAYS ONTARIO  
 BRIDGE DIVISION

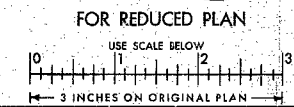
**CANADIAN NATIONAL RAILWAYS OVERHEAD**  
 1.3 MI. WEST OF EASTERLY JCT. OF HWY #2

KING'S HIGHWAY No. 502 DIST. No. 8  
 CO. LENNOX & ADDINGTON  
 TWP. RICHMOND LOT 19 CON. I

**GENERAL LAYOUT**

APPROVED: [Signature] BRIDGE ENGINEER  
 DESIGN: R.S.R. CHECK: [Signature]  
 DRAWING: A.A. CHECK: [Signature]  
 DATE: MAY 1970 LOADING: H1 20-44

SITE No. 17-116 W.P. No. 183-66-00  
 CONTRACT No. [Blank]  
 DRAWING No. D-6769-1

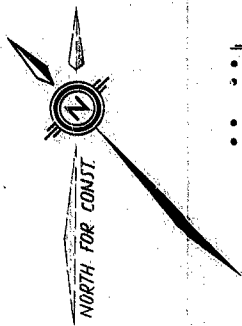
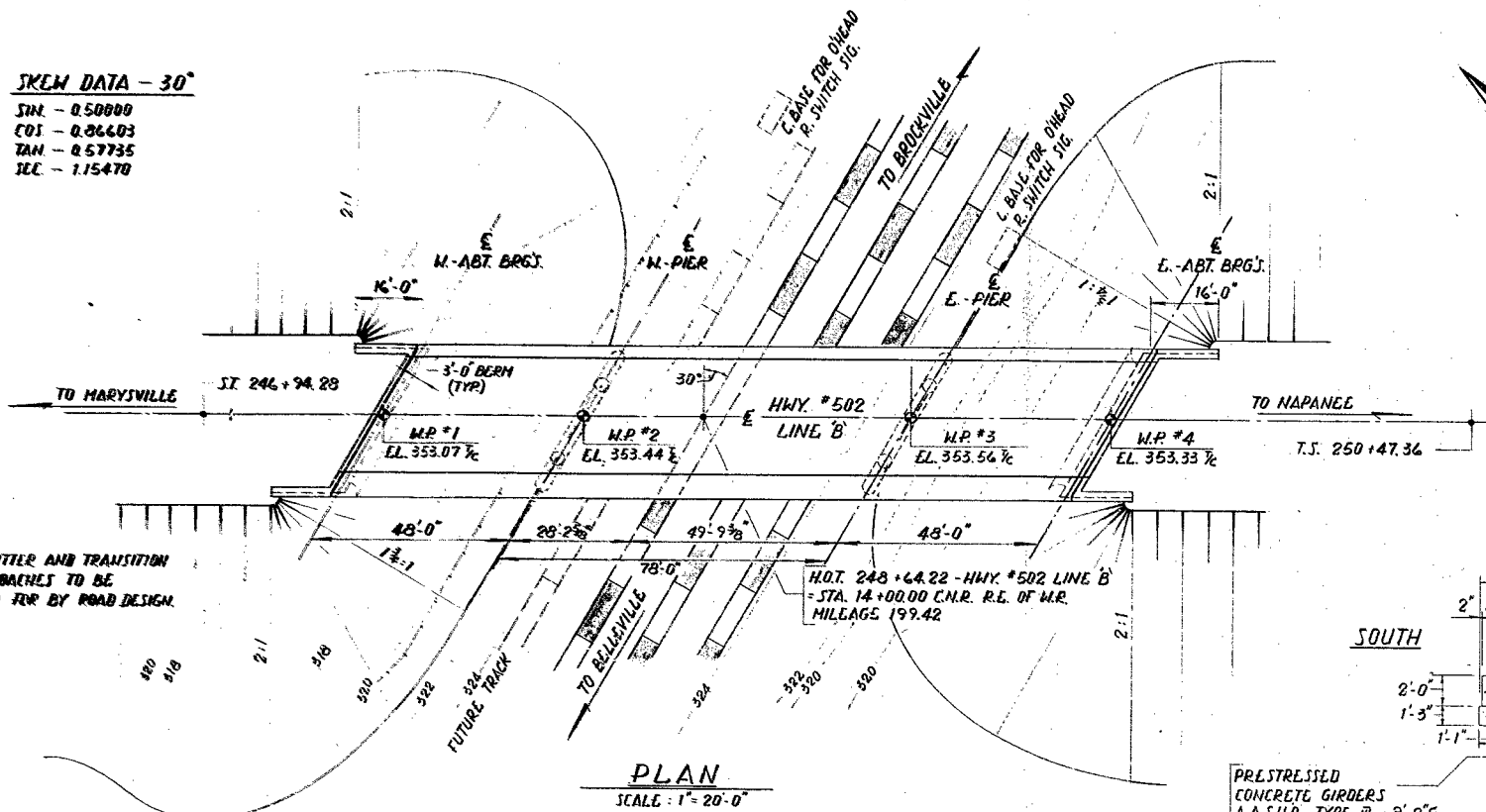




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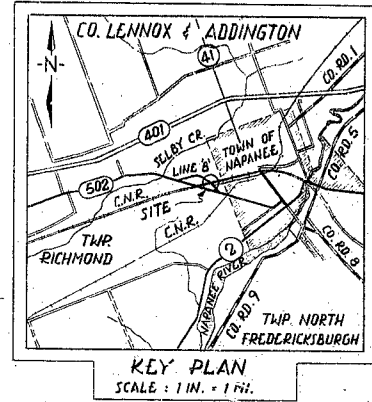
SIN - 0.50000  
COS - 0.86603  
TAN - 0.57735  
SEC - 1.15470

