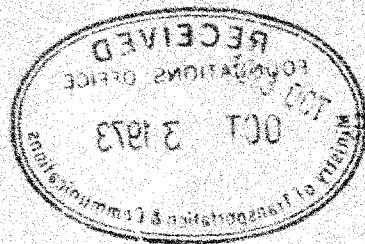


72-11159



0266

PM 4:14

K

KINR DOWN 7 OCT 3/73 3:52P VR

E R SAINT - REGN'L MTLN ENGR

RE : BAUDETTE RIVER AND HIGHWAY NO.34, W.O.72-11159, W.P.861-67-01.

THIS IS TO CONFIRM OUR TELEPHONE CONVERSATIONS (AUGUST 7 & AUGUST 14, 1973) WITH YOUR OFFICE. NO STABILITY PROBLEMS ARE ANTICIPATED FOR THE PROPOSED FINAL CROSS SECTIONS AS SUBMITTED TO OUR OFFICE ON JULY 31, 1973.

P PAYER - SNR FOUNDATIONS ENGR, FOUNDATIONS OFFC.

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P PAYER - SRR FOUNDATIONS ENGR, FOUNDATIONS OFFC.

JULY 31, 1973.

THE PROPOSED FINAL CROSS SECTIONS AS SUBMITTED TO OUR OFFICE ON
1973) WITH YOUR OFFICE. NO STABILITY PROBLEMS ARE ANTICIPATED FOR
THIS IS TO CONFIRM OUR TELEPHONE CONVERSATIONS (AUGUST 7 & AUGUST 14,
RE : BAUDETTE RIVER AND HIGHWAY NO.34, W.O.7S-11152, W.P.861-67-01.

E R SAINT - REGN'L MILS ENGR
KIRK DOWN 7 OCT 2473 3:52P VR



MEMORANDUM

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

FROM: Structural Planning Office,
Kingston, Ontario.

ATTENTION: Mr. M. Devata

DATE: December 18, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 861-67-01, Highway 34, From Lancaster North Limits
Northerly to Alexandria South Limits 12.0 Miles
Beaudette River Bridge, Site 31-126, Hwy. 34, District 9

Further to our telephone conversation today, I confirm my request for a foundation investigation at the above location. The bore holes are required at the structure approaches for approximately 200 ft. each side of the river.

The purpose of the investigation is to obtain information concerning the settlement problem at this site. Over the last ten years settlement has occurred at approximately 2 inches a year. In the year 1965-66 a fairly large amount of padding was placed at the approaches.

We should be glad to know over what period of time settlement will continue to take place and we should also be glad to have any recommendations you feel are required.

T. C. Kingsland

T. C. Kingsland
Regional Structural Planning Engineer

TCK/hl

c.c. J. E. Callaghan
A. J. Percy - Att. A. E. Irving
C. S. Grebski

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A. J. Percy,
Regional Manager, Systems Design,
Kingston, Ontario.

FROM: Structural Planning Office,
Kingston, Ontario.

ATTENTION: Mr. A. E. Irving

DATE: December 18, 1972.

OUR FILE REF.

IN REPLY TO

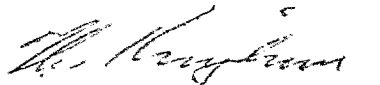
SUBJECT: W.P. 861-67-01, Highway 34, From Lancaster North Limits
Northerly to Alexandria South Limits 12.0 Miles
Beaudette River Bridge, Site 31-126, Hwy. 34, District 9

With reference to your letter dated December 12, 1972, please note that this Section has requested a foundation investigation at the Beaudette River bridge in order to obtain the recommendations of Foundations Section relating to the settlement at the structure approaches.

With regard to the problem of washouts at the corners of the structure due to the inadequate wingwalls, we understand that the District will be placing some rock fill under maintenance in the near future so that this work will be excluded from the work project.

I confirm that the culvert at Sta. 404+10 will require to be replaced.

With regard to the 4' x 4' concrete culvert at Sta. 240+50, which has a 12" dia. x 140' long C.S.P. below footing level to deal with the local spring, it appears that some undermining of the footings has occurred at the downstream end and that some repairs will be required. Some rock fill placed at the culvert outlet would probably help to prevent further erosion.



T. C. Kingsland
Regional Structural Planning Engineer

TCK/hl

att.

c.c. B. R. Davis
J. E. Callaghan
C. S. Grebski
A. G. Stermac - Att. M. Devata

Design Services Branch,
1201 Wilson Avenue,
Downsview, Ontario.
M3M 1J8

January 31, 1973.

Telephone: 248-3282.

Master Soil Investigation,
104 Kenner Drive,
Woodbridge, Ontario.

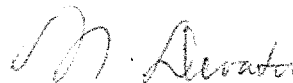
Dear Sirs:

This letter confirms our request of January 29, 1973,
for the supply of C.M.E. auger machine together with all
necessary equipment, as specified under the terms of our
Contract Agreement, at Alexandria, Ontario, on January 31,
1973.

Mobilization will be from Ottawa.

Our Project Number is W.O. 72-11159. ✓

Yours truly,



M. Devata,
Supervising Foundations Engineer,
A. G. Sternac,
Principal Foundations Engineer.

MD/ao

cc: W. W. Fry
(Attn: Mrs. M. Andrews)

For:

Foundations Files
Documents

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

72-11-159

TO: Mr. M. Devata,
Supervising Foundation Engineer,
Downsview, Ontario.

FROM: Structural Planning Office,
Kingston, Ontario.

ATTENTION: Mr. J. Bangs

DATE: February 23, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 861-67-01, Highway 34, From Lancaster North Limits
Northerly to Alexandria South Limits 12.0 Miles
Beaudette River Bridge, Site 31-126, Hwy. 34, District 9

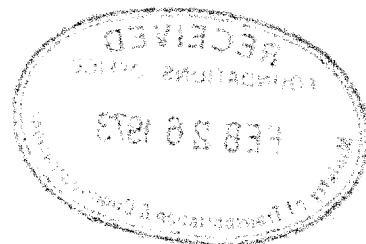
Further to our letter of December 18, 1972, we are enclosing
as requested partial prints of Plan B-33-34-2 and Profile
C-33-34-2 for the above-noted project.

A. Van Dalen

A. Van Dalen

For: T. C. Kingsland
Regional Structural Planning Engineer

/hl
encls.



MEMORANDUM

Structural Planning Office,
Kingston, Ontario.

Mr. J. Davis,
Superintendent of Construction Engineering,
Department of Transportation,
Ottawa, Ontario.

February 22, 1973.

DATE

Mr. J. Davis

IN REPLY TO

Re: 8, 801-01-01, Highway 34, From Lancaster North Limits
to Alexbridge South Limits 12.0 Miles
Alexbridge River Bridge, Site 81-120, Hwy. 34, District 2

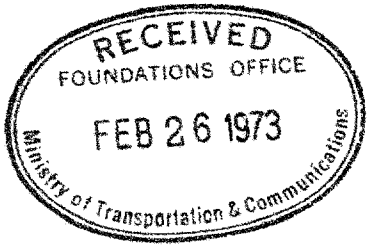
Further to our letter of December 14, 1972, we are enclosing

as requested partial prints of Plan P-32-34-2 and 1/4

(P-32-34-2 for the above-noted project).

A. Van Galen
I. L. King-Isaac
Regional Engineer, Kingston

Encs.



MEMORANDUM

72-11159

TO: Mr. E. R. Saint,
Regional Materials Engineer,
Kingston, Ontario.

FROM: Structural Planning Office,
Kingston, Ontario.

ATTENTION: Mr. M. Batten

DATE: 14 May 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 861-67-01, Highway 34, From Lancaster North Limits
Northerly to Alexandria South Limits 12.0 Miles,
Beaudette River Bridge, Site 31-126, Hwy. 34, District 9

We have not yet received the Foundation Investigation Report for the above-mentioned site. This is expected to be issued within the next few days and in the meantime Mr. C. Poon of Foundations Section has passed on the following information concerning the subsoil conditions at the above location.

The approach fills to the structure are underlain by approximately 50 ft. of very soft compressible clay with shear strengths as low as 150 lb. per sq. ft. Underneath the clay is a 4 ft. layer of glacial till underlain by bedrock.

The total predicted settlement under the existing approach fills is 3 to 4 ft. It is strongly advised that no padding be placed on the existing fills to restore the original grade since this action will induce an additional 9 to 10 in. of settlement. The present rate of settlement is approximately 2 in. per annum. *observed settlement to date - 3'*

In addition to the settlement problems, it is predicted that if additional fill is placed at the approaches a severe stability problem could arise which may necessitate the use of berms. Again, if any widening of the approach fills is contemplated, a very severe differential settlement problem is anticipated between the old and the new fill. *During the first year after the addition of 2' of fill is placed.*

We will pass on any further information as soon as it becomes available.

T. C. Kingsland

T. C. Kingsland
Regional Structural Planning Engineer

TCK/hl

c.c. B. R. Davis
P. D. Billings
A. J. Percy
✓ A. G. Stermac-Att. M. Devata
J. M. Childs-Att. J. Cruickshank
C. S. Grebski-Att. K. Bassi

MEMORANDUM

Mr. E. H. Selin
Regional Materials Engineer
Kingston, Ontario

Mr. E. H. Selin
Regional Materials Engineer
Kingston, Ontario

Mr. M. M. Harris



Mr. E. H. Selin
Regional Materials Engineer
Kingston, Ontario

Following information is being provided for your information:

1. The following information is being provided for your information:

2. The following information is being provided for your information:

3. The following information is being provided for your information:

MEMORANDUM

31G-76

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

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

ATTENTION:

DATE: June 4, 1973.

