

#69-F-90

W.P. 203-67-01

HW.Y. #416 (N.B.L.)

LINE 'A'

RIDEAU RIVER BRIDGE

258-3906 DEPARTMENT OF HIGHWAY, ONTARIO
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. McConbie

Date: December 4, 1969.

Our File No.

IN REPLY TO

DEC - 9 1969

SUBJECT:

FOUNDATION INVESTIGATION REPORT
for the
Proposed Rideau River Bridge
(4.3 Mi. North of Hwy #43)
Highway #416 District #8
W.J. 69-F-90 W.P. 203-67-01

Attached, we are forwarding to you our final Foundation Investigation Report pertaining to the above site. Presented in this report are the results of the investigation, together with our general comments as to the stability of the approaches and recommendations regarding structure foundations.

We believe that the information contained therein, will prove adequate for your immediate use. Should you require further data, or clarification of the report, please feel free to contact this Office.

AGS/ak
Attach.

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

A. G. Sternat
A. G. Sternat
PRINCIPAL FOUNDATION ENGINEER

Foundation Files
General Files

FOUNDATION INVESTIGATION REPORT
for the

Proposed Rideau River Bridge
(0.3 Mi. North of Hwy #413)
Highway #416 District #8

W.J. 69-F-90

W.P. 203-67-01

1. INTRODUCTION

The results of a foundation investigation at the site of the proposed Rideau River Bridge on Hwy. #416 is reported. The investigation was requested by Mr. T. C. Kingsland, Regional Bridge Planning Engineer (Kingston Region) in a memo dated September 30, 1969. It is understood that for the time being only the north bound lanes of Line "A" will be constructed, crossing the river with a 36 ft. wide bridge.

A preliminary investigation was already carried out for this crossing early in 1967. The boreholes were placed along the originally proposed lines #1 and 2. Neither of these lines however coincided with the presently proposed Line "A".

In the following sections details of the field and laboratory work, together with recommendations for the foundations and embankment stability are presented.

2. DESCRIPTION OF THE SITE

The proposed crossing is situated some 5 Mi. north of the town of Kemptville on the Rideau River and canal. Proposed line A crosses the 900+ ft. wide river approximately at right angles. The line runs through farm and pasture land on both banks of the River. Further north however the east bank is built up with summer cottages. The west bank of the river is some 6 - 10 ft. higher than the east bank and large size boulders are visible on the ground, particularly near the beach area. Although the site lies within the physiographic region known as the "Edwardsburg Land Plain", the subsoil bears rather the characteristics of the neighbouring "North Gower Drumlin Field" region. The clay and silty clay soils were likely deposited within the Champlain Sea.

3. FIELD AND LABORATORY INVESTIGATION PROCEDURE

Some 14 sampled boreholes and 4 dynamic cone penetration tests - adjacent to certain boreholes - were carried out during the course of the fieldwork. Washboring techniques were followed using conventional diamond drill rigs adapted for soil sampling purposes. A portable raft was utilized for the execution of those holes located on the river. The dynamic cone and standard penetration tests were performed according to the method described at the end of the text, under the heading "Abbreviations used in this report". Frequent field vane shear tests were carried out within the cohesive layers in order to determine the undrained and remoulded shear strengths of the materials. "Undisturbed soil samples

3. FIELD AND LABORATORY INVESTIGATION PROCEDURE (Cont'd.)

were recovered by pushing 2" ID Shelby tubes some 18 inches manually into the soil. The locations and elevations of all boreholes together with the estimated soil stratigraphy are presented on Drawing #69-F-90-A. Upon arrival in the laboratory all the samples were subjected to visual classification tests. Laboratory tests were then performed on representative samples to obtain natural moisture contents, Atterberg limits, grain size distributions, organic contents, chloride concentrations, undrained shear strength and consolidation characteristics. Field and laboratory test results are plotted on the accompanying borehole records.

4. SOIL CONDITIONS

4.1) GENERAL

The soil stratigraphy along the investigated line shows considerable variations as indicated on the soil profile. The main soil type at the east side of the river was identified to be a sensitive silty clay, underlain by glacial tills. The silty clay is a marine deposit, the tills having been deposited by the moving glacier as drumlins. The till rises to ground level at the west beach of the river, dipping again below the marine clay further west. A recent deposit of thick organic muck was found to lie under the river. Bedrock was encountered at two borehole locations on the east side.

A brief description of each soil stratum follows.

4.2) SILTY CLAY

The silty clay was observed on the east side of the river from groundlevel downwards to el. 230-239 ft., the thickness of the layer being

4. SOIL CONDITIONS (Cont'd.).....

4.2) SILTY CLAY (Cont'd.)

around 45-52 ft. The same deposit occurs again some 300-400 ft. west of the west bank of the river, overlying the slope of the glacial ridge. Here the thickness of the clay layer increases towards the west, but even at the westerly limit of the investigation (BH #14) it was observed to be only 16 ft. thick. Undisturbed and remoulded field vane tests gave sensitivity values as high as 100, averaging about 10-12. The clay is grey in colour and believed to be part of the marine deposit known as Leda clay.

The plastic limit moisture contents range from 18% to 24% with an average of 21.5%; the liquid limits from 32% to 45% averaging 39%. Based on the above values the material is classified as being of intermediate plasticity. A plasticity chart with representative plots is presented on Figure #1. The moisture contents of the samples were found to be at or just below the liquid limits within the upper 20 ft. or so. At lower elevations the moisture contents are slightly higher and the liquid limits slightly lower: the net result of this is a considerable decrease in strength and an increase in sensitivity.

The measured field and laboratory shear strength values concur with the moisture contents, being higher within the upper 20 ft. and much lower at the deeper elevations. A plot of undrained shear strength versus elevation is shown on Figure #2. For stability analyses the deposit was divided into two zones, and the average shear strengths established within each zone. Between groundlevel and el. 260 ft. the

4. SOIL CONDITIONS (Cont'd.)

4.2 SILTY CLAY (Cont'd.)

average undrained shear strength was taken to be 1000 PSF, below this level down to the bottom of the layer an average of 550 PSF was used. The bulk density of the material varies between 99 PCF and 122 PCF averaging 107 PCF. The lower densities are the results of some organic contaminations.

At the lower elevations horizontal stratifications and fissures were observed. The seams were around 1/16" - 1/2" thick, consisting of clays, silty clays and clayey silts.

Laboratory consolidation tests were performed on representative samples. The average coefficient of consolidation was computed to be $c_v = 0.036 \frac{\text{in}^2}{\text{min}}$ ($180 \frac{\text{ft}^2}{\text{year}}$). The preconsolidation pressures were constructed by casagrande's graphical method and by the method suggested by Schmertmann (1955). The probable preconsolidation pressures (P_c) as compared to the existing effective overburden pressures (P'_0) are plotted on Figure #3. It will be noted that all the samples tested are slightly over-consolidated by pressures of approx. 0.5 TSF in excess of the existing overburden pressures.

4.3) HETEROGENEOUS MIXTURE OF GRAVEL, SAND, SILT AND CLAY

This material forms the surficial layer at the west bank of the river and underlies the marine silty clay or the organic muck at other locations. The deposit contains a large amount of boulders of various sizes, some of them having dimensions of several ft. Below the clay on the east bank the material appeared to have an appreciable percent of

4. SOIL CONDITIONS (Cont'd.)

4.3) HETEROGENEOUS MIXTURE OF GRAVEL, SAND, SILT AND CLAY (Cont'd.)

finer, so that it is slightly plastic. Below the river and at the west bank several samples were recovered having hardly any silt or clay content: these zones are non cohesive and quite permeable. Laboratory moisture content determinations yielded values between 3% and 12%. Typical grain size distribution curves are presented on Figure #4. The constituent particle sizes of the samples showed a wide scatter. The gravel was found to vary between 15% and 52%, sand between 26% and 62% and silt and clay between 4% and 37%.

4.4) FINE SANDY SILT

A 7-8 ft. thick surficial layer of brown fine sandy silt was found to overlie the marine clay at the locations of Bb's #13 and 14. The relative density of the layer is loose, corresponding to penetration "W" values of 5-7 blows/ft. The natural moisture contents were measured to be 21-22%.

4.5) BLACK ORGANIC MUCK

The river bed was observed to be covered with a layer of black marine muck, varying in thickness between 5 ft. and 20 ft. The deposit has an extremely soft consistency, so that drill rods and casing penetrated through the stratum by their own weight. The material consists almost of pure vegetable matter, hence its fibrous, spongy texture and strong odour. No shear strength can be attributed to this stratum.

4. SOIL CONDITIONS (Cont'd.)

4.6) BEDROCK

Bedrock was proved in Bb's #2 and 4 at the east side of the river. The bedrock surface dips towards the river, being around el. 215.3 ft. in Bb #2 and at el. 207 ft. in Bb #4 right beside the river's edge. Some 2-5 ft. of rock was recovered in AX size core barrels. Roughly 40-60% of rock core was recovered and identified to be sound dolomite of the Big Mountain formation.

4.7) GROUNDWATER CONDITIONS

Groundwater levels were established in the borcholes and were found to apprx. coincide with the river level at the east side and some 3-4 ft. below the higher ground at the west, roughly paralleling the ground surface. The water level in the river was at el. 279.96 ft. at the time of the field investigation.

5. DISCUSSION AND RECOMMENDATION

5.1) GENERAL

Proposed Hwy. #16 line "A" will cross the Rideau River at this site. According to the site plan the bridge is proposed to be an eight span structure with a total length of 1200 ft. and a width of 36 ft. The max. height of approach embankment on the east bank will be around 29-30 ft. and on the west bank 22-23 ft.

Soil conditions were found to be more favourable at the west side than at the east from both the stability and the foundation point of view. In the next sections the bridge foundations and the approach fill stability are dealt with separately.

5. DISCUSSION AND RECOMMENDATIONS (Cont'd.)

5.2) BRIDGE FOUNDATIONS

The organic deposits and the marine clay deposits have insufficient strength to provide support for spread footing type foundations. It is recommended therefore to support the entire structure, with the exception of the most westerly pier and west abutment, on piles and bearing within the hard or very dense glacial till stratum. For this purpose steel 'H' piles appear to be the most suitable in which case the maximum allowable design load for the particular steel section adopted should be achieved by driving into the zone between el. 220.0 and el. 230.0. Due to the presence of boulders, some of them large, it is possible however, that refusal to further penetration may be encountered at higher elevations than the afore-mentioned zone in some cases. Because of the possibility of damage to piles glancing off boulders it is recommended that standard flange plates be welded to the tips.

At the locations of the extreme west pier and west abutment the glacial till deposit was found to be at groundlevel. This soil - having very high relative densities - is a competent load bearing stratum. Spread footings should therefore be utilized for the west pier and abutment placing the footing bases as high as frost penetration permits. (5 ft. below finished ground). 3 TSW safe loads may be assumed on each footing. For a spill through type abutment, the west abutment may also be supported on steel H piles driven through the fill, down to appr. el. 270 ft. - 275 ft., where practical refusal should be reached. The pile caps should be formed within the approach fill, which at this location should be devoid of bouldery material. Again, the maximum

5. DISCUSSION AND RECOMMENDATIONS (Cont'd.)

5.2) BRIDGE FOUNDATIONS (Cont'd.)

allowable load may be assumed for the particular steel section of pile adopted.

Quite permeable zones were noticed within the glacial till during the fieldwork. In the case of excavating within these zones quick conditions may develop under an unbalanced hydrostatic head. Special dewatering schemes will be necessary in order to prevent such conditions. It is felt that no appreciable settlement will occur either under the piled foundations or under the suggested spread footings.

5.3) APPROACH FILLS

Soil conditions differ considerably between the east and the west sides of the river below the proposed approach fills. The max. height of the fill at the east side will be around 29-30 ft., at the west side around 22 ft. Due to the different conditions stability of the slopes and the predicted magnitude and rate of settlements under the embankment loads are discussed separately for each side.

5.3.1) EAST APPROACH FILL

Beneath the proposed east approach fill a 45 - 52 ft. thick layer of stiff to soft silty clay is present. Large stresses will be concentrated within this layer under the superimposed embankment loads, exceeding the estimated preconsolidation pressures. (See Figure #3). Stability analyses were carried out by an electronic computer using the Swedish circular arc failure criterion. Strength parameters were expressed in terms of total stresses, since the stability of a fill is usually the most critical right after construction. Calculations

5. DISCUSSION AND RECOMMENDATIONS (Cont'd.)

5.3.1) EAST APPROACH FILL (Cont'd.)

indicated that the max. stable height of an embankment at the east bank of the river is 20 ft. provided it is built with 2 horizontal to 1 vertical slopes. Fills higher than 20 ft. will require counterbalancing berms in order to maintain stability. The height of berms should be half the total height of the embankment, and the top of the berms should slope with 30 horizontal to 1 vertical towards the toes. On Figure #5 the required berm lengths are plotted relative to the heights of approach fills. It may be seen that a 25 ft. high fill needs a 60 ft. long berm and a fill of 30 ft. height requires berms of 100 ft. lengths.

The marine clay deposit is a highly compressible layer and fairly large consolidation settlements are anticipated to occur under the embankment loads. Settlements were calculated based on laboratory consolidation tests, which were performed by the application of incremental loading. Settlements were computed beneath the middle, beneath the crest

beneath the toe of the proposed fill. Largest settlement will naturally occur under the middle of the fills, whereas at the toe, settlements of the order of 3-5 inches are predicted. Beneath the middle of a 30 ft. high fill settlements were calculated to be between 46 inch and 32 inch, while beneath a fill of 20 ft. height the corresponding values were 29 in and 20 in. The low values were obtained by using a factor (λ) which is a function of the pore pressure coefficient 'A' as suggested by Skempton. It is believed that the actual settlements will be near the computed maximum values. Time settlement curves are given for both the

5. DISCUSSION AND RECOMMENDATIONS (Cont'd.)

5.3.1) FAST APPROACH FILL (Cont'd.)

30 ft. and 20 ft. high fills on Figure #6. According to calculations 90% of the predicted settlements will take a little more than four years.

Actual settlement measurements under existing fills built on sensitive Leda clays concur with the above values, only on the rate of settlement is probably somewhat slower than the computed one.

In order to compare the predicted and actual settlements the Foundation section would like to instrument this approach fill with settlement plates. It is requested therefore that this Section be advised at least 2-3 weeks before commencing the fill construction.

It is understood that the presently proposed highway of 2 lanes will be widened to 4 lanes at some time in the future. For the west approach embankment when settlements are anticipated to be negligible this should present no problem. For the east approach fill however considerable settlements are anticipated and the effect of placing new fill would be to cause additional settlement with consequent cracking of the pavement. If therefore it is intended to carry out the widening in the foreseeable future it would be advantageous to construct now for the full 4 lane width, that portion of the east approach where the fill height exceeds 15 ft.

Because of the anticipated settlements under the east approach fill and because of the performance of certain structures in the Cornwall

5. DISCUSSION AND RECOMMENDATIONS (Cont'd.)

5.3.1) EAST APPROACH FILL (Cont'd.)

area (tilting abutments) which is believed to be related in some way to large settlements it is strongly recommended that the embankment on the east side within at least 100 feet of the bridge be completed for as long a period as possible in advance of the structure. Obviously this will reduce the amount of settlement which will occur after the bridge abutment is built. The longer the duration the better the performance of the structure will be. In our view the importance of this aspect cannot be over emphasised.

5.3.1) WEST APPROACH FILL

The maximum height of the west approach fill at the abutment is proposed to be 22 ft. Beneath the easterly appr. 200 ft. of fill the compressible marine clay deposit is missing. Within this length the surficial layer is the very dense and hard glacial till with a large amount of gravel and boulders. Further west the marine clay reappears, the thickness of which increases towards the west. Due however to the decreasing height of the proposed fill, it is believed that the embankment of the west approach will be stable without constructing berms, provided of course that the fill is built with side slopes of 2 to 1.

No settlements are anticipated within the length of the fill built over the glacial till. Some consolidation settlements will occur further back on account of the compressibility of the marine clay.

5. DISCUSSION AND RECOMMENDATIONS (Cont'd.)

5.3.1) WEST APPROACH FILL (Cont'd.)

Settlements will however be much less than those predicted beneath the east approach fill, since the height of the west approach is smaller and the silty clay layer is thinner.

Some settlements within the fills will also occur, the magnitude of which will depend on the material and the compaction of the embankment.

