

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 31F-18

DIST. 9 REGION EASTERN

W.P. No. 6-67-02

CONT. No. 73-186

W. O. No. 71-F-084

STR. SITE No. 29-192

HWY. No. 17 N

LOCATION BOMECHERE RIVER (RENEW
BY-PASS) BRIDGE

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: DOCUMENTS TO BE UNFOLDED BEFORE
MICROFILMED

FIELD RECONNAISSANCE REPORT
REQUIRED BY FOUNDATION SECTION
FOR

PC-89
SEPT. 1966

W.P. NO. 6-67-02 HIGHWAY NO. 17N DISTRICT 9 SMC PLAN NO. 9-EP-174 PROFILE NO. 9-EP-175
RIVER CROSSING ☒ GRADE SEPARATION ☐ R.R. X ☐ OTHER (SPECIFY) _____
ALTERNATE SCHEME (IF ANY) NO

EXISTING SITE CONDITIONS

DESCRIPTION:

TOPOGRAPHY: HILLY ☐ ROLLING ☐ VALLEY ☒ GULLIED ☐ FLAT ☐
VEGETATION: TREES ☒ BRUSH ☒ GRASS ☐ SWAMP ☐ FARM CROPS ☐ CLEARED ☐
SNOW COVER: 0"-6" ☒ 6"-12" ☐ >12" ☐
ROCK OUTCROP (SPECIFY LOCATIONS) None visible

UNDERGROUND UTILITIES:

UTILITY COMPANY

TELEPHONE NO. FOR DEFINITE LOCATION

1 None

2 _____

3 _____

4 _____

5 _____

EXISTING STRUCTURE(S): N.A.

FOUNDATIONS: SPREAD FOUNDATIONS ☐ SIZE _____ ELEVATION(S) _____
PILES ☐ TYPE _____ LENGTH(S) _____
DESIGN LOAD _____ T.S.F. _____ TONS/PILE _____
CONDITION OF STRUCTURE _____

APPROACHES: CUT ☐ FILL ☐ SIDE SLOPES _____
BERMS YES ☐ NO ☐

OTHER OBSERVATIONS (USE BACK OF SHEET TO DESCRIBE ANY FAILURES IN AREA, PAST PERFORMANCE OF EXISTING APPROACHES & STRUCTURE, ETC.)

ACCESSIBILITY

IS STRUCTURE LOCATED ON D.H.O. RIGHT OF WAY? YES ☐ NO ☒ IF NO,
HAS PERMISSION BEEN OBTAINED TO ENTER PROPERTY? YES ☒ NO ☐ IF NO,
PROPERTY OWNER(S):

NAME

ADDRESS

TELEPHONE NO.

1 _____

2 _____

3 _____

4 _____

WHO WILL OBTAIN NECESSARY PERMISSION? _____

HAS SITE BEEN SURVEYED & STAKED? YES ☒ NO ☐ IF YES, DATE OF MOST RECENT SURVEY _____

WILL CLEARING BE NECESSARY TO ENTER SITE AREA? YES ☒ NO ☐

IS SITE ACCESSIBLE TO WHEELED VEHICLES? YES ☐ NO ☒

IF RIVER CROSSING:

WILL A RAFT BE NECESSARY? YES ☒ NO ☐ IF YES, GIVE MAX. DEPTH OF WATER 8 (varies) FT.

CURRENT: SWIFT ☒ MODERATE ☐ SLOW ☐

DRILLING OPERATIONS

NEAREST SOURCE OF WATER (GIVE HAULING DISTANCE, IF KNOWN) At site

ADDITIONAL INVESTIGATION REQUIRED FOR THE FOLLOWING PURPOSES:

ALTERNATE SCHEME: YES ☐ NO ☒ IF YES, SPECIFY _____


HYDROLOGIC REASONS: YES ☐ NO ☐ IF YES, SPECIFY (SCOUR, ETC.) _____

REMARKS

NEAREST AVAILABLE ACCOMMODATION: Motels at Renfrew

OTHER COMMENTS: _____

DATE August 3, 1971


A. VanDalen for T. C. Kingsland

REGIONAL BRIDGE PLANNING ENGINEER

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

FILE 71-11084
INDEX

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

FROM: Bridge Section,
Kingston, Ontario.

ATTENTION: Mr. M. Devata

DATE: August 31, 1971.

OUR FILE REF.

IN REPLY TO

71-11085

71-11087

71-11088

SUBJECT:

W.P. 6-67-02, Site 29-192, Bonnechere River Bridge 71-11084
W.P. 7-67-02, Site 29-193, C.N.R. Overhead 71-11087
W.P. 7-67-03, Site 29-194, C.P.R. Overhead, Horton Twp. 71-11085
W.P. 7-67-04, Site 29-195, C.P.R. Overhead, Ross Twp. 71-11088
Highway 17N, District 9 - Ottawa

We are sending you herewith one print each of Bridge Site Plans for the above structures as follows:

E-5216-1	Site 29-192	Bonnechere River Bridge 71-11084
E-5219-1	Site 29-193	C.N.R. Overhead 71-11087
E-5218-1	Site 29-194	C.P.R. Overhead, Horton Twp.
E-5217-1	Site 29-195	C.P.R. Overhead, Ross Twp.

The proposed locations of the structures have been marked on the site plans. Field Reconnaissance Reports for these structures were mailed to you on August 10th and 17th.

One copy of each plan has been delivered by hand to your field staff on this date.

We would be pleased to have your report in due course.



T. C. Kingsland
Regional Bridge Planning Engineer

TCK/hl

Encls.

c.c. (with encls.)

Mr. S. McCombie

c.c. Mr. R. J. Forrest

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. M. Devata,
Supervising Foundations Engineer.

FROM: K. Ingham

ATTENTION:

DATE: March 3, 1972

OUR FILE REF.

IN REPLY TO

SUBJECT:

Foundation Investigation 71-11084
Bonnechere River Bridge, Hwy. 17

A brief description is given below for each of ten boreholes drilled to bedrock at this site, together with the appropriate bedrock elevation.

The rock, a medium to coarse grained marble, appears to contain areas of coarse porosity which together with a system of vertical fractures and variable weathering has resulted in much broken and ground core, and relatively poor recovery.

Hole No. 1 bedrock at 178.1

157.5 - 158.0 marble; light to medium grey; coarse grained, moderately fractured.

158.0 - 171.7 light grey coarse grained marble.

Hole No. 2 bedrock at 178.8

157.5 - 158.5 marble; light grey to white; coarse grained, porous; slightly weathered and moderately fractured.

158.5 - 168.5 marble; light grey; coarse grained; slightly weathered throughout.

Hole No. 3 bedrock at 207.7

74.2 - 84.5 marble; light to medium grey; coarse grained, variable porosity.

Hole No. 4 bedrock at 199.6

101.5 - 107.0 marble; light grey; coarse grained, slightly weathered.

107.0 - 116.3 light to medium grey coarse grained marble.

Hole No. 5 bedrock at 212.2

70 - 75.3 marble; light grey; coarse grained, variable porosity; upper 1.0 ft weathered and moderately patched, lower 2.5 ft. core badly broken to vertical joint.

Hole No. 6

bedrock at 213.5

68.0 - 72.0 marble; light to medium grey; coarse grained;
slightly weathered and moderately fractured.

72.0 - 84.5 light grey coarse grained marble.

Hole No. 8

bedrock at 230.0

115.5 - 125.0 marble; light grey; coarse grained; slightly
weathered throughout; top 8.0 ft. moderately
fractured.

Hole No. 9

bedrock at 205.7

96.8 - 100.5 marble; medium grey; coarse grained; coarse porosity;
slightly weathered and badly fractured.

100.5 - 109.5 marble; light to medium grey; coarse grained;
slightly weathered throughout; frequent sections of
broken core due to vertical joints.

Hole No. 10

bedrock at 199.3

112.1 - 120.0 marble; light to medium grey; coarse grained;
coarse porosity; slightly weathered throughout;
moderately fractured in the upper 4.0 ft.

120.0 - 131.7 marble; light to medium grey; coarse grained;
coarse porosity.

Hole No. 11

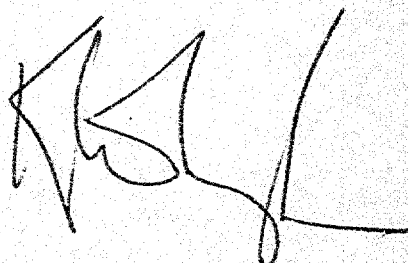
bedrock at 233.6

69.0 - 83.0 light grey coarse grained marble.

Hole No. 12

bedrock at 229.6

72.0 - 83.5 marble; light to medium grey; coarse grained;
slightly weathered throughout.



K. Ingham,
Geologist.

KI:nr

Department of Highways Ontario
Copy for the information of
A. Stermac

~~W.C. Kingland,~~
Reg. Bridge Planning Engr.,
Kingston Region.

Structural Office,
West Bldg., Downsview.

April 13, 1972.

Re: Bonnechere River Bridge,
Approx. 2 Mi. Northwest of Hwy. 17,
W.P. 6-67-02, Site 29-192,
Hwy. 17N(WBL), District 49.

71-11-084

Attached herewith are prints of the Preliminary Bridge
Plan Drawing 6-29-192-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is
\$1,150,000.00, which includes tender, materials, engineering and
sundry construction.

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

C.S. Grebski,
Structural Design Engineer.

CSG:sr
Attach.

c.c. A. McKim
B. Davis
A. Stermac (2)
J. Anderson
K. Forrest

2.0 Comments

M.S.

MEMORANDUM

TO: Mr. T. C. Kingsland, (2)
Regional Structural Planning Eng.,
Eastern Region, Kingston.

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

ATTENTION:

DATE: July 20, 1972.

OUR FILE REF.

IN REPLY TO JUL 28 1972

31F-18

FOUNDATION INVESTIGATION REPORT
For

Proposed Structure at the Crossing of
Hwy. #17 'New' and the Bonnechere River
Township of Horton, County of Renfrew
District No. 9 (Ottawa)
W.O. 71-11084 -- W.P. 6-67-02

CONT 73-186

Attached we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above-mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

AGS/ao
Attch.

cc: Messrs. D. W. Farren

B. R. Davis

A. Rutka

S. J. Markiewicz

J. E. Callaghan

B. J. Giroux

E. R. Saint

G. A. Wrong

B. A. Singh

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATIONS ENGINEER.

Foundations Files ✓
Documents

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-

FOUNDATION INVESTIGATION REPORT
For
Proposed Structure at the Crossing of
Hwy. #17 'New' and the Bonnechere River
Township of Horton, County of Renfrew
District No. 9 (Ottawa)
W.O. 71-11084 -- W.P. 6-67-02

1. INTRODUCTION:

Major reconstruction is proposed for that portion of Hwy. #17 extending from the Town of Arnprior westerly to the Town of Petawawa, in the County of Renfrew. A number of interchanges and structures will be required at the crossing of Hwy. #17 'New' and various roadways and railways. In addition, many rivers and creeks will have to be crossed.

The realignment of Hwy. #17 'New' will bypass the Town of Renfrew at a point about 1 mile north of the town. In connection with this bypass scheme the Foundation Office was requested to carry out a subsurface investigation at the site of the proposed structure at the crossing of Hwy. #17 'New' (W.B.L.) and the Bonnechere River, in the Township of Horton. The request was contained in a memo from Mr. T. C. Kingsland, Regional Structural Planning Engineer, Eastern Region, dated August 10, 1971. An investigation was subsequently carried out by this Office to determine the subsoil, bedrock and groundwater conditions at the site.

This report contains the factual results obtained from the investigation, together with the recommendations pertaining to the foundations of the proposed structure. In addition, a study was carried out to determine the stability of the existing as well as the proposed revised natural banks of the Bonnechere River Valley. The results of this study are

presented in this report, together with comments with regard to the measures necessary to ensure the long term stability of these banks.

Foundation reports for other structure, interchanges, creek and river crossings will be presented under separate cover.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The area under investigation is located along the Bonnechere River, specifically at a point about 1-1/2 miles north-east of the Town of Renfrew, in the Township of Horton, County of Renfrew.

The Bonnechere River is deeply incised into the topography in this area. Geologically speaking it is relatively youthful, which would tend to explain its tortuous, meandering nature. In this area the river valley is between 700 and 800 feet wide from crest to crest and approximately 100 feet deep. The water in the river is approximately 4 to 5 feet deep with the surface level being at about elevation 272. The brush and tree covered river banks have an irregular topography. Along the steeper western bank the slope varies from 1.4:1 to 2 to 1, while along the eastern bank the slope ranges from 2:1 to 3:1.

The table land, outside of the river banks is gently undulating in relief between about elevations 350 to 380. This non-built-up area is being used for farming purposes.

In Renfrew County there are prominent east-west trending scarps (fault zones) on both sides of a valley which encompasses the area being investigated. The south-westerly one, lying south of Calabogie Lake and Clear Lake, is known as the St. Patrick fault, while on the northeastern side the Conlonge fault separates the valley from the Laurentian Plateau. Thus a block, 35 miles in width, has been downdropped, forming a depression which is geologically known as the "Ottawa-Bonnechere" graben. The Ottawa River is located within this downdropped block. Within it are many minor breaks and disconformities, the most important of which as far as this

site is concerned, is the Dore fault. This is an east-west trending fault which crosses the Bonnechere River Valley at a point immediately west of the site.

The valley is situated in the physiographic region known as the "Ottawa Valley Clay Plains," specifically in "Bonnechere Clay Plains" subsection. Here extensive clay deposits are interrupted by ridges of sand and rock. The sensitive marine clay, which was deposited in the geologic past in the Champlain Sea, varies markedly in thickness over the region; in some localized areas it is known to extend for depths in excess of 200 feet. The clay is generally underlain by glacial drift deposits complexly interbedded with granular deposits of glacio-fluvial and glacio-lacustrine origin. The combined thickness of these deposits is quite variable; it, however, generally ranges from 30 to 100 feet. Much of the glacial material was reworked and redistributed by the Champlain Sea. The overburden is underlain by bedrock of Precambrian Age.

The drainage in the general area of the site is provided by the Bonnechere River.

3. FIELD AND LABORATORY WORK:

Twelve sampled boreholes, 10 of which were accompanied by a dynamic cone penetration test, were put down at the site. The borings and cones were advanced by using conventional diamond drill rigs adapted for soil sampling purposes.

Samples of the overburden were obtained, at specified intervals, in a 2" O.D. split-spoon sampler, which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. In the cohesive portion of the overburden, the testing programme was supplemented by taking some 2" and 3" I.D. Shelby tubes, which were manually pushed into the soil. In addition, field vane tests were carried

out, where possible, to determine the undrained shear strength of the cohesive stratum. Bedrock was proven in eleven of the boreholes by obtaining either AXT or BX size rock core samples.

Groundwater level observations were carried out, during the period of the investigation, in the open boreholes.

The soil, bedrock and groundwater conditions, encountered at the boring locations, are presented on the Record of Borelog sheets contained in Appendix I of this report. The location and elevation of the various boreholes were provided by personnel from the Eastern Region Engineering Surveys Section. The elevations in this report are referenced to a Geodetic datum. The boring locations are shown in plan on Drawing No. 71-11084A, together with an estimated stratigraphical profile across the site.

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

- Bulk Density
- Natural Moisture Content
- Atterberg Limits
- Grain-Size Distribution
- Undrained Shear Strength
- Strength in Terms of Effective Stresses
- Consolidation Characteristics

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

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The extent and composition of the overburden, within the area under investigation, varies markedly. Over the major portion of the site the surficial deposit is composed of a

stiff to hard silty clay to clayey silt of marine origin. The thickness of this cohesive stratum ranges from 4 feet, on the valley floor, to as much as 75 feet on the west bank of the Bonnechere River Valley. The cohesive stratum is underlain by complexly interbedded granular deposits of glacio-fluvial or glacio-lacustrine origin, whose thickness ranges from 63 to 108 feet. The relative density of these deposits ranges from loose, in the upper portion, increasing to very dense with depth; in the lower regions the granular soils tend to be quite bouldery.

The overburden is underlain by marble bedrock of Precambrian Age. The surface of the bedrock was encountered between elevations 177.5 and 233.5.

The stratigraphy encountered in the borings is plotted on the Record of Borelog sheets. An estimated lithographical profile across the site, inferred from the boring data, is plotted on Drawing No. 71-11084A. The subsoil and bedrock types encountered, from ground surface downward, are presented in the subsections to follow.

4.2) Silty Clay to Clayey Silt:

A surficial stratum of silty clay to clayey silt with a trace of sand and gravel is generally present beneath a thin topsoil cover (1/2 to 1-1/2 feet thick). This stratum, which is of marine origin, is not present at B.H.'s #11 and #12, located on the east bank of the Bonnechere River. The thickness of the cohesive stratum ranges from 4 feet, on the valley floor, to as much as 75 feet on the west bank of the river. In general, the cohesive stratum is more extensive on the west bank of the river. Numerous seams and layers of silt and sand, which range from 1 inch to up to 2 feet in thickness, are present throughout the stratum.

The engineering properties of the cohesive subsoil, as determined by the field and laboratory testing, are plotted on the Record of Borelog sheets and summarized in tabular form below.

<u>Identity Tests</u>		<u>Range (Average)</u>
Bulk Density (p.c.f.)	(γ)	114 - 126
Liquid Limit (%)	(W_L)	22 - 40 (33)
Plastic Limit (%)	(W_P)	15 - 28 (22)
Natural Moisture Content (%)	(W)	25 - 33 (30)
Liquidity Index	(I_L)	0.4 - 1.5 (0.8)
<u>Undrained Shear Strengths (C_u) (p.s.f.)</u>		
In Situ Field Vane Tests		1,400 to >2,000
Laboratory Tests		1,200 to >2,000
<u>Standard Penetration Resistance Values (N) (Blows/ft.)</u>		
		2 - 18

Compressibility Characteristics

Void Ratio (e_o)	1 Test {	0.93
Compression Index (C_c)		0.17
Degree of Preconsolidation ($P_c - P_o'$) (p.s.f.)		5,400

The Atterberg Limit Test results, given in the Table, are also summarized on the Plasticity Chart, Figure #1. The testing indicates that the cohesive stratum is inorganic with the plasticity being typically in the intermediate range. The natural moisture content is quite variable throughout the stratum; this was indicated by the wide range in the liquidity indices (0.4 to 1.5).

