70-F-59	36-66-13	Hwy.417 & Hwy.34 Interchange	316-66
W.O.	W.P.	LOCATION	GEOCRES NO.

● DATA ON FILE IN SOIL MECHANICS SECTION

REFER TO: Contract 72-196

REMARKS

GEOCRES INDEXING CARD FOR REPORTS NOT MICROFILMED

GI-20 AUG. 74

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

From: Bridge Section,
Kingston, Ontario.

Attention:

Date: June 18, 1970.

Our File Ref.

In reply to

Subject: W.P. 36-66-13, Site 31-292,
Highway 34 Interchange Underpass,
Highway 417, District 9 - Ottawa

70-110-59

We are sending you herewith two prints of Bridge Site Plan E-4696-1 on which we have marked the proposed location of the above structure. Also enclosed are two copies of your Field Reconnaissance Report.

We would be pleased if you will make arrangements for the necessary foundation investigation and to have your report, the scheduled date for which is August 26, 1970.

A. VanDalen
For: T. C. Kingsland
Regional Bridge Planning Engineer

AV/TCK/hl
Encls.
c.c. (with encl.)
Bridge Office Files Section (Mr. S. McCombie)
c.c. Mr. R. Forrest

AUG. 26. 1970.

FIELD RECONNAISSANCE REPORT
REQUIRED BY FOUNDATION SECTION 70-1059
FOR

FF-69
SEPT. 1968

W.P. NO. 36 66-13 HIGHWAY NO. 417 DISTRICT 9 SITE PLAN NO. E-4696-1 PROFILE NO. _____
RIVER CROSSING ☐ GRADE SEPERATION ☒ R.R.X. ☐ OTHER (SPECIFY) _____
ALTERNATE SCHEME (IF ANY) _____

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

UNDERGROUND UTILITIES: UTILITY COMPANY — TELEPHONE NO. FOR DEFINITE LOCATION

1 Ottawa Gas
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 1970
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 _____ FT.
CURRENT: SWIFT ☐ MODERATE ☐ SLOW ☐

DRILLING OPERATIONS

Hauling distance less than 1 mi.
NEAREST SOURCE OF WATER (GIVE HAULING DISTANCE, IF KNOWN) Culverts under Hwy. 34 south of 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 ACCOMODATION: Hawkesbury - Normandie Motel on Hwy. 34
OTHER COMMENTS: _____

DATE June 18, 1970
REGIONAL BRIDGE ~~LOCATION~~ Planning ENGINEER _____ A. VanDalen for T.C. Kingsland

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM 31G-66

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

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

Attention: Mr. S. McCombie

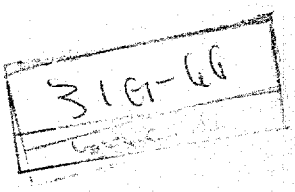
Date: September 9, 1970

Our File Ref.

In reply to SEP 17 1970

Subject: CONT 72-196

FOUNDATION INVESTIGATION REPORT
For
Proposed Underpass Structure at the
Crossing of Hwy. #34 and Hwy. #417
Twp. of Lochiel -- Co. of Glengarry
District No. 9 (Ottawa)
W.O. 70-11059 -- W.P. 36-66-13



Attached, we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above structure 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.

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

AGS/MdeF
Attach.
cc: Messrs. B. R. Davis
H. A. Tregaskes
D. W. Farren
S. J. Markiewicz
J. E. Callaghan
M. R. Ernesaks (2)
T. C. Kingsland (2)
J. E. Gruspier
B. A. Singh

Foundations Files
Gen. Files

TABLE OF CONTENTS

FOUNDATION INVESTIGATION REPORT
For
Proposed Underpass Structure at the
Crossing of Hwy. #34 and Hwy. #417
Twp. of Lochiel -- Co. of Glengarry
District No. 9 (Ottawa)
W.O. 70-11059 -- W.P. 34-66-13

1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation at the aforementioned underpass structure crossing. The request was contained in a memo from the Eastern Region Bridge Section (Mr. T. C. Kingsland, Regional Bridge Planning Engineer), dated June 18, 1970. An investigation was subsequently carried out by the Foundation Section to determine the subsoil, bedrock and groundwater conditions at the site.

This report contains all the factual data obtained from this investigation, together with recommendations pertaining to the foundations of the proposed structure, as well as the stability and settlement of the approach embankments.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located in the vicinity of existing Hwy. #34, about 7 miles southwest of the Village of Vankleek Hill, in the Township of Lochiel, County of Glengarry.

In the immediate vicinity of the site the terrain is gently undulating in relief between about elevations 236 and 250; in general, the ground surface increases in a northerly direction. The land is cultivated and is being used for farming purposes.

Existing Hwy. #34, which has 2 paved lanes, is carried on a fill which is superelevated about 4 feet above the surrounding land.

..... 2

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

The site is situated on the southern boundary of the physiographic region known as the "Winchester Clay Plains". The predominant stratum throughout this region is composed of a marine clay deposited by the Champlain Sea. The clay, which is encountered at a shallow depth below ground surface, is generally of the order of 10 to 25 feet in thickness. The clay is underlain by a competent glacial till sheet, which in many localized areas, protrudes to within a few feet of ground surface.

These overburden deposits of clay and glacial till are underlain by black shale of the Collingwood formation, Ordovician Period.

3. FIELD AND LABORATORY INVESTIGATION:

Nine sampled boreholes, all of which were accompanied by a dynamic cone penetration test, as well as an additional cone test, were put down during the course of the field study. The borings were advanced by means of conventional diamond drill rigs adapted for soil sampling purposes.

Samples of the overburden were obtained in a 2" O.D. split-spoon sampler, which was hammered into the ground in accordance with the specifications for the Standard Penetration Test. The dynamic cone penetration tests were advanced using the same method. In addition, samples of the cohesive stratum were obtained, where possible, in 2" I.D. Shelby tubes which were manually pushed into the soil. Where practical, in-situ vane tests were also carried out within the cohesive subsoil to determine the undrained shear strength and the sensitivity of the clay. Bedrock was proven in 8 of the borings by obtaining either BXT or AXT size rock core samples.

The groundwater level conditions across the site were determined by recording the water levels in the open boreholes during the course of the investigation.

..... 3

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

The locations and elevations of all the boreholes, together with estimated stratigraphical sections across the site, are shown on Drawing No. 70-11059A. The surveying was carried out by personnel from the Kingston Regional Engineering Surveys Section. All elevations were referenced to a Geodetic datum.

All the samples were subjected to careful visual examination both in the field and in the laboratory. Following this examination, laboratory testing was performed on selected samples to determine the engineering properties of the various soil types, namely:

Natural Moisture Content
Grain-size Distribution
Atterberg Limits
Undrained Shear Strength
Consolidation Testing

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

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The surficial stratum over the majority of the site is composed of a firm to very stiff compressible marine clay. The overall thickness of this stratum varies from 5 feet to 21 feet, being most extensive in the southern portion of the site. The cohesive stratum is underlain by a competent, basically granular glacial till.

In the extreme northern portion of the area investigated, the cohesive stratum is absent - here the glacial till deposit protrudes to within about 5 feet of ground surface.

..... 4

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

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

Shale bedrock is present beneath the overburden deposits, at depths of between 33 and 42 feet below ground surface.

The stratigraphical sections, shown on Drawing No. 70-11059A, were inferred from the borehole data as illustrated on the Record of Borehole sheets.

Following is a description of the different soil types encountered from the ground surface downward.

4.2) Surficial Deposits:

The terrain in the area is covered with a mantle of topsoil approximately 12 to 18 inches thick.

In the northern portion of the site (refer to B.H.'s #1 and 8) the topsoil is underlain by a 4 to 5 feet thick deposit composed of a compact to dense silty sand with a trace of clay and gravel.

4.3) Clay to Silty Clay (Sensitive):

Over the majority of the site the topsoil is underlain by a stratum of brown to grey clay to silty clay with a trace of sand. The overall thickness of the stratum ranges from 5 feet to 21 feet, being most extensive in the southern areas. The upper 5 to 9 feet of the cohesive stratum has been desiccated forming a crust. Throughout the stratum there are random seams of sand up to 2 inches thick.

The engineering properties of the cohesive subsoil, as determined by field and laboratory testing, are summarized on Figure #1. A brief resumé, presented in tabular form, follows:

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

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

		Lower Zone Range	Lower Zone (Avg.)	Desiccated Zone Range	Desiccated Zone (Avg.)	
Identity Tests:						
Bulk Density (p.c.f.)	(γ)	98 - 105	(103)	113 - 115		
Liquid Limit (%)	(W_L)	58 - 76	(70)	78 and 88		2 Tests
Plastic Limit (%)	(W_P)	24 - 31	(25)	26 and 32		2 Tests
Natural Moisture Content (%)	(W)	51 - 76	(55)	55 and 62		2 Tests
Liquidity Index	(I_L)	0.6 - 1.0	(0.8)	0.5 and 0.6		2 Tests
Consolidation Characteristics:						
Initial Void Ratio	(e_o)	1.8		2.45		1 Test
Compression Index	(C_c)	0.9		2.1		1 Test
Degree of Preconsolidation (p.s.f.)	(P_c-P_o')	5,300		2,200		1 Test
Undrained Shear Strength (p.s.f.)	(C_u)					
1) Field Tests		650 - 1,600		1,550 - 2,850		
2) Lab. Tests		600 - 1,400		-		
Sensitivity:	(S)	4 - 22	(9)	5 - 6		
Standard Penetration Resistance ('N') Testing: (Blows/ft.)		-		9 -26	(15)	

..... 6

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

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

The Atterberg limit tests are also plotted on the Plasticity Chart, Figure #2. These results indicate that the material is essentially inorganic with a plasticity in the high range.

The consistency of the upper desiccated zone varies from stiff to very stiff, while that of the lower zone varies from firm to stiff.

The consolidation characteristics of the stratum were determined by carrying out two laboratory tests, the results of which are shown as Void Ratio vs. Pressure plots on Figure #3. The results of these tests indicate that the cohesive stratum is preconsolidated by about 2,000 to 2,500 p.s.f. in excess of the existing overburden pressure. In the upper desiccated zone, the degree of preconsolidation is in excess of 5,000 p.s.f. The relatively high values for the initial void ratio (e_o) and the compression index (C_c) compare favourably with those of other cohesive deposits in this area, and are a further indication of the sensitive nature of the stratum.

4.4) Heterogeneous Mixture of Silt, Sand and Gravel - Trace of Clay (Glacial Till):

Over the majority of the area investigated, the cohesive stratum is underlain by a compact to very dense ('N' values 23 to 200 blows/ft.) glacial till. In the northern portion of the site (refer to B.H.'s #1 and 8), where the clay is not present, the glacial till protrudes to within 5 feet of ground surface. The thickness of the deposit varies from 12 feet (B.H. #7) to 38 feet (B.H. #8). The glacial till is primarily granular in nature - i.e., composed of silt and sand binding gravel. There are localized random cohesive zones throughout, however, where the matrix is composed of clayey silt binding sand and gravel. Occasional fragments of shale are present throughout the deposit. Grain-size distribution testing

..... 7

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

4.4) Heterogeneous Mixture of Silt, Sand and Gravel - Trace of Clay (Glacial Till): (cont'd.) ...

was carried out on typical samples from the deposit; the results are plotted in envelope form on Figure #4.

4.5) Shale Bedrock:

The glacial till is directly underlain by bedrock which was proven in 8 boreholes, by obtaining from 6 to 21.5 feet of either BXT or AXT size rock core samples. Over the site the bedrock surface varies from elevations 201 to 209.5, generally decreasing in a southerly direction. These elevations correspond to depths below ground surface of 33 to 42 feet.

The bedrock is composed of a black, calcareous shale, with irregular seams and interbeds of limestone up to 1/2 inch in thickness. The upper 1 to 8 feet of the bedrock is in a fractured and weathered condition. Below this depth the bedrock is sound as evidenced by the high percentage of core recovery.

5. GROUNDWATER CONDITIONS:

During the period of the investigation, groundwater level observations were carried out at all the boring locations. The results are plotted on the Record of Borelog sheets, as well as on Drawing No. 70-11059A.

The groundwater level in the overburden is at a depth of between 1 and 5 feet below the existing ground surface. These depths correspond to elevations between 234 and 243. The groundwater level decreases in elevation in a southerly direction as does the ground surface.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct a two-span (202' - 203') 34 feet wide underpass structure at the crossing of Hwy. #417 and Hwy. #34, in the Township of Lochiel, County of Glengarry.

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

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

The profile grade of Hwy. #34, in the vicinity of the crossing, will vary between elevations 260 and 264. The associated north and south approach fills will have a maximum height of about 18 and 26 feet, respectively.

Over the majority of the site the surficial stratum is composed of a firm to very stiff clay, whose thickness varies from 5 to 21 feet. The clay is most extensive in the southern portion of the site. The clay is underlain by a competent glacial till which, in turn, is followed by fractured to sound shale bedrock, the surface of which was encountered between elevations 201 and 209.5.

Along the northern approach the clay stratum is not present; here the glacial till protrudes within 5 feet of ground surface.

The presence of the sensitive firm to stiff cohesive stratum at a shallow depth below ground surface in the southern portion of the area, is the governing factor from a foundation point of view, since it will be necessary to ensure that it is not overstressed by either the embankment or the structure foundation surcharge loadings. The relevance of this will be discussed in the sub-sections to follow.

6.2) Approach Fills:

6.2.1) Stability Considerations -

A firm to very stiff cohesive stratum, which is up to 21 feet in thickness, is present along the proposed south approach to the structure. The north approach, however, is underlain by competent glacial till.

Stability computations were carried out using a total stress analysis ($\phi = 0$ condition), both manually and with the use of the electronic computer. Based on the computations, it is

..... 9

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

6.2) Approach Fills: (cont'd.) ...

6.2.1) Stability Considerations - (cont'd.) ...

estimated that embankments of the maximum height contemplated, namely:

South Approach : 26 feet
North Approach : 18 feet

will be inherently stable with respect to a deep-seated foundation failure, provided standard 2:1 slopes are used.