**NOTE**  
CURB & GUTTER AND TRANSITION  
AT APPROACHES TO BE  
PROVIDED FOR BY ROAD DESIGN.



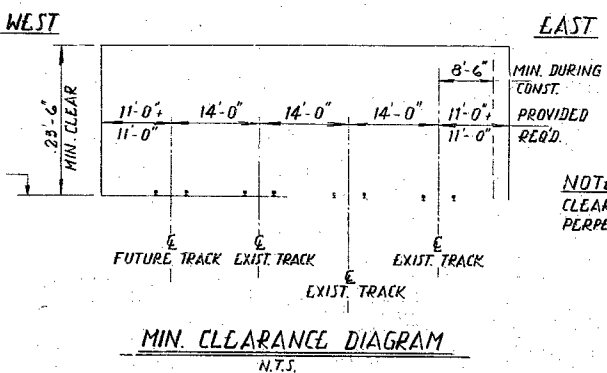
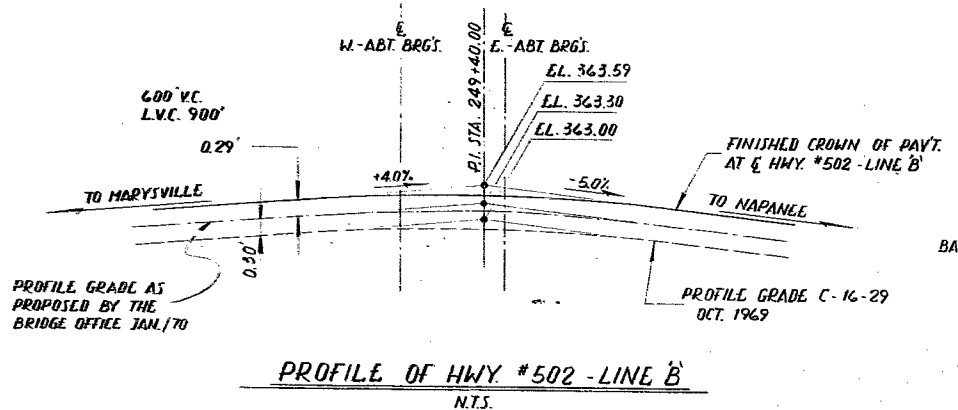
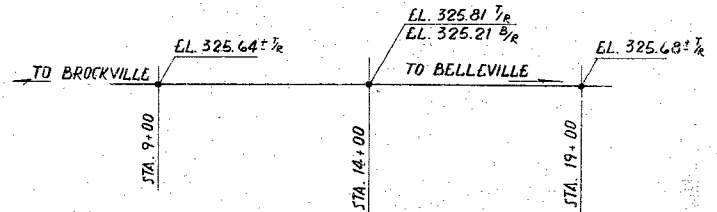
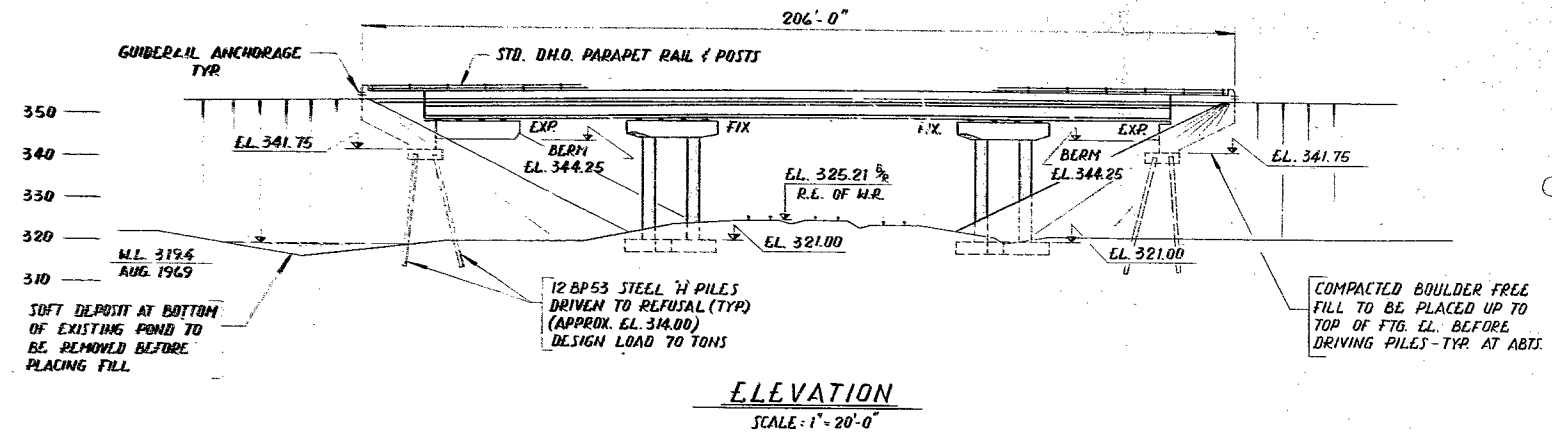
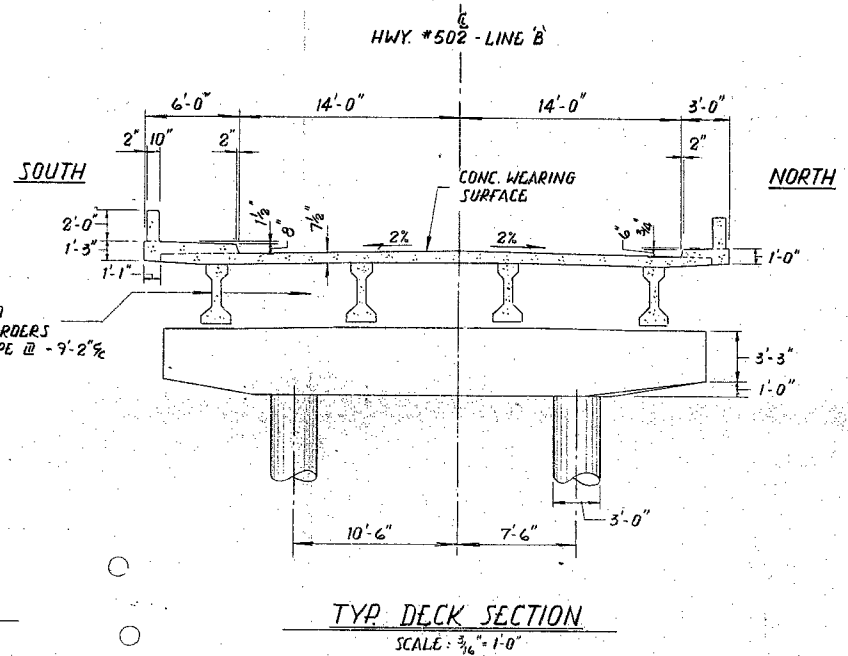
# **NOTE:**

- W.P. DENOTES WORKING POINT
- $\frac{1}{2}$ \"/>



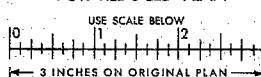
# **REFERENCE BENCH MARK**

B.M. EL. 322.98 GEODETIC DATUM  
TOP  $\frac{1}{2}$ \"/>



**NOTE:**  
CLEARANCES SHOWN ARE  
PERPENDICULAR TO TRACKS

FOR REDUCED PLAN



|   |                                 |
|---|---------------------------------|
| REVISIONS   |                                 |
| DATE  | DESCRIPTION                     |
|   |                                 |
|   |                                 |
|   |                                 |
| DEPARTMENT OF HIGHWAYS ONTARIO<br>BRIDGE DIVISION |                                 |
| Hom. 10/1/69                                      |                                 |
| CANADIAN NATIONAL RAILWAYS OVERHEAD               |                                 |
| 1.3 MI. WEST OF EASTERLY JCT. OF HWY. #2          |                                 |
| KING'S HIGHWAY No. 502                            | DIST. No. 8                     |
| CO. LENNOX & ADDINGTON                            | TWP. RICHMOND                   |
| LOT 19  | CON. 1                          |
| PRELIMINARY PLAN                                  |                                 |
| APPROVED  | SITE No. 17-116 W.P. No. 183-66 |
| DESIGN R.T.R.                                     | CHECK                           |
| DRAWING A.A.                                      | CHECK                           |
| DATE JAN/70                                       | LOADING H20-44                  |
| CONTRACT No.                                      | DRAWING No. D-6769-P            |



## MEMORANDUM

23/71-191

69-F-202 C

To: Mr. B. R. Davis,  
Bridge Engineer,  
Bridge Office,  
Admin. Bldg.

From: Foundation Section,  
Materials & Testing Office,  
Room 107, Lab. Bldg.

ATTENTION: Mr. S. McCombie

DATE: November 21, 1969

Our File Ref.

IN REPLY TO

NOV 21 1969

## SUBJECT:

FOUNDATION INVESTIGATION REPORT  
By Dominion Soil Investigation Ltd.  
C.N.R. Overhead Crossing, Hwy. #502  
Near Napanee, District #8 (Kingston)  
W.P. 183-66 -- Site 17-116

Attached please find the above mentioned report prepared and submitted by the Consultant, Dominion Soil Investigation Limited.

We have reviewed the report and feel that it contains all the information necessary for you to proceed with the design.

A number of alternatives present themselves for the foundations of both the abutments and piers. The final choice will be made based on practical and economic reasons by the bridge designer.

Should you wish to discuss the report or any part thereof, please feel free to contact this Office.

AGS/MdeF  
Attach.

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

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
S. J. Markiewicz  
V. A. Snell  
T. C. Kingsland (2)  
J. E. Gruspier  
B. A. Singh

Foundations Files  
Gen. Files

Ref. No. 9-10-15.  
November 18th, 1969

*69 - F - 202 C*

FOUNDATION INVESTIGATION

C.N.R. OVERHEAD CROSSING  
HIGHWAY #502 NEAR NAPANEE  
DISTRICT 8 (KINGSTON)  
W.P. 183-66

PREPARED FOR:  
DEPARTMENT OF HIGHWAYS, ONTARIO.  
MATERIALS & TESTING DIVISION  
FOUNDATION SECTION.

Distribution:  
12 copies - Department of Highways, Ontario.  
2 copies - Dominion Soil Investigation Ltd.



**DOMINION SOIL INVESTIGATION LIMITED**  
CONSULTING SOIL & FOUNDATION ENGINEERS

HEAD OFFICE  
104 CROCKFORD BLVD.  
SCARBOROUGH, ONT.  
CANADA  
TELEPHONE: 751-6565

BRANCH OFFICE  
369 QUEENS AVE.  
LONDON, ONT.  
TELEPHONE: 433-3851

Your Ref. No. W.P. 183-66  
Our Ref. No. 9-10-15.

November 18th, 1969.

Department of Highways, Ontario,  
Materials & Testing Division,  
Downsview, Ontario.

Attention: Mr. A. Rutka, P.Eng.  
Materials & Testing Engineer.

Re: Foundation Investigation  
C.N.R. Overhead Crossing,  
Highway #502 near Napanee, Ont.

Dear Sirs,

We are pleased to present herewith our report on the above project in accordance with directions received from your office in a letter dated October 17th, 1969.

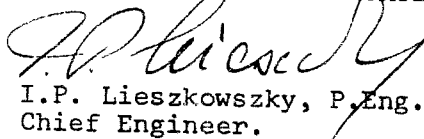
The accompanying report describes the foundation conditions in detail but generally it is concluded that no major problems exist. The site is underlain by about 8 feet of stiff to hard clay overburden, followed by the sound limestone bedrock at a uniform elevation of about 313<sup>+</sup> ft.

