#68-F-88

WP. #34-66

#34-66-18-38-4

HWY #417 (LINE 'D')

VARS EASTERLY

TO SOUTH NATION R

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. J. L. Forster,
Functional Planning Engr.,
Eastern Region,
KINGSTON, Ontario.

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

Attention:

Date: April 29, 1969

Our File Ref:

In reply to MAY - 5 1969

Subject:

PRELIMINARY FOUNDATION REPORT
For
Proposed Hwy. 417 - (Line 'D')
Vars Easterly to South Nation River
Structure Sites No. 1, 2, 3, 4, 4S,
5, 6, 6S, 8, 8S, 79 & 80, Twps. of
Cumberland, Russell and Prescott
District No. 9 (Ottawa)
W.J. 68-F-88 -- W.P. 34-66 & 35-66

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

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

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

AGS/MdeF
Attach.
cc: Messrs. J. L. Forster (2)
B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
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Foundations Files
Gen. Files

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PRELIMINARY FOUNDATION REPORT
For
Proposed Hwy. 417 - (Line 'D')
Vars Easterly to South Nation River
Structure Sites No. 1, 2, 3, 4, 4S,
5, 6, 6S, 8, 8S, 79 & 80, Twps. of
Cumberland, Russell and Prescott
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W.J. 68-F-88 -- W.P. 34-66 & 35-66

1. INTRODUCTION:

The Foundation Section was requested to provide preliminary subsoil information at the proposed crossings along Hwy. 417 (Line 'D'), namely, between Vars and the Quebec Border. This portion of the proposed highway is approximately 52 miles in length. The request was contained in a memo from the Eastern Region Functional Planning Section (Mr. J. L. Forster, Regional Functional Planning Engineer), dated December 10, 1968. An investigation was subsequently carried out by this Section to determine the subsoil conditions at the crossings.

This report presents preliminary information on the subsoil and groundwater conditions encountered at the proposed structure, creek and river crossings of Hwy. 417, located between Vars and the South Nation River. Also included are recommendations pertaining to foundation design and stability and settlement of approach embankments. In addition, comments are made on the feasibility of re-aligning the western section of the proposed highway, particularly between Limoges and Benoit.

Preliminary Foundation Reports have been prepared and submitted on that portion of the alignment from Casselman easterly to the Quebec Border (Reports No. 68-F-89, 90 and 91).

2. DESCRIPTION OF THE SITES AND GEOLOGY:

The proposed alignment for Hwy. 417, from Vars easterly to the South Nation River, is located in the Townships of Cumberland,

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

Russell and Cambridge, County of Russell. The terrain is gently undulating in relief, between about elevation 215 and 250; in general, the surface elevation increases gradually moving in a westerly direction. The land is basically being utilized for farming purposes; there are, however, localized timbered areas. The surficial drainage in the area is quite poor, being provided mainly by the South Nation River, located to the south of this alignment. A few tributary valleys have been dissected through the overburden. The largest of these are occupied by the arms of South Indian Creek. The overall depth of these valleys, in the vicinity of the proposed Line, varies from 20 to 45 feet.

This portion of the alignment is located in the physiographic region known as the "Russell and Prescott Sand Plains". In this area a mantle or cap of sand overlies extensive deposits of clay. The sand is of deltaic origin formed by the Ottawa River and its northern tributaries. The thickness of the surficial granular deposits generally range from 5 to 15 feet. The gradation of the granular mantle varies from fine sand to silt.

The deep stratum of marine clay, known locally as "Leda Clay", was deposited by the Champlain Sea, which inundated the area during the post-glacial period following the Wisconsin Glacial Age. The thickness of the clay varies from 40 feet to 180 feet; in general, it decreases in a southerly direction. The clay stratum is underlain by a glacial till, which is, in turn, followed by bedrock. In the western portion of the alignment the bedrock is composed of grey and black shale and dolomite limestone of the Meaford-Dundas and Blue Mountain Formations, while in the eastern portion it is limestone of the Trenton and Black River Groups.

An exception to the aforementioned occurs in the Vars area where glacial till protrudes to within a few feet of ground surface.

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3. FIELD AND LABORATORY WORK:

One or more detailed sampled boreholes were put down at each of the crossings, during the course of the investigation, by a conventional diamond drill rig adapted for soil sampling purposes.

The location of the structure sites and borings are shown on Drawing No. 68-F-88A, located in the Appendix of this report. The location of the sites, and respective borings, were provided by the Engineering Surveys Section (Eastern Region). The elevations given in the report, with the exception of Sites 1 and 2, are referenced to the ground surface contours given on the County Militia maps (scale 1:50,000, contour interval 25 feet). The former sites are referenced to a Geodetic datum.

Samples of the overburden were taken using standard sampling equipment and techniques. Bedrock was proven at some of the boring locations by obtaining either AXT or BXL rock core samples. Laboratory testing was carried out on selected samples to determine the engineering properties of the overburden.

The subsoil conditions encountered at the boring locations, are shown on the Record of Borelog sheets; a stratigraphical profile along the alignment has been inferred from this data, and is shown on Drawing 68-F-88A. In addition, two stratigraphically located soil sections are plotted on Drawing 68-F-88B. The results of the laboratory testing carried out are shown on the borelog sheets as well as on Figures No. 1 to 13, inclusive, all of which are located in the Appendix of this report.

4. SUBSOIL CONDITIONS:

4.1) General:

The predominant stratum across the various structure sites, is a soft to stiff sensitive clay to silty clay. The thickness of the clay, in the area, varies from about 20 feet to 156 feet; it is most extensive in the region between Limoges easterly to Benoit. This stratum is overlain by either of the following:

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

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

i) over the majority of the area - compact to dense silty fine sand to sandy silt, between 5 to 27 feet in thickness;

ii) in the vicinity of the South Nation River and the various creek crossings - organic silt to organic clay between 4 and 10 feet in thickness.

The extensive clay stratum is underlain by competent granular deposits and/or glacial till, followed by bedrock.

An exception to the above pattern was observed in the immediate area around Vars. Here glacial till and bedrock protrude to within a few feet of ground surface.

The stratigraphy encountered at the borings is plotted on the Record of Borelog sheets. A stratigraphic profile along the alignment, as well as two sections, were inferred from this data and plotted on Drawings 68-F-88A and B. The subsoil encountered from ground surface downward, is presented in the following sub-sections:

4.2) Surficial Deposits:

4.2.1) Silty Sand:

The surficial deposit across the region, except in the following areas: i) in the vicinity of Vars and ii) along the north bank of the South Nation River, is composed of a brown to grey silty fine sand to sandy silt. The thickness of the deposit ranges from 5 feet to 27 feet, being on the average, about 12 feet. The granular deposit has occasional zones which exhibit slight stratification. Grain-size distribution curves, obtained on samples of the sand and silt, were plotted. An envelope encompassing all these curves, is given on Figure #1. The natural water content of the deposit, determined from laboratory testing, was found to vary between 20 and 30%.

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

4.2) Surficial Deposits: (cont'd.) ...

4.2.1) Silty Sand: (cont'd.) ...

Standard penetration tests, carried out within the deposit, gave 'N' values which range between 11 and 53 blows/ft., with the average being about 25 blows/ft. Based on these results, it is estimated that the relative density of the granular soil ranges from compact to very dense.

4.2.2) Organic Silt to Organic Clay:

A deposit of loose organic silt with some sand, was encountered in those borings put down through the creek beds (Sites No. 5, 8, and 8 South). The thickness of this cover varies from 4 to 6 feet.

A floodplain deposit, composed of stiff to firm grey brown organic clay to organic silt, is present along the west bank of the South Nation River (Site 80 - B.H. #2). The organic matter, which is approximately 10 feet in thickness, is surficially covered by 8 feet of very stiff to stiff clayey silt. A laboratory test indicated that the organic content of the organic subsoil is approximately 17 percent (by weight).

4.3) Clay to Silty Clay (Sensitive):

Underlying the surficial deposits, except in the vicinity of Site #2, is the predominant stratum across the area; this stratum is composed of a sensitive marine clay to silty clay, with a trace of sand. The thickness of the cohesive soil varies from 17 feet at Site #1 to 158 feet at Site #4. In general, the clay is most extensive in the central portion of the alignment, namely, within a nine-mile stretch encompassing Limoges, Gagnon and Benoit. At a few locations the upper 3 to 5 feet of the stratum has been desiccated. The deposit is basically grey in colour; there are, however, numerous reddish-brown laminations throughout. Random

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

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

sand and silt partings and seams, up to 5 inches in thickness, were encountered within the deposit; the frequency of these zones generally increases with depth. Grain-size distribution curves, obtained on samples from the stratum, were plotted; the results are presented in envelope form on Figure No. 2.

Atterberg limit tests were carried out on representative samples of the clay; the results of this testing, which are given on the Borelog sheets, are summarized on the Plasticity Chart, Figure No. 3. The results indicate that the liquid and plastic limits vary from 27 to 82 (average 46) and 16 to 25 (average 22), respectively. From these values, it is estimated that the stratum is inorganic with the plasticity being typically in the intermediate to high range. The natural moisture contents range from 25 to 80 percent; these values correspond to liquidity indices between 0.5 and 1.4 (average 0.9).

The field and laboratory undrained shear strength results are plotted on the Record of Borelog sheets. The results of this testing indicates that the undrained shear strength of the stratum generally varies, in a linear fashion, from as low as 400 to 500 p.s.f. near the surface to as much as 1,700 p.s.f. with depth. At a few sites, notably Sites 4, 6 and 80, the undrained shear strength is somewhat higher in the upper portion of the deposit, having a minimum shear strength of 700 p.s.f. Based on these values, it is estimated that the consistency of the stratum, over the majority of the area under consideration, is soft, increasing with depth, to stiff. At Sites 4, 6 and 80, however, the consistency ranges from firm to stiff.

The consolidation characteristics of the stratum were determined by carrying out a series of laboratory consolidation tests, the results of which are shown as Void Ratio vs. Pressure plots on Figures 7 to 13, inclusive. The results of this testing indicate that the clay is preconsolidated in excess of existing

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

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

overburden pressure by approximately 400 to 800 p.s.f. in the upper portion of the deposit, increasing to as much as 2,000 p.s.f. in the lower, more heavily consolidated portion. In the vicinity of the creek crossings, however, the preconsolidation is often between 1,200 to 1,600 p.s.f. in excess of existing overburden pressure, the overburden pressure being computed with respect to the creek valley floor. The relatively high values given for the initial void ratio (e_o) and the compression index (C_c), are within the normal range for such values obtained from laboratory consolidation testing on sensitive "Leda Clay".

4.4) Lower Deposits:

4.4.1) Sand and Silty Sand:

At a few sites (No. 1, 4, 79 and 80) the sensitive clay is underlain by a compact to very dense granular deposit, which varies in composition from a gravelly sand to silty sand. The thickness of the granular zone is generally about 4 to 6 feet; however, at Site 79 it extends for a depth of 14 feet. Grain-size distribution curves, for two typical samples obtained from the deposit, are shown on Figure #4.

4.4.2) Glacial Till:

The clay stratum and/or the aforementioned granular deposit, is underlain by a glacial till composed of a heterogeneous mixture of clay, silt, sand and gravel. Where penetrated, the thickness of this deposit was found to vary between 5 and 22 feet, being typically about 10 feet. The matrix of the till is generally cohesive - i.e., a clayey silt binding sand and gravel. There are, however, random zones within the deposit where the matrix is basically granular (silt, sand and gravel), such areas are non-cohesive in nature. The range in the grain-size gradation of this subsoil is indicated by the envelope shown on Figure #5.

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

4.4) Lower Deposits: (cont'd.) ...

4.4.2) Glacial Till: (cont'd.) ...

Atterberg limit tests, carried out on the more cohesive portions of the glacial till, are summarized on the Plasticity Chart shown on Figure #6. The results of this testing indicates that such areas are representative of an inorganic clayey silt of low plasticity. The natural water content of the stratum is consistently 3 to 4 percent less than the plastic limit.

Based on the results of the standard penetration resistance testing, carried out within this deposit, it is estimated that the consistency of the cohesive portions is in the very stiff to hard range. The relative density of the non-cohesive portions is considered to be dense to very dense.

4.5) Bedrock:

Bedrock was proven at the majority of the sites by obtaining between 5 and 15 feet of either AXT or BXL rock core. The surface of the bedrock was found to vary from elevation 233.5 (Site No. 2) to 65 (Site No. 3); the boring at Site No. 4, however, was terminated at elevation 42.5 without encountering bedrock. The maximum difference in bedrock elevation was observed to be between Sites 2 and 3, which are approximately 3-1/2 miles apart. In general, it appears the bedrock surface is dish-shaped across the area investigated, with the low points situated in the vicinity of Limoges (refer to Drawing 68-F-88A). An exception to the above pattern was noted at a point 1-1/2 miles south of Site No. 4, along the same township road. At this location a bedrock ridge is present (refer to Section 'A', Drawing 68-F-88B).

The bedrock, in the western portion of the alignment, is a shaley dolomitic limestone, while in the eastern portion, it is composed of a limestone with numerous shale interbeds, up to 4 inches in thickness, located throughout. In general, bedrock is sound throughout; however, some signs of fracturing and jointing were observed in the upper 2 to 5 feet at a few of the boring locations.

5. GROUNDWATER CONDITIONS:

Groundwater level observations have been carried out during the period of the investigation in: i) sealed piezometers installed in some of the boreholes, and ii) the open holes at the remaining boring locations. The observations are recorded on the borelog sheets and summarized on Drawings No. 68-F-88A and B. The results of the measurements indicate that the piezometric groundwater level, within the surficial deposit and underlying clay stratum, is between 2 and 12 feet below existing ground surface, being typically about 5 feet.

Piezometers installed in the glacial till indicated the piezometric groundwater level within this deposit is between 8 and 22 feet below existing ground surface, which represents a level some 3 to 17 feet below the level recorded in the overlying deposits. This would indicate that there is some downward drainage through the relatively impervious clay stratum into the underlying more pervious glacial till.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

Proposed Hwy. 417 (Line 'D'), will be a 4-lane highway incorporating a wide median. The discussion presented herein is applicable for that portion of the alignment of the proposed highway from Vars easterly to the South Nation River.

A number of structures are proposed at the crossing of Hwy. 417 and various County and Township roads, namely, at Sites No. 1, 2, 3, 4, 6 and 79. It is understood that these will be underpass structures. In addition, Hwy. 417 will cross creek valleys at three locations; these are designated as Site Nos. 5, 7 and 8. Further, a structure will be necessary where Hwy. 417 crosses the South Nation River (Site No. 80). At this stage the profile grades, as well as other pertinent design data for the various crossings, has not been finalized.

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

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

Preliminary recommendations pertaining to structure foundations, as well as stability and settlement of approach fills, will be given in the sub-sections to follow. For presentation purposes, the sites will be discussed in these groupings:

Sub-section	6.2)	Structure Site No. 1
"	6.3)	Structure Site No. 2
"	6.4)	Structure Sites No. 3, 4, 6 and 79.
"	6.5)	Creek Crossings - Sites No. 5, 7 and 8.
"	6.6)	South Nation River Crossing - Site 80.

In order to improve the foundation conditions along that portion of Line 'D', between Limoges and Benoit (Sites 4, 5, 6, 7 and 8), a re-alignment is being considered; this re-alignment will be to the south of proposed Hwy. 417, Line 'D'. A discussion on the feasibility of such a re-alignment, as far as foundation conditions are concerned, is given in Section 7. Also included in this section, are detailed foundation recommendations at three possible alternate crossings, designated as Site 4 South, 6 South and 8 South.

6.2) Structure Site No. 1:

Preliminary design information indicates that, in the vicinity of this crossing, the profile grades of Hwy. 417 and the County Road (to Vars) will be approximately at elevations 250 and 271, respectively, with the natural ground being at about elevation 248. This being the case, the maximum height of the approach fills will be 23 feet above existing ground surface.

Presently the Regional Functional Planning Section indicated that four possible alternate crossings are being considered, namely, County Rd. alignments 'A' to 'D', with 'A' being the most westerly and 'D' the most easterly. The locations of the alternate crossings are shown on Drawing 68-F-88C.

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

6.2) Structure Site No. 1: (cont'd.) ...

The borings (B.H.'s #1 and 2), put down before the aforementioned information was available, provide the subsoil conditions for alignments 'B' and 'C' only. At these locations between 17 and 19 feet of soft compressible clay was encountered at a shallow depth below ground surface. The presence of this deposit makes it necessary to take steps to ensure the overall stability of the approach embankments. It is believed that these conditions will prevail at alternate alignments 'A', 'B' and 'C'. The foundation recommendations, at these locations, are presented in tabular form as follows:

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FOUNDATION RECOMMENDATIONS - SITE No. 1

County Road Alignment	Approx. Exist. Ground Elev. (ft.)	RECOMMENDATIONS			Remarks
		STRUCTURE	EMBANKMENTS		
			Height of Approach Fill (Proposed)	Comments	
'A' 'B' 'C' (Note: Comments on 'D' follow this table.)	247 ±	Piers and Abutments: End-bearing piles driven to bedrock - designed for max. capacity of the pile section chosen.	23' (Slopes 2:1)	Stability: 1) Fills up to 16' (with 2:1 slopes) will be stable. 2) Fills in excess of 16' will require berms in all directions. - mid-height berm of 25' will be required for a fill of 23'. (F.S. ≥ 1.3). Probable Consolidation Settlement: 1) 16' fill (2:1 slopes) - 1-1/2' in 2 months. 2-1/2' in 1 year - (Max.) 2) 23' fill with a berm length of 25' at mid-height - 2' in 2 months. 3-1/2' in 1 year (Max.)	Settlements will take place in a short period of time. Consideration should, therefore be given to constructing the approach fills prior to construction of the structure foundations. As an alternate, the compressible clay could be sub-excavated in the immediate vicinity of the structure.

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

6.2) Structure Site No. 1: (cont'd.) ...

County Road alignment 'D' is located due east of the intersection. Based on available geological information, it is known that at some point in this immediate area, the underlying glacial till and bedrock begins to protrude near ground surface. It is considered, therefore, that there is a possibility that the thickness of the clay could be much less at alignment 'D' than at the other alternate alignments which are located to the west. In this regard, the Foundation Section will carry out a supplementary investigation at alignment 'D'.

6.3) Structure Site No. 2:

At this site the competent glacial till and bedrock extends to within a few feet of ground surface. No foundation problems are contemplated. Detailed recommendations are presented in tabular form as follows:

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FOUNDATION RECOMMENDATIONS - SITE No. 2

Approx. Exist. Ground Elev. (ft.)	RECOMMENDATIONS			Remarks
	STRUCTURE	EMBANKMENTS		
		Height of Approach Fill (Assumed)	Comments	
242 ±	**Piers:** Spread Footings within glacial till or to sound bedrock - allowable bearing pressure up to 5 t.s.f. and 20 t.s.f., respectively. **Abutments:** Spread Footings founded on granular pad within approach fills - allowable bearing pressure 2 t.s.f. - or, alternatively, end-bearing piles driven to bedrock - approx. tip elev. 233 - designed for max. capacity of the pile section chosen.	22' (Slope 2:1)	No stability problems for 2:1 slope, provided surficial organic matter sub-excavated as recommended in the "Remarks" column.	May require sub-excavation of up to 3' of surficial organic matter. Backfill with suitable granular material.

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

6.4) Structure Sites 3, 4, 6 and 79:

6.4.1) General Comments:

As discussed previously, the structures at the above sites will be of the underpass type. It is understood that the approach fills proposed will be of the order of 22 feet in height. The subsoil at the respective crossings have one thing in common - i.e., a deep deposit of clay (between 77 and 157 feet in thickness), located at a relatively shallow depth below ground surface.

The presence of the soft compressible clay requires that steps must be taken to: i) ensure overall stability of the approach embankments, and ii) to limit the consolidation settlement induced in the foundation subsoil, to tolerable limits. This, in fact, was the case at other sites, previously investigated where similar deposits exist. Two such sites, on which detailed reports have already been submitted, are the Hwy. 417 crossings at Anderson Road (67-F-112) and Seventh Line Road (67-F-113). At these sites (in the final design stage), it was deemed necessary to limit the fill heights to something considerably less than the heights originally proposed in order to keep the settlement within tolerable limits. Such measures, however, made it necessary to drastically increase the span length of the structure - i.e., the adoption of a multi-span structure. It is most probable that similar measures will be required at the majority of the sites discussed in this sub-section.

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

6.4) Structure Sites 3, 4, 6 and 79: (cont'd.) ...

6.4.2) Foundation Recommendations:

The thickness and strength-compressibility characteristics of the clay stratum vary from site to site (refer to the Borelog sheets in the Appendix). Therefore, the

i) overall stability of the embankments,

ii) the induced consolidation settlements in the foundation subsoil, and

iii) length of piling required to support the foundations, will also vary. Recommendations pertaining to foundation design at the various sites, are presented in tabular form as follows:

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FOUNDATION RECOMMENDATIONS

Site No. (Approx. Exist. Ground Elev.) (ft.)	Thickness of Clay Stratum (ft.)	RECOMMENDATIONS		Remarks
		STRUCTURE	EMBANKMENTS (Height of Fill Proposed = 22')	
3 (237 ±)	138'	Piers and Abutments: End-bearing piles driven to practical refusal within the glacial till or to bedrock. - designed for max. capacity of the pile section chosen at pier locations. (Note: Capacity of piles supporting abutments may have to be reduced in order to allow for negative skin frictional effects.)	Stability: 1) Fills up to 14' (with 2:1 slopes) will be stable. 2) Fills in excess of 14', will require berms in all directions. - mid-height berm of 40' will be required for a fill height of 22'. (F.S. ≧ 1.3) Probable Consolidation Settlement: 1) 14' fill (2:1 slopes) - 1-1/2' in 2 years. 3' in 25 years (Max.). 2) 22' fill with a berm length of 40' at mid-height - 2' in 2 years. 7-1/2' in 50 years (Max.).	Consideration should be given to constructing the approach fills prior to construction of the structure foundations in order to minimize the post-construction settlements.