The field and laboratory undrained shear strength results are plotted on the Record of Borelog sheets. The results indicate that the consistency of the silty clay to clayey silt stratum varies from stiff to hard.

The consolidation characteristics of the cohesive stratum were determined by carrying out a laboratory oedometer

test, the results of which are shown as a Void Ratio vs. Pressure plot on Figure #2. Referring to the table it can be seen that the silty clay is preconsolidated to a degree at least 2.5 t.s.f. in excess of the existing overburden pressure.

In addition to the more routinely employed tests previously described, an additional laboratory programme was carried out to determine the engineering properties of the cohesive stratum in terms of effective stresses. This was done by carrying out an isotropically consolidated undrained triaxial compression test, in which the excess pore water pressure buildup and eventual dissipation, due to the applied load, was monitored throughout (CIU test). The results of this testing are plotted on Figure #3, and summarized below.

c' (Apparent Effective Cohesive Intercept) - 0

ϕ' (Apparent Effective Angle of Friction) - 28.5°

4.3) Granular Deposits:

The cohesive stratum, where present, or a thin topsoil cover elsewhere, is underlain by extensive glacial and/or interglacial granular deposits. The overall thickness of these deposits varies from 63 to 108 feet. The granular subsoil can be subdivided into a number of separate sheets, each of which has distinct characteristics and engineering properties. These sheets will be discussed separately in the paragraphs to follow.

4.3.1) Silty Sand to Sandy Silt (Upper Sheet):

Over the major portion of the site the upper granular deposit is composed of a silty sand to sandy silt with a trace of gravel. The thickness of this deposit ranges from 4 feet (B.H. #8) to 46.5 feet (B.H. #9); in general it was found to be most extensive on the west bank of the Bonnechere River Valley. Numerous random clayey silt seams and layers are present throughout this granular material; the thickness of these zones range anywhere from 1/2 inch to up to 1 foot. The presence of these cohesive seams and layers are common to this upper sheet only; as such, they differentiate between this area and the underlying

granular deposits. Grain-size distribution testing was carried out on samples obtained from this material. The results are plotted in envelope form on Figure #4.

Standard penetration testing was performed within this sheet; the results are plotted on the Record of Borelog sheets. This testing gave 'N' values which range from 3 blows/ft. in the upper portion, increasing to in excess of 100 blows/ft. with depth. Based on these results it is estimated that the relative density of this sheet varies from loose to very dense.

4.3.2) Silty Sand to Sand With Some Gravel (Lower Sheet):

The upper granular sheet, where present, and the clayey silt elsewhere, is underlain by a complexly interbedded sequence of coarse grained granular sheets. The upper zone is generally composed of a silty sand to sand with a trace to some gravel throughout. The lower portion, however, is composed of a silty sand to sand with gravel - i.e., the gravel content is greater than that of the previous sheet. At B.H.'s #5 and 7 this sequence is interrupted, at these locations the coarser of the two sheets overlies the finer. Further, at some of the boring locations one or the other of these sheets is absent. The combined thickness of these sheets ranges from 24 feet (B.H. #3) to 91 feet (B.H. #8). Grain-size distribution testing was carried out, on samples obtained from these deposits using 2" O.D. sampling equipment. The results are plotted in envelope form on Figure #4.

The standard penetration testing, carried out within the deposit, gave 'N' values which range from 14 blows/ft. to greater than 100 blows/ft. Based on these values it is estimated that the relative density varies from compact to very dense, being generally in the dense to very dense range.

A bouldery zone is often present immediately beneath the lower granular sheets and above the bedrock. It was necessary to use diamond drilling techniques to advance the borings through this bouldery area. The thickness of the bouldery zone, where present, was found to range from 4 to

25.5 feet. The boulders encountered varied from 5 to 18 inches in size. An exception to this pattern occurred at B.H. #8, put down on the east bank of the river. Here the boulders were found to be present throughout the granular deposits.

4.4) Marble Bedrock:

The overburden is directly underlain by light grey medium to coarse grained marble bedrock of Precambrian Age. The bedrock was proved in 11 of the boreholes by obtaining between 6 and 27 feet of either AXT or BX size rock core samples.

The bedrock core samples were examined by Mr. K. W. Ingham, Geologist, Department of Transportation and Communications. Mr. Ingham presented the results of his bedrock examination, as well as an interpretation of the geologic conditions existing at this site, in a letter to this Office dated March 3, 1972. A copy of this letter is located in Appendix II of this report. The bedrock description, presented in the paragraphs to follow, is an excerpt from this letter.

The surface of the bedrock varies from elevation 177.5 (B.H. #1) to 233.5 (B.H. #11). The boring data obtained would appear to indicate that the bedrock surface slopes gently in a westerly direction.

The marble bedrock appears to contain areas of coarse porosity, which together with a system of vertical fractures and variable weathering has resulted in much broken and ground core. In some areas this has led to poor recovery during the drilling phase. Based on Mr. Ingham's examination the upper 1 to 8 feet was often found to be fractured; in some instances a transitional zone of weathering up to 9 feet in depth was then encountered. These fractured and weathered zones are, in turn, underlain by sound bedrock.

5. GROUNDWATER CONDITIONS:

The groundwater level conditions across the site were carried out, during the period of the investigation, in

the open boreholes. These observations are shown on the individual borelog sheets and are summarized on Drawing No. 71-11084A.

The observations indicated that the groundwater level across the site varies from elevation 272.5, along the valley floor in the vicinity of the Bonnechere River, to elevation 283 on the high ground along the banks of the river. These elevations correspond to depths below existing ground surface of from 4.5 to 64.5 feet. The water level, in the river at the time of the investigation, was at about elevation 272.3.

Referring to the drawing it can be seen that there is a natural hydrostatic gradient towards the Bonnechere River. This would confirm the fact that the Bonnechere River controls the drainage in this area.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

Proposed Hwy. #17 'New' (W.B.L.) is to by-pass the Town of Renfrew. A structure will be required at the crossing of this highway and the Bonnechere River, at a point about 1-1/2 miles north-east of the Town of Renfrew, in the Township of Horton, County of Renfrew. It is understood that the 36 feet wide structure is to have six spans (140' - 170' - 170' - 170' - 170' - 140'). The profile grade of Hwy. #17 'N', in the vicinity of the crossing is to vary from elevation 362 to 365. To realize this grade approximately 26 feet of fill will be placed along the west bank of the river, while only a nominal fill height will be required along the east bank. The bridge deck, however, will be approximately 90 feet above the level of the river bed.

Over the major portion of the site the surficial deposit is composed of a stiff to hard silty clay to clayey silt. The

thickness of this cohesive stratum ranges from 4 feet on the valley floor, to as much as 75 feet on the west bank of the Bonnechere River Valley. The cohesive stratum is underlain by loose to very dense complexly interbedded granular deposits of glacio-fluvial or glacial-lacustrine origin, whose thickness ranges from 63 to 108 feet. The overburden is underlain by marble bedrock of Precambrian Age.

From a foundation engineering point of view there are two main considerations:

- i) the long-term stability on the natural river valley, including the superimposed new fill sections, and
- ii) the foundation support of the various structural elements.

The two considerations will be discussed separately in the subsections to follow.

6.2) Stability Considerations Related to Bonnechere River Valley:

6.2.1) Existing Conditions:

It is a well known fact that the natural steep-sided valleys in this area are often in a state of limiting equilibrium. In certain areas slope failures have occurred; in some instances these take the form of minor slumps while in others they are of major proportions. One such major slide was observed approximately 1/4 mile upstream of the proposed crossing. The topography in the vicinity of the crossing would seem to indicate that some slumping has occurred in this area. In a report to the Foundations Office, dated January 20, 1972, Mr. B. Sen Mathur, Airphoto Interpretation Engineer, outlined the approximate limits of this slumping. This report is enclosed in Appendix II. It is considered that the instability in this area originated within the cohesive stratum and upper relatively loose zone of the stratified granular deposit.

The stability of a critical section located on the west bank of the river, immediately north of the proposed

structure, was studied in terms of effective stresses. In this method the stability is governed by the stress-strain characteristics of the subsoil as well as the pore water pressure fluctuations within the slope. The approach used was that developed by Messrs. Bishop and Morgenstern*. The following were assumed for computational purposes.

a) Configuration of Slope (Immediately North of Proposed Structure)

Height - 72' (above river bed)

Average Slope - 1.5:1

b) Engineering Parameters (Predicted From Laboratory Testing Results)

	<u>Clayey Silt</u>	<u>Upper Silty Sand to Sandy Silt</u>
Apparent Effective Cohesive Intercept (C')	0	0
Apparent Effective Angle of Internal Friction (ϕ)	29°	32°
Pore Pressure Ratio (r_u) = 0.2		

The results of the computations have indicated that such critical areas have a factor of safety of about unity - i.e., the steeper portions of the west bank of the Bonnechere River are in a state of limiting equilibrium.

6.2.2) Recommended Slope Treatment:

For reasons discussed in the previous subsection it will be necessary to flatten the west bank of the Bonnechere River, in the vicinity of the structure, in order to ensure the long-term stability of this area. Analyses were, therefore, carried out to determine what geometric configuration would most efficiently provide an acceptable level of stability (for design require F.S.= 1.3). These analyses were based on a method developed by

*Bishop, A.W. and Morgenstern, N., "Stability Coefficients for Earth Slopes," Geotechnique, Vol. 10, No. 4, 1960.

N. Janbu*. Using this method the critical surface need not be cylindrical in shape, instead it may assume any general configuration and thus maximize its length within zones of relative weakness. The assumptions made in these computations as well as the results are shown on Drawing No. 72-11084B.

Referring to the drawing it can be seen that the following recommendations are made:

- i) the steeper portions of the bank should be flattened to 2:1,
- ii) slopes flatter than 2:1 should be left intact,
- iii) new earth fill should be placed with standard 2:1 slopes, and
- iv) a 25 feet wide bench should be constructed at elevation 305.

The proposed lateral limits of this treatment are also included on the aforementioned drawing.

On the east bank of the river the upper cohesive deposit is thin and more competent. Thus, this bank would tend to be more stable than the west. In order to ensure the long-term stability of this bank as well, however, it is recommended that, within the area specified on Drawing No. 72-11084B, all steep portions of the slope be flattened to 2:1, while those flatter than this be left in tact.

Uncontrolled surface runoff could detrimentally effect the surficial stability of the natural valley banks. This can be prevented by providing an adequate positive drainage system, and seeding and mulching the slopes. The top of the banks, in the vicinity of the crossing, will have to be protected against the scour action of the Bonnechere River. This could be accomplished by providing a rip-rap cover to a level at least 2 feet above the recorded high water level.

*Janbu, N., "Stability Analysis of Slopes with Dimensionless Parameters," Harrard Soil Mechanics Series, No. 46, 1954.

6.3) Settlement Considerations - Approach Fills:

Up to 26 feet of fill will be placed along the west bank of the valley to realize the proposed profile grade, while only nominal fill will be placed on the east bank. The extensive, highly preconsolidated cohesive stratum, located beneath the former, will settle due to the imposed loading. This settlement, which will be of a recompression nature, will be of the order of 4 to 5 inches. The major portion of it should be realized within a period of 12 to 18 months.

6.4) Structure Foundations:

The presence of the cohesive stratum at a shallow depth below ground surface across the site precludes the economical use of shallow spread foundations to support the structure elements. It is considered that the most practical type of foundations would be end-bearing piles. End-bearing piles can be driven to practical refusal within the lower often bouldery silty sand to sand deposit, or where this deposit is less extensive to bedrock. In the former case the pile driving in the field should be controlled by the Hiley Dynamic Pile Driving Formula, in accordance with current M.T.C. practices. For estimating purposes, it can be assumed that the pile tips will be located at the elevations given in the following table:

<u>Location</u>	<u>Approx. Station</u>	<u>Estimated Tip Elevation</u>	<u>End-Bearing Deposit</u>	<u>Reference B.H.'s</u>
West Abut.	431+00	195 to 205	Granular Deposit	1 and 2
Pier #1	432+40	195 to 205	Granular Deposit	1 and 2
Pier #2	434+10	205 to 208	Bouldery Zone or Bedrock	9 and 10
Pier #3	435+80	210 to 214	Bouldery Zone or Bedrock	3 and 4
Pier #4	435+50	237 to 242	Granular Deposit	5 and 6
Pier #5	439+20	275 to 280	Granular Deposit	11 and 12
East Abut.	440+60	295-S. End 310-N. End	Granular Deposit	7 and 8

All the piles, with the exception of those supporting the west abutment, can be designed using the ultimate capacity of the pile section chosen. For instance, 12BP74 steel H-piles can be designed for 95 tons/pile.

The foundation subsoil, in the vicinity of the west abutment, will settle due to the imposed fill loading (refer to subsection 6.3). This downward movement will place a negative skin frictional load on the piling members, which should be taken into consideration in design. At this location only it is recommended that the design capacity be determined by using a value of 85 percent of the ultimate, i.e., 12BP74 sections can be designed using an allowable value of 80 tons/pile.

A minimum of 4 feet of earth cover should be provided above the base of the pile caps for frost protection purposes. Further, no bouldery or rock fill should be placed in areas where piles are to be driven.

7. MISCELLANEOUS:

The field work, performed during the period of August 23 to October 14, 1971, was carried out under the supervision of Mr. W. G. Hutton, Project Foundations Engineer.

The drilling equipment used was owned and operated by the F. E. Johnston Drilling Company Ltd., Ottawa.

This report was written by Mr. B. T. Darch, Senior Foundations Engineer, and reviewed by Mr. M. Devata, Supervising Foundations Engineer.

B. T. Darch
B. T. Darch, P. Eng.

M. Devata
M. Devata, P. Eng.



BTD/ao

July 20, 1972.

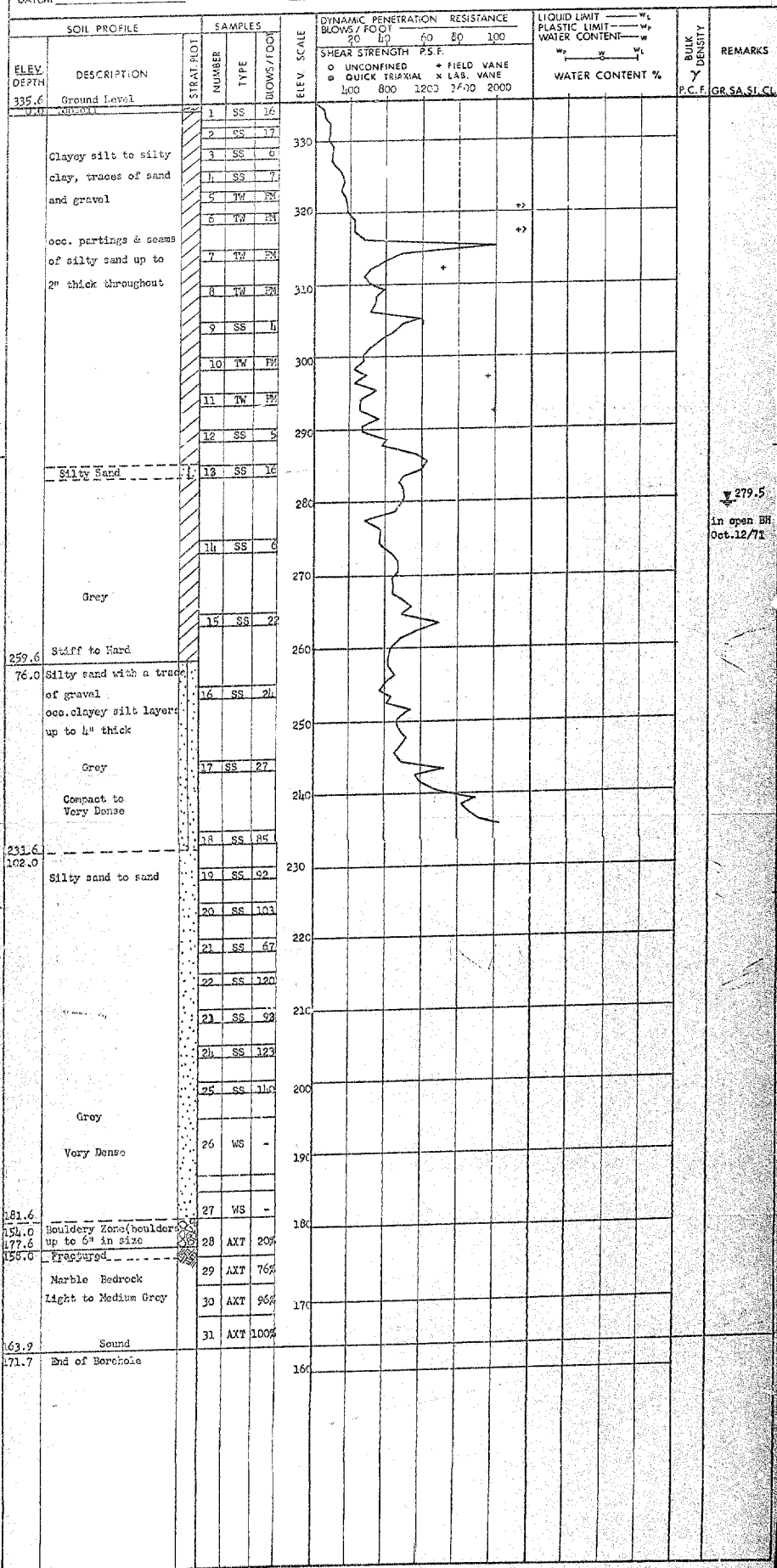
APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 71-1108h LOCATION Sta. 431 + 95 17' Rt. ORIGINATED BY WH
 BORING DATE Oct. 1, 4, 5, 6, 7, 8, & 11, 1971 COMPILED BY SD
 W.P. 6-67-92 BOREHOLE TYPE Washboring-NX, BY AX Casing-AXT Rock Core, Cone CHECKED BY