OUR FILE REF.

IN REPLY TO JUN 11 1973

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Settlement of Approach Embankments
Beaudette River Bridge on Hwy. #34
Site #31-126, District #9
Township of Lancaster & Charlottenburgh
County of Glengarry
W.O. #72-11159 - W.P. #861-67-01

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
Atch.

c.c. E. J. Orr
B. R. Davis
A. Rutka
A. J. Percy
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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 - 4.1) General.
 - 4.2) Fill Material (Approach Embankments).
 - 4.3) Silty Clay to Clay
 - 4.4) Heterogeneous Mixture of Silty Clay, Sand and Gravel (Glacial Till).
 5. GROUNDWATER CONDITIONS.
 6. DISCUSSIONS AND RECOMMENDATIONS.
 7. MISCELLANEOUS.
- - - - -

FOUNDATION INVESTIGATION REPORT

For

Settlement of Approach Embankments

Beaudette River Bridge on Hwy. #34, Site #31-126

Township of Lancaster & Charlottenburgh, County of Glengarry

W.O. #72-11159 -- W.P. #861-67-01

1. INTRODUCTION:

Over the past ten years, settlement of the approach embankments has occurred at a rate of approximately 2 inches a year. In the year 1965-66 a fairly large amount of padding was placed at the approaches. The Foundations Office was requested to carry out an investigation of sufficient scope to determine the probable causes of the subsidence and to provide recommendations regarding future heightening and widening of the approach embankments.

The request was contained in a memo from Mr. T.C. Kingsland, Regional Structural Planning Engineer, Eastern Region, dated Dec. 18/72. Subsequently, an investigation was carried out by this Office to determine the subsoil and groundwater conditions at the site.

This report contains all the visual observations made and the factual data obtained during the course of field investigation. In addition, an assessment of the causes of the approach subsidence, together with recommendations with regard to future widening and heightening of the roadway were also presented.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located $\frac{1}{2}$ -mile from the intersection of County Road #25 and Hwy. 34, approximately 1 mile south of

Green Valley. At this location, Hwy. #34 is a two-lane, paved road. The profile grade of this road is 5 to 8 ft. above the surrounding terrain. Shallow ditches run along both sides of Hwy. #34.

The surrounding area is generally flat-lying and is used for agricultural purposes.

Physiographically, the site is situated in the region known as the "Glengarry Till Plain". In this area, the surface is undulating to rolling, consisting of long drumlinoidal ridges and a few well-formed drumlins together with intervening clay flats and swamps. The till has a loamy texture and contains a high proportion of limestone with admixture of materials derived from the Precambrian rocks to the north and from the Nepean sandstone at the base of the Rigaud mountain. The depth to bedrock is seldom over 100 ft. and over much of the area the till is less than 25 ft. in depth.

3. FIELD AND LABORATORY INVESTIGATION:

3.1) Field Investigation:

Four sampled boreholes each accompanied by a dynamic cone penetration test, were put down at this site. In addition, one shallow hole was put down through the centre of the roadbed to determine the pavement and fill depths.

The borings were advanced by means of a continuous flight auger machine (commercially known as CME55) adapted for soil sampling purposes. This machine was equipped with hollow stem augers.

Disturbed samples were obtained at required intervals in a 2-inch O.D. split-spoon sampler, which was hammered into the soils. The method of driving the split-spoon sampler conformed to the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. This was supplemented by taking "relatively undisturbed"

samples in 2" I.D. Shelby Tubes in the cohesive portions of the overburden; these tubes were pushed either manually or hydraulically into the soil. In situ torque vane tests were carried out, as many as possible, to determine the undrained shear strength characteristics of the strata.

The locations and elevations of all borings were surveyed in the field by personnel from the Engineering Survey Section of Eastern Region (Kingston); they are shown on Drawing No. 72-11159A, together with inferred stratigraphic sections. All elevations in the report are referred to a geodetic datum.

3.2) Laboratory Procedures:

All samples were subjected to careful visual examination in the field and subsequently in the laboratory. Following the examination, laboratory tests were carried out on selected representative samples to determine the engineering properties of the various soil types encountered, namely:

- Natural Moisture Content
- Atterberg Limits
- Grain-size Distribution
- Undrained Shear Strength
- Bulk Density
- Consolidation Tests

4. SUBSOIL CONDITIONS:

4.1) General:

The extent and composition of the overburden within the area under investigation, was found to be similar in all borings. The predominant stratum is composed of silty clay to clay. This cohesive stratum is up to 52 feet in thickness. At certain locations, fill material (approach embankment) up to 12 feet thick was found overlying this cohesive deposit. Underlying this cohesive layer is a glacial till stratum.

The stratigraphical sequence encountered in the borings is plotted on the Record of Borehole sheets. Stratigraphical sections have been inferred from this data and plotted on Drawing 72-11159A. The subsoil encountered from ground surface downward, is presented in the subsections to follow:

4.2) Fill Material (Approach Embankments):

The roadway embankment is composed of fill material up to 12 ft. in thickness. One borehole put down through the pavement (B.H. #5) indicates that the asphalt is 8 inches in thickness. In general, the fill material consists of a granular mixture of gravel, sand and silt.

Grain-size distribution curves for the sample of the fill material are presented on Figure #1 of the Appendix.

Standard penetration testing was carried out within this stratum and the results were plotted on the individual Record of Borehole sheets. The "N" values generally vary from 17 blows/ft. to 100 blows/ft. Based on these "N" values, it is estimated that the fill material has been, in general, well-compacted.

4.3) Silty Clay to Clay:

Directly beneath a thin layer of organic top-soil is the predominant stratum across the site, which is composed of silty clay to clay with occasional inclusion of organics. The thickness of this cohesive deposit varies between 45 feet (B.H.#1) and 52 feet (B.H.#3). Grain-size distribution curves for samples of the clay stratum are shown on Figure 2, in the Appendix.

The engineering properties of the deposit, as determined by field and laboratory testing, are presented in Table 1. They are also summarized on Figure #5.

Table 1

<u>Identity Tests:</u>		<u>Range</u>
Bulk Density (γ)	(P.C.F.)	88 - 104
Liquid Limit (W_L)	(%)	51 - 73
Plastic Limit (W_P)	(%)	24 - 31
Natural Moisture Content (W)	(%)	59 - 100

Compressibility Characteristics:	Clay under Roadway Embankment	Clay Outside Roadway Embankment
Initial void ratio (e_o)	1.56-1.99	2.69-2.91
Compression Index (C_c)	0.39-0.64	1.01-1.62
Degree of Preconsolidation (P.S.F.) ($P_c - P_o'$)	Under consolidated	400 - 700

Undrained Shear Strength (C_u):

Field Vanes	(P.S.F.)	180 - 760
Lab. Vanes	(P.S.F.)	155 - 645
Unconfined compression tests	(P.S.F.)	385 - 1,000
Sensitivity (S_t)		2 - 9

The Atterberg limit tests, summarized in Table 1 are also plotted on the Plasticity Charts, Fig. #3. These results indicate that, in general, the clay is inorganic with a plasticity in the intermediate to high range.

Based on the undrained shear strength testing carried out, it is estimated that the consistency of the cohesive stratum varies from very soft to firm.

The consolidation characteristics of the stratum were determined by carrying out four laboratory tests, the results of which are shown as Void Ratio vs. Log of Pressure plots on Figure No. 4. Two tests were carried out on samples recovered in B.H. #1, which was put down through the roadway embankment. The results indicate that the clay was under-consolidated as evidenced by the fact that the preconsolidation pressure (P_c) was found to have a value less than the existing overburden pressure (P_o'). The other two tests were performed on samples recovered from B.Hs. #2 and #4, which were put down outside the roadway embankment. It was found that the clay in this area has been preconsolidated by 400 to 700 p.s.f. in excess of the existing overburden pressure.

4.4) Heterogeneous Mixture of Silty Clay, Sand and Gravel (Glacial Till):

The cohesive stratum is underlain by a basically cohesive glacial till composed of a heterogeneous mixture of silty clay with sand and gravel. The thickness of this stratum ranges from 4 feet (B.H. #1) to 5 feet (B.H. #2). The consistency of this deposit is generally hard.

This stratum was not fully penetrated.

5. GROUNDWATER CONDITIONS:

Groundwater level observations have been carried out during the period of the investigation in the open boreholes. These observations are recorded on the borelog sheets and summarized on Drawing No. 72-11159A. The results indicate that the groundwater level is at elevation 211, which is very close to the ground surface. A perched water level varying between elevations 212 and 214 was observed within the approach embankment fills.

6. DISCUSSIONS AND RECOMMENDATIONS:

According to available information supplied by the Structural Planning Office, Eastern Region, the Beaudette River Bridge was built during 1934. The approach embankments for the bridge, which were approximately up to 12 feet high, have settled considerably since the completion of the structure and the approaches. In the last ten years, continuous maintenance was required. At the present time, the Regional System Design Office is studying the possibility of raising the grade of the Hwy. #34 in the vicinity of this structure and also widening the roadway.

The subsoil consists of a very soft to firm silty clay to clay up to 52 feet thick, underlain by cohesive glacial till. The embankments were built on this very compressible clay stratum. Consolidation settlement of this stratum, result from

the embankment (original) loading, was computed using the following assumptions:

- i) Original ground surface at elevation 208.
- ii) Compressibility characteristics of the clay deposit as determined from samples obtained from area outside the influence of the embankment loading were used.
- iii) Height of embankment fill = 12 feet, and
- iv) Bulk density of fill material = 125 p.e.f.