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FOUNDATION RECOMMENDATIONS

Site No. Approx. Exist. Ground Elev.) (ft.)	Thickness of Clay Stratum (ft.)	R E C O M M E N D A T I O N S		Remarks
		STRUCTURE	EMBANKMENTS (Height of Fill Proposed = 22')	
4 (231 ±)	158'	Piers and Abutments: End-bearing piles driven to practical refusal within glacial till. - designed for max. capacity of the pile section chosen at pier locations. (Note: Capacity of piles supporting abutments may have to be reduced in order to allow for negative skin frictional effects.)	Stability: 1) Fills up to 17' (with 2:1 slopes) will be stable. 2) Fills in excess of 17', will require berms in all directions. - a mid-height berm of 30' will be required for a fill height of 22'. (F.S. ≧ 1.3) Probable Consolidation Settlement: 1) 17' fill (2:1 slopes) - 1-1/2' in 2 years. 2-1/2' in 25 years (Max.). 2) 22' fill with a berm length of 30' at mid-height - 2' in 2 years. 4' in 50 years (Max.).	Consideration should be given to constructing the approach fills prior to construction of the structure foundations in order to minimize the post-construction settlements.

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FOUNDATION RECOMMENDATIONS

Site No. (Approx. Exist. Ground Elev.) (ft.)	Thickness of Clay Stratum (ft.)	R E C O M M E N D A T I O N S		Remarks
		STRUCTURE	EMBANKMENTS (Height of Fill Proposed = 22')	
6 (225 ±)	95'	Piers and Abutments: End-bearing piles driven to practical refusal within glacial till or to bedrock. - estimated tip elev. 105. - designed for max. capacity of the pile section chosen at pier locations. (Note: Capacity of piles supporting abutments may have to be reduced in order to allow for negative skin frictional effects.)	Stability: 1) Fills up to 18' (with 2:1 slopes) will be stable. 2) Fills in excess of 18', will require berms in all directions. - a mid-height berm of 30' will be required for a fill height of 22'. (F.S. $\geq$ 1.3) Probable Consolidation Settlement: 1) 18' fill (2:1 slopes) - 1-1/2' in 2 years. 3' in 50 years (Max.). 2) 22' fill with a berm length of 30' at mid-height - 2' in 2 years. 5' in 50 years (Max.).	Consideration should be given to constructing the approach fills prior to construction of the structure foundations in order to minimize the post-construction settlements.

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FOUNDATION RECOMMENDATIONS

Site No. Approx. Exist. Ground Elev.) (ft.)	Thickness of Clay Stratum (ft.)	RECOMMENDATIONS		Remarks
		STRUCTURE	EMBANKMENTS (Height of Fill Proposed = 22')	
79 (216 ±)	77'	Piers and Abutments: End-bearing piles driven to practical refusal within glacial till - - estimated tip elev. 110. - designed for max. capacity of the pile section chosen at pier locations. (Note: Capacity of piles supporting abutments may have to be reduced in order to allow for negative skin frictional effects.)	Stability: 1) Fills up to 13' (with 2:1 slopes) will be stable. 2) Fills in excess of 13', will require berms in all directions. - a mid-height berm of 45' will be required for a fill height of 22'. (F.S. $\geq$ 1.3) Probable Consolidation Settlement: 1) 13' fill (2:1 slopes) - 1' in 2 years. 2-1/2' in 30 years (Max.). 2) 22' fill with a berm length of 45' at mid-height - 2' in 2 years. 6' in 30 years (Max.).	Consideration should be given to constructing the approach fills prior to construction of the structure foundations in order to minimize the post-construction settlements.

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

6.4) Structure Sites 3, 4, 6 and 79: (cont'd.) ...

6.4.2) Foundation Recommendations: (cont'd.) ...

If the fill heights are limited in order to control the consolidation settlement (Case (1) in the table), and if stage construction is adopted, as recommended in the "Remarks" column, it may be beneficial to place a surcharge fill on the embankments. A surcharge fill would accelerate the time-rate of settlement, and by so doing, reduce the post-construction maintenance requirements. Such a technique is being employed both at Anderson and Seventh Line Roads.

6.5) Creek Crossings - Sites 5, 7 and 8:

The proposed alignment of Hwy. 417 will cross creek valleys at the above sites. Earth embankments will be constructed over the creek valleys, with culverts being constructed in the valley floor, underneath the embankments.

These sites are underlain by the soft compressible clay stratum. The feasibility of employing earth fills will, therefore, be dependent on the following co-related factors:

i) the depth of the valley - i.e., the height of fill required;

ii) the strength-compressibility characteristics of the clay.

Both of the aforementioned will determine the overall stability of the fill sections as well as the magnitude of the consolidation settlement induced in the foundation subsoil.

Stability and settlement analyses were carried out, based on the contemplated height of fill at the various crossings; these are presented in the following table:

..... 22

RECOMMENDATIONS - CREEK VALLEY CROSSINGS

Site No. (Approx. Elev. Valley Floor)	--- E M B A N K M E N T ---			Remarks
	Height of Fill (2:1 Slopes) (ft.)	Stability (Length of Mid-height Berm Required)	Consolidation Settlement (Max. under Centre-Line)	
5 (213 ±)	10'	10'	1/2' in 15 years (Max.)	Require sub-excavation of up to 6' of surficial organic matter. Backfill with suitable granular material.
	15'	25'	1' in 2 years 3-1/2' in 30 years (Max.)	
* 8 (173 ±)	25'	5'	1/2' in 5 years (Max.)	Same as above.
	30'	15'	1' in 18 months 1-1/2' in 10 years (Max.)	
	35'	20'	1-1/2' in 1 year 3' in 10 years (Max.)	

*Note: Gully Site No. 7 located immediately to the west of Site No. 8 -- Similar

cont'd. 23

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

6.5) Creek Crossings - Sites 5, 7 and 8: (cont'd.) ...

At this stage the type of culvert contemplated is not known. The preceding table will enable the designer to choose the appropriate type of culvert, taking into consideration the magnitude of the possible settlements. If a flexible type of culvert is proposed, sufficient camber should be provided to accommodate the anticipated differential settlements. Alternatively, if excessive settlements cannot be tolerated on Hwy. 417, the above mentioned crossings could be bridged by a multi-span structure. The structure foundations should be supported on end-bearing piles driven to bedrock; the pile tip elevations can be inferred from the Borelog sheets. The associated approach fills will be nominal in height and thus stability and settlement problems are not contemplated.

6.6) South Nation River Structure Crossing - Site 80:

The structure crossing of the South Nation River is at a point south of Casselman. The maximum height of fill will be along the west approach to the structure; this fill will be of the order of 15 feet. The banks of the river and approaches are underlain, at a shallow depth, by up to 50 feet of compressible clay.

Preliminary recommendations pertaining to the structure foundations are presented in the following table:

..... 24

FOUNDATION RECOMMENDATIONS - SITE No. 80

Approx. Exist. Ground Elev. (ft.)	RECOMMENDATIONS			Remarks
	STRUCTURE	EMBANKMENTS		
		Height of Approach Fill (Assumed)	Comments	
198 ± to 208 ±	Piers and Abutments: End-bearing piles driven to bedrock - approx. tip elev. - 144 to 150. - designed for max. capacity of the pile section chosen.	15' (Slopes 2:1)	No stability problems for standard 2:1 slopes, provided organic deposit on west bank of river treated as discussed in "Remarks" column. Probable Consolidation Settlement: 1/2' in 1 year. 1' in 5 years (Max.)	The organic material on the west approach should be sub-excavated and backfilled with suitable granular material. (Note: The limits and engineering properties of this deposit to be fully delineated during final investigation phase.)

cont'd. 25

7. RE-ALIGNMENT OF HWY. 417 (LINE 'D') - LIMOGES TO BENOIT:

7.1) General:

During the course of this preliminary investigation, it was discovered that the thickness of the soft clay stratum generally decreases in a southerly direction. A reduction in thickness of the clay stratum is generally associated with improved foundation performance since, for a deposit of similar strength-compressibility characteristics, the

i) induced settlement is reduced (embankment loading); and

ii) the pile lengths required are less. This being the case, a southerly re-alignment is being considered in the region where the clay is most extensive, namely, between Limoges and Benoit (Sites 4, 5, 6, 7 and 8).

A reconnaissance of the area pointed out that:

a) bedrock outcrops at a point some 1-1/2 miles south of Site 4, a site at which 157 feet of clay was encountered.

b) the creek valleys encountered along Line 'D' of Hwy. 417 (Sites 5, 7 and 8) decrease in overall depth in a southerly direction.

Both of the aforementioned seem to infer that, as far as foundation conditions are concerned, such a revision may be both practical as well as economical.

Because of property and other related considerations, it would not be feasible to shift Line 'D' far enough in a southerly direction to intersect the bedrock outcrop. Based on this fact, a preliminary investigation was carried out at three sites located along a possible intermediate re-alignment of Hwy. 417; these are designated as Sites 4 South, 6 South, and 8 South. Typical stratigraphic cross-sections are presented on Drawing 68-F-88B.

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7. RE-ALIGNMENT OF HWY. 417 (LINE 'D') - LIMOGES TO BENOIT:
(cont'd.) ...

7.2) Foundation Recommendations:

Sites 4 South, 6 South and 8 South are all underlain by the soft compressible clay stratum. At the former two sites, the thickness of the clay, however, is considerably less than at the location of their more northerly counterparts; for instance, at Sites 4 and 4 South, the deposit is 158 and 90 feet thick, respectively. At Site 8 South (creek crossing) there does not seem to be an appreciable change.

Preliminary foundation recommendations are presented in the tables to follow:

..... 27

FOUNDATION RECOMMENDATIONS

ite No. pprox. xist. round lev.) (ft.)	Thickness of Clay Stratum (ft.)	R E C O M M E N D A T I O N S		Remarks
		STRUCTURE	EMBANKMENTS (Height of Fill Proposed = 22')	
South 231 ±)	90'	Piers and Abutments: End-bearing piles driven to bedrock. - estimated tip elev. 118. - designed for max. capacity of the pile section chosen at pier locations. (Note: Capacity of piles supporting abutments may have to be reduced in order to allow for negative skin frictional effects.)	Stability: 1) Fills up to 14' (with 2:1 slopes) will be stable. 2) Fills in excess of 14', will require berms in all directions. - mid-height berm of 65' will be required for a fill height of 22'. (F.S. ≧ 1.3) Probable Consolidation Settlement: 1) 14' fill (2:1 slopes) - 1-1/2' in 2 years. 4-1/2' in 40 years (Max.). 2) 22' fill with a berm length of 65' at mid-height - 2-1/2' in 2 years. 9' in 40 years (Max.)	Consideration should be given to constructing the approach fills prior to construction of the structure foundations in order to minimize the post-construction settlements.

cont'd. 28

FOUNDATION RECOMMENDATIONS

ite No. pprox. xist. round lev.) (ft.)	Thickness of Clay Stratum (ft.)	R E C O M M E N D A T I O N S		Remarks
		STRUCTURE	EMBANKMENTS (Height of Fill Proposed = 22')	
6 South 220 ±)	77'	Piers and Abutments: End-bearing piles driven to practical refusal within glacial till - - estimated tip elev. 115. - designed for max. capacity of the pile section chosen at pier locations. (Note: Capacity of piles supporting abutments may have to be reduced in order to allow for negative skin frictional effects.)	Stability: 1) Fills up to 15' (with 2:1 slopes) will be stable. 2) Fills in excess of 15' will require berms in all directions. - a mid-height berm of 40' will be required for a fill height of 22'. (F.S. $\geq$ 1.3) Probable Consolidation Settlement: 1) 14' fill (2:1 slopes) - 1-1/2' in 2 years. 4' in 30 years (Max.) 2) 22' fill with a berm length of 40' at mid-height - 2-1/2' in 2 years. 7' in 30 years (Max.)	Consideration should be given to constructing the approach fills prior to construction of the structure foundations in order to minimize the post-construction settlements.

cont'd. 29

RECOMMENDATIONS - CREEK VALLEY CROSSINGS

Site No. (Approx. Elev. Valley Floor)	--- E M B A N K M E N T ---			Remarks
	Height of Fill (2:1 Slopes) (ft.)	Stability (Length of Mid-height Berm Required)	Consolidation Settlement (Max. under Centre-Line)	
8 South (190 ±)	20'	5'	1/2' in 5 years (Max.)	Require sub-excavation of up to 5 feet of surficial organic matter. Backfill with suitable granular material.
	25'	15'	3/4' in 2 years. 1-1/2' in 15 years (Max.)	

cont'd. 30

7. RE-ALIGNMENT OF HWY. 417 (LINE 'D') - LIMOGES TO BENOIT:
(cont'd.) ...

7.2) Foundation Recommendations: (cont'd.) ...

It is interesting to note that at Sites 4 South and 6 South, the consistency of the upper portion of the cohesive stratum, is softer than at the respective northerly sites along the existing alignment. As indicated in the tables, this would make it necessary to limit the fills at these alternate sites to even a lower level in order to control the settlement and improve the stability. The pile lengths required to support the foundation elements would, however, be considerably less; for example, the estimated pile lengths required at intermediate pier locations, would be approximately 185 feet at Site 4 compared to 108 feet at Site 4 South.

The embankment fill height required at Site 8 South will be considerably less than that at Site 8, because of the reduction in the depth of the valley. This would be beneficial because: i) the overall stability of the fill section would be improved, and ii) the settlements induced in the underlying subsoil would be considerably reduced.

It can be stated that the final decision on whether or not a re-alignment, of the section specified, is warranted will also be dependent on other factors, such as property considerations, etc.

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

..... 31

8. MISCELLANEOUS:

The field work for this project was carried out during the periods of December 10 to 20, 1968, and January 2 to February 5, 1969, under the supervision of Messrs. W. Hutton, Project Foundation Engineer, and B. T. Darch, Senior Foundation Engineer.

This report was written by Mr. Darch and reviewed by Mr. M. Devata, Supervising Foundation Engineer.

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

April 1969.

APPENDIX I

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

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1 - SITE 1

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY WH
W.P. 35-66-01 BORING DATE Dec. 10, 11, 12 & 13, 1968 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring - NX, BX Casing - AXT Rock Core CHECKED BY

ELEV. / DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT
247 ±	Ground Level				
245.0	Clayey silt (Topsoil)		1	SS	12
2.0	Desiccated Crust (Mottled Brown)		2	SS	7
241.0	Stiff				
6.0	Clay to silty clay, trace of sand. (Grey)		3	SS	1
			4	TW	PM
			5	TW	PM
	Soft to firm		6	TW	PM
228.0					
19.0	Gravelly sand, trace of silt. (Grey)		7	SS	47
223.0	Dense.				
24.0	Clayey silt with sand & gravel (Glacila Till) (Grey)	T	8	SS	78
215.5	Hard	T	9&10	SS	100/6"
31.5			11	AXT	2.5" Rec
210.5	Fractured				
36.5	Shaley dolomitic Limestone Bedrock (Grey)		12	AXT	50%
			13	AXT	50%
			14	AXT	93%
200.5	Sound				
46.5	End of Borehole				

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

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
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.
2 c's
93

REMARKS
GR. SA. SI. CL.
3 20 44 33
WL ▽ 243.1 Jan. 21/69
22 42 30 6
Piez. Tip El. 212.

20
1/2 ✧ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2 - SITE 1

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY WH
W.P. 35-66-01 BORING DATE Jan. 21 & 22, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring - NX, BX Casing CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT
247 ±	Ground Level				
245.5	Sandy Silt (Topsoil)				
1.5	Desiccated Crust				
242.5	Stiff		1	SS	6
4.5	Clay to silty clay,		2	TW	PM
	trace of sand,				
	(occ. partings of silt & sand throughout)		3	TP	PM
	(Grey with red-brown laminations)		4	TP	PM
230.0	Soft to firm.		5	TP	PM
17.0	Clayey silt with sand & gravel (Glacial Till)		6	SS	35
			7	SS	28
	(occasional zones where the matrix is a silty sand binding gravel)		8	SS	56
	(Grey)				
216.5	Very stiff to hard.		9	SS	60/5"
30.5	End of Borehole				

ELEV SCALE: 240, 230, 220, 210

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

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

+s4 +s4 +s8

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
w_p w w_L
WATER CONTENT %

C

BULK DENSITY γ P.C.F.
99

REMARKS GR. SA. SI. CL.

W.L. in open BH. ▼ 239.

0 1 33 66

30 44 25 1

20
15 ⊹ 5 % STRAIN AT FAILURE
10

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

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE FOR SITE 2

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY WH
W.P. 35-66-01 BORING DATE Dec. 16, 17 & 18, 1968 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Drive BX Casing & Wash CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w WATER CONTENT % 20 40 60	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					GR. SA. SI. CL.
242.+	Ground Level									
240.0	Organic silt with some sand. Grey-brown. Loose		1	SS	6	240				
2.0	Net. mix. of clay, silt, sand & gravel (Glacial Till) (Brown)		2	SS	-			○		50 27 19 4
233.5	Hard or very dense.		3	SS	93/7"			○ ⊢		24 36 30 10
8.5	Shaley dolomitic Limestone Bedrock (Grey)		4	AXT	100%	230				
			5	AXT	47%					
221.0	Sound		6	AXT	100%	220				
21.0	End of Borehole									

20
15 ⊹ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE FOR SITE 3

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY WH
W.P. 35-66-01 BORING DATE Dec. 10 to 20/68 and Jan. 2 to 6, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring - NX, BX, AX Casing - AXT Rock Core CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT; 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 + Ground Level										
0.0	Silty fine sand to sandy silt, trace of clay (Brown to grey at el. 232) Compact		1	SS	11					0 ▼ 236.7 75 (25) Stand pipe tip.el.232. 0 11 81 5
			2	SS	16					
			3	SS	18					
225.0			4	SS	13					
12.0	Clay to silty clay with a trace of sand Sensitive (occasional seams of silt and sand up to 5" in thickness throughout) (grey with random reddish-brown laminations) Soft to very stiff		5	TW	PM					
			6	TW	PM	220	+s4 +s5		102	
			7	TW	PM		+s4			
			8	TW	PM	210	+s3		2 c's	0 6 81 13
			9	TW	PM		+s6 +s4			0 0 37 63
			10	TW	PM	200	×○ +s3 +s2		103	
			11	TW	PM		+s3 +s4			
			12	TW	PM	190	+s2 +s4			
			13	TW	PM	180	+s8 +s3 +s4		2 c's	
			14	TW	PM	170	+s2 +s6			
			15	TW	PM	160	×s3 +s6 +s6		107	
			16	TW	PM	150	+s7 +s4			
			17	TW	PM	140	+s3 +s4		105	0 0 32 68
			18	TW	PM	130	+s6 +s5		2 c's	
			19	TW	PM	120	s35 ×○		100	
			20	TW	PM	110				
87.0						100				
150.0	Clayey silt with sand & gravel (Glacial Till) (Occasional zones where the matrix is silt & sand binding gravel sizes) (Grey) Hard		21	SS	64	90				6 20 69 5
			22	SS	72					27 35 29 9
			23	SS	150	80				
			24	SS	220					
65.5						70				
171.5	Shaley dolomite bedrock with dolomitic shale interbeds (Grey) Sound		25	AXT	95%					
58.0			26	AXT	90%	60				
179.0										

20
1-◇-5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE FOR SITE 4

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy.417 (Line D) Refer to Drawing 68-F-88-4 ORIGINATED BY WH
W.P. 35-66-01 BORING DATE Dec.17 to 20, 1968 - Jan. 2 to 6, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring _ HX, BX Casing CHECKED BY

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
231.0	Ground Level					
0.0	Silty fine sand, trace of clay and gravel.		1	SS	18	230
			2	SS	30	
	(Brown to grey at elev. 224.)		3	SS	53	220
			4	SS	35	
			5	SS	39	
	Compact to dense.		6	SS	35	
			7	SS	13	210
204.0			8	SS	24	
27.0			9	SS	I	
	Clay to silty clay, trace of sand.		10	TW	PM	200
			11	TW	PM	
	Sensitive		12	TW	PM	190
	(seams and layers of sand & silt up to 4" thick randomly spaced throughout the stratum)		13	TW	PM	
			14	TW	PM	180
			15	TW	PM	
			16	TW	PM	170
	(Grey with random reddish-brown laminations)		17	TW	PM	160
	Firm to stiff		18	TW	PM	150
						140
			19	TW	PM	
						130
			20	TW	PM	120
			21	TW	PM	110
						100
			22	TW	PM	90
						80
			23	TW	PM	
						70
			24	TW	PM	60
			25	SS	9	50
46.0						
185.0	Sand & gravel with a trace of silt. (Grey) Dense		26	SS	45	
42.5			27	SS	46	
188.5	End of Borehole					40

DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT

SHEAR STRENGTH PSF
O 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
▽ 226				
C 76 (24)				
5 64 (31)				
Stand pipe tip el.219				
1 81 (18)				
▽ 202.5				
C 118 116	0	1	79	20
Piez.#2 tip el. 181.0				
Note: WL taken on Jan.15/69				
C 119 107				
C 107 104				
Piez.#1 Tip.elev. 46.0				

$\frac{1}{2}(\sigma_1 - \sigma_3)$ % STRAIN AT FAILURE

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE For Site 4 South FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY WH
W.P. 35-66 BORING DATE Jan. 17, 20 & 21, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring _ NX, BX Casing - BXL-Rock Core CHECKED BY

ELEV / DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE
231.0	Ground Level					230
0.0	Silty fine sand to sandy silt, trace of clay (randomly stratified) (brown to grey at elev. 224.)		1	SS	20	
			2	SS	30	
			3	SS	13	220
217.0	Compact		4	SS	19	
14.0	Clay to silty clay, trace of sand		5	ss	1	
	sensitive		6	TP	PM	210
			7	TW	PM	
	(seams of silt up to 2" thick randomly located throughout)		8	TW	PM	200
			9	TW	PM	
	(Grey with reddish-brown laminations)		10	TW	PM	190
			11	TW	PM	
	Soft to stiff		12	TW	PM	180
			13	TW	PM	160
			14	TW	PM	140
127.0						
104.0	Het. mix. of clay, silt, sand & gravel (Glacial Till) (Grey)		15	SS	36	120
118.2	Hard or dense.					
112.8	Dolomitic shale to shaly dolomite bedrock Grey		16	BXL	50%	
111.9	Fractured to sound at elev. 114.		17	BXL	100%	110
119.1	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
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.
	▼ 221. WL in open BH
2C'S	0 1 33 66
106.5	
118	
C 102	0 0 30 70

20
15 ÷ 5 % STRAIN AT FAILURE
10

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

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1 Site 5

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy.417 (line D) Refer to Drawing 68-F-88A ORIGINATED BY WH
W.P. 35-66 BORING DATE Jan. 20 and 21, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring - NX Casing CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
222.5	Ground Level						
0.0	Silty fine sand to sandy silt. (Brown)						
217.0	Compact		1	SS	19		0 85 (15)
5.0	Desiccated Crust (Mottled Brown) Stiff		2	TW	PM		
			3	OS	PM	106	214.2 0 1 49 50
	Clay to silty clay, trace of sand.		4	TP	PM		W.L. in open BH
			5	OS	PM		
	Sensitive		6	TP	PM	C 106	0 0 39 61
	(seams of silt & sand up to 4" thick below about elev. 182)		7	TP	PM		
			8	OS	PM		
	(Grey with reddish-brown laminations)		9	TP	PM	110	
			10	OS	PM		
			11	OS	PM	2 C'S 108	0 1 54 45
	Firm to Stiff						
			12	TP	PM		
			13	TP	PM		
119.0	Clayey silt with sand & gravel (Glacial Till) (Grey) Hard						
117.5		T.P.	14	SS	65		
104.5	End of Bore Hole						

ELEV. SCALE: 220, 210, 200, 190, 180, 170, 160, 150, 140, 130, 120

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
o 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

20 15 10 5 % STRAIN AT FAILURE

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

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2 Site 5

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY WH
W.P. 35-66-03 BORING DATE Jan. 9, 10, 13, 14, 15, 16 & 20, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring _ NX, BX Casing - BXL Rock Core CHECKED BY AC

ELEV. / DEPTH	SOIL PROFILE: DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	TYPE	BLOWS/FOOT
213.+	Ground Level				
0.0	Organic silt with some sand (creek bed deposit) (Dark Brown)		1	SS	2
207.0	Loose.		2	SS	2
6.0	Clay to silty clay, Trace of sand		3	TP	PM
			4	TP	PM
			5	TP	PM
	Sensitive		6	TP	PM
	(seams of silt & sand		7	TP	PM
	up to 3" thick		8	TP	PM
	located randomly		9	TP	PM
	throughout)		10	TP	PM
	(Grey, occasional random reddish-brown laminations)		11	TP	PM
			12	TP	PM
	Soft to stiff		13	TP	PM
			14	TP	PM
			15	TP	PM
			16	TP	PM
125.0					
88	Het. mix. of clay, silt, sand & gravel (Glacial Till) (boulders up to 5" in size below elev. 115)		17	SS	18
111.3	Very stiff to hard or Compact to dense (Grey)		18	BXL	50%
101.7	Limestone Bedrock with numerous irreg. shale seams up to 3" in thickness		19	BXL	90%
105.5	(grey) sound		20	BXL	100%
107.5	End of Borehole				

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
SHEAR STRENGTH P.S.F.
○ UNCONFINED · + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

ELEV. SCALE: 210, 200, 190, 180, 170, 160, 150, 140, 130, 120, 110

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.

ELEV.	BULK DENSITY γ P.C.F.
200	100.5
190	102
170	C 107
150	107
130	106

REMARKS

210.7
208.7
Org. 1-4 %
Piez. #2 Tip. elev 193

Note: Water level readings taken on Jan. 22/69

Piez. #1 Tip Elev. 123

GR SA SI CL
0 1 48 51

FORM OB-MT-126 (REV 1969)

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE For Site 6

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY BTD
W.P. 35-66-03 BORING DATE Jan. 6 to 10 and 13 and 14, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX Casing - BXL Rock Core CHECKED BY

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE
225 ±	Ground Level					
0.0	Silty fine sand (occasional stratified zones)		1	SS	16	220
	(Brown to grey at elev. 220.)					
			2	SS	15	
211.0	Compact					
14.0	Clay to silty clay, with a trace of sand		3	TP	PM	210
			4	TP	PM	
	Sensitive		5	TP	PM	200
	(occasional partings of silt and sand throughout)		6	TP	PM	
			7	TP	PM	190
	(Grey with random reddish-brown laminations)		8	TP	PM	
			9	TP	PM	180
			10	TP	PM	
	Firm to stiff		11	TP	PM	170
			12	TP	PM	160
			13	TP	PM	150
			14	TP	PM	140
			15	TW	PM	130
115.9						120
109.1	Het.mix.of clay, silt, sand & gravel (Glacial Till) (random boulders up to 8" in size below el. 108.) (Grey) Very stiff to hard or compact to very dense		16	SS	21	110
			17	BXL	25%	
100.9						100
124.1	Limestone bedrock with numerous irreg.shaley seams (grey) Frac.to sound at el.97		18	BXL	52%	
94.9			19	BXL	100%	
130.1	End of Borehole					90

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
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.

BULK DENSITY γ P.C.F.	REMARKS
109.5	
113	
C 114.5	
109	
C 104	

REMARKS	GR	SA.	SI	CL
220.1 83 (136) 217				
0	2	50	48	

Piez.#2 Tip el. 205

Note: WL reading taken Jan.23/69

	GR	SA.	SI	CL
	22	42	31	5

Piez.#1 Tip.el.110

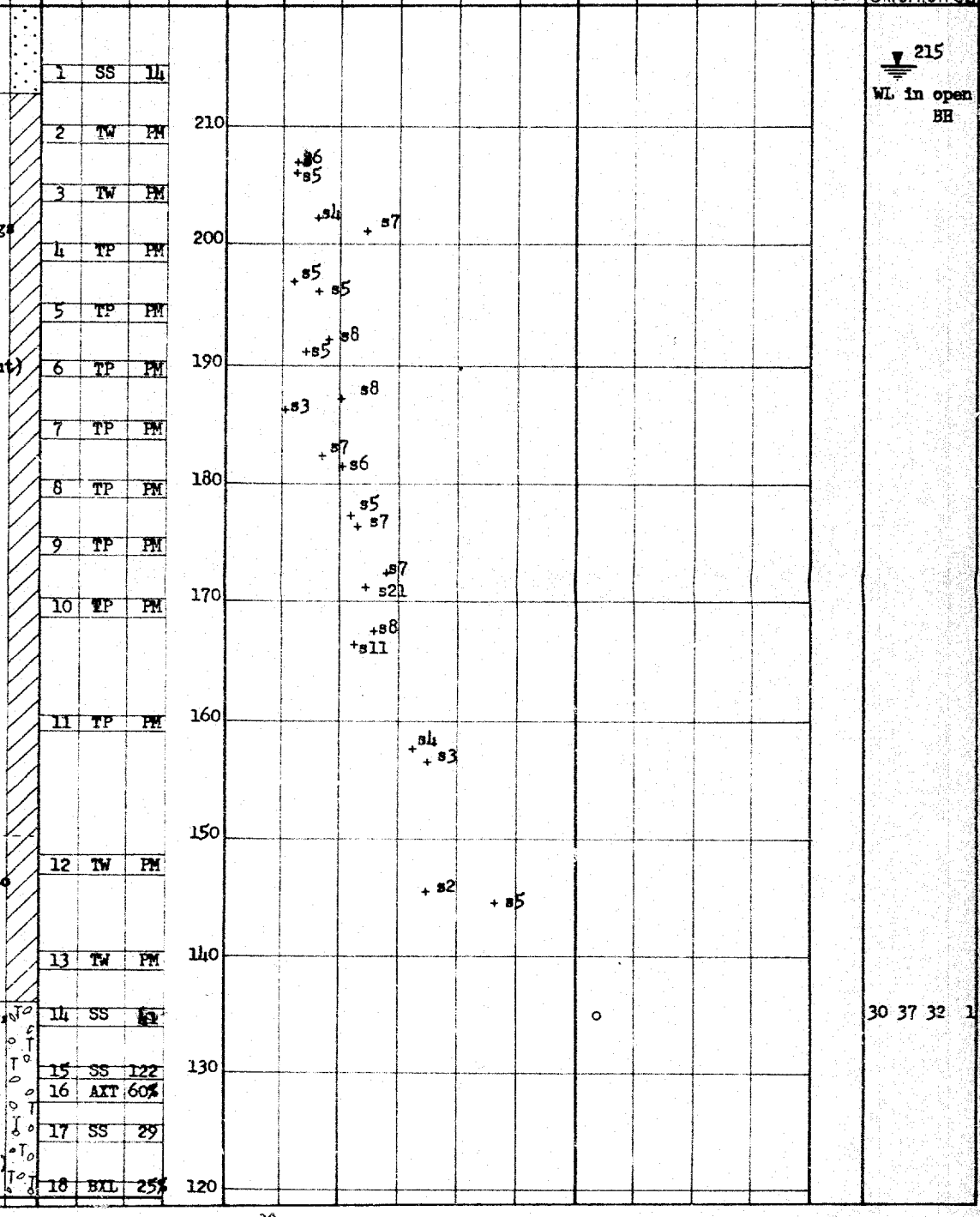
20
1/2 ⟡ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1 - Site 6 South FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY BTD
W.P. 35-66-03 BORING DATE Jan. 28 to 31 and Feb. 3 & 4, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX Casing - BXL Rock Core CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT
220.±	Ground Level				
0.0	Silty fine sand (slightly stratified) (brown)				
212.5	Compact		1	SS	14
7.5	Clay to silty clay, trace of sand		2	TW	PM
	sensitive		3	TW	PM
	(silt and sand partings throughout)		4	TP	PM
	(grey with random reddish-brown laminations throughout)		5	TP	PM
			6	TP	PM
	Soft to stiff		7	TP	PM
			8	TP	PM
			9	TP	PM
			10	TP	PM
			11	TP	PM
	(Numerous silt seams and layers up to 4" to 5" in thickness)		12	TW	PM
			13	TW	PM
135.5					
84.5	Het.mix. of clay, silt, sand & gravel (Glacial Till) (Grey)		14	SS	50
			15	SS	122
	Very stiff to hard or dense to very dense		16	AXT	60%
			17	SS	89
	(Boulders up to 8" in size below elev. 129.)		18	BXL	25%
119.0	End of Borehole				



20
15 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2-Site 6 South FOUNDATION SECTION

JOB 68-F-88 | LOCATION Hwy. 417 (Line D) 15' North of BH #1 | ORIGINATED BY WH
W.P. 35-66-03 | BORING DATE Feb. 5, 1969 | COMPILED BY VK
DATUM Geodetic | BOREHOLE TYPE Washboring - NX Casing | CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV SCALE
220.+	Ground Level					
0.0	Silty fine sand (slightly stratified) (Brown)					
212.5	Compact					
7.5	Clay to silty clay, trace of sand sensitive (silt and sand partings throughout) (Grey with random reddish-brown laminations throughout)		1	OS	PM	210
			2	TP	PM	200
			3	TP	PM	190
	Soft to firm.		4	TP	PM	
			5	TP	PM	180
176.0						
44.0	End of Borehole					170

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
SHEAR STRENGTH P.S.F.
o 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.
C	
105	Org.Cont. 0.7%

20
15 ⊹ 5 % STRAIN AT FAILURE
10

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

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1 - Site 8

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy.417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY WH
W.P. 35-66-03 BORING DATE Jan. 23, 24 and 27, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring - NX, BX Casing - BXL-Rock Core CHECKED BY

ELEV. DEPTH 218.±	DESCRIPTION (Ground Level)	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT
0.0	Sandy silt to silty fine sand (faintly stratified) (Brown)		1	SS	21
			2	SS	12
209.0	Compact				
9.0	Clay to silty clay, trace of sand		3	SS	1
			4	TW	PM
			5	TW	PM
	Sensitive				
			6	TW	PM
	(occasional partings of silt up to 2" thick throughout the deposit)				
			7	TW	PM
	(Grey with reddish-brown laminations)				
			8	TW	PM
	Soft to stiff		9	TW	PM
			10	TW	PM
141.2					
76.8	Het.mix. of clay, silt, sand and gravel (Glacial Till) Grey Hard or dense (boulders up to 5" in size below elev.136.)		11	SS	43
			12	SS	47
130.0			13	BXL	65%
88.0					
127.7			14	BXL	100%
90.3	End of Borehole				
	Limestone Bedrock with occ. irreg. shaly seams up to 3" thick (Grey) Sound				

ELEV. SCALE: 210, 200, 190, 180, 170, 160, 150, 140, 130, 120

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

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

s6, s8, s11, s5, s8, s11, s7, s9, s9, s6, s6, s13, s15, s4

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

112.8

BULK DENSITY γ P.C.F.

C 95
109
106

REMARKS GR. SA. SI. CL.

0 37 62 1
▼213.
0 30 69 1
WL in open BH
0 0 50 50
39 39 20 2

20
15 ⊹ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2-Site 8

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88 ORIGINATED BY WH
W.P. 35-66-03 BORING DATE Jan. 23, 24 and 27, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring - NX, BX, AX Casing-AXT,BXL Rock Core CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
0.0 / 169.0	Organic silt, trace of clay, (Grey-Brown) Loose		1	SS	2	170
4.0	Clay to silty clay, trace of sand Sensitive (occasional seams of silt and sand up to 2" thick throughout)		2	TW	PM	
			3	TW	PM	
			4	TW	PM	160
			5	TW	PM	
			6	TW	PM	
	(grey with random reddish-brown laminations)					150
			7	TW	PM	
137.0	Firm to stiff					140
36.0	(reworked zone)		8	SS	13	
	Het.mix.of clay,silt, sand & gravel (Gla.Till) (occ.boulders up to 6" in size below el.131) Grey. Hard or Dense.					130
128.0 / 45.0	Limestone Bedrock numerous irreg. shale seams. (Grey) Fractured.		9	BXL	36%	
123.3			10	AXT	no rec	120
49.7	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
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.
	WL in open BH ▽168.5
C 103	0 0 35 65
2CS 97	0 0 26 74
	44 44 (12)

20
15 ⊕ 5 % STRAIN AT FAILURE
10

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

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No.1-Site 8 South FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY WH
W.P. 35-66-03 BORING DATE Jan. 29, 30 and 31, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring - NX, BX Casing - BXL Rock Core CHECKED BY

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
216.+	Ground Level				
0.0	Silty fine sand to sandy silt. (Brown to grey at elev.211)		1	SS	11
208.0	Compact.		2	SS	23
8.0	Clay to silty clay, trace of sand.		3	TP	PM
			4	TP	PM
			5	TP	PM
	Sensitive				
	(occasional seams of silt and sand up to 3" thick throughout the stratum)		6	TP	PM
			7	TP	PM
			8	TP	PM
	(Grey with random reddish-brown laminations)		9	TP	PM
			10	TP	PM
			11	TP	PM
	Firm to stiff				
			12	TP	PM
135.0			13	TP	PM
131.0			14	SS	50/2"
82.0	Limestone Bedrock occasional irregular shaly seams up to 3" thick (Grey) fractured to sound at elev. 131.		14 15	BXL	80%
123.2			16	BXL	100%
			17	BXL	100%
92.8	End of Borehole				
	Het.mix.of clay,silt, sand & gravel (Glacial Till) Hard or Dense. (Grey)				

ELEV. SCALE: 210, 200, 190, 180, 170, 160, 150, 140, 130, 120

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

s8 s13 s8 s6 s11 s8 s12 s8 s14 s10 s6 s10 s17 s10 s24 s19 s11 s9

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.

204.
WL in open BH

20
15 5 % STRAIN AT FAILURE
10

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

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2-Site 8 South FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY WH
W.P. 35-66-03 BORING DATE Jan. 29, 30 and 31, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring - NX, BX Casing CHECKED BY

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
190.±	Ground Level				
0.0	Organic silt, some sand (Grey-brown)		1	SS	3
185.0	Loose				
5.0	Clay to silty clay, trace of sand sensitive (occasional seams and partings of silt up to 2" thick throughout) (Grey with random reddish-brown laminations)		2	TW	PM
			3	TP	PM
			4	TP	PM
			5	TP	PM
			6	TP	PM
			7	TP	PM
			8	TP	PM
			9	TP	PM
	Firm to stiff		10	TP	PM
145.5					
44.5	Het.mix. of clay, silt sand & gravel (Glacial Till) (Grey) Hard or dense to very dense.		11	SS	39
			12	SS	78
132.7			13	SS	116
			14	SS	100/2"
57.3	End of Borehole				

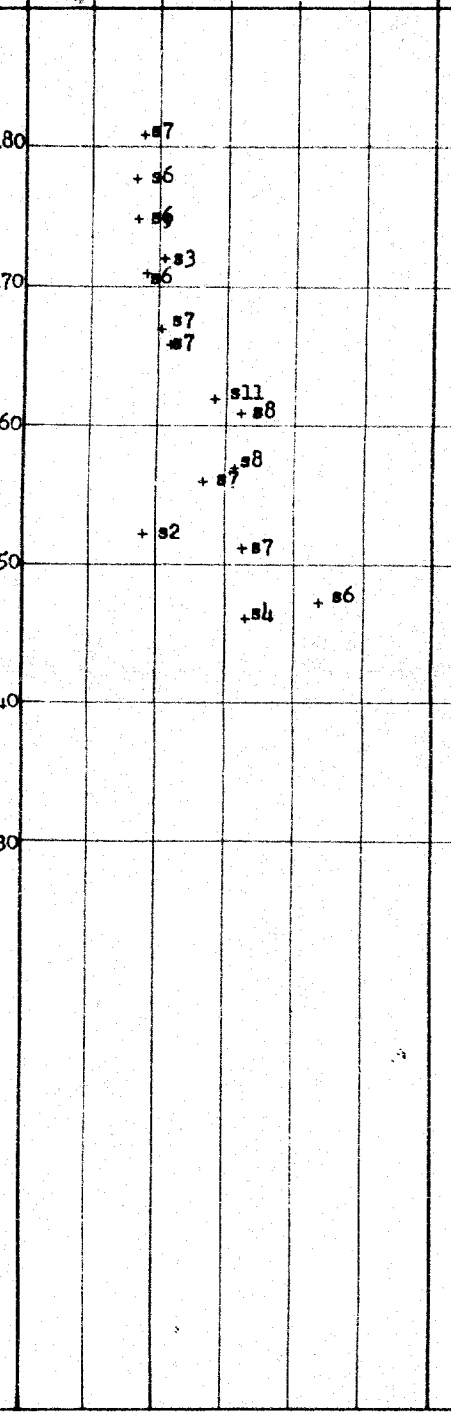
DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
400 800 1200 1600 2000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT %

BULK DENSITY γ P.C.F.

REMARKS GR.SA.SI.CL.