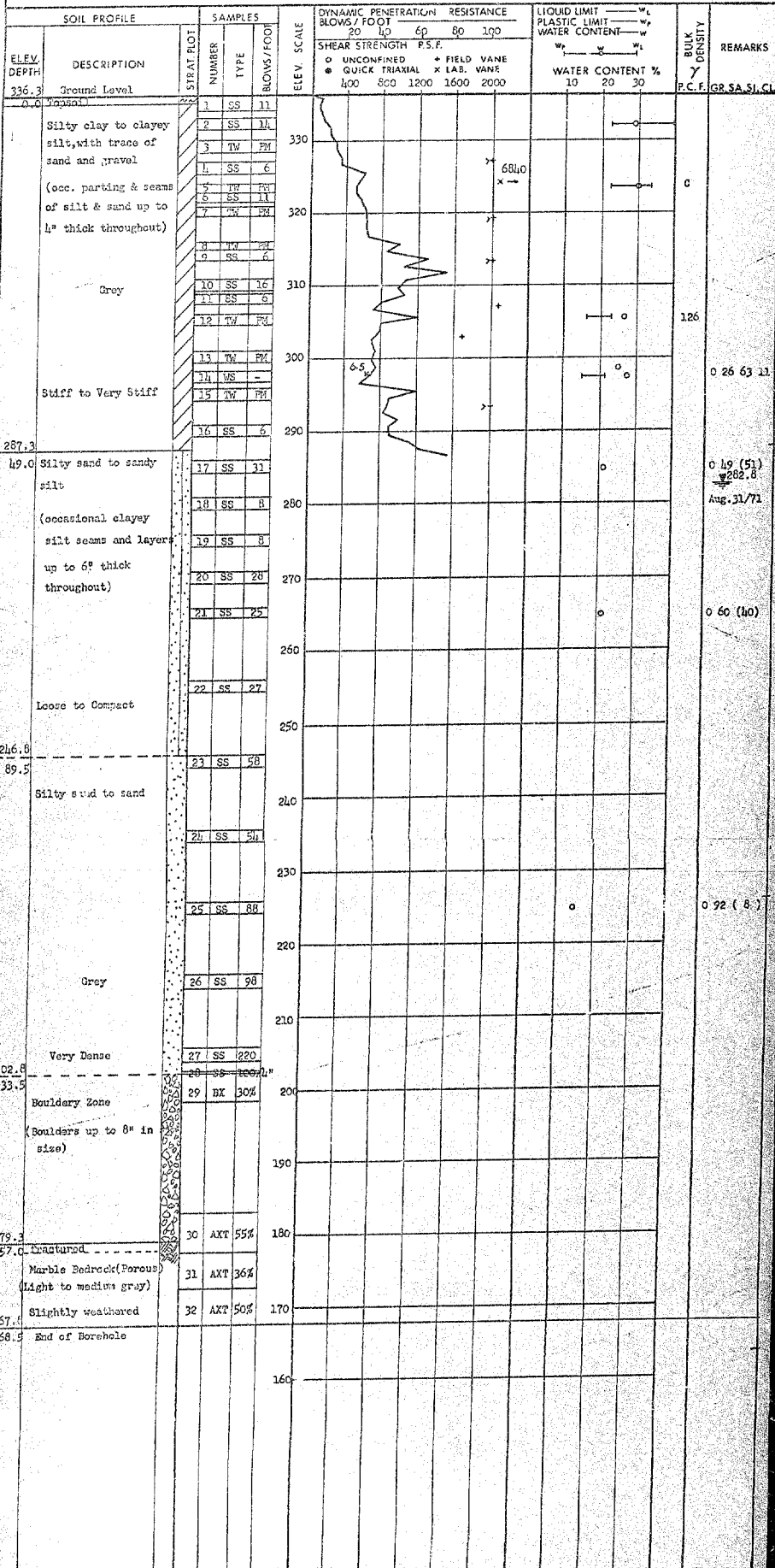


DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 71-11084 LOCATION Sta. 432+05 20' L.S. ORIGINATED BY WH
 W.P. 6-67-02 BORING DATE Aug. 23, 24, 25, 26 & 31, 1971 COMPILED BY SO
 DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX, AX Casing-BX, AXT Rock Core; Core CHECKED BY



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 71-11084 LOCATION Sta. 131 + 95 20' Rt. ORIGINATED BY WH
W.P. 6-67-02 BORING DATE Aug. 24, 25, 26, & 27, 1971 COMPILED BY HR
DATUM Geodetic BOREHOLE TYPE Washboring-BX, BX Casing; BX Rock Core; Cone CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.		WATER CONTENT %				
							c_u	c_v	w_p	w_L			
281.9	Ground Level						20	40	60	80	100		
0.0	Clayey silt with a trace of sand, (occ. sand & silt seams)		1	SS	9	280							
1.0	Stiff		2	SS	14								
272.9	Silty sand with a trace of gravel		3	SS	8								
9.0	(occ. clayey silt layers up to 1' thick throughout)		4	SS	3	270							
	Grey		5	SS	5								
			6	SS	6	260							
			7	SS	14								
			8	SS	10	250							
			9	SS	27								
			10	SS	24	240							
			11	SS	15								
			12	SS	54	230							
231.9	Loose to Dense		13	SS	106	220							
50.0	Silty sand with gravel.		14	SS	94	210							
	Grey		15	SS	112								
			16	SS	61								
207.7	Very Dense		17	BX	08%	200							
74.2	Marble Bedrock		18	BX	08%								
	Light to Med. Grey		19	BX	08%								
197.4	Sound		20	BX	08%								
84.5	End of Borehole												

DEPARTMENT OF HIGHWAYS- ONTARIO

MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 71-1108h

LOCATION Sta. 434 + 95 20' Lt.

ORIGINATED BY WH

W.P. 6-67-02

BORING DATE Aug. 31, Sept. 1, 2, 3, & 7, 1971

COMPILED BY HR

DATUM Geodetic

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

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT PLASTIC LIMIT WATER CONTENT			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE		20	40	60	80	100	W _p	W _L	W _u		
301.1	Ground Level					SHEAR STRENGTH P.S.F.					WATER CONTENT %				
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE									
						400	800	1200	1600	2000	10	20	30		
0.0	Clayey silt to silty clay with traces of sand & gravel (occ. sandy silt partings)		1	SS	7										
			2	SS	21										
			3	SS	21										
			4	SS	11										
286.6	Stiff to Hard		5	SS	22										
			6	SS	12										
14.5			7	SS	33										
	Silty sand to sandy silt		8	SS	6										
	(occ. layers of clayey silt up to 4" thick throughout)		9	SS	5										
			10	SS	7										
			11	SS	16										
	Grey		12	SS	15										
			13	SS	17										
251.6			14	SS	35										
49.5	Silty sand to sand														
	Grey		15	SS	36										
	Compact to Dense		16	SS	105 7/16"										
			17	SS	14										
216.1															
85.0	Bouldery Zone (boulders up to 8" in size)		18	AXT	37%										
			19	AXT	4%										
			20	AXT	44%										
199.6															
101.5	Weathered		21	AXT	72%										
	Marble Bedrock (Porous)		22	AXT	45%										
	Light to Medium Grey Sound		23	AXT	82%										
184.8			24	AXT	65%										
116.3	End of Borehole														

114.0

 274.8
 In open BH
 Sept. 7/71

0 47 42 11

JOB 71-11081 LOCATION Sta. 137 + 95 20' R.L.
W.P. 6-67-02 BORING DATE Aug. 30 & 31, Sept. 2, 1971
DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX Casing-BX Rock Core; Cone
ORIGINATED BY ML
COMPILED BY HR
CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					WATER CONTENT %				
							20	40	60	80	100	w_p	w	w_L		
						SHEAR STRENGTH P.S.F.										
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE										
						400 800 1200 1600 2000					10 20 30					
282.2	Ground Level		1	SS	5	280										
0.0	Clayey silt, occ. sand layers throughout.		2	SS	17											
1.0	Very Stiff		3	SS	80											
277.2			4	SS	155											
5.0	Sand & gravel with some silt.		5	SS	100/5"	270										
	Grey		6	SS	60											
262.2	Very Dense		7	SS	68	260										
20.0	Silty sand to sand (occasional seams of clayey silt up to 1/2" thick throughout)		8	SS	77											
	Grey		9	SS	121	250										
			10	SS	81	240										
			11	SS	131/6"											
			12	SS	94/6"											
	Very Dense		13	SS	103/6"	230										
227.7			14	SS	155/6"											
54.5	Bouldery Zone (Boulders up to 8" in size)		14	SS	181											
			15	SS	125/3"	220										
			16	BX	0%											
			17	SS	100/1"											
			18	BY	33%											
212.2	Fractured		19	BX	0%	210										
70.0	Marble Bedrock		20	BX	60%											
206.9	Grey Weathered		21	BX	26%											
75.3	End of Borehole					200										

JOB 71-11084 LOCATION Sta. 138 + 35 17' Lt.

ORIGINATED BY WH

W.P. 6-67-02 BORING DATE Sept. 7, 8 & 9, 1971

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Washboring-NX, BXL Casing; BX, AXT Rock Core; Cone

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLT.	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.						WATER CONTENT % 10 20 30	
							BLOWS / FOOT							
							P.S.F.							
281.5	Ground Level													
0.5	Clayey silt (numerous layers of silty sand)		1	SS	6	280								
275.5	Stiff		2	SS	14									
6.0	Sand to silty sand with a trace to some gravel.		3	SS	25									
			4	SS	20									
			5	SS	37									
			6	SS	45									
			7	SS	44									
			8	SS	88									
			9	SS	93									
	Compact to Very Dense		10	SS	29									
			11	SS	162									
			12	SS	161									
31.5		13	SS	257										
50.0	Sand and gravel													
	Very Dense													
21.5		14	SS	107										
60.0	Bouldery Zone (boulders up to 8" in size)		15	BX	29%									
12.5			16	BX	32%									
59.0	Weathered		17	AXT	53%									
	Marble Bedrock (Porous)		18	AXT	70%									
	Light to Medium Grey		19	AXT	65%									
27.0	Sound													
14.5	End of Borehole													


9 90 (10)
272.5

Sept. 9/71

17 71 (12)

JOB 71-1108h LOCATION Sta. 440 + 55 17' Rt. ORIGINATED BY WH
W.P. 6-67-02 BORING DATE Sept. 23, 24, 25 & 27, 1971 COMPILED BY SO
DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX Casing-BX Rock Core CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L PLASTIC LIMIT — w_P WATER CONTENT — w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS/FOOT 20 40 60 80 100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE	400 600 1200 1600 2000	WATER CONTENT % 20 40 60					
354.0	Ground Level														
0.0	10.50 ft														
0.5	Clayey silt with trace of sand & gravel		1	TM	PM	350									
	occ. seams of silty sand up to 2" thick throughout.		2	TM	PM										
			3	SS	17										
			4	TM	PM										
			5	SS	14										
338.5	Very Stiff to Hard					340									
15.5	Sand to sand with gravel		6	TM	PM										
			7	SS	54										
	occ. clayey silt seams up to 3" thick in the upper 4'.		8	SS	19										
			9	SS	49	330									
	Grey		10	SS	33	320									Hole Dry
	Compact to Very Dense		11	SS	34										
314.0			12	SS	144	310									
40.0	Silty sand with trace of gravel		13	SS	81										
			14	SS	104	300									
	Grey		15	SS	114										
	Very Dense		16	SS	164	290									
			17	SS	171										
286.0			18	SS	110										
68.0	Bouldery Zone (Boulders up to 6" in size)		19	RC	20%	280									
279.5															
74.5	End of Borehole					270									

DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE No. 8		FOUNDATION SECTION
MATERIALS & TESTING OFFICE				
JOB	71-11084	LOCATION	Sta. h40 + 55 17' Lt.	
W.P.	6-67-02	BORING DATE	Sept. 1, 2, 7, 8, 9, 10, 15, 16, 21 & 22, 1971	
DATUM	Geodetic	BOREHOLE TYPE	Washboring-NX, BK, AX Casings; BX, AXT Rock Core	
		ORIGINATED BY	ML	
		COMPILED BY	SO	
		CHECKED BY		

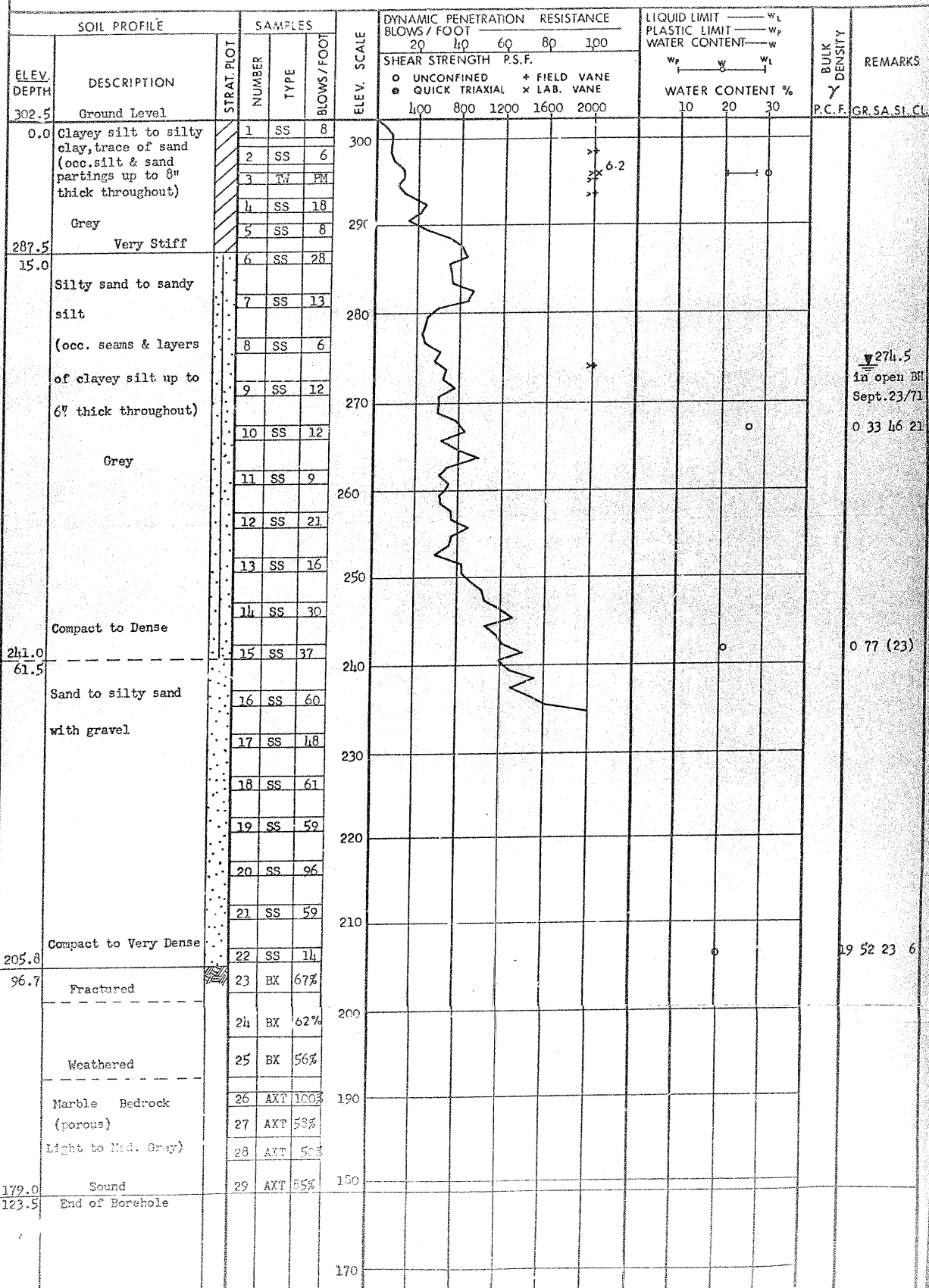
SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT					PLASTIC LIMIT — w_p				
						SHEAR STRENGTH P.S.F.					WATER CONTENT %				
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE									
						20	40	60	80	100					
						400	800	1200	1600	2000					
345.5	Ground Level		1	SS	9										
344.0	Topsoil		2	SS	13										
1.5	Clayey silt to silty clay with trace of sand		3	SS	13										
	(occ. seams & layers of clayey silt up to 1" thick)		4	WS	11										
			5	SS	12										
			6	SS	11										
			7	SS	12										
			8	SS	8										
325.0	Stiff to Very Stiff		9	SS	16										
20.5	Silty sand with clayey silt seams. Compact		10	SS	16										
321.0			11	SS	16										
24.5	Sand and gravel (boulders up to 9" in size throughout)		12	SS	172										
			13	BX	15%										
			14	BX	55%										
			15	SS	28										
			16	BX	41%										
			17	BX	20%										
			18	SS	109/10"										
			19	SS	150										
			20	SS	150										
			21	SS	60										
			22	SS	49										
			23	SS	64										
			24	SS	113										
			25	SS	87										
			26	SS	170/10"										
			27	SS	61										
			28	BX	20%										
			29	SS	14										
			30	SS	74										
			31	BX	62%										
			32	SS	41										
			33	BX	20%										
			34	SS	72										
			35	BX	16%										
			36	SS	105										
			37	BX	10%										
			38	AXT	50%										
			39	SS	29/10"										
			40	AXT	16%										
			41	AXT	30%										
230.0	Marble Bedrock		42	AXT	35%										
115.5	Light Grey		43	AXT	45%										
	Fractured		44	AXT	78%										
	Slightly Weathered														
215.7	Sound														
129.8	End of Borehole														

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 9

FOUNDATION SECTION

JOB 71-11084 LOCATION Sta. 433 + 55 17' Rt. ORIGINATED BY WH
 W.P. 6-67-02 BORING DATE Sept. 10, 14, 15, 21 & 22, 1971 COMPILED BY SO
 DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX, AX Casing; BX, AXT Rock Core; CONCHECKED BY



DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 9

FOUNDATION SECTION

JOB 71-11084

LOCATION Sta. 433 + 55 17' Rt.