No computation of the elastic settlements of the subsoils were carried out. These deformations will be completed during or immediately after the construction, thus no further remedial measures need be taken.

6. MISCELLANEOUS

The fieldwork performed during the period of Oct. 15 - Nov. 12, 1969 was supervised by Messrs. A. K. Barsvary & H. Szymanski. Equipment used was owned and operated by Master Soil Investigation Company. This report was prepared by A. K. Barsvary and reviewed by K. G. Selby.

December, 1969.

APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 69-F-90 LOCATION Sta. 618+89 ½
 W.P. 203-67-01 BORING DATE October 15-17, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring, BX & NX Casings

ORIGINATED BY AKB
 COMPILED BY AKB
 CHECKED BY

| SOIL PROFILE | | STRAT. PLCT | 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 | | 20 | 40 | 60 | 80 | 100 | SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE | | | | | WATER CONTENT % w_p — w — w_L |
| 283.7 | Ground Level | | | | | 1000 | 2000 | | | | | 20 | 40 | 60 | | |
| 0.0 | Silty, Clay Soft | | | | 280 | | | | | | | | | | | 0-2-73-25 |
| 274.7 | Brown, Mottled | | 1 | SS | | | | | | | | | | | | |
| 9.0 | Marine | | 2 | TW PM | | | | | | | | | | | 107 | |
| | Silty Clay | | 3 | SS | 270 | | | | | | | | | | | |
| | Occasionally Laminated | | 4 | TW PM | | | | | | | | | | | 113 | |
| | Firm to Stiff | | 5 | TW PM | 260 | | | | | | | | | | 110 109 | |
| | Dark Gr. y | | 6 | TW PM | | | | | | | | | | | 106 | |
| | | | 7 | TW PM | 250 | | | | | | | | | | 101 100 | |
| | | | 8 | TW PM | | | | | | | | | | | 110 | |
| 238.7 | | | 9 | SS 100/2" | 240 | | | | | | | | | | | 34-62-4 - |
| 45.0 | Gravelly Sand to Silty Sand with Gravel (Glacial Till) | | 10 | SS 56 | | | | | | | | | | | | |
| | V. Dense & Hard | | | | 230 | | | | | | | | | | | 30-34-30-6 |
| 227.2 | | | 11 | SS 125 | | | | | | | | | | | | |
| 56.5 | End of Borehole | | | | | | | | | | | | | | | |

JOB 69-F-90 LOCATION Sta. 620+48 Ø
 W.P. 203-67-01 BORING DATE Oct. 16, 17, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring, BX & NX Casings

ORIGINATED BY AKB

COMPILED BY AKB

CHECKED BY *AK*

| SOIL PROFILE | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT | | BULK DENSITY | REMARKS |
|--------------|------------------|------------|--------|--------------------------------|------------|--------------|--------------------|--------------|------------|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | BLOWS/FOOT | ELEV SCALE | SHEAR STRENGTH PSF | | |
| 283.8 | Ground Level | | | | | | | | |
| 0.0 | Silty Clay | | | | | | | | |
| | Pockets of Silt | | | | | | | | |
| | Stiff | | | | | | | | |
| 274.8 | Brown | | 1 | TW | PM | 280 | | 122 | |
| 9.0 | Marine | | 2 | SS | 1 | | | | |
| | Silty Clay | | | | | | | | |
| | Occasionally | | 3 | TW | TM | 270 | | 112 | |
| | Laminated | | | | | | | | |
| | Shells & Organic | | 4 | TW | PM | | | 113 | |
| | Inclusions | | | | | | | 112 | |
| | Soft to Stiff | | 5 | TW | PM | 260 | | 110 | |
| | Dark Grey | | | | | | | | |
| | | | 6 | TW | PM | | | 109 | |
| | | | | | | | | | |
| | | | 7 | TW | PM | 250 | | 99 | |
| | | | | | | | | | |
| | | | 8 | TW | PM | | | 107 | |
| | | | | | | | | 103 | |
| 237.8 | | | 9 | TW | PM | 240 | | | |
| 46.0 | Silty Sand with | | | | | | | | |
| | Gravel to Sand | | 10 | SS | 100/5" | | | | |
| | & Gravel | | | | | | | | |
| | (Glacial Till) | | 11 | SS | 130/5" | 230 | | | |
| | V. Dense | | | | | | | | |
| | | | 12 | SS | 80 | | | | 49-28-20-3 |
| | | | | | | | | | |
| | | | 13 | SS | 100/1" | 220 | | | |
| 215.3 | | | | | | | | | |
| 213.3 | Dolomite Bedrock | | 14 | RC | 40% | | | | |
| 70.5 | End of Borehole | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No: 3

FOUNDATION SECTION

JOB 69-F-90 LOCATION Sta. 622+25 ½
W.P. 203-67-01 BORING DATE October 17, 21, 1969
DATUM Geodetic BOREHOLE TYPE Washboring, BX & NX Casings

ORIGINATED BY AKB
COMPILED BY AKB
CHECKED BY

| SOIL PROFILE | | STRAT. PLT | SAMPLES | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | LIQUID LIMIT PLASTIC LIMIT WATER CONTENT | | BULK DENSITY Y P.C.F. | REMARKS |
|--------------|---------------------------------------|------------|---------|-------------|-------------|------------------------------------------------|------|---------------------------------------------|----|-----------------------------|-------------|
| ELEV. DEPTH | DESCRIPTION | | NUMBER | TYPE | | SHEAR STRENGTH P.S.F. | | WATER CONTENT % | | | |
| 282.5 | Ground Level | | | | | 1000 | 2000 | 20 | 40 | 60 | GR SA SI CL |
| 0.0 | Silty Clay Pockets of Silt | | | | 280 | | | | | | 0-2-73-25 |
| | Soft to Firm | | 1 | SS 2 | | | | | | | |
| | Brown | | 2 | TW PM | | | | | | 107 | |
| 271.0 | | | 2 | TW PM | | | | | | | 109 |
| 11.5 | Marine | | | | 270 | | | | | | 111.5 |
| | Silty Clay | | 3 | TW PM | | | | | | | |
| | Occasional light Seams | | 4 | TW PM | | | | | | | 115 |
| | Some shells & Org. matters | | 5 | TW PM | 260 | | | | | | 106 |
| | Fissured | | 6 | TW PM | | | | | | | |
| | Stiff to Soft | | 7 | TW PM | 250 | | | | | | 108 |
| | Dark Grey | | 8 | TW PM | | | | | | | 102 |
| | | | 9 | SS 2 | 240 | | | | | | 100.5 |
| | | | 10 | TW PM | | | | | | | |
| 230.5 | | | | | 230 | | | | | | |
| 52.0 | Silty Sand with gravel traces of clay | | 11 | SS 122 | | | | | | | |
| | V. Dense | | 12 | SS 105 | 220 | | | | | | |
| | | | 13 | SS 186 | | | | | | | 43-34-16-4 |
| | | | 14 | SS 111 1/4" | | | | | | | |
| 210.0 | Probably Bedrock | | | | 210 | | | | | | |
| 72.5 | End of Borehole | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 69-F-90 LOCATION Sta. 623+75 2
 W.P. 203-67-01 BORING DATE October 17 - 21, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring, BX & NX Casings

ORIGINATED BY AKB

COMPILED BY AKB

CHECKED BY

| SOIL PROFILE | | | SAMPLES | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | LIQUID LIMIT --- * PLASTIC LIMIT --- * WATER CONTENT --- * | | BULK DENSITY Y P.C.F. | REMARKS |
|---------------|-----------------------------------------------------------------------------|---------------|---------|------|-------------|------------------------------------------------|------|------------------------------------------------------------------|----|-----------------------------|-------------|
| ELEV DEPTH | DESCRIPTION | STRAI. PL. OT | NUMBER | TYPE | | SHEAR STRENGTH P.S.F. | | WATER CONTENT % | | | |
| 280.5 | Ground Level | | | | | 1000 | 2000 | 20 | 40 | 60 | GB SA SI CL |
| 0.0 | Silty Clay | | | | 280 | | | | | | |
| | Soft | | | | | | | | | | |
| | Brown | | 1 | SS | 2 | | | | | | 0-3-76-21 |
| 270.5 | | | 2 | TW | PM | | 2200 | | | | |
| 10.0 | Marine Silty Clay occasional light seams traces of organic matter. Fissured | | 3 | SS | 5 | | | | | | |
| | Stiff to Firm | | 4 | TW | PM | | | | | | |
| | Dark Grey | | 5 | TW | PM | | | | | | |
| | | | 6 | TW | PM | | | | | | |
| | | | 7 | TW | PM | | | | | | |
| 239.5 | | | 8 | TW | PM | | | | | | |
| 41.0 | Sandy silt with gravel, traces of clay (Glacial Till) | | 9 | SS | 31 | | | | | | |
| | V/ Dense | | 10 | SS | 69 | | | | | | |
| | | | 11 | SS | 96 | | | | | | |
| | | | 12 | SS | 109 | | | | | | |
| | | | 13 | SS | 111 | | | | | | |
| | | | 14 | SS | 101 1/4 | 210 | | | | | |
| 207.0 | | | | | | | | | | | |
| 73.5 | Dolomite | | | | | | | | | | |
| 202.5 | Bedrock | | 15 | RC | 60% | | | | | | |
| 78.0 | End of Borehole | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 69-F-90 LOCATION Sta. 625+25 g
 W.P. 203-67-01 BORING DATE Nov. 11, 12, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing

ORIGINATED BY HS
 COMPILED BY AKB
 CHECKED BY

| SOIL PROFILE | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | | BULK DENSITY Y | REMARKS |
|---------------|---------------------------------------------|-----------|----------------|------------------------------------------------|---------------|----------------------------------------------------------------|--|----------------------------------------------------------------------|--|-----------------|----------------------|-----------------|
| ELEV DEPTH | DESCRIPTION | STRAT BOT | NUMBER TYPE | BLOWS/FOOT | ELEV SCALE | SHEAR STRENGTH P.S.F. | | | | WATER CONTENT % | | |
| 280.0 | Water Level | | | | | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE | | | | 20 40 60 | P.C.F. | GR. SA. SI. CL. |
| 0.0 | River Water | | | | | 500 1000 1500 2000 | | | | | | |
| 3.0 | Organic Muck V. soft Black | | | | 270 | | | | | | | |
| 263.0 | | | 1 TW PM | | | | | | | | | |
| 12.0 | Marine Silty Clay, traces of Organics | | 2 TW PM | | 260 | | | | | | | |
| | Stiff to Soft | | 3 TW PM | | 250 | | | | | | 137 | |
| | Grey | | 4 TW PM | | 240 | | | | | | | |
| | | | 5 TW PM | | 230 | | | | | | | |
| | | | 6 TW PM | | 220 | | | | | | 98.5 | |
| | | | 7 TW PM | | | | | | | | | |
| | | | 8 TW PM | | | | | | | | 103 | |
| 226.0 | | | | | | | | | | | | |
| 54.0 | Sandy Silt with Gravel (Till) | | 9 SS 42 | | | | | | | | | |
| 218.5 | V. Dense | | 10 SS 175 | | | | | | | | | |
| 61.5 | End of Borehole | | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 6

FOUNDATION SECTION

JOB 69-F-90 LOCATION Sta. 626+75 Ø
 W.P. 203-67-01 BORING DATE November 12, 13, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring, BX & NX Casing

ORIGINATED BY HS

COMPILED BY AKB

CHECKED BY

| SOIL PROFILE | | | SAMPLES | | BLOWS/FOOT | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | LIQUID LIMIT — w _L PLASTIC LIMIT — w _p WATER CONTENT — w ₁ | | | BULK DENSITY Y | REMARKS | | |
|--------------|-------------------------------------------------------------------------------|-------------|---------|------|------------|-------------|--------------------------------|-----|------|------|---------------------------------------------------------------------------------------------------|--|----|-------------------|---------|--------|-----------------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLT. | NUMBER | TYPE | | | SHEAR STRENGTH P.S.F. | | | | WATER CONTENT % | | | | | | |
| | | | | | | | | 500 | 1000 | 1500 | 2000 | | 20 | 40 | 60 | P.C.F. | GR. SA. SI. CL. |
| 280.0 | Water Level | | | | | | | | | | | | | | | | |
| 0.0 | | | | | | | | | | | | | | | | | |
| 276.0 | River Water | | | | | | | | | | | | | | | | |
| 4.0 | Organic Muck Fibrous & Spongy V. Soft Black | | | | | 270 | | | | | | | | | | | |
| 265.0 | | | | | | | | | | | | | | | | | |
| 15.0 | Marine Silty Clay Black Organic Inclusions Stiff to Soft Grey | | 1 | TW | PM | | | | | | | | | | | | |
| | | | 2 | TW | PM | 260 | | | | | | | | | | | |
| | | | 3 | TW | PM | | | | | | | | | | | | |
| | | | 4 | TW | PM | 250 | | | | | | | | | | | |
| | | | 5 | TW | PM | | | | | | | | | | | 100 | |
| | | | 6 | TW | PM | 240 | | | | | | | | | | | |
| | | | 7 | TW | PM | | | | | | | | | | | | |
| | | | 8 | TW | PM | 230 | | | | | | | | | | | |
| | | | 9 | TW | PM | | | | | | | | | | | | |
| 221.0 | | | | | | | | | | | | | | | | | |
| 59.0 | Gravel with some sand & silt (Till) | | 10 | SS | LL | 220 | | | | | | | | | | | |
| 214.5 | V. Dense | | 11 | SS | 192 | | | | | | | | | | | | |
| 65.5 | End of Borehole | | | | | | | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 67-R-90 LOCATION Sta. 62R+25.0
 W.P. 203-67-01 BORING DATE November 3 - 7, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring, BX & MX Casing

ORIGINATED BY HS

COMPILED BY ARB

CHECKED BY

| SOIL PROFILE | | SAMPLES | | BLOWS/FOOT | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT | | PLASTIC LIMIT | | WATER CONTENT | | BULK DENSITY | REMARKS |
|--------------|-------------------------------------------------------------------------------------------------------------------------------|---------|------|------------|-------------|--------------------------------|------|--------------|------|-----------------|----|-----------------|--|--------------|---------|
| ELEV. DEPTH | DESCRIPTION | NUMBER | TYPE | | | SHEAR STRENGTH P.S.F. | | | | WATER CONTENT % | | WATER CONTENT % | | | |
| 280.0 | Water Level | | | | | 500 | 1000 | 1500 | 2000 | 20 | 40 | 60 | | GR SA SI CL | |
| 270.0 | River Water | | | | | | | | | | | | | | |
| 256.0 | Organic Muck Fibrous & Spongy V. Soft Black | 1 | SS | 0 | 260 | | | | | | | | | | |
| 24.0 | Marine Silty Clay Some Organic Inclusions Seams of Clayey Silt at the Lower Elevations Soft to Firm Grey | 2 | TW | PM | 250 | | | | | | | | | | |
| | | 3 | TW | PM | 250 | | | | | | | | | 107 111 | |
| | | 4 | TW | PM | 240 | | | | | | | | | 99 | |
| | | 5 | TW | PM | 230 | | | | | | | | | | |
| | | 6 | TW | PM | 230 | | | | | | | | | 104 | |
| | | 7 | TW | PM | 220 | | | | | | | | | | |
| 223.0 | | 8 | TW | PM | 220 | | | | | | | | | 107 111 | |
| 57.0 | Gravelly Silt with some sand Glacial Till | 9 | SS | 122/2" | 220 | | | | | | | | | | |
| | | 10 | SS | 100/5" | | | | | | | | | | | |
| | | 11 | SS | 125/5" | 210 | | | | | | | | | | |
| 204.1 | | 12 | SS | 135/11" | | | | | | | | | | | |
| 75.9 | End of Borehole | | | | | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 69-F-90 LOCATION Sta. 629+75 ½
W.P. 203-67-01 BORING DATE October 29 - 31, 1969
DATUM Geodetic BOREHOLE TYPE Washboring, BX & NX Casing