Based on the results of the computations it is estimated that the total settlement of the compressible clay stratum due to the original embankment loading would be of the order of 4 feet. By comparing the as-constructed profile of Hwy. #34 to that established recently, it is believed that a total settlement up to 3 feet might have occurred. It is therefore, estimated that the approach embankments would settle one foot more, but at a slower rate than that has occurred during the past ten years, as illustrated on Figure #6, contained in the Appendix. Calculations were also carried out to determine the additional settlement induced if a 3-foot padding will be placed on the existing approaches to restore the original grade. The results are tabulated below:

Time in Years	Estimated Consolidation Settlement (in inches)		
	Due to original fills	Due to padding to restore the original grade	Total
1	0.5	1.5	2
2	0.8	2.2	3
5	2	3	5
10	3.5	4.5	8

As mentioned elsewhere in this report, the clay is highly compressible and further has a very low shear strength. It should be noted that any widening of the existing approach

embankments will create a very severe differential settlement problem between the existing and the additional fill, because the latter would settle at a much faster rate.

Stability analysis in terms of total stress was carried out. The result indicates that the original embankments (up to 12 feet high) constructed with $4\frac{1}{2} : 1$ side slopes, were stable (F. of S. = 1.3). This would indicate that any heightening of the embankments other than placing a nominal padding to restore the original grade, will necessitate the use of mid height berm or flatter slopes. In addition, further settlement problems can be anticipated.

In view of the foregoing, it is our recommendation that only a nominal padding not more than 3 feet thick be placed on the approach fills to restore the original grade. In order to minimize post construction maintenance problems, consideration should be given to utilize light-weight fill material for padding purposes.

7. MISCELLANEOUS:

The field work was carried out between January 31 and February 9, 1973, under the supervision of Mr. J. T. Bangs, Project Foundations Engineer.

This report was prepared by Mr. J.T. Bangs, Project Foundations Engineer, who was assisted by Mr. C. S. Poon, Project Foundations Engineer.

The equipment used was owned and operated by Master Soils Investigation Ltd., Toronto.

This project was under the general supervision of Mr. M. Devata, Supervising Foundations Engineer, who also reviewed this report.

J. T. Bangs
J. T. Bangs

M. Devata
M. Devata, P. Eng.

JTB/kc
June 4, 1973



APPENDIX I

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1

JOB 72-11159

LOCATION # Hwy. 34 Sta. 470 + 80 16' Lt.

ORIGINATED BY JB

W.P. 861-67-01

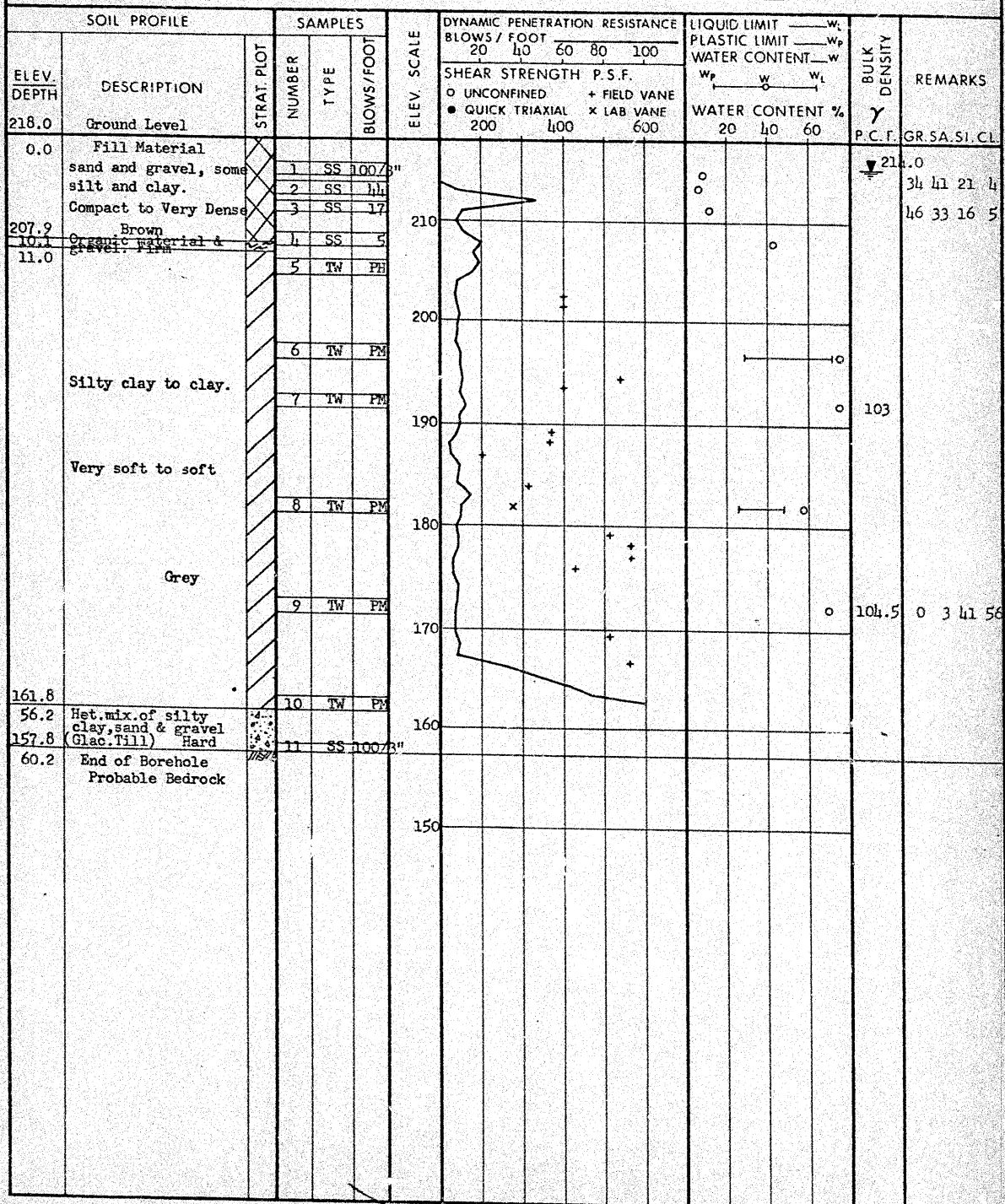
BORING DATE Jan. 31, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE GME Hollow Stem Auger

CHECKED BY C.P.



DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 2

FOUNDATIONS OFFICE

JOB 72-11159

LOCATION E Hwy. 34 Sta. 470 + 83 66' Lt.

W.P. 861-67-01

BORING DATE Feb. 6, 1973

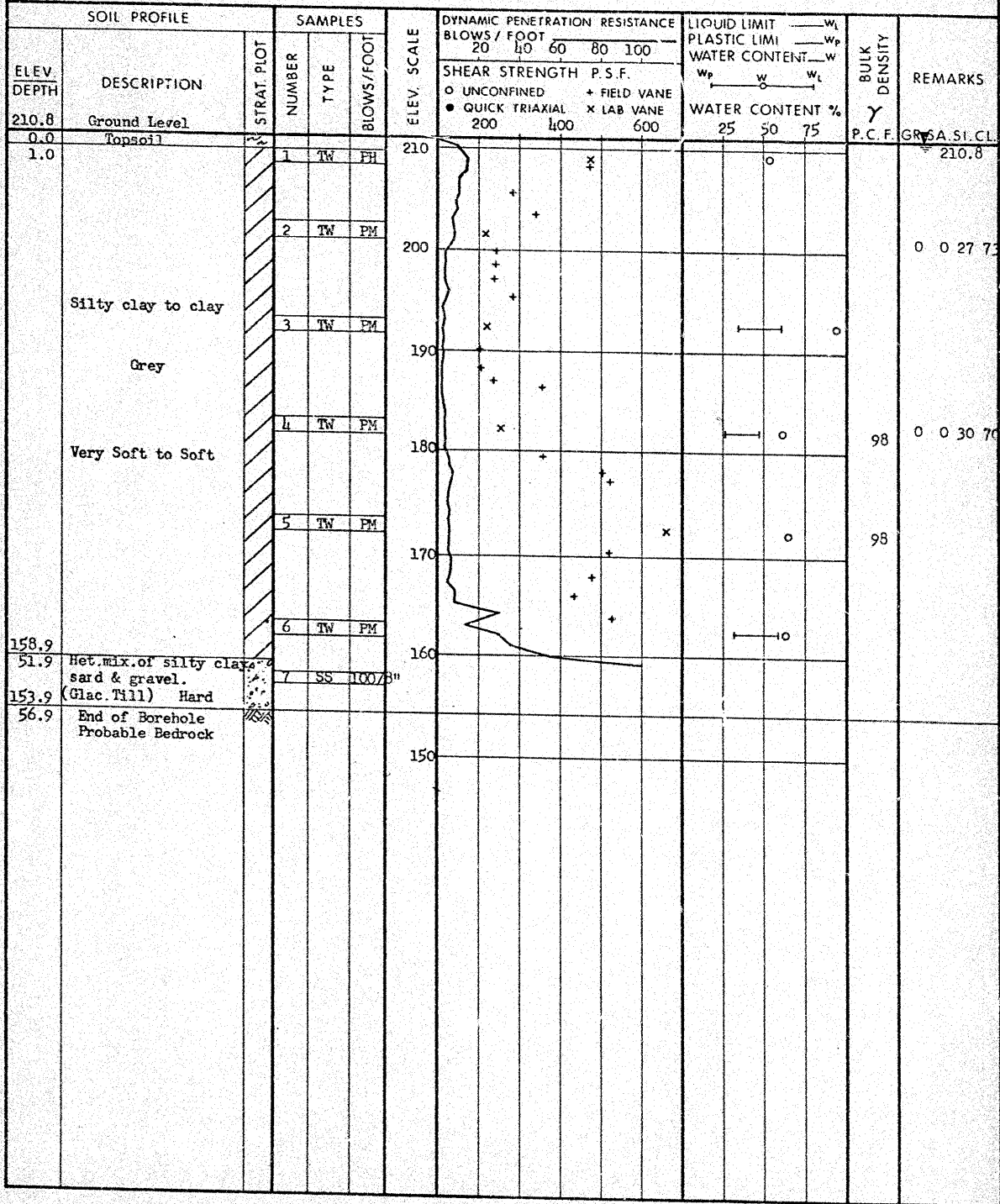
ORIGINATED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - Hollow Stem Auger

COMPILED BY JB

CHECKED BY CP



OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 72-11159

LOCATION Ø Hwy. 34 Sta. 468 + 68 16' Rt.