186. WL in open BH



20
15 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE Site 79

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) ORIGINATED BY SW
W P 35-66 BORING DATE Dec. 19, 1968 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Drive BX Casing & Wash CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
216.+	Ground Level				
0.0	Silty fine sand to sandy silt (faintly stratified) (brown to grey at el. 212.)		1	SS	13
			2	SS	20
			3	SS	12
204.0	Compact to dense.		4	SS	35
12.0	Clay to silty clay, trace of sand Sensitive (occasional seams of silt and sand up to 4" thick throughout)		5	SS	2
			6	TW	PM
			7	TW	PM
			8	TW	PM
			9	TW	PM
			10	TW	PM
	(Grey with random reddish-brown laminations)		11	TW	PM
			12	TW	PM
			13	TW	PM
	Soft to stiff		14	TW	PM
			15	TW	PM
			16	TW	PM
127.0					
89.0	Silty sand to sandy silt, some gravel (grey)		17	SS	45
			18	SS	68
113.0	Dense to very dense		19	SS	69
103.0	Het.mix of clay, silt, sand & gravel (glacial Till) (boulders up to 8" in size below el.114.) (grey)		20	AXT	20%
			21	BXL	Nil
102.0	Hard or very dense				
114.0	End of Borehole				

ELEV. SCALE: 210, 200, 190, 180, 170, 160, 150, 140, 130, 120, 110, 100

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

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.
99 100
99 101
102 100

REMARKS
1 58 (1
213.
204.2
Piez.#2 Tip.el. 180
Note: WL taken on Jan. 23
Piez.#1 Tip el.138.
0 29 67 4

20
15 → 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1-Site 80

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY BTD
W.P. 35-66-03 BORING DATE Jan. 13, 14 & 15, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring - NX Casing CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT
208.±	Ground Level				
	Clayey silt Topsoil				
1.0	Desiccated Crust (Mottled Brown Stiff		1	SS	22
			2	SS	14
			3	SS	7
	Clay to silty clay, trace of sand sensitive (occasional partings of silt & sand up to ¼" thick throughout) (Grey with reddish-brown laminations) Firm to stiff		4	TP	PM
			5	TP	PM
			6	TP	PM
			7	TP	PM
			8	TP	PM
			9	TP	PM
	Silt layers up to 5" thick		10	TW	PM
			11	SS	5
156.5			12	TW	PM
51.5	Silty sand, some gravel				
153.5	Grey. Dense.		13	SS	33
54.7	End of Borehole				

ELEV. SCALE: 200, 190, 180, 170, 160, 150

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

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.

2C'S
○ 95

196.
WL in open BH

REMARKS

GR. SA. SI. CL.
0 0 28 66
0 77 21 2

20
15 ⊹ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2 - Site 80 FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY BTD
W.P. 35-66-03 BORING DATE Jan. 7, 8, 9 and 10, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring _ NX,BX Casing - BXL Rock Core CHECKED BY

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT
198.±	Ground Level				
0.0	Claysy silt with some sand, trace of root fibre in upper 3' (mottled grey & brown)		1	SS	15
190.0	Very stiff to stiff		2	SS	7
8.0	Organic clay to organic silt, occ. root fibre and other related organic matter. (River bed deposits) (Grey brown)		3	TW	PM
180.0	Stiff to firm.		4	TW	PM
18.0	Sand & gravel. Grey.				
177.5	Compact		5	SS	5
20.5	Clay to silty clay with a trace of sand Sensitive (occasional seams and partings of silt and sand up to 2" thick throughout) (grey with occasional reddish-brown laminations)		6	TW	PM
			7	TW	PM
			8	TW	PM
			9	TW	PM
154.0	Firm to stiff				
44.0	Silty fine sand, occ. pockets of fine sand,		10	SS	16
150.0	occ. 2" thick throughout Grey. Compact.				
48.0	Wet mix of clay, silt, sand & gravel (Glacial Till)		11	SS	51
144.7	Grey. Hard & very dense				
53.3	Limestone Bedrock with occasional irregular shaly seams up to 4" in thickness. (Grey)		12	BXL	80%
			13	BXL	100%
			14	BXL	100%
136.3	Fractured to sound at elev. 143.				
61.7	End of Borehole				

ELEV SCALE: 190, 180, 170, 160, 150, 140, 130

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 800 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.
120
C 79
104
100

REMARKS
GR. SA. SI. CL.
191.5
Org. Content 17.3%
Piez.# Tip Elev. 178
WL. reading taken on Jan. 23/69
17 55 25 3

20
15 5 % STRAIN AT FAILURE
10

FORM OB-MT-426 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3-Site 80

FOUNDATION SECTION

JOB 68-F-88 LOCATION Hwy. 417 (Line D) Refer to Drawing 68-F-88A ORIGINATED BY SW

W.P. 35-66-03 BORING DATE Nov. 19, 1968 COMPILED BY SW

DATUM Geodetic BOREHOLE TYPE Washboring - NX Casing CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
210.+	Ground Level					
209.0	Roadway Fill					
1.0 / 205.0	Clayey silt Stiff (Brown)					
5.0	Silty clay to clay with a trace of sand (occasional silt seams from a fraction of an inch up to 3" in thickness)		1	TW	PM	200
	Sensitive (Grey with random reddish-brown laminations)		2	TW	PM	180
	Firm to stiff					170
162.0 / 48.0 / 157.0	Silty fine sand. (Grey) Dense		3	SS	42	160
53.0 / 150.5	Clayey silt with sand & gravel (Glacial Till) (Grey) Hard	T T				150
59.5	End of Borehole (Probably Bedrock)					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 1000 1500 2000 2500

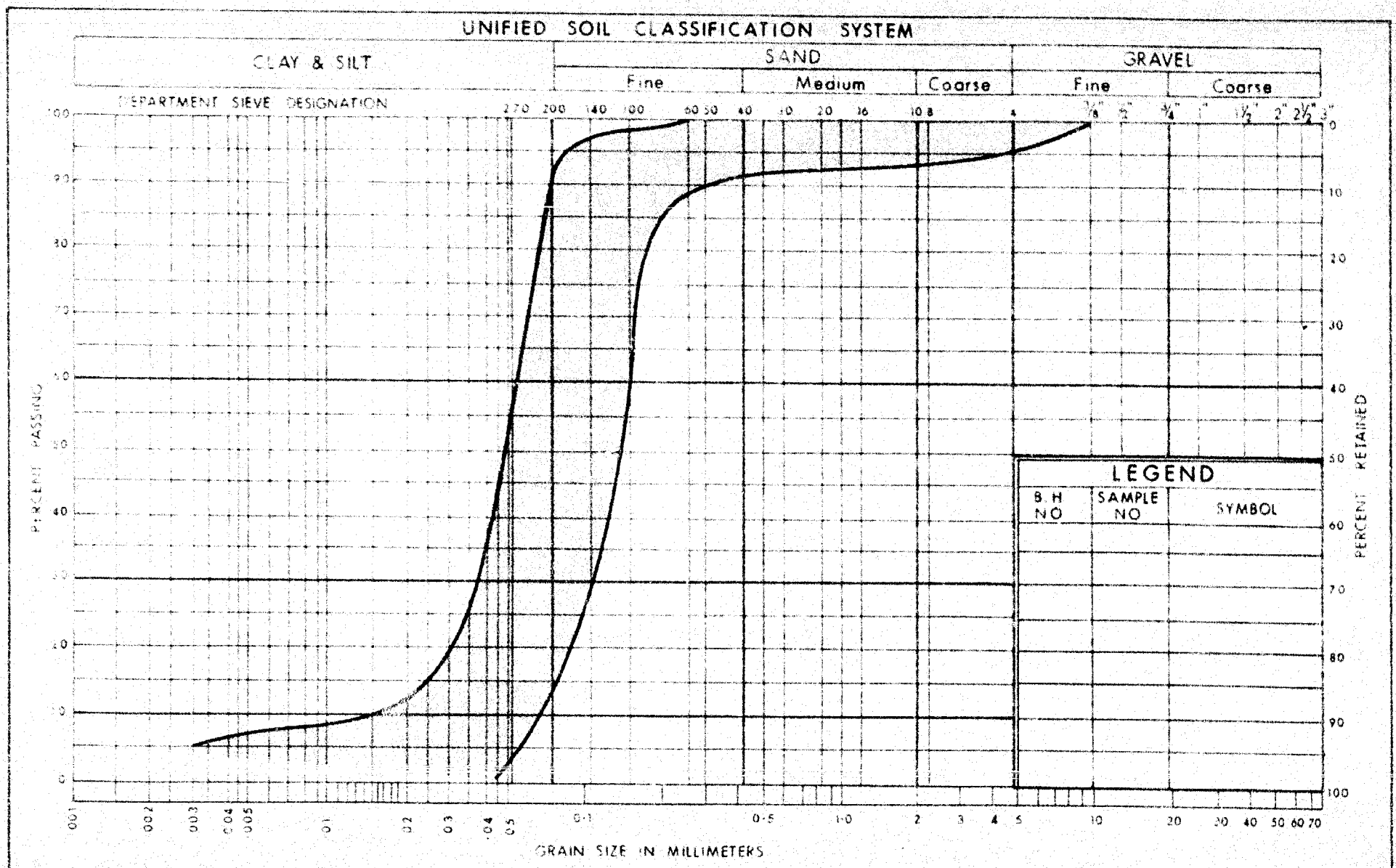
+s2 +s3 +s8 +s1

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.
105	
C 103 99	0 5 45 50
	0 75 (25)

20
15 5 % STRAIN AT FAILURE
10

FORM OB MT - 17
REV. APR. 1965



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

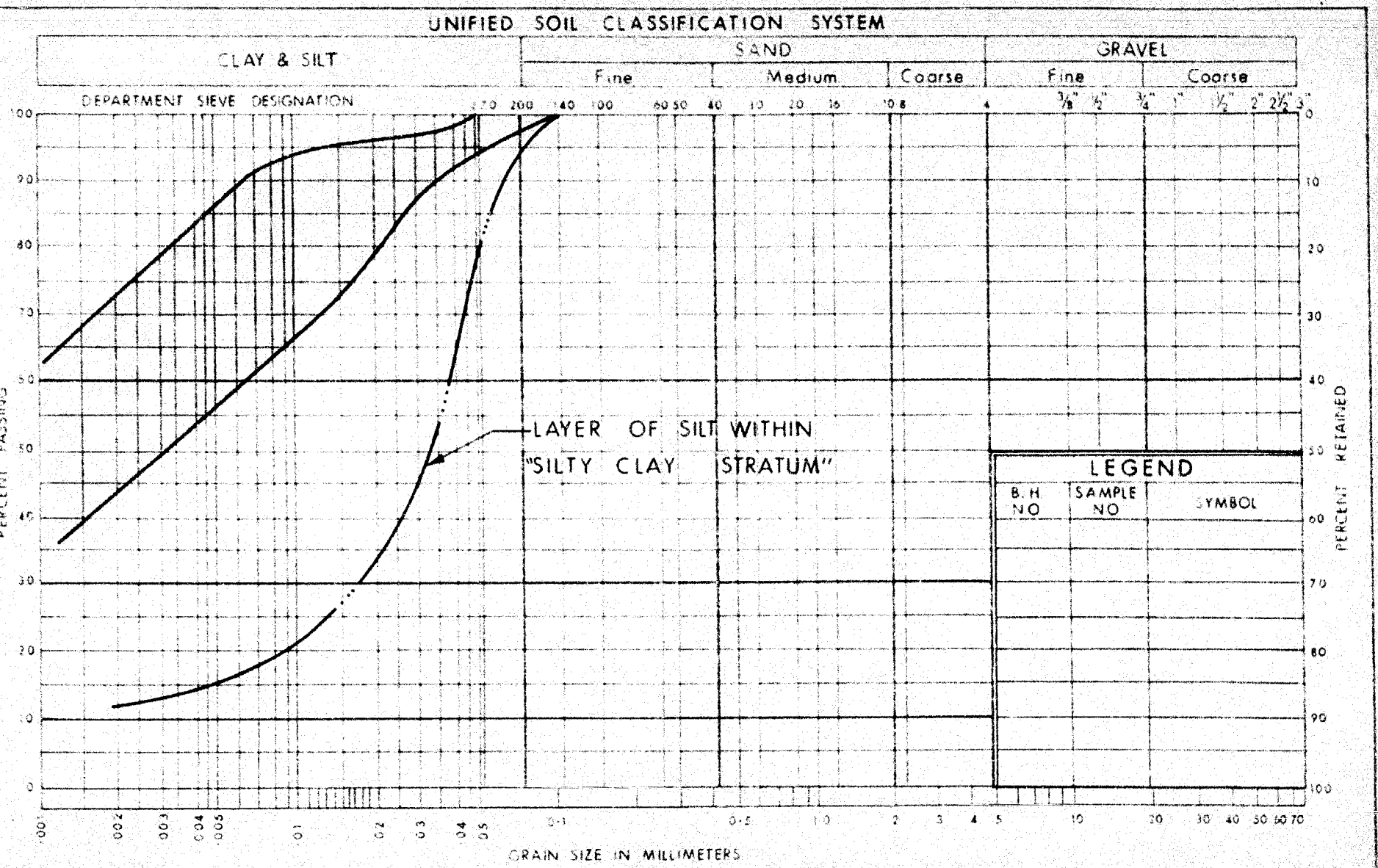
GRAIN SIZE DISTRIBUTION

SILTY FINE SAND TO SANDY SILT

W.P. No. 35 – 66

JOB No. 68 – F – 88

FIG. NO. 1

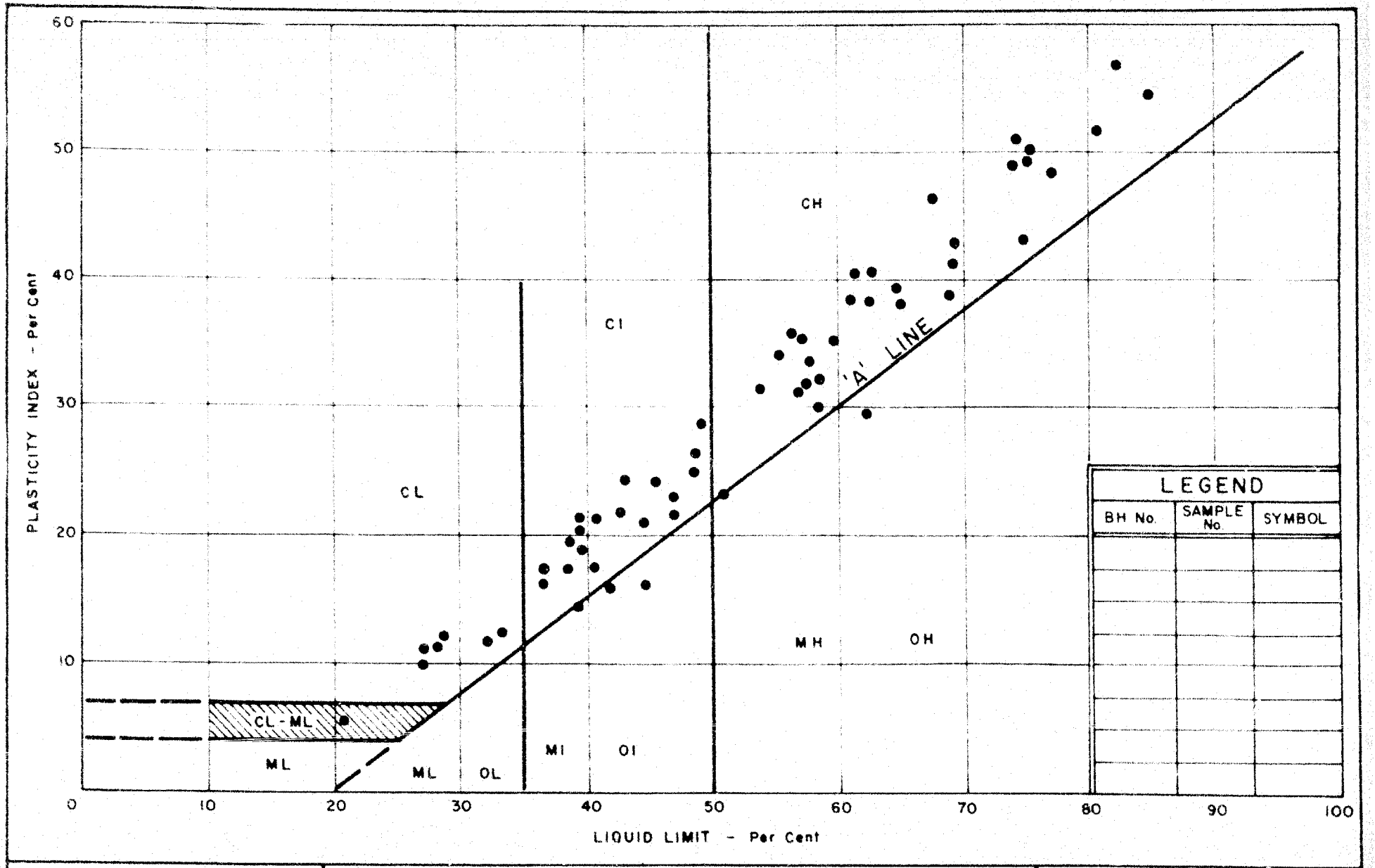


DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

GRAIN SIZE DISTRIBUTION
SILTY CLAY TO CLAY
(Sensitive)

W.P. No. 35 – 66
JOB No. 68 – F – 88
FIG. NO 2

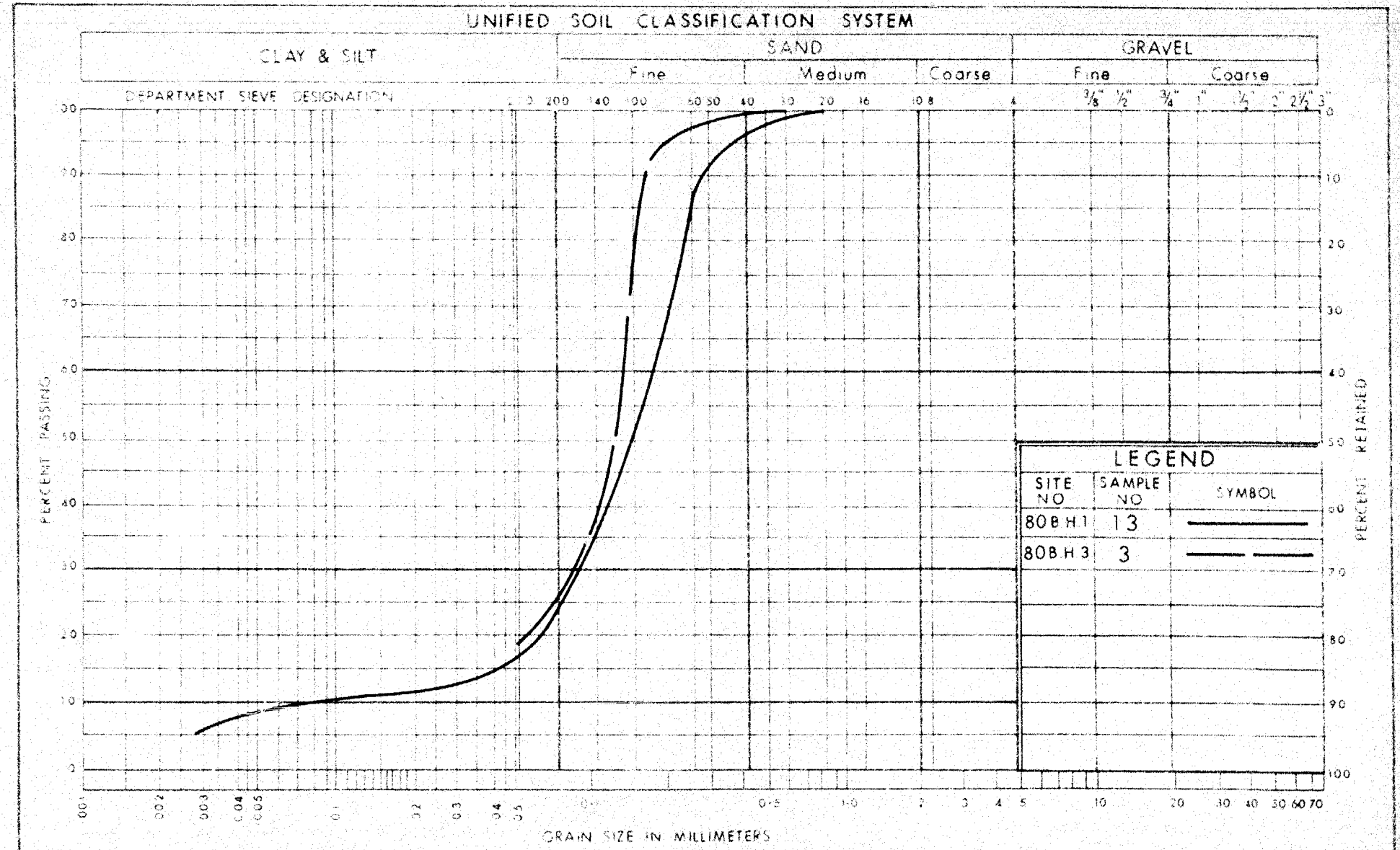
FORM SB-MT-252
REVISED JULY 1966



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

PLASTICITY CHART
SILTY CLAY TO CLAY
(Sensitive)

W.P. No. 35 – 66 – 03
JOB No. 68 – F – 88
FIG. NO. 3



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

GRAIN SIZE DISTRIBUTION
SAND SOME SILT
(Lower Deposit)

