

69-F-19

W.P.'s 5-67 AND 190-67

H.W.Y. #17

MADAWASKA RIVER

AND ASSOCIATED

INTERCHANGE

MEMORANDUM

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: May 30, 1969

OUR FILE REF:

IN REPLY TO

JUN - 9 1969

SUBJECT:

PRELIMINARY
FOUNDATION INVESTIGATION REPORT
For Proposed Hwy. #17 Crossings of
The Madawaska River and Associated
Interchange - Alternate Alignments
(Red and Yellow)
Twp. of McNab -- Co. of Renfrew
District No. 9 (Ottawa)
W.J. 69-P-19 -- W.P.'s 5-67 & 190-67

Attached, we are forwarding to you our preliminary subsoil information to aid the Regional Functional Planning Section in carrying out a feasibility study for the alternate alignments proposed for Hwy. #17 near the Madawaska River area.

The report outlines the subsoil conditions existing at the alternate alignments, together with our general comments pertaining to the stability of the approaches at the crossings.

We believe that the information contained in this report, will prove adequate for your immediate use. Should you have any queries, please do not hesitate to contact our Office.

AGS/MdeF

Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
S. J. Markiewicz
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A. G. Sternec
A. G. Sternec
PRINCIPAL FOUNDATION ENGINEER

TABLE OF CONTENTS

1. INTRODUCTION.
2. DESCRIPTION OF THE SITE AND GEOLOGY.
3. FIELD AND LABORATORY WORK.
4. SUBSOIL CONDITIONS:
 - 4.1) General.
 - 4.2) Surficial Deposits.
 - 4.3) Clayey Silt to Silty Clay (Sensitive):
 - 4.3.1) General.
 - 4.3.2) Shear Strength - Compressibility Characteristics.
 - 4.4) Bedrock.
5. GROUNDWATER CONDITIONS.
6. DISCUSSION AND RECOMMENDATIONS:
 - 6.1) General.
 - 6.2) Nadeauaska River Crossing:
 - Red Alignment - B.H.'s R-3 and R-4
 - Yellow Alignment - B.H.'s Y-2 and Y-3
 - 6.2.1) Preliminary Design Data.
 - 6.2.2) Structure Foundations.
 - 6.2.3) Approach Fills.
 - 6.3) Hwy. #17 and Relocated Hwy. #29:
 - B.H. R-5 - Red Alignment
 - B.H.'s Y-4 & Y-4A - Yellow Alignment
 - 6.3.1) General.
 - 6.3.2) Structure Foundations.
 - 6.3.3) Approach Embankments.
 - 6.4) Hwy. #17 and Relocated Side Road:
 - B.H.'s R-2 and Y-1 - and
 - Hwy. #17 and County Road:
 - B.H. R-1
 - 6.4.1) General.
 - 6.4.2) Structure Foundations.
 - 6.4.3) Approach Embankments.
7. CONCLUSIONS.
8. MISCELLANEOUS.

PRELIMINARY
FOUNDATION INVESTIGATION REPORT
For Proposed Hwy. #17 Crossings of
The Madawaska River and Associated
Interchange - Alternate Alignments
(Red and Yellow)
Twp. of McNab -- Co. of Renfrew
District No. 9 (Ottawa)
W.J. 69-F-19 -- W.P.'s 5-67 & 190-67

1. INTRODUCTION:

The Foundation Section was requested to carry out a preliminary foundation investigation at the proposed Hwy. #17 crossings of:

- i) The Madawaska River,
- ii) Relocated Hwy. #29,
- iii) Relocated Side Road - Western outskirts of Arnprior, and
- iv) Relocated County Road #2,

all located in the Township of McNab, County of Renfrew. Two alternate alignments, designated as (Red and Yellow), are presently being considered.

The request for this foundation investigation was contained in a memo from Mr. J. L. Forster, Regional Functional Planning Engineer, Eastern Region, dated March 14, 1969. An investigation was subsequently carried out by this Section to determine the subsoil conditions at the structure sites.

This report presents information on the subsoil and groundwater conditions encountered at the proposed structure locations, along both alternate alignments. Included are recommendations pertaining to foundation design, as well as the stability of the approach fills.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The portions of the proposed alternate alignments under consideration, are located due south of Arnprior, bounded by Hwy. #29 on the east and Hwy. #17 on the west. The tableland in the area is flat to gently undulating in relief between about elevations 340 and 350. This land is cultivated and being used for farming purposes.

The Madawaska River is deeply incised into the topography within this area. The river is approximately 1,200 feet wide from crest to crest with the water level being at about elevation 259 - i.e., approximately 80 feet below the high ground. The slope of the east bank varies between 4:1 and 5:1, while the west bank is standing at a slope of between 2:1 and 3:1. Visual observations, made during the period of the investigation, indicate that, in the vicinity of the crossings, bedrock outcrops in the river and partially up the east bank. On the west bank, however, the bedrock outcrop extends as far back as 900 to 1,000 feet from the crest of the slope. The river banks are densely covered with tree growth.

The C.P.R. track traverses along the east bank of the Madawaska River. The track is situated on a terrace located between 30 and 40 feet below the tableland.

In Renfrew County there are prominent east-west trending scarps (fault zones) on both sides of a valley which encompasses the alignments being investigated. The south-westerly one, lying south of Calabogie Lake and Clear Lake, is known as the St. Patrick fault, while on the north-eastern side the Coulange fault separates the valley from the Laurentian Plateau. Thus a block, 35 miles in width, has been downdropped, forming a depression which is geologically known as the "Ottawa-Bonnechère" graben. Within it are many minor breaks, the major of which is, as far as this project is concerned, the Packenham fault; this north facing scarp traverses between Packenham and Arnprior.

2. DESCRIPTION OF THE SITE AND GEOLOGY: (cont'd.) ...

East of the Madawaska River the bedrock is overlain by up to 70 feet of overburden, while west of the river it is generally covered by only a thin surficial mantle. On the east side the overburden consists of clay covered by a thin discontinuous veneer of sand. These sediments were both laid down in the Champlain Sea. The sand is a deltaic alluvial deposit, while the clay is of marine origin. On the west bank a thin deposit of clay directly overlies bedrock.

The drainage in the area is provided by the Madawaska River.

3. FIELD AND LABORATORY WORK:

Five boreholes were put down at each of the alternate alignments (Red and Yellow). The borings were advanced by using a conventional diamond drill rig adapted for soil sampling purposes.

Samples of the overburden were obtained at specified intervals, in a 2" O.D. split-spoon sampler, which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. In the cohesive portion of the overburden the aforementioned was supplemented by taking 2" I.D. Shelby tubes, which were manually pushed into the soil. In addition, field vane tests were carried out, where feasible, to determine the undrained shear strength of the clay stratum. Bedrock was proven in 7 of the boreholes by obtaining from 6 to 12 feet of AXT size rock core samples.

The groundwater level conditions across the site were determined, during the course of the investigation, by recording the water levels in the open boreholes. In addition, two piezometers were installed in borehole #R-5.

The soil conditions encountered at the boring locations are presented on the Record of Borelog sheets. The location and elevation of the various boreholes were provided by personnel from

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

the Eastern Region Engineering Surveys Section. The elevations in this report are referenced to geodetic datum. Boring locations and elevations for the alternate alignments (Red and Yellow) are shown on Drawing 69-F-19A, together with an estimated stratigraphical profile along each.

All the samples were subjected to a careful visual examination in the field, and subsequently in the laboratory. Following this examination, laboratory testing was carried out on selected representative samples to determine the following engineering properties of the overburden:

- Bulk Densities
- Natural Water Contents
- Atterberg Limits
- Grain-Size Distributions
- Undrained Shear Strengths
- Consolidation Characteristics

The results of this testing are plotted on the Record of Borelog sheets and summarized on Figures 1 to 4, inclusive, contained in Appendix I of this report.

4. SUBSOIL CONDITIONS:

4.1) General:

The extent of the overburden, within the area under investigation, varies markedly on either side of the Madawaska River. On the east side the predominant stratum is a stiff to very stiff silty clay varying from 20 to 45 feet in thickness; the thickness generally increases in a southerly direction. In the vicinity of the river the clay is capped by a mantle of compact silty fine sand between 3 and 12 feet in depth. The clay stratum is underlain by sound crystalline limestone bedrock.

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.1) General: (cont'd.)