ORIGINATED BY HS
COMPILED BY AKB
CHECKED BY HIR

| SOIL PROFILE | | STRAT. PLT. | SAMPLES | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | LIQUID LIMIT — % PLASTIC LIMIT — % WATER CONTENT — % | | BULK DENSITY Y | 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 | | |
| 280.0 | Water Level | | | | | | | | | | GR. SA. SL. CL. |
| | River | | | | | | | | | | |
| | Water | | | | | 270 | | | | | |
| | | | | | | 260 | | | | | |
| 256.0 | | | | | | | | | | | |
| 24.0 | Organic Muck Fibrous & Spongy Very Soft Black | | | | | 250 | | | | | |
| | | | 1 | SS | 0 | 240 | | | 45.4% | | |
| 236.0 | | | | | | | | | | | |
| 41.0 | Marine Silty | | 2 | SS | 3 | | | | | | |
| 231.5 | Clay Soft | | | | | | | | | | |
| 48.5 | | | 3 | SS | 110/5" | 230 | | | | | |
| | Gravelly Silt with some sand (Glacial Till) Very Dense | | 4 | SS | 66 | | | | | | |
| | | | 5 | SS | 75 | 220 | | | | | |
| | | | 6 | SS | 209 | | | | | | |
| | | | 7 | RC | 6" | | | | | | |
| | | | 7A | SS | 150 | 210 | | | | | |
| | | | | | | | | | | | |
| | | | 8 | SS | 198 | | | | | | |
| 203.0 | | | | | | | | | | | |
| 77.0 | End of Borehole | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 9

FOUNDATION SECTION

JOB 69-F-90 LOCATION Sta. 631+25 E
 W.P. 203-67-01 BORING DATE October 22-27, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring, BX & NX Casing

ORIGINATED BY HS

COMPILED BY AKB

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 Y P.C.F. | REMARKS |
|--------------|-------------------------------------------------------|---------|-------------|-------------|-----------------------------------------------------------------------------------|--|----------------------------------------------------------------------|--------|-----------------------------|-----------------|
| ELEV. DEPTH | DESCRIPTION | NUMBER | TYPE | | SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE | | WATER CONTENT % 20 40 60 | | | |
| 280.0 | Water Level | | | | | | | | | GR. SA. SI. CL. |
| 0.0 | River Water | | | | | | | | | |
| | Water | | | | | | | | | |
| 262.0 | | | | 270 | | | | | | |
| 18.0 | Organic Muck Very Soft Black | | | 260 | | | | | | |
| 256.0 | | | | | | | | | | |
| 24.0 | | 1 | SS 31 | | | | | OH | | 32-33-28-7 |
| | Sandy Silt with clay & gravel (Glacial Till) | 2 | SS 46 | 250 | | | | ○ | | |
| | | 3 | SS 148 | | | | | ○ | | 15-34-45-6 |
| | V. Dense | 4 | SS 148 | 240 | | | | ○ | | |
| | | 5 | SS 40 | | | | | OH | | 16-26-49-9 |
| | | 6 | SS 66 | 230 | | | | ○ | | |
| | | 7 | SS 76 | | | | | ○ | | |
| | | 8 | SS 128 | 220 | | | | ○ | | |
| | | 8A | SS 154 1/4" | | | | | | | |
| | | 9 | SS 100 5/8" | 210 | | | | ○ N.P. | | |
| | | 9A | SS 105 3/8" | | | | | | | |
| | | 10 | SS 185 | 200 | | | | ○ | | |
| | | 11 | SS 110 3/8" | | | | | | | |
| 193.5 | | | | | | | | | | |
| 86.5 | End of Borehole | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 10

FOUNDATION SECTION

JOB 69-F-90 LOCATION Sta. 632+75 Ø
 W.P. 203-67-01 BORING DATE November 4-6, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing

ORIGINATED BY HS

COMPILED BY AKB

CHECKED BY

| SOIL PROFILE | | STRAT. NO. | SAMPLES | | BLOWS / FOOT | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w | | BULK DENSITY γ | REMARKS |
|---------------|----------------------------------------------------------------------------------------------------------------------|------------|---------|-----------|--------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------|--|-----------------------------|-------------|
| ELEV DEPTH | DESCRIPTION | | NUMBER | TYPE | | | SHEAR STRENGTH P.S.F. | | WATER CONTENT % | | | |
| | | | | | | | <input type="checkbox"/> UNCONFINED <input type="checkbox"/> FIELD VANE <input checked="" type="checkbox"/> QUICK TRIAXIAL <input type="checkbox"/> LAB VANE | w_p w w_L | | | | |
| 280.0 | Water Level | | | | | | | | 20 40 60 | | P.C.F. | GR SA SI CL |
| 277.4 | River Water | | | | | | | | | | | |
| 2.6 | Gravelly Sand to Silty Sand, Sandy Silt & Gravelly Silt Traces of Clay (Glacial Till) V. Dense | | 1 | SS 124/1" | | | | | | | | |
| | | | 2 | SS 107 | | 270 | | | | | | |
| | | | 2A | SS 41 | | | | | | | | |
| | | | 3 | SS 138 | | 260 | | | | | | |
| 253.5 | | | 4 | SS 224 | | | | | | | | |
| 26.5 | End of Borehole | | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No 11

FOUNDATION SECTION

JOB 69-F-90 LOCATION Sta. 634+25 μ
 W.P. 203-67-01 BORING DATE October 29, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring BX & NX Casings

ORIGINATED BY HS
 COMPILED BY AKB
 CHECKED BY *AKB*

| SOIL PROFILE | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT — % PLASTIC LIMIT — % WATER CONTENT — % | | BULK DENSITY pcf | REMARKS | | | | | | | | | | |
|---------------|---------------------------------------------------------------------------------------------------------------------------------|---------|------|--------------------------------|---------------|--------------------------------------------------------------------|----|------------------------|---------|----|--------------------|-----|--|--|--|--|--|--|--|
| ELEV DEPTH | DESCRIPTION | NUMBER | TYPE | BLOWS/FOOT | ELEV SCALE | 20 | 40 | | | 60 | 80 | 100 | | | | | | | |
| 288.7 | Ground Level | | | | | SHEAR STRENGTH — p.s.f. | | | | | WATER CONTENT % | | | | | | | | |
| | | | | | | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE | | | | | 20 40 60 | | | | | | | | |
| 0.0 | Gravelly sand to Silty Sand sandy silt & Gravelly silt Traces of Clay (Glacial Till) V. Dense Boulders | 1 | SS | 100/2" | | | | | | | | | | | | | | | |
| | | 2 | SS | 100/3" | 280 | | | | | | | | | | | | | | |
| | | 3 | SS | 263 | | | | | | | | | | | | | | | |
| | | 4 | SS | 178 | 270 | | | | | | | | | | | | | | |
| | | 5 | SS | 57 | | | | | | | | | | | | | | | |
| | | 5A | SS | 200/2" | 260 | | | | | | | | | | | | | | |
| | | | Rec | | | | | | | | | | | | | | | | |
| 254.7 | | 6 | RC | 20% | | | | | | | | | | | | | | | |
| 34.0 | End of Borehole | | | | | | | | | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 12

FOUNDATION SECTION

JOB 69-F-90 LOCATION Sta. 636+00 Ø ORIGINATED BY HS
 W.P. 203-67-01 BORING DATE October 27-28, 1969 COMPILED BY AKB
 DATUM Geodetic BOREHOLE TYPE Washboring, BX & NX Casings CHECKED BY *AKB*

| 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 | NUMBER | TYPE | BLOWS/FOOT | | BLOWS / FOOT | | | | | SHEAR STRENGTH P.S.F. | | | | | WATER CONTENT % | | |
| | | | | | | 20 | 40 | 60 | 80 | 100 | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE | | | 20 40 60 | | | | |
| 287.9 | Ground Level | | | | | | | | | | | | | | | | | |
| 0.0 | Gravelly Sand to Silty Sand, Sandy Silt & Gravelly Silty traces of clay (Glacial Till) | 1 | SS | 11 3/6" | 280 | | | | | | | | | | | | | |
| 272.7 | V. Dense | 2 | SS | 6 1/2" | | | | | | | | | | | | | | |
| 15.2 | End of Borehole | 3 | SS | 15 0/2" | | | | | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 13

FOUNDATION SECTION

JOB 69-P-90 LOCATION Sta. 638+00 Z
 W.P. 203-67-01 BORING DATE October 23 - 27, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring, BX & NX Casings

ORIGINATED BY HS
 COMPILED BY AXB
 CHECKED BY

| SOIL PROFILE | | STRAT. PLOT | SAMPLES | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | LIQUID LIMIT ——— % PLASTIC LIMIT ——— % WATER CONTENT ——— % | | BULK DENSITY Y | REMARKS |
|---------------|----------------------------------------------|-------------|---------|-----------|-------------|------------------------------------------------|------|------------------------------------------------------------------|----|----------------------|---------------------|
| ELEV DEPTH | DESCRIPTION | | NUMBER | TYPE | | SHEAR STRENGTH P.S.F. | | WATER CONTENT % | | | |
| 287.4 | Ground Level | | | | | 500 | 1000 | 20 | 40 | 60 | P.C.F. GR. SA SI CL |
| 0.0 | Fine Sandy Silt Loose | | | | | | | | | | |
| 280.4 | Brown | | 1 | SS 5 | 280 | | | | | | |
| 7.0 | Marine Silty Clay, Soft | | 2 | TM PM | | | | | | 108 | |
| 272.2 | Grey | | 3 | SS 100/3" | | | | | | | 52-27-16-5 |
| 15.2 | Sandy Gravel with Silt & Clay V. Dense | | 4 | SS 141 | 270 | | | | | | |
| 260.9 | | | 5 | SS 103 | | | | | | | |
| 26.5 | End of Borehole | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

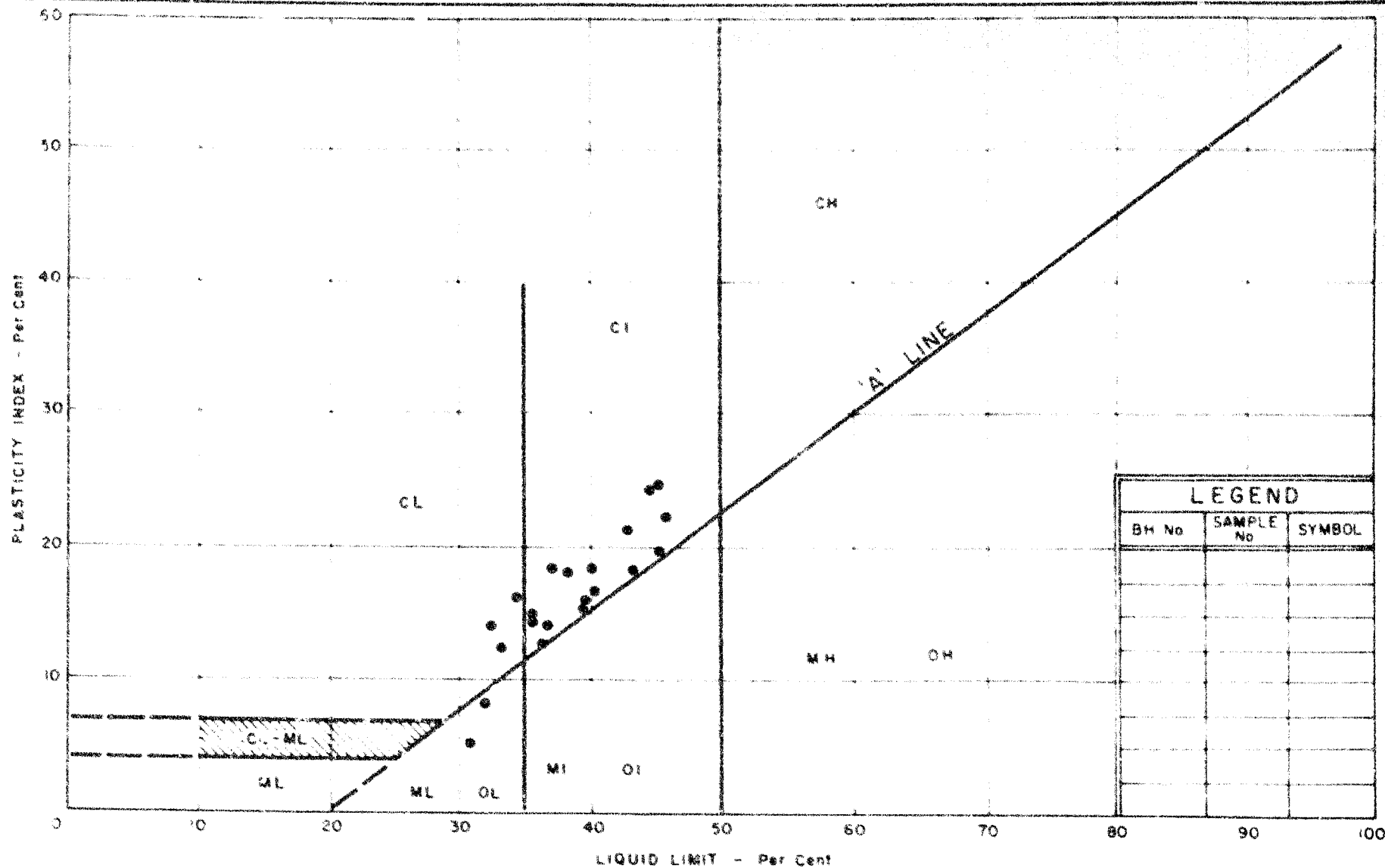
RECORD OF BOREHOLE No. 14

FOUNDATION SECTION

JOB 69-F-90 LOCATION STA. 640+00 3 ft. Rt. of R
 W.P. 203-67-01 BORING DATE October 22, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring, BX & NX Casings

ORIGINATED BY AKB
 COMPILED BY AKB
 CHECKED BY

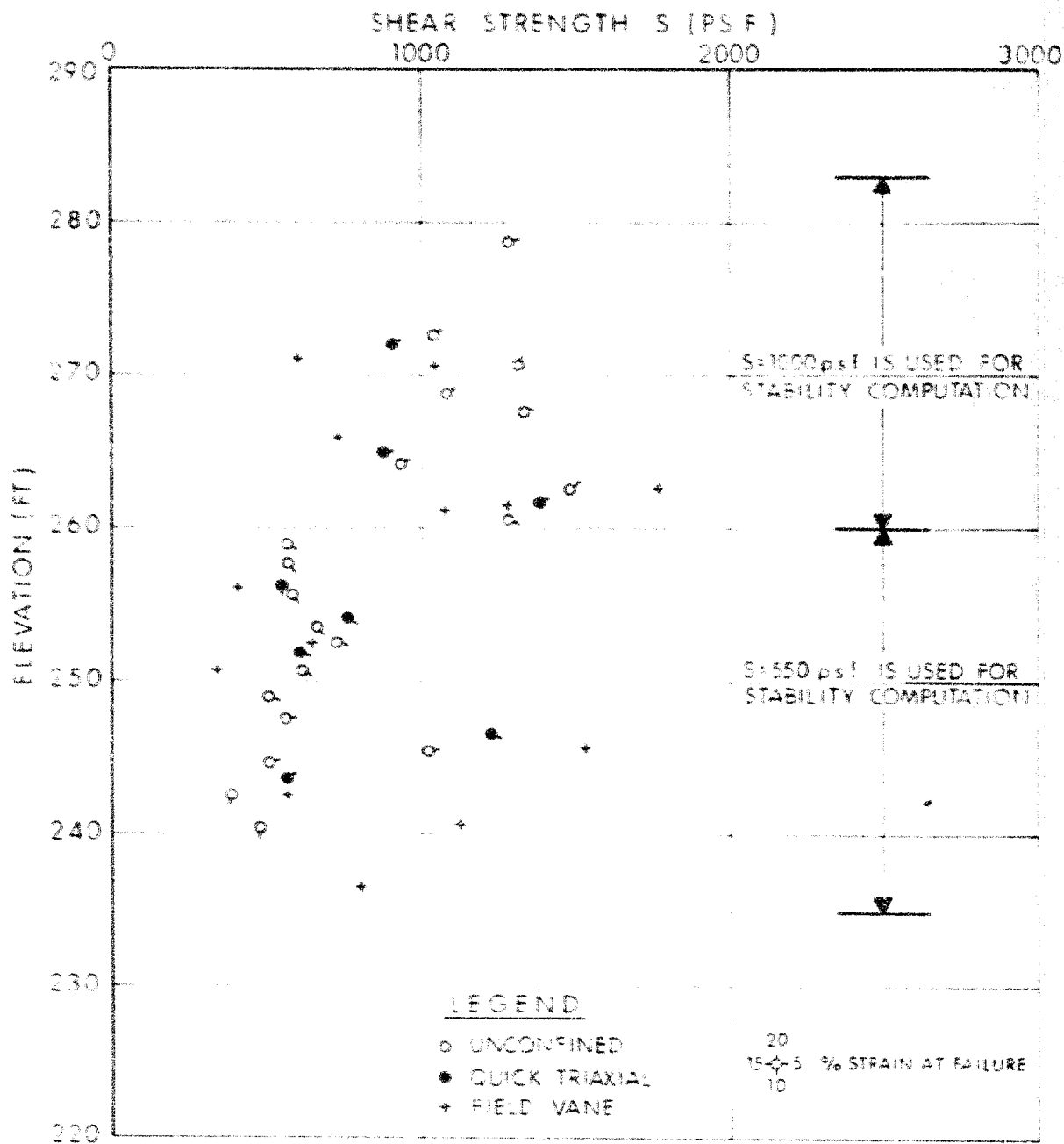
| SOIL PROFILE | | STRAT. PLOT | SAMPLES | | BLOWS/FOOT | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | BULK DENSITY γ | REMARKS |
|--------------|------------------------------------------------|-------------|---------|------|------------|-------------|--------------------------------|-----------------------|----------------------------------------------------------------------|-------|--------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | | NUMBER | TYPE | | | BLOWS / FOOT | SHEAR STRENGTH P.S.F. | WATER CONTENT % | | | |
| 287.0 | Ground Level | | | | | | 20 40 60 80 100 | 20 40 60 | | | | |
| 0.0 | Fine Sandy Silt, Loose Brown | | 1 | SS | 7 | 280 | | | | | | |
| 279.0 | Marine Silty Clay to Clayey Silt Firm Grey 16' | | 2 | TW | PM | | | | | 106 | | |
| 8.0 | | | 3 | TW | PM | 270 | | | | 103.5 | | |
| | | | 4 | TW | PM | | | | | 101 | | |
| 263.0 | | | | | | | | | | 117 | | |
| 24.0 | Sandy Silt with Clay & Gravel | | 5 | SS | 56 | 260 | | | | | | |
| 255.5 | V. Dense | | 6 | SS | 100/3" | | | | | | 17-30-45-8 | |
| 31.5 | End of Borehole | | | | | | | | | | | |