ORIGINATED BY JB

W.P. 861-67-01

BORING DATE Feb. 8, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE OME Hollow Stem Auger

CHECKED BY CR

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.			WATER CONTENT %					
217.4	Ground Level						○ UNCONFINED	+	FIELD VANE	w_p — w — w_L	25	50	75	P.C. 5 G.S.A. S.I. CL	
0.0	Fill Material gravel and san', trace of silt & clay.		1	SS	100/9"		● QUICK TRIAXIAL	x	LAB VANE					212.5	64 39 (7)
209.9	Compact to Very Dense		2	SS	39	210								137	68 24 (8)
7.5	Silty sand, some clay & gravel. Brown		3	TW	PH										16 40 33 11
205.9	Organic material. Black		4	TW	PH										
11.5			5	TW	PM	200								95.5	0 0 30 70
	Silty clay to clay.														
	Very Soft to Soft		6	TW	PM	190									
			7	TW	PM	180									
			8	TW	PM	170								98	0 9 33 56
	Grey					160									
153.4			9	TW	PM	150									
64.0	Hard														
149.4	Het. mix. of silty clay sand & grav. (Glac. Till)														
68.0	End of Borehole Probable Bedrock														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4

JOB 72-11159

LOCATION 1/2 Hwy. 34 Sta. 468 + 49 61' Rt.

ORIGINATED BY JB

W.P. 861-67-01

BORING DATE Feb. 7, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME Hollow Stem Auger

CHECKED BY CP

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — w_L			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT — w_p					
211.8	Ground Level						20	40	60	80	100	WATER CONTENT — w			
210.8	Topsoil (brown)						SHEAR STRENGTH P.S.F.			WATER CONTENT %					
1.0							O UNCONFINED + FIELD VANE			w_p — w — w_L					
							O QUICK TRIAXIAL X LAB. VANE			25 50 75					
							200	400	600						
210			1	TW	PM	210									
	Silty clay to clay (Grey)		2	TW	PM	200							88		
			3	TW	PM	190								0 0 19 81	
	Very Soft to Soft														
			4	TW	PM	180									
			5	TW	PM	170									
161.0															
50.8	Net mix of silty clay & sand, grey (dust. fill)		6	TW	PM	160									
158.0	End of Borehole														
155.0	End of Cone Test														
56.0	Probable Bedrock														
						150									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 5

JOB 72-11159

LOCATION Ø Hwy. 34 Sta. 468 + 79 3' Rt.

ORIGINATED BY JB

W.P. 861-67-01

BORING DATE Feb. 9, 1973

COMPILED BY JB

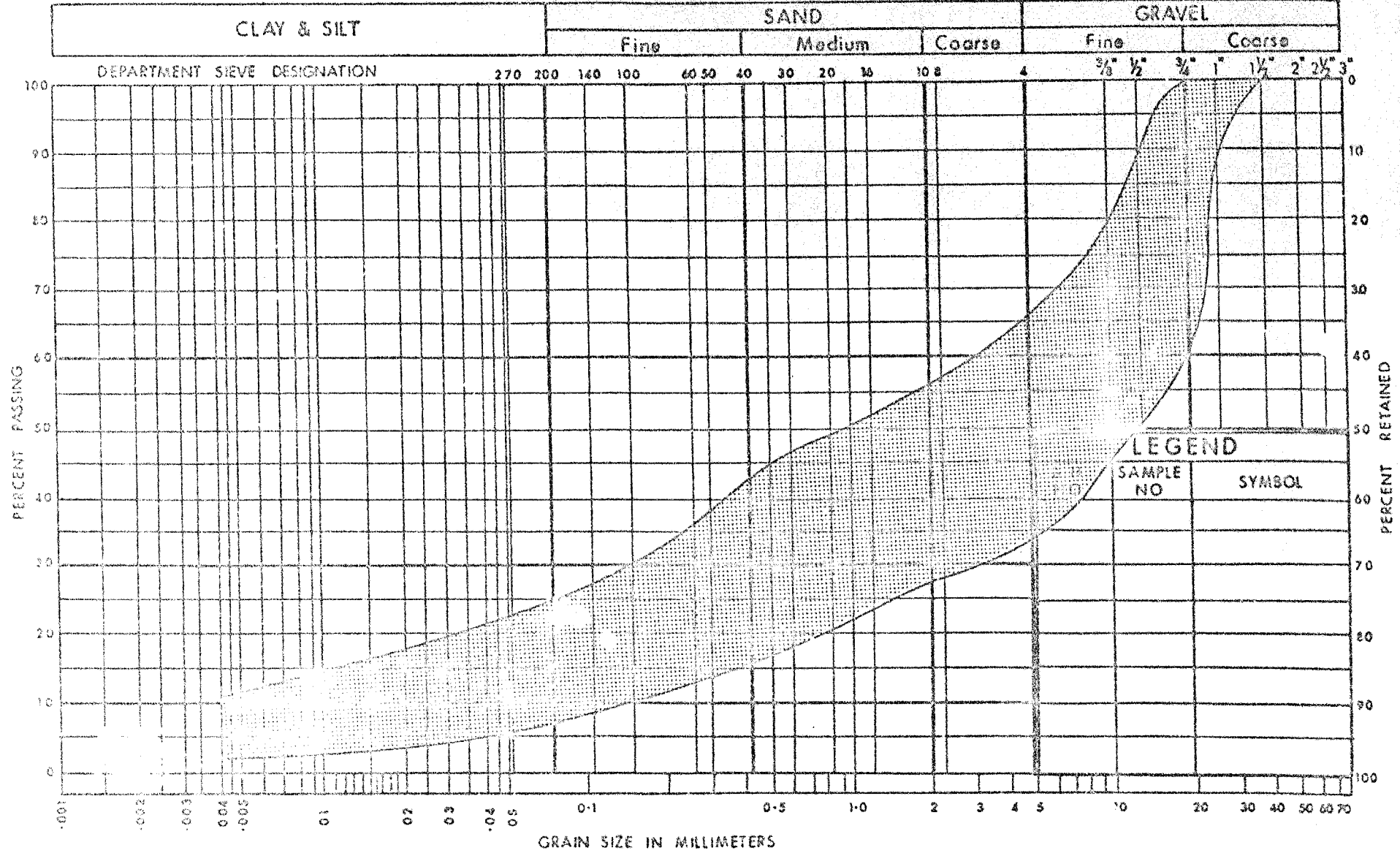
DATUM Geodetic

BOREHOLE TYPE CME Auger

CHECKED BY C.P.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L WATER CONTENT %				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEP. ft	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.									
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
217.7	Ground (Pvt) Level														GR.SA.SI.CL	
0.3	Fill Material		1	AS		210									58 34 (8) 3 46 40 11	
	Sand and gravel, silt and clay.		2	AS												
			3	AS												
			4	AS												
	Brown		5	AS												
205.2			6	AS												
12.5	End of Borehole					200										