ORIGINATED BY WH

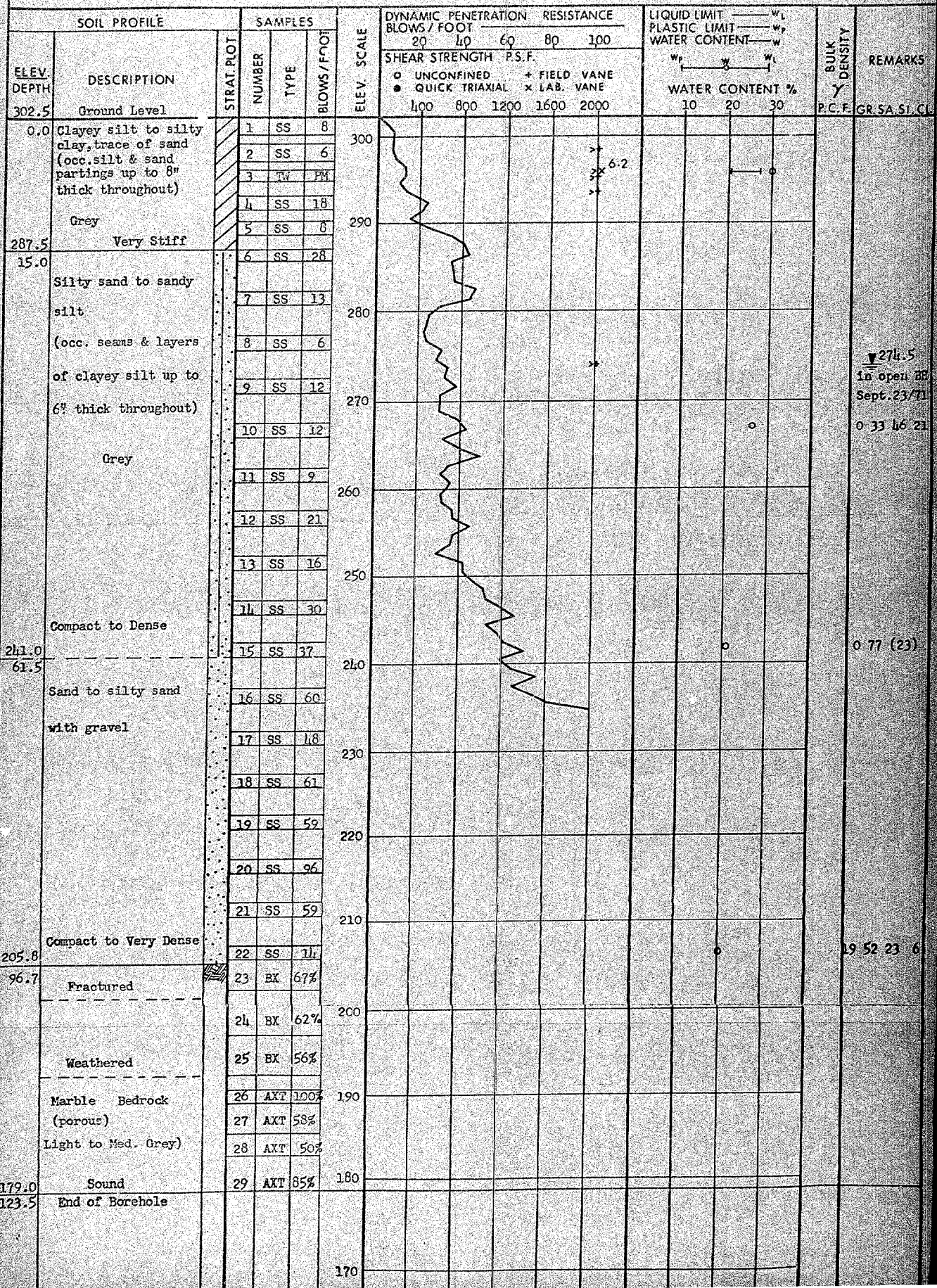
W.P. 6-67-02

BORING DATE Sept. 10, 14, 15, 21 & 22, 1971

COMPILED BY SOT

DATUM Geodetic

BOREHOLE TYPE Washboring-NX, BX, AX Casing; BX, AXT Rock Core; Checked BY



DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No.10

FOUNDATION SECTION

JOB 71-11084

LOCATION Sta. 433 + 55 17' Lt.

ORIGINATED BY DF

W.P. 6-67-02

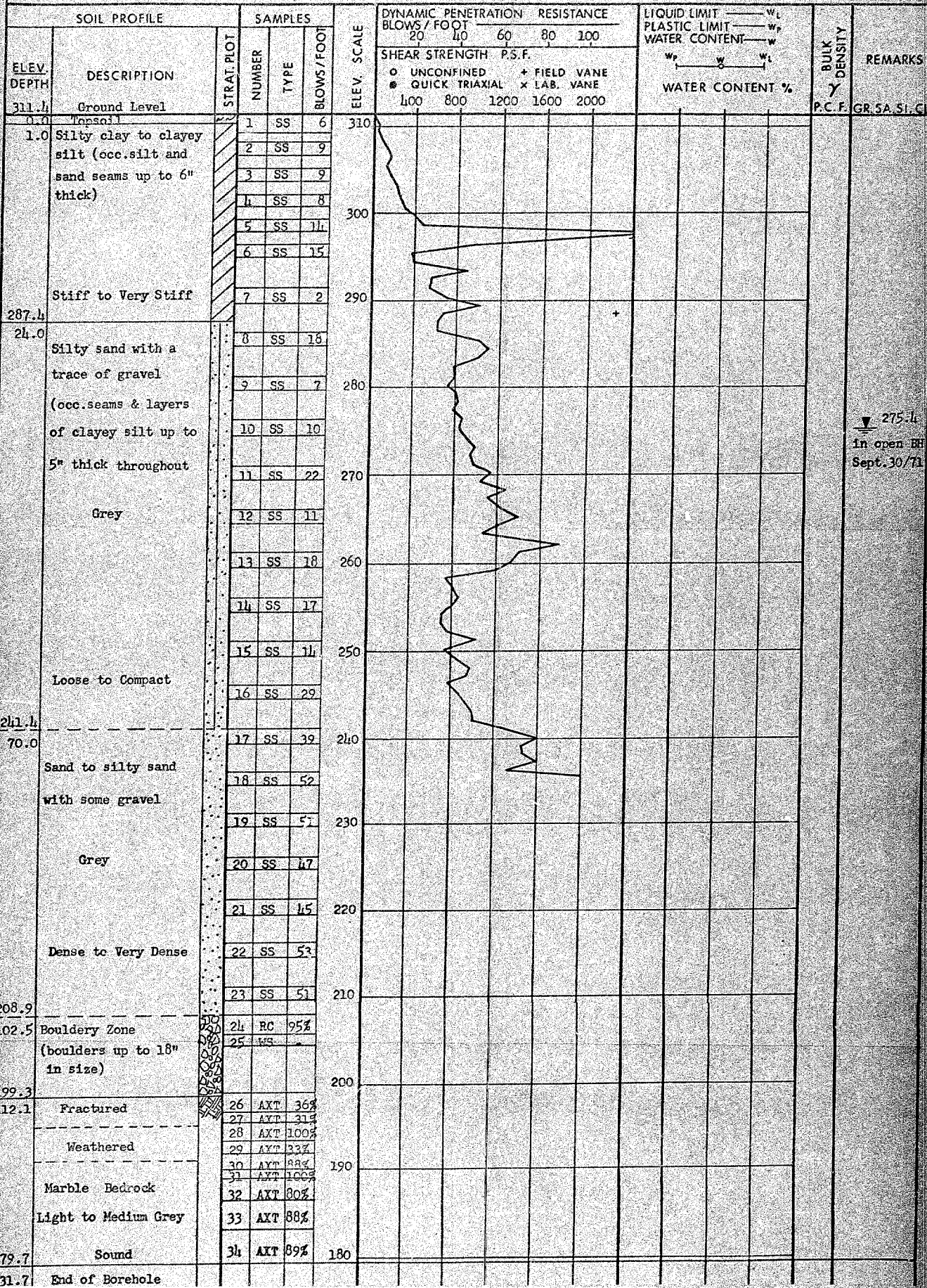
BORING DATE Sept. 23, 24, 27, 28 & 29, 1971

COMPILED BY SO

DATUM Geodetic

BOREHOLE T = Washboring-NX, BX, AX Casing; Cone

CHECKED BY



JOB 71-11041

LOCATION Sta. 339 + 40 17' Rt.

ORIGINATED BY WHI

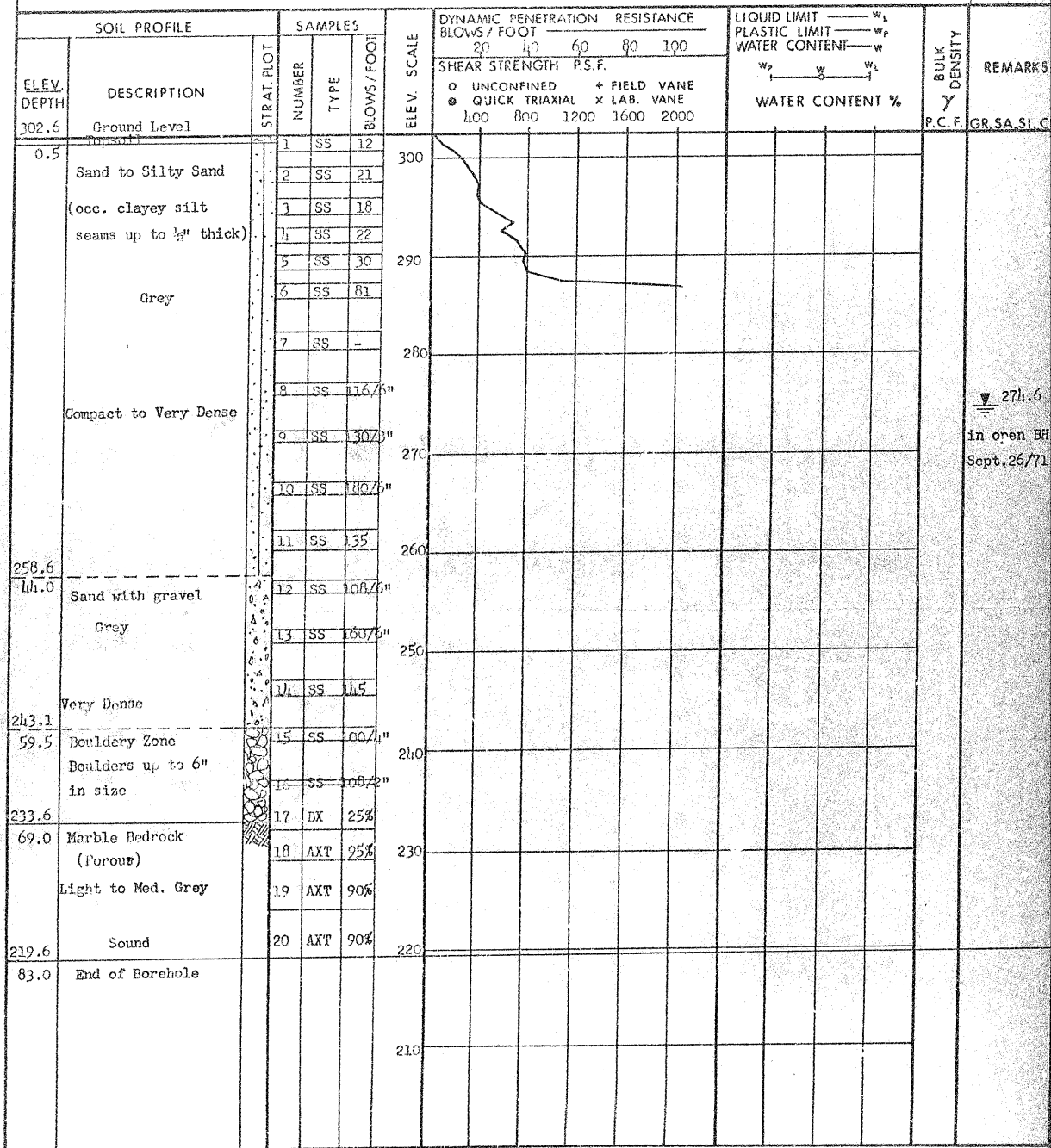
W.P. 6-67-02

BORING DATE Sept. 22, 23, 24 & 25, 1971

COMPILED BY SO

DATUM Goodale

BOREHOLE TYPE Washboring-MX, BX, AX Casing; BX, AXT Rock Core; Cone CHECKED BY



JOB 71-1108h

LOCATION Sta. 332 + 1.0 17' Lt.

ORIGINATED BY JR

W.P. 6-67-02

BORING DATE Sept. 14, 15, 16 & 21, 1971

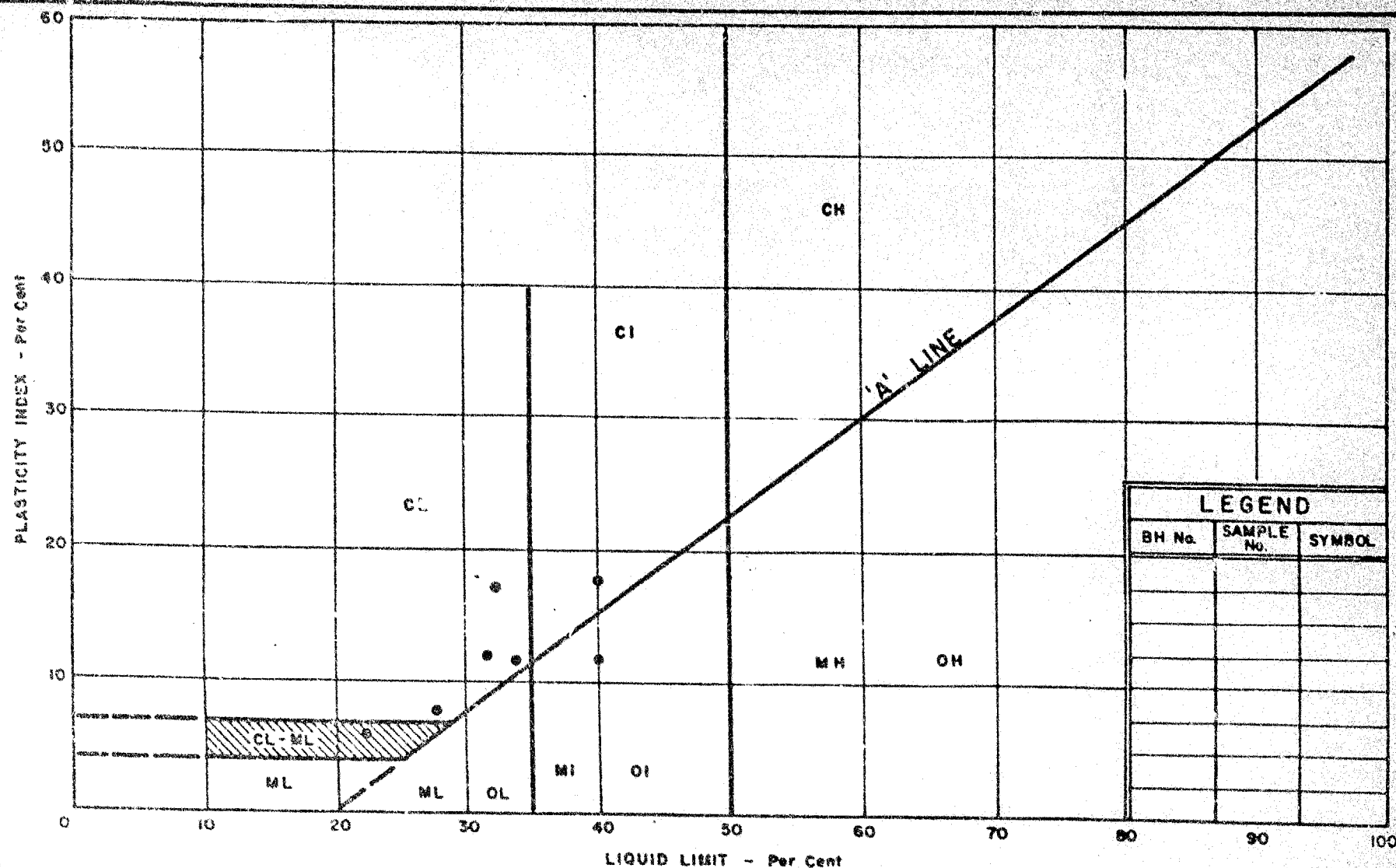
COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Washboring-MX, BX AX Casin, BX, AXT Rock Core; Cons

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	w_p	w	w_L		
301.6	Ground Level														
1.0	Sand with some gravel trace of silt (occ. seams of clayey silt)	1	SS	15	300										
		2	SS	23											
			SS	33											
290.6	Compact to Very Dense	3	SS	158 7/6"											
11.0		4	BX	57%											
		5	SS	154 7/6"	290										
	Sand with a trace of silt	6	SS	188											
		7	SS	115	280										
		8	SS	115											
	Grey	9	SS	232											
		10	SS	232	270										
	Very Dense	11	SS	126											
		12	SS	-	260										
		13	SS	116 7/6"											
251.6		14	SS	103 7/6"	250										
50.0	Sand to silty sand with gravel	15	SS	108											
	Grey	16	SS	150 1/4"	240										
	Very Dense	17	SS	115 5/5"											
236.6	Bouldery Zone	18	BX	16%											
65.0	(boulders up to 6" in size)	19	BX	10%	230										
229.6		20	BX	40%											
72.0	Marble Bedrock (Porous)	21	AXT	75%											
		22	AXT	100%	220										
218.1	Slightly Weathered														
83.5	End of Borehole				210										