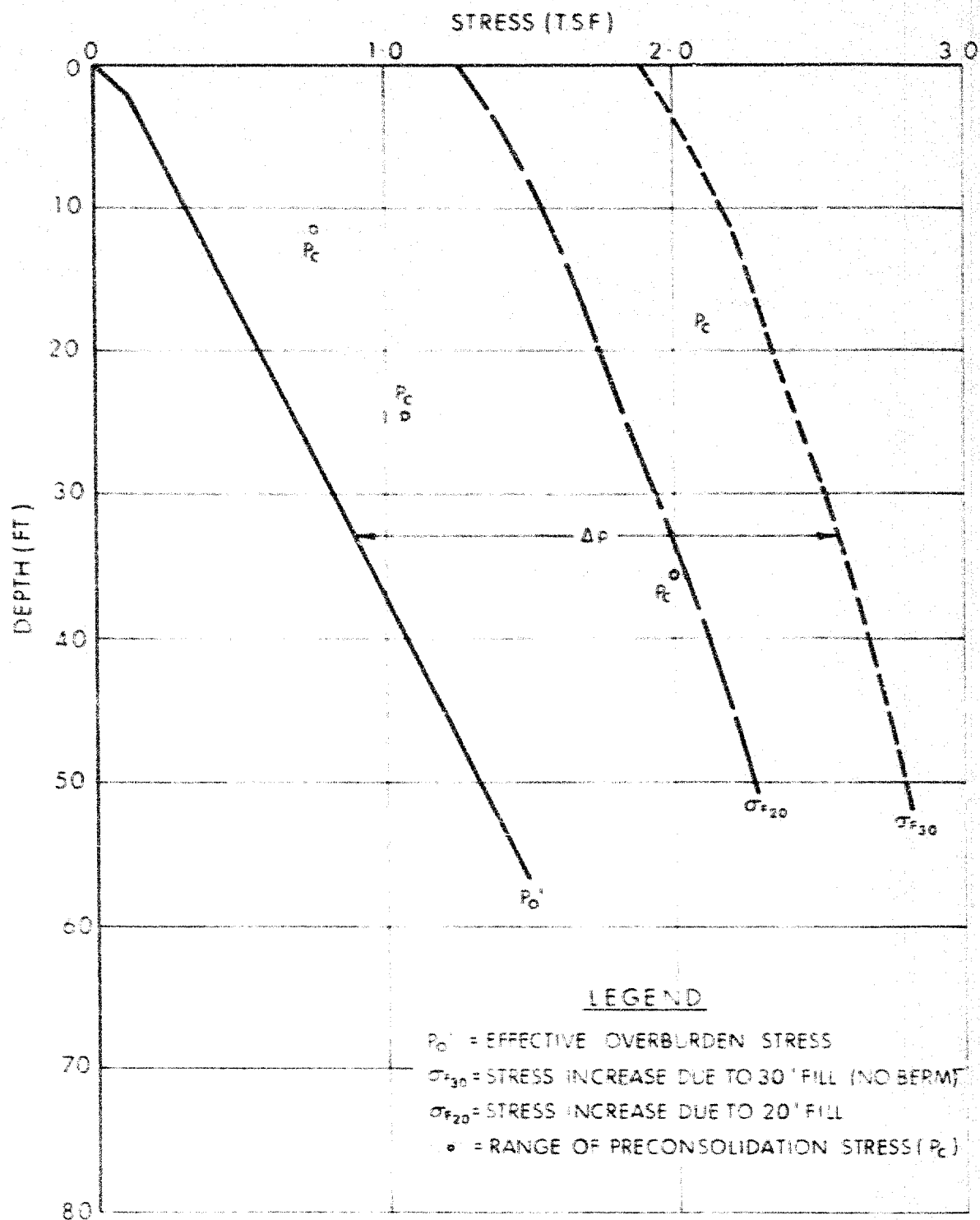
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART MARINE SILTY CLAY

WP No. 203-67-01
JOB No. 69-F-90
FIG 1



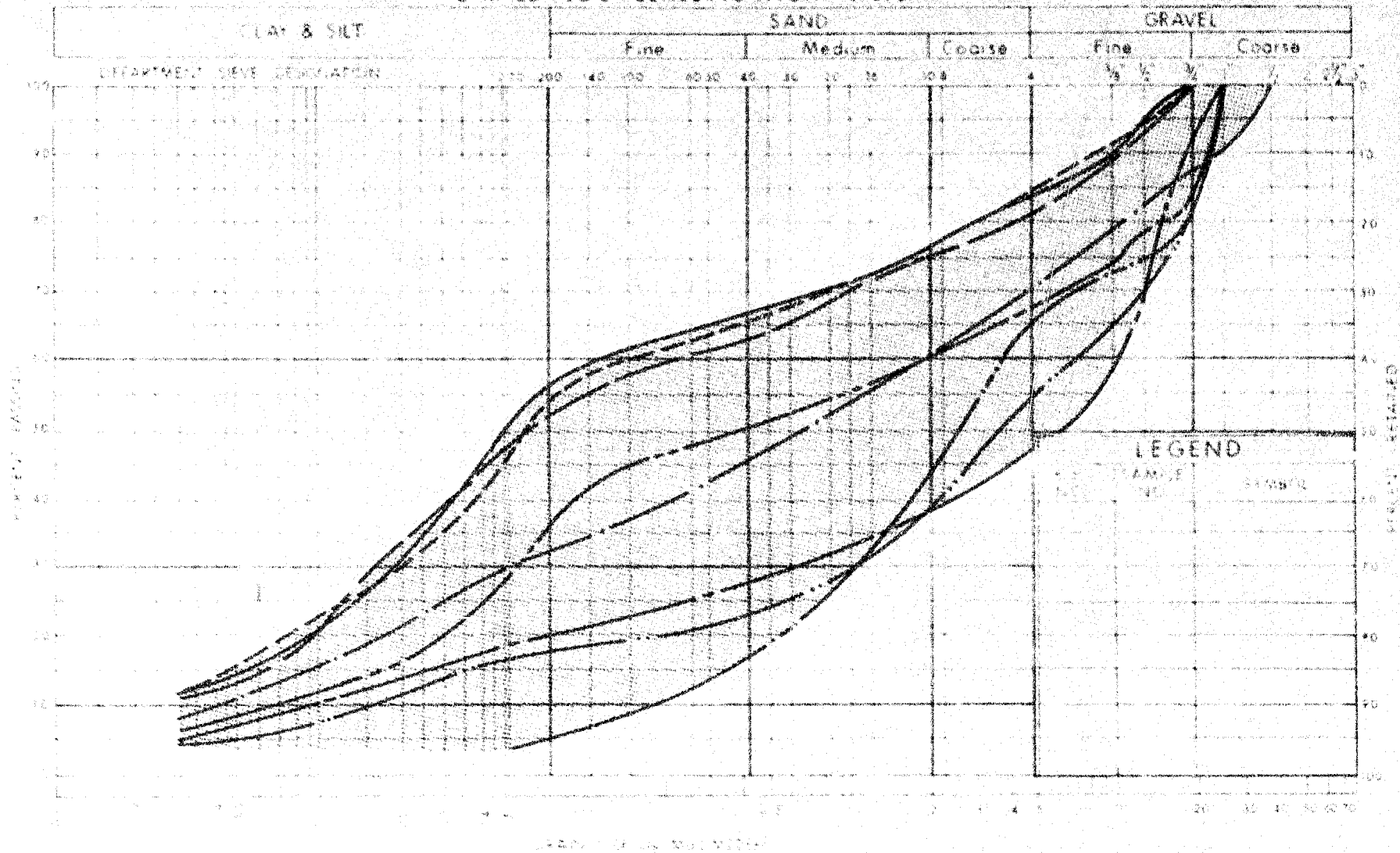
UNDRAINED SHEAR STRENGTH VS DEPTH
(SILTY CLAY STRATUM ALONG THE EAST APPROACH FILL)



STRESS CHARACTERISTICS - EAST SIDE

FIG. 3

UNIFIED SOIL CLASSIFICATION SYSTEM



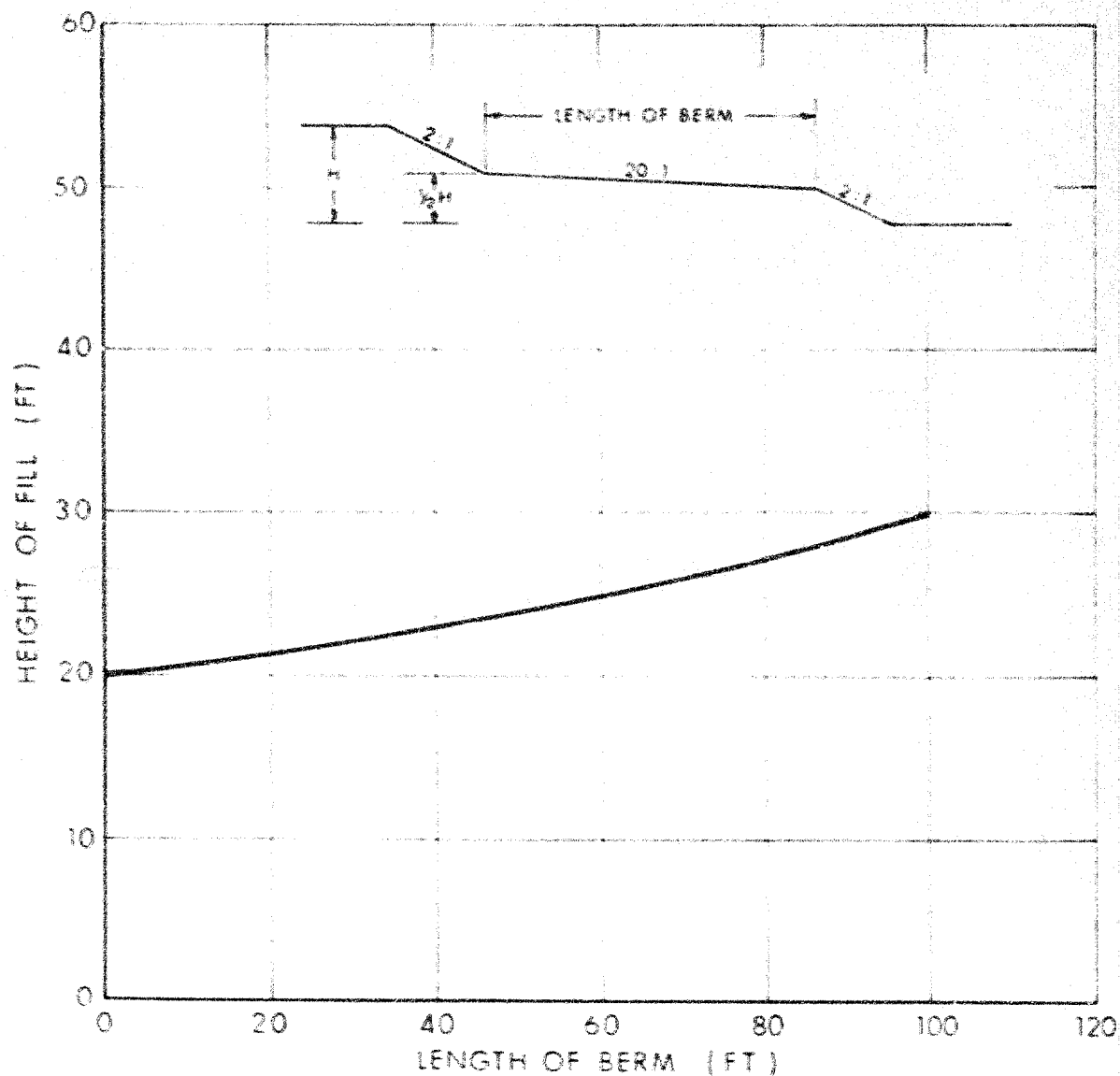
DEPARTMENT OF PUBLIC WORKS
MATERIALS AND TESTING DIVISION

GRAIN SIZE DISTRIBUTION GLACIAL TILL

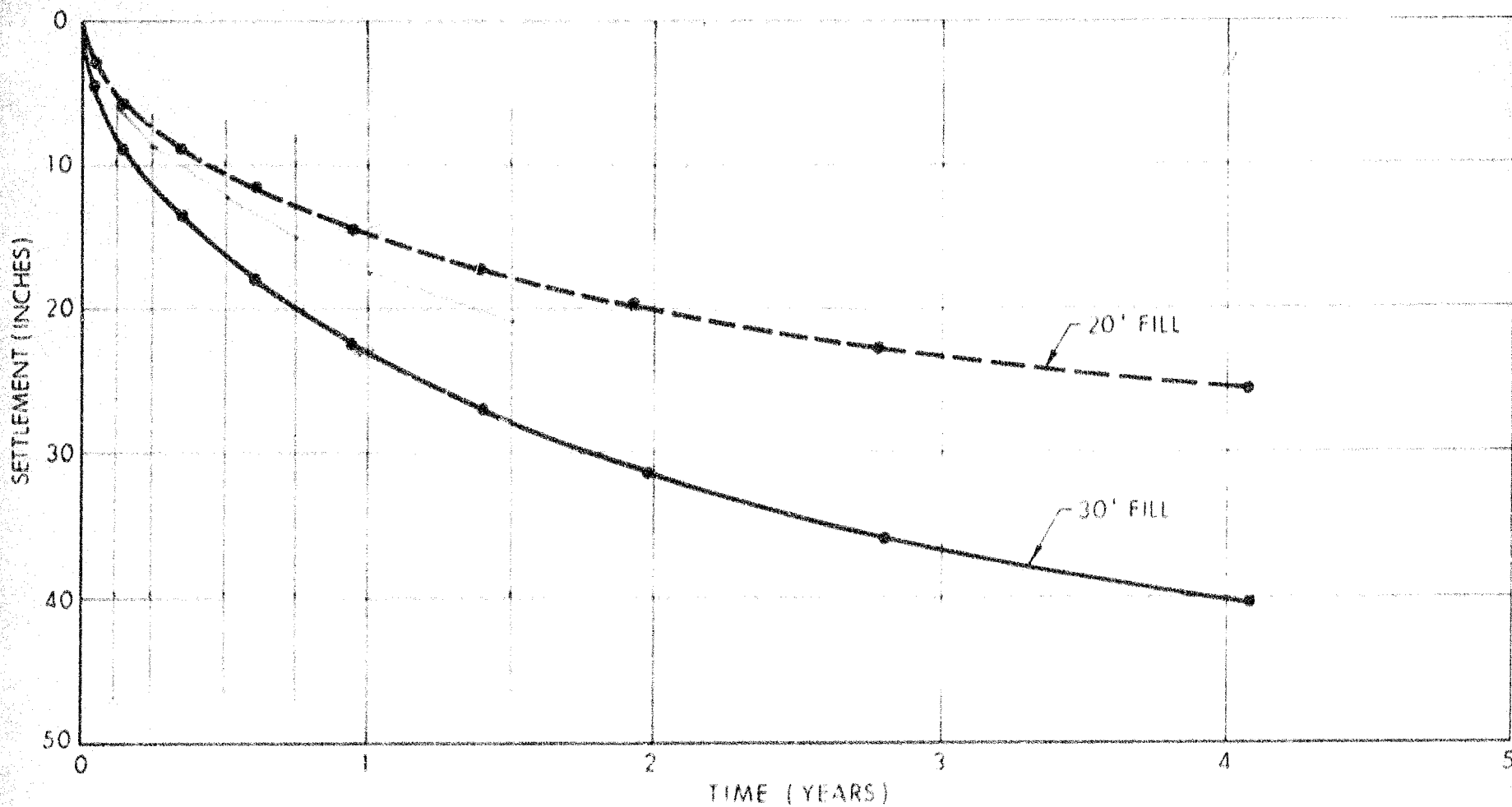
W.P. No. 203-67-01

Job No. 69-F-90

FIG. 4



LENGTH OF BERMS REQUIRED FOR VARIOUS HEIGHTS OF FILLS
(EAST SIDE)