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS
DESIGN SERVICES
BRANCH

GRAIN SIZE DISTRIBUTION
FILL MATERIAL
SAND & GRAVEL, TRACE OF SILT & CLAY

W.P. No. 861-67-01
JOB No. 72-11159
FIG. 1

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT

SAND

GRAVEL

Find

Medium

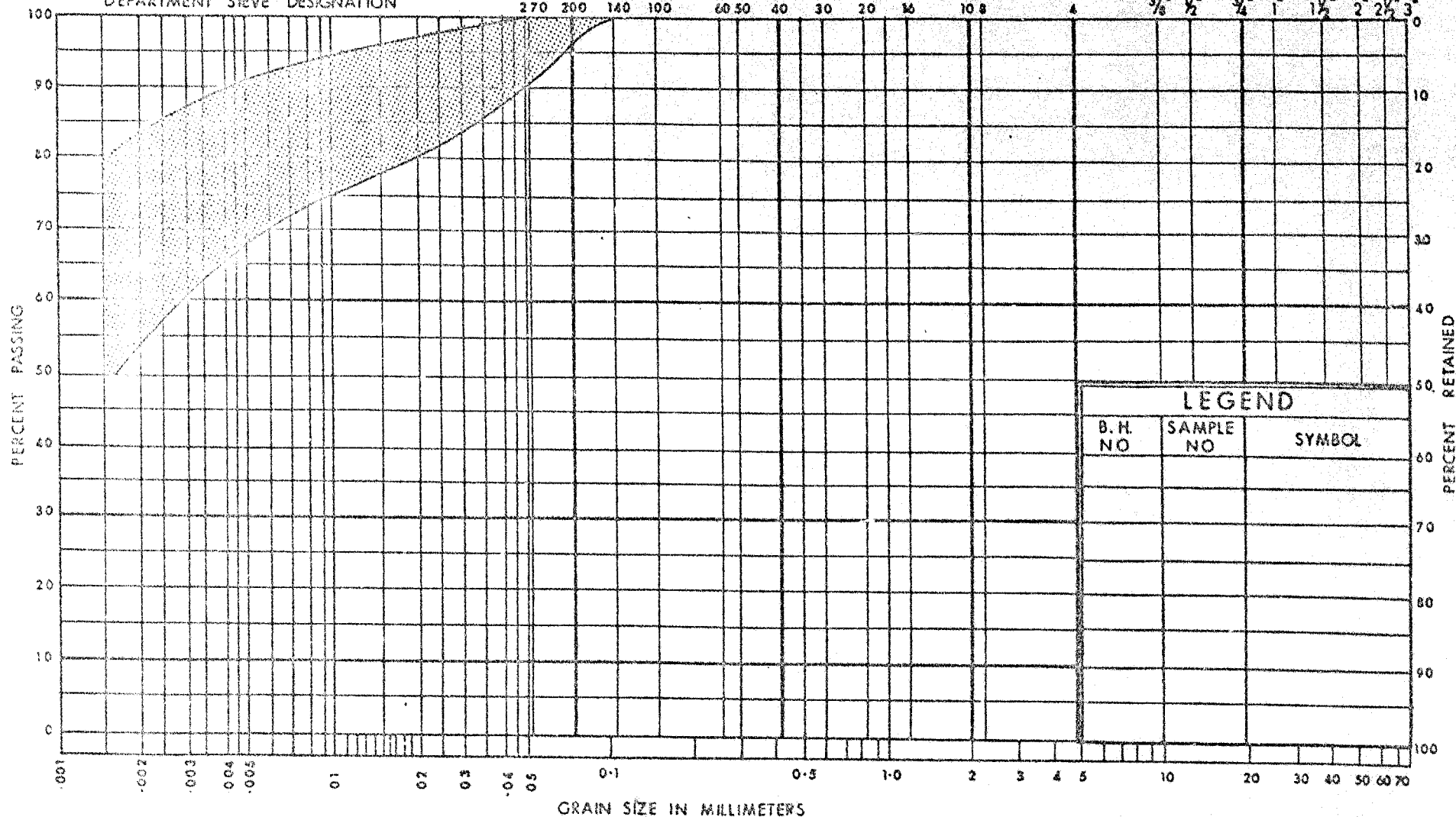
Course

Fine

Course

DEPARTMENT SIEVE DESIGNATION

270 200 140 100 60 50 40 30 20 10 8 4 $\frac{3}{8}$ " $\frac{1}{2}$ " $\frac{3}{4}$ " 1" $1\frac{1}{2}$ " 2" $2\frac{1}{2}$ " 3"