As discussed previously, bedrock outcrops in the river bed and west of the river for a distance of up to 1,000 feet. Beyond this, the bedrock is usually capped by a thin surficial mantle of stiff silty clay.

The stratigraphy encountered at the borings is plotted on the Record of Borelog sheets. A stratigraphical profile along the alternate alignments (Red and Yellow) has been inferred from this data and plotted on Drawing No. 69-F-19A. The subsoil encountered from ground surface downward, is presented in the following sub-sections. It should be noted that prefixes 'R' and 'Y' designate boreholes put down on the Red and Yellow alignments, respectively.

4.2) Surficial Deposits:

The area in the immediate vicinity of the east bank of the Madawaska River is surficially covered with a deposit composed of loose to compact fine sand to silty fine sand, with a trace of gravel. The thickness of this deposit ranges from 3 feet at B.H. #Y-3 to 12 feet at B.H. #R-4. Numerous seams of clayey silt up to 1 inch thick were encountered within the granular material, particularly in the lower 4 to 5 feet. Grain-size distribution curves, obtained on three representative samples of the deposit, are plotted on Figure #1 in Appendix I.

B.H. #R-1, put down through the shoulder of County Rd. #2, encountered 3.5 feet of fill composed of compact, brown silty sand, with a trace of gravel. A grain-size distribution curve, obtained on a representative sample of the fill, is plotted on Figure #1.

4.3) Clayey Silt to Silty Clay (Sensitive):

4.3.1) General:

Underlying the surficial deposits, except where bedrock outcrops, is the predominant stratum across the area; this stratum is composed of a grey clayey silt to silty clay with a trace of sand.

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.3) Clayey Silt to Silty Clay (Sensitive): (cont'd.) ...

4.3.1) General: (cont'd.) ...

As discussed previously, the thickness of the cohesive subsoil is more extensive east of the Madawaska River. At boreholes #R-5 and #Y-4 (Red and Yellow Alignments - Proposed Relocated Hwy. #29), the clay is typically 20 feet thick. In the vicinity of the Madawaska River, however, the thickness varies from 28 feet (B.H. #Y-3) to 48 feet (inferred at B.H. #R-5) - i.e., increases in a southerly direction. On the west side of the Madawaska River, bedrock is covered by only a thin veneer of cohesive soil varying between 1 and 5 feet in thickness. The upper portion of the stratum is mottled grey-brown in colour, indicating this zone has been desiccated; where the deposit is most extensive, this zone is up to 16 feet thick. Occasional sand and silt seams and partings were encountered within the stratum, particularly in the lower 5 to 8 feet. Grain-size distribution curves, obtained on samples from the clay stratum, are plotted on Figure #2.

Atterberg limit tests were carried out on representative samples of the clay; the results of this testing, which are given on the Borelog sheets, are summarized on the Plasticity Chart, Figure #3. The results indicate that the liquid and plastic limits vary from 30 to 65 (average 46) and 16 to 29 (average 21), respectively. Based on these values, it is estimated that the stratum is inorganic with the plasticity being typically in the low to intermediate range. The natural moisture contents range from 31 to 59 percent; these values correspond to liquidity indices between 0.4 and 1.2, being higher in the lower, more normally consolidated portion of the stratum.

4.3.2) Shear Strength - Compressibility Characteristics:

The field and laboratory undrained shear strength results are plotted on the Record of Borelog sheets. The consolidation

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.3) Clayey Silt to Silty Clay (Sensitive): (cont'd.) ...

4.3.2) Shear Strength - Compressibility Characteristics:
(cont'd.) ...

characteristics of the stratum were determined by carrying out 3 consolidation tests, the results of which are shown as Void Ratio vs. Pressure plots on Figure #4. The clay is most extensive east of the river; the correlated engineering properties, in this area, are summarized below.

i) Area Immediately East of the Kdawaska River - (B.H.'s #R-3, R-4 and Y-3) -

The undrained shear strength, in the upper desiccated portion of the stratum, exceeds 2,000 p.s.f.; below this zone, however, it decreases to as low as 1,700 p.s.f. Based on these results, it is estimated that the consistency of the desiccated zone is very stiff; below this zone it varies from very stiff to stiff. The consolidation testing carried out, indicates that the clay is preconsolidated in excess of existing overburden pressure by approximately 3 to 4 t.s.f. throughout.

ii) Relocated Hwy. #29 (B.H.'s #R-5 and Y-4) -

The undrained shear strength in the upper desiccated portion (upper 11 to 13 feet) varies from 1,600 to greater than 2,000 p.s.f. In the lower, more normally consolidated zone, however, the strength varies between 1,200 and 700 p.s.f. It is estimated, therefore, that the consistency of the desiccated zone ranges from stiff to very stiff. Below this zone, however, it ranges from stiff to firm. The consolidation testing indicates that the clay is preconsolidated in excess of existing overburden pressure by approximately 3 t.s.f. in the upper desiccated zone, decreasing to about 2 t.s.f. with depth.

West of the river, where the deposit is thin, the clay is desiccated with a consistency in the very stiff range.

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.4) Bedrock:

Bedrock outcrops in the river, up the west bank and back as far as 1,000 feet from the crest. East of the river, however, it underlies the overburden described in the previous sub-sections.

Bedrock was proven at the majority of the borings by obtaining between 6 and 12 feet of AXT rock core. The surface of the bedrock is quite variable across the area in question, ranging from elevation 343 (B.H. #R-1) to elevation 276 (in the Madawaska River). The bedrock profile is shown in detail on Drawing 69-F-19A.

The bedrock is a massive, medium-grained crystalline limestone with occasional calcite inclusions. Where drilled the bedrock was sound, as evidenced by the high percentage of core recovered. Numerous faults cross this physiographic region, however, (refer to Section 2); some areas may, therefore, be badly fractured.

5. GROUNDWATER CONDITIONS:

Groundwater level observations have been carried out, during the period of the investigation, in the open boreholes. In addition, 2 piezometers were installed in B.H. #R-5. The observations are recorded on the borelog sheets and summarized on Drawing 69-F-19A. The results of the measurements indicate that the piezometric groundwater level, within the surficial deposits and underlying clay stratum, varies from a few feet below ground surface, east of Hwy. #29 (B.H.'s #R-5 and Y-4), to 18 feet below the tableland adjacent to the east bank of the river (B.H.'s #R-3, R-4 and Y-3). It is considered that the lower levels observed adjacent to the river are indicative of the natural drawdown occurring towards the river level (elev. 259).

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

Proposed Hwy. #17, will be a 4-lane divided highway incorporating a wide median. The discussion presented herein is applicable for that portion of the proposed highway traversing between Hwy. #29 and County Rd. No. 2; this section will form the Arnprior By-Pass network. Two possible alignments are being considered: namely, Red (most southerly) and Yellow alignments. A preliminary profile grade has been proposed for Hwy. #17; this is shown on Drawing No. 69-P-19A.

A structure is proposed at the proposed alternate crossings of the Madawaska River. In addition, structures of the underpass type are proposed at the following crossings:

- i) Relocated Hwy. #29.
- ii) Relocated Side Road - Western outskirts of Arnprior;
and
- iii) County Road #2.

At this stage the profile grades of these crossings, as well as other pertinent design data, have not been finalized. Preliminary recommendations pertaining to structure foundations, as well as stability of approach fills, will be given in the sub-sections to follow.

A comparison of the merits of the alternate alignments will be given in Section 7 of this report.

6.2) Madawaska River Crossing:

- | | |
|--------------------|----------------------|
| - Red Alignment | - B.H.'s R-3 and R-4 |
| - Yellow Alignment | - B.H.'s Y-2 and Y-3 |

6.2.1) Preliminary Design Data:

At the proposed Hwy. #17 profile grade, the span length of the structure would be approximately 1,100 and 1,200 feet, respectively, at the Yellow and Red alignments, and would provide

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

6.2) Madawaska River Crossing: (cont'd.) ...

6.2.1) Preliminary Design Data: (cont'd.) ...

a minimum clearance of 27.5 feet over the C.N.R. tracks located on the east bank. In the vicinity of the east bank the highway would be at grade (Red alignment), or in a shallow cut of about 7 feet (Yellow alignment). On the west bank, however, fills of up to 20 and 25 feet will be required to form the approaches for the Red and Yellow alignments, respectively.