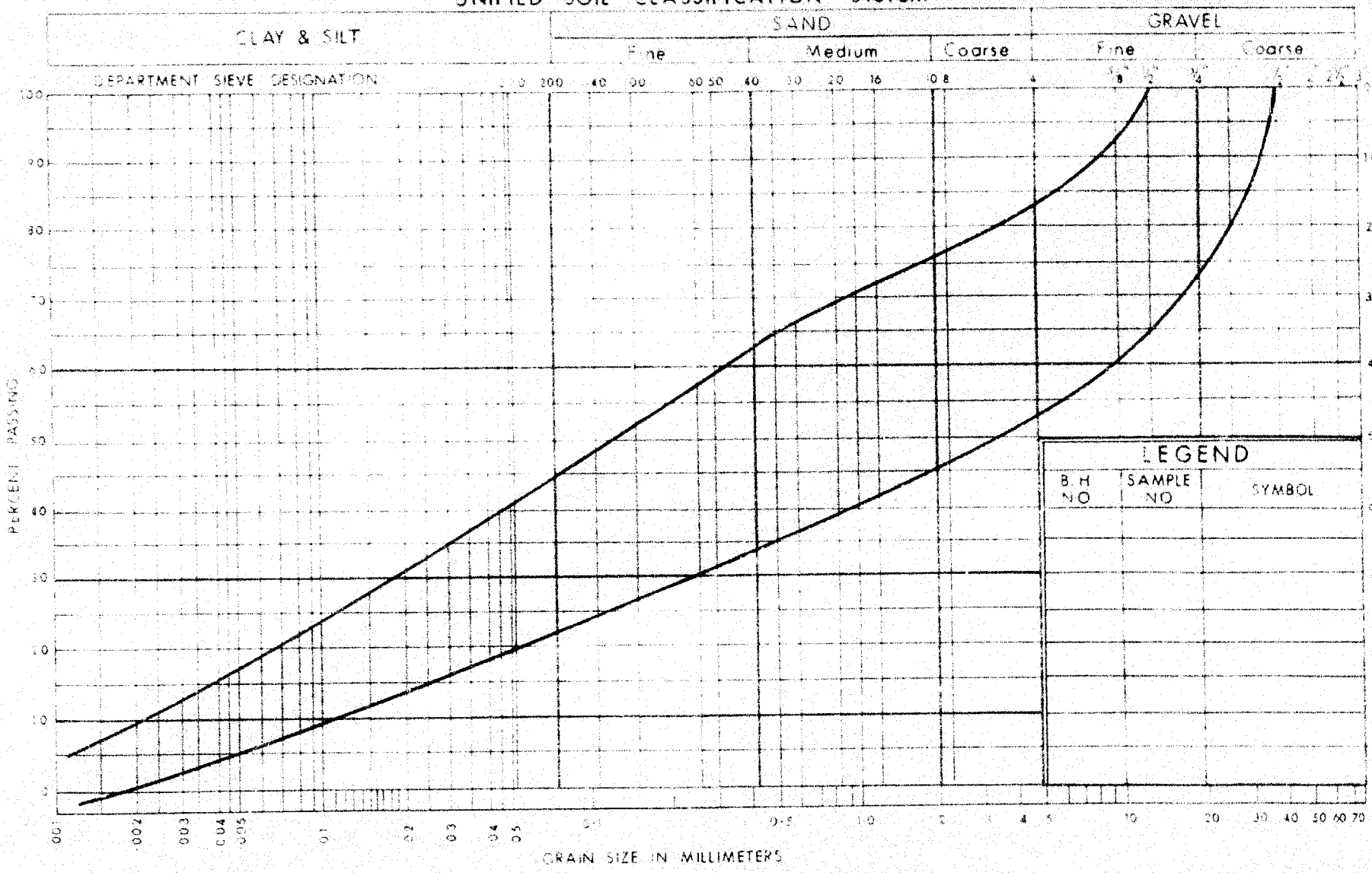
W.P. No. 35 – 66

JOB No. 68 – F – 88

FIG. NO. 4

FORM OB MT - 17
REV APR 1965

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

GRAIN SIZE DISTRIBUTION

GLACIAL TILL

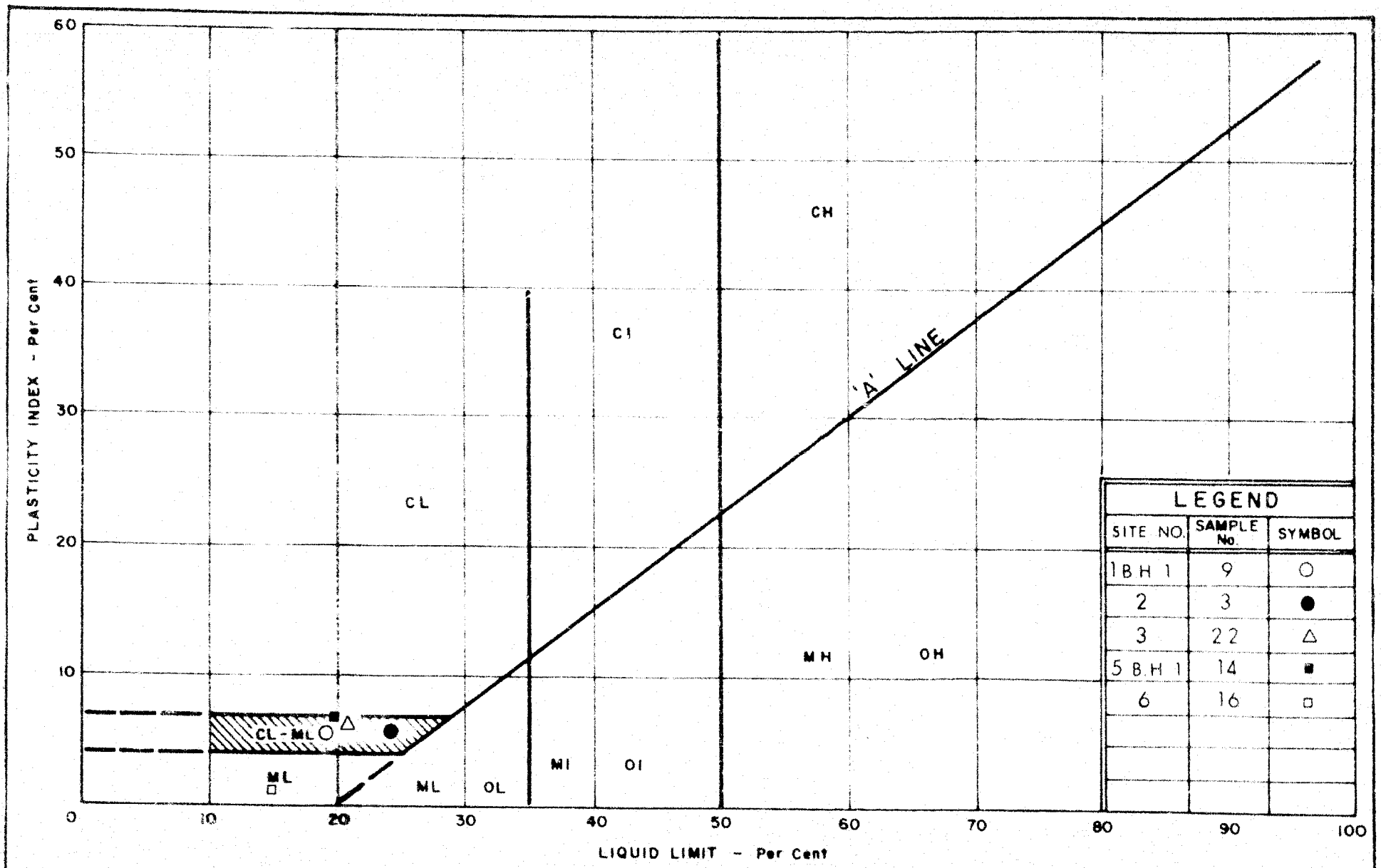
HETROGENEOUS MIXTURE OF CLAY, SILT, SAND & GRAVEL

W.P. No. 35 – 66

JOB No. 68 – F – 88

FIG NO 5

REVISED JULY 1966



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

PLASTICITY CHART

GLACIAL TILL

HETROGENEOUS MIXTURE OF CLAY, SILT, SAND & GRAVEL

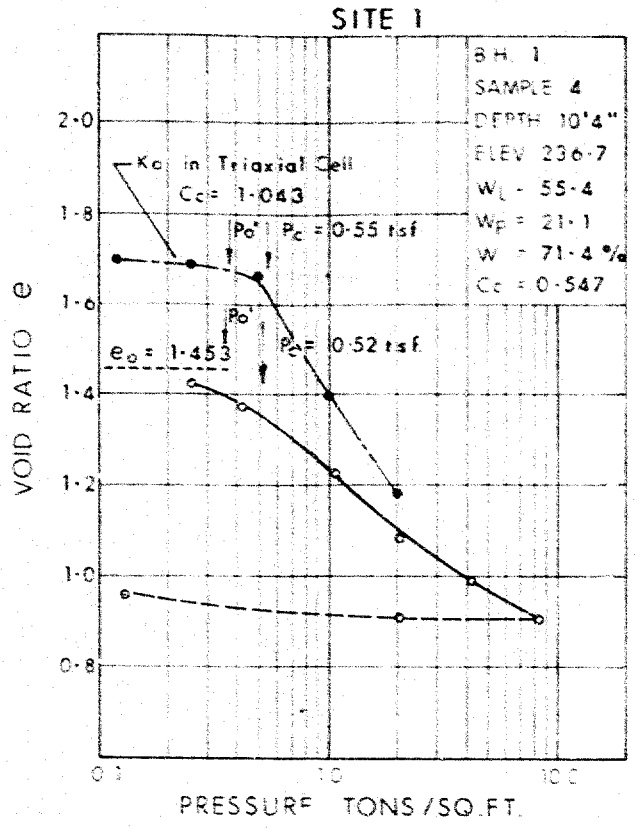
W.P. No. 35 – 66

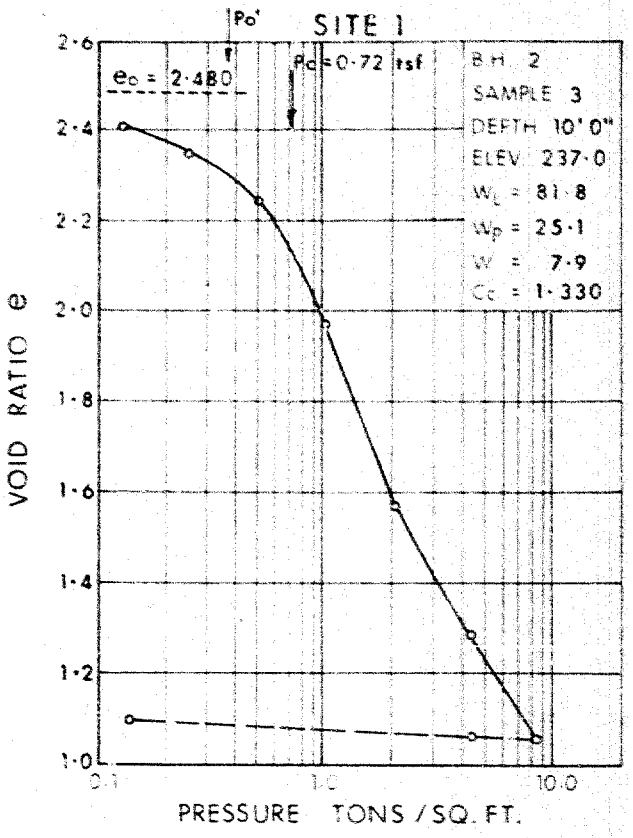
JOB No. 68 – F – 88

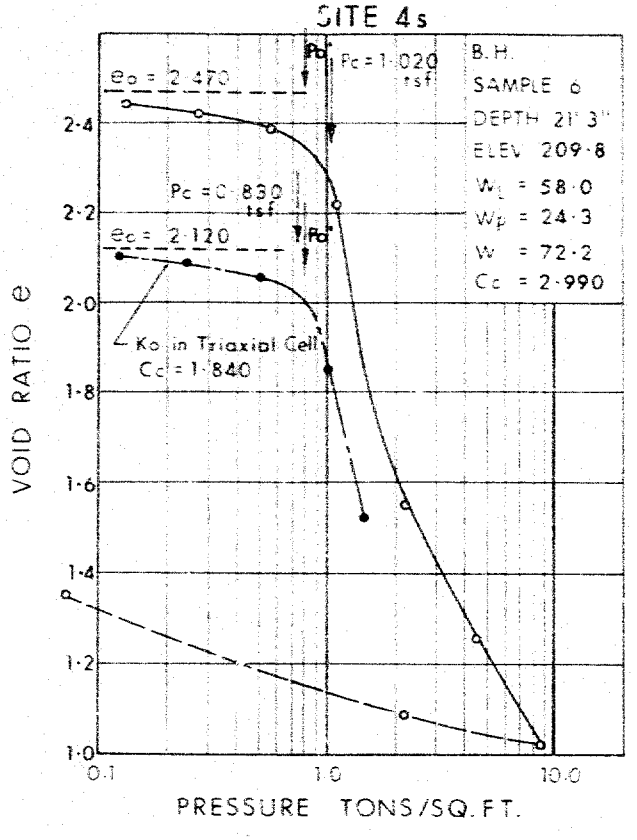
FIG NO. 6

VOID RATIO – PRESSURE CURVES

JOB NO. 68-F-88







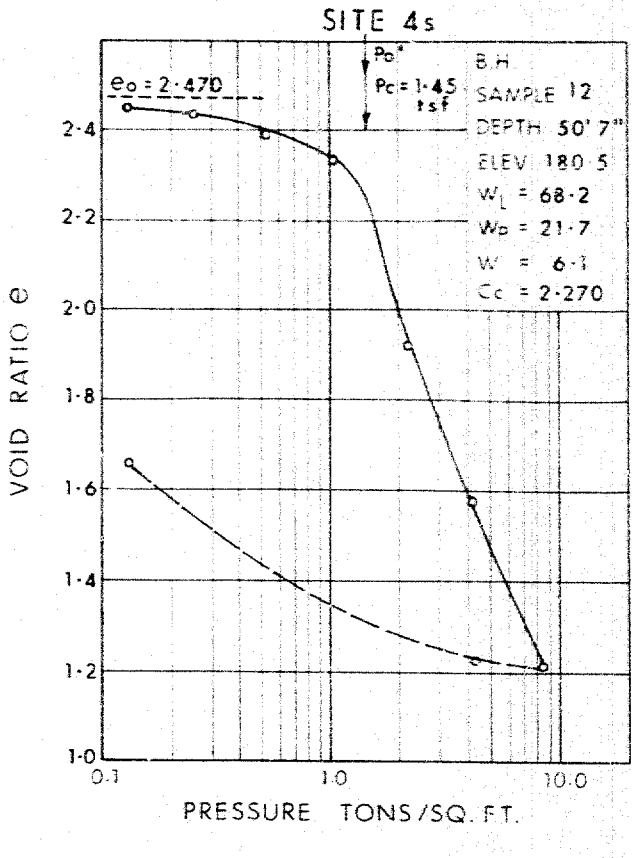
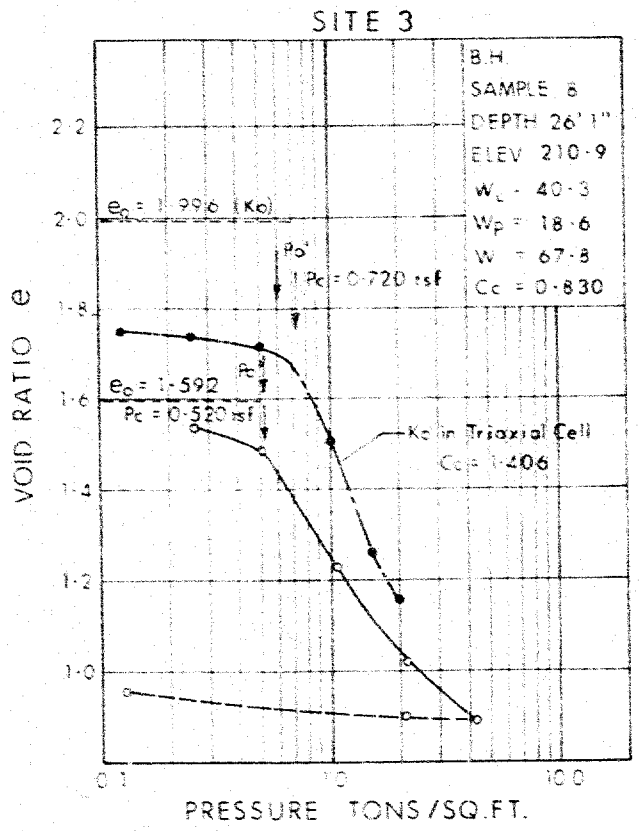
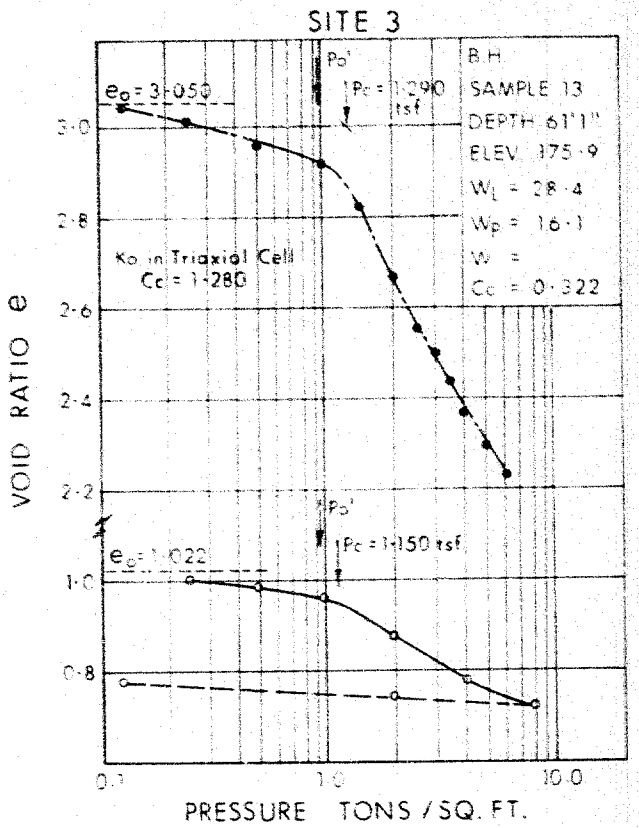