GRAIN SIZE IN MILLIMETERS

DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES
BRANCH

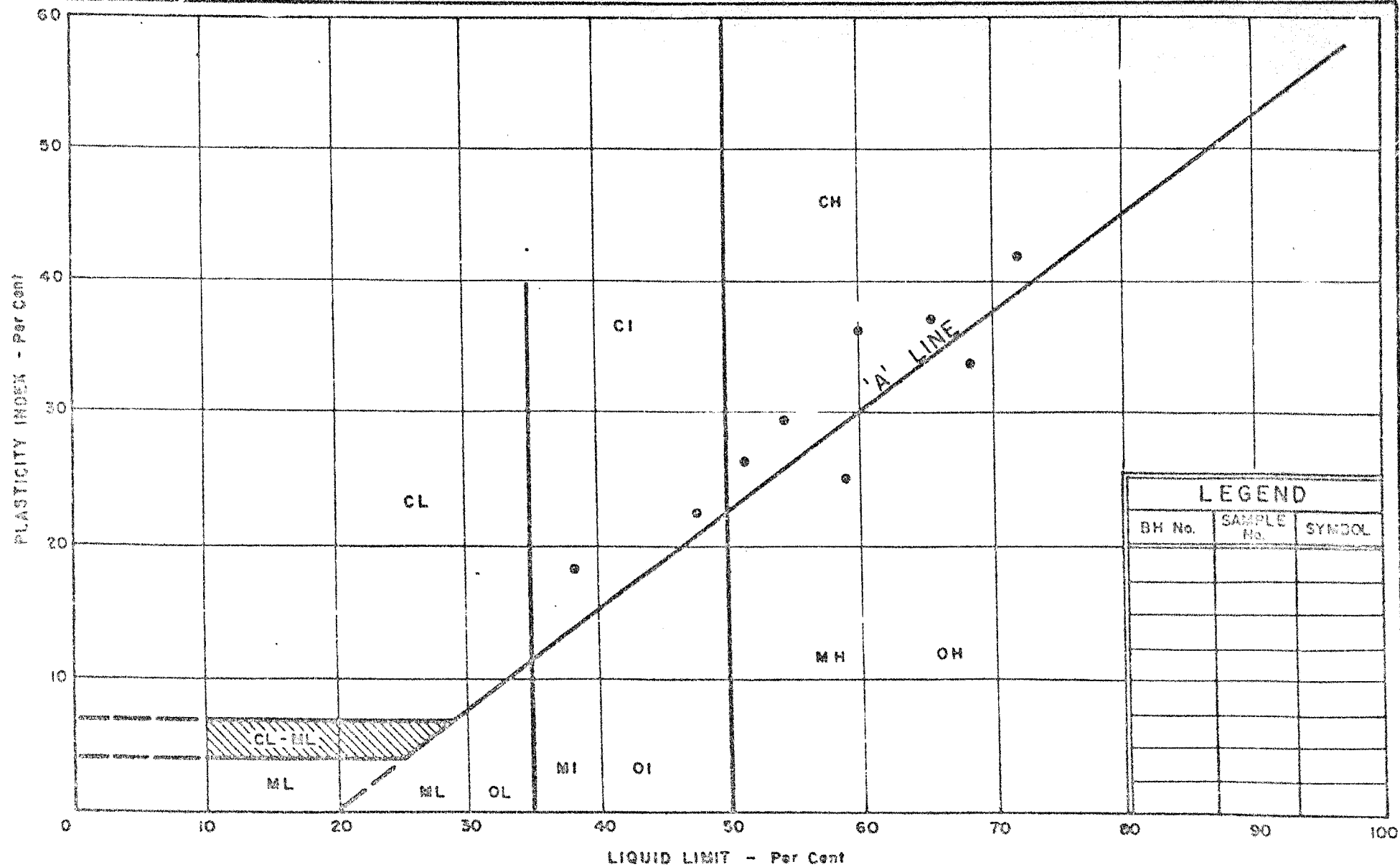
GRAIN SIZE DISTRIBUTION

SILTY CLAY TO CLAY

W.P. No. 861 - 67 - 01

JOB No. 72 - 11159

FIG. 2



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART SILTY CLAY TO CLAY

MR. No. 861-67-01

JOB No. 72-11159

FIG. 3

VOID RATIO - PRESSURE CURVES

JOB NO. 72-11159

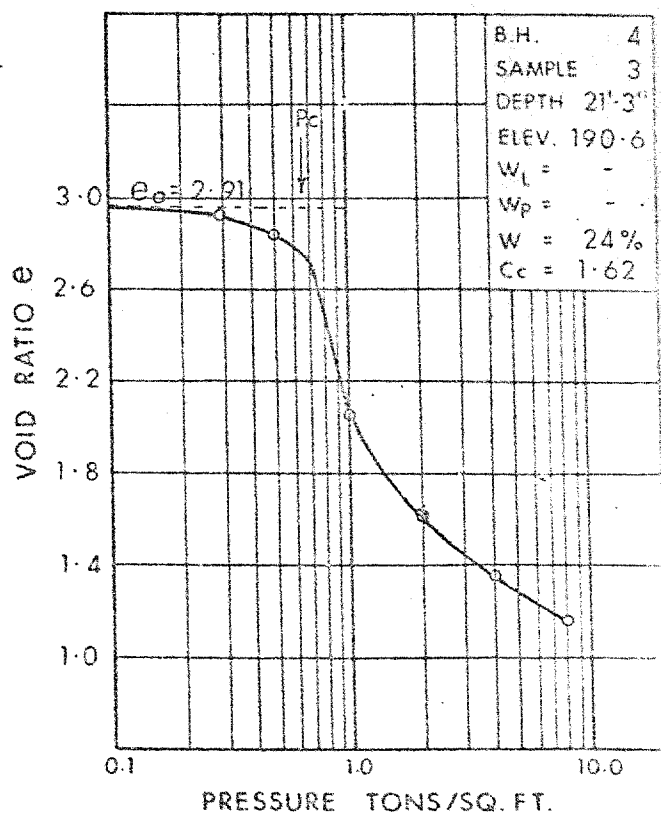
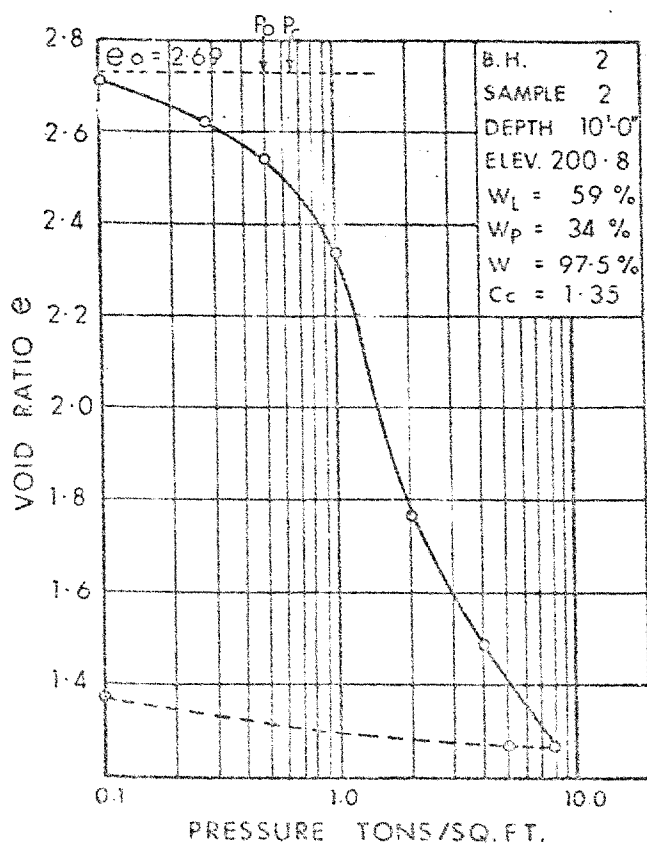
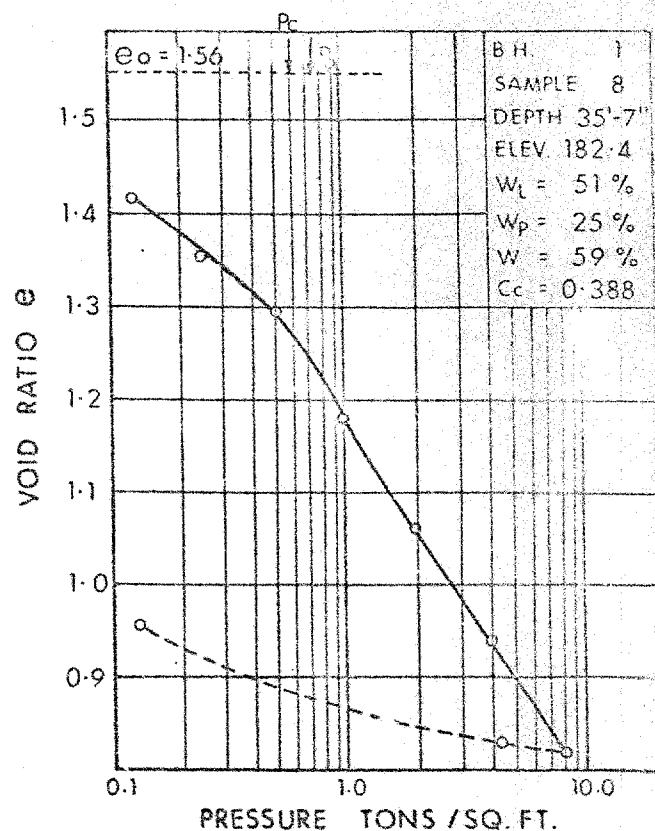
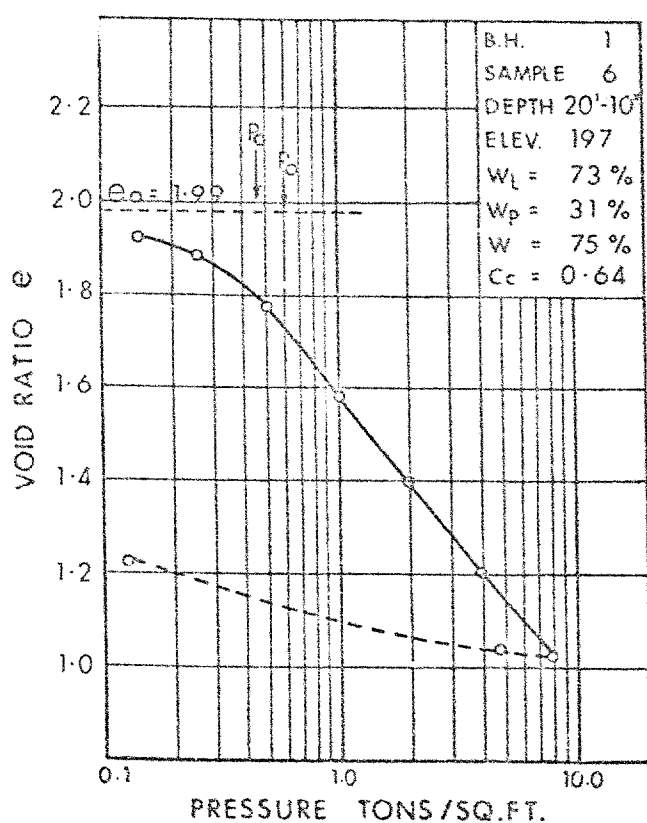
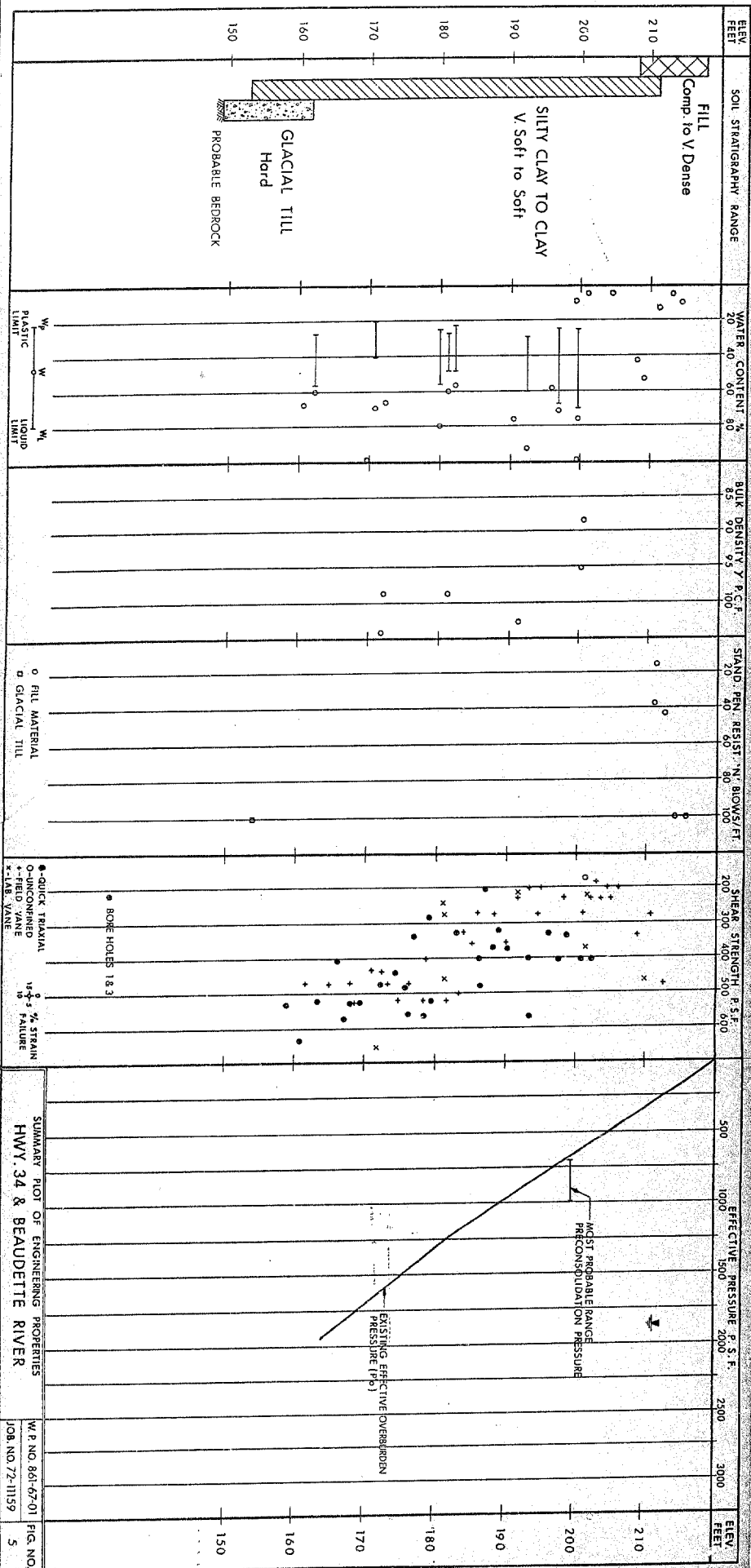
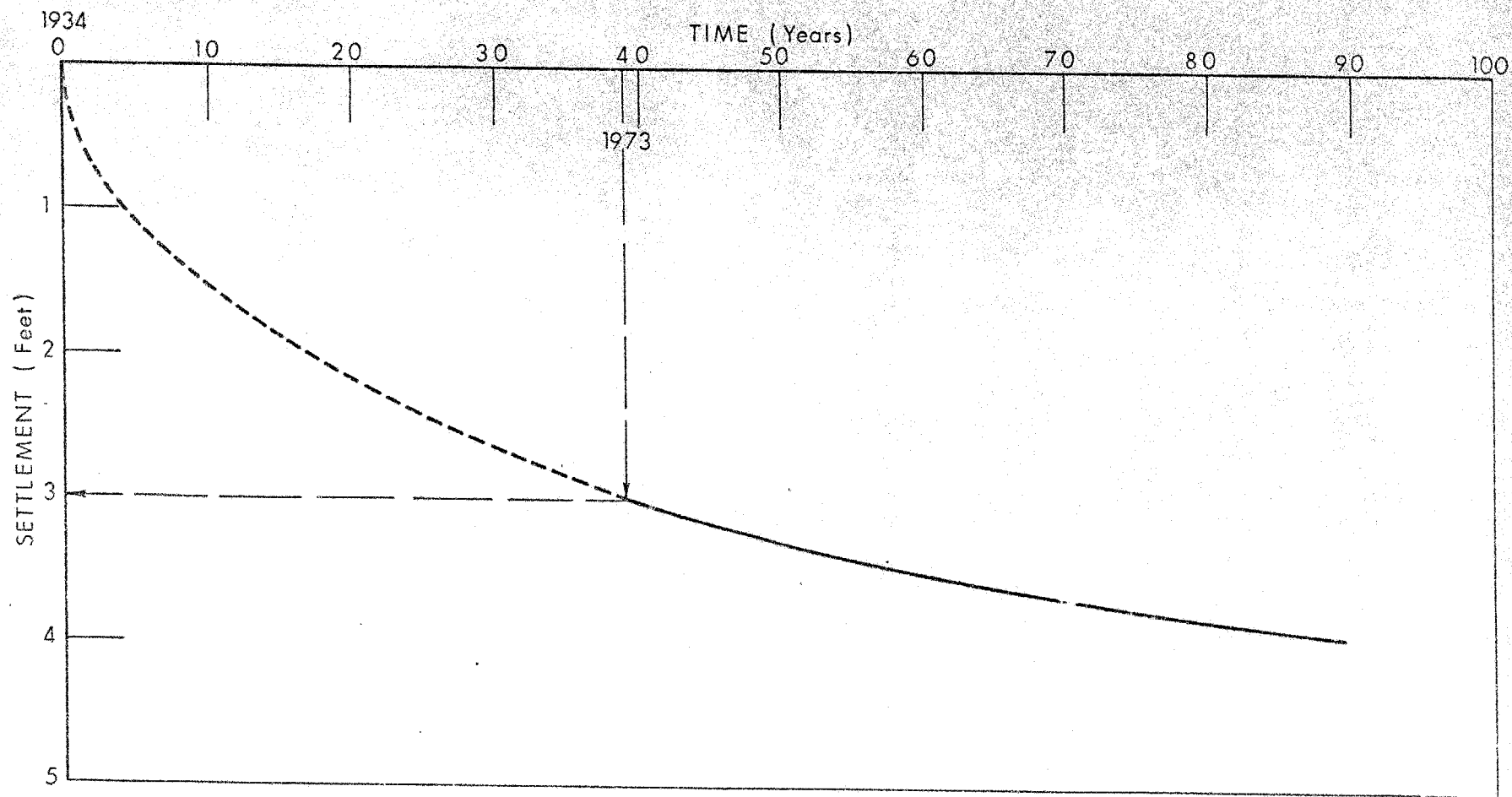