6.2.2) Structure Foundations:

The recommendations for foundation design at the two alternate crossings are given in tabular form as follows:

FOUNDATION RECOMMENDATIONS
-- MADAWASKA RIVER --

Structure Element	A L I G N M E N T S		Remarks
	RED	YELLOW	
1. <u>Abutments</u> - East Bank	<u>End-Bearing Piles</u> - driven to bedrock - approx. tip elev. 279. - designed for max. capacity of the pile section chosen.	<u>Spread Footings</u> - within desiccated zone of silty clay stratum - allowable bearing pressure - 2 t.s.f. (negligible settlement). Or, alternatively, <u>End-Bearing Piles</u> - driven to bedrock - approx. tip elev. 309. - designed for max. capacity of the pile section chosen.	--
- West Bank	<u>End-Bearing Piles</u> - driven through fill to bedrock - approx. tip elev. 295 to 300. - designed for max. capacity of the pile section chosen.	<u>End-Bearing Piles</u> - driven through fill to bedrock - approx. tip elev. 280 to 285. - designed for max. capacity of the pile section chosen.	Piles may have to be equipped with Oslo points to penetrate into sloping bedrock.
2. <u>Piers</u>	<u>Spread Footings</u> - founded on sound bedrock. - allowable bearing pressure up to 20 t.s.f.		Dewatering required if footings placed within river channel.

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

6.2) Madawaska River Crossing: (cont'd.) ...

6.2.3) Approach Fills:

To form the approaches on the west side of the river, fills ranging in height between 20 and 25 feet will be required, depending on which alignment is finally selected.

No stability problems are anticipated for fills with standard 2:1 slopes, provided all surficial organic matter is sub-excavated. With regard to shallow cuts required at the east bank (Yellow alignment), stability problems are not anticipated with standard 2:1 slopes.

It should be noted that the forward slopes of the approaches, near the river banks, should not be trimmed steeper than the existing slopes.

6.3) Hwy. #17 and Relocated Hwy. #29:

- B.H. R-5 - Red Alignment
- B.H.'s Y-4 & Y-4A - Yellow Alignment

6.3.1) General:

Preliminary design information indicates that, in the vicinity of this crossing, the profile grade of Hwy. #17 will be approximately 5 feet above existing ground surface at both the alternate alignments. The profile grade of Hwy. #29, however, has not been finalized. It is known the structure will be of the underpass type.

The stratigraphy encountered at the ~~crossing~~ crossing is similar - i.e., the predominant deposit is a very stiff (desiccated zone) to firm (with depth) silty clay approximately 20 feet in thickness. This stratum directly overlies bedrock. This being the case, the foundation recommendations given as follows, will be applicable to both alternate alignments.

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

6.3) Hwy. #17 and Relocated Hwy. #29: (cont'd.) ...

6.3.2) Structure Foundations:

i) Piers:

The proposed piers can be founded on spread footings located as high up as possible in the desiccated zone of the clay; the footings, however, should be provided with 5 feet of earth cover for frost protection purposes. For footings founded as above, an allowable bearing value of 2.0 t.s.f. can be used in design. Settlement of the foundation subsoil will take place due to the applied footing loading. The stresses induced in the foundation subsoil by footings imposing a pressure of 2.0 t.s.f. would not exceed the preconsolidation pressure of the silty clay stratum. The consolidation settlement will, therefore, be primarily due to recompression and, as such, will occur during or immediately following the construction period. The magnitude of the total and differential settlements will thus be within tolerable limits for any type of structure constructed.

As an alternative, the piers can be supported on end-bearing piles driven to bedrock. For estimating purposes, pile tip elevation may be considered to be at approximately 318 (Red Alignment) and 326 (Yellow Alignment). Allowable loads will depend on the pile section chosen (e.g., 12 BP 74 steel H-piles may be designed for 90 tons per pile).

ii) Abutments:

The abutments may be supported on spread footings, perched within the approach fills constructed of granular material; an allowable bearing pressure of 2 t.s.f. can be used in design. Under such a scheme the settlement will be within tolerable limits.

Alternatively, the abutments may be supported on end-bearing piles driven to bedrock. The pile tip elevations and estimated capacity will be the same as those presented for the pier foundations.

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

6.3) Hwy. #17 and Relocated Hwy. #29: (cont'd.) ...

6.3.3) Approach Embankments:

Total stress stability analyses ($\phi = 0$) were carried out to determine the safe height to which fills can be constructed at the proposed alternate crossings. The results of these analyses indicate that fills up to 27 feet in height, with standard 2:1 slopes, will be stable with respect to an overall deep-seated failure - i.e., factor of safety ≥ 1.3 (minimum acceptable value).

Settlement of the foundation subsoil will occur due to the surcharge embankment loading. The induced stress, beneath an embankment of the above height, will, however, not exceed the preconsolidation pressure of the soil. The settlement that does occur, therefore, will be of a recompression nature - i.e., take place during or immediately following the construction period. The magnitude of this settlement should not exceed 3 to 4 inches.

6.4) Hwy. #17 and Relocated Side Road:

- B.H.'s R-2 and Y-1 - and

Hwy. #17 and County Road:

- B.H. R-1

6.4.1) General:

These crossings have one thing in common and that is that the bedrock is covered by only a thin veneer of very stiff silty clay (between 2 and 5 feet in thickness). For this reason, they are considered jointly.

Preliminary design information indicates that, in the vicinity of the crossings, the profile grade of Hwy. #17 will be approximately 2 to 3 feet above existing ground surface. The profile grade of the interchanges, however, has not been finalized. Again, the structures will be of the underpass type.

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

6.4) Hwy. #17 and Relocated Side Road and
Hwy. #17 and County Road: (cont'd.) ...

6.4.2) Structure Foundations:

The piers can be founded on spread footings founded on or within sound bedrock, the surface of which is given on the pertinent borelog sheets. Footings founded in such a manner, can be designed for up to 20 t.s.f.

The abutments may be supported on spread footings, perched within the approach fills constructed of granular material; an allowable bearing pressure of 2 t.s.f. can be used in design. Alternatively, they may be supported on end-bearing piles driven to bedrock. The pile tip elevations can be inferred from the respective borelog sheets. Allowable loads will depend on the pile section chosen (e.g., 12 BP 75 steel H-piles may be designed for 90 tons per pile).

6.4.3) Approach Embankments:

No stability problems are anticipated for embankments constructed with standard 2:1 slopes.

7. CONCLUSIONS:

In this Section the relative merits of the alternate alignments ('Red' and 'Yellow') will be discussed.

At the interchange crossings, namely:

- i) Relocated Hwy. #29,
- ii) Relocated Side Road,
- and
- iii) County Rd. #2,

the subsoil sequence is similar along both the 'Red' and 'Yellow' alignments. The recommendations pertaining to foundation design at the respective crossings are, therefore, very similar (refer to Subsections 6.3) and 6.4)).

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

At the Madawaska River crossing, however, the subsoil conditions vary, particularly east of the river. Along the 'Red' alignment, there is a mantle of sand approximately 12 feet thick overlying the very stiff to stiff cohesive deposit, the total depth of the overburden being approximately 62 feet. In the vicinity of the 'Yellow' alignment, however, there is only about 3 feet of sand overlying the silty clay, with the total thickness of the overburden being of the order of 31 feet. There would, therefore, be some merit in adopting the 'Yellow' alignment, particularly since:

i) the east abutment could be founded on spread footings located in the upper desiccated portion of the cohesive stratum. Further, if it was decided to found this abutment on piled foundations, the pile lengths would be less along this alignment - (refer to Sub-section 6.2)), and

ii) the span length of the structure would be less if the 'Yellow' alignment is employed, since the channel in this area is not as wide.

In conclusion, it is considered that it would be feasible, from a foundation point of view, to adopt either of the alternate alignments. Based on the comments presented in the previous paragraphs, however, the 'Yellow' alignment would provide some advantages.

As discussed in Sub-section 4.4), bedrock outcrops in the river and along the west bank. It is known that the geologic history of this area is quite complex, particularly since it has been dissected by a number of fault zones. Because of this, it is recommended that a detailed geologic survey of the area would be advisable during the final investigation stage, in those areas where footings have to be located directly on bedrock.

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

It should be stressed that this report is of a preliminary nature. A complete foundation investigation will be required at all the structure sites, when design details become available.