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

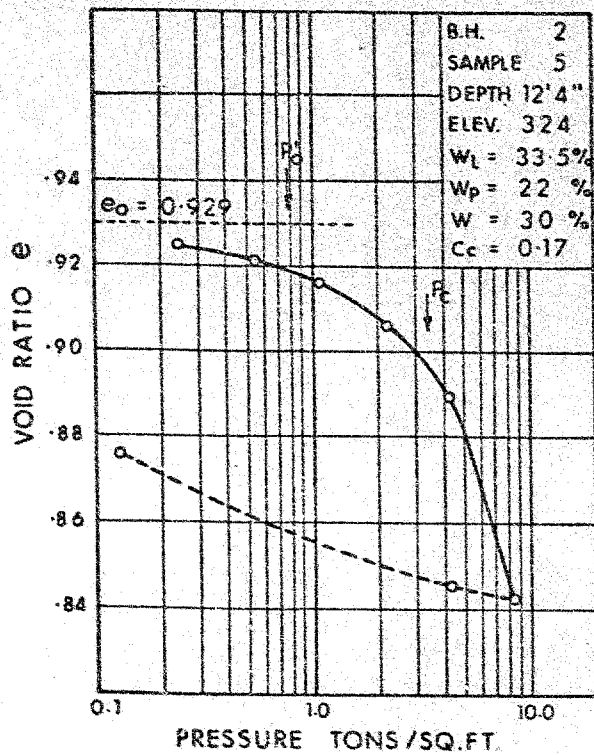
WP No. 6 - 67 - 02

JOB No. 71 - 11084

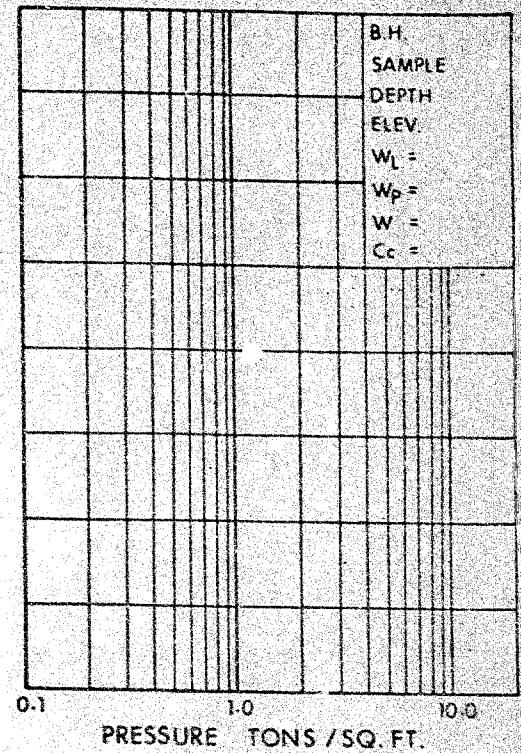
FIG. 1

VOID RATIO-PRESSURE CURVES

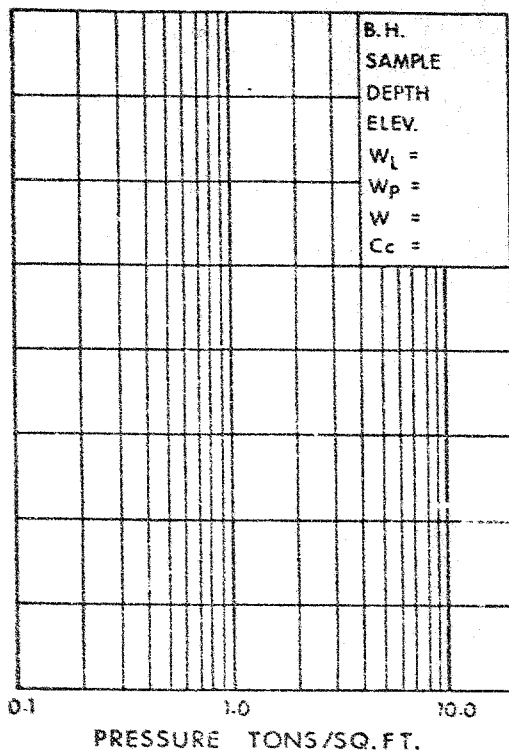
JOB NO. 71-11084



VOID RATIO e



VOID RATIO e



VOID RATIO e

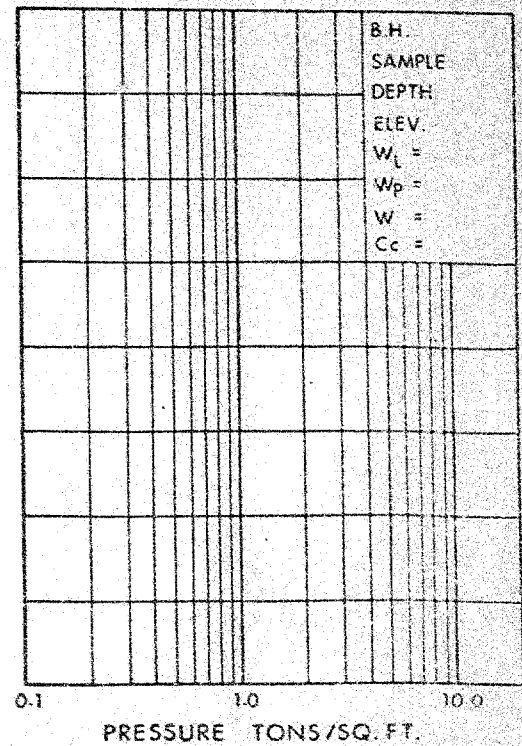


FIG. 2

CONSOLIDATED UNDRAINED TRIAXIAL TEST (WITH PORE WATER PRESSURE MEASUREMENTS)

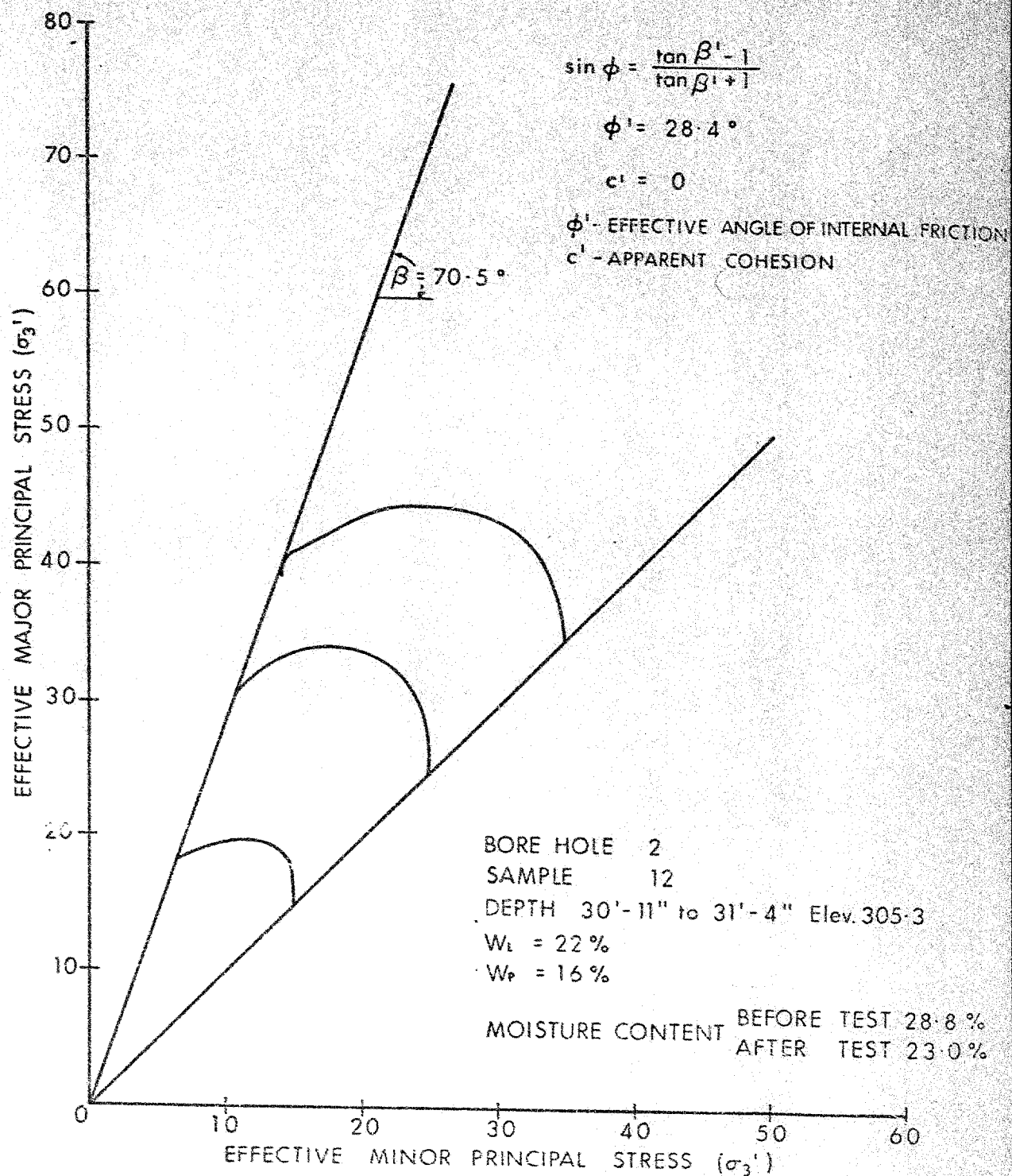
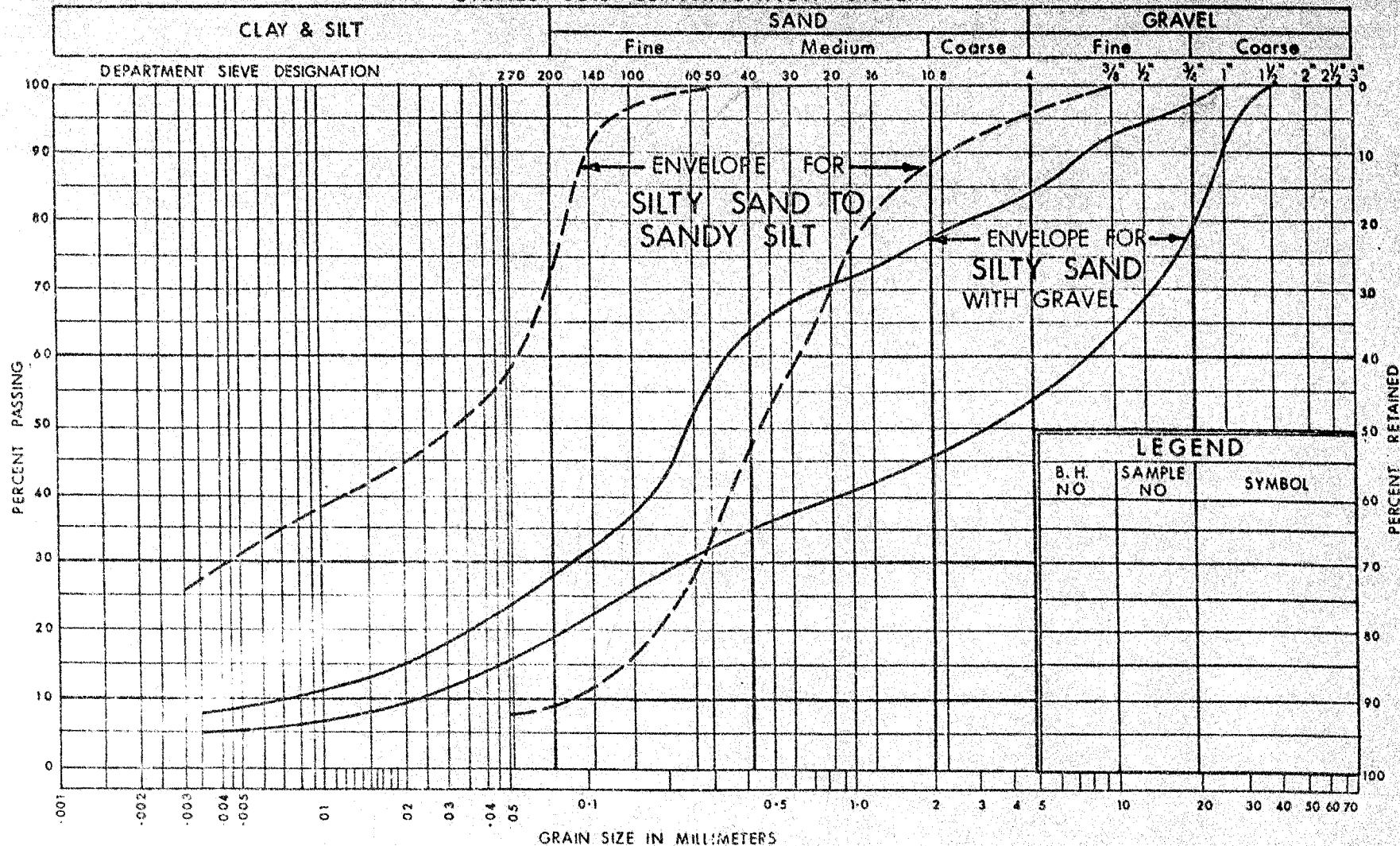


FIG. 3

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS



DESIGN SERVICES
BRANCH

GRAIN SIZE DISTRIBUTION

W.P. No. 6 - 67 - 02

JOB No. 71 - 11084

FIG. 4

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

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

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

DESCRIPTION OF SOIL

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

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

TYPE OF SAMPLE

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

SOIL TESTS

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

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

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

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ 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
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

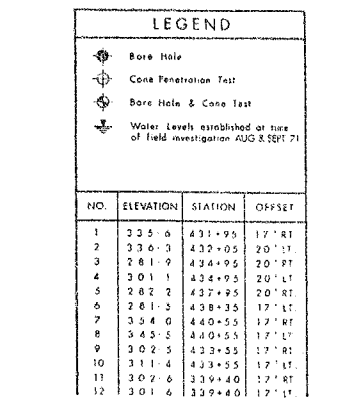
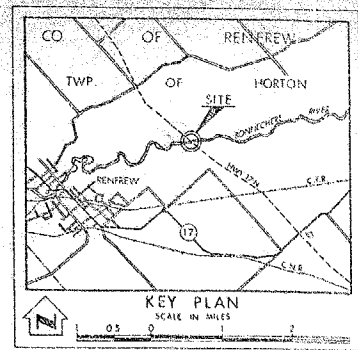
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

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

SLOPES

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



— 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.

SEARCHED	SERIALIZED	INDEXED	FILED	MAR 19 1968	FBI - NEW YORK	ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED DATE 05-10-2001 BY 60322 UCBAW
						DATE BY

DEPARTMENT OF TRANSPORTATION & COMMUNICATION
DESIGN SERVICES BRANCH - FOUNDATION OFFICE

BONNECHERE RIVER			
HIGHWAY NO. 17 N W.B.I.		DIST NO. 9	
CO. RENFREW		CO.	
TWP. HOPTON		LOT. 11	CON. 3
BORE HOLE LOCATIONS & SOIL STRAT.			
SUBNO B'D	CHECKED BY	WP NO. 8-67-02	DRAWING NO.
ORDEN 50	ENGELER	JOHNSON 71-10804	71-10804
DATE 1 MAR 1972	SITE NO.	B.F. OFG. CIRCLES 105	
APPROVED: <i>[Signature]</i>	CONT. NO.		

71-11-084
DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

Copy for the information of

T. C. Kingsland,

Regional Structural Planning
Engineer, EASTERN REGION,
Kingston.

Structural Office,
West Building, DOWNSVIEW.

October 13, 1972

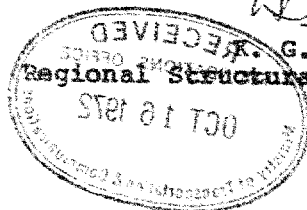
Bonnechere River Bridge,
W.P. #6-67-02, Site #29-192,
Hwy. #17N (W.B.L.), District #9.
Ottawa.

The design of this structure is now almost complete. But, with the grading of the North bank, there is some uncertainty (as far as we are concerned) regarding the top of pier footing elevations for Piers #1 and #2. We have detailed our drawings with the top of Pier #1 footing at El. 316.00 and Pier #2 footing at El. 296.00. However, on plotting the contours to suit the grading requirements of the Foundation Office, we find that the top of Pier #1 footing can be raised to El. 319.00. Since the North bank grading is to be taken care of by Regional Systems Design, we would like to have their confirmation before we revise our drawings.

Attached for your information are two prints of the contours plotted by us to arrive at the top of Pier #1 and Pier #2 footing elevations.

KGB:dp
Attach.

cc. M. Devata



R.
G. Bassi,
Regional Structural Design Engineer.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

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

FROM: Structural Office,
West Building, DOWNSVIEW.

ATTENTION:

DATE: October 19th, 1972

OUR FILE REF.

IN REPLY TO

SUBJECT:

Bonnechere River Bridge,
Approx. 2 Miles NW of Hwy. #17,
W.D. #6-67-02, Site #29-192,
Hwy. #17N W.B.L., District #9.

71-11-084

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

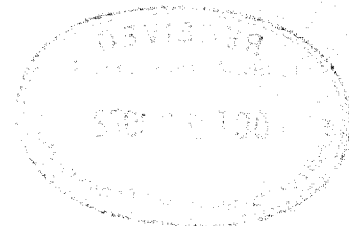
Kindly give us your comments at your earliest convenience.

sdg
Attach.



C. S. Grebski,
Structural Design Engineer.

cc. Foundation Office.



Mr. C. S. Grebski, P. Eng.,
Structural Design Engineer,
Structural Office,
Design Services Branch,
West Bldg., Downsview.

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

October 30, 1972.

Proposed Structure at the Crossing of Hwy. #17
'New' and the Bonnechere River, Twp. of Eorton,
County of Renfrew, District No. 9 (Ottawa)
W.O. 71-11084 -- W.P. 6-67-02

We have reviewed the final bridge drawings for the aforementioned structure (Drawing No. 29-192-1 and 3, dated October, 1972), and submit the following comments.

Piers #3 and 4, to be located within the Bonnechere River channel, are to be supported on end-bearing 12BP74 steel H-piles. The majority of these piles will have to penetrate through portions of the lower bouldery zone of the granular deposit. In discussions between personnel from your Office and ours it has been decided to place reinforced tips on the ends of the piles at these pier locations only in order to prevent pile damage during the driving operations.



B. T. Darch,
Senior Foundations Engineer,
M. Devata,
Supervising Foundations Engineer.

BTD/ao

For:

cc: G.C.E. Burkhardt

Foundations Files
Documents

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

Copy for the information of
Mr. A.G. Stermac - Att. Mr. M. Devata

Mr. C. S. Grebski,
Structural Design Engineer,
Downsview, Ontario.

Structural Planning Office,
Kingston, Ontario.

Mr. K. Bassi

October 31, 1972.

W.P. 6-67-02, Site 29-192,
Bonrechere River Bridge,
Highway 17N (WBL), District 9-Ottawa

With reference to your memo dated October 13, 1972, enclosing prints of the contours plotted by you to arrive at the elevations for the top of footings for Piers #1 and #2, Systems Design Section have studied these and I enclose herewith a copy of two sketches showing their proposed bank treatment for the east and west banks of the river.

From these sketches the minimum finished ground elevation at Pier #1 will be approximately 320 and at Pier #2, 296+.

I am sending a copy of these sketches to Mr. M. Devata, Foundations Office, for his observations.

T. C. Kingsland
Regional Structural Planning Engineer

TCK/hl
encls.

c.c. / A. G. Stermac - Att. M. Devata
A. J. Percy - Att. A.E. Irving

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

71-11084
M.D.
Nov 1/72

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

FROM: Structural Planning Office,
Kingston, Ontario.