PREDICTED RATE OF SETTLEMENT BENEATH THE MIDDLE OF THE EAST APPROACH FILL

FIG 6

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 | C.S | CESTERBERG 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

| | | | |
|-----------------|---------------------------------|-----|-----------------|
| Q _u | UNCONFINED COMPRESSION | L.V | LABORATORY VANE |
| Q | UNDRAINED TRIAXIAL | F.V | FIELD VANE |
| Q _{cu} | CONSOLIDATED UNDRAINED TRIAXIAL | C | CONSOLIDATION |
| Q _d | 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 | SHEAR STRENGTH |
| c | EFFECTIVE COHESION |
| ϕ' | EFFECTIVE ANGLE OF SHEARING RESISTANCE OR FRICTION |
| c_u | APPARENT COHESION |
| ϕ_u | APPARENT ANGLE OF SHEARING RESISTANCE OR FRICTION |
| μ | COEFFICIENT OF FRICTION |
| S | SENSITIVITY |

GENERAL

| | |
|-------------------------------------|-----------------------------------|
| π | $= 3.1416$ |
| e | BASE OF NATURAL LOGARITHMS 2.7183 |
| $\log_e \sigma$ OR $\ln \sigma$ | NATURAL LOGARITHM OF σ |
| $\log_{10} \sigma$ OR $\log \sigma$ | LOGARITHM OF σ 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 |
| $\bar{\sigma}$ | NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED) |
| τ | SHEAR STRESS |
| e | 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

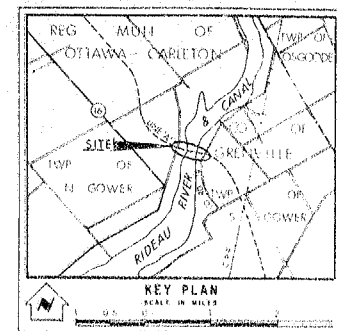
| | |
|----------|---------------------------------------------------------------------------------------------------------------|
| d | DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE |
| δ | ANGLE OF WALL FRICTION |
| K | DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS 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. ICF No. 7

| NO. | ELEVATION | STATION | OFFSET |
|-----|-----------|---------|--------|
| 1 | 281.7 | 618+60 | 4 |
| 2 | 281.4 | 620+48 | 4 |
| 3 | 282.1 | 622+25 | 4 |
| 4 | 280.0 | 623+71 | 4 |
| 5 | 280.0 | 625+25 | 4 |
| 6 | 280.0 | 627+71 | 4 |
| 7 | 280.0 | 628+25 | 4 |
| 8 | 280.0 | 629+25 | 4 |
| 9 | 280.0 | 631+25 | 4 |
| 10 | 280.0 | 632+25 | 4 |
| 11 | 280.0 | 633+25 | 4 |
| 12 | 280.0 | 634+25 | 4 |

NOTE

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

| DATE | BY | REVISION |
|------|----|----------|
| | | |

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION - FOUNDATION SECTION

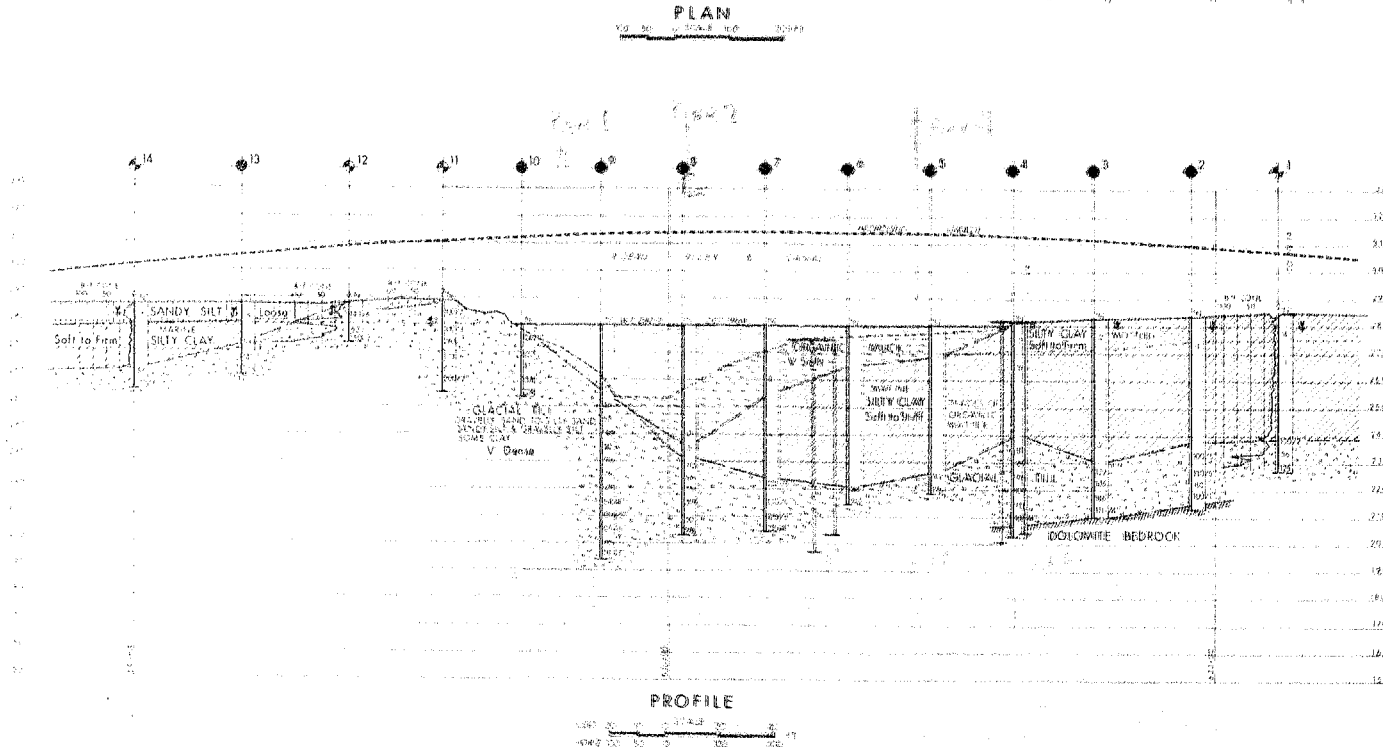
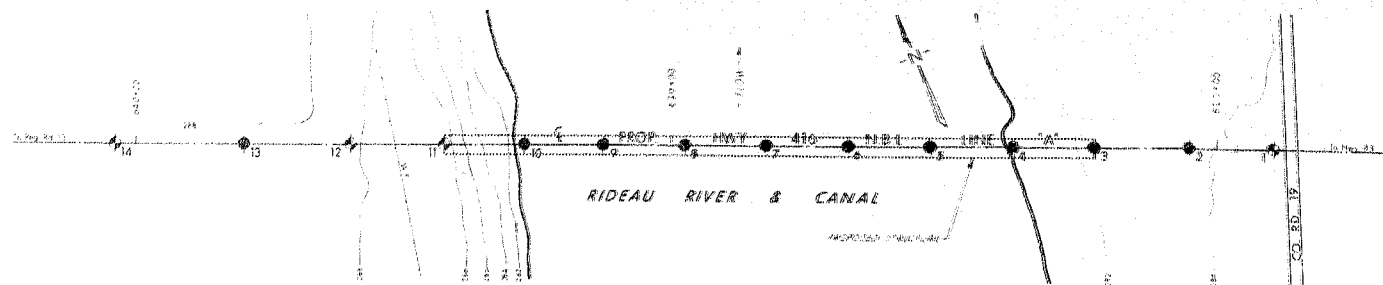
RIDEAU RIVER & CANAL

KING'S HIGHWAY NO. 416 N.B.I. LINE 'A' DIST NO. 8
CO. GRENVILLE & REG. MUN. OTTAWA-CARLETON
TWP. N. & S. GOWER LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

| | | | | | |
|-----------------------------|-------------|------------|-----------|--------------------|----------|
| SUBNO. A-6 | CHECKED ✓ | W.P. NO. | 701-67-01 | U.S. DRAWING NO. | 69-F-90A |
| DRAWN 50 | CHECKED ✓ | FOR NO. | 67-1-90 | | |
| DATE | 20 NOV 1990 | SITE NO. | | BRIDGE DRAWING NO. | |
| APPROVED <i>[Signature]</i> | | REPORT NO. | | | |

REF. NO. 1. 400-1



| PRINT RECORD | NO. | FOR | DATE |
|--------------|-----|-----|------|
| | | | |

RIDEAU RIVER BRIDGE

69-F-90

RECOMMENDED SUBEXCAVATION - PRELIMINARY (April 17th 7)

BEARINGS ABT
STA 623+40

STA 622+90

50 Ft.

2:1

Existing Gravel

EXCAVATE & REPLACE WITH GRAVULAR 4:1

El. 262±

2:1

Existing Gravel

EXCAVATE & REPLACE WITH
GRAVULAR.

El. 262±

sup

SETTLEMENT PLATES

DATE 7-10-33
 TIME 8:10
 LOCATION 8, 71

9

| PLATE NO. | STATION | DEFLECT | S-E CORNER | S-W | N-W | N-E | CENTER | AVERAGE |
|-----------|-----------|-----------|------------|------|-----|-----|--------|---------|
| 1 | 623+15.10 | 47.30 RT | 280.33 | .30 | .32 | .34 | .32 | 280.32 |
| 2 | 623+14.97 | 19.00 RT | 280.53 | .50 | .49 | .51 | .51 | 280.51 |
| 3 | 623+14.90 | 5.00 NB | 280.89 | .90 | .90 | .89 | .90 | 280.90 |
| 4 | 623+15.20 | 19.00 LT | 280.40 | .40 | .42 | .41 | .41 | 280.41 |
| 5 | 623+14.90 | 50.00 LT | 280.20 | .18 | .17 | .19 | .20 | 280.19 |
| 6 | 623+15.00 | 48.00 RT | 281.87 | .84 | .81 | .83 | .86 | 281.85 |
| 7 | 623+15.00 | 19.00 RT | 281.99 | 2.02 | .05 | .01 | 2.00 | 282.01 |
| 8 | 623+15.00 | 5.00 S.E. | 281.56 | .55 | .57 | .57 | .58 | 281.57 |
| 9 | 623+15.00 | 19.00 LT | 281.73 | .89 | .73 | .76 | .74 | 281.73 |
| 10 | 623+15.00 | 47.00 LT | 281.70 | .89 | .86 | .83 | .83 | 281.87 |

SETTLEMENT PLATES

APPEAR AS INDICATED ON FILM.

RIDEAU RIVER & CANAL



FLOW

E ABUT BRG'S
STA. 623+65

624+00

624+00

623+00

623+00

PROPOSED HWY 416
LINE 'A' N.B.L.

FUTURE S.B.L.

PLAN

SCALE 1" = 50'

SETTLEMENT PLATE DATA

| PLATE N ^o | STATION | OFFSET | PLATE ELEVATION |
|----------------------|-----------|---------|-----------------|
| 1 | 623 + 151 | 473' RT | 280.32 |
| 2 | 623 + 150 | 190' RT | 280.51 |
| 3 | 623 + 149 | ☐ | 280.90 |
| 4 | 623 + 152 | 190' LT | 280.41 |
| 5 | 623 + 149 | 500' LT | 280.19 |
| 6 | 623 + 150 | 480' PT | 280.85 |
| 7 | 623 + 150 | 190' RT | 282.01 |
| 8 | 623 + 150 | ☐ | 281.57 |
| 9 | 623 + 150 | 190' LT | 281.73 |
| 10 | 623 + 150 | 470' LT | 281.87 |

N.B.L.

S.B.L.

SUMMARY OF PILE DRIVING RECORDS

W.O. 69-11090 W.P. 203-67-01 CONT. 70-233 DIST. 8
 SITE RIDEAU RIVER BRIDGE 5 MI. N. OF KENPVILLE
 DATE DRIVEN FEB 18 - 16 MARCH 1972 WEIGHT OF ANVIL 0-25 TON
 HAMMER TYPE DELMAE D-12 WEIGHT 1.38 T ENERGY 22500 FT/LB

| LOCATION OF PILES | PILE | | | | ESTIMATED TIP EL. (ft.) | DIFFERENCE Longer (+) Shorter (-) Than Estimated (ft.) | REMARKS |
|-------------------|----------|-----|--------------|---------------|-------------------------|--------------------------------------------------------|---------|
| | TYPE | NO. | LENGTH (ft.) | TIP EL. (ft.) | | | |
| EAST ABUT | 12 BP 74 | 1 | 80.0 | 201.0 | 220-230 | + 19.0 | |
| --- | --- | 2 | 81.0 | 200.5 | --- | + 19.5 | |
| --- | --- | 3 | 80.3 | 201.2 | --- | + 18.8 | |
| --- | --- | 4 | 80.3 | 205.4 | --- | + 14.6 | |
| --- | --- | 5 | 79.3 | 206.3 | --- | + 13.7 | |
| --- | --- | 6 | 79.3 | 206.4 | --- | + 13.6 | |
| --- | --- | 7 | 79.4 | 206.4 | --- | + 13.6 | |
| --- | --- | 8 | 80.9 | 205.3 | --- | + 14.7 | |
| --- | --- | 9 | 81.2 | 204.5 | --- | + 15.5 | |
| --- | --- | 10 | 81.5 | 204.2 | --- | + 15.8 | |
| --- | --- | 11 | 79.0 | 202.5 | --- | + 17.5 | |
| --- | --- | 14 | 78.2 | 203.3 | --- | + 16.7 | |
| --- | --- | 15 | 80.5 | 201.0 | --- | + 19.0 | |
| --- | --- | 16 | 81.5 | 200.0 | --- | + 20.0 | |
| --- | --- | 17 | 81.0 | 200.5 | --- | + 19.5 | |
| --- | --- | 18 | 81.0 | 200.5 | --- | + 19.5 | |
| --- | --- | 19 | 80.2 | 201.3 | --- | + 18.7 | |
| --- | --- | 20 | 80.4 | 201.1 | --- | + 18.9 | |
| DER#3 TUBE 1 | --- | 1 | 77.2 | 196.8 | --- | + 23.2 | |
| --- | --- | 2 | 76.3 | 197.7 | --- | + 22.3 | |
| --- | --- | 3 | 74.3 | 199.7 | --- | + 20.3 | |
| --- | TUBE#2 | 1 | 75.2 | 198.2 | --- | + 21.2 | |
| --- | --- | 2 | 72.7 | 201.3 | --- | + 19.7 | |