8. MISCELLANEOUS:

The field work, performed during the period of April 24 to May 1, 1969, was supervised by Mr. B. T. Darch, Senior Foundation Engineer.

The preparation of this report was undertaken by Mr. Darch and reviewed by Mr. M. Devata, Supervising Foundation Engineer.

Equipment was owned and operated by Johnston Diamond Drilling Co. Ltd., Ottawa, Ontario.

May, 1969

APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. Y-1

FOUNDATION SECTION

JOB 69-F-19

LOCATION Sta. 2 + 60 @ Median

ORIGINATED BY BTD

W.P. 5-67 & 190-67

BORING DATE April 29, 1969

COMPILED BY BTD

DATUM Geodetic

BOREHOLE TYPE Washboring - NX, AX Casing - AXT - Rock Core

CHECKED BY JK

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT		PLASTIC LIMIT — w_p	WATER CONTENT — w		
						SHEAR STRENGTH P.S.F.		WATER CONTENT %			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		w_p — w — w_L			
245.4	Ground Level										
0.8	Clayey silt topsoil	1	SS	7							
341.5	Silty clay to clayey silt, trace of sand										
341.5	Disintegrated Stiff	2	AXT 100%		340						
3.9	Crystalline limestone bedrock (massive, medium grained)	3	AXT 95%								
	Grey Sound	4	AXT 100%								
330.4											
15.0	End of Borehole				330						

Borehole
dry
April 29/69

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. Y-2

FOUNDATION SECTION

JOB 69-F-19

LOCATION Hwy. #17 & Madawaska Rive - Yellow Alignment
Sta. 32 + 00 % of Median

ORIGINATED BY BTB

W.P. 5-67 & 190-67

BORING DATE April 30, 1969

COMPILED BY BTB

DATUM

BOREHOLE TYPE Hand Dug

CHECKED BY

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L		BULK DENSITY Y P.C.F.	REMARKS							
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS/FOOT	PLASTIC LIMIT — w_p										
							WATER CONTENT — w										
						SHEAR STRENGTH P.S.F.						WATER CONTENT %					
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE											
280.5	Ground Level									GR, SA, SI, CL							
0.0	Clayey silt to soil				280					Hand Dug hole dry Apr. 30/69							
7.0	Silty clay to clayey																
277.2	silt, trace of sand desiccated — very stiff																
3.3	Crystalline																
	Limestone Bedrock																
	Grey				270												

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. Y-3

FOUNDATION SECTION

JOB 69-F-19

Hwy. #17 & Madawaska River - Yellow Alignment
LOCATION Sta. 44 + 00 @ Median

ORIGINATED BY BTB

W.P. 5-67 & 190-67

BORING DATE April 30, 1969

COMPILED BY BTB

DATUM Geodetic

BOREHOLE TYPE Washboring - NX, AX Casing - AXT - Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					w_p ——— w ——— w_L WATER CONTENT %				
							400 800 1200 1600 2000					20 40 60				
							O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE									
340.2	Ground Level															
0.0	Silty sand, topsoil		1	SS	3	340										
1.0	Silty sand, tr. of gravel															
337.2	Brown Compact															
3.0	Silty clay to clayey silt, with a trace of sand.		2	SS	14											
	(occasional seams of silt & sand up to 1/4" thick)		3	SS	6	330										
	mottled grey & brown		4	TW	PM											
322.2	Desiccated. Very stiff															
18.0			5	SS	8	320										
	(Numerous silt & sand layers up to 5" thick, particularly below elev. 315)		6	TW	PM											
309.3	Grey		7	SS	3	310										
30.9	Stiff to very stiff															
	Crystalline Limestone															
	Bedrock		8	AXT	94%											
303.7	(massive, medium grained)															
	Grey Sand															
36.5	End of Borehole					300										

3750

s=7

s=2.5

110.5 0 324. 3 61 36

W.L. in open
BH. Apr. 30/69

119

DATUM Geodetic

BOREHOLE TYPE Washboring - NX, AX Casing - AXT Rock Core

FOUNDATION SECTION

CHECKED BY 

SOIL PROFILE		SAMPLES	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	Liquid Limit — w _L Plastic Limit — w _p Water Content — w	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER TYPE BLOWS/FOOT	SHEAR STRENGTH P.S.F.	w _p w _s w _i	P.C.F.	
			O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			
			400 800 1200 1600 2000			
348.5	Ground Level					
0.0	Clayey silt topsoil	1 SS S				
1.5	Clayey silt to silty clay, trace of sand (numerous sand layers up to 4" in thickness below elev. 340)	2 TW FM				
335.5	(mottled Grey & Brown) Desiccated, Stiff to v stiff	3 TB FM				
13.0	(layers of sand up to 6" in thickness) particularly below el. 329).	4 TW FM				
Grey						
326.7	Stiff to firm	5 SS 9				
21.8	Crystalline Limestone Bedrock with pockets of coarsely crystalline calcite (medium grained)	6 AXT 94%				
321.0	Grey Sand					
27.5	End of Borehole					

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. Y-1A

FOUNDATION SECTION

108 69-F-19

LOCATION

Hwy. #17 & Re-located Hwy. #29 - Yellow Alignment
Sta. 75 + 80 @ of median - 10' N. of BH. YL

ORIGINATED BY **BTD**

W P 5-67 & 190-67

BORING DATE

April 25, 1969

COMPILED BY

DATUM Geodetic

BORE HOLE TYPE

Washboring - NX Casing

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. R-1

FOUNDATION SECTION

Hwy. #17 and Relocated County Rd. #2

JOB 69-P-19

LOCATION

ORIGINATED BY

BMD

WP 5-67 & 190-67

BORING DATE

April 28, 1969

COMPILED BY

BTD

DATUM Geodetic

BOREHOLE TYPE

Washboring NX, AX Casing AXT Rock core

CHECKED BY

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY Y P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH — P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % 20 40 60				
347.4	Ground Level												
0.0	Silty sand, trace of gravel (Fill)		1	SS	15	340						7 25 63 5	
343.9	Brown Compact												
3.5	Clayey silt to silty clay, trace of sand		2	SS	24								
332.2	mottled grey & brown very stiff												Borehole dry
8.2	Crystalline Limestone Bedrock (medium grained)		3	AXT 100%									Apr. 28/69
330.2	Grey Sound		4	AXT 100%									
17.2	End of Borehole					330							

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. R-2

FOUNDATION SECTION

JOB 69-F-19

LOCATION Sta. 2 + 80 % of median

ORIGINATED BY LTD

W.P. 5-67 & 190-67

BORING DATE April 30, 1969

COMPILED BY LTD

DATUM Geodetic

BOREHOLE TYPE Washboring - AXT Rock Core

CHECKED BY

SOIL PROFILE		SAMPLES			FLY SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ----- %		BULK DENSITY	REMARKS
DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/FOOT		BLOWS/FOOT		PLASTIC LIMIT ----- %	WATER CONTENT ----- %		
						SHEAR STRENGTH P.S.F.		W _L ----- %			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL + LAB VANE		W _P ----- %			
								WATER CONTENT %			
345.2	Ground Level										
0.0	Clayey silt topsoil	1	SS	5							
342.7	Silty clay to clayey silt, cr. band. Stiff	2	AXT	77%							
2.5	Crystalline Limestone	3	AXT	100%	340						
336.6	bedrock pockets of crystalline calcite Grey Sound										
8.6	End of Borehole				330						
			</								

Borehole
dry
Apr. 30/69

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. R-3

FOUNDATION SECTION

JOB 69-F-19 LOCATION Hwy. #17 & Madawaska River - Red Alignment
W.P. 5-67 & 190-67 BORING DATE April 28 & 29, 1969
DATUM Geodetic BOREHOLE TYPE Washboring - NX, AX Casing - AXT Rock core