The footings for the piers can be established either in the hard clay overburden or on bedrock, and the abutments can be supported either on piles driven to refusal on bedrock through the approach fills or on spread footings placed in the compacted fill. In either case both total and differential settlements will be within tolerable limits for a continuous structure.

We trust that you will find the following report satisfactory however, we will be pleased to discuss any aspect of this project with you at your convenience.

Respectfully submitted.

DOMINION SOIL INVESTIGATION LTD.

  
I.P. Lieszkowszky, P.Eng.  
Chief Engineer.

IPL:jm.



C O N T E N T S

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Ref. No. 9-10-15.



E N C L O S U R E S

|                                    |    |    |    |    |    | <u>No.</u>                |
|------------------------------------|----|----|----|----|----|---------------------------|
| Borehole Logs                      | .. | .. | .. | .. | .. | 1 to 13<br>inclusive      |
| Grain Size Distribution Curve      | .. |    |    | .. | .. | 14                        |
| Consolidation Test                 | .. | .. | .. | .. | .. | 15                        |
| Borehole Locations and Soil Strata | .. |    |    | .. | .. | Dwg.No.1<br>(side pocket) |



1.0. INTRODUCTION

Described in this report are the results of a foundation investigation carried out at the site of the proposed crossing of Highway #502 over the C.N.R. tracks near Napanee, Ontario.

Details of the project and the scope of the investigation were discussed with Mr. A.G. Stermac, P.Eng., Principal Foundation Engineer. A 200 feet long three span structure is proposed with approximately 30 foot high approach fills on both sides. The purpose of the investigation was to establish the foundation conditions at the pier and abutment locations of the structure and to determine the stability and the feasibility of constructing the approach fills to the proposed heights.

The exploratory drilling programme consisted of a sampled borehole with an adjacent cone penetration test and a separate cone penetration test at each pier and abutment locations. Additional cone penetration tests were also put down along the centreline in the approach fill area. The results of the borings can be found on the borehole logs and further details of the field work are given in the appendix.

## 2.0. SITE & GEOLOGY

The site lies near the west end of the Town of Napanee, about 300 feet east of the present secondary Highway #502.

The area is characterized by a generally low relief and flat topography with an average ground surface elevation of 320 feet. The land is mainly used for farming or as a pasture. There is a small wood on the west side of the highway and several small trees or large bushes on the north side of the embankment, but for the above and the grass cover on the ground the terrain is generally barren on both sides.

There is a small pond on the north side of the rails which starts some 50 feet east from the crossing and runs several hundred feet west of the site. The pond is about 50 feet wide and its bottom is generally 3 to 4 feet below the surrounding ground level. The water depth in the pond ranges between 15 and 28 inches.

Rock outcrops at the Napanee River about 2/3rds of a mile to the south and also along Highway #401 some 1-1/2 miles away from the site. There are no visible outcrops in the immediate vicinity.

Physiographically the site is located on the Napanee Plain which is underlain by the slightly undulating Black River limestone from which the glaciers have stripped most of the overburden. The shallow overburden



consists of glacial till or stratified clay.

### 3.0. GENERAL SUBSURFACE CONDITIONS

The ground surface in the area of the structure varies between elevation 324 and 321 feet. The surface of the bedrock lies between elevation 314.5 and 313 feet and is overlain by clay overburden.

#### Overburden

Covered by a few inches of organic topsoil or fill used for the railway construction, the subsoil is a clay of high plasticity (CH). The top 3 to 4 feet of the clay is weathered and has a firm to stiff consistency with an undrained shear strength value of about 2000 pounds per square foot. Below this weathered zone the clay is hard as indicated by undrained shear strength values of over 4000 pounds per square foot. Between the clay and the underlying bedrock a thin, 9 to 12 inches thick layer of gravelly silty sand till was encountered.

#### Bedrock

The surface of the bedrock was encountered or inferred from refusal between elevation 313 and 314.5 feet. In the boreholes the rock was cored in Bx size for a length of 5 feet. The rock is a grey coloured limestone belonging to the Black River formation of the Ordovician system. Visual inspection of the cores and the excellent recovery (97 to 100%) indicate that the bedrock is dense and sound with no

Si

visible signs of vertical jointing.

Groundwater

Groundwater observations made in the open boreholes at the end of the field work are recorded on the borehole logs. Accordingly the groundwater table at the time of the investigation was at about elevation 318± feet which corresponds approximately to the water level in the nearby pond.

For further details of the soil conditions, reference shall be made to the individual borehole logs and the subsurface profile shown on Drawing No.1. The significant index and engineering properties of the clay are discussed in the Appendix.

4.0. DISCUSSION OF THE RESULTS

Based on information available at the time when this report was prepared and as shown on the Department of Highways, Ontario, Drawing No. E-4679-1, the proposed structure will be 206 feet long with two 64 feet long exterior spans and a 78 foot long centre span. Leading to the abutments on both sides, approximately 30 foot high approach fills are proposed. The fill will be spilled through the open type of abutments.

4.1. Piers

The subsurface conditions at the pier locations are indicated on the log of boreholes No.4 and 5 and by cone tests No.3 and 6. The ground surface level ranges between 323 and 324 feet. The surface of the hard clay lies between elevation 319 and 318 feet and the bedrock at about elevation 314 feet.

i) Foundation in Overburden: The footings of the piers could be established within the hard zone of the clay at about elevation 318 feet. At this depth the footings will have adequate earth cover for frost protection. The allowable bearing pressure for continuous strip footings is 8.0 kips per square foot, which value incorporates a safety factor of at least 3.0 against general shear failure of the underlying soil.



The maximum total settlement under a 10 foot wide footing carrying 80 kips per linear foot of abutment was calculated to be 1.2 inches.

ii) Foundations on Bedrock: Because of the relatively shallow depth to the surface of the bedrock, footings could also be established on the surface of the bedrock. A design pressure of 40 kips per square foot can be adopted for such footings without measurable settlements.

#### 4.2. Abutments

Because of the more than 30 foot high approach fills spread footing foundations in the natural subsoil or bedrock would not be practical and therefore one of the following foundation treatments are recommended for the abutments.

i) Piled Foundations: The abutments could be supported on piles driven to practical refusal on the bedrock. To facilitate the driving of the piles through the approach fills, the use of steel-H piles is recommended. The suggested safe working loads for a number of economical pile sections are listed below.

|          |   |         |
|----------|---|---------|
| 8 BP 36  | - | 47 tons |
| 10 BP 42 | - | 55 tons |
| 12 BP 53 | - | 70 tons |
| 14 BP 73 | - | 95 tons |





The amount of settlement will be limited to the elastic compression of the pile section.

ii) Footings in compacted fill: Alternatively the abutments could be supported on spread footings laid 4 feet below the finished grade within the compacted fill of the approach embankment. To provide an adequate support for the footings and to avoid excessive deformation, the fill shall be compacted to a uniform density of not less than 100% of its Standard Proctor maximum dry density. An allowable bearing pressure of 3.5 kips per square foot is recommended for the design. It is estimated that the maximum total settlement of the abutment would be of the order of 2 inches, most of it due to the consolidation settlement of the clay overburden under the weight of the embankment. The compression of the embankment proper under the weight of the structure and its own weight is estimated to be less than half an inch.

#### 4.3. Approach Fill

There are no stability problems foreseen from the construction of the approximately 30 foot high approach fills. The embankment can be constructed with the normal 2 to 1 side and end slopes. The maximum total settlement under the embankment was calculated to be about 1.5 inches.



Some subexcavation is suggested on the north side under the end slopes where the fill spills through into the pond. Borehole No.9 which was located in the pond area indicates that there is about 24 inches of very soft deposit below the bottom of the pond. Although the presence of this thin soft zone under the embankment possibly would not be detrimental, in view of the small cost involved it is recommended that this material be removed before the embankment is placed. The placement and compaction of the fill shall be in accordance with D.H.O. Form #200, Section 214 except for the case when the abutment is supported on spread footings in the fill. In this case the degree of compaction within the last 100 foot long section at the south end of the north approach shall be not less than 100% of the Standard Proctor maximum dry density.

#### 4.4. Construction

Because of the cohesive and impervious nature of the clay overburden, no major excavation or dewatering problems are expected during construction.

#### 5.0. CONCLUSIONS

From the above discussion it can be concluded that the foundation conditions at the site are suitable for the construction of a continuous structure. The



differential settlement between the piers and the abutments will depend on the foundation treatment adopted but will be within tolerable limits.

DOMINION SOIL INVESTIGATION LIMITED

*I. P. Lieszkowsky*

I. P. Lieszkowsky, P. Eng.  
Chief Engineer.



IPL:JM



A P P E N D I X

A. PROCEDURES

1) Field Work

The work in the field was carried out between October 23rd and October 28th, 1969. During this period six sampled boreholes each with adjacent dynamic cone penetration test and seven separate cone penetration tests were put down. Boreholes in the field were laid out with the aid of D.H.O. Drawing No. E-4679-1 and existing centre-line stakes on the site. Elevations were referred to the top of the most northerly rail at Station 248 + 64.22. The elevation of this point was shown on the above D.H.O. Drawing as 325.81 ft. above geodetic datum.