6.2.2) Settlement Considerations -

The sensitive clay stratum, located beneath the south approach fill, will undergo settlement due to consolidation, over a period of time, under the surcharge loading. Based on computations carried out, it is estimated that this consolidation settlement could be of the order of 6 to 9 inches.

The total amount of the predicted settlement, along this approach, should take place within a period of 30 to 36 months. About 50% should, however, occur within 6 to 8 months.

Since the predicted settlements will occur in a relatively short period of time, it would be advantageous to place the south approach fill prior to construction of the structure, in order to minimize post-construction maintenance. If scheduling permits, a period of at least 6 months should be provided for this purpose. In any event, final paving should be delayed as long as possible.

The settlement induced in the competent glacial till deposit by the surcharge loading of the north approach fill will be elastic in nature (i.e., take place during or immediately following the construction period) and negligible in magnitude.

..... 10

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

6.3) Structure Foundations:

6.3.1) Centre Pier -

At the proposed location of the pier, compressible clay is located at a shallow depth below ground surface. The thickness of the clay varies from 5 feet in the eastern portion of the pier to 12 feet in the western. The cohesive stratum is underlain by competent glacial till.

The pier can be supported on a spread footing, provided the foundation is carried down to bear on the glacial till deposit. This will entail constructing a stepped footing varying from elevation 236 in the eastern portion to 227 in the western. In any event, a minimum of 4 feet of earth cover should be provided to the underside of the footing for frost protection purposes. A footing, founded as recommended, could be designed using an allowable bearing pressure of 3.0 t.s.f.

The footing excavation will extend through the relatively impervious cohesive stratum down into the basically granular glacial till. Groundwater seepage will therefore occur in the excavation. Further, a boiling condition may develop in the glacial till due to the existing unbalanced hydrostatic water pressure head. A dewatering scheme will, therefore, be required. If interlocking steel sheeting is incorporated into a dewatering scheme, it should be driven to a depth below the base of the excavation equal to the prevailing unbalanced head above this level. Any seepage or surface run-off into the enclosure could be controlled by conventional means such as, pumping from sumps.

Settlement of the glacial till, due to the induced footing pressure, will be negligible, provided the subsoil is not loosened during the construction period. In this regard, it is recommended that either a pad composed of lean concrete, or a working mat of well compacted select granular material be placed over the foundation subsoil as soon as the footing level is reached.

..... 11

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

6.3) Structure Foundations: (cont'd.) ...

6.3.1) Centre Pier - (cont'd.) ...

As an alternative, the pier can be supported on end-bearing piles driven to bedrock. The pile tip elevations would range from 203 to 206. The allowable pile load would be dependent on the section chosen - for example, 12 BP 74 steel H-piles may be designed for 95 tons/pile.

Frost protection should be provided to the underside of the pile cap, as discussed previously. In order to minimize the need for a dewatering scheme, it is recommended that the pile cap be located within the impervious cohesive stratum.

6.3.2) Abutments -

The presence of compressible clay at the proposed location of the south abutment will necessitate that this element be perched within the approach fills and supported on end-bearing piles driven to bedrock. The approximate tip elevations would be between 200 and 203. The pile capacities will be similar to those discussed in Sub-section 6.3.1).

No bouldery or rock fill should be used in areas in which piles are to be driven.

The north abutment is underlain by competent glacial till. This element may, therefore, be supported on a spread footing perched within the approach fill. The material, below the top of the footing, should consist of well compacted G.B.C. Class 'A' material, and should extend to a horizontal distance of at least 10 feet from the footing edges in the plane of the footing top. This portion of the fill should be constructed with side slopes no steeper than 2:1. The remainder of the fill should be completed to about profile grade for a distance of about 50 feet behind the abutment before re-excavating for the abutment

..... 12

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

6.3) Structure Foundations: (cont'd.) ...

6.3.2) Abutments - (cont'd.) ...

footing. An allowable bearing value of 2.5 t.s.f. may be used in footing design.

As an alternative, the north abutment could be supported on end-bearing piles driven to bedrock, as discussed in detail in the previous paragraphs. The approximate tip elevations would be between 208 and 210.

6.3.3) Differential Settlement Between Structure Elements -

The maximum differential settlement would occur between an abutment and the adjacent pier, one of which is pile-supported, while the other is founded on a spread footing. It is inferred, however, that the magnitude of this differential settlement will be negligible.

7. MISCELLANEOUS:

The field work, performed during the period of July 13 to 28, 1970, was supervised by Mr. A. R. Newman, Student Technician (Field).

The equipment used was owned and operated by the F. E. Johnston Drilling Co. Ltd.

The preparation of this report was undertaken by Mr. B. T. Darch, Senior Foundation Engineer.

The investigation was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.