PILES DRIVEN TO BEDROCK

DRIVEN TO GLACIAL TILL

164

| LOCATION OF PILES | PILE | | | | ESTIMATED TIP EL. (ft.) | DIFFERENCE Longer(+) Shorter(-) Than Estimated (ft.) | REMARKS |
|--------------------------------------------------------------|----------|-----|-----------------|------------------|-------------------------------|---------------------------------------------------------------|---------------------------------|
| | TYPE | NO. | LENGTH (ft.) | TIP EL. (ft.) | | | |
| PIER* 3 TUBE* 2 | 12 BP 74 | 3 | 73.8 | 200.2 | 220-230 | +19.8 | TO DRIVEN GLACIAL TILL |
| PIER* 3 TUBE* 3 | --- | 1 | 72.2 | 201.8 | --- | +18.2 | |
| --- | --- | 2 | 73.2 | 200.8 | --- | +19.2 | |
| --- | --- | 3 | 73.2 | 200.8 | --- | +19.2 | |
| --- | TUBE* 4 | 3 | 75.9 | 198.1 | --- | +21.9 | |
| --- | --- | 2 | 76.5 | 197.5 | --- | +22.5 | |
| --- | --- | 1 | 75.8 | 198.2 | --- | +21.8 | |
| PIER* 3 TUBE* 5 | --- | 1 | 71.8 | 202.2 | --- | +17.8 | |
| --- | --- | 2 | 72.2 | 201.8 | --- | +18.2 | |
| --- | --- | 3 | 77.6 | 196.4 | --- | +23.6 | |
| PIER* 3 TUBE* 6 | --- | 3 | 76.8 | 197.2 | --- | +22.8 | |
| --- | --- | 2 | 75.3 | 198.7 | --- | +21.3 | |
| --- | --- | 1 | 75.2 | 198.8 | --- | +21.2 | |
| <p>REPRESENTATIVE DRIVING RECORDS ARE LEFT ATTACHED.</p> | | | | | | | |

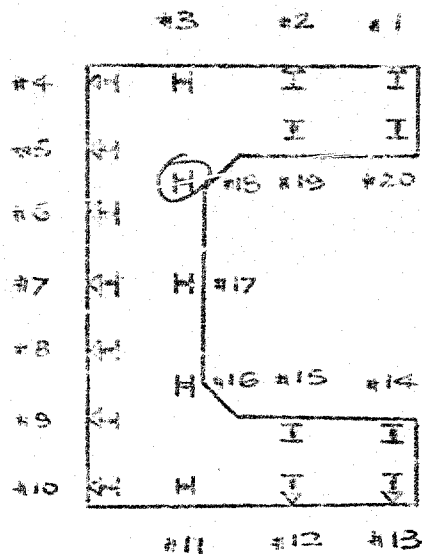
REPRESENTATIVE DRIVING RECORDS ARE KEPT
ATTACHED.

~~EAST~~ ABUTMENT

CONT. 70.233

PILE # 18

DATE



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND TESTING OFFICE
FOUNDATION SECTION

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 8 CONTRACT NO. 70-233 STRUCTURE RIDEAU RIVER BRIDGE
 CONTRACTOR W. D. LAFLAMME LTD. DESIGN LOAD OF PILE 90 TONS
 HAMMER DETAILS: TYPE DEURAL D-12 WEIGHT 1.38T HEIGHT OF FALL OR ENERGY 11.25 T/FT
 TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 0.25 TONS
 PILE DETAILS 12 B.P. 74 "H" PILES VERTICAL
 PILE NO. 18 LOCATION EAST ABUTMENT DATE DRIVEN MAR 13 / 72

| TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. |
|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|
| | 1 | | | 26 | | | 51 | | | 76 | 384 |
| | 2 | | | 27 | | | 52 | | | 77 | 192 |
| | 3 | | | 28 | | | 53 | | | 78 | 204 |
| | 4 | | | 29 | | | 54 | | | 79 | 456 |
| | 5 | | | 30 | | | 55 | 4 | | 80 | PERMANENT |
| | 6 | | | 31 | | | 56 | | | 81 | PERMANENT |
| | 7 | | | 32 | | | 57 | | | 82 | |
| | 8 | | | 33 | | | 58 | | | 83 | |
| | 9 | | | 34 | | | 59 | | | 84 | |
| | 10 | | | 35 | | | 60 | 72 | | 85 | |
| | 11 | | | 36 | | | 61 | | | 86 | |
| | 12 | | | 37 | | | 62 | | | 87 | |
| | 13 | | | 38 | | | 63 | | | 88 | |
| | 14 | | | 39 | | | 64 | | | 89 | |
| | 15 | | | 40 | | | 65 | 84 | | 90 | |
| | 16 | | | 41 | | | 66 | | | 91 | |
| | 17 | | | 42 | | | 67 | | | 92 | |
| | 18 | | | 43 | | | 68 | | | 93 | |
| | 19 | | | 44 | | | 69 | | | 94 | |
| | 20 | | | 45 | | | 70 | 120 | | 95 | |
| | 21 | | | 46 | | | 71 | | | 96 | |
| | 22 | | | 47 | | | 72 | | | 97 | |
| | 23 | | | 48 | | | 73 | | | 98 | |
| | 24 | | | 49 | | | 74 | | | 99 | |
| | 25 | | | 50 | | | 75 | 180 | | 100 | |

| DETAILS FOR FINAL SIX INCHES OF PENETRATION | 1 | 2 | 3 | 4 | 5 | 6 |
|---------------------------------------------|--------|---|---|--------------------------------|---|---|
| BLOWS PER INCH | - | - | - | - | - | - |
| MEASURED REBOUND IN INCHES | | | | | | |
| FINAL LENGTH OF PILE | 91.00' | | | FINAL CUT OFF ELEVATION 281.50 | | |

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
 MATERIALS & TESTING DIVISION
 DEPARTMENT OF HIGHWAYS
 DOWNSVIEW, ONTARIO

SIGNED GARTH MALCOLMNAME (PRINT) GARTH MALCOLMDATE MAR 22 / 72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

281.5
 91.0
 200.5
 TIP

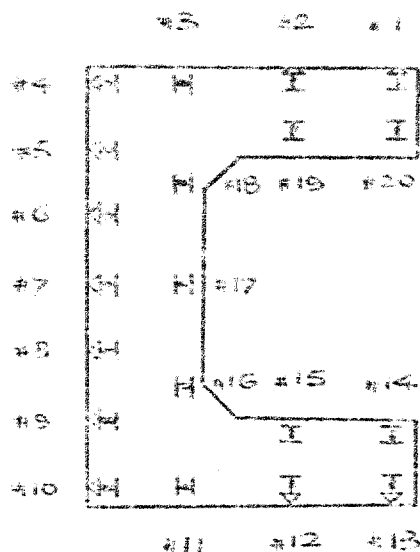
EAST
~~WEST~~

ABUTMENT

CONT. 70-233

PILE # 15

DATE



OVER

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND TESTING OFFICE
FOUNDATION SECTION

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 8 CONTRACT NO. 70-233 STRUCTURE RIDEAU RIVER BRIDGE
 CONTRACTOR W.D. McFARLANE LTD. DESIGN LOAD OF PILE 90 TONS
 HAMMER DETAILS: TYPE DELMAC D-12 WEIGHT 1.38 T HEIGHT OF FALL OR ENERGY 11.25 T/FT.
 TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 0.25 TONS
 PILE DETAILS 12 B.P. 74 "H" PILES VERTICAL
 PILE NO. 15 LOCATION EAST ABUTMENT DATE DRIVEN FEB 18/72

| TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. |
|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|
| | 1 | | | 26 | | | 31 | | | 76 | |
| | 2 | | | 27 | | | 32 | | | 77 | |
| | 3 | | | 28 | | | 33 | | | 78 | |
| | 4 | | | 29 | | | 34 | | | 79 | |
| | 5 | | | 30 | | | 35 | | | 80 | |
| | 6 | | | 31 | | | 36 | | | 81 | |
| | 7 | | | 32 | | | 37 | | | 82 | |
| | 8 | | | 33 | | | 38 | | | 83 | |
| | 9 | | | 34 | | | 39 | | | 84 | |
| | 10 | | | 35 | | | 40 | | | 85 | |
| | 11 | | | 36 | | | 41 | | | 86 | |
| | 12 | | | 37 | | | 42 | | | 87 | |
| | 13 | | | 38 | | | 43 | | | 88 | |
| | 14 | | | 39 | | | 44 | | | 89 | |
| | 15 | | | 40 | | | 45 | | | 90 | |
| | 16 | | | 41 | | | 46 | | | 91 | |
| | 17 | | | 42 | | | 47 | | | 92 | |
| | 18 | | | 43 | | | 48 | | | 93 | |
| | 19 | | | 44 | | | 49 | | | 94 | |
| | 20 | | | 45 | | | 50 | | | 95 | |
| | 21 | | | 46 | | | | | | 96 | |
| | 22 | | | 47 | | | | | | 97 | |
| | 23 | | | 48 | | | | | | 98 | |
| | 24 | | | 49 | | | | | | 99 | |
| | 25 | | | 50 | | | | | | 100 | |

| DETAILS FOR FINAL SIX INCHES OF PENETRATION | 1 | 2 | 3 | 4 | 5 | 6 |
|---------------------------------------------|-------|---|---|---|---|-------------------------------|
| BLOWS PER INCH | — | — | — | — | — | — |
| MEASURED REBOUND IN INCHES | | | | | | |
| FINAL LENGTH OF PILE | 80.50 | | | | | FINAL CUT OFF ELEVATION 281.5 |

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
 MATERIALS & TESTING DIVISION
 DEPARTMENT OF HIGHWAYS
 DOWNSVIEW, ONTARIO

SIGNED Garth Malcolm
 NAME (PRINT) GARTH MALCOLM
 DATE MAR 22/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

281.5
 80.5
 TIP 2010

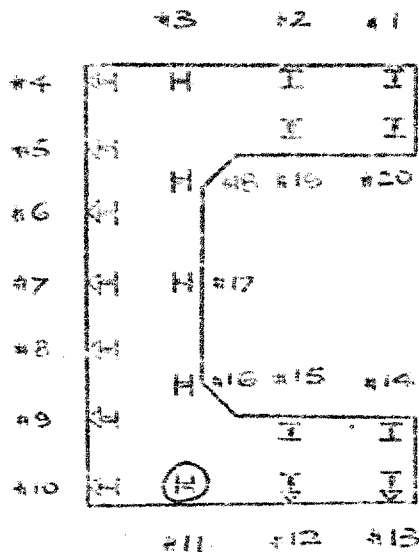
EAST
~~WEST~~

ABUTMENT.

CONT. 70-233

PILE # 11

DATE



OVER

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. B CONTRACT NO. 70-233 STRUCTURE RIDEAU RIVER BRIDGE
CONTRACTOR H.D. LAFLAMME LTD. DESIGN LOAD OF PILE 90 TONS
HAMMER DETAILS: TYPE DELMAG D-12 WEIGHT 1.3 FT HEIGHT OF FALL OR ENERGY 11.25 FT
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 0.25 TON
PILE DETAILS 12 B.P. 74 "H" PILES VERTICAL
PILE NO. 11 LOCATION EAST ABUTMENT DATE DRIVEN MAR. 11/72

| TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. |
|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|
| | 1 | | | 26 | | | 51 | | | 76 | |
| | 2 | | | 27 | | | 52 | | | 77 | |
| | 3 | | | 28 | | | 53 | | | 78 | |
| | 4 | | | 29 | | | 54 | | | 79 | |
| | 5 | | | 30 | | | 55 | 3 | | 80 | |
| | 6 | | | 31 | | | 56 | | | 81 | |
| | 7 | | | 32 | | | 57 | | | 82 | |
| | 8 | | | 33 | | | 58 | | | 83 | |
| | 9 | | | 34 | | | 59 | | | 84 | |
| | 10 | | | 35 | | | 60 | 96 | | 85 | |
| | 11 | | | 36 | | | 61 | | | 86 | |
| | 12 | | | 37 | | | 62 | | | 87 | |
| | 13 | | | 38 | | | 63 | | | 88 | |
| | 14 | | | 39 | | | 64 | | | 89 | |
| | 15 | | | 40 | | | 65 | 108 | | 90 | |
| | 16 | | | 41 | | | 66 | | | 91 | |
| | 17 | | | 42 | | | 67 | | | 92 | |
| | 18 | | | 43 | | | 68 | | | 93 | |
| | 19 | | | 44 | | | 69 | | | 94 | |
| | 20 | | | 45 | | | 70 | 168 | | 95 | |
| | 21 | | | 46 | | | 71 | | | 96 | |
| | 22 | | | 47 | | | 72 | | | 97 | |
| | 23 | | | 48 | | | 73 | | | 98 | |
| | 24 | | | 49 | | | 74 | | | 99 | |
| | 25 | | | 50 | | | 75 | 240 | | 100 | |

| DETAILS FOR FINAL SIX INCHES OF PENETRATION | 1 | 2 | 3 | 4 | 5 | 6 |
|---------------------------------------------|--------|---|---|-------------------------|---|---|
| BLOWS PER INCH | - | - | - | - | - | - |
| MEASURED REBOUND IN INCHES | | | | | | |
| FINAL LENGTH OF PILE | 79.00' | | | FINAL CUT OFF ELEVATION | | |
| | | | | 281.50 | | |

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
MATERIALS & TESTING DIVISION
DEPARTMENT OF HIGHWAYS
DOWNSVIEW, ONTARIO

SIGNED Garth Malcolm
NAME (PRINT) GARTH MALCOLM
DATE MAR 22/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

281.5
79.0
202.5

TIP

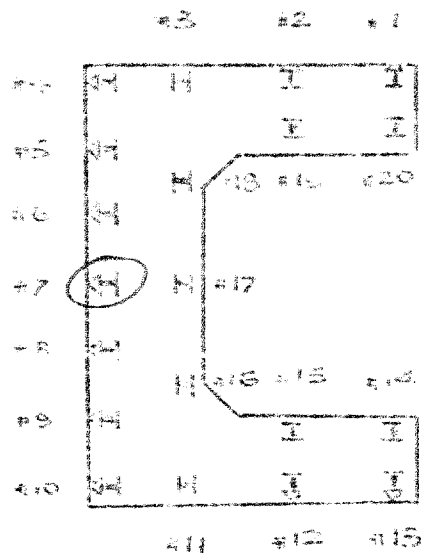
EPST

~~SECRET~~ ADJUTMENT

CONF 70-233

PAGE # 7

DATE



OVER

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 8 CONTRACT NO. 70-233 STRUCTURE RIDEAU RIVER BRIDGE
CONTRACTOR W.D. LAFLAMME LTD. DESIGN LOAD OF PILE 90 TONS
HAMMER DETAILS: TYPE DELMAC D-12 WEIGHT 1.38 T HEIGHT OF FALL OR ENERGY 11.25 T/FT
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 0.25 TONS
PILE DETAILS 12 B.P. 74 "H" PILES ENTER 123
PILE NO. 7 LOCATION EAST ABUTMENT DATE DRIVEN MAR 12/72

| TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. |
|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|
| | 1 | | | 26 | | | 51 | | | 76 | |
| | 2 | | | 27 | | | 52 | | | 77 | |
| | 3 | | | 28 | | | 53 | | | 78 | |
| | 4 | | | 29 | | | 54 | | | 79 | |
| | 5 | | | 30 | | | 55 | | | 80 | |
| | 6 | | | 31 | | | 56 | | | 81 | |
| | 7 | | | 32 | | | 57 | | | 82 | |
| | 8 | | | 33 | | | 58 | | | 83 | |
| | 9 | | | 34 | | | 59 | | | 84 | |
| | 10 | | | 35 | | | 60 | 72 | | 85 | |
| | 11 | | | 36 | | | 61 | | | 86 | |
| | 12 | | | 37 | | | 62 | | | 87 | |
| | 13 | | | 38 | | | 63 | | | 88 | |
| | 14 | | | 39 | | | 64 | | | 89 | |
| | 15 | | | 40 | | | 65 | 72 | | 90 | |
| | 16 | | | 41 | | | 66 | | | 91 | |
| | 17 | | | 42 | | | 67 | | | 92 | |
| | 18 | | | 43 | | | 68 | | | 93 | |
| | 19 | | | 44 | | | 69 | | | 94 | |
| | 20 | | | 45 | | | 70 | 84 | | 95 | |
| | 21 | | | 46 | | | 71 | | | 96 | |
| | 22 | | | 47 | | | 72 | | | 97 | |
| | 23 | | | 48 | | | 73 | | | 98 | |
| | 24 | | | 49 | | | 74 | | | 99 | |
| | 25 | | | 50 | | | 75 | 132 | | 100 | |

| DETAILS FOR FINAL SIX INCHES OF PENETRATION | 1 | 2 | 3 | 4 | 5 | 6 |
|---------------------------------------------|-------|---|---|---|---|--------------------------------|
| BLOWS PER INCH | — | — | — | — | — | — |
| MEASURED REBOUND IN INCHES | | | | | | |
| FINAL LENGTH OF PILE | 77.42 | | | | | FINAL CUT OFF ELEVATION 281.50 |