A standard diamond drill machine equipped for soil testing and rock coring was used and the boreholes were lined with Bx size (2-7/8") steel casing. Disturbed and undisturbed soil samples were recovered either continuously or at 2-1/2 foot intervals. Disturbed sampling was effected by the standard penetration test methods whereas undisturbed samples were recovered with a 2-inch inside diameter thin-walled Shelby tube sampler. Where the consistency of the soil permitted in-situ vane tests were also performed. The bedrock was cored at four locations in Bx size to a depth of 5 feet. Records of the borings, sampling and penetration tests are shown on the borehole logs.



The field work was under the constant supervision of Mr. Z. Ozden, P.Eng., Soils Engineer.

2) Laboratory Work

In the laboratory samples shipped in from the field in airtight glass jars were subjected to further visual examination and testing.

Testing consisted of identification tests, such as mechanical sieve and hydrometer tests, Atterberg tests and the determination of the natural unit weight and moisture content. Among the engineering properties the undrained shear strength and compressibility of the subsoil was determined. The undrained shear strength was measured by unconfined compression tests, performed on both undisturbed Shelby tube samples and slightly disturbed split-spoon samples. The results of the sieve analysis are plotted on enclosure No.14 and the consolidation test results on enclosure No.15. Other laboratory test results are given on the borehole logs.

B. DETAILED DESCRIPTION OF THE SUBSOIL

Clay:

The natural non-organic subsoil underlying the site is a brown to grey coloured clay deposit. The thickness of this stratum ranges between 6 and 8 feet.

A typical grain size distribution curve of the soil is shown on enclosure No.14 indicating that it



consists of about 30% of fine sand and about 70% of plastic soil fines. Atterberg tests performed on the soil fines gave the following results:

|                           |            |
|---------------------------|------------|
| Liquid Limit:             | 54 to 68%  |
| Plastic Limit:            | 22 to 29%  |
| Plasticity Index:         | 30 to 40%  |
| Natural Moisture Content: | 26 to 37%  |
| Liquidity Index:          | 0.1 to 0.2 |

On the basis of the above properties, the soil is described as a clay of high plasticity (CH).

The natural unit weight of the material ranges between 115 and 129 pounds per cubic foot, and the void ratio is of the order of 0.9.

To a depth of about 3 to 5 feet the clay is weathered, and has a firm to stiff consistency. Laboratory unconfined compression tests indicate the undrained shear strength value of this zone to be between 2000 and 2500 pounds per square foot. Below this weathered zone the clay has a hard consistency as indicated by field vane tests and laboratory unconfined compression tests. The measured shear strength values range between 4000 and 5500 pounds per square foot. It was also found that the Standard Penetration tests under-estimate the shear strength of the soil.

The results of a consolidation test performed on an undisturbed sample recovered from the upper zone of the clay is shown on enclosure No.15. The test shows



an initial void ratio of 0.93 and suggests that the clay is slightly over consolidated. The modulus of compressibility,  $K = \Delta p \frac{(1 + e_0)}{\Delta e}$  for the pressure range to be considered in the present design ranges between 100 and 150 tons per square foot.

E N C L O S U R E S



# LOG OF BOREHOLE.....1.....

Our Reference N<sup>o</sup> 9-10-15

Enclosure N<sup>o</sup> 1

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO  
PROJECT: C.N.R. & HWY 502 CROSSING.  
LOCATION: LOT 19, CON. 1, RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

## DRILLING DATA

Method: WASHBORING.  
Diameter: Bx (2 7/8")  
Date: OCT. 23, 1969

| SUBSURFACE PROFILE          |                         |             |        | SAMPLES         |        |      | PENETRATION RESISTANCE |   |      |      |    | WATER CONTENT |                  |         | REMARKS |                 |
|-----------------------------|-------------------------|-------------|--------|-----------------|--------|------|------------------------|---|------|------|----|---------------|------------------|---------|---------|-----------------|
| ELEVATION<br>F <sub>1</sub> | DEPTH<br>F <sub>1</sub> | DESCRIPTION | SYMBOL | GROUND<br>WATER | NUMBER | TYPE | 'N'<br>Blows / Foot    | Blows / Foot                                  |      |      |    |               | %                |         |         |                 |
|                             |                         |             |        |                 |        |      |                        | 20  | 40   | 60   | 80 | 100           | PLASTIC<br>LIMIT | NATURAL |         | LIQUID<br>LIMIT |
|                             |                         |             |        |                 |        |      |                        | UNDRAINED SHEAR STRENGTH<br>+ FIELD VANE TEST |      |      |    |               | COMPRESSION TEST |         |         | W <sub>p</sub>  |
|                             |                         |             |        |                 |        |      |                        | 1000  | 3000 | 5000 |    | 10            | 20               | 30      | 40      | 50              |

|       |      |  |    |  |   |             |        |  |  |  |  |  |  |  |  |  |  |
|-------|------|--|----|--|---|-------------|--------|--|--|--|--|--|--|--|--|--|--|
| 321.5 | 0    | GROUND SURFACE   |    |  |   |             |        |  |  |  |  |  |  |  |  |  |  |
|       |      | 12" Topsoil  |    |  | 1 | SS          | 6      |  |  |  |  |  |  |  |  |  |  |
|       |      | V. Stiff to Hard<br>CLAY<br>some sand Bembded<br>fine gravel | CH |  | 2 | SS          | 27     |  |  |  |  |  |  |  |  |  |  |
|       | 5    | brown<br>grey  |    |  | 3 | SS          | 30     |  |  |  |  |  |  |  |  |  |  |
| 314.0 | 7.5  | Dense SAND & SILT  |    |  | 4 | SS          | 8 1/2" |  |  |  |  |  |  |  |  |  |  |
| 313.0 | 8.5  | some gravel  |    |  |   |             |        |  |  |  |  |  |  |  |  |  |  |
|       | 10   | grey<br>LIMESTONE<br>BEDROCK                                 |    |  | 5 | BxT.<br>RC. | 99%    |  |  |  |  |  |  |  |  |  |  |
| 308.0 | 13.5 | END OF BOREHOLE  |    |  |   |             |        |  |  |  |  |  |  |  |  |  |  |

W.L. 318.0'  
OCT. 28, 1969

Cone Test

γ = 124 p.c.f

VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A. CHECKED:

# LOG OF BOREHOLE 2

Our Reference No. 9-10-15

Enclosure No. 2

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO.  
PROJECT: C.N.R. & HWY. 502 CROSSING  
LOCATION: LOT. 19, CON. 1, RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x. (2 7/8")  
Date: OCT. 23, 1969

| SUBSURFACE PROFILE |             |                                     |        | SAMPLES         |        |      | PENETRATION RESISTANCE |   |    |    |    | WATER CONTENT % |                                    |              | REMARKS                                      |                                   |
|--------------------|-------------|-------------------------------------|--------|-----------------|--------|------|------------------------|---|----|----|----|-----------------|------------------------------------|--------------|--|-----------------------------------|
| ELEVATION<br>Ft    | DEPTH<br>Ft | DESCRIPTION                         | SYMBOL | GROUND<br>WATER | NUMBER | TYPE | N<br>Blows / Foot      | Blows / Foot                                  |    |    |    |                 | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>W |  | LIQUID<br>LIMIT<br>W <sub>L</sub> |
|                    |             |                                     |        |                 |        |      |                        | 20  | 40 | 60 | 80 | 100             |                                    |              |  |                                   |
|                    |             |                                     |        |                 |        |      |                        | UNDRAINED SHEAR STRENGTH<br>+ FIELD VANE TEST |    |    |    |                 |                                    |              |  |                                   |
| 321.4              | 0           | GROUND SURFACE                      |        |                 |        |      |                        |   |    |    |    |                 |                                    |              |  |                                   |
|                    | 5           | CLAY<br>(inferred)<br>stiff<br>hard |        |                 |        |      |                        |   |    |    |    |                 |                                    |              |  |                                   |
| 314.8              | 6.6         | END OF CONE TEST                    |        |                 |        |      |                        |   |    |    |    |                 |                                    |              |  |                                   |
|                    |             |                                     |        |                 |        |      |                        |   |    |    |    |                 |                                    |              | REFUSAL AT<br>EL. 314.8'<br>PROBABLY BEDROCK |                                   |

VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A. CHECKED:

## LOG OF BOREHOLE...3.....

Our Reference No. 9-10-15

Enclosure № 3

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO.  
PROJECT: C.N.R. & HWY. 502 CROSSING.  
LOCATION: LOT 19, CON. 1, RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