September, 1970

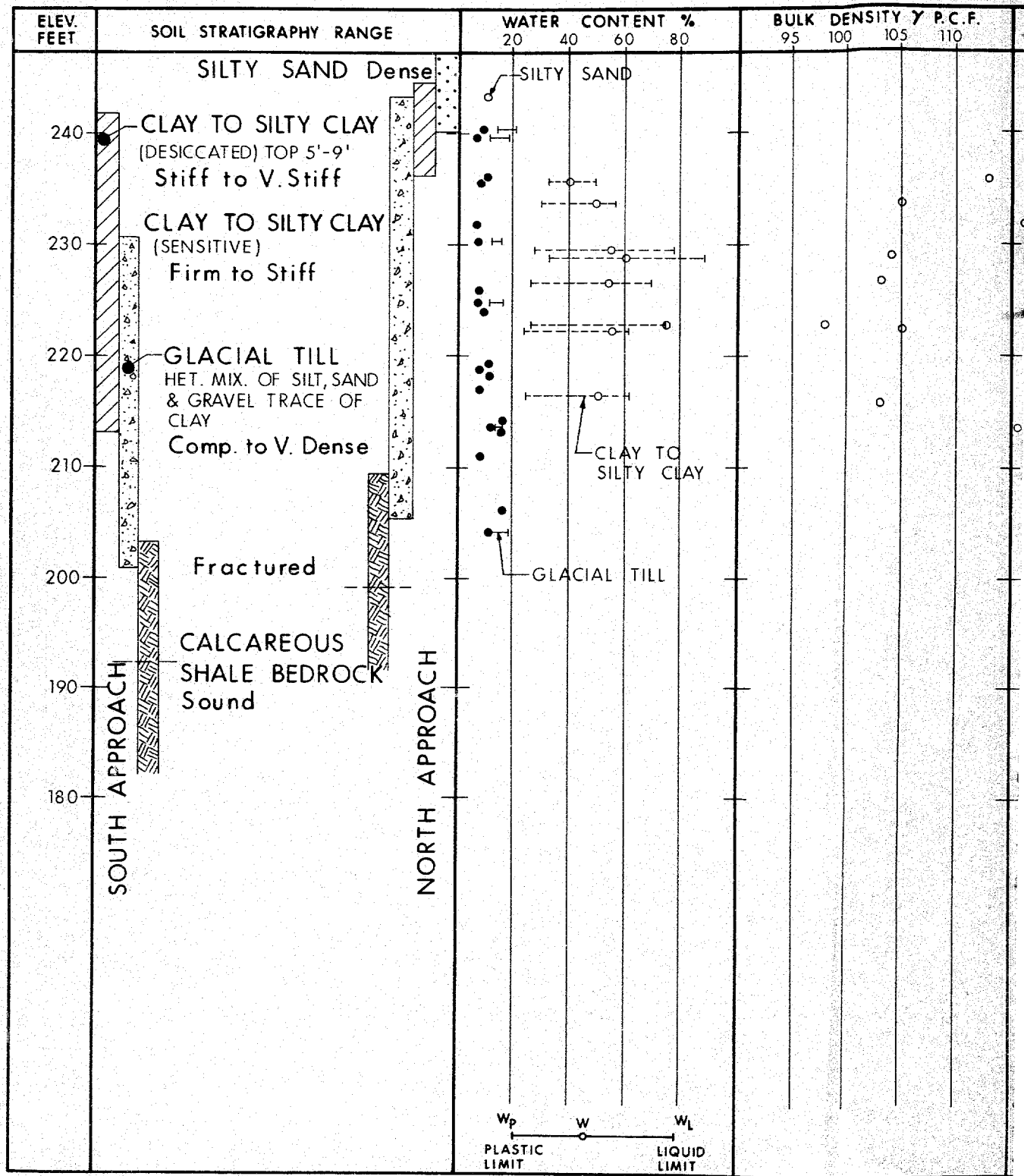
APPENDIX I

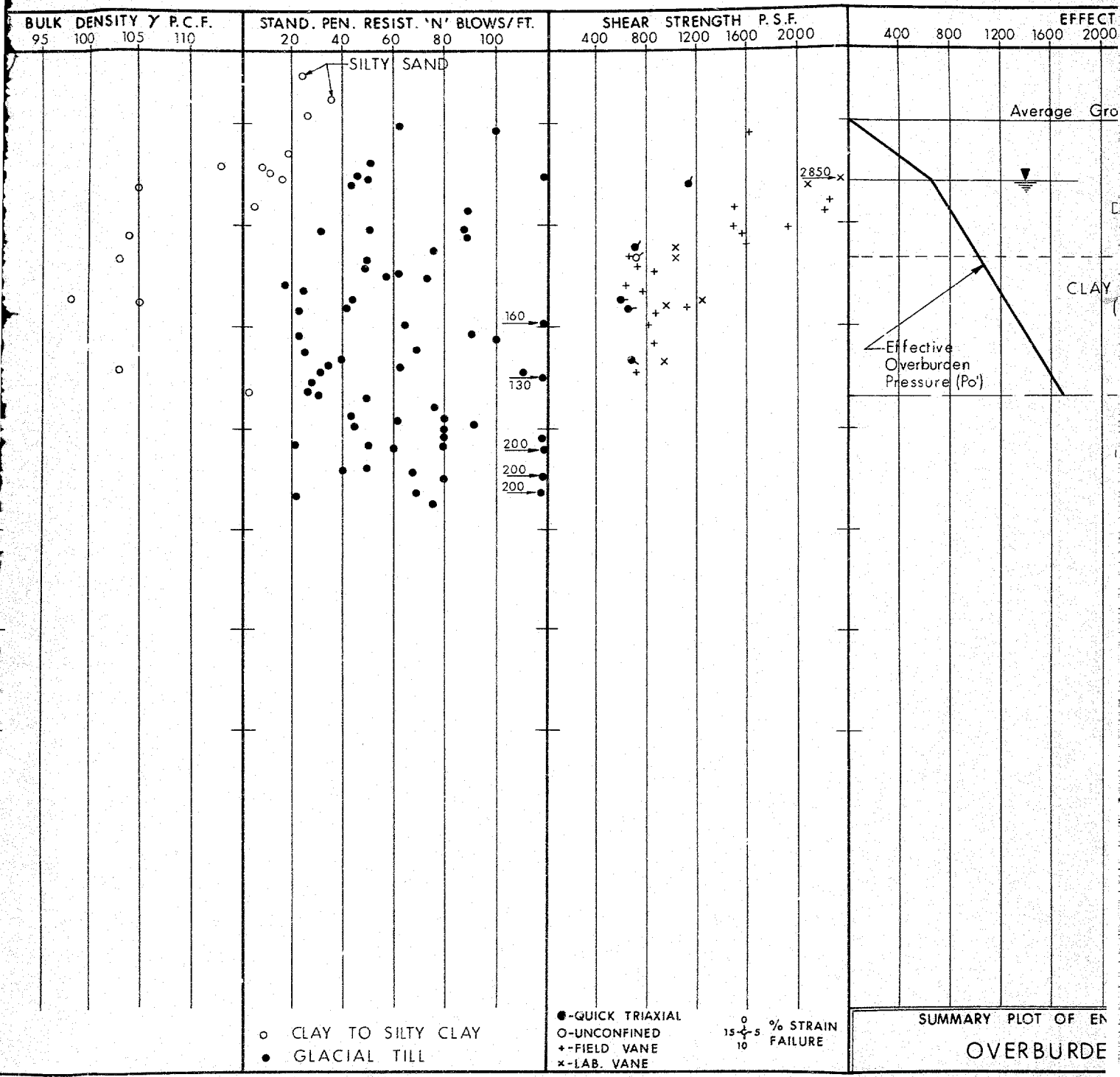
OVERSIZED DRAWINGS

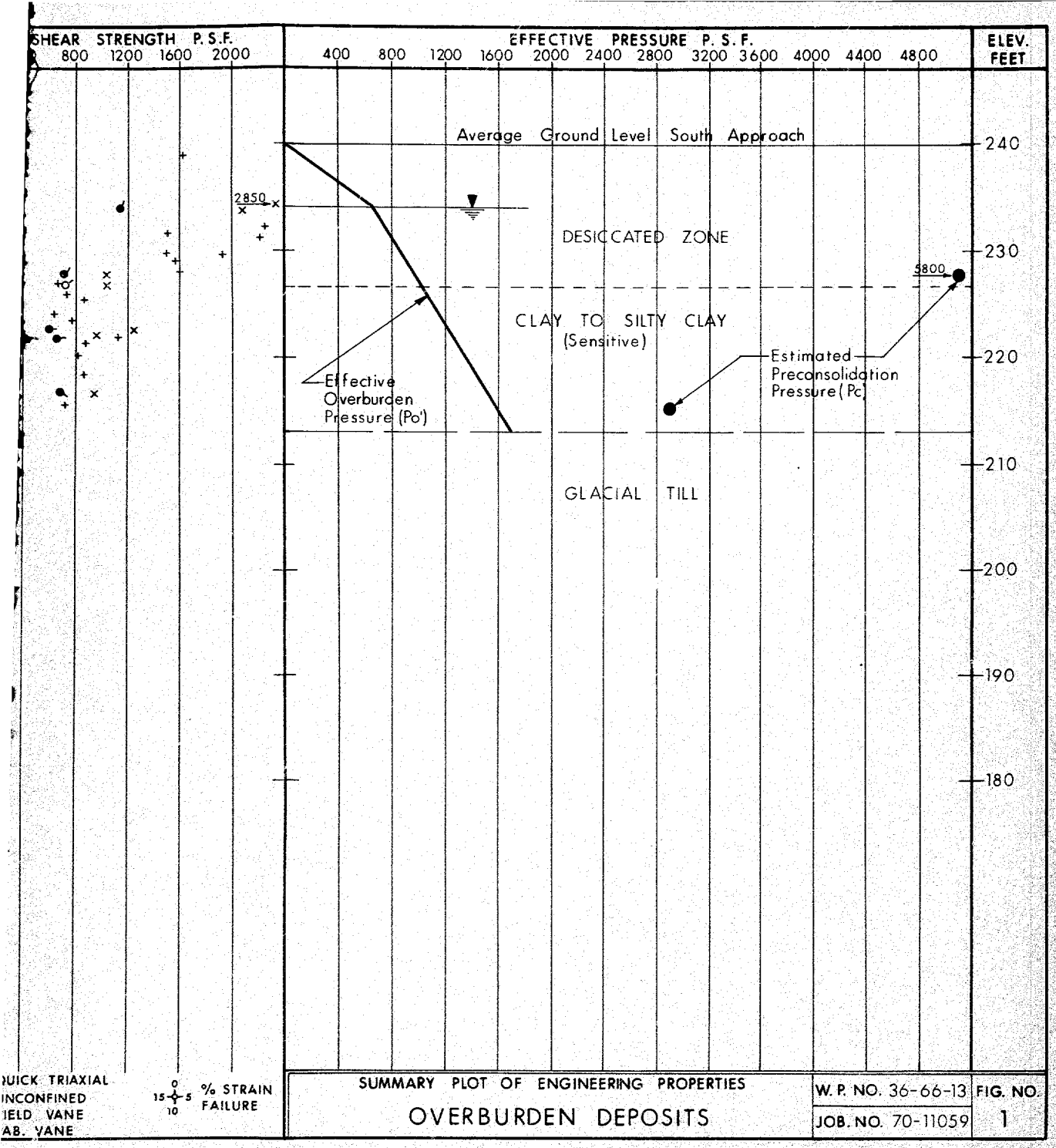
Record of B.H. #1
2
3
3A
4
5
6
7
8
9

F.D. 28

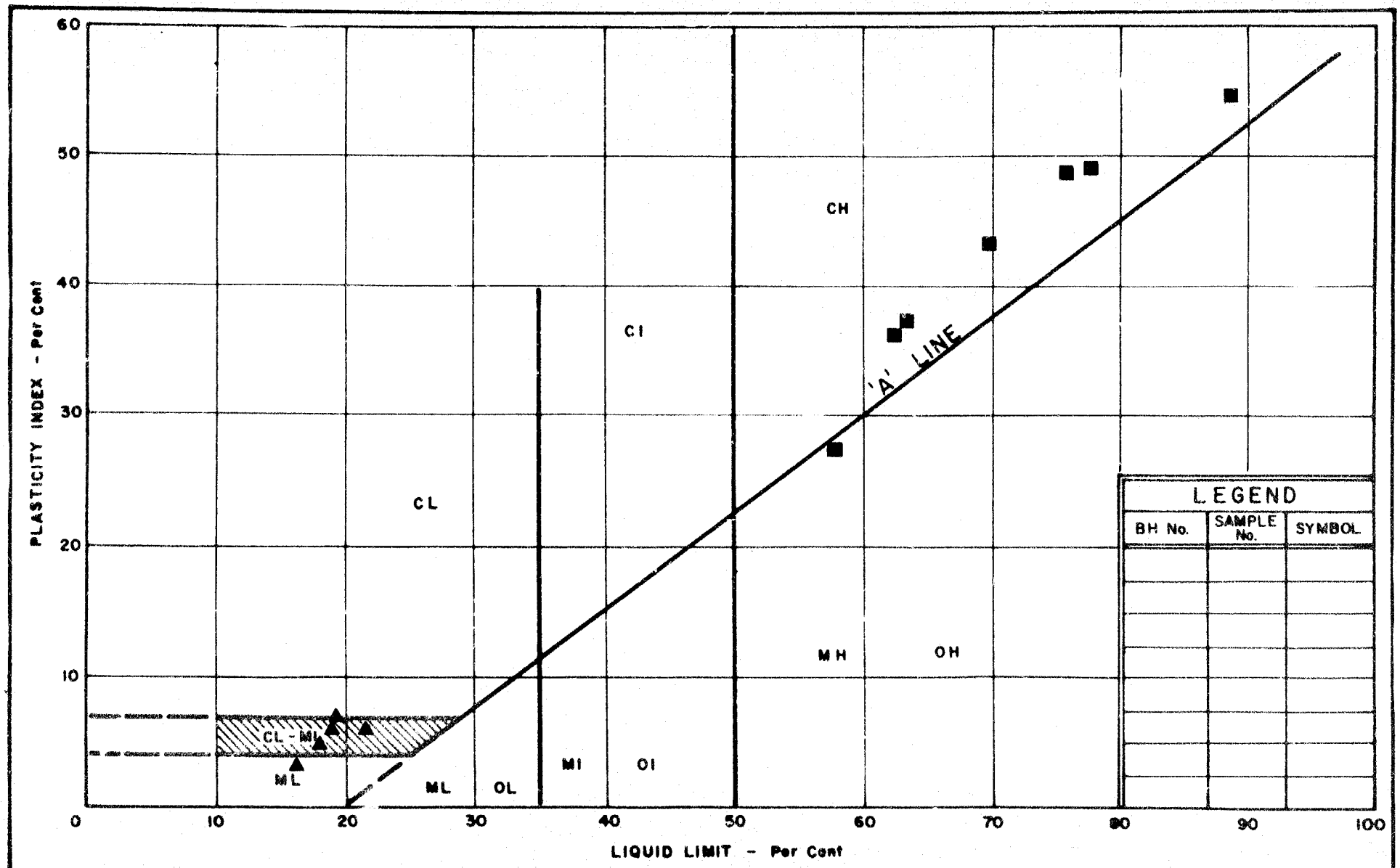
SUMMARY PLOT OF ENGINEERING PROPERTIES




BULK DENSITY γ P.C.F.
95
100
105
110
STAND. PEN. RESIST. 'N' BLOWS/FT.
20
40
60
80
100
SILTY SAND
160
130
200
200
200
SHEAR STRENGTH P.S.F.
400
800
1200
1600
2000
2850
EFFECT
400
800
1200
1600
2000
Average Gro
CLAY
Effective
Overburden
Pressure (Po')
○ CLAY TO SILTY CLAY
● GLACIAL TILL
●-QUICK TRIAXIAL
○-UNCONFINED
+-FIELD VANE
×-LAB. VANE
0
15
5
10
% STRAIN
FAILURE
SUMMARY PLOT OF EN
OVERBURDE


SHEAR STRENGTH P.S.F.
800 1200 1600 2000
EFFECTIVE PRESSURE P. S. F.
400 800 1200 1600 2000 2400 2800 3200 3600 4000 4400 4800
ELEV. FEET
Average Ground Level South Approach
240
2850
DESICCATED ZONE
230
5800
CLAY TO SILTY CLAY
(Sensitive)
Effective Overburden Pressure (Po')
Estimated Preconsolidation Pressure (Pc)
220
210
GLACIAL TILL
200
190
180
UICK TRIAXIAL
INCONFINED
IELD VANE
AB. VANE
0
15 5
10
% STRAIN
FAILURE
SUMMARY PLOT OF ENGINEERING PROPERTIES
OVERBURDEN DEPOSITS
W. P. NO. 36-66-13
JOB. NO. 70-11059
FIG. NO.
1

FORM OB–MT–252
REVISED JUL[redacted] 1966



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

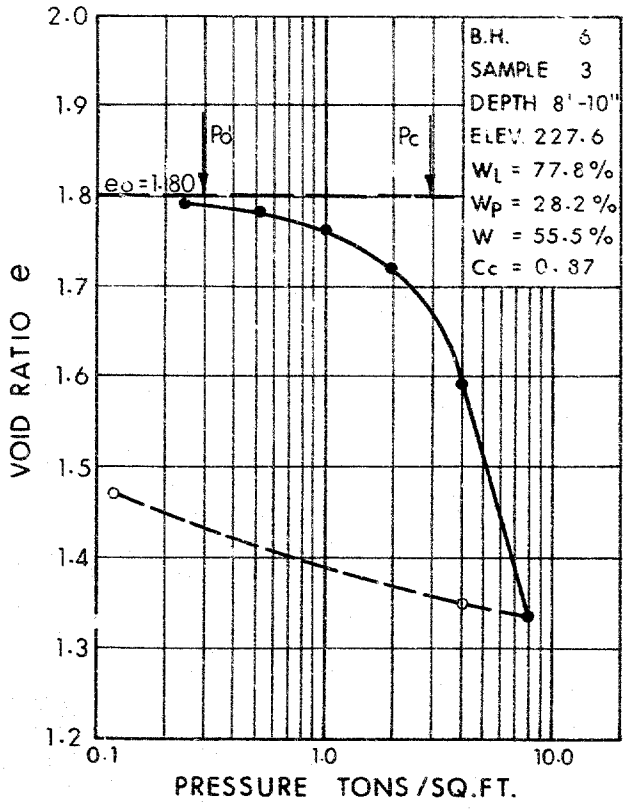
PLASTICITY CHART

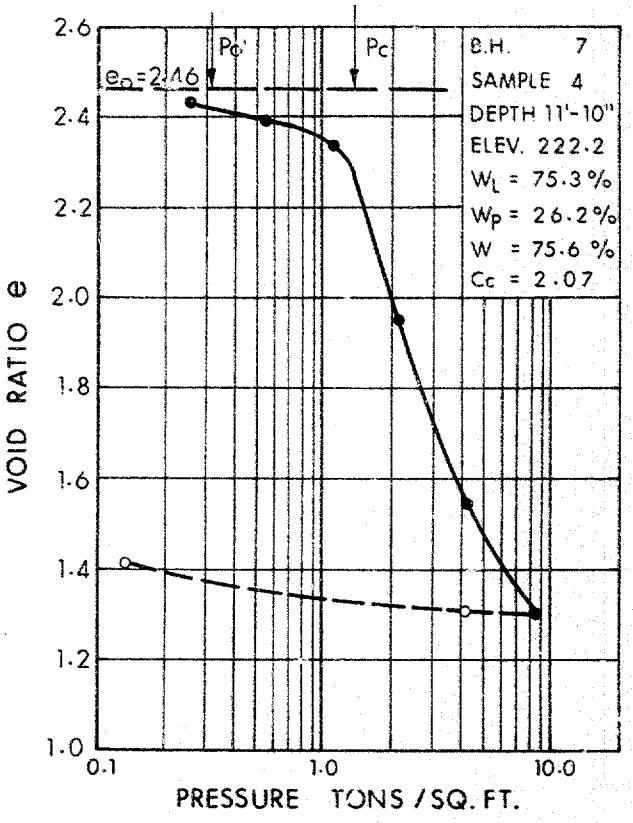
■ – CLAY TO SILTY CLAY
▲ – GLACIAL TILL

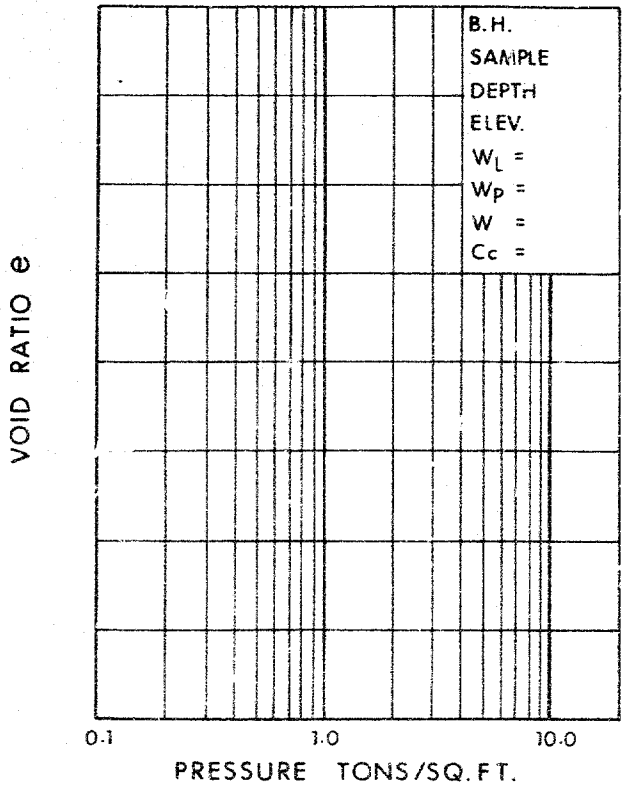
W.P. No. 36–66–13
JOB No. 70–11059
FIG. NO. 2