FIG. 4





PREDICTED TIME - RATE OF SETTLEMENT

FIG. 6

FD-9a (Rev. Jan. 73)

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

PENETRATION RESISTANCE

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

TERMS TO BE USED IN DESCRIBING SOILS:-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

F.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

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

EARTH PRESSURE

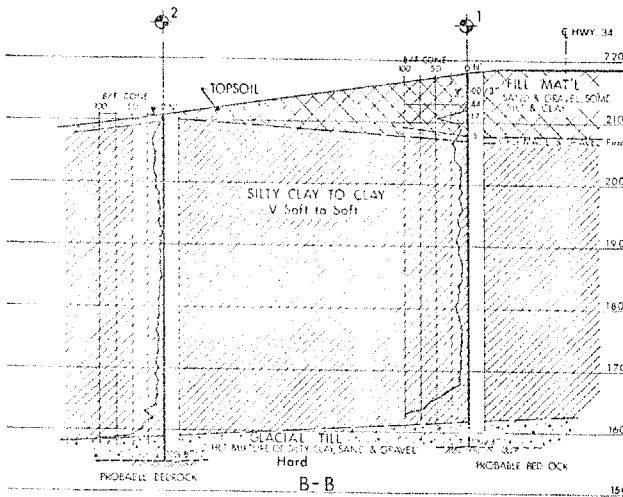
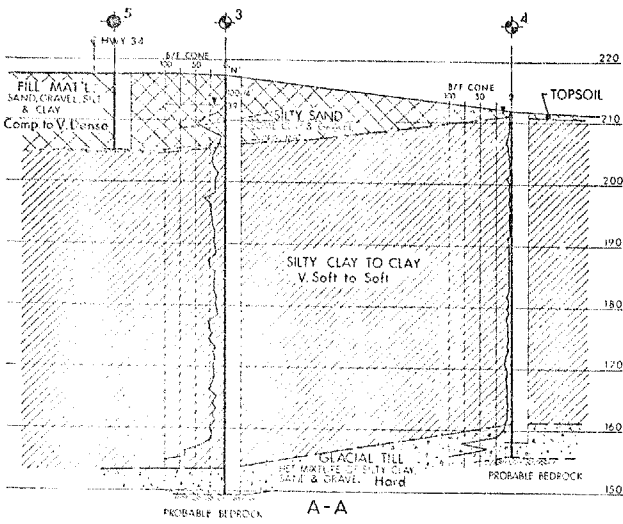
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

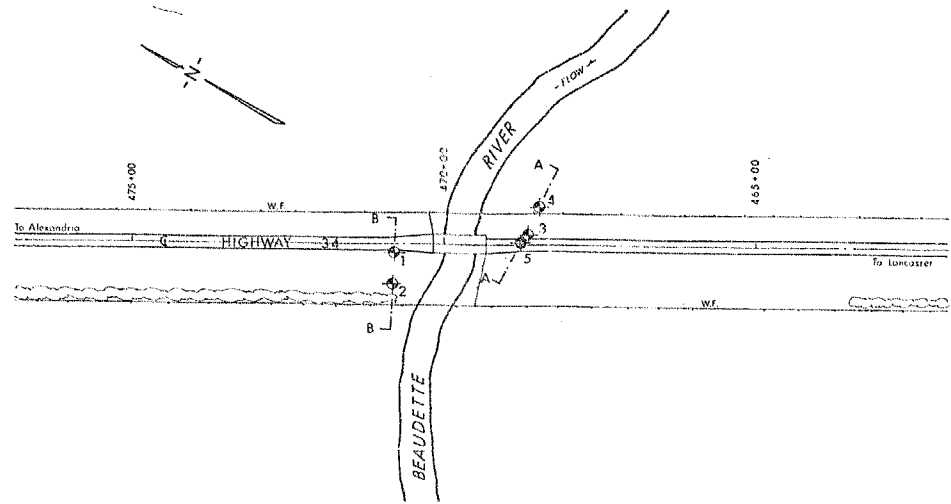
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

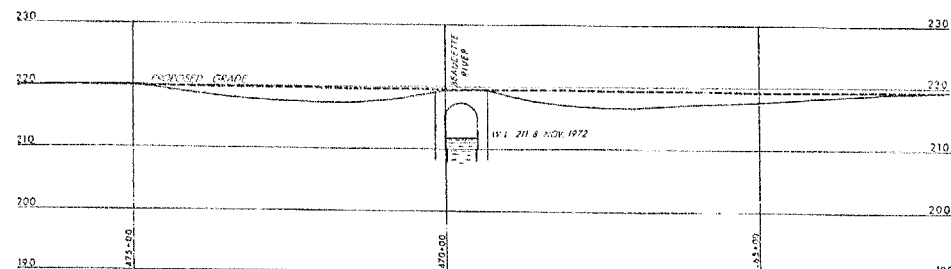
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



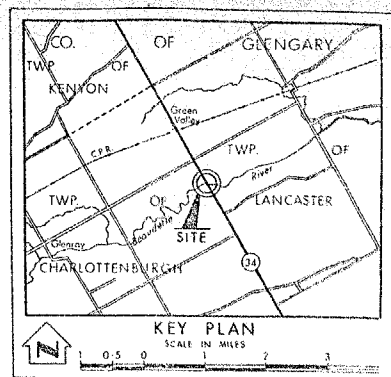
SECTIONS
10 5 0 SCALE 10 20 FT



100 50 0 SCALE 100 200 FT



VERT. 10 5 0 SCALE 10 20 FT
HORIZ. 100 50 0 SCALE 100 200 FT



LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation FEB 1973

NO.	ELEVATION	STATION	OFFSET
1	218.0	470+50	16' LT.
2	210.8	470+83	66' LT.
3	217.4	468+68	16' RT.
4	211.8	468+40	61' RT.
5	217.7	468+79	31' RT.

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NO.	DATE	BY	DESCRIPTION
1	8 MAY 1972	W.F.	BORE HOLE LOCATIONS & SOIL STRATA

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

BEAUDETTE RIVER
SETTLEMENT OF APPROACH EMBANKMENTS

HIGHWAY NO. 34 DIST. NO. 9
CO. GLENGARY
TWP. LANCASTER & CHARLOTTENBURGH

BORE HOLE LOCATIONS & SOIL STRATA

SUBMITTAL CHECKED BY W.F. NO. 801-67-01 DRAWING NO. 72-11159A
DRAWN BY S.O. CHECKED BY W.F. NO. 77-11159A
DATE 8 MAY 1972 SITE NO. BRIDGE DRAWING NO.
APPROVED BY W.F. NO. 77-11159A

72-11157
file off

MEMORANDUM

TO: File

FROM: Mr. C. Poon

ATTENTION:

DATE: June 4, 1973

OUR FILE REF.

IN REPLY TO

SUBJECT: SETTLEMENT OF APPROACH EMBANKMENTS - BAUDETTE RIVER BRIDGE -
HWY. 34, W.O. 72-11159

Approximately 50 feet of very soft to soft silty clay was found across the site. In boreholes put down through the roadway, some 12 feet of fill was found over-lying the silty clay stratum. By comparing the present ground elevation with the original profile, max. settlement of the approaches is estimated to be 2.8 feet. Computations carried out indicate that total settlement is in the order of 4-feet.