ORIGINATED BY BTDCOMPILED BY BTDCHECKED BY J.R.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT	SHEAR STRENGTH P.S.F.					WATER CONTENT %				
324.8	Ground Level					○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE 400 800 1200 1600 2000					w_p — w — w_L 20 40 60				
0.0	Sandy silt topsoil		1	SS	2										
1.0	Silty sand, trace of gravel. (occ. layers of clay up to 1/4" thick below el. 317)		2	SS	5										0 79 15 6
313.8	Brown Loose to compact		3	SS	15										
11.0	Silty clay, trace of sand, (occ. sand & silt seams & partings up to 1/4" thick throughout) (mottled grey & brown)		4	TW	PM										
	Desiccated		5	TW	PM										
300.8	Very stiff		6	TW	PM										
24.0			7	TW	PM										
	Grey (layers of silt & sand up to 1/4" in thickness below elev. 287)		8	TW	PM										
			9	TW	PM										
278.9	Stiff to very stiff		10	TW	PM										
45.9	Crystalline Limestone Bedrock (Massive, medium grained)		11	AXT	100%										
268.5	Grey Sound		12	AXT	100%										
56.3	End of Borehole														

ELEV. SCALE	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980	1000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. R-4

FOUNDATION SECTION

JOB 69-F-19

LOCATION Hwy. #17 & Madawaska River - Red Alignment
Sta. 45 + 00 @ of median

ORIGINATED BY BTD

W.P. 5-67 & 190-67

BORING DATE April 30, 1969

COMPILED BY BTD

DATUM Geodetic

BOREHOLE TYPE Washboring - BX Casing

CHECKED BY

SOIL PROFILE		SAMPLES		BLOW COUNT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w _L PLASTIC LIMIT — w _P WATER CONTENT — w		BULK DENSITY Y P C F	REMARKS
DEPTH	DESCRIPTION	NUMBER	TYPE			SHEAR STRENGTH — P S F		w _p — w _L — w			
						O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE <td colspan="2">WATER CONTENT % 20 40 60<td></td><td></td></td>		WATER CONTENT % 20 40 60 <td></td> <td></td>			
340.8	Ground Level										
0.0	Silty sand Topsoil				340						
1.0	Sand to silty sand trace of gravel (occ. seams of clayey silt up to 1" thick below a depth of 329)	1	SS	13							
328.3	Brown Compact	2	SS	13	330						0 73 21 6
12.5	Silty clay to clayey silt, trace of sand (mottled grey & brown)	3	SS	23							
319.3	Desiccated Very stiff	4	SS	17	320						
21.5	End of Borehole										
					310						

0 73 21 6

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. R-5

FOUNDATION SECTION

JOB 69-F-19 LOCATION Sta. 61 + 00 $\frac{1}{2}$ of Median Hwy. #17 & Relocated Hwy. #29 - Red Alignment

ORIGINATED BY BTB

W.P. 5-67 & 190-67 BORING DATE April 24 & 25, 1969

COMPILED BY BTB

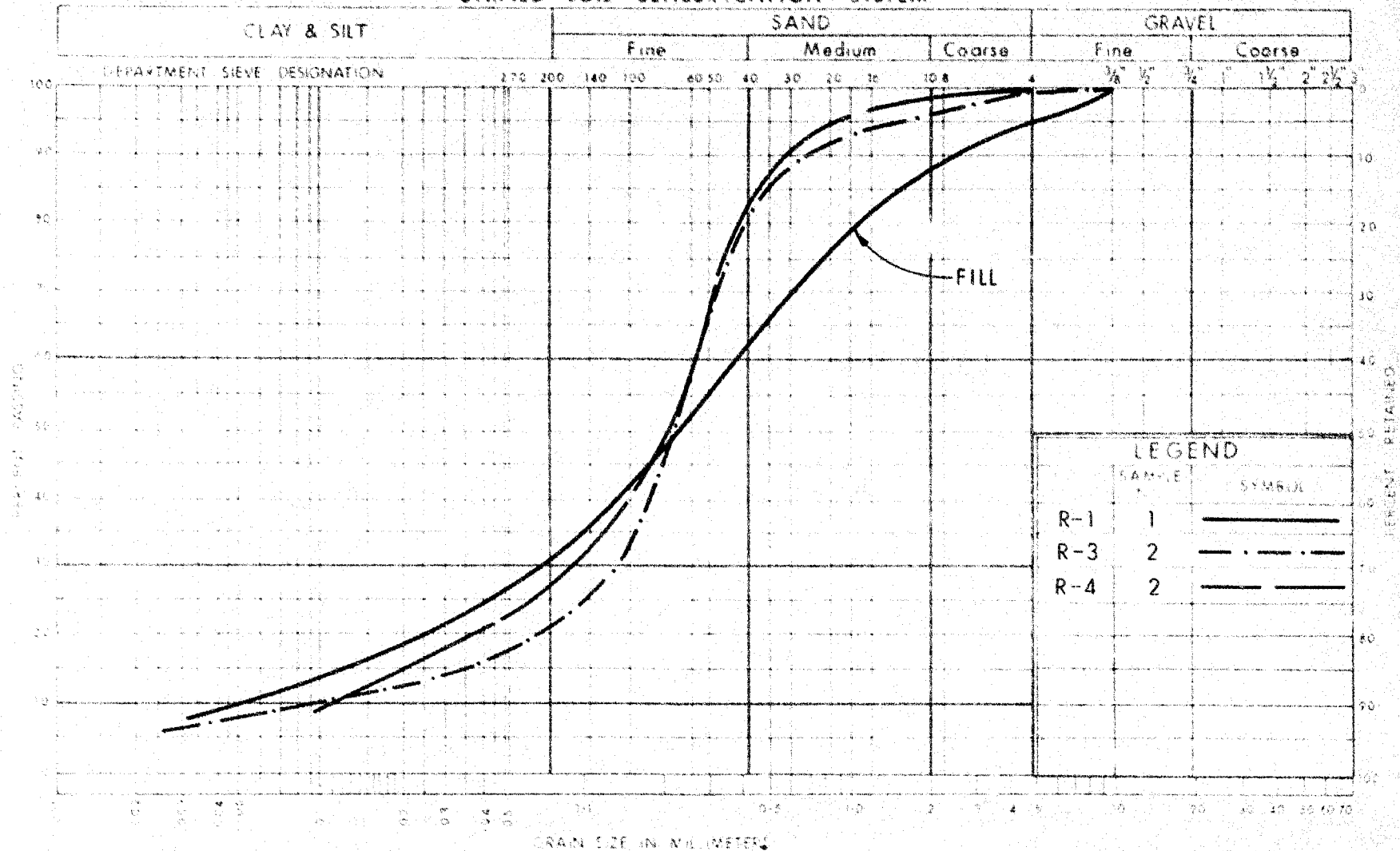
DATUM Geodetic BOREHOLE TYPE Washboring - NX, AX Casing - AXT Rock Core

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT % w_p — w — w_L				
						O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE 400 800 1200 1600 2000									
340.3	Ground Level														
0.0	Gray-Brown Clayey silt	1	SS	5	340										
1.0	topsoil														
	Silty clay to clayey silt, trace of sand (occ. seams of fine sand up to 1/2" thick) (mottled grey & brown) Desiccated	2	TW	PM											
		3	TW	PM	330										
326.3	Stiff to very stiff														
14.0	(seams of silt & sand up to 1" thick)	4	TW	PM											
318.7	Firm	5	TW	PM	320										
21.6	Crystalline Limestone Bedrock, massive medium grained.	6	AXT	88%											
	Grey	7	AXT	100%											
308.5	Sound	8	AXT	100%	310										
31.8	End of Borehole														