VOID RATIO – PRESSURE CURVES

JOB NO. 70 – 11059







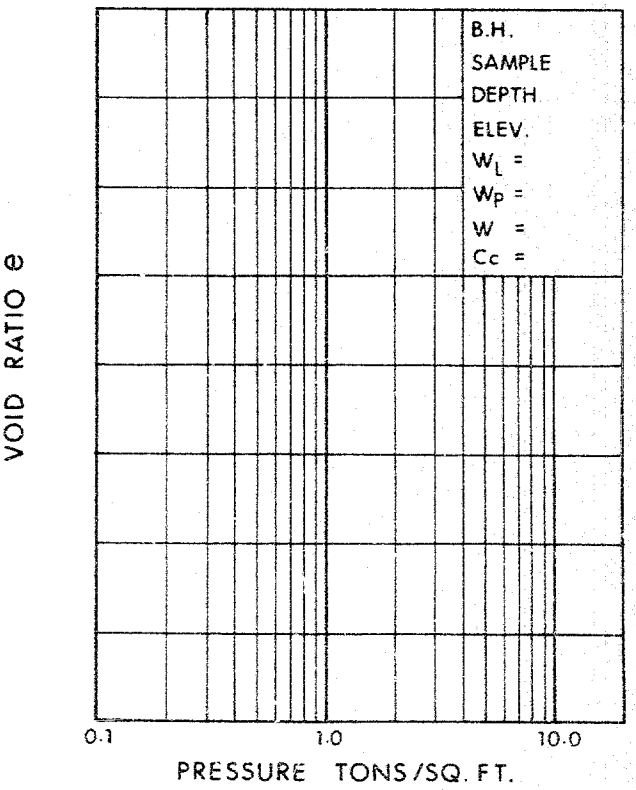
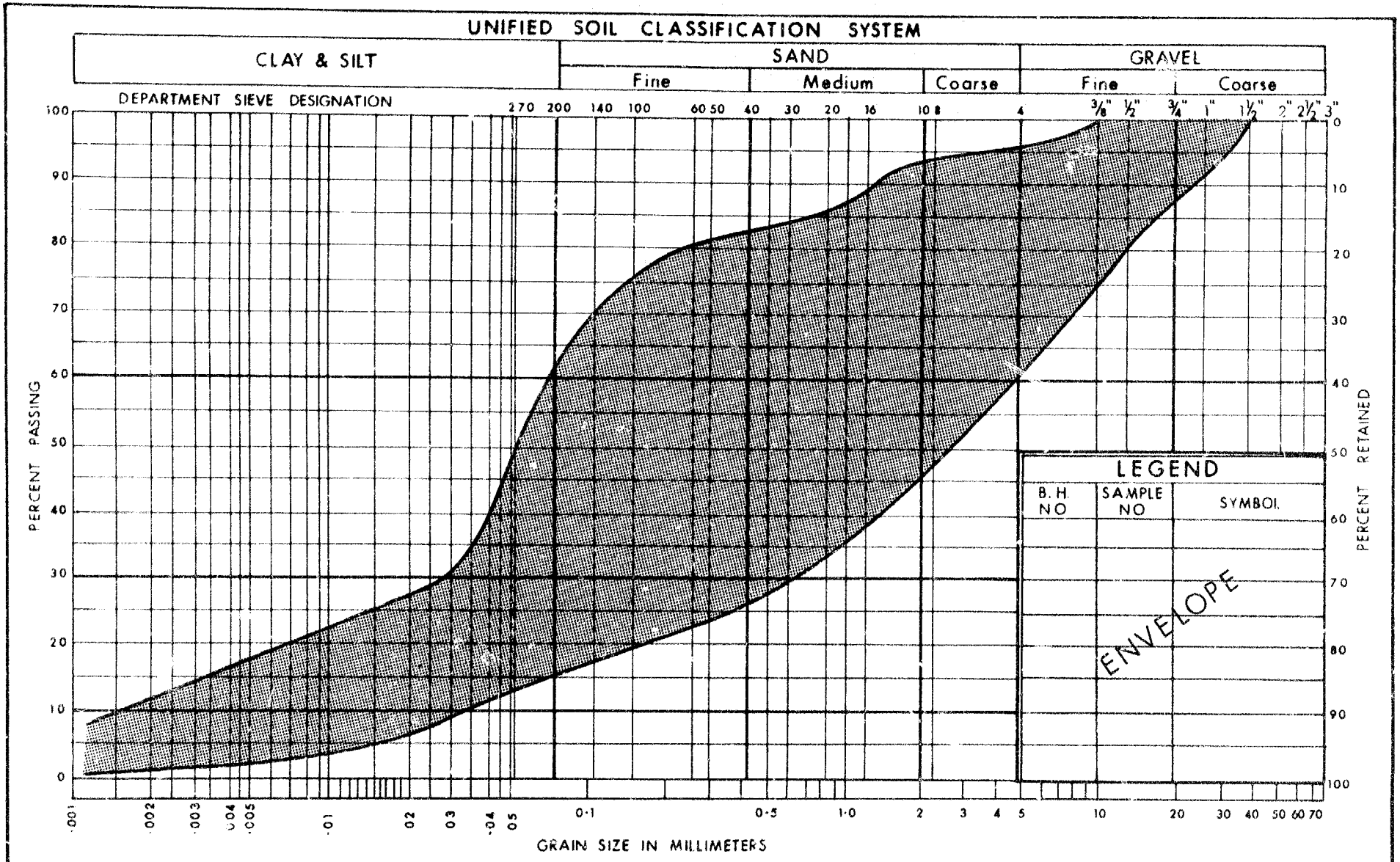


FIG. 3

FORM CB MT-17
REV. APR. 1965



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

GRAIN SIZE DISTRIBUTION

GLACIAL TILL

HET. MIXTURE OF CLAY, SILT SAND & GRAVEL

W.P. No. 36-66-13

JOB No: 70-11059

FIG. NO. 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 :-

CONSISTENCY	'N' BLOWS / FT.	c LB. / SQ. FT.	DENSENESS	'N' BLOWS / FT.
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
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

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

EARTH PRESSURE

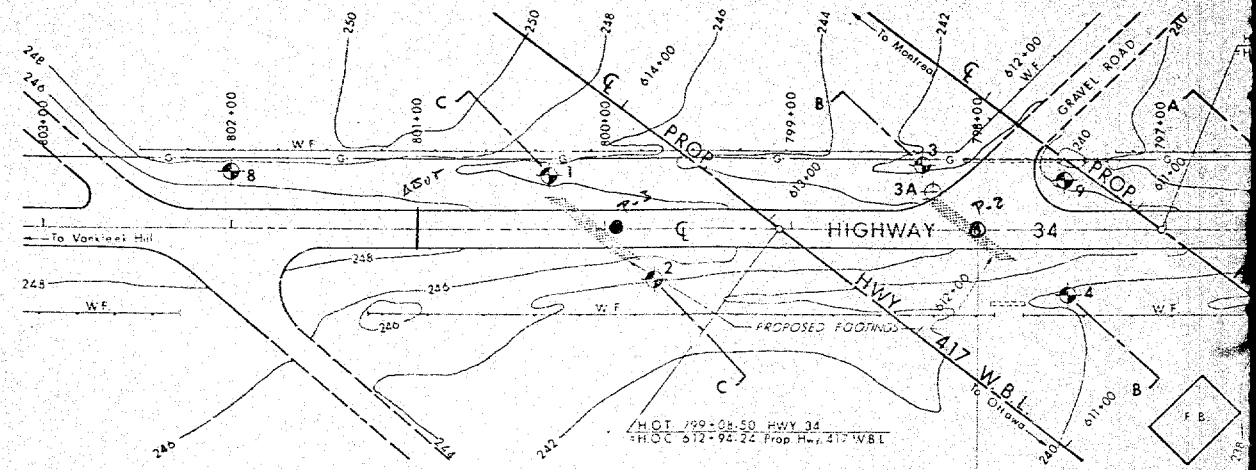
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

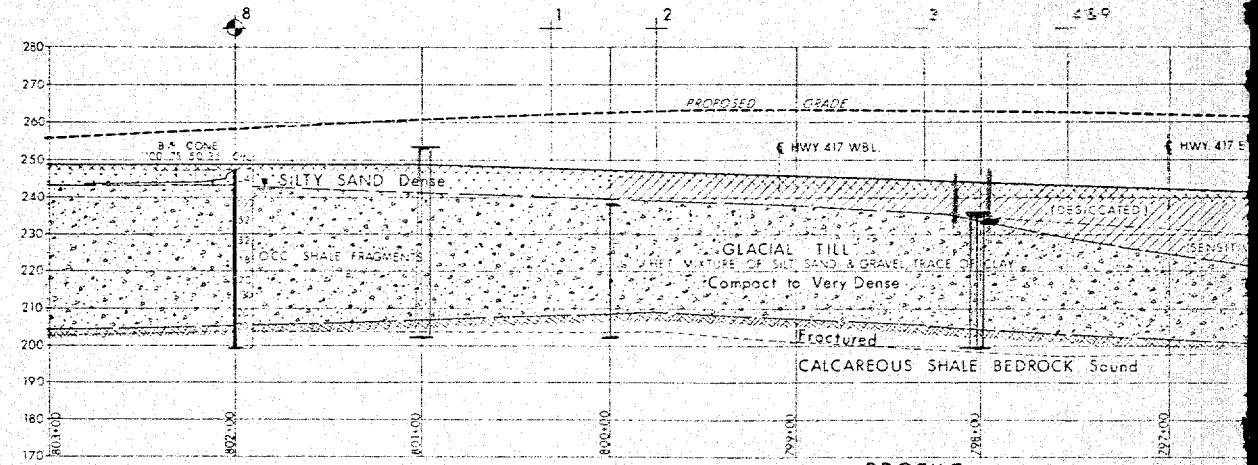
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

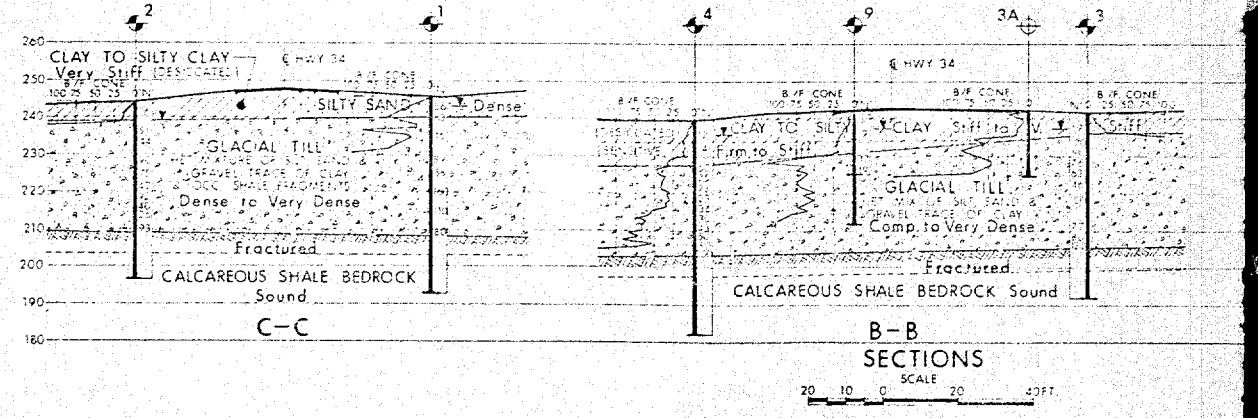
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



PLAN
SCALE
0 20 40FT

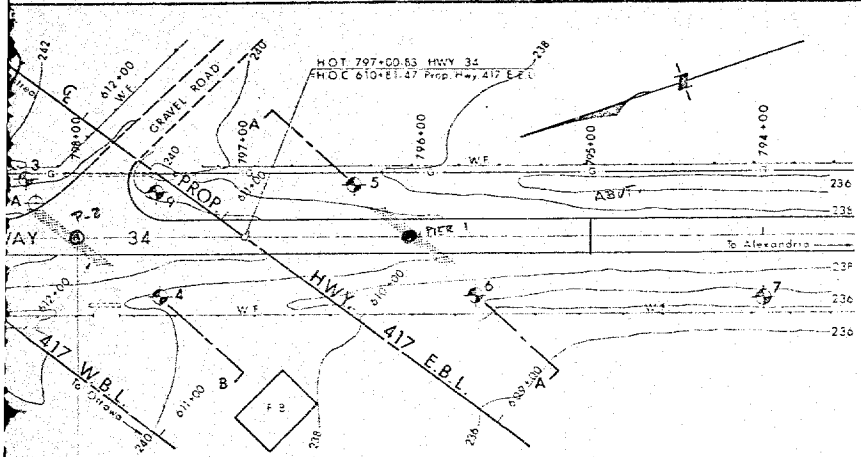


PROFILE
SCALE
HORIZ 40 20 0 40 80FT
VERT. 20 10 0 20 40FT



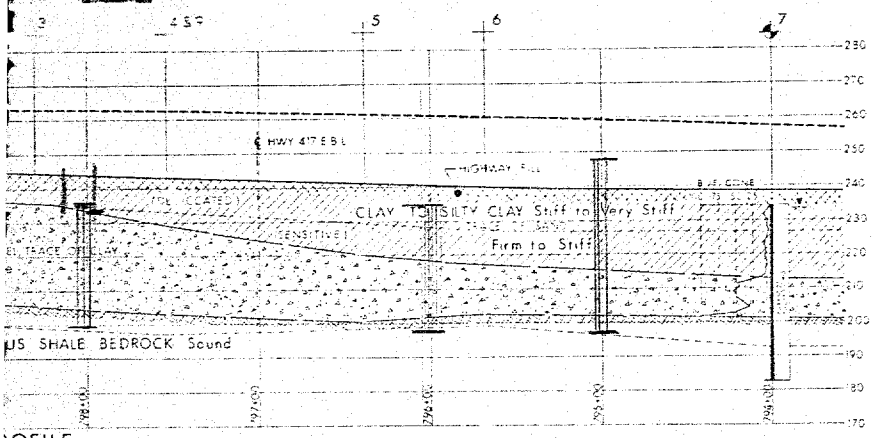
C–C B–B
SECTIONS
SCALE
20 10 0 20 40FT

PRINT RECORD		
NO.	FOR	DATE



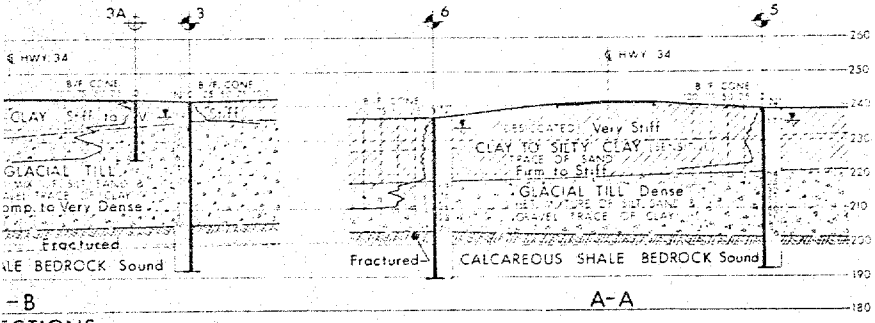
PLAN

SCALE



ROFILE

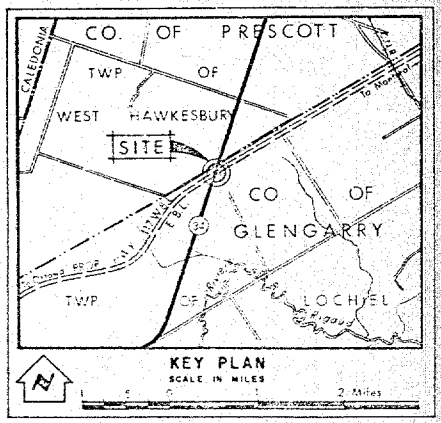
SCALE



-B

ECTIONS

SCALE



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation, July & Aug 1970

NO.	ELEVATION	STATION	OFFSET
1	245.5	800+30	28' RT.
2	244.4	799+75	28' LT.
3	241.1	798+30	35' RT.
3A	243.4	798+25	20' RT.
4	239.3	797+52	25' LT.
5	238.4	796+38	31' RT.
6	236.5	795+68	35' LT.
7	234.1	794+00	37' LT.
8	247.3	802+00	31' RT.
9	241.5	797+54	27' 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 and may be subject to considerable error.