## DRILLING DATA

Method: WASHBORING  
Diameter: Bx. (2 7/8)  
Date: OCT. 27, 1969

[illegible]

VERTICAL SCALE: 1 inch to 5 feet

**DOMINION SOIL INVESTIGATION LIMITED**

MADE: Z . A . CHECKED :

# LOG OF BOREHOLE 4

Our Reference No. 9-10-15

Enclosure No. 4

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO.  
PROJECT: C.N.R. & HWY. 502 CROSSING.  
LOCATION: LOT 19, CON. 1, RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

## DRILLING DATA

Method: WASHBORING  
Diameter: 8" (2 7/8")  
Date: OCT. 27 1969

| SUBSURFACE PROFILE          |                         |   |        | SAMPLES         |        |          | PENETRATION RESISTANCE |   |    |    |    | WATER CONTENT % |                                    |              |                                   |           | REMARKS |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
|-----------------------------|-------------------------|---|--------|-----------------|--------|----------|------------------------|---|----|----|----|-----------------|------------------------------------|--------------|-----------------------------------|-----------|---------|--|--|--|------|--|--|--|--|------|--|--|--|--|--|
| ELEVATION<br>F <sub>1</sub> | DEPTH<br>F <sub>1</sub> | DESCRIPTION                             | SYMBOL | GROUND<br>WATER | NUMBER | TYPE     | 'N'<br>Blows / Foot    | Blows / Foot                                  |    |    |    |                 | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
|                             |                         |   |        |                 |        |          |                        | 20  | 40 | 60 | 80 | 100             |                                    |              |                                   |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
|                             |                         |   |        |                 |        |          |                        | UNDRAINED SHEAR STRENGTH<br>+ FIELD VANE TEST |    |    |    |                 |                                    |              |                                   | 1000      |         |  |  |  | 3000 |  |  |  |  | 5000 |  |  |  |  |  |
|                             |                         |   |        |                 |        |          |                        | COMPRESSION TEST                              |    |    |    |                 |                                    |              |                                   | 100/sq ft |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
| 324.2                       | 0                       | GROUND SURFACE                          |        |                 |        |          |                        |   |    |    |    |                 |                                    |              |                                   |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
| 321.7                       | 2.5                     | Compact Brown SAND FILL some gravel     |        |                 | 1      | SS       | 9                      |   |    |    |    |                 |                                    |              |                                   |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
| 321.2                       | 3.0                     | TOPSOIL                                 |        |                 | 2      | TW       |                        |   |    |    |    |                 |                                    |              |                                   |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
|                             | 5                       | firm hard CLAY some sand brown grey     |        |                 | 3      | SS       | 26                     |   |    |    |    |                 |                                    |              |                                   |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
|                             |                         |   |        |                 | 4      | SS       | 29                     |   |    |    |    |                 |                                    |              |                                   |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
| 315.2                       | 9.0                     | Compact, yellow-brown SANDY CLAYEY SILT |        |                 | 5      | SS       | 10/9"                  |   |    |    |    |                 |                                    |              |                                   |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
| 313.9                       | 10.3                    | grey Limestone BEDROCK (sound)          |        |                 | 6      | BXT. RC. | 98 %                   |   |    |    |    |                 |                                    |              |                                   |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
|                             | 15                      |   |        |                 |        |          |                        |   |    |    |    |                 |                                    |              |                                   |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |
| 308.7                       | 15.5                    | END OF BOREHOLE                         |        |                 |        |          |                        |   |    |    |    |                 |                                    |              |                                   |           |         |  |  |  |      |  |  |  |  |      |  |  |  |  |  |

VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z.A.

CHECKED:

# LOG OF BOREHOLE.....5

Our Reference No. 9-10-15

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO.  
PROJECT: C.N.R. & HWY. 502 CROSSING.  
LOCATION: LOT 19, CON. 1 RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

Enclosure No. 5

## DRILLING DATA

Method: WASHBORING  
Diameter: Bx. (2 7/8")  
Date: OCT. 24, 1969

| SUBSURFACE PROFILE |              |             |        |                 | SAMPLES |      |                     | PENETRATION RESISTANCE                        |      |    |    |     | WATER CONTENT %        |              |                       | REMARKS |                               |    |    |    |
|--------------------|--------------|-------------|--------|-----------------|---------|------|---------------------|---|------|----|----|-----|------------------------|--------------|-----------------------|---------|-------------------------------|----|----|----|
| ELEVATION<br>Ft.   | DEPTH<br>Ft. | DESCRIPTION | SYMBOL | GROUND<br>WATER | NUMBER  | TYPE | 'N'<br>Blows / Foot | Blows / Foot                                  |      |    |    |     | PLASTIC<br>LIMIT<br>Wp | NATURAL<br>W | LIQUID<br>LIMIT<br>WL |         |                               |    |    |    |
|                    |              |             |        |                 |         |      |                     | 20  | 40   | 60 | 80 | 100 |                        |              |                       |         |                               |    |    |    |
|                    |              |             |        |                 |         |      |                     | UNDRAINED SHEAR STRENGTH<br>+ FIELD VANE TEST |      |    |    |     |                        |              |                       |         | lb/sq. ft<br>COMPRESSION TEST |    |    |    |
|                    |              |             |        |                 |         |      |                     | 1000  | 3000 |    |    |     | 5000                   |              |                       | 10      | 20                            | 30 | 40 | 50 |

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| 323.2 | GROUND SURFACE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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## LOG OF BOREHOLE .....6.....

Our Reference No 9-10-15

Enclosure № 6

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO  
PROJECT: C.N.R. & HWY. 502 CROSSING  
LOCATION: LOT 19, CON. 1, RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

### DRILLING DATA

Method: WASHBORING  
Diameter: 8x (2 7/8")  
Date: OCT. 27, 1969

| SUBSURFACE PROFILE |              | SAMPLES            |        |              | PENETRATION RESISTANCE | Blows / Foot | WATER CONTENT %     |  |                                | REMARKS |               |         |              |           |                |   |   |
|--------------------|--------------|--------------------|--------|--------------|------------------------|--------------|---------------------|--|--------------------------------|---------|---------------|---------|--------------|-----------|----------------|---|---|
| ELEVATION<br>Ft.   | DEPTH<br>Ft. | DESCRIPTION        | SYMBOL | GROUND WATER | NUMBER                 | TYPE         | 'N'<br>Blows / Foot | UNDRAINED SHEAR STRENGTH + FIELD VANE TEST | STRENGTH<br>• COMPRESSION TEST |         | PLASTIC LIMIT | NATURAL | LIQUID LIMIT |           |                |   |   |
|                    |              |                    |        |              |                        |              |                     | 20   | 40                             |         | 60            | 80      | 100          | lbs/sq ft | W <sub>p</sub> | W | W <sub>L</sub>                            |
| 323.5              | 0'           | GROUND SURFACE     |        |              |                        |              |                     |  |                                |         |               |         |              |           |                |   |   |
|                    |              | CLAY<br>(inferred) |        |              |                        |              |                     |  |                                |         |               |         |              |           |                |   |   |
|                    | 5            | STIFF<br>HARD      |        |              |                        |              |                     |  |                                |         |               |         |              |           |                |   |   |
| 314.5              | 9.0          | END OF CONE TEST   |        |              |                        |              |                     |  |                                |         |               |         |              |           |                |   |   |
|                    |              |                    |        |              |                        |              |                     |  |                                |         |               |         |              |           |                |   | REFUSAL AT EL. 314.5<br>PROBABLY BEDROCK. |

VERTICAL SCALE: 1 inch to 5 feet

**DOMINION SOIL INVESTIGATION LIMITED**

MADE: Z. A. CHECKED:

# LOG OF BOREHOLE .....7.....



Our Reference No. 9-10-15

Enclosure No. 7

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO  
PROJECT: C.N.R. & HWY. 502 CROSSING  
LOCATION: LOT 19, CON. 1, RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x. (2 7/8")  
Date: OCT. 24, 1969

| SUBSURFACE PROFILE |             |                       |   | SAMPLES         |        |      | PENETRATION RESISTANCE Blows / Foot |                          |  |  |  | WATER CONTENT % |                    |         | REMARKS |   |  |                |   |    |  |
|--------------------|-------------|-----------------------|---|-----------------|--------|------|-------------------------------------|--------------------------|--|--|--|-----------------|--------------------|---------|---------|---|--|----------------|---|----|--|
| ELEVATION<br>Ft    | DEPTH<br>Ft | DESCRIPTION           | SYMBOL  | GROUND<br>WATER | NUMBER | TYPE | 'N'<br>Blows / Foot                 | 20 40 60 80 100          |  |  |  |                 | PLASTIC<br>LIMIT   | NATURAL |         | LIQUID<br>LIMIT                           |  |                |   |    |  |
|                    |             |                       |   |                 |        |      |                                     | UNDRAINED SHEAR STRENGTH |  |  |  |                 | lbs/sq. ft.        |         |         |   |  | Wp             | W | WL |  |
|                    |             |                       |   |                 |        |      |                                     | + FIELD VANE TEST        |  |  |  |                 | ● COMPRESSION TEST |         |         |   |  | 10 20 30 40 50 |   |    |  |
| 320.7              | 0           | GROUND SURFACE        |   |                 |        |      |                                     |                          |  |  |  |                 |                    |         |         |   |  |                |   |    |  |
|                    | 5           | CLAY<br>stiff<br>hard |  |                 | 1      | TW   |                                     |                          |  |  |  |                 |                    |         |         | LL = 68 %<br>γ = 116 P.C.F                |  |                |   |    |  |
|                    |             |                       |   |                 | 2      | TW   |                                     |                          |  |  |  |                 |                    |         |         | LL = 66 %<br>γ = 119 P.C.F                |  |                |   |    |  |
| 312.7              | 8.0         | END OF CONE TEST      |  |                 |        |      |                                     |                          |  |  |  |                 |                    |         |         | CONSOLIDATION TEST<br>ENCL. 15            |  |                |   |    |  |
|                    |             |                       |   |                 |        |      |                                     |                          |  |  |  |                 |                    |         |         | REFUSAL AT EL. 312.7'<br>PROBABLY BEDROCK |  |                |   |    |  |

VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A. CHECKED:

# LOG OF BOREHOLE.....8.....

Our Reference No. 9-10-15

Enclosure No. 8

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO  
PROJECT: CNR. & HWY. 502 CROSSING  
LOCATION: LOT 19, CON. 1, RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

## DRILLING DATA

Method: WASHBORING  
Diameter: 8 x. (2 7/8")  
Date: OCT. 24, 1969

| SUBSURFACE PROFILE          |                         |             |        | SAMPLES         |        |      | PENETRATION RESISTANCE |                  |      |      |    | Blows / Foot |                                      |          | WATER CONTENT % |                  |         | REMARKS |                 |
|-----------------------------|-------------------------|-------------|--------|-----------------|--------|------|------------------------|------------------|------|------|----|--------------|--------------------------------------|----------|-----------------|------------------|---------|---------|-----------------|
| ELEVATION<br>F <sub>1</sub> | DEPTH<br>F <sub>1</sub> | DESCRIPTION | SYMBOL | GROUND<br>WATER | NUMBER | TYPE | 'N'<br>Blows / Foot    | 20               | 40   | 60   | 80 | 100          | UNDRAINED SHEAR<br>+ FIELD VANE TEST | STRENGTH | lbs/sq. ft.     | PLASTIC<br>LIMIT | NATURAL |         | LIQUID<br>LIMIT |
|                             |                         |             |        |                 |        |      |                        | COMPRESSION TEST |      |      |    |              | W <sub>p</sub>                       | W        | W <sub>L</sub>  |                  |         |         |                 |
|                             |                         |             |        |                 |        |      |                        | 1000             | 3000 | 5000 | 10 | 20           | 30                                   | 40       | 50              |                  |         |         |                 |

|       |      |                     |  |  |   |      |        |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-------|------|---------------------|--|--|---|------|--------|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 321.1 | 0    | GROUND SURFACE      |  |  |   |      |        |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      | 9" topsoil          |  |  | 1 | SS   | 7      |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      | grey - brown        |  |  | 2 | SS   | 26     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      | hard                |  |  |   |      |        |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      | CLAY                |  |  | 3 | SS   | 28     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      | some sand           |  |  | 4 | SS   | 25/11" |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 313.9 | 7.2  | SILTY SAND & GRAVEL |  |  |   |      |        |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 313.1 | 8.0  | buff to grey        |  |  |   |      |        |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      | Dolomitic           |  |  |   |      |        |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      | LIMESTONE           |  |  | 5 | BXT  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      | BEDROCK             |  |  |   | R.C. | 100%   |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      | (sound)             |  |  |   |      |        |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 308.1 | 13.0 | END OF BOREHOLE     |  |  |   |      |        |  |  |  |  |  |  |  |  |  |  |  |  |  |

CH

W.L. 318.1  
OCT. 28, 1969

Cone Test

X = 117.0 P.C.F.  
L.L. = 61 %

Y = 129 P.C.F.

VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A. CHECKED:



## LOG OF BOREHOLE .....9.....

Our Reference No. 9-10-15

Enclosure № 9

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO  
PROJECT: C.N.R. & HWY. 502 CROSSING  
LOCATION: LOT 19, CON. 1 RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

## DRILLING DATA

Method: WASHBORING  
Diameter: Bx. (2 7/8")  
Date: OCT. 29, 1969

[illegible]

VERTICAL SCALE: 1 inch to 5 feet

**DOMINION SOIL INVESTIGATION LIMITED**

MADE: Z. A. CHECKED:

# LOG OF BOREHOLE 10

Our Reference No. 9-10-15

Enclosure No. 10

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO  
PROJECT: C.N.R. B HWY. 502 CROSSING.  
LOCATION: LOT 19, CON. 1, RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

## DRILLING DATA

Method: WASHBORING  
Diameter: Bx. (2 7/8")  
Date: OCT. 23, 1969

| SUBSURFACE PROFILE |              |  |        | SAMPLES         |        |      | PENETRATION RESISTANCE |   |    |    |    | WATER CONTENT % |                  |         | REMARKS |                 |   |                |  |
|--------------------|--------------|--|--------|-----------------|--------|------|------------------------|---|----|----|----|-----------------|------------------|---------|---------|-----------------|---|----------------|--|
| ELEVATION<br>Ft.   | DEPTH<br>Ft. | DESCRIPTION                            | SYMBOL | GROUND<br>WATER | NUMBER | TYPE | 'N'<br>Blows / Foot    | Blows / Foot                              |    |    |    |                 | PLASTIC<br>LIMIT | NATURAL |         | LIQUID<br>LIMIT |   |                |  |
|                    |              |  |        |                 |        |      |                        | 20  | 40 | 60 | 80 | 100             |                  |         |         | W <sub>p</sub>  | W   | W <sub>L</sub> |  |
|                    |              |  |        |                 |        |      |                        | UNDRAINED SHEAR STRENGTH                  |    |    |    |                 | lbs/sq. ft.      |         |         |                 |   |                |  |
|                    |              |  |        |                 |        |      |                        | + FIELD VANE TEST      • COMPRESSION TEST |    |    |    |                 |                  |         |         |                 |   |                |  |
| 321.7              | 0            | GROUND SURFACE                         |        |                 |        |      |                        |   |    |    |    |                 |                  |         |         |                 |   |                |  |
|                    | 5            | firm<br>v. stiff<br>CLAY<br>(inferred) |        |                 |        |      |                        |   |    |    |    |                 |                  |         |         |                 |   |                |  |
| 314.2              | 7.5          | END OF CONE TEST                       |        |                 |        |      |                        |   |    |    |    |                 |                  |         |         |                 | REFUSAL AT EL. 314.2<br>PROBABLY BEDROCK. |                |  |

VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A.

CHECKED:

## LOG OF BOREHOLE .....!!.....

Our Reference No. 9-10-15

Enclosure № 11

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO  
PROJECT: C.N.R. & HWY. 502 CROSSING  
LOCATION: LOT 19, CON. 1, RICHMOND TWP.  
DATUM ELEVATION G.S.C.

### DRILLING DATA

Method: WASHBORING  
Diameter: Bx. ( 2 7/8")  
Date: OCT. 23. 1969

| SUBSURFACE PROFILE |             |   |        | SAMPLES         |        |      | PENETRATION RESISTANCE |              |    |    |    | WATER CONTENT |   |                                  | REMARKS |   |
|--------------------|-------------|---|--------|-----------------|--------|------|------------------------|--------------|----|----|----|---------------|---|----------------------------------|---------|---|
| ELEVATION<br>Ft    | DEPTH<br>Ft | DESCRIPTION                                 | SYMBOL | GROUND<br>WATER | NUMBER | TYPE | 'N'<br>Blows / Foot    | Blows / Foot |    |    |    |               | PLASTIC<br>LIMIT                              | NATURAL                          |         | %<br>LIQUID<br>LIMIT                      |
|                    |             |   |        |                 |        |      |                        | 20           | 40 | 60 | 80 | 100           | UNDRAINED SHEAR STRENGTH<br>+ FIELD VANE TEST | lbs/sq. ft<br>● COMPRESSION TEST |         | W <sub>p</sub>                            |
| 321.5              |             | GROUND SURFACE                              |        |                 |        |      |                        |              |    |    |    |               |   |                                  |         |   |
|                    | 5           | firm<br>stiff to<br>hard CLAY<br>(inferred) |        |                 |        |      |                        |              |    |    |    |               |   |                                  |         |   |
| 314.5              | 7.0         | END OF CONE TEST                            |        |                 |        |      |                        |              |    |    |    |               |   |                                  |         | REFUSAL AT EL. 314.5<br>PROBABLY BEDROCK. |

VERTICAL SCALE: 1 inch to 5 feet

**DOMINION SOIL INVESTIGATION LIMITED**

MADE: Z. A. CHECKED:

# LOG OF BOREHOLE .....12.....

Our Reference No. 9-10-15

Enclosure No. 12

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO.  
PROJECT: C.N.R. & HWY 502 CROSSING.  
LOCATION: LOT 19, CON. 1, RICHMOND TWP.  
DATUM ELEVATION: G.S.C.