Piez. #1
Tip el. 308.9WL's on
Apr. 30/69

UNIFIED SOIL CLASSIFICATION SYSTEM



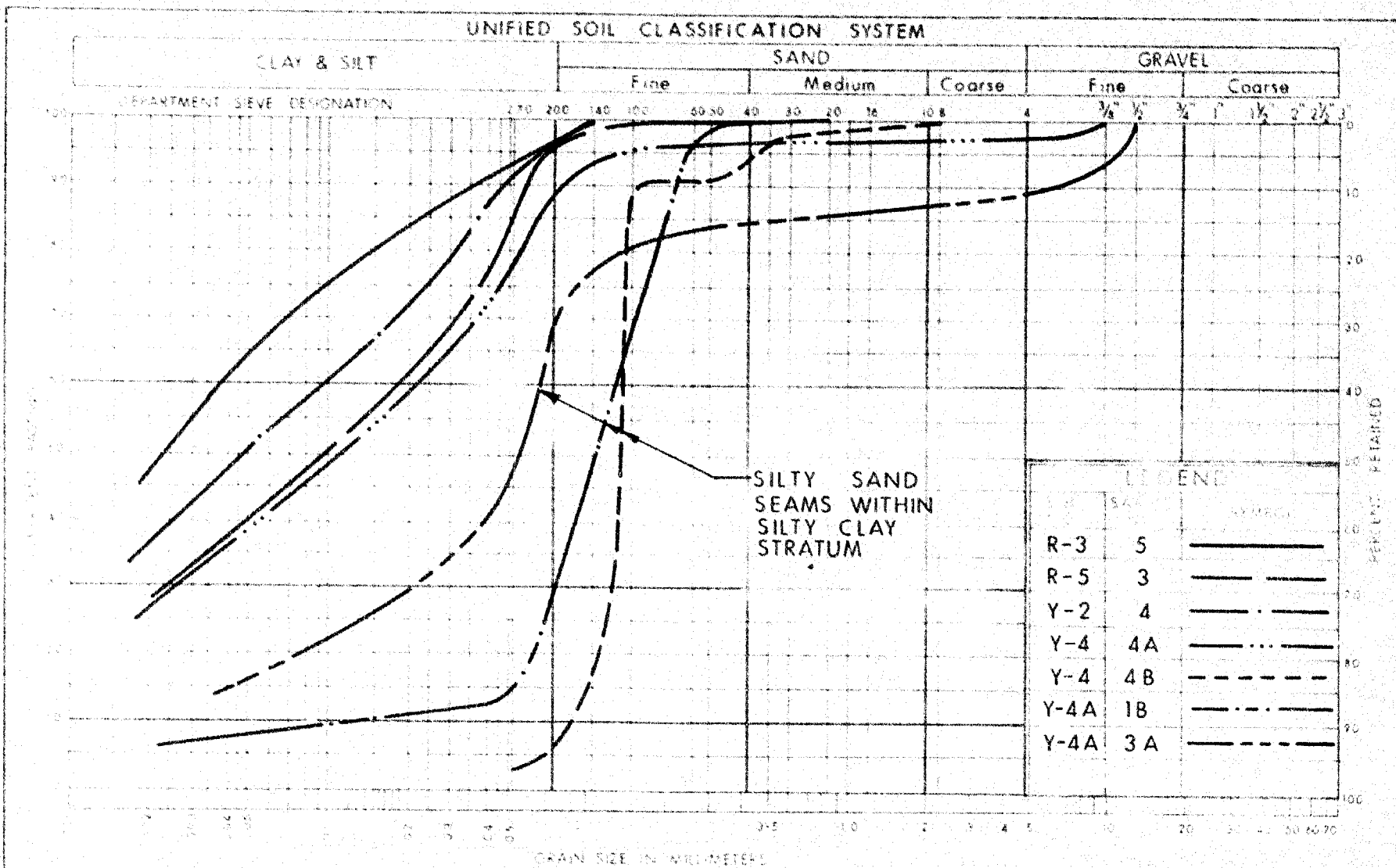
DEPARTMENT OF HIGHWAYS
MATERIALS AND
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
SILTY SAND
(SURFICIAL DEPOSITS)

W.F. No. 5-67 & 190-67

JOB No. 69-F-19

FIG NO 1



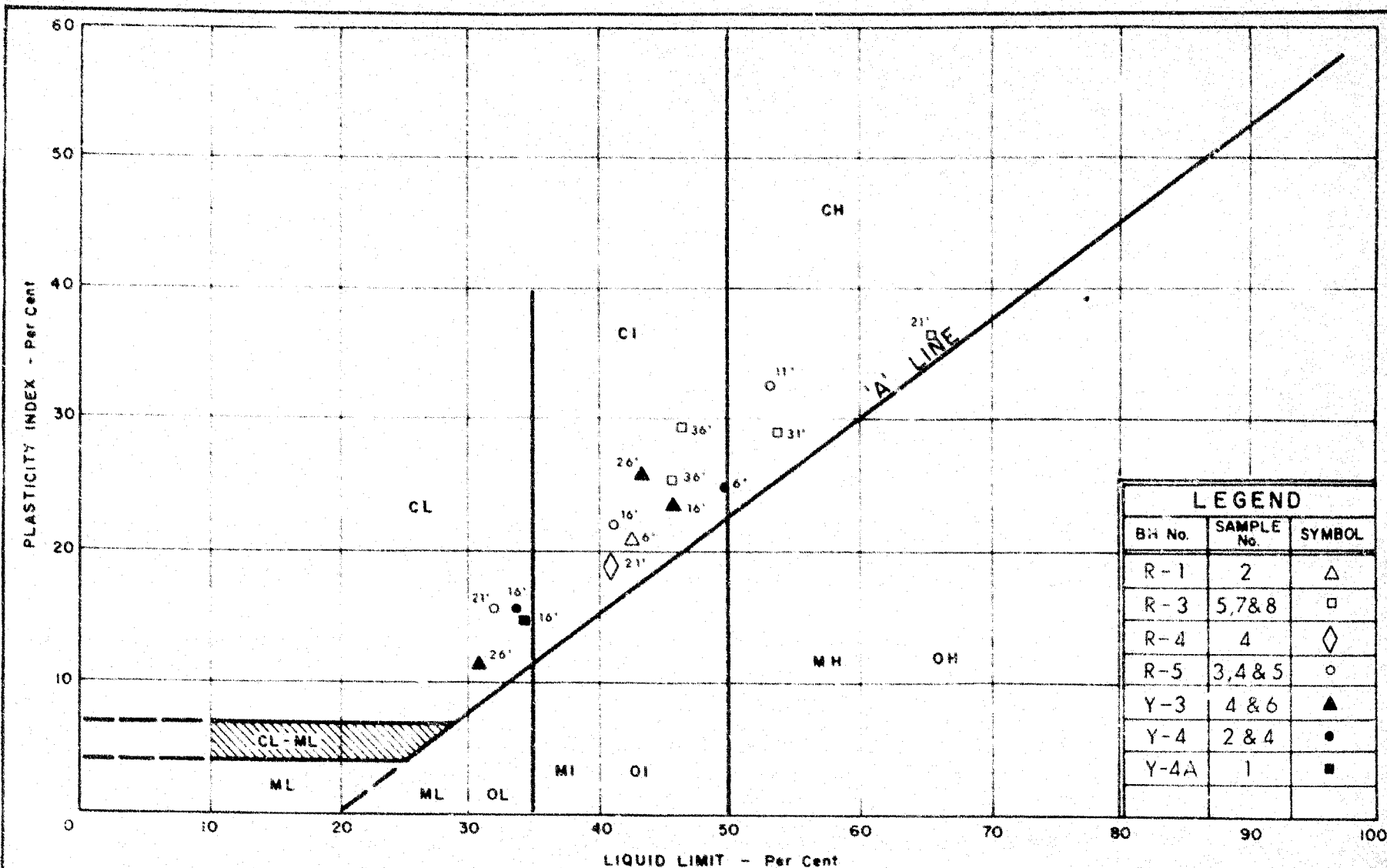
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT

W.P. No. 5-67 & 190-67

69-F-19

FIG. NO. 2



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

W.P. No. 5-67 & 190-67

JOB No. 69-F-19

FIG NO. 3

VOID RATIO - PRESSURE CURVES

JOB NO. 69-F-19

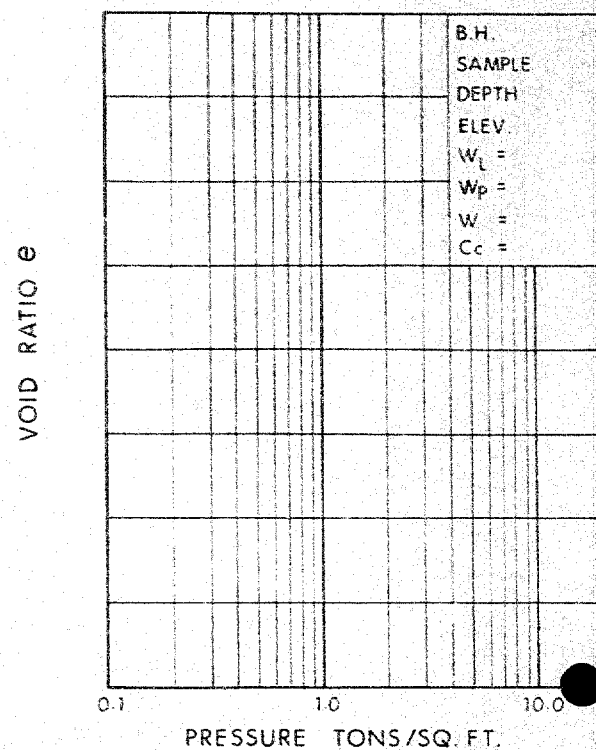
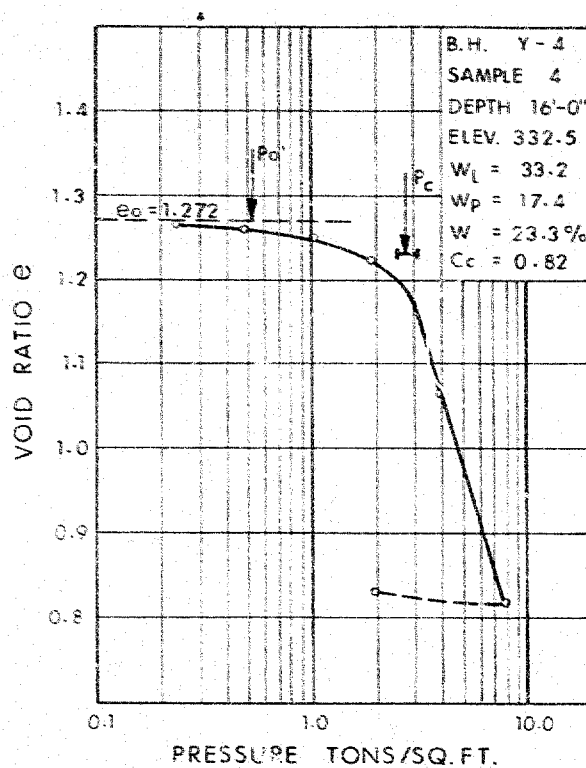
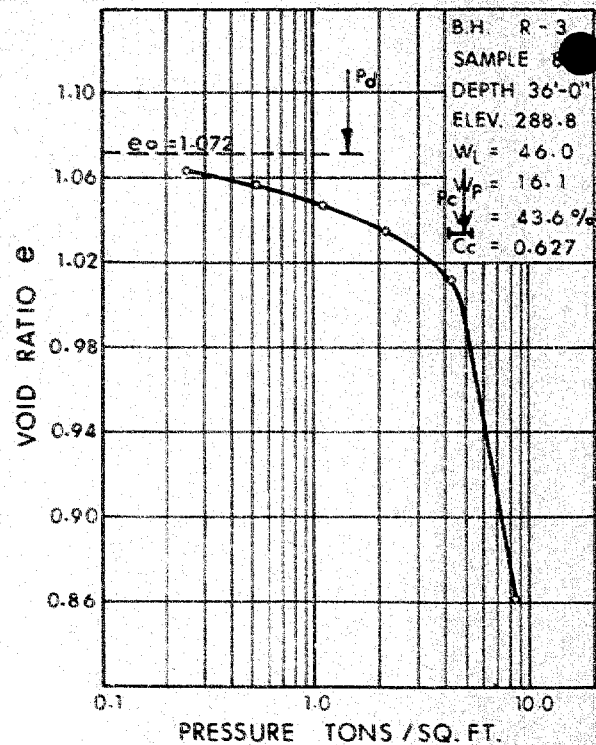
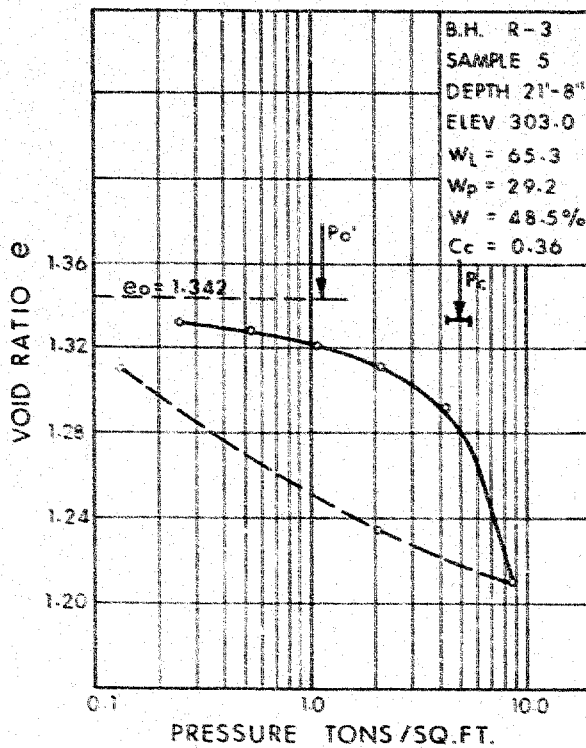


FIG. 4

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS:-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_C	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

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

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

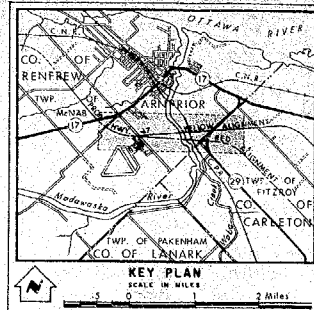
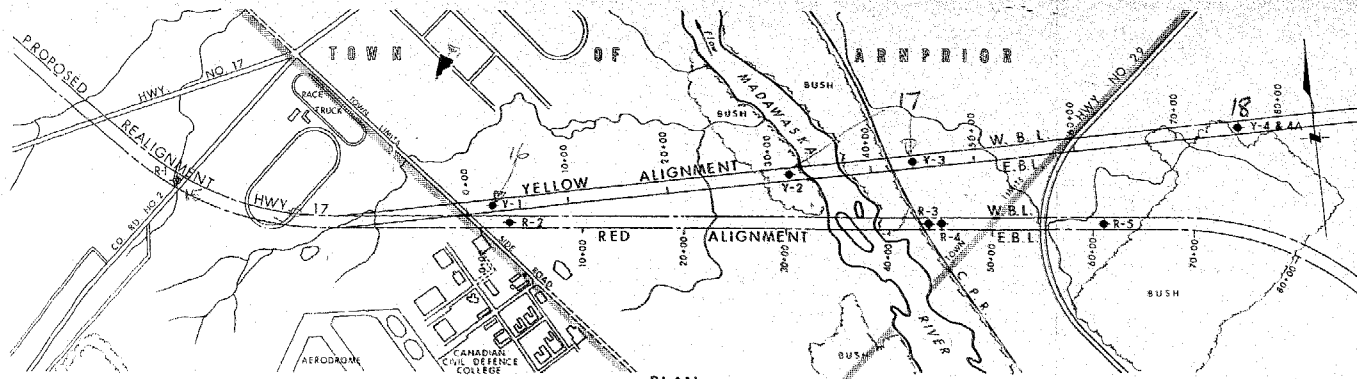
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