REVISIONS			
DATE	BY	DESIGNATION	

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE - FOUNDATION SECTION

HIGHWAY 34

KING'S HIGHWAY NO. 417 E.B.L. & W.B.L. DIST. NO. 9
CO. GLENGARRY
TWP. LOCHIEL LOT 23 CON. IX

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D A.N.	CHECKED	W.P. NO. 30-66-13	M.&T. DRAWING NO. 70-11059A
DRAWN G.F.	CHECKED	JOB NO. 70-11059	
DATE Sept 2, 1970		SITE NO.	BRIDGE DRAWING NO.
APPROVED A.N. Thomas		CONT NO.	

REF NO E-4696-1

Department of Highways Ontario

Copy for the information of
Mr. A. Stermac

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

Bridge Office,
Downsview

November 25, 1970

Hwy. #34 Interchange Underpass
3.5 Miles South of Vankleek Hill
W.P. 36-66-13, Site 31-292
Highway 417, District No. 9

70-110-9

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6915-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is $462,000. This cost includes tender, materials, engineering and sundry construction.

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

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

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

Pile Size ?
Design Loads ?

M Devata
Nov 27/70

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

TO:	Mr. A. Stermac, Principal Foundation Engineer, Room 107, Lab. Bldg.	FROM:	C.S. Grebski, Bridge Office
ATTENTION:		DATE:	March 31, 1971
OUR FILE REF.		IN REPLY TO	

SUBJECT: Hwy. #34 Interchange Underpass
3.5 Miles South of Vankleek Hill
W.P. 36-66-13, Site No. 31-292
Highway 417, District No. 9

70-11-059

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.

for C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office

No comment.
PTS April 5/71

17 May 71

No Comments
O.I. Lenz
April 5th/1971

SUMMARY OF PILE DRIVING RECORDS

W.O. 70-11057 W.P. 36-66-13 CONT. 72-196 DIST. 9

SITE HWY 417 & HWY 34

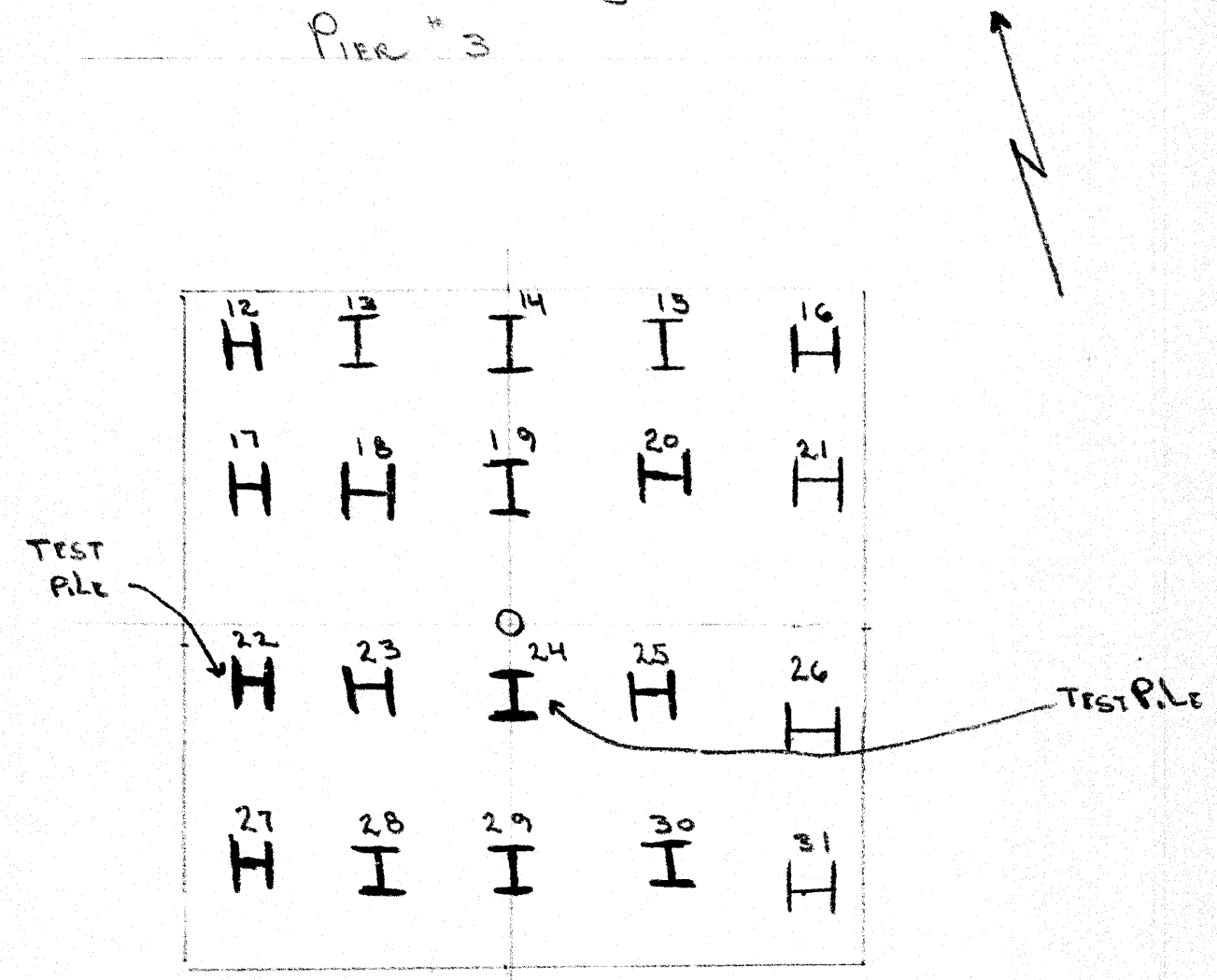
DATE DRIVEN MAY 73 WEIGHT OF ANVIL 600 LBS

HAMMER TYPE GRAVITY WEIGHT 10,000 LBS / 8,000 " / 6,000 " ENERGY 50,000 FT LBS / 40,000 " / 30,000 "

LOCATION OF PILES	PILE				ESTIMATED TIP EL. (ft.)	DIFFERENCE Longer(+) Shorter(-) Than Estimated (ft.)	REMARKS
	TYPE	NO.	LENGTH (ft.)	TIP EL. (ft.)			
SOUTH ABUTMENT	12 HP-53	104	52	196.5	200-203	+3.5	
	"	84	"	"	"	"	
	"	89	"	"	"	"	
PIER # 1	12 HP-74	81	36	198.5	"	+1.5	
	"	67	"	"	"	"	TIP
	"	65	"	"	"	"	
	"	79	"	"	"	"	
	"	68	"	"	"	"	
							DRIVEN
PIER # 2	"	42	36	199.5	203-206	+2.5	
		33	"	"	"	"	
		39	"	"	"	"	
PIER # 3	"	24	36	202.5	"	+1.5	
NORTH ABUTMENT	12-HP-53	4	50.5	202.5	200-203	OK	
	"	11	"	"	"	OK	