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x. (2 7/8")  
Date: OCT. 24, 1969

| SUBSURFACE PROFILE |              |   |        | SAMPLES         |        | PENETRATION RESISTANCE |                     |   |    |    | WATER CONTENT % |     |                  | REMARKS |         |  |
|--------------------|--------------|---|--------|-----------------|--------|------------------------|---------------------|---|----|----|-----------------|-----|------------------|---------|---------|--|
| ELEVATION<br>Ft.   | DEPTH<br>Ft. | DESCRIPTION                               | SYMBOL | GROUND<br>WATER | NUMBER | TYPE                   | 'N'<br>Blows / Foot | Blows / Foot                              |    |    |                 |     | PLASTIC<br>LIMIT |         | NATURAL | LIQUID<br>LIMIT                          |
|                    |              |   |        |                 |        |                        |                     | 20  | 40 | 60 | 80              | 100 | Wp               |         | W       | WL                                       |
|                    |              |   |        |                 |        |                        |                     | UNDRAINED SHEAR STRENGTH                  |    |    |                 |     |                  |         |         |  |
|                    |              |   |        |                 |        |                        |                     | ← FIELD VANE TEST      • COMPRESSION TEST |    |    |                 |     |                  |         |         |  |
| 320.8              | 0            | GROUND SURFACE                            |        |                 |        |                        |                     |   |    |    |                 |     |                  |         |         |  |
|                    | 5            | firm<br>v. stiff<br>to<br>hard (inferred) |        |                 |        |                        |                     |   |    |    |                 |     |                  |         |         |  |
| 313.3              | 7.5          | END OF CONE TEST                          |        |                 |        |                        |                     |   |    |    |                 |     |                  |         |         |  |
|                    |              |   |        |                 |        |                        |                     |   |    |    |                 |     |                  |         |         | REFUSAL AT EL. 313.3<br>PROBABLY BEDROCK |

VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE: Z. A. CHECKED:

## LOG OF BOREHOLE.....13.....

Our Reference N<sup>o</sup> 9-10-15

Enclosure № 13

CLIENT: DEPARTMENT OF HIGHWAYS ONTARIO  
PROJECT: C.N.R. & HWY. 502 CROSSING  
LOCATION:  
DATUM ELEVATION

## DRILLING DATA

Method: WASHBORING  
Diameter: 8x. (2 7/8")  
Date: OCT. 24. 1969

[illegible]

VERTICAL SCALE: 1 inch to 5 feet

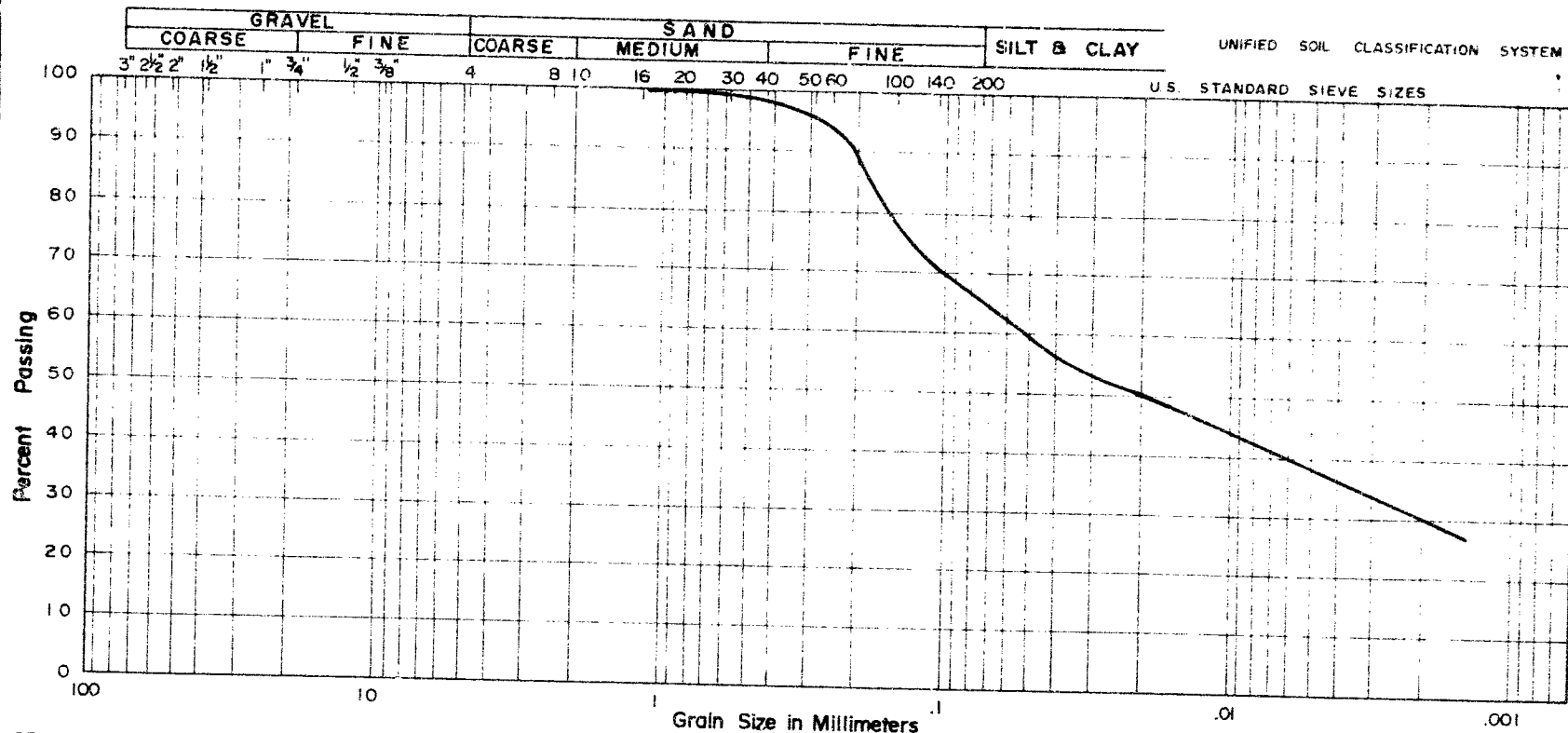
**DOMINION SOIL INVESTIGATION LIMITED**

MADE: Z. A.      CHECKED:

# DOMINION SOIL INVESTIGATION LIMITED

## GRAIN SIZE DISTRIBUTION

OUR REFERENCE № 9-10-15



PROJECT: C.N.R. & HWY. 502 CROSSING

LOCATION: RICHMOND TWP.

BOREHOLE №: 4

SAMPLE №: 3

DEPTH: 5.5' - 7'

ELEVATION: 318'

COEFFICIENT OF UNIFORMITY: N.A.  
COEFFICIENT OF CURVATURE: N.A.