In view of the incompetence and high compressibility of the overburden, it is very undesirable to heighten or widen the existing approaches. (Differential settlement as well as stability problems).

To bring the roadway back to the original grade, 2 inches of settlement is expected in the first year after construction. Total settlement due to the additional 3-feet of fill will be in the order of 9-10 inches.

CSP/ks



C.S. Poon, P. Eng.

The above information was conveyed to Mr. F.C. Kugelstad
by telephone on May 14, 1973
CSP

Mr. E. R. Saint,
Regional Materials Engineer,
Eastern Region,
Kingston, Ontario.

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

July 24, 1973.

Mr. A. M. Batten,
Senior Soils Supervisor.

*Settlement of Approach Embankments,
Beaudette River Bridge, Hwy. #34,
District #9 (Ottawa)
W.O. 72-11159 -- W.P. 861-67-01*

According to your recent teletype, the bulk density of the fill material to be used in the above-mentioned project is approximately 145 p.c.f. In addition, it is understood that 1 foot of surcharge will be placed on the existing approaches (total thickness of padding will be 4 feet). Computations were carried out to determine the settlement induced by the 4-foot padding and the results are as follows:


Time In Years	Estimated Consolidation Settlement (in inches)		
	Due to Original Fills	Due to 4-Foot Padding	Total
1	0.5	2.5	3
2	0.8	3.2	4
5	2	4.5	6.5
10	3.5	7	10.5

Should you require additional information regarding this project, please contact this Office.

CSP/ao

C.C. T. C. Kingsland
A. J. Percy
J. A. Cruickshank

Foundations Files
Documents


C. S. Poon,
Project Foundations Eng.,
For: M. Devata,
Supervising Foundations Eng.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A. G. Stermac,
Foundations Office,
DOWNSVIEW, Ontario.

FROM: Materials and Testing Office,
KINGSTON, Ontario.

ATTENTION: Mr. M. Devata

DATE: July 31st, 1973

OUR FILE REF.

IN REPLY TO

SUBJECT:

Hwy. 34, W.P. 861-67-01, Approach Embankments, Baudette
River Bridge, W. O. 72-III59

We are forwarding herewith cross sections for the proposed fill and granular lift over the existing fills. The anticipated weight of the granular materials and fill materials is approximately 145 lb./cu. ft.

Please review the proposed final cross section for compliance with your recommendations in the Foundation Investigation Report.

H. A. Meyer
H. A. Meyer,
For: A. M. Batten,
Senior Soils Supervisor

HAM/AMB/sgp

Encl.

c. c. - A. J. Percy

*PROVED H. A. MEYER (AUG 7/73), THE STABILITY
SHOULD BE CHECKED.*

*REVISED REGION: (MR. A. M. BATTEN) NO STABILITY
PROBLEMS ARE ANTICIPATED IF THE FOUNDATION REPORT
RECOMMENDATIONS ARE CARRIED OUT.*

AUG. 14/73

PP.

72-11-159

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MX KINR NOVEMBER 26, 1973

COPIES TO:

OTTA 2 - J CHILDS DISTRICT ENGINEER OTTAWA

DOWNS 5 - I WILLIAMS PROGRAM OFFICE

A E MCKIM CONSTRUCTION BRANCH

B GIROUX MANAGER ESTIMATING OFFICE

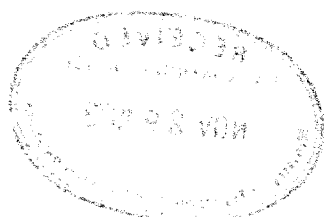
KINR E SAINT

H B MCKAY ENGINEERING AUDIT

P D BILLINGS

R J FORREST

~~T~~ C KINGSLAND



RE: W.P. 861-67-01, HIGHWAY 34, FROM LANCASTER TO ALEXANDRIA

A REGIONAL CONTRACT REVIEW HAS BEEN SET FOR THE ABOVE PROJECT. THE DATE OF THE REVIEW IS DECEMBER 6TH, 1973, AT 10:30 A.M. IN BOARDROOM NO. 3, KINGSTON REGIONAL OFFICE.

THIS PROJECT WAS PREVIOUSLY REVIEWED AND ALSO THERE WAS A HEAD OFFICE REVIEW. THE ADDITIONS TO THE PROJECT ARE VERTICAL ALIGNMENT IMPROVEMENTS AND PROVISION FOR AN URBAN SECTION IN THE VILLAGE OF GREEN VALLEY.

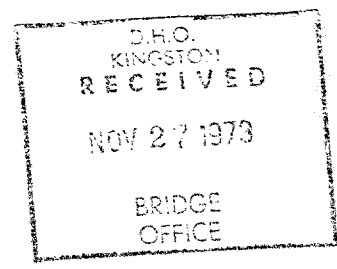
H R MCINTYRE SYSTEMS DESIGN OFFICE KINGSTON

CAB

Copies made for: (TCK: 27/11/13)

A. G. Stermac - Att. M. Devata
C. S. Grebski - Att. K. Bassi

Security





72-11159

Mr. A. J. Percy,
Regional Manager, Systems Design,
Kingston, Ontario.

Structural Planning Office,
Kingston, Ontario.

Mr. H.R.E. McIntyre

14 December 1973.

W.P. 861-67-01, Highway 34, From Lancaster North
Limits Northerly to Alexandria South Limits 12.0 miles
Beaudette River Bridge, Site 31-126, Hwy. 34, District 9

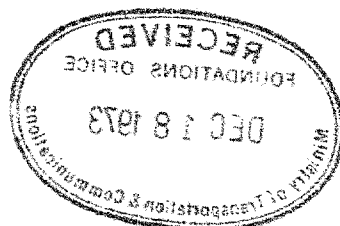
With reference to your memorandum dated December 12, 1973, to Mr. E. J. Orr, attention Mr. J. Wear, I have now received an estimate for the cost of lightweight slag. This would appear to be in the order of \$12.00 to \$15.00 per ton f.o.b. Iroquois, even using bulk shipment by freighter.

This material would therefore be precluded from use at the approaches to the Beaudette River bridge in view of the cost comparison with the Granular 'C'. The predicted settlement is not severe enough to warrant the very high additional cost involved.

T. C. Kingsland
Regional Structural Planning Engineer

TCK/hl

c.c. B. R. Davis
J. M. Childs - Att. J. A. Cruickshank
✓ A. G. Stermac - Att. M. Devata
E. R. Saint
B. McKay
B. Giroux



72-11157

Structural Planning Office,
Kingston, Ontario.

Mr. A. J. Ferry,
Regional Manager, Systems Design,
Kingston, Ontario.

Mr. R. H. McIntyre

14 December 1973.

Beaudette River Bridge, Site 31-126, Hwy. 34, District 9
Limits Northerly to Alexandria South Limits 12.0 miles
W.P. 301-67-01, Highway 34, From Lancaster North

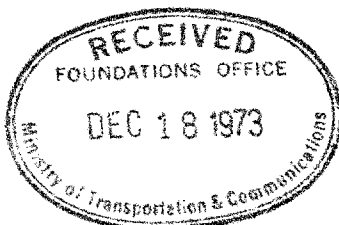
With reference to your memorandum dated December 12, 1973,
to Mr. E. J. Orr, attention Mr. J. West, I have now received an
estimate for the cost of lightweight slabs. This would appear to be in
the order of \$12.00 to \$18.00 per ton for 100 ft. spans, even using bulk
shipment by freighter.

This material would therefore be precluded from use at the
approaches to the Beaudette River bridge in view of the cost comparison
with the Granular 'C'. The predicted settlement is not severe enough
warrant the very high additional cost involved.

T. C. Kingsland
Regional Structural Planning Engineer

TCE/MI

c.c.
B. R. Davis
J. M. Childs - Attn. J. A. Crickshaw
A. G. Starnes - Attn. M. Davis
E. R. Saint
D. McKay
B. Groux



DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 316-76

DIST. 9 REGION Eastern

W.P. No. 861-67-01

CONT. No. 73-108

W. O. No. 72-11159

STR. SITE No. 31-126

HWY. No. 34

LOCATION BERDETTE RIVER BRIDGE

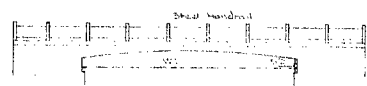
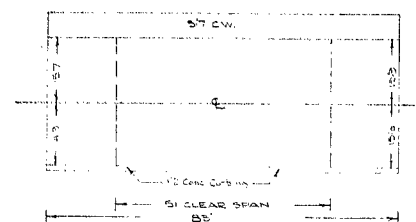
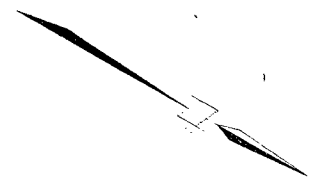
ON HWY. 34

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 1

REMARKS: DOCUMENTS TO BE UNFOLDED

BEFORE MICROFILM

CLIP 30 SEP. 1978



CONC RISE FRAME SLAB BRIDGE
51' CLEAR SPAN
(Not to Scale)

SCALE
1 IN = 100 FT
1 IN = 50 FT

TWP 46R03
RD ALLCE
TWP 46R03

CON 8
LOT 1

CON 8
LOT 1

APPROVED BY SYSTEMS DESIGN
JAN. 1975

LOT 38
CON 7

LOT 38
CON 7

SANDETTE RIVER
CONC RISE FRAME SLAB BRIDGE
51' CLEAR SPAN

TWP 46R03
RD ALLCE
TWP 46R03