ATTENTION: Mr. M. Devata

DATE: October 31, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 6-67-02, Site 29-192,
Bonnechere River Bridge,
Highway 17N (WBL), District 9-Ottawa

Please find enclosed copy of sketches supplied to me by
Mr. A. E. Irving, Regional Systems Design Section,
showing their proposals for bank treatment at the above
structure location.

I shall be glad to have as soon as possible any observations
you may have on the proposed treatment.

Attached also is a copy of letter of today's date to Mr. K.
Bassi.



T. C. Kingsland
Regional Structural Planning Engineer

TCK/hl
encls.

c.c. C. S. Grebski - Att. K. Bassi

MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundation Eng.,
DOWNSVIEW, Ontario.

FROM: Materials and Testing Office,
KINGSTON, Ontario.

ATTENTION: Mr. M. Devata

DATE: October 31st, 1972

OUR FILE REF.

IN REPLY TO

SUBJECT: W. P. 5-67-01, Proposed Grading and Drainage, Hwy. 17N, From 9.7
Mi. W. of Arnprior W. Lmts. W'ly. to Renfrew Cty. Road # 4

Recommendation 6.2.2 in the foundation investigation report for the Bonnechere River crossing just north-east of the town of Renfrew (W.P. 6-67-02) outlines grading treatment to flatten the existing river banks in the vicinity of the proposed structure.

The attached sheets illustrate contours of the existing conditions and the grading proposals per the foundation's recommendation.

In view of the small change to existing conditions on the east bank, it would appear that it would be better to leave conditions as they are. The stability of the embankment would probably be adversely affected by removal of existing vegetation with the shallow slope flattening that is proposed.

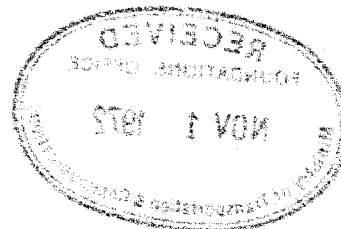
The grading proposal on the west embankment is quite substantial and appears to meet the requirements outlined in your recommendations.

Could you please return these sheets with your comments before this work is included in the proposed contract drawings.

A.M. Batten

A.M. Batten,
Senior Soils Supervisor

c. c. - G. A. Wrong



MEMORANDUM

Mr. J. A. G. Stewart
Principal Foundation Engineer
Downsview, Ontario

Mr. M. L. Davis
Chief Engineer
Ottawa, Ontario

W. E. G. Stewart, Principal Geologist and Director, Hwy. Div., Hwy. 407
W. W. W. Stewart, W. L. W. Stewart, W. L. W. Stewart, W. L. W. Stewart

The attached report illustrates the results of the investigation conducted in the vicinity of the proposed highway interchange at the intersection of Highway 407 and Highway 404. The investigation was conducted in the vicinity of the proposed interchange and the results are as follows:

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MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

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

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

ATTENTION:

DATE: November 15, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: Bank Treatment, Structure Crossing at
Hwy. #17 'New' and the Bonnechere River
Township of Horton, County of Renfrew
District No. 9 (Ottawa)
W.O. 71-11084 -- W.P. 6-67-02

As per your request (letter dated October 31, 1972), we have reviewed the sketches prepared by the Regional Systems Design Section in which they show a proposal for slope treatment along the east and west banks of the Bonnechere River in the vicinity of the aforementioned crossing. The proposed treatment for each bank complies with the recommendations presented in Subsection 6.2.2) of our foundation report for this project (W.O. No. 71-11084, dated July 20, 1972). As such we recommend that the treatment be adopted.

In order i) to flatten the steeper portions of the banks to 2:1 and ii) to form, in two specified locations along the west bank, a 25 foot wide berm at elevation 305, it will be necessary to cut into the natural banks. The parent cohesive subsoil in these treated denuded areas will have to be protected against the erosional effects of uncontrolled surface runoff. This could be accomplished by ensuring that these areas are sodded and staked, or alternatively seeded and mulched.

If additional comments are required on the aforementioned, or if we can be of any further assistance to you on this project please contact this Office.

B. T. Darch

B. T. Darch,
Senior Foundations Engineer,
M. Devata,
Supervising Foundations Engineer.

BTD/ao

For:

cc: A. J. Percy
C. S. Grebski
E. R. Saint
G. A. Wrong

Foundations Files ✓

Documents

Mr. K. Howe,
Structural Materials Officer,
Structural Office.

Construction office,
Third Floor, Central Bldg.

December 18, 1974.

Contract 73-186, W.P. 6-67-02, Bonnechere R. Bridge,
Site 29-192, Highway 17N, District 9.

This will confirm our telephone conversation of 18th
December 1974 regarding the piling for the above bridge.

For the pile driving of the CPR Overhead Bridge, a
shortage of 9.990 tons of HP 12 x 74 piling was occasioned.
The 9.99 tons consist of extra lengths of piles driven and
wastage of approximately 3' per pile. This was supplemented
from the stockpile for the Bonnechere River Bridge.


For the pile driving of Piers 4 and 5 and the East Abutment
of the Bonnechere River Bridge, the total shortage (actual,
including waste) was 107.559 tons.

For the remainder of Bonnechere River Bridge, based on
experience, we anticipate a shortage including wastage of
35.705 tons.

The total shortage, actual and anticipated including wastage,
is 153.254 tons, or in terms of 45' lengths of HP 12 x 74,
92 piles.

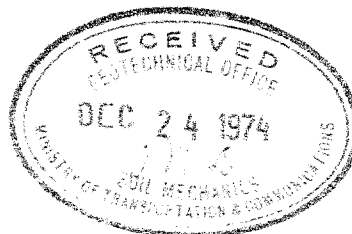
The contractor is planning to drive the remaining piles in
early January of next year, and will require the extra
piling as soon as possible.

Could you please arrange to have the extra piling ordered
and shipped from our Central Stores.


W.T. Mashizume,
Regional Construction Engineer,
Structures.

WTH/JC

c.c. J.M. Childs
B.R. Davis ✓



RIDEAU VALLEY CONSTRUCTORS LIMITED

STRATFORD, ONTARIO

Ministry of Transportation & Communications,
c/o Smith Construction Co. Arnprior Ltd.,
Hwy. 17,
Arnprior, Ontario.

NSA 6V8

March 21, 1975.

Accounts are Due When Rendered

Interest Charged at 1% per Month on Overdue Accounts

Re: M.T.C. Contract 73-186
Bonnechere River Bridge

Extra costs due to lost crew time for Driving increased pile lengths. The arrangement and batter of the piles produced an average of 1 1/4 Hours lost time for each of the 110 extra splices.

Lost time $110 \times 1 1/4 = 137.5$ Hours

Labour - 2 crane operators	137.5 @ 13.90 =	1,911.25	
welder	137.5 @ 9.70 =	1,333.75	
3 men	137.5 @ 12.00 =	1,650.00	
Foreman	68 @ 10.50 =	714.00	
Equipment - Linn Crane	137.5 @ 33.30 =		4,576.75
3/8 Ton crane	137.5 @ 16.60 =		2,282.50
Hammer & Leads	137.5 @ 12.00 =		1,650.00
Welder	137.5 @ 2.00 =		275.00
		<u>5,609.00</u>	<u>8,786.25</u>
	+ 22%	1,233.98	
		<u>6,842.98</u>	
	+ 20%	1,368.60	8,211.58
		<u>Total</u>	<u>\$16,997.83</u>
Less payment for splices			
110 @ \$44.00			4,844.00
		<u>Total Extra Costs</u>	<u>\$12,153.83</u>

Anticipated payment quantity for Tender item 69

"Drive Steel 'H' Piles" = 13,666 L.F.

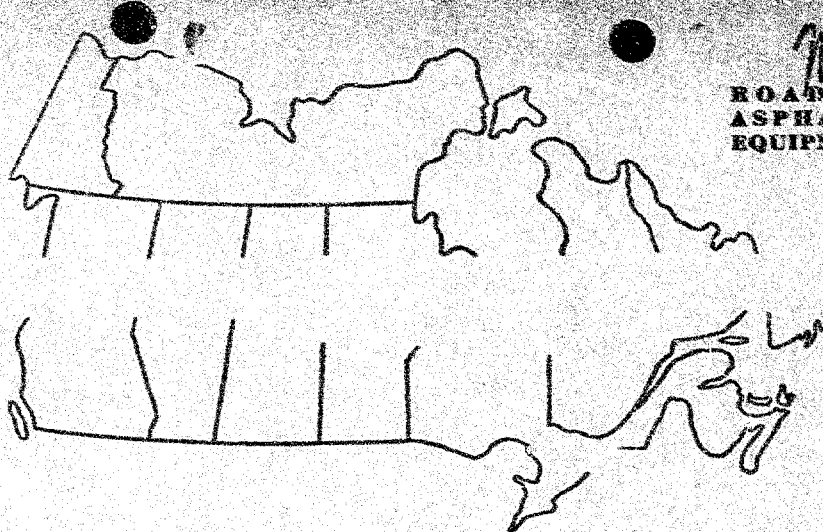
Extra Cost = \$12,153.83 ÷ 13,666 = \$0.89 L.F.

Contract payment unit price = 1.60 L.F.

Revised payment unit including
extra costs = \$2.49 L.F.

CRUSHING
FLOATING
GRADING

ROAD BUILDERS
ASPHALT PAVING
EQUIPMENT RENTALS



HIGHWAY 17, ARNPRIOR, ONTARIO, PHONE 623-3144

June 12, 1975.
Arnprior, Ontario.

Ministry of Transportation
& Communication,
530 Tremblay Road,
Ottawa, Ontario.

Attention: Mr. W. Stewart,
District Construction Engineer

Dear Sir:

Re: Contract 73-186, Highway #17
Renfrew, Ontario

We attach details of extra costs incurred
by our structure sub-contractor, Rideau Valley
Construction Limited in connection with driving
of extra pile lengths.

Trusting this meets with your approval.

We remain,

Yours very truly,
SMITHS CONSTRUCTION,
ARNPRIOR, ONTARIO.

Per: N. Smith,
Secretary-Treasurer.

NS:dz
Encl.

Copy to Mr. Stewart

JUN 16 1975

Mr. W. Stewart, District Engineer

745-6841

530 Tremblay Road
Ottawa, Ontario
K1G 0E4

July 17, 1975

Smiths Construction Company Amprior Limited
Hwy. 17
Amprior, Ontario

Attention: Mr. N. Smith, Secretary-Treasurer

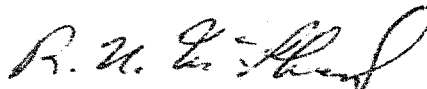
Dear Sir:

Re: Contract 73-186, Hwy. 17N, Renfrew, Ontario

The Ministry acknowledges receipt of your letter of June 12, 1975 with the attached breakdown of extra costs incurred by Rideau Valley Construction Limited due to placing an additional 110 splices in the H Piling on the Bonnechere River Structure.

This matter is under review and this Office will be contacting you in this matter at a later date.

Yours truly,



R.N. McPhail
Construction Supervisor

RNP:lh

Attach

H. McPhail

745-6841

530 Tremblay Road
Ottawa, Ontario
K1G 0E4

September 8, 1975

Smiths Construction Company Arnprior Limited
Highway 17
Arnprior, Ontario

Attention: Mr. N. Smith, Secretary-Treasurer

Dear Sir:

Re: Contract 73-186, Hwy. 17N, Renfrew Ex-
Pass, District #9, Ottawa

Regarding Rideau Valley Construction Limited submission of March 21, 1975 for extra costs due to placing an additional 110 splices in the Steel H Piling at the Bonnechere River Structure.

Rideau Valley Construction Limited have requested an increased price in Tender Item No. 69 - "Drive Steel H Piles" because of the additional 110 splices involved in Tender Item No. 68 "Splice Steel H Piles".

It is the Ministry's opinion that the unit price bid, per splice, under Tender Item No. 68 would include any affect the splicing operation might have on the pile driving operation, under Tender Item No. 69.

Therefore the Ministry does not consider Rideau Valley's invoice a negotiable item as existing tender items apply and payment has been made accordingly.

Yours truly,

R. N. McPhail
R.N. McPhail
Construction Supervisor

RNM:lh

Copy to C. Quick
H. McPhail



DEPARTMENT OF HIGHWAYS

NOTIFICATION OF INTENT TO CLAIM

ASSISTANT DEPUTY MINISTER, (ENGINEERING),
DEPARTMENT OF HIGHWAYS ONTARIO.

Date October 16 1975

Against Contract No. 73-186

District Ottawa

Location Highway # 17 (New)

Contractor Rideau Valley Constructors Limited

In accordance with Section 104 "Control of the Work" of the "General Conditions of the Contract" D.H.O. Form 100, I/We declare my/our intention to file a claim against the above contract due to the following (Give complete details, attaching separate sheets if necessary.)

The payment quantities for both pile driving and pile splices on the Bonnechere River Bridge increased significantly from those shown in the Tendering Documents. The figures are as follows:

Description	Tendered Quantities	Actual Payment Quantities
Splice H Piles	139 each	249 each
Drive H Piles	10 487 l.f.	13666 l.f.

The combinations of driving and splicing indicated by the Tender quantities was changed by these actual payment quantities. The work and lost time as a result of the extra splices was increased, and the compensation yield from the payments for the additional driving fell far short of offsetting this increase.

This work combination change produced a change in the character of the work, and I request the right to submit a claim based on Contract clause 103-2 including all direct and indirect costs related to this portion of the work.

NOTE: Contractor must give this notice to the Assistant Deputy Minister, (Engineering) and District Engineer within 7 days of his date of commencement on the work out of which this claim arises - Refer - Section 104 "General Conditions of the Contract" D.H.O. Form 100.

Signed

Contractor or Authorized Representative

TO BE MADE IN QUINTUPLICATE BY THE CONTRACTOR
COPIES 1, 2, 3, TO BE SENT TO ASSISTANT DEPUTY MINISTER, (ENGINEERING)
COPY 4 TO BE SENT TO DISTRICT ENGINEER
COPY 5 TO BE RETAINED BY CONTRACTOR

(1) ASSISTANT DEPUTY MINISTER (ENGINEERING)

CRUSHING
FLOATING
GRADING

ROAD BUILDERS
ASPHALT PAVING
EQUIPMENT RENTALS



HIGHWAY 17, ARNPRIOR, ONTARIO, PHONE 623-3144

Arnprior, Ontario.
October 20, 1975.

Ministry of Transportation
& Communications,
530 Tremblay Road,
Ottawa, Ontario.

Attention: Mr. J. M. Childs,
District Engineer

Dear Sir:

Re: Contract 73-186, Hwy. #17, Renfrew
Bonnechere River Bridge

We submit the attached "Notification of Intent to Claim"
on behalf of our sub-contractor, Rideau Valley Constructors
Limited.

Trusting this meets with your approval.

We remain, :

Yours very truly,
SMITHS CONSTRUCTION LIMITED
ARNPRIOR LIMITED

Per: N. Smith,
Secretary/Treasurer.

NS:djz

RECEIVED
OCT 21 1975
DISTRICT 9, OTTAWA

H.W. Adcock
Assistant Deputy Minister (Engineering)
Downsview

District #9, Ottawa

November 25, 1975

Contract 73-186

Attached for your information is a "Notification of Intent to Claim" dated October 16, 1975, which has been submitted by Rideau Valley Constructors Limited, who are the approved Sub-Contractor for Smith Construction.

The District's report on this intent will be submitted to Mr. Callaghan and Mr. MacDougall's office as soon as it has been prepared.



R. Wert
Dist. Eng. Office Supvr.

RW:lh

Attach

cc--B. Quick

Mr. F. G. Allen,
Executive Director,
Operations Division.

J. W. MacDougall

December 4, 1975

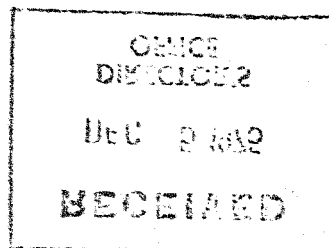
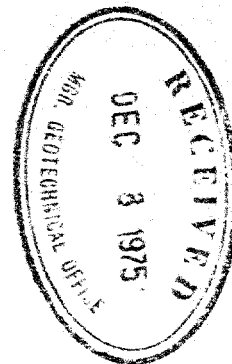
Claim on Contract 73-186
Smiths Construction Co. Arnprior
Ottawa District

Attached please find for your information, copy of
Notification of Intent to Claim dated October 16, 1975 from
Smiths Construction Co. Arnprior, on behalf of the subcontractor
Rideau Valley Constructors Limited, regarding the above contract.

J. W. MacDougall,
Claims Engineer.

JWM/jm
attach.

cc: J. B. Wilkes
W. G. Wigle /
B. D. Riddell
J. M. Crannie
J. M. Childs



Mr. J. C. Callaghan,
Director,
Construction Branch.

Copies to - C. Muzat
M. Nevada
W. G. Wigle

February 3, 1976.

Notification of Intent to Claim
Contract 73-186,
Smiths Construction Company, Arnprior,
Ponnehchere River Bridge.

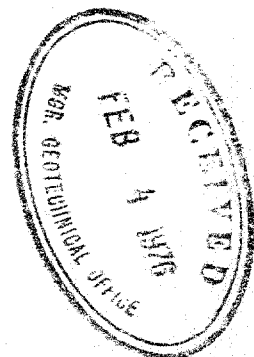
Further to our discussion of this morning, attached is a copy of a report on the Intent to Claim on this contract which I asked Mr. Rutka to prepare upon receipt of a copy of the memo of December 4, 1975, from the Claims Engineer to Mr. F. C. Allen. It would appear that the overruns on the contract items number 68 and 69 are due to a decision made by the Structural Inspection Engineer, Head Office.

I conferred further with Mr. Rutka on this aspect and with Mr. Grebski, the Structural Design Engineer, regarding the extent to which changes in the field are discussed with the Geotechnical and Structural Offices. Apparently, discussions and co-operation are quite good between the personnel of the affected offices except that on occasion Mr. Hashizume makes decisions relative to alterations in contracts without consultation with the designers or the foundation engineers. It would appear to me that a little more co-operation and liaison in this area might reduce the need for contract changes or at least provide better documentation of the need for those changes considered appropriate.