### PLASTIC PROPERTIES

LIQUID LIMIT % = 61  
PLASTIC LIMIT % = 29  
PLASTICITY INDEX % = 32  
MOISTURE CONTENT % = 32

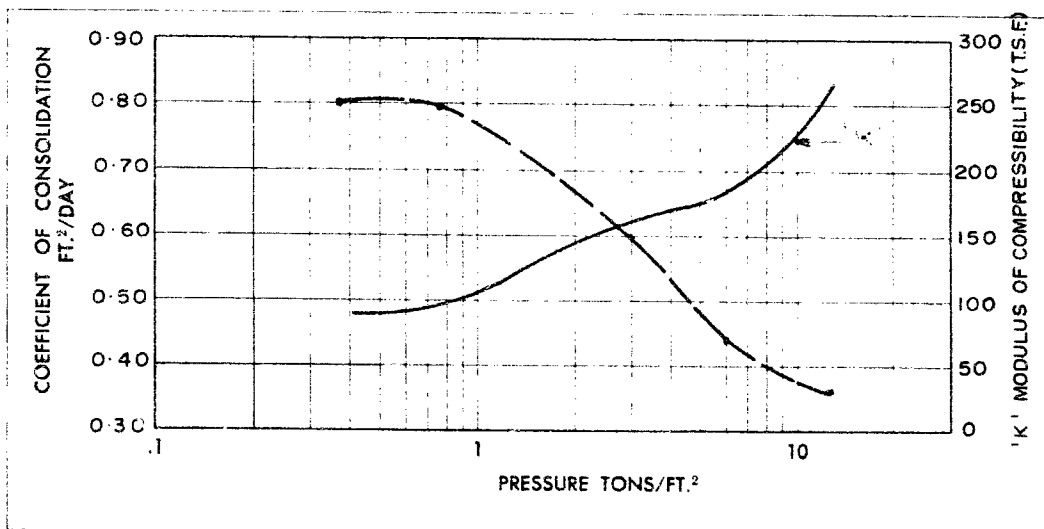
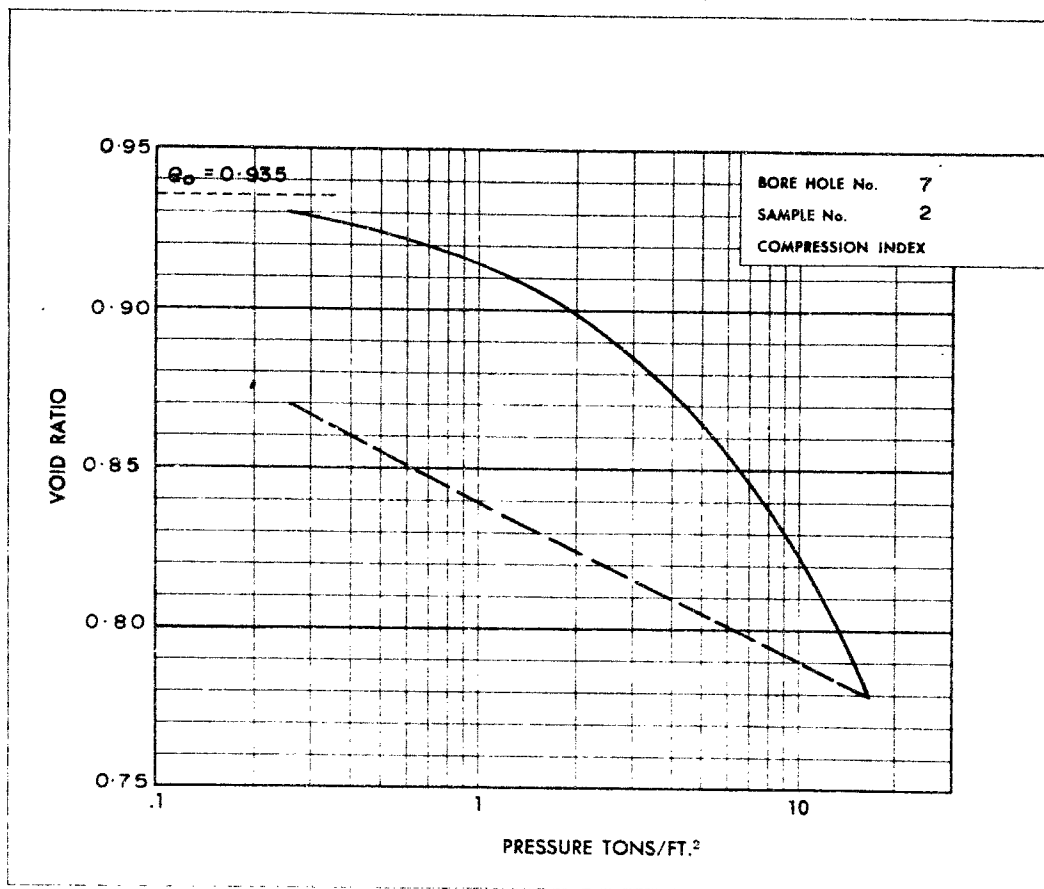
**Classification of Sample and Group Symbol:**  
**CLAY**  
**WITH SOME SAND**

CH

ENCLOSURE № 14

# DOMINION SOIL INVESTIGATION LIMITED

## CONSOLIDATION TEST





Hwy. 401 & Keele St.,  
Downsview 464, Ontario.

Tel. 248-3282  
(Area Code 416)

DEPARTMENT OF HIGHWAYS  
Materials and Testing Office

October 17, 1969

Dominion Soil Investigation Ltd.,  
Consulting Engineers,  
104 Crockford Blvd.,  
Scarborough, Ontario.

Attention: Mr. I. Lieszkowsky

Re: LETTER OF AUTHORITY - FOUNDATION INVESTIGATION  
Canadian National Railway Overhead  
Highway 502 -- District No. 8 (Kingston)  
W.P. 183-66 -- Site 17-116

Dear Sirs:

Please consider this your authorization to carry out the necessary foundation investigation at the above mentioned site.

The plans and other pertinent material were handed to you on October 17, 1969, at which time, the size and scope of the investigation were also discussed.

Should you encounter any difficulty in organizing or carrying out the investigation, please contact the Foundation Section, or Mr. T. C. Kingsland, Regional Bridge Location Engineer, 355 Counter Street, Kingston - Tel. No. 544-2220 - (Area Code 613).

You are requested, when working outside the Department's Right-of-Way, to ascertain that permission to enter and carry out the field work has been obtained from the owner of the property in question.

You are requested to submit twelve (12) copies of your report by not later than November 21, 1969.

At all times, a qualified representative of your office is to be in charge of the field work.



2

Re: Letter of Authority - Foundation Investigation  
C.N.R. Overhead - Hwy. 502 - W.P. 183-66

Charges for drilling will be in accordance with your Schedule of Rates, effective May 1, 1969, laboratory testing, in accordance with your Schedule of Rates, effective August 1, 1966, and the engineering services in accordance with Scale 1 and 2 of the Schedule of Fees for Consulting Engineering Services recommended by the Association of Professional Engineers of Ontario, 1967.

Q. Rucka

A. Rutka  
MATERIALS & TESTING ENGINEER

[illegible]

MEMORANDUM

To: Mr. S. R. Davis,  
Bridge Engineer,  
Bridge Office,  
Admin. Bldg.

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

ATTENTION Mr. S. McCombie

DATE: November 21, 1969

OUR FILE REF.

IN REPLY TO

NOV 21 1969

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
By Dominion Soil Investigation Ltd.  
C.N.R. Overhead Crossing, Hwy. #502  
Near Napanee, District #8 (Kingston)  
W.P. 183-66 -- Site 17-116

Attached please find the above mentioned report prepared and submitted by the Consultant, Dominion Soil Investigation Limited.

We have reviewed the report and feel that it contains all the information necessary for you to proceed with the design.

A number of alternatives present themselves for the foundations of both the abutments and piers. The final choice will be made based on practical and economic reasons by the bridge designer.

Should you wish to discuss the report or any part thereof, please feel free to contact this Office.

AGS/MdeF  
Attach.

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

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
S. J. Marklewicz  
V. A. Snell  
T. C. Kingsland (2)  
J. E. Gruspler  
B. A. Singh

Foundations Files ✓  
Gen. Files

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

**Mr. T.C. Kingsland,  
Reg. Bridge Planning Engineer,  
Kingston Regional Office,  
Kingston, Ontario**

**Bridge Office,  
Downsview, Ontario**

**January 16, 1970**

**Canadian National Railways Overhead  
1.3 MI. West of Easterly Jct. of Hwy. #2  
W.P. 183-66, Site 17-116  
Highway 502, District No. 8**

*11.02.1969*

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6769-P for the above-mentioned structure.

The estimated cost of the proposed structure is \$116,000. This cost includes tender, materials, engineering and sundry construction.

Any comments or revisions you may have should be submitted within three weeks.

CSG:rd

**C.S. Grebaki,  
Bridge Design Engineer**

Attach.

c.c. S. McCombie  
A. Stermac (2)  
J. Anderson

*For Comments*

*Dr. Swartz*

*Jan 24/70*

MEMORANDUM

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

From: C.S. Grebski,  
Bridge Office

ATTENTION:

DATE: May 5, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT: Canadian National Railways Overhead  
1.3 Mi. West of Easterly Jct. of Hwy. #2  
W.P. 183-66-00, Site 17-16  
Highway 502, District No. 8

*nom. Soil / 69*

Attached herewith we are submitting the final  
bridge drawings which show the foundation design for  
this structure.

Kindly give us your comments at your earliest  
convenience.

*[Signature]*  
C.S. Grebski,  
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office



*OK*

*mak*

*dk*

*no comment.  
AD. Devata  
May 15th 1970*