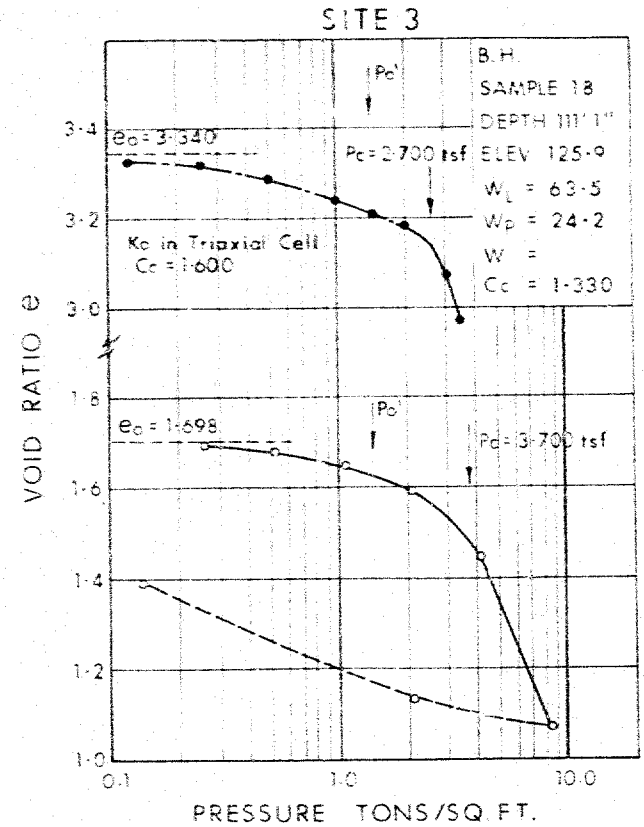
FIG. 7

VOID RATIO – PRESSURE CURVES

JOB NO. 68-F-88







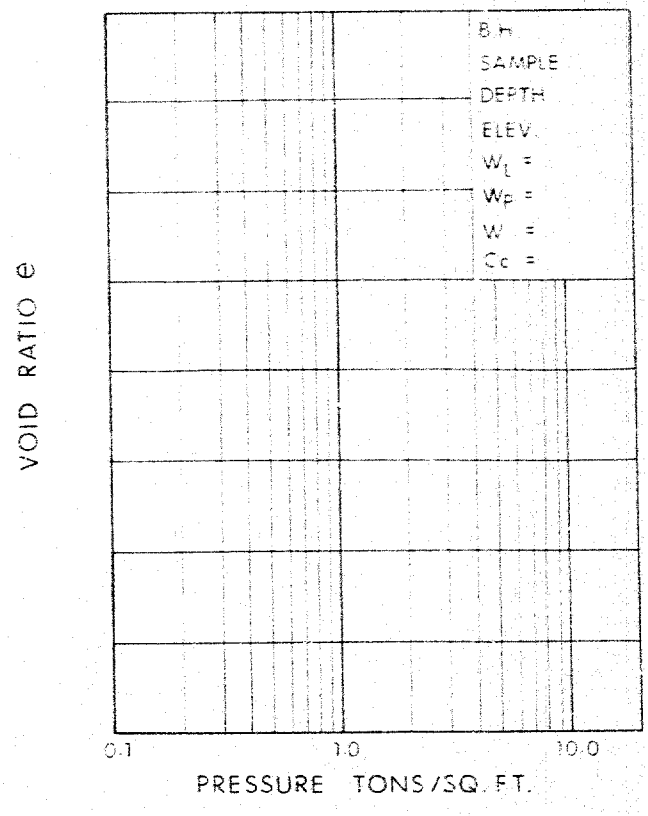
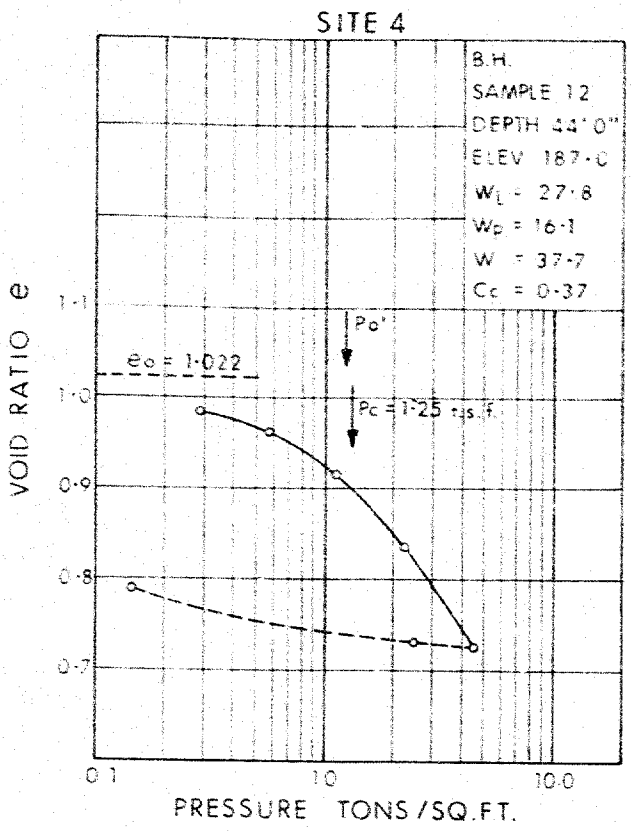
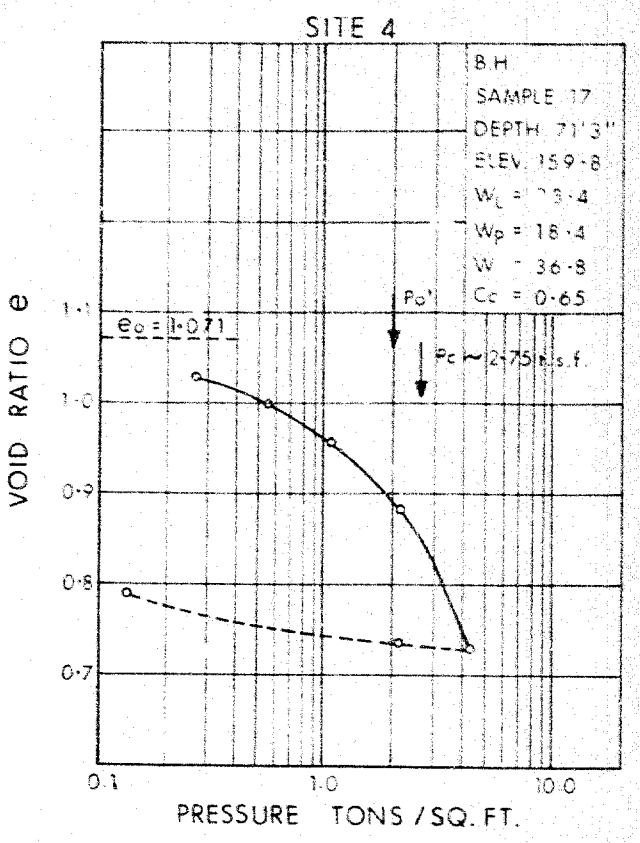


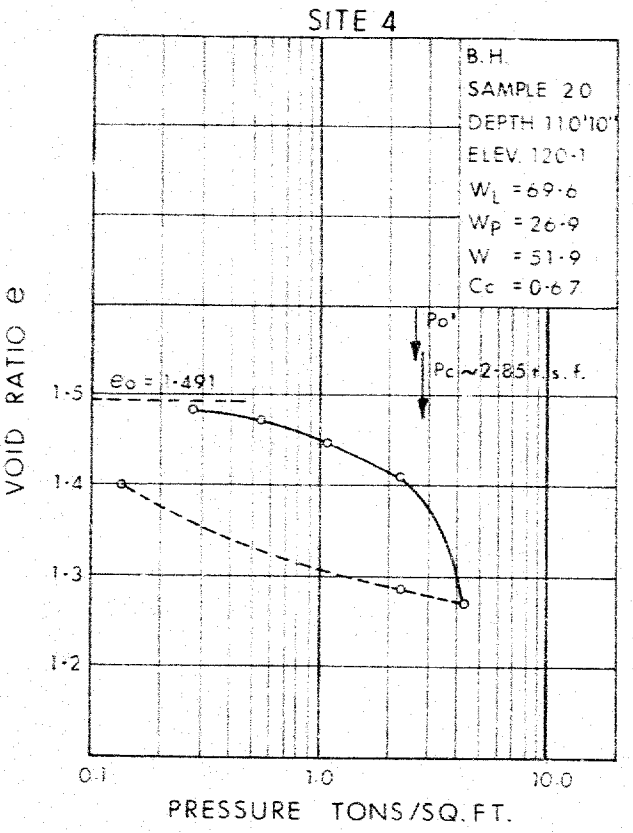
FIG. 8

VOID RATIO – PRESSURE CURVES

JOB NO. 68-F-88







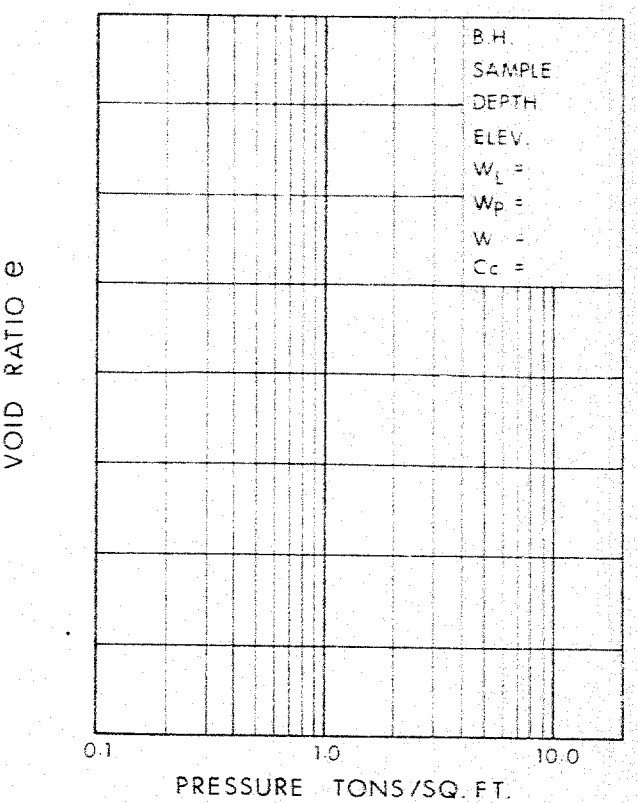
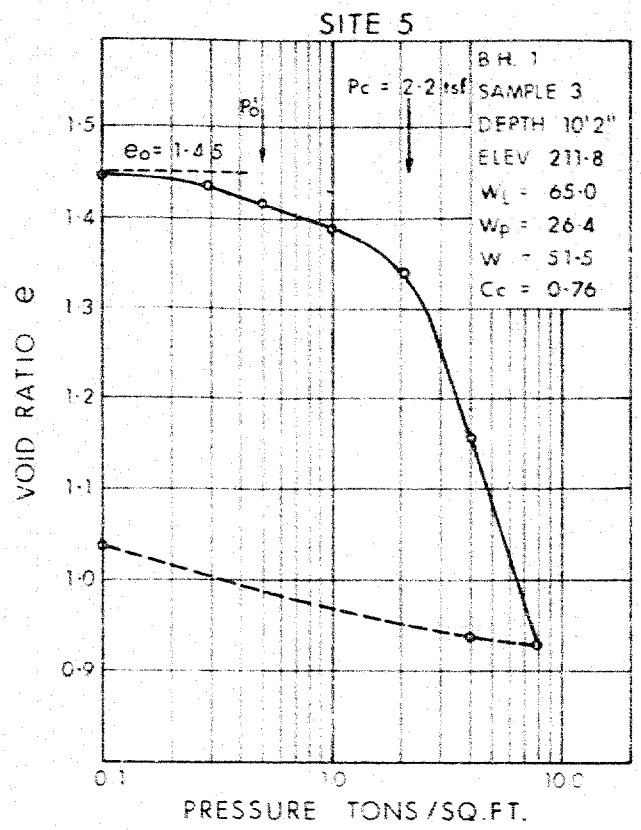
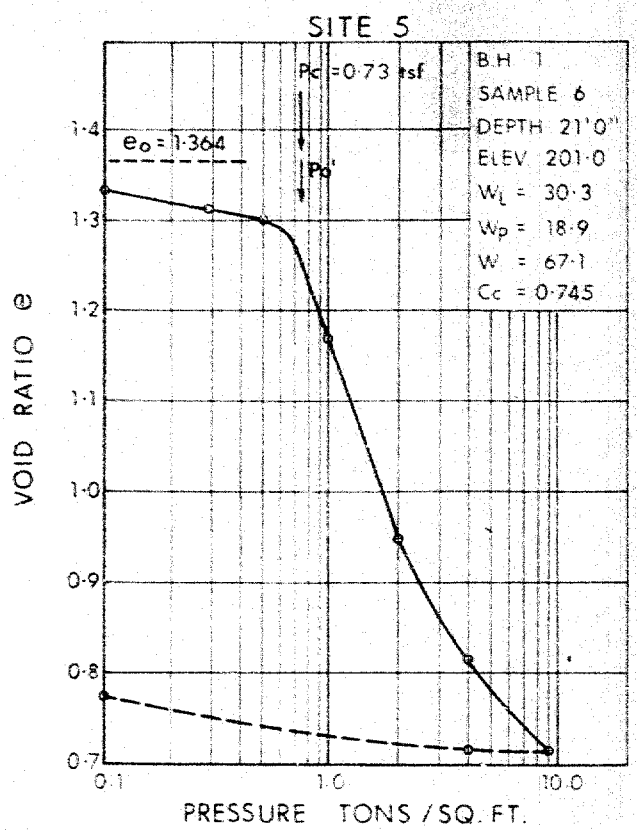


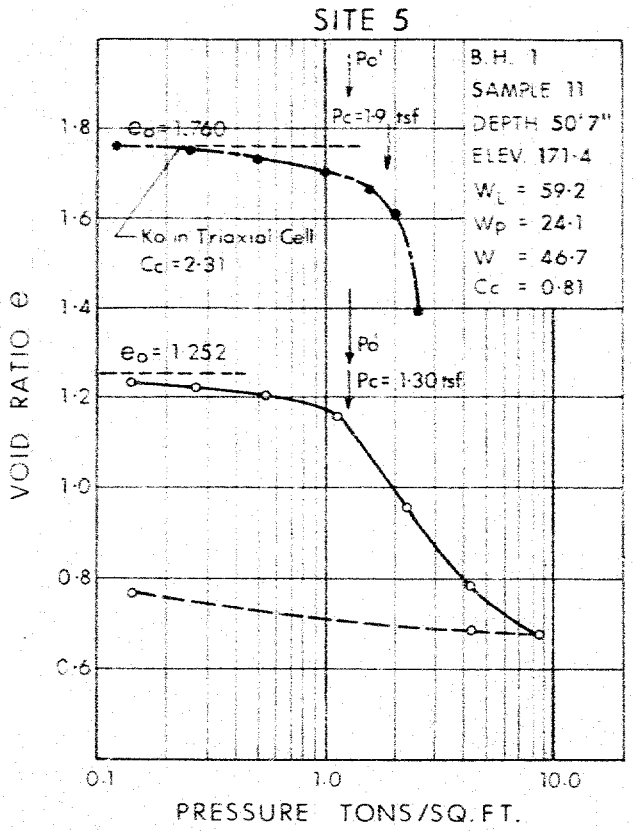
FIG. 9

VOID RATIO – PRESSURE CURVES

JOB NO. 68-F-88







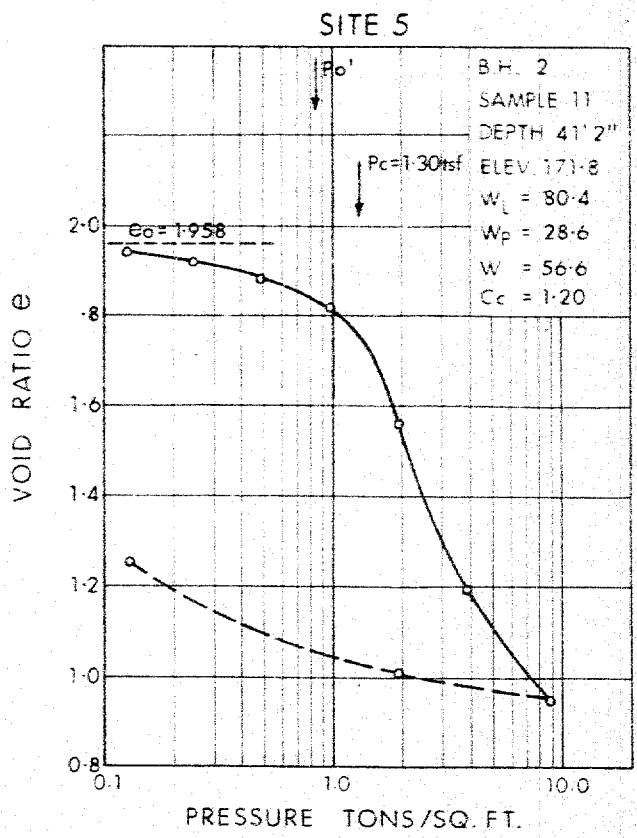
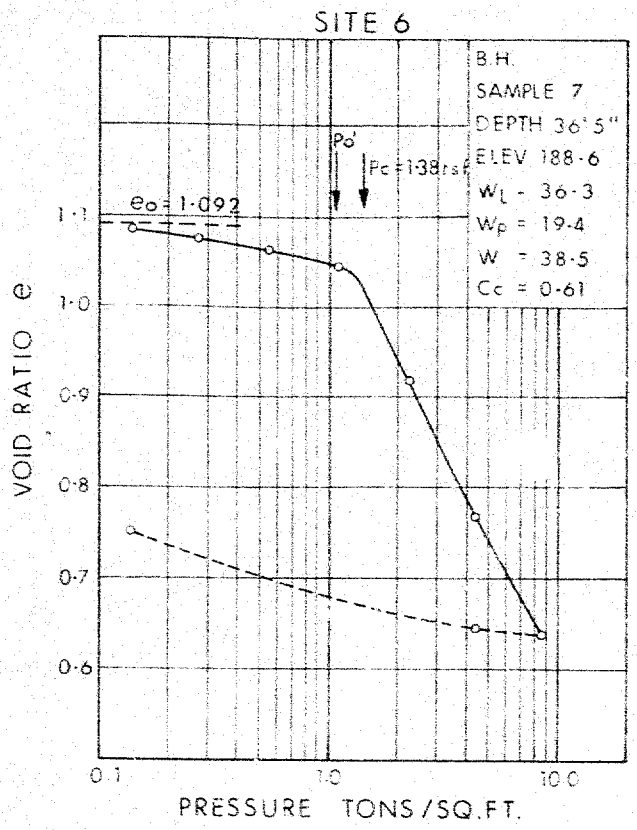
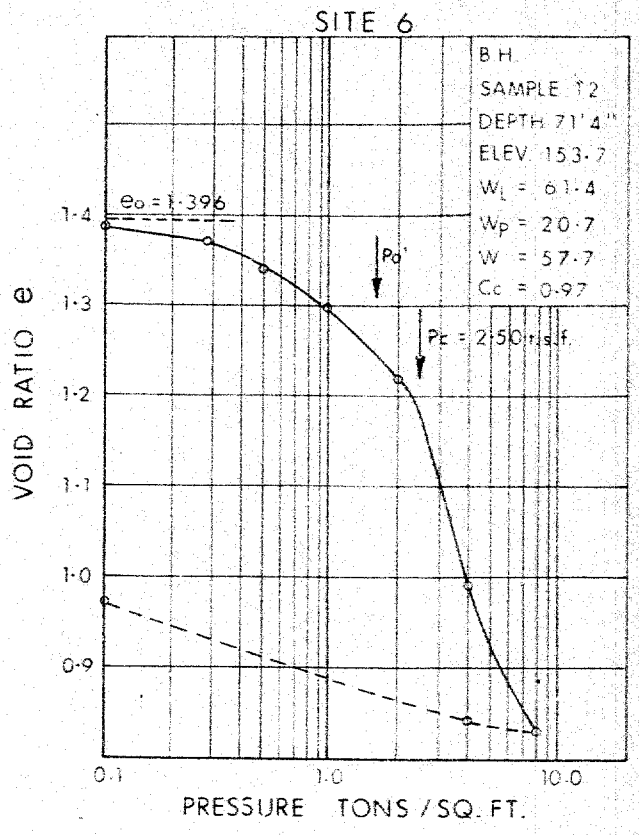


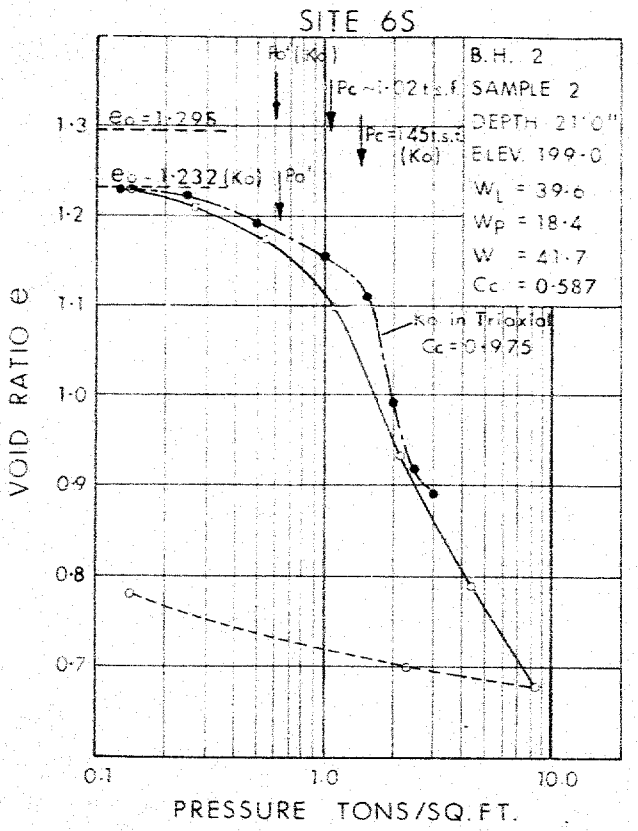
FIG. 10

VOID RATIO – PRESSURE CURVES

JOB NO. 68-F-88







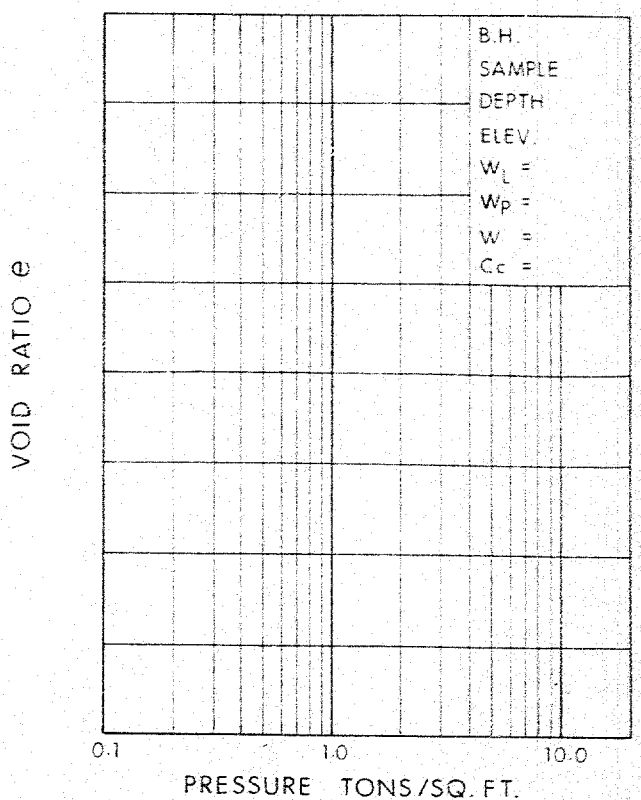
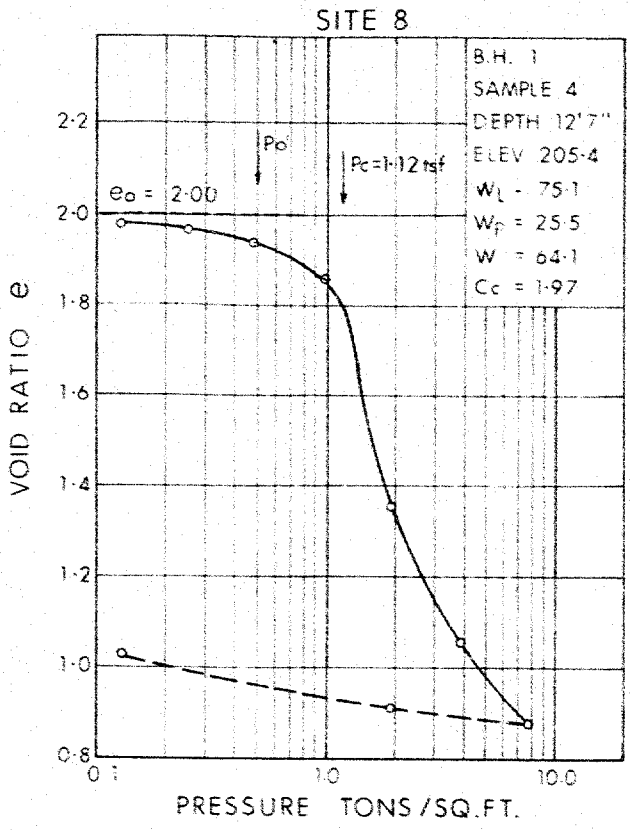
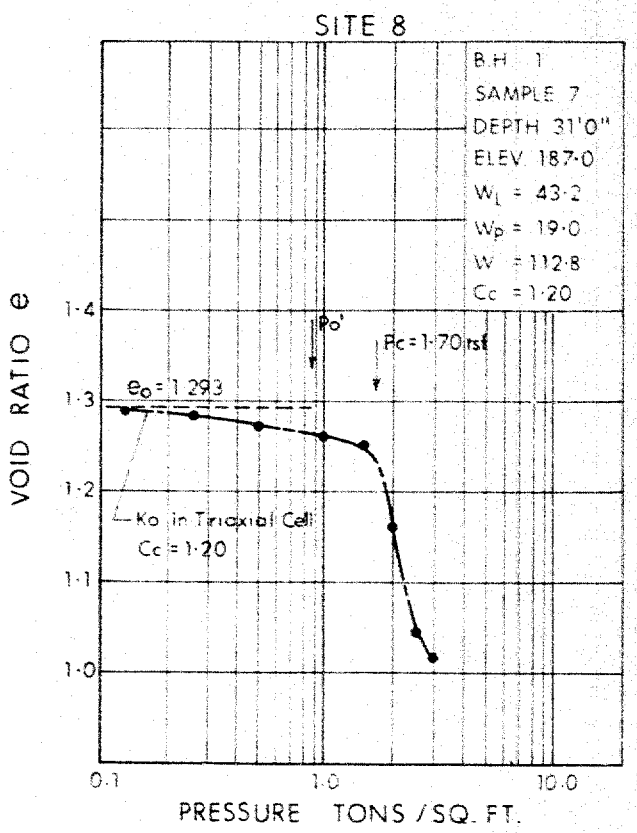