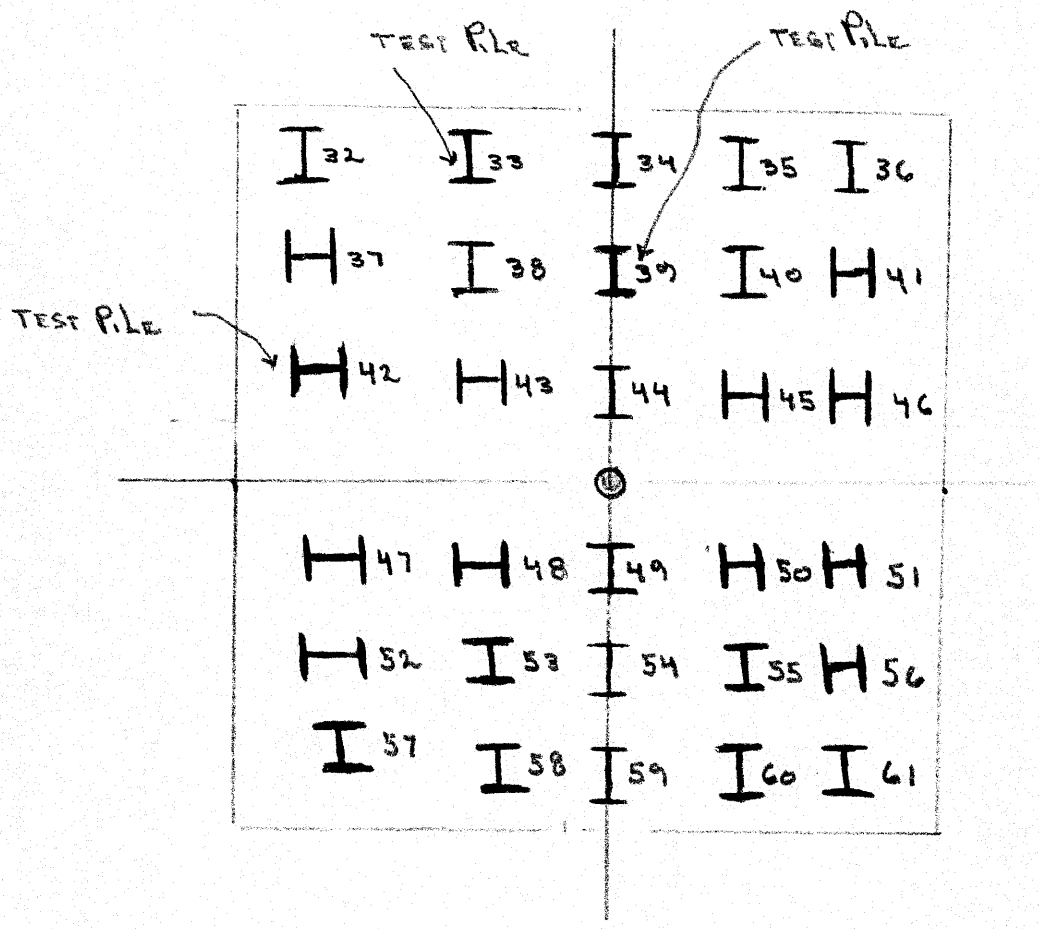
CONT 72-196 HWY #34 STRUCTURE

PIER # 3



CONT. 72-196 Hwy #34 STRUCTURE

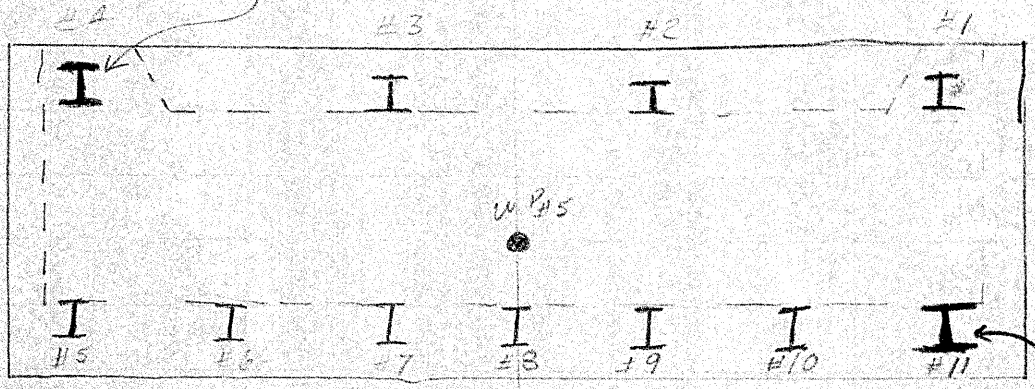
PIER #2



Hwy 134

℄

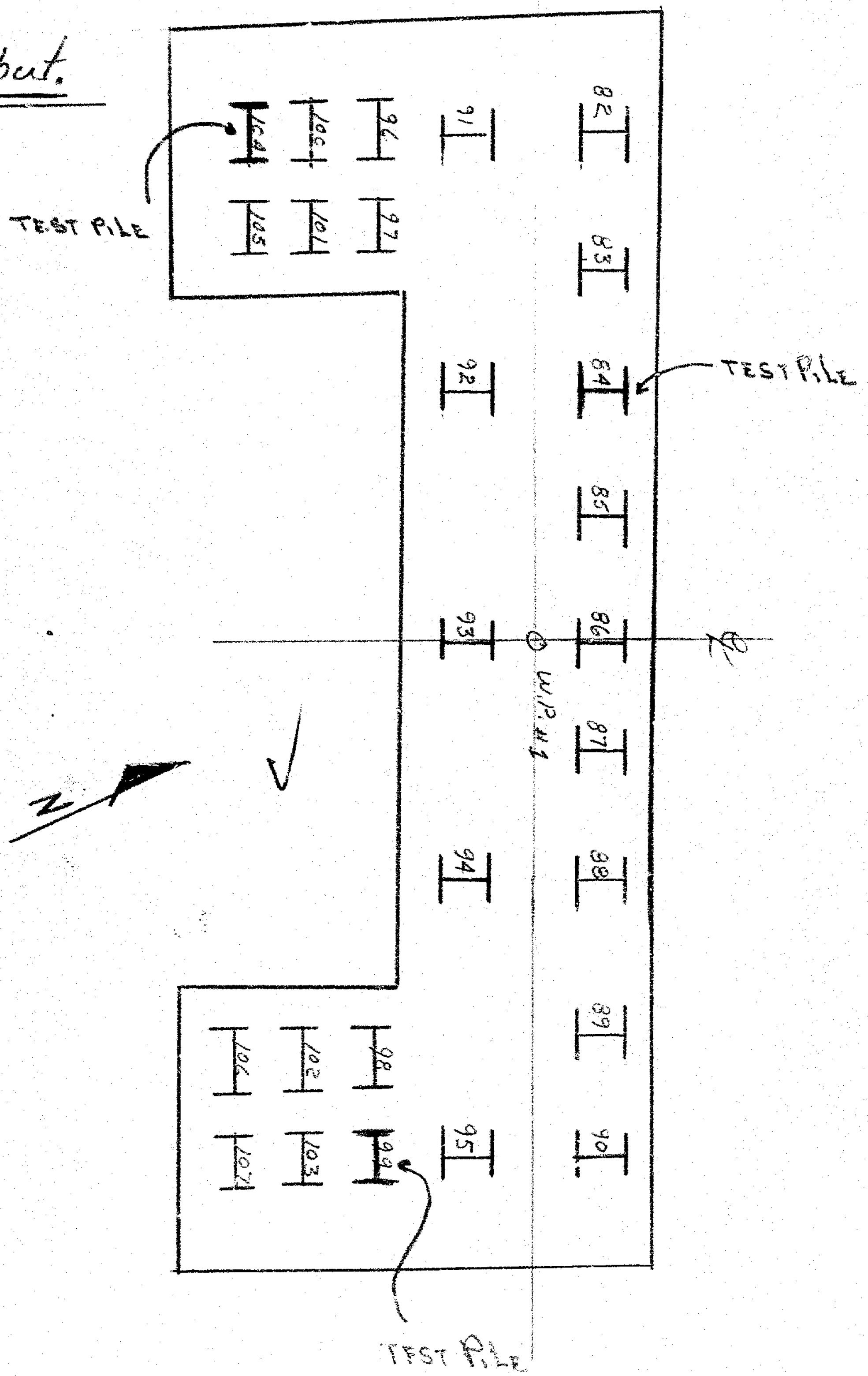
NORTH ABUT.



TEST PILE
May 23/73

NORTH ABUTMENT Hwy # 34 STRUCTURE
CONTRACT 72-196

South Abut.



TEST PILE
TEST PILE
TEST PILE
W.P. #1
82
83
84
85
86
87
88
89
90
91
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93
94
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96
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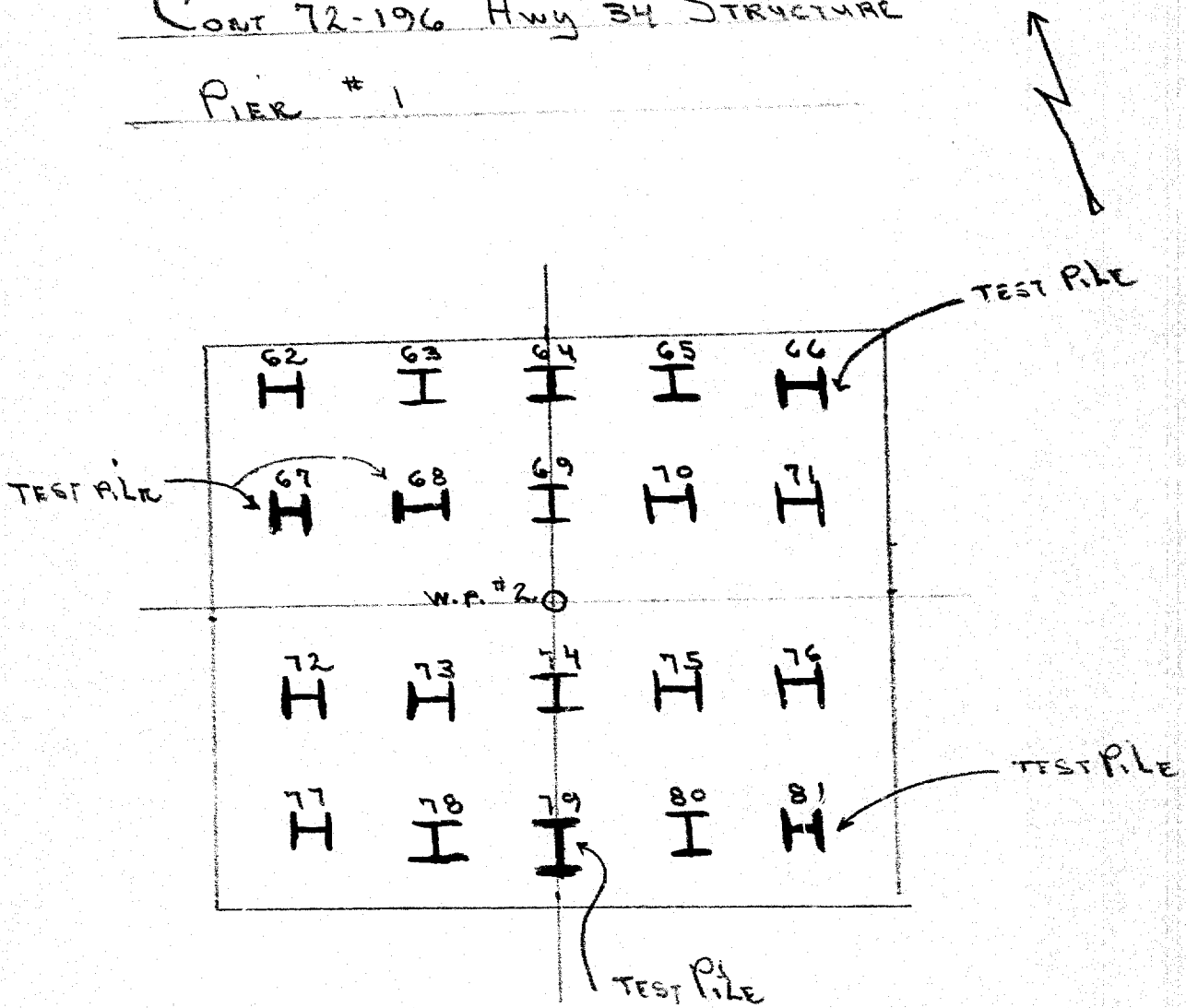
101
102
103
104
105
106
107

Cont 72-196 Hwy #34 Structure

Pier #1



K. Bassi
T. Sterma...

Mr. J.M. Childs,
District Engineer,
District 9, Ottawa.

Mr. W.T. Hashizume.

Mr. J.A. Cruickshank

June 12, 1973.

Contract 72-196, W.P. 36-66-13, Highway 34 Interchange Underpass, Site 31-292, Highway 417, District 9.

70-11-059

We have been advised by your field office that because of underlying boulders, two piles of Pier #3 of the above bridge could not be driven according to the layout shown on D-6915-3, and these piles ended up outside the footing limits as shown in the accompanying sketch.

The piles as driven will be acceptable. The footing will, however, require widening by 1'-10" as shown in the sketch. Please note that A-5004 bars (top) and A 1101 bars (bottom) should be staggered to cover the enlarged footing.

WTH/JC

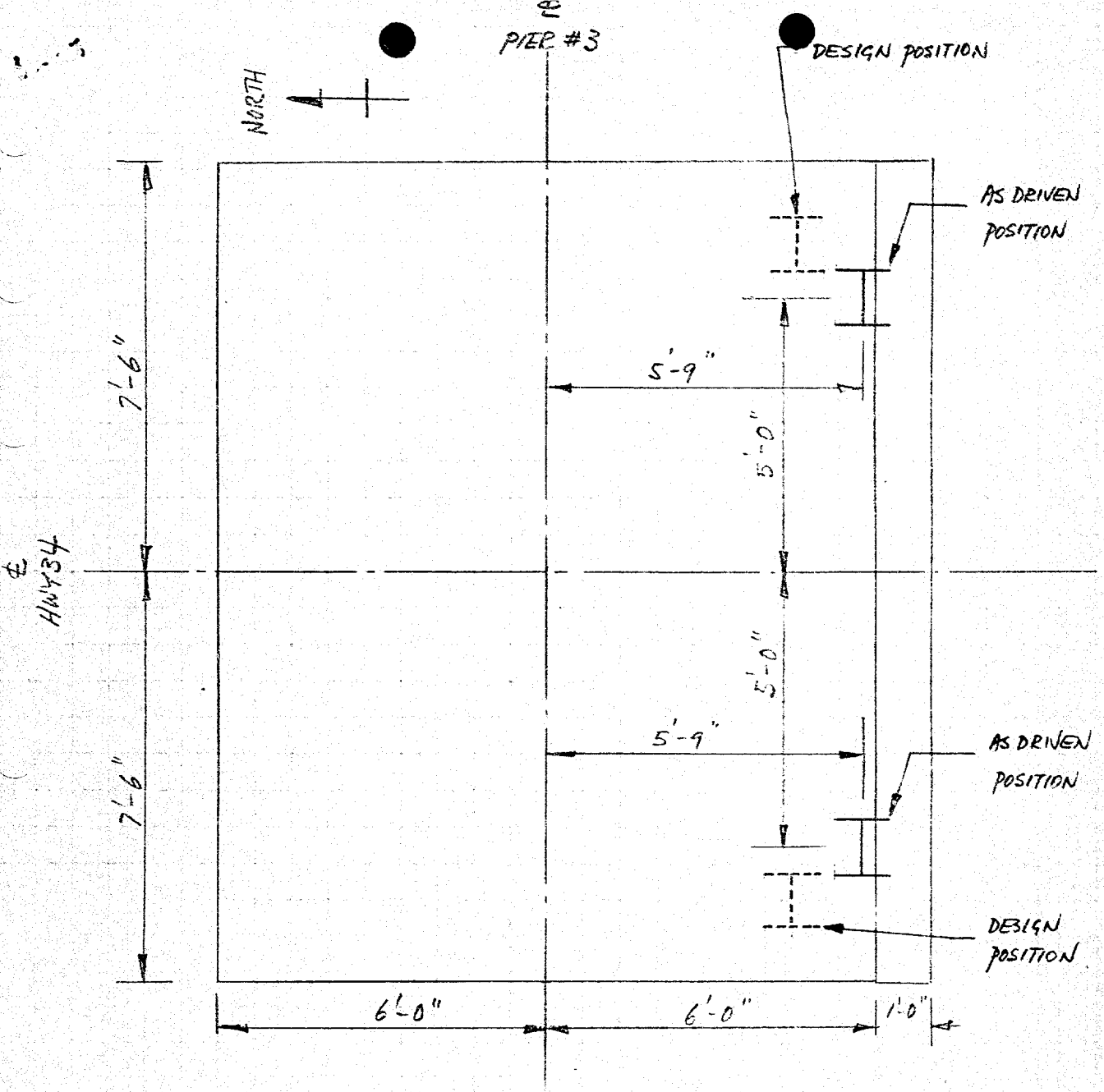
W.T. Hashizume,
Regional Construction Engineer,
Structures.

c.c. B.R. Davis ✓

June 13/73

Ches —
I don't know if Tony Sterma was aware ...

D.H.O.
TORONTO
RECEIVED
JUN 12 1973
BRIDGE
OFFICE



NOTE: STAGGER A5004 (TOP) AND A1101 (BOTTOM) BARS.

CONTRACT 72-196 W.P. 36-66-13
HWY 34 INTERCH. BR. SITE #31-292
HWY 417 DISTRICT 9
12 JUNE 1973 W.T.H.

OVERSIZED DRAWINGS

General Layout

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 31G-66

DIST. 9 REGION EASTERN

W.P. No. 36-66-13

CONT. No. 72-196

W. O. No. 70-F-59

STR. SITE No. 31-292

HWY. No. 417

LOCATION HWY. 417 AND HWY. 34 INTERCHANGE

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 11

REMARKS: DOCUMENTS TO BE UNFOLDED BEFORE MICROFILMED

G-I-30 SEPT. 1976

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

GEOCRES No. 31G-64

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 70-11059 LOCATION Hwy. 34 Sta. 800 + 30 o/s 28' Rt. ORIGINATED BY AN
W.P. 36-66-13 BORING DATE July 14 & 15, 1970 COMPILED BY AN
DATUM Geodetic BOREHOLE TYPE Washboring NX, BX Casing, BXT Rock Core; Cone CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT
245.5	Ground Level				
0.0	Silty Sand				
240.0	Brown Dense		1	SS	36
5.5			2	SS	63
	Het.mix.of silt,sand & gravel, trace of clay (Glacial Till)		3	SS	46
	occasional fragments of shale throughout		4	SS	89
			5	SS	58
	Black to Grey		6	SS	160
			7	SS	110
	Very Dense				
208.5			8	SS	80
37.0	Fractured Zone		9	BXT	85%
203.2			10	BXT	100%
42.3	Calcareous Shale Bedrock		11	BXT	100%
			12	BXT	100%
	Black				
192.8	Sound		13	BXT	90%
52.7	End of Borehole				

ELEV. SCALE: 240, 230, 220, 210, 200, 190

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 400 800 1200 1600 2000
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % — 20 40 60

BULK DENSITY γ P.C.F.

REMARKS

GR.SA.SI.CL.

▼ 243.2
4 14 46 6
WL in open BH July 24/70

15 20 5 10 % STRAIN AT FAILURE

FORM OB-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

3164-66
RECORDS No.