Orig. signed by
W. G. WIGLE

Attach.
C.C. J. B. Wilkes
J. W. MacDougall

W. G. Wigle,
Director,
Engineering Services Branch.





Memorandum

cc A Rutka
R. Horton

*seems to have been some
misunderstanding on size &
type of hammers needed.
Hopefully this
is an isolated
incident but will
prompt, & slow the
need for better
liaison*

To: Mr. W. G. Wigle,
Director,
Engineering Services Branch.

From: Construction Branch,
Room 224,
Central Building.

Attention:

Date: April 9, 1976.

Our File Ref.

In Reply to

Subject:

Re: Contract 73-186, Bonnechere River Bridge,
Notification of Intent to Claim,
Smiths Construction Company.

Further to your memorandum of February 3rd, 1976 and Mr. Rutka's attached to it, I have discussed the subject with our Structures Office who have been in touch with the Geotechnical Office.

Apparently the pile driving records from the field did not record any readings in blows per inch taken during driving, which would indicate that the driving was not controlled by the Hiley formula. However, the attached excerpts from the minutes of a site meeting show that the Hiley formula was used during driving. Bedrock was reached before the capacity of the piles using the Hiley formula was obtained and our field staff neglected to fill in the pile driving forms properly. While at this time it is impossible to determine if other solutions to the driving problem would have been acceptable, we believe that the decision to continue driving was the correct one.

With regard to the lack of information on the pile driving forms, a memo will be issued to the Districts impressing upon them the need to record all the driving information taken in the field.

It is unfortunate that the Geotechnical Office was not consulted during the driving of the piles. We agree that cooperation and liaison in this area is important, and could possibly prevent unnecessary contract changes. At the least, it will provide better documentation of the facts surrounding the changes, and information to the Soils Mechanics Section. However, we feel this is an isolated incident.

J. E. Callaghan
J. E. Callaghan,
Director,
Construction Branch.



Mr. Jackson stated that the trucks transporting the structural steel would not be overloaded but would only require a permit for an overlength load and if a permit could be issued to them during the half load restricted time, he would inform Dominion Bridge that he would expect them to honour the original contract and start fabricating the structural steel immediately.

Mr. Stewart checked with the Ministry's Permit Branch in Toronto to determine if it would be possible to obtain a permit for Hwy. 417 and 17 during the half load restrictions. Mr. Stewart returned to the meeting and told Mr. Jackson that a permit could be obtained during the half load restrictions and he would send a letter to Mr. Jackson confirming this.

It was pointed out that the contractor or Dominion Bridge would have to deal with County and Township officials for permission to use their roads during half load season at which time Mr. F. Smith said that there would be no problem with Renfrew County or Horton Township and he would obtain the permission.

Mr. Jackson stated by double shifting everything would be ready for Dominion Bridge to start erecting structural steel on March 15, 1975 starting from the east abutment and continuing through to the west abutment therefore completing all the structural steel work in one move.

Mr. Jackson then left the meeting to phone his office in Stratford, to instruct them to send a telegraph to Dominion Bridge insisting that they start the fabricating of the structural steel immediately.

When Mr. Jackson returned to the meeting he stated that he would keep the Ministry informed of the progress of Dominion Bridge.

3. Piles in West Abutment and Pier No. 1

Mr. Jackson stated that the piles were being driven to a lower elevation than had been anticipated in the design and this was resulting in an extra splice on most piles, which takes from an hour to an hour and a half per splice, resulting in loss of time for the pile driver.

The piles in the west abutment and Pier No. 1 are shown as friction piles on the design drawing and due to length of the piles the contractor had to bring a heavier hammer onto the contract in order to use the Hiley formula. It was agreed by the Ministry that if the piles reached rock before the desired blows per inch were obtained these piles no longer would be friction piles but end bearing piles and the contractor would not be required to use the heavier hammer.

4. Mr. Jackson inquired as to the Ministry's policy for the removal of forms on the pier caps, as they are using steel forms and only one set is available to them. Mr. Quick checked with the Bridge Office in Toronto and they claim that the strength should be 80% but if in cold weather, the withdrawal of protection as outlined in Form 9.04 - 10 (12) would have to be maintained.

5. Scheduling of Work on the C.N.R. and C.P.R. Structures

Mr. Jackson indicated that their schedule is to pour the deck of the C.P.R. structure in the first week of May. The deck of the C.N.R. structure is scheduled for the first week of June but to date the falsework drawings has not been approved by the C.N.R. Engineering Department. The C.N.R. is insisting on changes to the drawing which have been submitted three times and two sets have been lost.

Mr. L. Jackson and B. Gaffney left the meeting at 11:15 a.m.

6. A discussion took place re: Rock and Earth Excavation on D. Jamieson's Property in the Vicinity of the House and Barns.

Mr. McPhail informed F. Smith that there were no plans or profiles for the revised alignment Sta. 375+ to 420+ but the rock excavation is anticipated to drop from 49,000+ cu. yds. to 10,000+ cu. yds. and the earth excavation and earth borrow will increase but no quantities are available at this time. This information will be forwarded to Smiths Construction when it becomes available.

Mr. F. Smith stated that all grading operations are shut down at this time and is not anticipating doing anything again until April 1975.

Bridge-Site Investigation
For The Proposed Hwy. #17N
At Bonnechere River Crossing
W.P. 5-67-01 & W.P. 6-67-02

Bridge-Site Investigation
For The Proposed Hwy. #17N
At Bonnechere River Crossing
W. P. 5-67-01 & W. P. 6-67-02

LOCATION

T1 above site is located in the Township of Horton,
Renfrew County, District #9 - Ottawa.

TOPOGRAPHY

The relief in the general area is influenced by bedrock. Some local variations are however caused by surficial deposits. There are several rock knobs and small lake basins scattered along the entire area.

DRAINAGE

The surface drainage in the study area is controlled by the Bonnechere River and its watershed. This river drains the region that includes the basins of Round Lake and Golden Lake.

BEDROCK GEOLOGY

The general area in the vicinity of the proposed river crossing is underlain by pre-cambrian rocks. The oldest of these rocks consist of gneiss and the younger consist of crystalline limestones and dolomites. These limestones and dolomites are flat lying and can be seen along the Bonnechere River where ever the rocks are exposed.

SURFICIAL DEPOSITS

The unconsolidated surficial deposits mask much of the bedrock in

the study area. These pleistocene materials fall into the following two types and ages:-

1. Glacial, glacio-fluvial and glacio-lacustrine materials deposited during the earlier and greater part of the Pleistocene period.
2. The clay beds laid down in the Champlain Sea towards the close of the Pleistocene time.

Small quantities of overburden classed as Recent Deposits occur as muck, some alluvium, sand and gravel. These deposits are mainly derived from the reworking of the Pleistocene materials and have accumulated in stream-valleys and lakes. Figure 1 illustrates the lithology of various unconsolidated formations.

The clay beds laid down towards the close of the Pleistocene time form the ground surface in the vicinity of the proposed river crossing. These are underlain by the sand and gravel deposits. Some of the typical engineering properties of these soils are described below:

Station 427+00 to Station 435+56, and
Station 437+83 to Station 444+00

1 CLAY BEDS

1. Plasticity: - can vary from high to low. Top layers should be desiccated.

2. Frost Susceptibility: - Often very frost susceptible due to high silt content and poor internal drainage.
3. Compaction: - Very difficult to compact, especially when moisture is above optimum.
4. Shear Strength: - Generally varies with depth.
5. Instabilities: - Susceptible to slope failures in cuts and slumping along the rivers. (See plan, Figure 2); some settlements can be expected.
6. Drainage: - Internal drainage generally poor and water table often high.

II GLACIAL DRIFT

A. Glacial Deposits:

1. General: These soils are heterogeneous mixtures of clay, sand and gravel. Generally well graded.
2. Drainage: poor to fair internal drainage;
Moisture content usually between 5% to 15%. Ground water usually not a problem.
3. Frost Susceptibility: Borderline to non-frost susceptible.

4. Compaction: Usually readily compacted material.
5. Shear Strength: Usually high
6. Bearing Capacities: Bearing values generally range between 2 T.S.F. to 4 T.S.F. High pre-consolidation pressures can be expected.

B. Glacio-Fluvial Deposits:

1. General: These materials usually consist of well sorted sands, gravels and silts. Generally stratified.
2. Drainage: Fair to good internal drainage. Water seepage can be a problem in cuts and excavations. The water table can fluctuate thus affecting earth pressure calculations.
3. Frost Susceptibility: Generally non-frost susceptible.
4. Compaction: Fair to good
5. Shear Strength: Generally high
6. Bearing Capacities: Usually fair to good

CONCLUSIONS AND RECOMMENDATIONS

1. The clay beds about 10-15 feet thick form the existing ground

surface between Station 427+00 to Station 435+56 and Station 437+83 to Station 444+00. The engineering properties of these soils have been discussed earlier (Page 2). This material has undergone slumping in the past, especially along the river valley (Figure 2).

2. Underlying this is a more stable and thick deposit of glacial and glacio-fluvial material. This deposit in turn overlies the bedrock. No instability problems are anticipated in this material. (Fig.

3. It is recommended that the loads should be transferred through the unsuitable clayey soils to a more dense and suitable bearing stratum of glacial and glacio-fluvial deposits by the use of end bearing piles. The engineering properties of these soils are described on Page 3.

4. The bedrock is very deep from the surface. No instability problems because of bedrock conditions are anticipated. No field work was carried out during these investigations. Lands and Forests photography at a scale of 1" = 1,320 feet was used.

B. Sen Mathur,
Airphoto Interpretation Engineer.

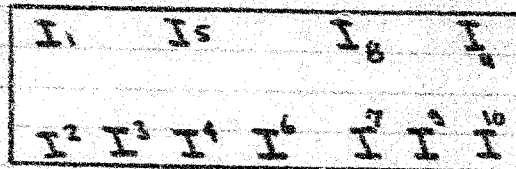
Surficial Deposits
In the Vicinity Of
W. P. 5-67-01 & W. P. 6-67-02

AGE		SOIL TYPES
I RECENT		Organic materials, clay, sand & gravel, swamps, river alluvium.
II PLEISTOCENE	Champlain Beds	Mainly clay beds, some seams of sand, fine gravel & clay can be expected.
	Glacial Drift	<u>Glacial Deposits (till):</u> Consists of unsorted to poorly sorted mixture of clay particles through silt, sand & gravel. <u>Glacio-Fluvial Deposits:</u> Stratified material consisting of sand & gravel, often bouldery. <u>Glacio-Lacustrine Deposits:</u> Stratified clay, silt, sand & some gravel deposited in glacial lakes.

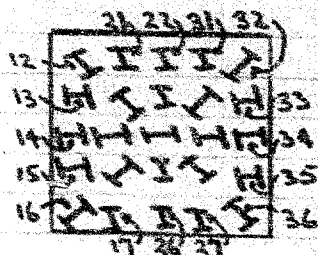
Figure No. 1

DONNECHERE RIVER BRIDGE

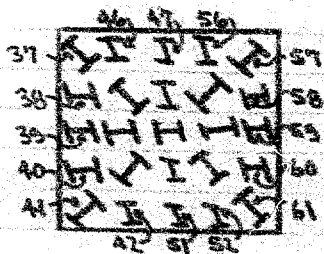
Cont. 73-186
Dist. #9.



West
Abutment
(*1-11)



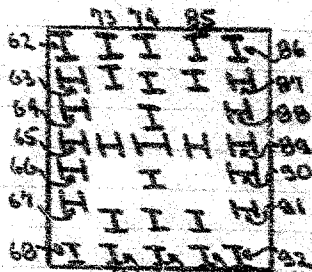
Pier #1
(*12-36)



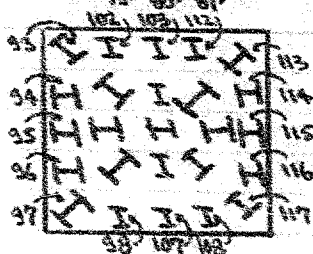
Pier #2
(*37-61)

CONSTRⁿ NORTH

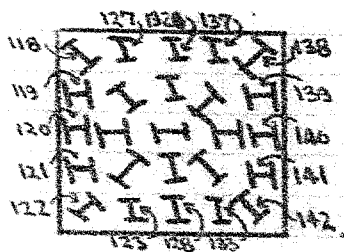
Actual N.



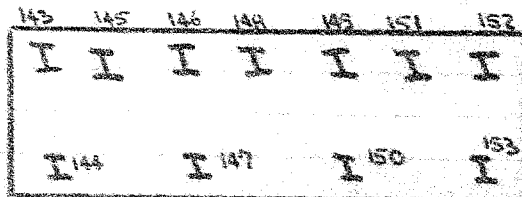
Pier #3
(*62-92)



Pier #4
(*93-117)



Pier #5
(*118-142)



East
Abutment
(*143-153)

BONNECHERE RIVER BRIDGE

100-100000

Figure 1 consists of five sub-graphs labeled (a) through (e), each showing the percentage of correct responses (Y-axis, 0 to 100) for a specific task across five age groups (X-axis: 5, 7, 9, 11, 13 years). The tasks are: (a) Copying, (b) Copying + 1, (c) Copying + 2, (d) Copying + 3, and (e) Copying + 4. In all tasks, performance increases with age. Copying + 4 shows the highest performance, reaching nearly 100% for the oldest age group.

Task	5 years	7 years	9 years	11 years	13 years
(a) Copying	~10%	~20%	~30%	~40%	~50%
(b) Copying + 1	~15%	~25%	~35%	~45%	~55%
(c) Copying + 2	~20%	~30%	~40%	~50%	~60%
(d) Copying + 3	~25%	~35%	~45%	~55%	~65%
(e) Copying + 4	~30%	~40%	~50%	~60%	~90%

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

2000

The following table shows the results of the analysis of variance for the dependent variable of the number of correct responses. The independent variables were the type of stimulus (word or nonword), the type of task (lexical decision or word matching), and the type of response (lexical decision or word matching). The results show that the type of stimulus and the type of task had a significant effect on the number of correct responses, while the type of response did not have a significant effect.

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Total	100.000	100			
Corrected Model	10.000	10	1.000	1.000	.999
Corrected Total	100.000	100			
Corrected Model	10.000	10	1.000	1.000	.999
Corrected Total	100.000	100			
Corrected Model	10.000	10	1.000	1.000	.999

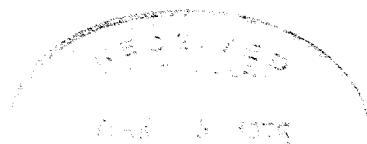
The results of the analysis of variance for the dependent variable of the number of correct responses are shown in the following table. The independent variables were the type of stimulus (word or nonword), the type of task (lexical decision or word matching), and the type of response (lexical decision or word matching). The results show that the type of stimulus and the type of task had a significant effect on the number of correct responses, while the type of response did not have a significant effect.

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Total	100.000	100			
Corrected Model	10.000	10	1.000	1.000	.999
Corrected Total	100.000	100			
Corrected Model	10.000	10	1.000	1.000	.999
Corrected Total	100.000	100			
Corrected Model	10.000	10	1.000	1.000	.999

Figure 1 shows a 2D hexagonal lattice of atoms. A central atom is labeled 'A'. A dashed line connects atom 'A' to its nearest neighbor, labeled 'B'. The distance between them is labeled 'a'. A solid line connects atom 'A' to its next-nearest neighbor, labeled 'C'. The distance between them is labeled $\sqrt{3}a$. The lattice is enclosed in a square frame with a dashed line representing the boundary.

A 4x4 grid of 16 small, stylized illustrations of various insects, including beetles, flies, and bees, arranged in a square pattern.

100



OVER

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186 STRUCTURE W.P. NO. Bowman's R. Bridge
CONTRACTOR Ridgway Valley Constructors DESIGN LOAD OF PILE 95 Tons
HAMMER DETAILS: TYPE Delmag D-32 WEIGHT 10,300 HEIGHT OF FALL OR ENERGY 25.75
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 1100
PILE DETAILS H.P. 12 - 78 H Piles BATTER: 1/3
PILE NO. 4 LOCATION West Abutment DATE DRIVEN Jan 30/75

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.
105'	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			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	186' 9"			FINAL CUT OFF ELEVATION		

REPORT TO BE SENT TO:-

GEOTECHNICAL OFFICE TIP EL.
ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
DOWNSVIEW, ONTARIO

SIGNED

NAME (PRINT)

DATE

ATTACH SKETCH OF PILE NUMBERING SYSTEM

Jan 30 1975
Nelson Wood
Nelson Wood

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186 STRUCTURE W.P. NO. Bowman's R. Bridge
 CONTRACTOR Ridgway Valley Constructors DESIGN LOAD OF PILE 95 Tons
 HAMMER DETAILS: TYPE Delmag D-22 WEIGHT 10,380 HEIGHT OF FALL OR ENERGY 39,700
 TYPE OF ANVIL OR CAP Steel WEIGHT OF ANVIL OR CAP 1000
 PILE DETAILS H.P. 12 - 78 H Piles BATTER: 1/3
 PILE NO. 4 LOCATION West Abutment DATE DRIVEN Jan. 30/75

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.
105'	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			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	186' 9"			FINAL CUT OFF ELEVATION		

REPORT TO BE SENT TO:-

GEOTECHNICAL OFFICE TIP EL.
 ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
 DOWNSVIEW, ONTARIO

SIGNED Jan. 30 1975
 NAME (PRINT) Nelson Wood
 DATE Jan. 30 1975
 ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

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.

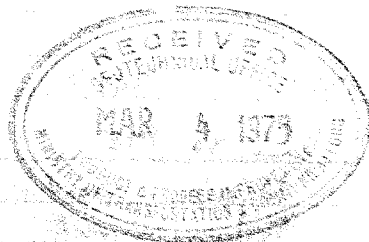
File Details must include type, dimensions and weight per foot, details of shoe, and slope of batter: e.g. 12 3/4" O.D. steel tube x 0.251" @ 33 lbs. per foot vertical. 12 3/4" x 1/2" steel plate shoe.

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.



BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186 STRUCTURE W.P. NO. Bourgeois & Bridge
 CONTRACTOR Ridwan Valley Constructors DESIGN LOAD OF PILE 95 Tons
 HAMMER DETAILS: TYPE Delmag D-22 WEIGHT 10,500 HEIGHT OF FALL OR ENERGY 25.700
 TYPE OF ANVIL OR CAP Steel WEIGHT OF ANVIL OR CAP _____
 PILE DETAILS HP 12 - 74 H Piles BATTER: 4/1
 PILE NO. 12 LOCATION Pier 11 Fly DATE DRIVEN Jan 24/75

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.
102'-1"	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			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE <u>129' 9"</u>	FINAL CUT OFF ELEVATION <u>314.32</u>					

REPORT TO BE SENT TO: -

GEOTECHNICAL OFFICE TIPEL
 ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
 DOWNSVIEW, ONTARIO

SIGNED Nelson Wood
 NAME (PRINT) Nelson Wood
 DATE Jan 24/75
 ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186 STRUCTURE W.P. NO. BOWNEBERRY R. BRIDGE
 CONTRACTOR Rideau Valley Constructors. DESIGN LOAD OF PILE 85 TONS.
 HAMMER DETAILS: TYPE Delmag D-22 WEIGHT 10,300 HEIGHT OF FALL OR ENERGY 25.700
 TYPE OF ANVIL OR CAP Steel WEIGHT OF ANVIL OR CAP 44.45
 PILE DETAILS 12 H.D. 74 H Piles BATTER: Nil
 PILE NO. 2A LOCATION Pier 1 & 2 DATE DRIVEN Jan. 20/75

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.
131'-2"	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			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	129' 10"			FINAL CUT OFF ELEVATION		

REPORT TO BE SENT TO:-

GEOTECHNICAL OFFICE
 ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
 DOWNSVIEW, ONTARIO

SIGNED Melvin Wood.
 NAME (PRINT) Melvin Wood.
 DATE Jan 20/75.
 ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186

STRUCTURE W.P. NO. BOWBACHER R. BRIDGE

CONTRACTOR Rideau Valley Constructors

DESIGN LOAD OF PILE 95 Tons

HAMMER DETAILS: TYPE Belmag A-22

WEIGHT 10,300 HEIGHT OF FALL OR ENERGY 39.700

TYPE OF ANVIL OR CAP Steel

WEIGHT OF ANVIL OR CAP

PILE DETAILS 12 H.D. 74 H PILES

BATTER: 4H

PILE NO. 35 LOCATION Pier F1, 01

DATE DRIVEN Jan. 22/75

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.
130'	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			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			96	
	22			47			72			97	
	23			48			73			98	
	24			49			74			99	
	25			50			75			100	

DETAILS FOR FINAL SIX INCHES OF PENETRATION

BLOWS PER INCH

MEASURED REBOUND IN INCHES

FINAL LENGTH OF PILE

129' 9"

FINAL CUT OFF ELEVATION

314.3'

REPORT TO BE SENT TO:-

GEOTECHNICAL OFFICE TRAC. 128.95
ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
DOWNSVIEW, ONTARIO

SIGNED

Nelson Wood

NAME (PRINT)

Nelson Wood

DATE

Jan. 22/75

ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186 STRUCTURE W.P. NO. Barnes Creek R. Bridge
 CONTRACTOR Ridgway Valley Constructors DESIGN LOAD OF PILE 95 Tons
 HAMMER DETAILS: TYPE Barnes Creek R. Bridge WEIGHT 6900 HEIGHT OF FALL OR ENERGY 25 ft
 TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 1100
 PILE DETAILS H. 12 74 H Piles BATTER: N. 1
 PILE NO. 49 LOCATION Rice Rd. 82 DATE DRIVEN Feb. 6/75

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.
24	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	release
	10			35			60			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	84'-8"			FINAL CUT OFF ELEVATION		

REPORT TO BE SENT TO:-

GEOTECHNICAL OFFICE TP EL.
 ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
 DOWNSVIEW, ONTARIO

SIGNED Nelson Wood
 NAME (PRINT) Nelson Wood
 DATE Feb 6/75
 ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186 STRUCTURE W.P. NO. BONNEVILLE P. BRIDGE
CONTRACTOR Robert Wilson Constructors DESIGN LOAD OF PILE 95 TONS
HAMMER DETAILS: TYPE Bonanza 825 Diesel WEIGHT 6000 HEIGHT OF FALL OR ENERGY 25-30
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 1100
PILE DETAILS H.P. 12 74 H. Pile BATTER: 1/4
PILE NO. 61 LOCATION Pier No. 2 DATE DRIVEN Feb. 10/75

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.
100'-1"	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			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	rebound
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	91'-6"			FINAL CUT OFF ELEVATION		

REPORT TO BE SENT TO: -

GEOTECHNICAL OFFICE
ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
DOWNSVIEW, ONTARIO

SIGNED Nelson Wood
NAME (PRINT) Nelson Wood
DATE Feb. 10/75
ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186 STRUCTURE W.P. NO. BONNECHERE R. BRIDGE
CONTRACTOR Rideau Valley Constructors. DESIGN LOAD OF PILE 35 TONS.
HAMMER DETAILS: TYPE Brannanham 8225 Diesel WEIGHT 6200 HEIGHT OF FALL OR ENERGY 25.000 ft-lb.
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 1100
PILE DETAILS 12 HP 74 H PILES BATTER: Nil
PILE NO. 257 LOCATION Pier 44. #3 DATE DRIVEN Feb. 13/75

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.
85'	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			85	
	11			36			61	retreat		86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	61'-2"					
FINAL CUT OFF ELEVATION	259.69					

REPORT TO BE SENT TO:-

GEOTECHNICAL OFFICE
ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
DOWNSVIEW, ONTARIO

SIGNED Nelson Wood
NAME (PRINT) Nelson Wood.
DATE Feb. 13/75
ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-196 STRUCTURE W.P. NO. Bonnechere R. Bridge
 CONTRACTOR Nelson Valley Constructors DESIGN LOAD OF PILE 95 Tons
 HAMMER DETAILS: TYPE Bonnechere Bros Diesel WEIGHT 6200 HEIGHT OF FALL OR ENERGY 25 ft
 TYPE OF ANVIL OR CAP Steel WEIGHT OF ANVIL OR CAP 1100
 PILE DETAILS 12 H.P. 70 "K" Piles BATTER: 1/4
 PILE NO. 92 LOCATION Pier F4, #3 DATE DRIVEN Feb 10/75

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.
72.9"	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			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65	retains		90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	65'-1"			FINAL CUT OFF ELEVATION		
				260.89		

REPORT TO BE SENT TO:-

GEOTECHNICAL OFFICE
 ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
 DOWNSVIEW, ONTARIO

SIGNED Nelson Wood
 NAME (PRINT) Nelson Wood
 DATE Feb. 10/75
 ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186 STRUCTURE W.P. NO. Bonnechere R. Bridge
 CONTRACTOR Rideau Valley Constructors. DESIGN LOAD OF PILE 95 Tons.
 HAMMER DETAILS: TYPE Bunnemann 6215 Diesel WEIGHT 6800 HEIGHT OF FALL OR ENERGY 21 ft.
 TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 1100
 PILE DETAILS 12 H.D. 74 H Piles BATTER: 1/4
 PILE NO. 71 LOCATION Pier Fly. #3 DATE DRIVEN Feb. 13/75

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.
80'	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			85	
	11			36			61	Final		86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	61' 4"					
FINAL CUT OFF ELEVATION	259.54					

REPORT TO BE SENT TO: -

GEOTECHNICAL OFFICE
 ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
 DOWNSVIEW, ONTARIO

SIGNED Nelson Wood
 NAME (PRINT) Nelson Wood
 DATE Feb. 13/75
 ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 78-136 STRUCTURE W.P. NO. ROVERCHURCH R. BRIDGE
 CONTRACTOR QUEEN VALLEY CONSTRUCTORS DESIGN LOAD OF PILE 55 TON
 HAMMER DETAILS: TYPE BRUNNENMANN 805 DIESEL WEIGHT 6000 HEIGHT OF FALL OR ENERGY 2500
 TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 1100
 PILE DETAILS H.P. 12 74 H PILES BATTER: NIL
 PILE NO. 105 LOCATION Pile No. 105 DATE DRIVEN 06/2/74

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.
78'	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	return		82	
	8			33			58			83	
	9			34			59			84	
	10			35			60			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	57'-1"					FINAL CUT OFF ELEVATION 261.8'

REPORT TO BE SENT TO: -

GEOTECHNICAL OFFICE
 ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
 MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
 DOWNSVIEW, ONTARIO

SIGNED Nelson Wood
 NAME (PRINT) Nelson Wood
 DATE 06/2/74
 ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-106 STRUCTURE W.P. NO. BRIDGE R. BRIDGE
CONTRACTOR ROSEAU VALLEY CONSTRUCTION DESIGN LOAD OF PILE 95 TON
HAMMER DETAILS: TYPE BRIDGEHAMMER 875 BUSH WEIGHT 6000 HEIGHT OF FALL OR ENERGY 3500 FT.
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 1100
PILE DETAILS H.P. 12 74 H ALLOY BATTER: 4:1
PILE NO. 113 LOCATION Pier No. 2 DATE DRIVEN Oct. 8/74

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.
79'	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	return		85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	66'-0"					FINAL CUT OFF ELEVATION 261.92

REPORT TO BE SENT TO:-

GEOTECHNICAL OFFICE TID EL.
ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
DOWNSVIEW, ONTARIO

SIGNED William Wood
NAME (PRINT) William Wood
DATE Oct 8/74
ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186 STRUCTURE W.P. NO. Reinforced Concrete Bridge
CONTRACTOR Ridgway Hanks Construction DESIGN LOAD OF PILE 95 Tons
HAMMER DETAILS: TYPE Single Hammer 2735 Dura WEIGHT 6000 HEIGHT OF FALL OR ENERGY 25 ft.
TYPE OF ANVIL OR CAP Steel WEIGHT OF ANVIL OR CAP 1100
PILE DETAILS 12 H.P. 74 H Piles BATTER: nil
PILE NO. 130 LOCATION Parade Fr. DATE DRIVEN Oct. 10/74

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.
81'	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			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65	refusal		90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	65' 9"					FINAL CUT OFF ELEVATION 292.28

REPORT TO BE SENT TO: -

GEOTECHNICAL OFFICE
ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
DOWNSVIEW, ONTARIO

SIGNED Nelson Wood
NAME (PRINT) Nelson Wood
DATE Oct 10/74
ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 3 CONTRACT NO. 73-186 STRUCTURE W.P. NO. ROBINSON R. BRIDGE
CONTRACTOR ROBEY VALLEY CONSTRUCTORS DESIGN LOAD OF PILE 95 TONS
HAMMER DETAILS: TYPE SIEMENS-HALSKE 3215 DIESEL WEIGHT 1200 HEIGHT OF FALL OR ENERGY 25.000
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 1100
PILE DETAILS H.P. 12 74 H PILES BATTER: 4 1/2
PILE NO. 118 LOCATION PROV. H.W. 25 DATE DRIVEN OCT 21 1974

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.
86'	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			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65	return		90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	65'-1"					FINAL CUT OFF ELEVATION

REPORT TO BE SENT TO: -

GEOTECHNICAL OFFICE
ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
DOWNSVIEW, ONTARIO

SIGNED Nelson Wood
NAME (PRINT) Nelson Wood
DATE OCT 21 1974
ATTACH SKETCH OF PILE NUMBERING SYSTEM

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 9 CONTRACT NO. 73-186 STRUCTURE W.P. NO. Bowditch R. Bridge
CONTRACTOR Riviera Valley Constructors DESIGN LOAD OF PILE 85 Tons
HAMMER DETAILS: TYPE DALMEG D-12 WEIGHT 5200 HEIGHT OF FALL OR ENERGY 11.16
TYPE OF ANVIL OR CAP STEEL WEIGHT OF ANVIL OR CAP 750
PILE DETAILS H.P. 12 74 H PILES BATTER: 3/1
PILE NO. 148 LOCATION East Arrow Pt. DATE DRIVEN Oct. 31/74

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.
136'	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			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	127' 10"					FINAL CJT OFF ELEVATION 344' 16"

REPORT TO BE SENT TO:-

GEOTECHNICAL OFFICE
ATTENTION: PRODUCT & PROCESS IMPROVEMENT SECTION,
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,
DOWNSVIEW, ONTARIO

SIGNED Nelson Wood
NAME (PRINT) Nelson Wood
DATE Oct 31/74
ATTACH SKETCH OF PILE NUMBERING SYSTEM

1
RENFREW ONT.

DEC. 3, 1975

Mr. R. N. McPherson
Const. ~~Eng.~~ Supervisor
OTAWA

Cont. 73-186 Hwy. 17(N)
RE:- INTENT TO CLAIM FOR PILE
DRIVING @ BOURNEMERE RIVER STRUCT.

THE INFORMATION SHOWN ON THE PLAN SHOWS THE PILES IN PIER N^o 2 AND 3 WERE TO BE DRIVEN TO BEDROCK AND THE PILES IN PIER N^o 1, 4, 5, EAST AND WEST ABUTMENTS WERE TO BE FRICTION PILES DRIVEN IN ACCORDANCE WITH STO. BO 82-7 (HILEY FORMULA) USING A DESIGN LOAD OF 95 TONS PER PILE.

THE CONTRACTOR STARTED TO DRIVE PILES IN PIER N^o 4. USING THE FORMULA THE PILES WOULD OF REACHED THE DESIGN BEARING IN 5 OR 6 BLOWS PER INCH BUT THE MOST BLOWS PER INCH THAT COULD BE OBTAINED BEFORE BEDROCK WAS REACHED WAS 3 OR 4 BLOWS PER INCH. THIS RESULTED IN AN ADDITIONAL 25 SPLICES AND 783 LIN. FT. OF PILING BEING REQUIRED.

THE SAME PROBLEM AROSE IN PIER N^o 5 RESULTING IN AN ADDITIONAL 27 SPLICES AND 1187 LIN. FT. OF PILING BEING REQUIRED.

THE CONTRACTOR STARTED TO DRIVE PILES IN THE EAST ABUTMENT AND WHEN THE PILES REACHED OVER 40' (LIMIT THAT THE HILEY FORMULA IS ABLE TO BE USED WITH A D-12 HAMMER) MR. B. HANSHAW STRUCTURAL CONSTRUCTION LTD. DOWNSVIEW WAS CONTACTED AND HE SAID THE PILING IN THE EAST ABUTMENT SHOULD BE DRIVEN BY A LARGER HAMMER OR TO 20 BLOWS PER INCH. THE CONTRACTOR

ELECTED TO USE THE SMALLER HAMMER (D-12 AND B-225) WHICH REQUIRED 20 BLOWS PER INCH. THE EAST ABUTMENT REQUIRED AN ADDITIONAL 23 SPACES AND 743 Lm. FT. OF PILING.

THE PILING IN PIER N^o: 4, 5 AND EAST ABUTMENT WAS DRIVEN BETWEEN SEPT. 30 AND NOV. 6th 1974 USING A D-12 AND B-225 HAMMERS.

THE SPECIAL PROVISIONS PAGE N^o: 31 STATES THAT NO PILE DRIVING SHALL COMMENCE ON THE BONNECHERE RIVER STRAIGHTENING UNTIL THE SLOPE TREATMENT IS COMPLETED. PAGE N^o: 2 OF ADDENDUM N^o: 3 STATES THAT THE CONSTRUCTION SHALL ENTER ONTO D. JAMIESON'S PROPERTY STA. 421+00 TO 439+50 UNTIL OCT. 15th 1974 OR UNTIL AUTHORIZED TO DO SO BY THE MINISTRY. PERMISSION GRANTED ON NOV. 4th 1974.

ON NOV. 7th THE CONTRACTOR STARTED TO CONSTRUCT AN ACCESS ROAD TO THE STRUCTURE SITE. NOV. 8th THE CLEARING CONTRACTOR STARTED CLEARING ON THE WEST BANK OF THE BONNECHERE RIVER BANK WHICH WAS FOLLOWED BY GRUBBING, EXCAV. OF BANK TREATMENT, EXCAV. OF PIER N^o: 1 CONSTRUCTION OF W. ABUTMENT APPROACH AND MATERIAL FOR CATERDRAIT FILLING PIER N^o: 3. ON DEC. 11th THE SUB CONTRACTOR (RIDEAU VALLEY) WERE INFORMED THAT THEY COULD START DRIVING "H" PILES AND SHEET PILING FOR PIER N^o: 3 ON MONDAY DEC. 16th.

THE SUB CONTRACTOR STARTED TO DRIVE PILES ON JAN. 3rd 1975 IN PIER N^o: 1

THE SUB CONTRACTOR HAD BEEN GIVEN WRITTEN INSTRUCTIONS ON NOV. 27TH 1974 THAT HE WOULD BE REQUIRED TO SUPPLY A LARGER HAMMER TO DRIVE THE PILES IN V. ABUTMENT AND PIER N^o:1

THE SUB CONTRACTOR RENTED A D-22 HAMMER FROM JAN. 16TH TO FEB. 4TH 1975

THE PILING IN V. ABUTMENT AND PIER N^o:1 WENT TO BEDROCK BEFORE THE PRACTICAL REFUSAL USING THE HILEY FORMULA COULD BE OBTAINED.

THE V. ABUTMENT REQUIRED 11 ADDITIONAL SPLICES AND 232 LIN. FT. OF PILING. PIER N^o:1 REQUIRED 5 ADDITIONAL SPLICES AND 173 LIN. FT. OF PILING.

PIER N^o:3 WAS DRIVEN USING A B-225 HAMMER AND DRIVEN TO BEDROCK THIS FOOTING REQUIRED 3 ADDITIONAL SPLICES AND 128 LIN. FT. LESS OF PILING. THE ADDITIONAL SPLICES WERE REQUIRED DUE TO DIFFERENT LENGTHS PILE AVAILABLE TO THOSE SHOWN IN THE PLANS.

THE SUB CONTRACTOR DRIVING STARTED BETWEEN FEB. 12TH - 16TH AND FINISHED PIER N^o:3. THE PILING WENT TO BEDROCK AND REQUIRED 11 ADDITIONAL 6 SPLICES AND 177 LIN. FT. OF PILING.

THE PILING IN V. ABUTMENT PIER N^o:1, 2 AND 3 WERE DRIVEN IN THE WINTER MONTHS RESULTING IN LABOUR AND EQUIPMENT NOT WORKING AT PEAK PERFORMANCE.

DUE TO THE BATTER ON THE PILES IN THE PIERS THE CONTRACTOR HAD A LARGE AMOUNT OF STAND BY TIME DURING THE SPICING TIME AS IT WAS NOT FEASIBLE TO MOVE TO ANOTHER PILE WHILE THE SPICING WAS BEING DONE.

C. J. SUMER.