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
MATERIALS & TESTING DIVISION
DEPARTMENT OF HIGHWAYS
DOWNSVIEW, ONTARIO

SIGNED Garth Malcolm
NAME (PRINT) GARTH MALCOLM
DATE MAR 22/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

281.5
75.1
206.4

TIP

OVER

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 8 CONTRACT NO. 70-233 STRUCTURE RIDEAU RIVER BRIDGE
CONTRACTOR W.D. LAFAMME LTD. DESIGN LOAD OF PILE 90 TONS
HAMMER DETAILS: TYPE DELMAG D-12 WEIGHT 1.28 T. HEIGHT OF FALL OR ENERGY 11.25 T/FT
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 0.25 TONS
PILE DETAILS 12 B.P. 74 "H" PILES VERTICAL
PILE NO. 1 LOCATION EAST ABUTMENT DATE DRIVEN MAR. 15/72

| TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. |
|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|
| | 1 | | | 26 | | | 51 | | | 76 | |
| | 2 | | | 27 | | | 52 | | | 77 | |
| | 3 | | | 28 | | | 53 | | | 78 | |
| | 4 | | | 29 | | | 54 | | | 79 | 360 |
| | 5 | | | 30 | | | 55 | | | 80.5 | REBARK |
| | 6 | | | 31 | | | 56 | | | 81 | |
| | 7 | | | 32 | | | 57 | | | 82 | |
| | 8 | | | 33 | | | 58 | | | 83 | |
| | 9 | | | 34 | | | 59 | | | 84 | |
| | 10 | | | 35 | | | 60 | 72 | | 85 | |
| | 11 | | | 36 | | | 61 | | | 86 | |
| | 12 | | | 37 | | | 62 | | | 87 | |
| | 13 | | | 38 | | | 63 | | | 88 | |
| | 14 | | | 39 | | | 64 | | | 89 | |
| | 15 | | | 40 | | | 65 | 96 | | 90 | |
| | 16 | | | 41 | | | 66 | | | 91 | |
| | 17 | | | 42 | | | 67 | | | 92 | |
| | 18 | | | 43 | | | 68 | | | 93 | |
| | 19 | | | 44 | | | 69 | | | 94 | |
| | 20 | | | 45 | | | 70 | 180 | | 95 | |
| | 21 | | | 46 | | | 71 | | | 96 | |
| | 22 | | | 47 | | | 72 | | | 97 | |
| | 23 | | | 48 | | | 73 | | | 98 | |
| | 24 | | | 49 | | | 74 | | | 99 | |
| | 25 | | | 50 | | | 75 | 300 | | 100 | |

| DETAILS FOR FINAL SIX INCHES OF PENETRATION | 1 | 2 | 3 | 4 | 5 | 6 |
|---------------------------------------------|-------|---|---|-------------------------|---|---|
| BLOWS PER INCH | - | - | - | - | - | - |
| MEASURED REBOUND IN INCHES | | | | | | |
| FINAL LENGTH OF PILE | 80.5' | | | FINAL CUT OFF ELEVATION | | |
| | | | | 281.50 | | |

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
MATERIALS & TESTING DIVISION
DEPARTMENT OF HIGHWAYS
DOWNSVIEW, ONTARIO

SIGNED GARTH J. WALCOLL
NAME (PRINT) GARTH J. WALCOLL
DATE MAR. 22/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

281.5
80.5
201.0

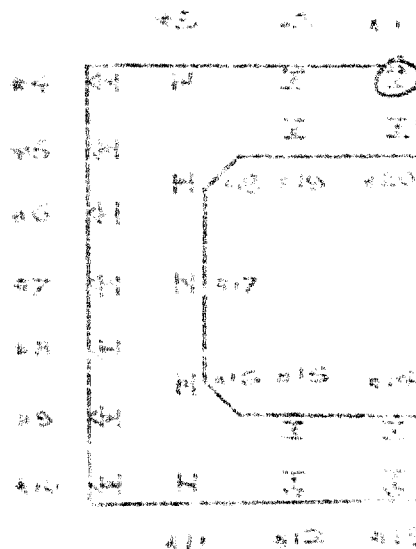
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ADJUSTMENT

CONT. 70-233

PAGE 4 /

DATE



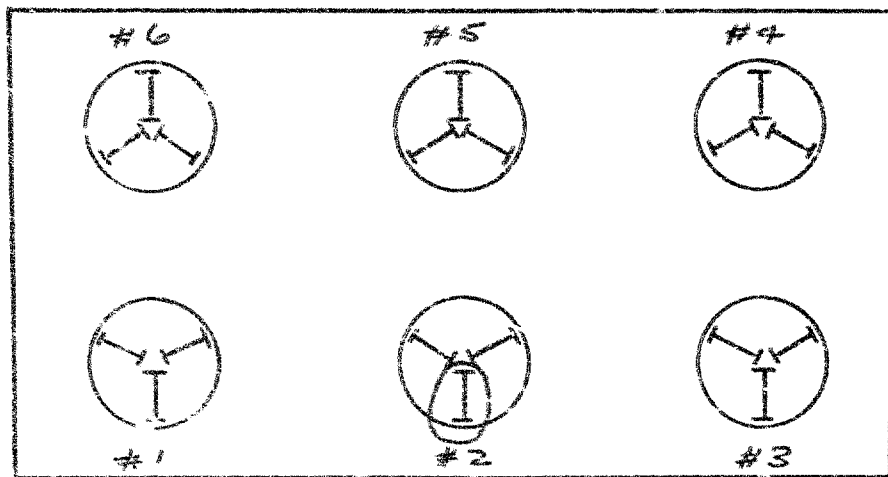
CONT. N° 70-233

PIEC # 3

DATE.

TUBE # 2

H-PLE # 1



OVER

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 8 CONTRACT NO. R-233 STRUCTURE 2 IDEAL RIVER BRIDGE
CONTRACTOR W.D. LACLAMME LTD. DESIGN LOAD OF PILE 100 TONS
HAMMER DETAILS: TYPE DELMAG D-12 WEIGHT 1.38 T HEIGHT OF FALL OR ENERGY 11.25 FT.
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 0.25 TONS
PILE DETAILS 12 B.P. 74 " H" PILE

PILE NO. #1 LOCATION PIER #3, TUBE #2 DATE DRIVEN Mar 16/72

| TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. |
|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|
| | 1 | | | 26 | | | 51 | | | 76 | |
| | 2 | | | 27 | | | 52 | | | 77 | |
| | 3 | | | 28 | | | 53 | | | 78 | |
| | 4 | | | 29 | | | 54 | | | 79 | |
| | 5 | | | 30 | | | 55 | 60 | | 80 | |
| | 6 | | | 31 | | | 56 | | | 81 | |
| | 7 | | | 32 | | | 57 | | | 82 | |
| | 8 | | | 33 | | | 58 | | | 83 | |
| | 9 | | | 34 | | | 59 | | | 84 | |
| | 10 | | | 35 | | | 60 | 132 | | 85 | |
| | 11 | | | 36 | | | 61 | | | 86 | |
| | 12 | | | 37 | | | 62 | | | 87 | |
| | 13 | | | 38 | | | 63 | | | 88 | |
| | 14 | | | 39 | | | 64 | | | 89 | |
| | 15 | | | 40 | | | 65 | 480 | | 90 | |
| | 16 | | | 41 | | | 66 | 780 | | 91 | |
| | 17 | | | 42 | | | 67 | 600 | | 92 | |
| | 18 | | | 43 | | | 68 | 168 | | 93 | |
| | 19 | | | 44 | | | 69 | | | 94 | |
| | 20 | | | 45 | | | 70 | | | 95 | |
| | 21 | | | 46 | | | 71 | | | 96 | |
| | 22 | | | 47 | | | 72 | 528 | | 97 | |
| | 23 | | | 48 | | | 73 | | | 98 | |
| | 24 | | | 49 | | | 74 | | | 99 | |
| | 25 | | | 50 | | | 75 | | | 100 | |

| DETAILS FOR FINAL SIX INCHES OF PENETRATION | 1 | 2 | 3 | 4 | 5 | 6 |
|----------------------------------------------|---------------------------------------|-----------|-----------|-----------|-----------|-----------|
| BLOWS PER INCH (<u>0.12 DECMAG HAMMER</u>) | <u>42</u> | <u>43</u> | <u>44</u> | <u>44</u> | <u>44</u> | <u>44</u> |
| MEASURED REBOUND IN INCHES | | | | | | |
| FINAL LENGTH OF PILE <u>72.15</u> | FINAL CUT OFF ELEVATION <u>274.00</u> | | | | | |

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
MATERIALS & TESTING DIVISION
DEPARTMENT OF HIGHWAYS
DOWNSVIEW, ONTARIO

SIGNED GARTH MALCOLM
NAME (PRINT) GARTH MALCOLM
DATE Mar 23/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

274.0
272
TIP 1988

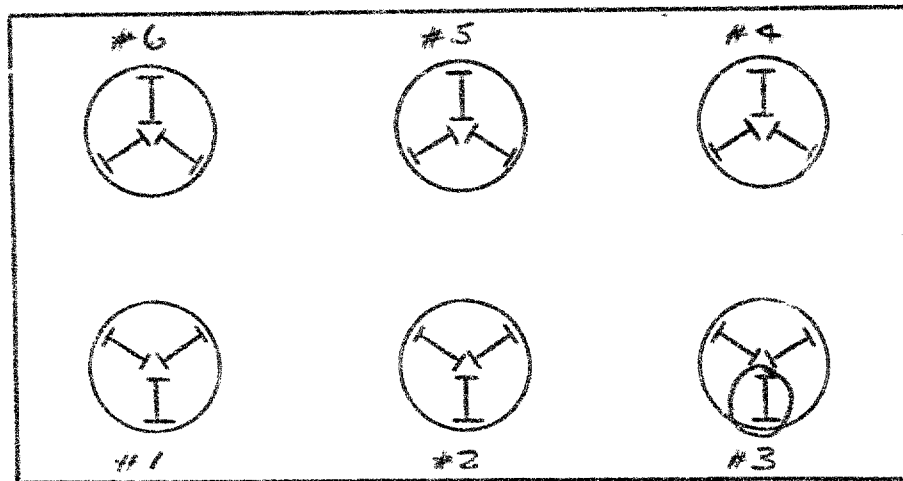
CONT. No 70-233

PIER # 3

DATE

TUBE # 3

H-PILE # 1



BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 8 CONTRACT NO. 70-233 STRUCTURE RIDEAU RIVER BRIDGE

CONTRACTOR W.D. CAFLANNE LTD DESIGN LOAD OF PILE 100 TONS

HAMMER DETAILS: TYPE DELMAC D-12 WEIGHT 1387 HEIGHT OF FALL OR ENERGY 11.25 FT

TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 0.25 TONS

PILE DETAILS 12 B.P. 74 "H" PILE

PILE NO. #1 LOCATION PIECE #3, TUBE #3 DATE DRIVEN MAR 16/72

| TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. |
|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|
| | 1 | | | 26 | | | 51 | | | 76 | |
| | 2 | | | 27 | | | 52 | | | 77 | |
| | 3 | | | 28 | | | 53 | | | 78 | |
| | 4 | | | 29 | | | 54 | | | 79 | |
| | 5 | | | 30 | | | 55 | 48 | | 80 | |
| | 6 | | | 31 | | | 56 | | | 81 | |
| | 7 | | | 32 | | | 57 | | | 82 | |
| | 8 | | | 33 | | | 58 | | | 83 | |
| | 9 | | | 34 | | | 59 | | | 84 | |
| | 10 | | | 35 | | | 60 | 120 | | 85 | |
| | 11 | | | 36 | | | 61 | | | 86 | |
| | 12 | | | 37 | | | 62 | | | 87 | |
| | 13 | | | 38 | | | 63 | | | 88 | |
| | 14 | | | 39 | | | 64 | | | 89 | |
| | 15 | | | 40 | | | 65 | 456 | | 90 | |
| | 16 | | | 41 | | | 66 | | | 91 | |
| | 17 | | | 42 | | | 67 | 960 | | 92 | |
| | 18 | | | 43 | | | 68 | | | 93 | |
| | 19 | | | 44 | | | 69 | 180 | | 94 | |
| | 20 | | | 45 | | | 70 | | | 95 | |
| | 21 | | | 46 | | | 71 | 468 | | 96 | |
| | 22 | | | 47 | | | 72 | | | 97 | |
| | 23 | | | 48 | | | 73 | | | 98 | |
| | 24 | | | 49 | | | 74 | | | 99 | |
| | 25 | | | 50 | | | 75 | | | 100 | |

| DETAILS FOR FINAL SIX INCHES OF PENETRATION | 1 | 2 | 3 | 4 | 5 | 6 |
|----------------------------------------------|--------|----|----|----|----|--------------------------------|
| BLOWS PER INCH (<u>D-12 DELMAC Hammer</u>) | 39 | 39 | 39 | 39 | 39 | 39 |
| MEASURED REBOUND IN INCHES | | | | | | |
| FINAL LENGTH OF PILE | 72.15' | | | | | FINAL CUT OFF ELEVATION 274.00 |

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
MATERIALS & TESTING DIVISION
DEPARTMENT OF HIGHWAYS
DOWNSVIEW, ONTARIO

SIGNED Garth Malcolm
NAME (PRINT) GARTH MALCOLM
DATE MAR 23/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

TIP
274.0
72.2
201.8

Notes:-

In general this form should be completed for every tenth pile in a group, but at least one is required for every pier and abutment.

Piles driven vertically should be selected where possible.

Pile Details must include type, dimensions and weight per foot, details of shoe, and slope of batter: e.g. 12 $\frac{1}{2}$ " O.D. steel tube x 0.251" @ 33 lbs. per ft. Vertical. 12 $\frac{1}{2}$ " x $\frac{1}{2}$ " steel plate shoe.

Details for the final six inches of penetration must be completed for all piles except in the case of an end bearing pile driven to bedrock. Final length of pile, and final cut off elevation must always be given.

The total length being driven is the full length of the pile and remains unchanged until a length is cut off or spliced on.

The penetration in blows per foot must be recorded for every foot of penetration of the pile.

Measured rebounds recorded on this form must be the average for each individual inch for the final six inches of penetration.

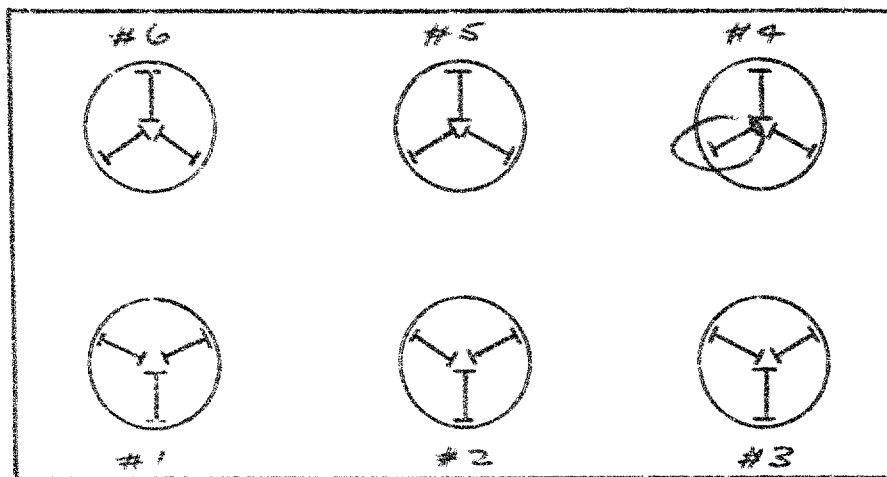
CENT NO 70-233

DATE.