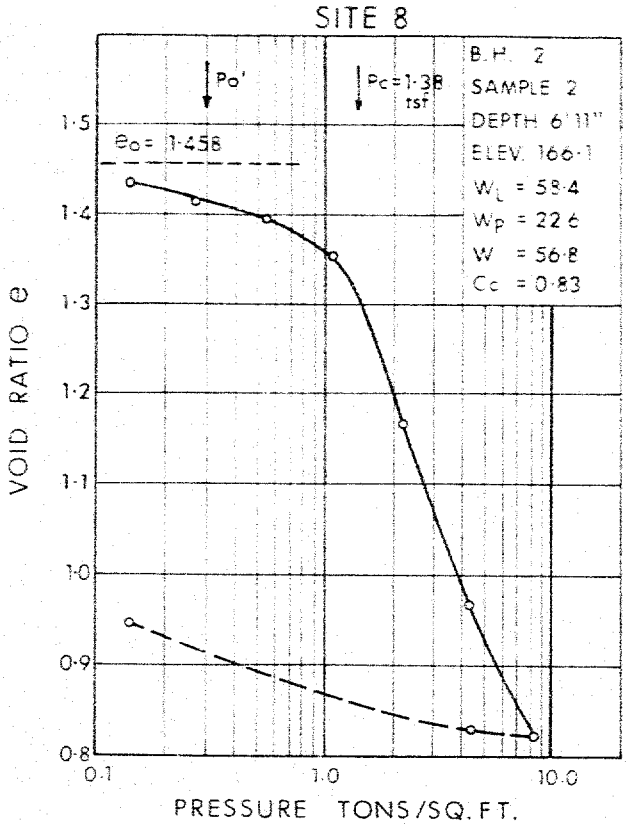
FIG. 11

VOID RATIO – PRESSURE CURVES

JOB NO. 68-F-88







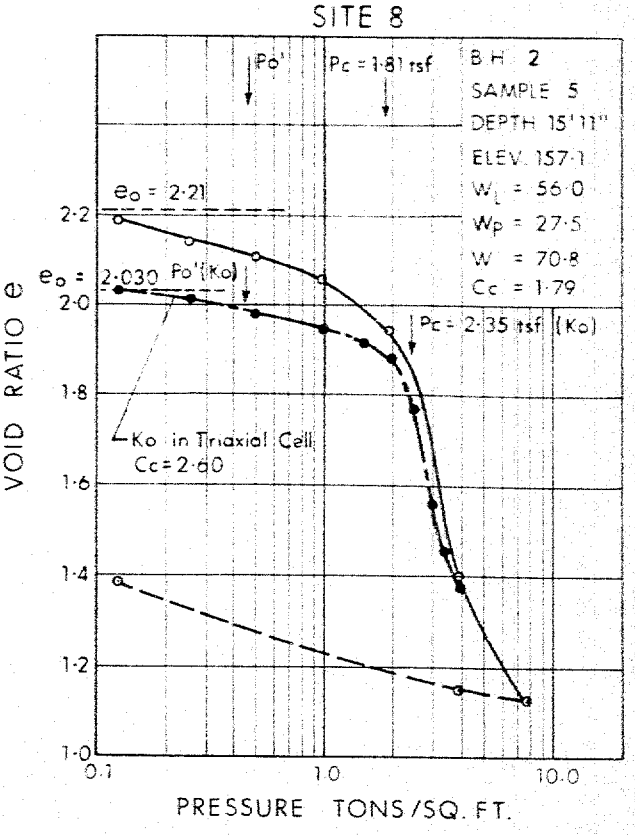
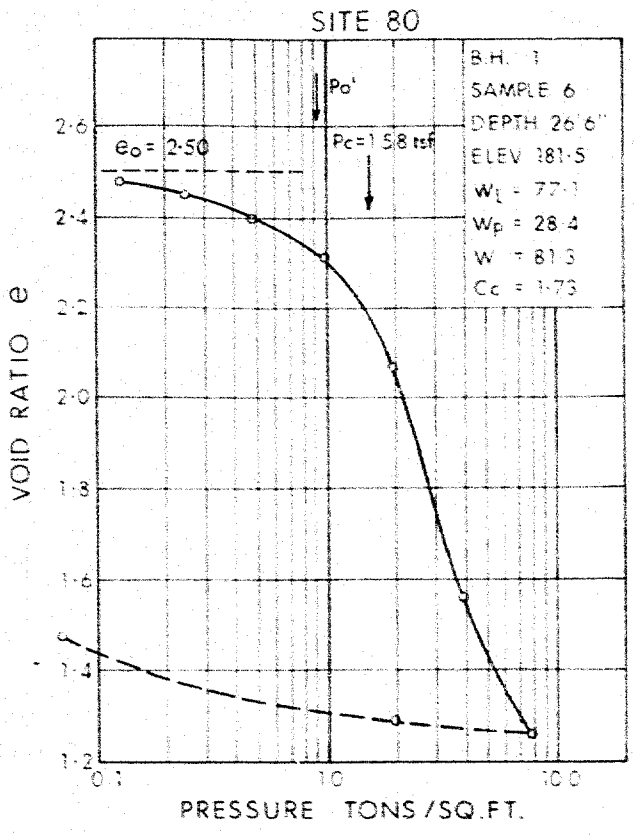
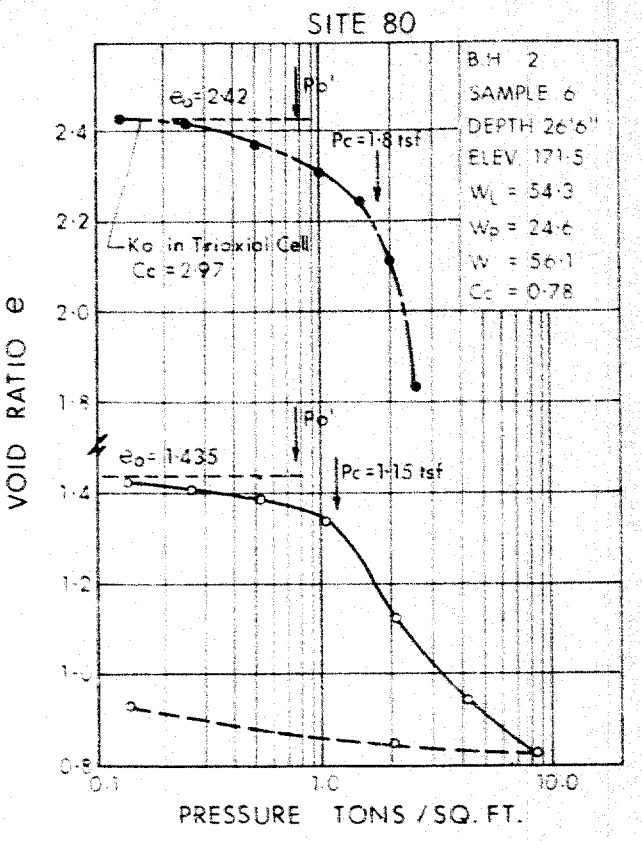


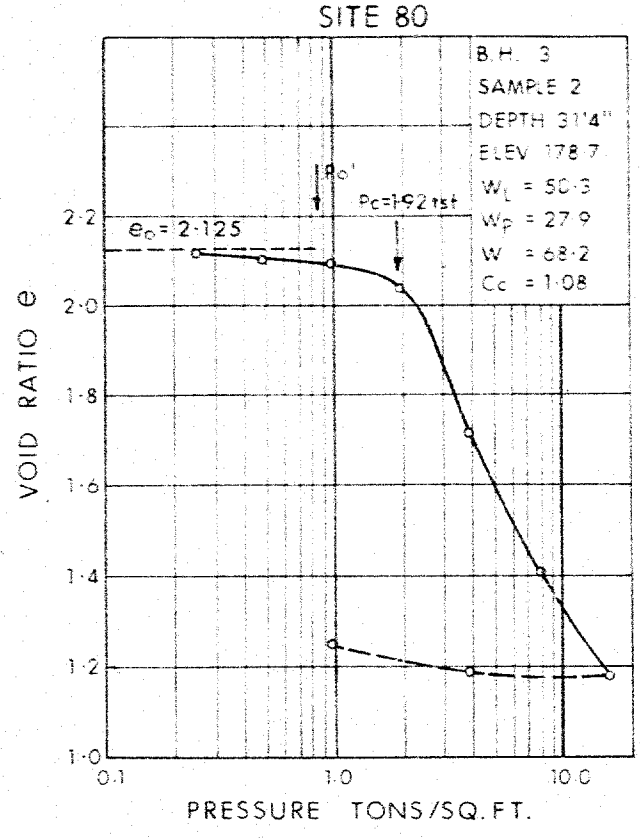
FIG. 12

VOID RATIO – PRESSURE CURVES

JOB NO. 68-F-88







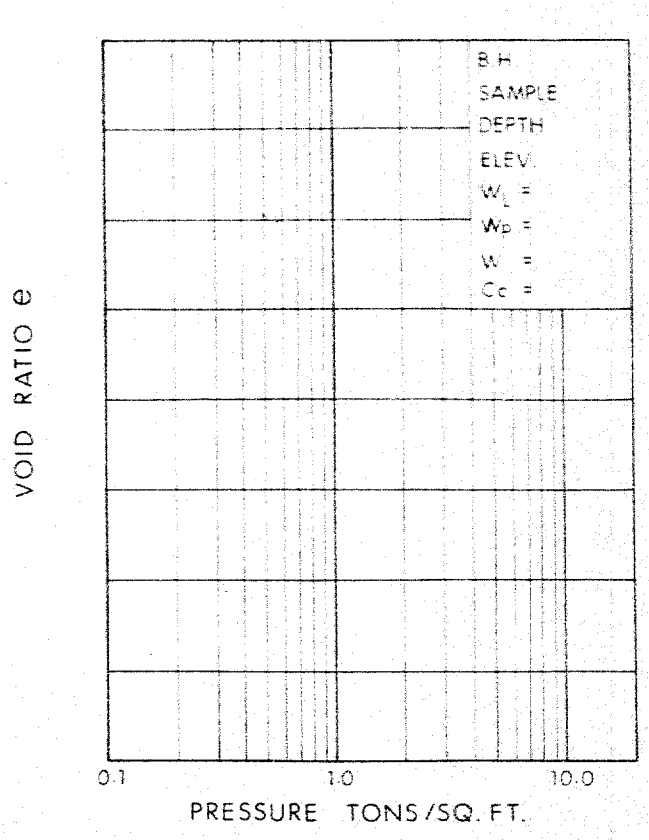


FIG. 13

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

S' NDARD 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.
VERY SOFT	0 - 2	0 - 250
SOFT	2 - 4	250 - 500
FIRM	4 - 8	500 - 1000
STIFF	8 - 15	1000 - 2000
VERY STIFF	15 - 30	2000 - 4000
HARD	> 30	> 4000

DENSENESS	'N' BLOWS / FT.
VERY LOOSE	0 - 4
LOOSE	4 - 10
COMPACT	10 - 30
DENSE	30 - 50
VERY DENSE	> 50

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

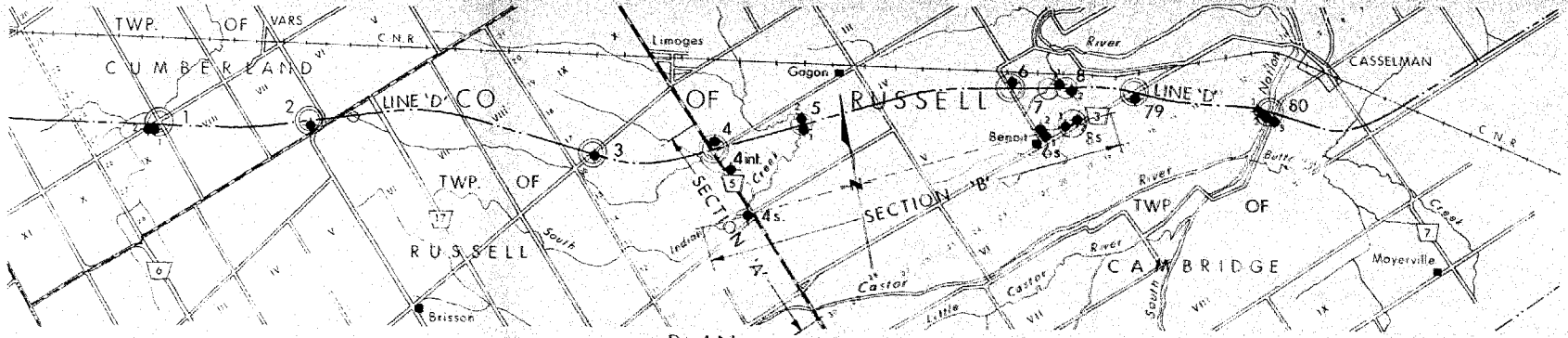
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

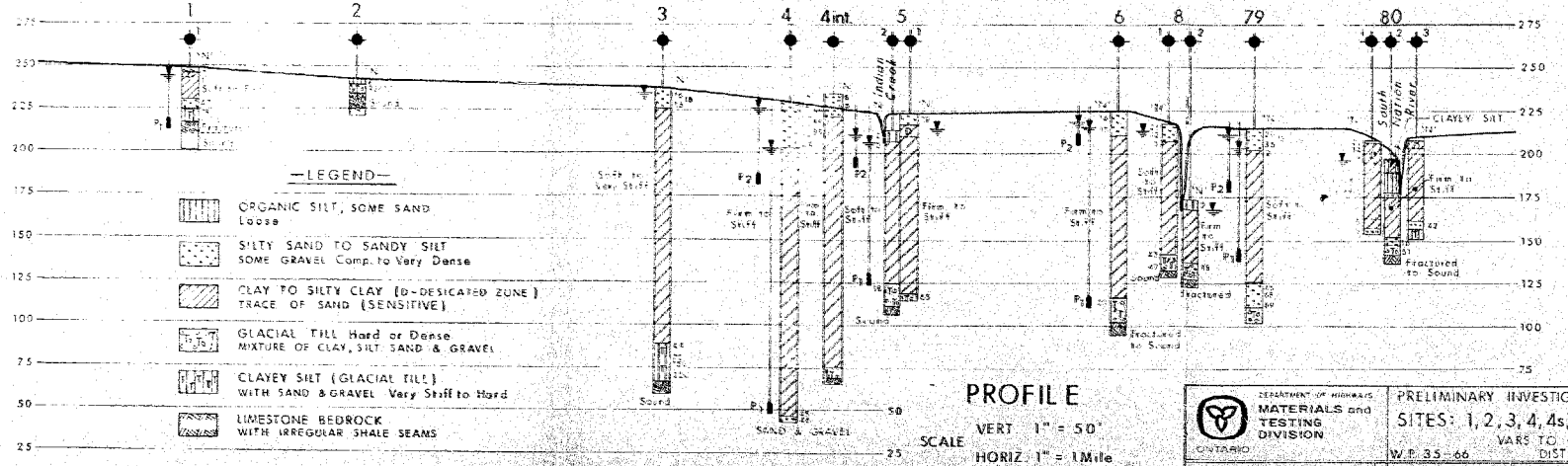
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY. DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