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 70-11059 LOCATION Hwy.34 Sta. 799 + 75 o/s 28' Lt. ORIGINATED BY AN
W.P. 36-66-13 BORING DATE July 20 & 21, 1970 COMPILED BY AN
DATUM Geodetic BOREHOLE TYPE Washbore NX,BX Casing, BXT Rock Core; Cone Test CHECKED BY

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
244.4	Ground Level					
0.0	Clay to silty clay (Desiccated Zone)		1	SS	26	240
239.4	Very Stiff					
5.0	Het.mix. of silt, sand & gravel, trace of clay (Glacial Till) occasional fragments of shale throughout) (Black to Grey)		2	SS	51	
			3	SS	44	
			4	SS	90	230
			5	SS	75	
			6	SS	42	
			7	SS	92	220
			8	SS	40	
	Very Dense		9	SS	26	
209.4			10	SS	93	210
35.0	Fractured Zone		11	BXT	30%	
203.9			12	BXT	75%	
40.5	Calcareous Shale Bedrock		13	BXT	100%	200
196.5	Black Sound		14	BXT	100%	
47.9	End of Borehole					190

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE — 400 800 1200 1600 2000
LIQUID LIMIT —— w_L PLASTIC LIMIT —— w_p WATER CONTENT —— w — WATER CONTENT % — 20 40 60

BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
	▼ 239.4
	25 42 30 3
	WL in open BH Aug.5/70
	15 33 47 5

20
15 ◇ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION 314-66

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 70-11059 LOCATION Hwy. 34 Sta. 798 + 30 o/s 35' Rt. ORIGINATED BY AN
W.P. 36-66-13 BORING DATE July 13 & 28, 1970 COMPILED BY AN
DATUM Geodetic BOREHOLE TYPE Washboring NX,BX Casing,BXT Rock Core; Cone CHECKED BY

ELEV. / DEPTH	DESCRIPTION (Ground Level)	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
241.1					
0.0	Clay to silty clay (Desiccated Zone)		1	TW	PM
			2	SS	19
236.1	Very Stiff		3	SS	120
5.0					
	Het. Mix. of silt, sand & gravel, trace of clay		4	SS	90
			5	SS	76
			6	SS	63
	(Glacial Till)		7	SS	46
	(Black to Grey)		8	SS	100
	Very Dense		9	SS	77
			10	SS	80
205.6			11	SS	120
35.5	Fractured Zone		12	BXT	65%
			13	BXT	50%
199.1					
42.0	Calcareous Shale Bedrock		14	BXT	90%
	Black				
191.6	Sound		15	BXT	87%
49.5	End of Borehole				

ELEV. SCALE: 240, 230, 220, 210, 200, 190

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT: 20 40 60 80 100
SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE: 400 800 1200 1600 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT %: 20 40 60

BULK DENSITY γ P.C.F.

REMARKS — GR.SA.SI.CL.

237.3
25 51 20 4
WL in open BH Aug.5/70
36 48 (16)

20
15 ✛ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

316-66

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3A

FOUNDATION SECTION

JOB 70-11059 LOCATION Hwy. 34 Sta. 798 + 25 o/s 20' Rt. ORIGINATED BY AN
W.P. 36-66-13 BORING DATE July 28, 1970 COMPILED BY AN
DATUM Geodetic BOREHOLE TYPE Dynamic Cone Penetration Test CHECKED BY AK

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
243.4	Ground Level					
0.0	Probably Clay to silty clay					240
236.4						
7.0	Probably Glacial Till					230
225.4						
18.0	End of Cone Test					220

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT 20 40 60 80 100
SHEAR STRENGTH P.S.F.
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL x LAB. VANE

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 GR.SA.SI.CL.

20
15 ⊹ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

316-66

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 70-11059 LOCATION Hwy.34 Sta. 797 + 52 o/s 35' Lt. ORIGINATED BY AN.
W.P. 36-66-13 BORING DATE July 20,1970 COMPILED BY AN
DATUM Geodetic BOREHOLE TYPE Washboring, NX,BX Casing, BXT Rock Core; Cone CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
239.3	Ground Level							
0.0	Desiccated Zone							
233.8	Stiff to Very Stiff		1	SS	12		105	▼ 236.0 WL in open BH Aug.5/70
5.5	Clay to silty clay (sensitive)		2	TW	PM			
227.3	Firm to Stiff		3	SS	4			
12.0	Het.mix.of silt,sand & gravel trace of clay (Glacial Till) Grey		4	SS	50	230		19 42 37 2
			5	SS	25			
			6	SS	23	220		
			7	SS	23			
			8	SS	36			27 26 44 3
			9	SS	30			
			10	SS	43	210		
			11	SS	50			
			12	SS	50			
203.3	Compact to Very Dense		13	SS	200			
36.0	Fractured Zone		14	BXT	90%	200		
197.3			15	BXT	80%			
42.0	Calcareous Shale Bedrock Black Sound		16	BXT	86%			
			17	BXT	100%			
			18	AXT	100%	190		
182.0			19	AXT	100%			
57.3	End of Borehole					180		

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE — 400 800 1200 1600 2000
s6 × 2850
+ s7.5

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % — 20 40 60
○ ○ CH

% STRAIN AT FAILURE — 20 / 15 / 10 / 5

FORM OB-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

314-66
GEOCRES No.

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 70-11059 LOCATION Hwy. 34 Sta. 796 + 38 o/s 31' Rt. ORIGINATED BY AN
W.P. 36-66-13 BORING DATE July 23, 1970 COMPILED BY AN
DATUM Geodetic BOREHOLE TYPE Washboring NX, BX Casing, BXT Rock Core; Cone CHECKED BY

SOIL PROFILE ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
238.4	Ground Level					
0.0	Desiccated Zone Mottled Brown		1	TW	PM	
			2	SS	17	
230.4	Very Stiff		3	TW	PM	
8.0	Clay to silty clay, trace of sand (sensitive) Grey		4	TW	PM	
			5	TW	PM	
			6	TW	PM	
220.6	Firm to stiff					
17.8	Het.mix.of silt,sand & gravel trace of clay (Glacial Till) Grey		7	SS	64	
			8	SS	25	
			9	SS	32	
			10	SS	51	
			11	SS	46	
			12	SS	80	
200.6	Dense		13	SS	80	
36.6	Fractured Zone		14	SS	76	
37.3	Calcareous Shale Bedrock Black		15	BXT	93%	
191.5	Sound		16	BXT	100%	
46.9	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
400 800 1200 1600 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % 20 40 60

BULK DENSITY γ P.C.F.

REMARKS

GR.SA.SI.CL.

ELEV.	BULK DENSITY	REMARKS	GR.SA.SI.CL.
	113	▼235.4 WL in open BH Aug.5/70	
	103.5		
			31 37 28 4
			9 30 57 4

230 220 210 200 190

+s4 ×s8 +s14 +s11

% STRAIN AT FAILURE 15 20 10 5

FORM 08-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

B1Gn-646

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 6

FOUNDATION SECTION

JOB 70-11059 | LOCATION Hwy.34 Sta. 795 + 68 o/s 35' Lt. | ORIGINATED BY AN
W.P. 36-66-13 | BORING DATE July 22, 1970 | COMPILED BY AN
DATUM Geodetic | BOREHOLE TYPE Washboring, NX,BX Casing, BXT Rock Core; Cone | CHECKED BY

ELEV. / DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
236.5	Ground Level				
0.0	(Desiccated Zone) Brown and Grey		1	TW	PM
			2	TW	PM
227.2	Stiff to Very Stiff		3	TW	PM
9.3	Clay to silty clay, trace of sand(Sensitive)		4	TW	PM
	Grey		5	TW	PM
217.2	Firm		6	TW	PM
19.3	Het.mix.of silt,sand & gravel,trace of clay (Glacial Till)		7	SS	63
			8	SS	26
			9	SS	62
	Black to Grey		10	SS	22
			11	SS	68
203.0	Dense		12	SS	70
33.5	Fractured Zone		13	BXT	100%
179.8					
36.7	Calcareous Shale Bedrock		14	BXT	92%
	Black Sound		15	BXT	96%
189.2					
47.3	End of Borehole				

ELEV. SCALE: 230, 220, 210, 200, 190, 180

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
400 800 1200 1600 2000

s26, s3, s9, s22, s5, s20

LIQUID LIMIT —— w_L
PLASTIC LIMIT —+— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % 20 40 60

104, 105

BULK DENSITY γ P.C.F.

REMARKS

GR.SA.SI.CL.

233.8
WL in open BH Aug.5/70

22 46 31 1

32 27 31 10

20
13 ⟡ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

314-66

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 70-11059 LOCATION Hwy. 34 Sta. 794 + 00 o/s 37' Lt. ORIGINATED BY AN
W.P. 36-66-13 BORING DATE July 22, 1970 COMPILED BY AN
DATUM Geodetic BOREHOLE TYPE Washboring NX,BX AX Casing, BXT Rock Core; Cone CHECKED BY AK

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT
234.1	Ground Level				
0.0	Desiccated Zone Mottled Brown		1	TW	PM
227.1	Very Stiff		2	TW	PM
7.0	Clay to Silty Clay trace of sand (sensitive)		3	TW	PM
	Grey		4	TW	PM
			5	TW	PM
			6	TW	PM
213.1	Firm		7	SS	2
21.0	Het.mix.silt,sand and gravel,trace of clay (Glacial Till)		8	SS	80
			9	SS	60
			10	SS	40
201.3	Compact to Very Dense		11	SS	22
32.8	Fractured Zone		12	BXT	50%
192.9			13	BXT	70%
41.2	Calcareous shale bedrock		14	AXT	65%
	Black		15	AXT	100%
182.8	Sound				
51.3	End of Borehole				

ELEV. SCALE: 230, 220, 210, 200, 190, 180

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE
400 800 1200 1600 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % 20 40 60

BULK DENSITY γ P.C.F.

REMARKS

GR SA SI CL

233.8 WL in open BH Aug.5/70

98
103

42 39 15 4
9 83 (8)

20
15 ⟡ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

316-66

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 70-11059 LOCATION Hwy. 34 Sta. 802 + 00 o/s 31' Rt. ORIGINATED BY AN
W.P. 36-66-13 BORING DATE July 16 & 17, 1970 COMPILED BY AN
DATUM Geodetic BOREHOLE TYPE Washboring,NX,BX Casing, BXT Rock Core; Cone CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
247.3	Ground Level					
0.0	Silty Sand					
243.3	Brown Compact		1	SS	24	
4.0						
	Het.mix of silt, sand		2	SS	100	240
	and gravel, trace of		3	SS	52	
	clay (Glacial Till)					
	occasional fragments		4	SS	52	230
	of shale throughout		5	SS	18	
	Black to Grey		6	SS	70	220
	Very Dense		7	SS	130	
205.3			8	SS	200	210
204.3	Fractured Zone		9	SS	200	
43.0	Calcareous Shale Bedrock		10	BXT	92%	
			11	BXT	100%	200
199.3	Black Sound		12	BXT	87%	
48.0	End of Borehole					190

DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
400 800 1200 1600 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P — w — w_L
WATER CONTENT % 20 40 60

BULK DENSITY γ P.C.F.

REMARKS

GR.SA.SI.CL.

▼ 242.5
WL in open BH Aug.5/70

26 37 31 6

20
15 ⟡ 5 % STRAIN AT FAILURE
10

FORM OB-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

316-66
PROJECT NO.

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 9

FOUNDATION SECTION

JOB 70-11059 LOCATION Hwy. 34 Sta. 797 + 54 o/s 27' Rt. ORIGINATED BY AN
W.P. 36-66-13 BORING DATE July 24, 1970 COMPILED BY AN
DATUM Geodetic BOREHOLE TYPE Washboring NX Casing; Cone CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT
241.5	Ground Level				
0.0	Clay to silty clay (Desiccated Zone) Mottled Brown		1	TW	PM
			2	SS	9
233.5	Stiff		3	TW	PM
8.0	Grey (Sensitive)				
230.5	Firm to Stiff				
11.0	Het.mix.silt,sand and gravel,trace of clay (Glacial Till)		4	SS	33
225.0	Dense		5	SS	49
16.5	End of Borehole				
211.5					
30.0	End of Cone Test				

ELEV. SCALE: 240, 230, 220, 210

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
400 800 1200 1600 2000

+85
+97.5

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % 20 40 60

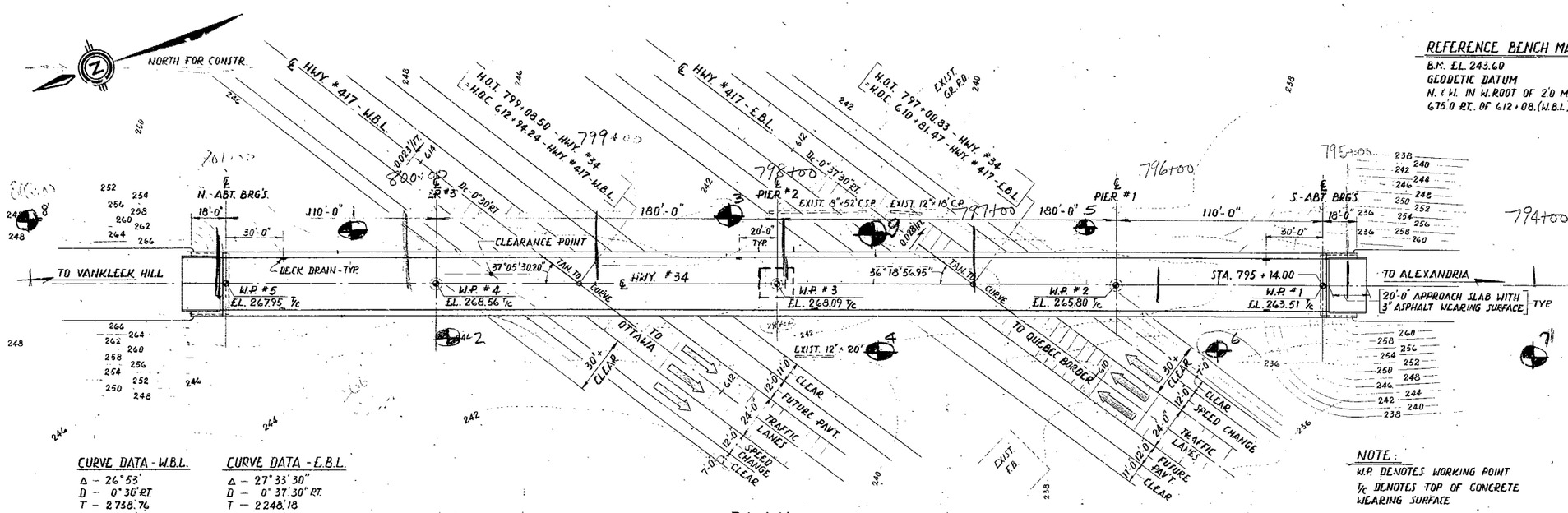
BULK DENSITY γ P.C.F.