PIEC # 3

TUBE # 4

H-PIE # 3



OVER

Form O8-MT-283 (Formerly O8-MT-285)
200 P.C. 45-278DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION
FOUNDATION SECTION

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 8 CONTRACT NO. 70-233 STRUCTURE RIDEAU RIVER BRIDGECONTRACTOR W.D. LAFLAMME LTD. DESIGN LOAD OF PILE 100 TONSHAMMER DETAILS: TYPE DELTA D-12 WEIGHT 138T HEIGHT OF FALL OR ENERGY 11.25 FT.TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 0.25 TONSPILE DETAILS: 12 B.P. 74" H" PILEPILE NO. #3 LOCATION PIER #3, TUBE #4 DATE DRIVEN MAR 16/72

| TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. |
|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|
| | 1 | | | 26 | | | 51 | | | 76 | |
| | 2 | | | 27 | | | 52 | | | 77 | |
| | 3 | | | 28 | | | 53 | | | 78 | |
| | 4 | | | 29 | | | 54 | | | 79 | |
| | 5 | | | 30 | | | 55 | 72 | | 80 | |
| | 6 | | | 31 | | | 56 | | | 81 | |
| | 7 | | | 32 | | | 57 | | | 82 | |
| | 8 | | | 33 | | | 58 | | | 83 | |
| | 9 | | | 34 | | | 59 | | | 84 | |
| | 10 | | | 35 | | | 60 | 132 | | 85 | |
| | 11 | | | 36 | | | 61 | | | 86 | |
| | 12 | | | 37 | | | 62 | | | 87 | |
| | 13 | | | 38 | | | 63 | | | 88 | |
| | 14 | | | 39 | | | 64 | | | 89 | |
| | 15 | | | 40 | | | 65 | 324 | | 90 | |
| | 16 | | | 41 | | | 66 | 528 | | 91 | |
| | 17 | | | 42 | | | 67 | | | 92 | |
| | 18 | | | 43 | | | 68 | 780 | | 93 | |
| | 19 | | | 44 | | | 69 | | | 94 | |
| | 20 | | | 45 | | | 70 | | | 95 | |
| | 21 | | | 46 | | | 71 | | | 96 | |
| | 22 | | | 47 | | | 72 | 252 | | 97 | |
| | 23 | | | 48 | | | 73 | | | 98 | |
| | 24 | | | 49 | | | 74 | | | 99 | |
| | 25 | | | 50 | | | 75 | 528 | | 100 | |

| DETAILS FOR FINAL SIX INCHES OF PENETRATION | 1 | 2 | 3 | 4 | 5 | 6 |
|-----------------------------------------------|---------------------------------------|----|----|----|----|----|
| BLOWS PER INCH (<u>D-12 DELTA D Hammer</u>) | 44 | 44 | 44 | 44 | 44 | 44 |
| MEASURED REBOUND IN INCHES | | | | | | |
| FINAL LENGTH OF PILE <u>75.72'</u> | FINAL CUT OFF ELEVATION <u>274.00</u> | | | | | |

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
MATERIALS & TESTING DIVISION
DEPARTMENT OF HIGHWAYS
DOWNSVIEW, ONTARIOSIGNED Garth MalcolmNAME (PRINT) GARTH MALCOLMDATE MAR 23/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

274.0
75.72

75.72

TIP

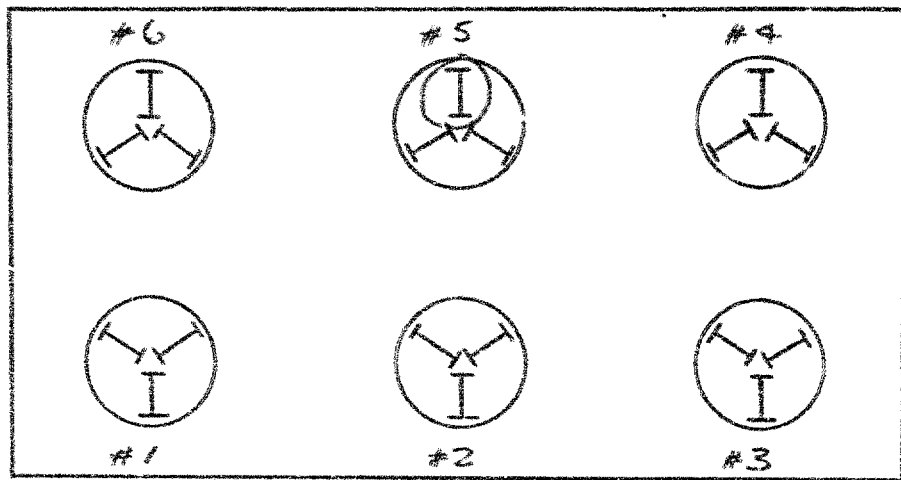
CONT. No 70-233

DATE

PIER # 3

TUBE # 5

H-PILE # 1



OVER

Form OB-MT-283 (Formerly OB-MT-285)
200 Pads - 65-275DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION
FOUNDATION SECTION

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 8 CONTRACT NO. 70-233 STRUCTURE RIDEAU RIVER BRIDGE
 CONTRACTOR W.D. LAFLAMME LTD. DESIGN LOAD OF PILE 100 TONS
 HAMMER DETAILS: TYPE DELMAC 3-12 WEIGHT 1-387 HEIGHT OF FALL OR ENERGY 11-25.5'
 TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 0.25 TONS
 PILE DETAILS 12 B.P. 74 4 1/4" PILE
 PILE NO. #1 LOCATION PIER #3 TUBE #5 DATE DRIVEN MAR 16/72

| TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS / FT. |
|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|------------------------------|---------------------|----------------------------|
| | 1 | | | 26 | | | 51 | | | 76 | |
| | 2 | | | 27 | | | 52 | | | 77 | |
| | 3 | | | 28 | | | 53 | | | 78 | |
| | 4 | | | 29 | | | 54 | | | 79 | |
| | 5 | | | 30 | | | 55 | 72 | | 80 | |
| | 6 | | | 31 | | | 56 | | | 81 | |
| | 7 | | | 32 | | | 57 | | | 82 | |
| | 8 | | | 33 | | | 58 | | | 83 | |
| | 9 | | | 34 | | | 59 | | | 84 | |
| | 10 | | | 35 | | | 60 | 132 | | 85 | |
| | 11 | | | 36 | | | 61 | | | 86 | |
| | 12 | | | 37 | | | 62 | | | 87 | |
| | 13 | | | 38 | | | 63 | | | 88 | |
| | 14 | | | 39 | | | 64 | | | 89 | |
| | 15 | | | 40 | | | 65 | 300 | | 90 | |
| | 16 | | | 41 | | | 66 | | | 91 | |
| | 17 | | | 42 | | | 67 | | | 92 | |
| | 18 | | | 43 | | | 68 | | | 93 | |
| | 19 | | | 44 | | | 69 | | | 94 | |
| | 20 | | | 45 | | | 70 | 456 | | 95 | |
| | 21 | | | 46 | | | 71 | 540 | | 96 | |
| | 22 | | | 47 | | | 72 | | | 97 | |
| | 23 | | | 48 | | | 73 | | | 98 | |
| | 24 | | | 49 | | | 74 | | | 99 | |
| | 25 | | | 50 | | | 75 | | | 100 | |

| DETAILS FOR FINAL SIX INCHES OF PENETRATION | 1 | 2 | 3 | 4 | 5 | 6 |
|----------------------------------------------|-------|----|--------------------------------|----|----|----|
| BLOWS PER INCH (<u>D-12 DELMAC HAMMER</u>) | 45 | 45 | 45 | 45 | 45 | 45 |
| MEASURED REBOUND IN INCHES | | | | | | |
| FINAL LENGTH OF PILE | 71.76 | | FINAL CUT OFF ELEVATION 274.00 | | | |

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
 MATERIALS & TESTING DIVISION
 DEPARTMENT OF HIGHWAYS
 DOWNSVIEW, ONTARIO

SIGNED Garth Malcolm
 NAME (PRINT) GARTH MALCOLM
 DATE MAR 23/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

TIP

27.0
 7.8
 20.2

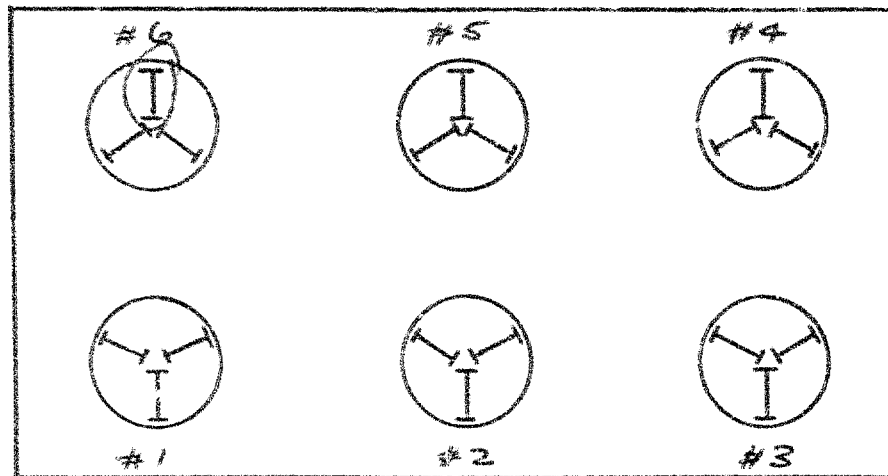
CONT. NO 70-233

DATE.

PIEC # 3

TUBE # 6

H-PIE # 1



OVER

Form OB-MT-285 (Formerly OB-MT-285)
200 Parts - 65-278DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION
FOUNDATION SECTION

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 8 CONTRACT NO. 70 233 STRUCTURE IDEAU RIVER BRIDGE
 CONTRACTOR W.D. LAFLAMME LTD. DESIGN LOAD OF PILE 100 TONS
 HAMMER DETAILS: TYPE DELWING D-12 WEIGHT 1387 HEIGHT OF FALL OR ENERGY 1125 FT.
 TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 0.25 TONS
 PILE DETAILS 12 B.P. 74 #11" PILE
 PILE NO. #1 LOCATION PIER #3, TUBE #6 FINAL DATE DRIVEN MAR 16/72

| TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. | TOTAL LENGTH BEING DRIVEN | LENGTH IN GROUND | PENETRATION BLOWS/FT. |
|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|------------------------------|---------------------|--------------------------|
| | 1 | | | 26 | | | 51 | | | 76 | |
| | 2 | | | 27 | | | 52 | | | 77 | |
| | 3 | | | 28 | | | 53 | | | 78 | |
| | 4 | | | 29 | | | 54 | | | 79 | |
| | 5 | | | 30 | | | 55 | 48 | | 80 | |
| | 6 | | | 31 | | | 56 | | | 81 | |
| | 7 | | | 32 | | | 57 | | | 82 | |
| | 8 | | | 33 | | | 58 | | | 83 | |
| | 9 | | | 34 | | | 59 | 42 | | 84 | |
| | 10 | | | 35 | | | 60 | 108 | | 85 | |
| | 11 | | | 36 | | | 61 | | | 86 | |
| | 12 | | | 37 | | | 62 | | | 87 | |
| | 13 | | | 38 | | | 63 | | | 88 | |
| | 14 | | | 39 | | | 64 | | | 89 | |
| | 15 | | | 40 | | | 65 | 216 | | 90 | |
| | 16 | | | 41 | | | 66 | | | 91 | |
| | 17 | | | 42 | | | 67 | 540 | | 92 | |
| | 18 | | | 43 | | | 68 | | | 93 | |
| | 19 | | | 44 | | | 69 | 300 | | 94 | |
| | 20 | | | 45 | | | 70 | | | 95 | |
| | 21 | | | 46 | | | 71 | | | 96 | |
| | 22 | | | 47 | | | 72 | | | 97 | |
| | 23 | | | 48 | | | 73 | 228 | | 98 | |
| | 24 | | | 49 | | | 74 | 480 | | 99 | |
| | 25 | | | 50 | | | 75 | | | 100 | |

| DETAILS FOR FINAL SIX INCHES OF PENETRATION | 1 | 2 | 3 | 4 | 5 | 6 |
|---------------------------------------------|--------|----|----|-------------------------|----|----|
| BLOWS PER INCH (10.000 LB DELWING HAMMER) | 27 | 27 | 27 | 27 | 27 | 27 |
| MEASURED REBOUND IN INCHES | | | | | | |
| FINAL LENGTH OF PILE | 75.23' | | | FINAL CUT OFF ELEVATION | | |
| | | | | 274.00 | | |

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
 MATERIALS & TESTING DIVISION
 DEPARTMENT OF HIGHWAYS
 DOWNSVIEW, ONTARIO

SIGNED GARTH MALEDON
 NAME (PRINT) GARTH MALEDON
 DATE MAR 23/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

274.0
 75.2
 719.2

KGE

Mr. T. C. Kingsland,
Regional Bridge Planning Engr.,
Eastern Region,
KINGSTON, Ont.

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

May 27, 1971

Rideau River Bridge -- Site 3-264
Hwy. #416, District No. 8 (Kingston)
M.P. 203-67-01 -- A.O. 69-11090

As requested in your memo of May 3, 1971, we have studied your proposals for the relocation of County Road #13 with regard to the subsoil information contained in our Foundation Report 69-11090. Although the latter requires a fair amount of extrapolation, we have arrived at the following conclusions which are:

- Proposal #1

Involves raising the grade of Hwy. #416 approx. 4 ft. up to a height of 22 - 23 ft. Short berms will likely be necessary for the approach fills, berms being not longer than 20 ft. Estimated settlement under the centre of the fill is 12 - 15". Forward berms will not be required.

- Proposal #2

Grade of Hwy. #416 will be raised to grade 'C'. Height of fill at the overpass will be 25 ft. Longitudinal and forward berms will be required. At the crossing of County Road #13 the length of berms necessary will be some 60 - 70 ft. Settlements anticipated will be in the order of 2 - 3 ft.

- Proposal #3

Since the proposed location of the County Road #13 underpass is some 700 ft. farther from the west limit of our investigation, no estimate can be given. Berms would probably be required; however, the berm lengths and settlements of the County Road approach fills would depend upon the thickness and shear strength of the underlying marine clay at this location.

We trust that the foregoing will be sufficient for your purposes; if further information is required, please contact this Office.

K. G. Selby

KCS/8deF

K. G. Selby
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac
PRINCIPAL FOUNDATION ENGR.

cc: Foundations Files
Gen. Files

MEMORANDUM

TO: Mr. A. Sternac,
Principal Foundation Engineer,
Room 107, Lab. Building

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: September 14, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT: Rideau River Bridge N.B.L.
4.3 Miles North of Highway 43
W.P. 203-67-01, Site 3-264
Highway 416, District No. 8

69-B-90

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.

CSG:rd

C.S. Grebski,
Bridge Design Engineer

Attach.

c.c. Foundation Office

[Handwritten signature]

[Handwritten notes]
203-67-01-20

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MEMORANDUM

TO: Mr. A. G. Sterma,
Regional Bridge Planning Engineer,
KINGSTON, ONTARIO.

FROM: Road Design Section,
KINGSTON, ONTARIO.

ATTENTION:

DATE: May 8th, 1970.

OUR FILE NO.

IN REPLY TO

SUBJECT: S.B. 201-47-02 - Highway #416 - From Highway #43 Northerly
to Relocated County Road 13 -
S.B. 201-47-02 - Site - 2-288 - Rideau River Bridge N.D.D.

Further to your memo of April 28th, 1970, we have the following comments:

1. Our Consultants inform us that the profile shown on D-621-P is correct.
2. It will probably be 10 years or more before the S.B.L.'s of Highway 416 are constructed, would you therefore review the necessity for placing the south embankment fills for S.B.L. at this time.

This office will initiate the Property Request in the near future.

R. H. B. Bennett,
SR. PROJECT DESIGN ENGINEER.

WHS/mac

S.C. - J. Woods, De Leon, Cathar, Toronto

Copy sent to A.G. Sterma

John A. Wood

Mr. A.G. Sterma - Attn. Mr. K. Selby