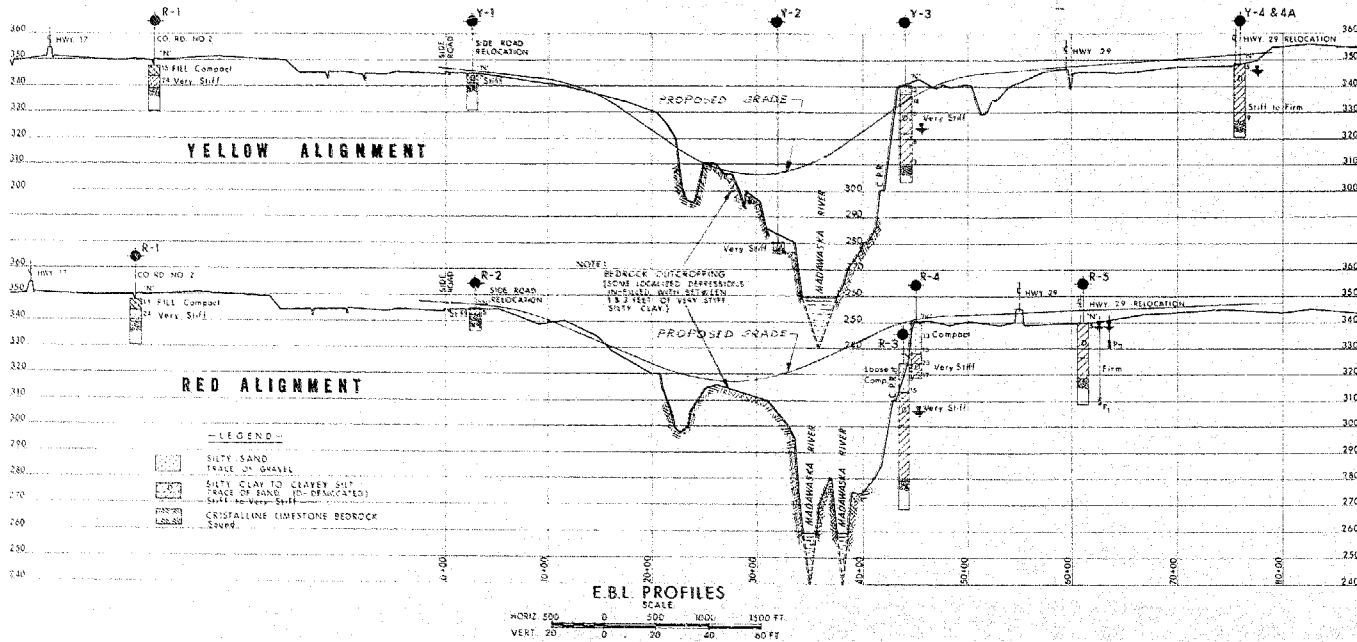


LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- ★ Water Levels established at time of field investigation, April 1969
- Piezometer

NO.	ELEVATION	STATION	OFFSET
Y-1	345.4	2+60	Q MEDIAN
Y-2	340.5	32+00	"
Y-3	340.2	44+00	"
Y-4	345.5	75+80	"
Y-4A	348.5	75+80	10' LT Q MED
R-1	347.4	AS SHOWN	Q MEDIAN
R-2	345.2	2+80	"
R-3	324.8	43+85	"
R-4	340.8	45+00	"
R-5	340.3	61+00	"

NOTE
The boundaries between soil strata have been established only from Bore Hole locations. Between Bore Holes the boundaries are guessed from geological evidence and may be subject to considerable error.



LEGEND

□	SILTY SAND
□	TRACE OF GRAVEL
□	SILTY CLAY TO CLAYEY SILT
□	TRACE OF SAND (DISFRAGMENTED)
□	SLIT TO VERY SLIT
□	CRYSTALLINE LIMESTONE BEDROCK
□	SAND

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE - FOUNDATION SECTION
PRELIMINARY INVESTIGATION
PROPOSED ARNPRIOR BY-PASS
KING'S HIGHWAY NO. 17 REALIGNMENT DIST. NO. 9
CO. RENFREW & CARLETON
TWP. McNAB & FITZROY, Town of ARNPRIOR
BORE HOLE LOCATIONS & SOIL STRATA
SOUND S.T.D. CHECKED 1/1 W.P. NO. 5-67 & 100-67 K.B.T. DRAWING NO.
DRAWN G.P. CHECKED 1/1 JOB NO. 50-F-19 69-F-19A
DATE May 18, 1969 SITE NO. BRIDGE DESIGNING NO.
APPROVED *[Signature]* ENGINEER

MEMORANDUM

TO: Mr. T. C. Kingsland,
Regional Structural Planning Eng.,
Eastern Region,
Kingston, Ontario.

FROM: Foundations Office,
Design Services Branch,
West Bldg., Downsview.

ATTENTION:

DATE: March 23, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT: *Revised Alignment, Hwy. #17 'N', Arnprior
Bypass, Twp. of McNab, County of Renfrew,
Twp. of Pitsroy, County of Carleton,
Site No. 29-191, District No. 9 (Ottawa)
W.O. 69-11019 - W.P. 198-62*

This letter is in reply to your letter of March 2, 1973, in which you requested that the Foundations Office carry out an additional preliminary foundation investigation for the revised alignment. The results of the preliminary investigation for the originally proposed alternate alignments (designated red and yellow), was presented in Report No. W.O. 69-F-19, dated May 30, 1969.

We have reviewed the revised plans and profiles for the two-lane and ultimate four-lane scheme and find that the alignment is reasonably close to the original yellow alignment discussed in the aforementioned report. For the proposed structure crossings along the revised alignment the pertinent boreholes are listed in the table to follow:

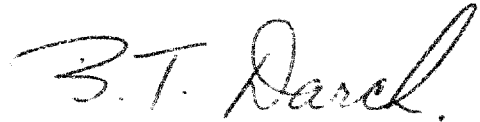
<u>Location</u>	<u>Structure Type</u>	<u>Refer to B.H. #</u>	<u>Approx. Location of B.H.'s</u>
Realigned Hwy. #29	Underpass	Y-4 and Y-4A	400' N-W'
Madawaska River	--	Y-2 and Y-3	--
Realigned Baskin Dr.	Underpass	Y-1	250' S-E'
County Rd. #2	Level Crossing	R-1	--

We feel that the boring data available is sufficient and that at this stage additional borings are not required. Further, the preliminary recommendations pertaining to foundation design as well as the stability and settlement considerations associated with the approach fills (at each site), presented in report W.O. 69-F-19, are still applicable.

March 23, 1973

Two profiles are shown for Hwy. #17 'N' in the vicinity of the Madawaska River. From a foundation point of view either profile would be quite satisfactory.

It should be stressed that a complete foundation investigation will be required at all the structure sites, when the final design details become available.



B. T. Darch,
Senior Foundations Engineer,

For: M. Devata,
Supervising Foundations Engineer.

BTD/ao

cc: P. D. Billings
A. J. Percy
E. R. Saint
C. S. Grebski (Attn: K. Bassi)

Foundations Files
Documents

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

W-69-F-19

TO: Mr. A. G. Stermac,
Principal Foundations Engineer,
Downsview, Ontario.

FROM: Structural Planning Office,
Kingston, Ontario.

ATTENTION: Mr. M. Devata

DATE: 2 March 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 198-62 - Arnprior By-pass - Site 29-191
Highway 17N, District 9 - Ottawa

Enclosed please find a plan and profile showing the proposed revised location of the Highway 17N Arnprior By-pass. The revision is due to the proposed location of the hydro dam on the original line. Plans and profiles for both the 2-lane and the ultimate 4-lane scheme are enclosed.

I shall be glad if you will make arrangements to carry out further investigations on the revised alignment and to let me have your recommendations in due course.

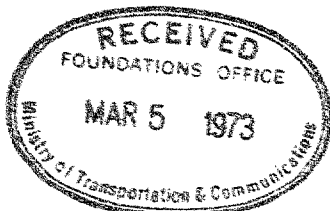
You will note that two profiles, an upper and lower one, are shown on each profile drawing. The upper profile is shown as a possible alternative should any problems arise associated with cuttings in the clay areas. However, I understand that from your previous studies in the area there is no reason why the lower profile should not be adopted.

T. C. Kingsland

T. C. Kingsland
Regional Structural Planning Engineer

TCK/hl
encls.

c.c. P. D. Billings
A. J. Percy
E. R. Saint
C. S. Grebski - Att. K. Bassi



MEMORANDUM

To: Mr. A. G. Stermac,
Principal Foundation Engineer,
Downsview, Ontario.

From: Functional Planning Section,
Kingston, Ontario.

Attention:

Date: March 14th, 1960

Our File Ref.

In Reply To

Subject: W.P.'s 5-67 & 190-67, Highway #17 (New),
Highway #44 to Halsey's Station,
43.1 miles, District #9, Ottawa

Enclosed please find two plans and profiles of possible crossings of the Macawaska River for which preliminary foundation investigations are required.

Preliminary foundation investigations are also required at the sites of proposed underpasses at the following approximate locations:


- (1) Relocated Highway #29. Station 60, red alignment or Station 75 yellow alignment.
- (2) Relocated side road, Station 2, red and yellow alignments.
- (3) Relocated County Road No. 2, the realignment at this location will only be minor.

Interchanges will be involved at the first and last locations.

More precise details of the exact location of these structures will not be available for some time but we feel that sufficient data for planning purposes may be obtained utilizing the locations given above.

As in the case of the Mississippi River, a request to stake the lines has been submitted to Engineering Surveys, with whom you may get in touch to coordinate the work.

BK/JLF/mjs
Att.
c.c. G. Scott
A. G. Boucher


B. Khojajian,
For: J. L. Forster,
Regional Functional Planning Engineer