REMARKS

GR.SA.SI.CL.

237.0
WL in open BH Aug.5/70

20
15 ⟡ 5 % STRAIN AT FAILURE
10



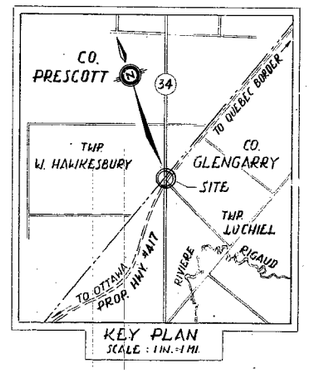
PLAN
SCALE : 1" = 30'-0"

CURVE DATA - W.B.L.
Δ – 26°53'
D – 0°30' RT.
T – 2738.76
L – 5376.47
E – 322.74

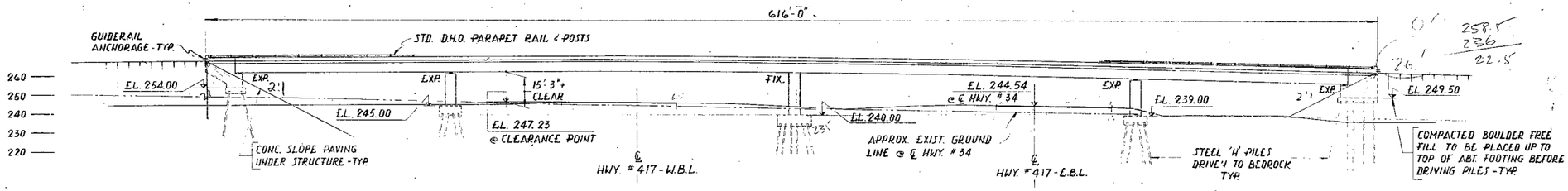
CURVE DATA - E.B.L.
Δ – 27°33'30"
D – 0°37'30" RT.
T – 2248.18
L – 4409.33
E – 271.64

NOTE:
W.P. DENOTES WORKING POINT
T/C DENOTES TOP OF CONCRETE WEARING SURFACE

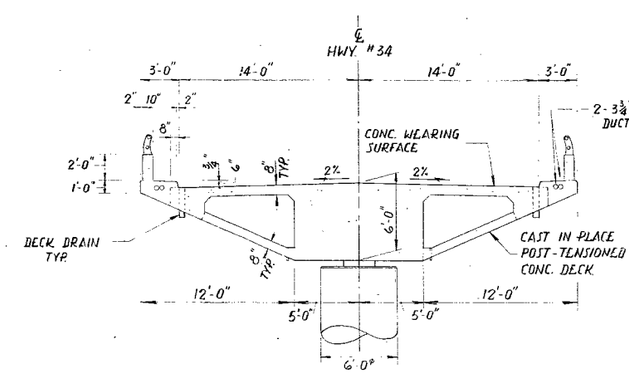
REFERENCE BENCH MARK
B.M. EL. 243.60
GEODETIC DATUM
N. ℄ W. IN W. ROOT OF 2'0 MAPLE 675.0 FT. OF 612+08.(W.B.L.)



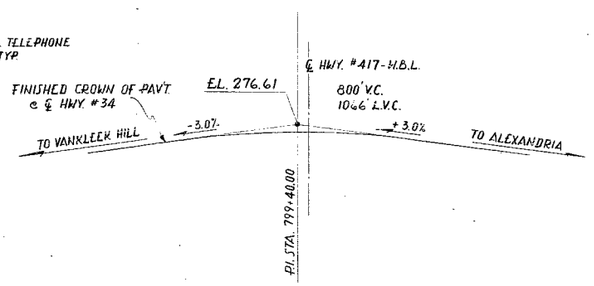
LIST OF DRAWINGS
D-6915 - 1 GENERAL LAYOUT
2 BORE HOLE LOCATIONS ℄ SOIL STRATA
3 FOUNDATION LAYOUT
4 SOUTH ABUTMENT
5 NORTH ABUTMENT
6 PIERS
7 DECK DETAILS
8 CABLE DETAILS
9 DECK REINFORCEMENT I
10 DECK REINFORCEMENT II
11 BEARINGS ℄ EXPANSION JT. DETAILS
12 PARAPET WALL DETAILS
13 STANDARD STEEL PARAPET RAIL
14 APPROACH SLABS
15 DETAILS OF CONC. SLOPE PAVING
16 STANDARD DETAILS I
D-6915 - 17 STANDARD DETAILS II



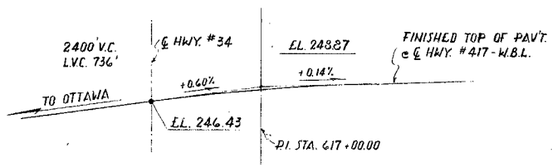
ELEVATION
SCALE : 1" = 30'-0"



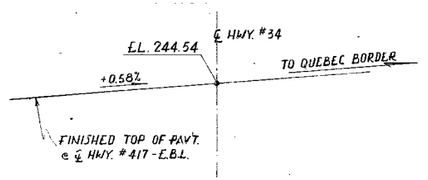
TYP. DECK SECTION
SCALE : 3/16" = 1'-0"



PROFILE OF HWY. #34
N.T.S.



PROFILE OF HWY. #417-W.B.L.
N.T.S.



PROFILE OF HWY. #417-E.B.L.
N.T.S.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — A. A. WITECKI — PROVINCE OF ONTARIO

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

NOTES

CLASS OF CONCRETE
DECK, CURBS, ℄ PARAPET WALLS — 5000 P.S.I.
PIER COLUMNS — 5000 P.S.I.
REMAINDER — 3000 P.S.I.

CLEAR COVER ON REINF. STEEL
FOOTINGS ℄ ABUTMENTS – 3"
PIER COLUMNS, CURBS – 2"
TOP OF DECK – 2", BOTT. – 1½"
PARAPET WALL – 1½"

CONSTRUCTION NOTES
THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± ⅛".

NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED, STRESSED AND GROUTED.

316-66
GEOCRES No.

REVISIONS	DATE	BY	DESCRIPTION

PRINT RECORD		
No.	FOR	DATE

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

70-11-059

HWY. #34 INTERCH. U'PASS
3.5 MILES SOUTH OF VANKLEEK HILL

KING'S HIGHWAY No. 417 — DIST. No. 9
CO. GLENGARRY
TWP. LOCHIEL — LOT 23 — CON. IV

— GENERAL LAYOUT —

APPROVED _____ BRIDGE ENGINEER

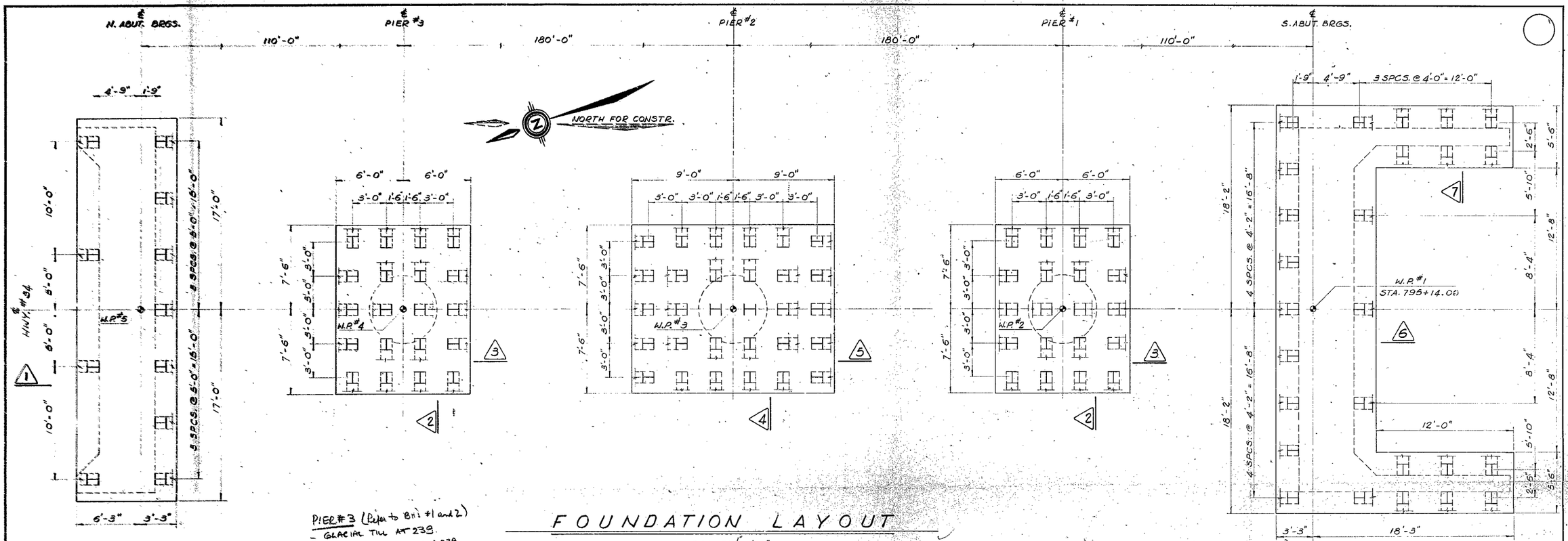
DESIGN	A.W.	CHECK	G.A.
DRAWING	A.A.	CHECK	R.G.S.
DATE	MARCH/71	LOADING	HS20-44

SITE No. 31-292 — W.P. No. 36-66-13
CONTRACT No.
DRAWING No. D-6915-1

TRANSLAN 2M-5-69

FOUNDATION LAYOUT

SCALE: 1/4" = 1'-0"



PIER #3 (Refer to B/H's #1 and 2)

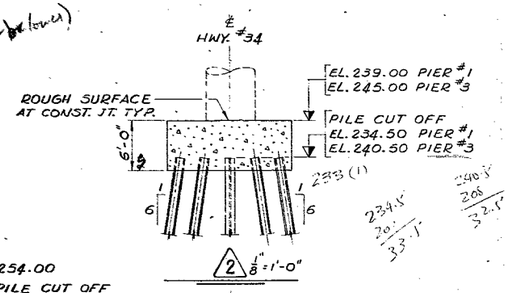
- GLACIAL TILL AT 239.
- PROPOSED BASE OF FOOTING 239.
why not spread footing located in glacial Till (9 actions = 4 ots ft)

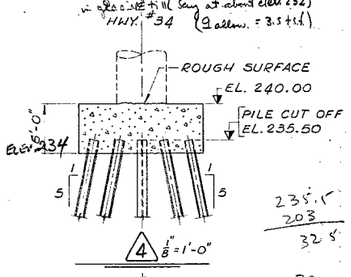
PIER #2

(Refer to B/H's 3, 4 and 9)

- PROPOSED BASE OF FOOTING 234
- why not spread footing located in glacial till (say at about elev 232)

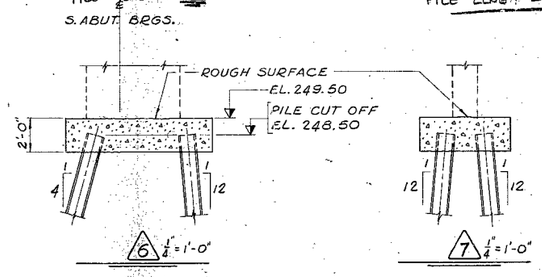
HWY. #34 (9 actions = 3.5 ots ft)





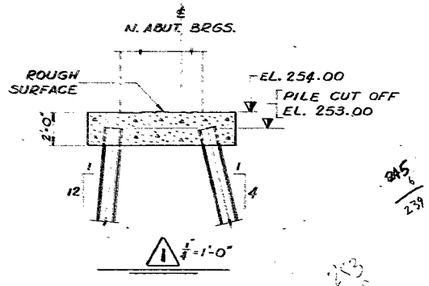
PIER #1 (Refer to B/H's 5 and 6)

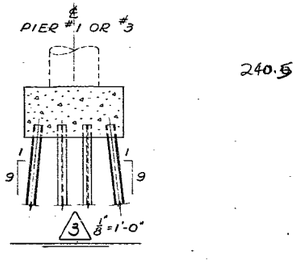
Pile Cut-off 234.5
PILE SUPPORT — OK
PILE LENGTHS OK
S. ABUT. BRGS.

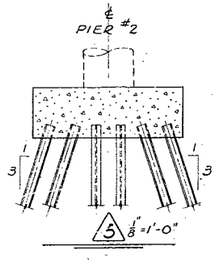


SOUTH ABUTMENT (Refer to B/H's 6 & 7)

Pile Cut-Off - 248.5
PILE SUPPORT — OK
PILE LEGHT — OK







PILES

LOCATION	QTY.	TYPE	LENGTH	DESIGN LOAD
S. ABUT.	26	12BP53	52'-0"	70 T./PILE
PIER #1	20	12BP74	36'-0"	95 T./PILE
PIER #2	30	12BP74	36'-0"	95 T./PILE
PIER #3	20	12BP74	36'-0"	95 T./PILE
N. ABUT.	11	12BP53	50'-0"	70 T./PILE

NOTES:

- PILE SPACINGS TO BE MEASURED AT UNDERSIDE OF FOOTINGS.
- PILES TO BE DRIVEN TO BEDROCK.

REGISTERED PROFESSIONAL CIVIL ENGINEER — A. A. WITECKI — PROVINCE OF ONTARIO

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

PRINT RECORD

No.	FOR	DATE

REVISIONS

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE OFFICE

70-11-059

HWY. #34 INTERCH. U'PASS
3.5 MILES SOUTH OF VANKLEEK HILL
KING'S HIGHWAY No. 417 — DIST. No. 9
CO. GLENGARRY
TWP. LOCHIEL — LOT 23 — CON. IX

FOUNDATION LAYOUT

APPROVED _____ BRIDGE ENGINEER

DESIGN	A.W.	CHECK	GP	
DRAWING	B.S.	CHECK	AJT	
DATE	MAR./71	LOADING	H S20-44	

SITE No. 31-292 — W.P. No. 36-66-13
CONTRACT No.
DRAWING No. D-6915-3