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



PLAN SCALE 1" = 1 Mile



PROFILE

SCALE VERT 1" = 50'
HORIZ. 1" = 1 Mile

—LEGEND—

- Bore hole
- Water Level
- Piezometer
- Structure and Interchange
- Structure

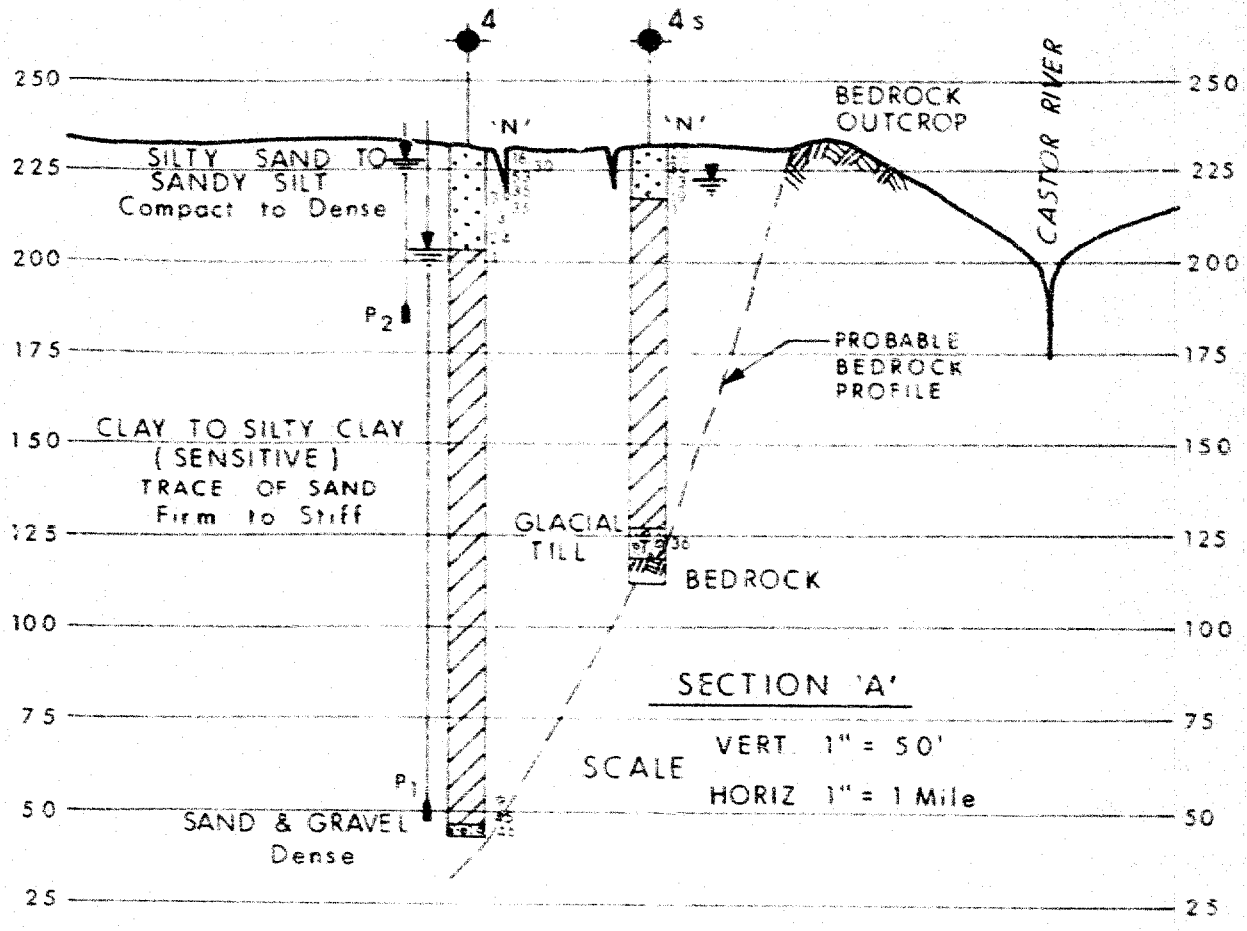
ELEVATIONS ARE APPROX. ONLY

See Dwg 68-F-888 for soil strata on sections A & B

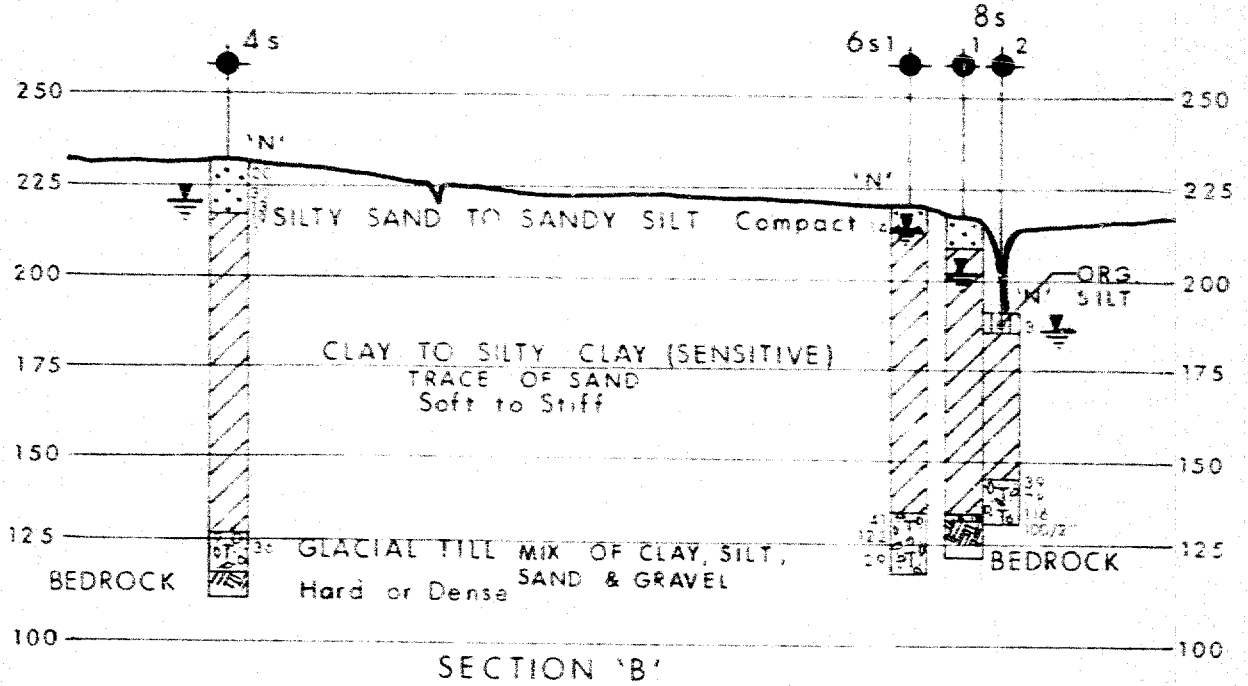
DEPARTMENT OF HIGHWAYS ONTARIO
MATERIALS and TESTING DIVISION

PRELIMINARY INVESTIGATION HWY. 417 LINE 'D'
SITES: 1, 2, 3, 4, 4s, 5, 6, 6s, 7, 8, 8s, 79 & 80
VARS TO CASSELMAN
W.P. 35-66 DIST. NO. 9 JOB. 68-F-88

DATE March 31, 1969 APPROVED DRAWING NO. 68-F-88A



SECTION 'A'



SECTION 'B'

DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION
ONTARIO

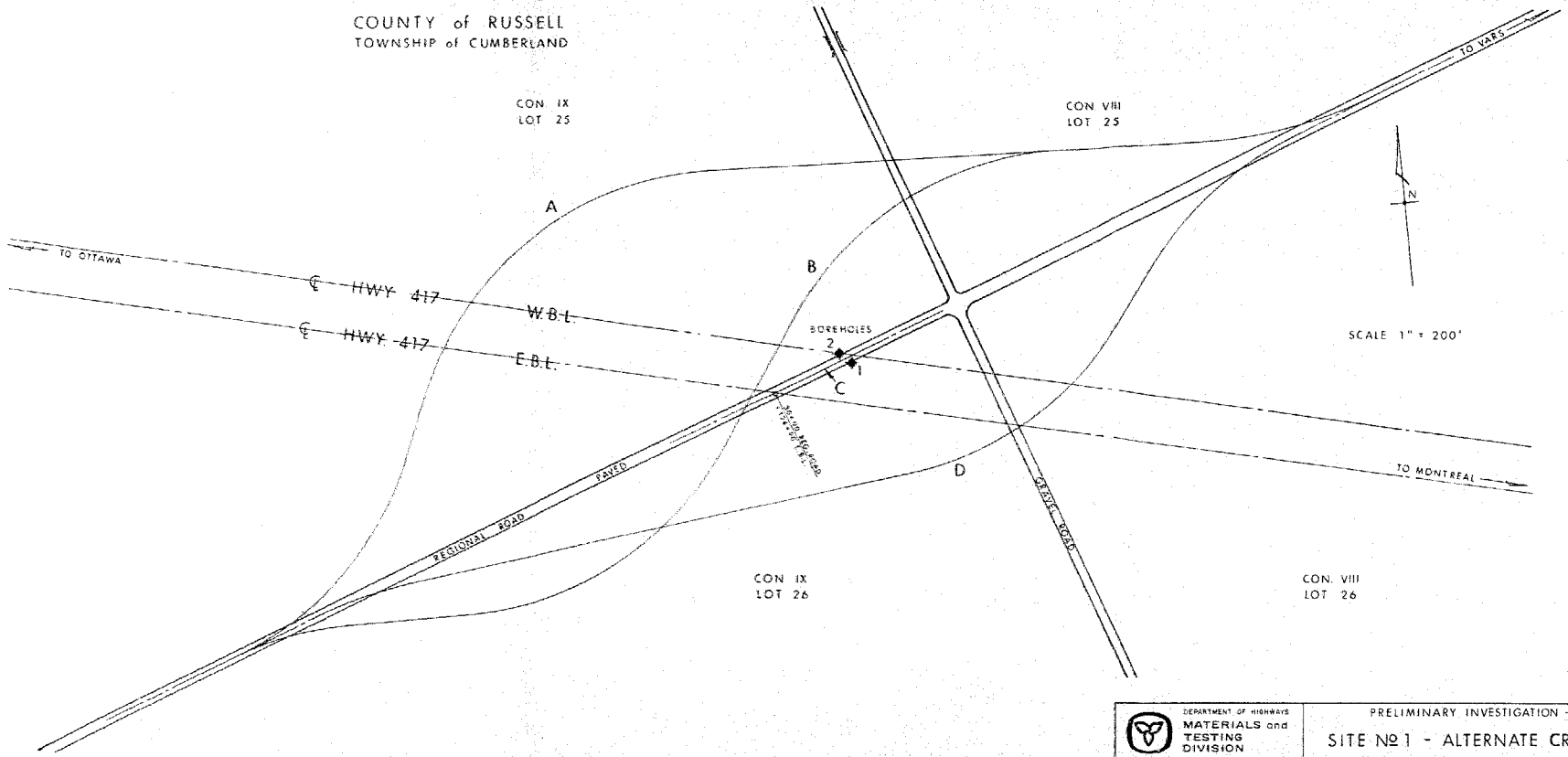
PRELIMINARY INVESTIGATION HWY 417

SECTIONS 'A' & 'B'

VARS TO CASSELMAN

W.P. 35-66 DIST. NO. 9 JOB 68-F-88

DATE April 1 1969 APPROVED DRAWING NO. 68 — F —88B



DEPARTMENT OF HIGHWAYS
ONTARIO
MATERIALS and TESTING DIVISION

PRELIMINARY INVESTIGATION - HWY. 417

SITE Nº 1 - ALTERNATE CROSSINGS

WP 34-66-16 DIST. 9 JOB 68-F-88

DATE 23 APRIL 1969 APPROVED A.F. Stermac DRAWING NO. 68-F-88C

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

Site #1
68-F-88

To: Mr. M. Devata,
Materials & Testing Office,
Downsview, Ontario.

From: Functional Planning Section,
Kingston, Ontario.

Attention:

Date: June 30, 1969.

Our File Ref.

In reply to

Subject: W.P. 34-66-16, Hwy. 417, Sideroad Reg. Rd. No. 8 to Vars structure - District 9 - Ottawa

Based on the profile issued with W.P. 35-66-01 for the proposed treatment of the above structure, please advise as to the length, depth, width, side slopes, etc. which would be required for subexcavating the marine clay to avoid the need for berms on the approach fills. This is per discussion at the co-ordinating committee meeting on June 10th, 1969, and will enable us to determine the most economical solution.

Your early attention to this matter would be appreciated.

J. Williams

for A. J. Percy,
for: MrR. Ernesaks,
Regional Functional Planning Engineer.

AJP/mjh

MINUTES OF THE HIGHWAY 417

CO-ORDINATING COMMITTEE MEETING

Including Field Review of W. P. 35-66-01

June 10th, 1969 at 1:30 p. m.

Boardroom No. 3 - Regional Office Kingston

Those present were:-

Mr. S. J. Markiewicz	Road Design Section
Mr. M. Devata	Materials & Testing, Head Office
Mr. H. Meyer	Materials & Testing Section
Mr. R. Forrest	Program Office, Downsview
Mr. A. Hall	Traffic Section
Mr. L. Timson	Photogrammetry
Mr. T. C. Kingsland	Bridge Section
Mr. M. J. MacMaster	Road Design Section
Mr. A. G. Boucher	Engineering Surveys
Mr. K. Westerby	Construction Engineer, District 9
Mr. J. E. Gruspier	Materials & Testing Section
Mr. C. E. Pritchard	Road Design Section
Mr. J. L. Caldwell	Right-of-Way Section
Mr. H. Forsyth	Right-of-Way Section
Mr. J. Desrocher	Functional Planning Section
Mr. A. J. Percy	Functional Planning Section
Mr. I. Williams	Functional Planning Section

1. Status of W. P. 37-66-05

Mr. A. J. Percy gave a brief resume of the status of this project which is summarized as follows:

(a) The Carillon Park Road (County Road #14) interchange design has almost been completed and Head Office approval will soon be sought.

(b) The United Counties of Prescott & Russell has approved this project and have agreed to accept the relocated portions of County Road #14 and #24.

(c) The Township of East Hawkesbury has approved of the project with the exception of the closing of the road to Chute-a-Blondeau between Lot 19 and Common Lot, Concession 1 at the freeway.

(d) Contact has been made with the Province of Quebec, but as yet no comments have been received with regard to the proposed connection to Quebec Highway #40.

(e) The Engineering Survey field work has been completed.

(f) Road closing counts were presently being taken and application will be made to the O. M. B. this summer for permission to close the necessary road.

(g) With reference to the minutes of the previous meeting; since it was decided not to change the grade of existing Highway #17 (future eastbound lane), it was felt that it was not necessary to provide a breakdown of quantities to Road Design and the District for staging considerations.

2. Status of W. P. 34-66-01 and -03

This project was reviewed by Mr. Percy as follows:

(a) The Anderson Road interchange design was completed when it was found that the structure designed was not compatible with the interchange design. As a result, this interchange had to be redesigned. Similar problems were found with the Boundary Road interchange. This has delayed the completion of these interchange designs.

(b) The proposed revision to the Vars sideroad (Reg. Rd. #8 - W. P. 34-66-16) was reviewed. Considerable discussion took place on the feasibility of subexcavating and marine clay (approximately 19' deep) below the structure approaches rather than constructing the fills on the existing ground utilizing berms for stability. Mr. M. Devata advised that he would make recommendations on the amount of subexcavation required. Functional Planning could then make an assessment to determine the most economical solution. Functional Plannings concern was that a long expensive structure should be avoided at this location.

3. Progress on W. P. 10-69 and W. P. 13-68

Mr. Percy reviewed the progress on this project as follows:

(a) A meeting was recently held with the Ottawa Freeway Technical Advisory Committee at which time several basic schemes for the relocation of Highway 31 and the alignment of Highway 417 from Baseline Road to Walkley Road were reviewed.

(b) Preliminary Foundation investigations have been started throughout these projects.

(c) A meeting with the working subcommittee of the Ottawa Freeway Technicial Advisory Committee was recently held, at which time the arterial road system of the City of Ottawa and the effect this system would have on the freeway was reviewed.

4. Review of W. P. 35-66-01 (Vars to Limoges) Field Meeting

Mr. Percy reviewed the Functional Planning proposals for this project as follows:

(a) The easterly 1.5 miles of the project would not be reviewed at this time, since it is dependent upon the alignment of the adjacent project W. P. 35-66-03 which has as yet not been finalized. The review for the westerly six miles± was being done at this time to expedite the issuing of the survey request. The survey request for the easterly 1.5 miles will be issued as soon as the alignment of W. P. 35-66-03 was approved.

(b) The alignment basically follows the approved corridor for the freeway from Vars to the Quebec Border.

(c) The major controls in the selection of the horizontal alignment were reviewed.

(d) It was noted that the vertical alignment was generally set on the low side and it was understood that Road Design would likely have to adjust the grade for drainage and soils considerations. The grade could be better assessed when the run profile is received.

(e) In areas where fills would be in the 10' or more range, the Regional Materials Engineer would have to consider if a foundation investigation would be necessary.

(f) It was explained that it was difficult to design the interchanges for this project with any accuracy until the length of the structures were known and the run alignment and profiles were received.

(g) The staging of construction was discussed with Functional Planning recommending the following:

Contract #1 - G.D. with structure approaches
Contract #2 - G.B. & Paving with structures and interchanges

5. Mr. Percy advised that he would issue the survey request for the westerly 6± miles as soon as it could be prepared, if there was no objection.

Objections were not expressed.

(a) Mr. Percy asked that written comments be forwarded by June 24th, 1969.

6. Brief Review of W. P. 35-66-03

Mr. Percy briefly outlined the problems on this project using a 1"-400' mosaic with an overlay on which several alternative alignments were shown.

The meeting adjourned.

K Williams

for A. J. Percy,
Project Planning Engineer.

IW/mjh

c. c. S. J. Markiewicz
M. Devata ✓
R. Forrest
L. Timson
T. C. Kingsland
A. G. Boucher
K. Westerby
J. E. Gruspier
J. L. Caldwell
H. Forsyth
K. M. Williams

July 11, 1969.

Structure Site No. 1.

Cu. = 560 p.s.f.
thickness of soft compress. bl layer
~ 16' to 18' to till stratum.

$$Hc = \frac{4S}{1.3\gamma} = \frac{4 \times 560}{1.3 \times 100} = 17'$$

$d \cong 1$

$N_0 = 5.7$ slope 1:1

$$Hab = \frac{5.7 \times 500}{1.3 \times 100} \cong 22'$$

Recommendations:
(Temporary (cont'd))

1) Slopes for cut-excavation in soft clay should not be steeper that 1:1.

2) Since N.T. is close to surface backfill should consist of well drained (free draining) granular type of material to the full base width of the embankment, down to the till stratum.

3) Depth of excavation can be estimated to vary adjacent from 16' to 18'.

4) If this scheme is chosen additional boreholes should be carried out to assert the vertical and lateral extent.

of the cost involved.

5) Such excavations ~~may~~ ~~have~~ to be carried out by a drag line operation.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM WJ 68-F-88.

To: Mr. S. J. Markiewicz,
Regional Road Design Engineer,
Kingston, Ontario.

From: Functional Planning Section,
Kingston, Ontario.

Attention:

Date: July 29, 1969.

Our File Ref.

In reply to

Subject: W.P. 35-66-03, Limoges to Casselman
Highway 417, District 9 - Ottawa

Attached for your information is one copy of the minutes of the Field Meeting held on July 16, 1969, in Boardroom #3 of the Regional Office.

A. J. Percy
Project Planning Engineer

AJP/hl
Encl.

c.c. I. C. Campbell
H. Aron
A. G. Boucher
J. E. Gruspier
T. C. Kingsland
L. Timson
J. S. Trew
C. R. Robertson
A. G. Stermac
R. Forrest

68-F-85

MINUTES OF FIELD MEETING

W.P. 35-66-03 - Hwy. 417 - Limoges to Casselman

A field meeting for the above project was held on Wednesday, July 16, 1969, at 1:30 p.m., Boardroom #3, Kingston Regional Office.

Those present:

M. Devata	H.O. Foundations Section
G. Costello	Engineering Surveys
R. Forrest	H.O. Program Section
J. Cruickshank	Materials & Testing Section
R. Wert	Engineering Office-District 9
J. Mullins	Construction Supt. -District 9
L. Timson	Reg. Photogrammetrist
D. Thomas	Reg. Road Design
A. Hall	Traffic Section
K. Westerby	Construction Engr.-District 9
T. Kingsland	Bridge Section
S. Markiewicz	Reg. Road Design
A. Smith	Functional Planning
J. Percy	Functional Planning
I. Williams	Functional Planning

Mr. Percy presented a general review of W.P. 35-66-03 and adjacent projects, using a 1" = 800' mosaic. He mentioned that very little information was available and the alignment was established using an uncontrolled 1" = 400' mosaic; consequently the amount of accurate information available is limited, particularly with regard to the profile. Mr. Percy discussed all the controls that governed the choice of the alignment for the freeway in the area of the project.

Next, the group was shown a 1" = 400' mosaic on which the recommended alignment for W.P. 35-66-03 was shown, along with several alternatives which were considered.

Mr. Percy discussed the recommended and alternative schemes on a section by section basis. The various alternative schemes were gradually eliminated on the grounds of economics and engineering feasibility.

Mr. Timson noted that there may be drainage problems due to the nature of the topography. Mr. Percy agreed and said that Road Design and Materials and Testing Sections would have to give careful consideration to this in their recommendations.

Mr. Percy said there is only one complete Road Closing proposed for W.P. 35-66-03. This is the Township Road between Lots 24 & 25, Concession V. The other locations are either being serviced by structures and/or service roads, or the road allowance is not opened.

Mr. Markiewicz asked about the overall foundation problems on W.P. 35-66-03. Mr. Percy said that the foundation conditions were poor on the west side of the South Nation River but no severe problems are anticipated east of the river.

After much discussion on various aspects of the project, Mr. Percy said that if the group was in general agreement with the proposals as presented, Functional Planning would issue a Survey Request for W.P. 35-66-03 as soon as possible. No objections to the proposals were apparent.

Mr. Kingsland was asked to supply Functional Planning with structure clearances for the South Nation River crossing.

Mr. Percy asked the group to submit written comments by July 30, 1969, at the latest.

The meeting adjourned.

A. J. Percy
Project Planning Engineer

AJP/hl

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. M. R. Ernesaks,
Regional Functional Planning
Engineer, Regional Office,
KINGSTON, Ontario.

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

Attention: Mr. A. J. Percy

Date: July 14, 1969

Our File Ref

In reply to

Subject:

Sideroad Reg. Rd. No. 8 to Vars Structure
Highway #417 -- District No. 9 (Ottawa)
W.P. 34-66-16 -- W.J. 68-F-88

Further to your recent memo, we have carried out stability analyses with regard to cut slopes for excavations for the above mentioned project for preliminary cost estimating purposes. Our comments are as follows:

1) Slopes for excavation of soft clay should not be steeper than 1:1.

2) Since the water table is very close to the ground surface, backfill should consist of well-drained granular type material.

3) Depths of excavations can be estimated to vary from 16 to 18 ft. down to the glacial till stratum. The width of the excavation should be the full base width of the embankments.

4) Additional borings will be required in order to determine the vertical and lateral extent of the sub-excavations for the above mentioned project, if this scheme is chosen.

MD/MdeP

M. Devata,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. J. E. Gruspier
S. J. Markiewicz

Foundations Files
Gen. Files

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. R. Forrest,
Scheduling Expeditor,
Program Office,
Downsview, Ontario.

ATTENTION:

From: Functional Planning Section,
Kingston, Ontario.

Date: July 17, 1969.

68-E-88

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 35-66-01, Hwy. 417, Vars to Limoges,
District 9 - Ottawa

With reference to the field meeting of June 10th, 1969, I would recommend that W.P. 35-66-08 be cancelled. It is our intention to approach the Ontario Municipal Board with the point of view of closing the road at this location (Twp. of Russell, Lot 15 & 16, Con. 9) and therefore the structure over the freeway will not be required.

Since the foundations conditions are adverse at this location, we feel the road closing will constitute a large savings in expenditures.

A. J. Percy,
for: M. R. Ernesaks,
Regional Functional Planning Engineer

AJP/mjh

c. c. C. R. Robertson
J. E. Gruspier
S. J. Markiewicz
T. C. Kingsland
A. G. Stermac

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

62-F-89

To: Mr. R. Forrest,
Scheduling Expeditor,
Program Office,
Downsview, Ontario.

From: Functional Planning Section,
Kingston, Ontario.

Attention:

Date: July 17, 1969.

Our File Ref.

In reply to

Subject: W.P. 35-66-03, Hwy. 417, Limoges to Casselman,
District 9 - Ottawa

With reference to the field meeting on July 11th, 1969 for the above project and our discussion that date, I would recommend that the following structure work project numbers be cancelled as they are not required on the approved scheme:

1. W.P. 35-66-11
2. W.P. 35-66-12
3. W.P. 35-66-13

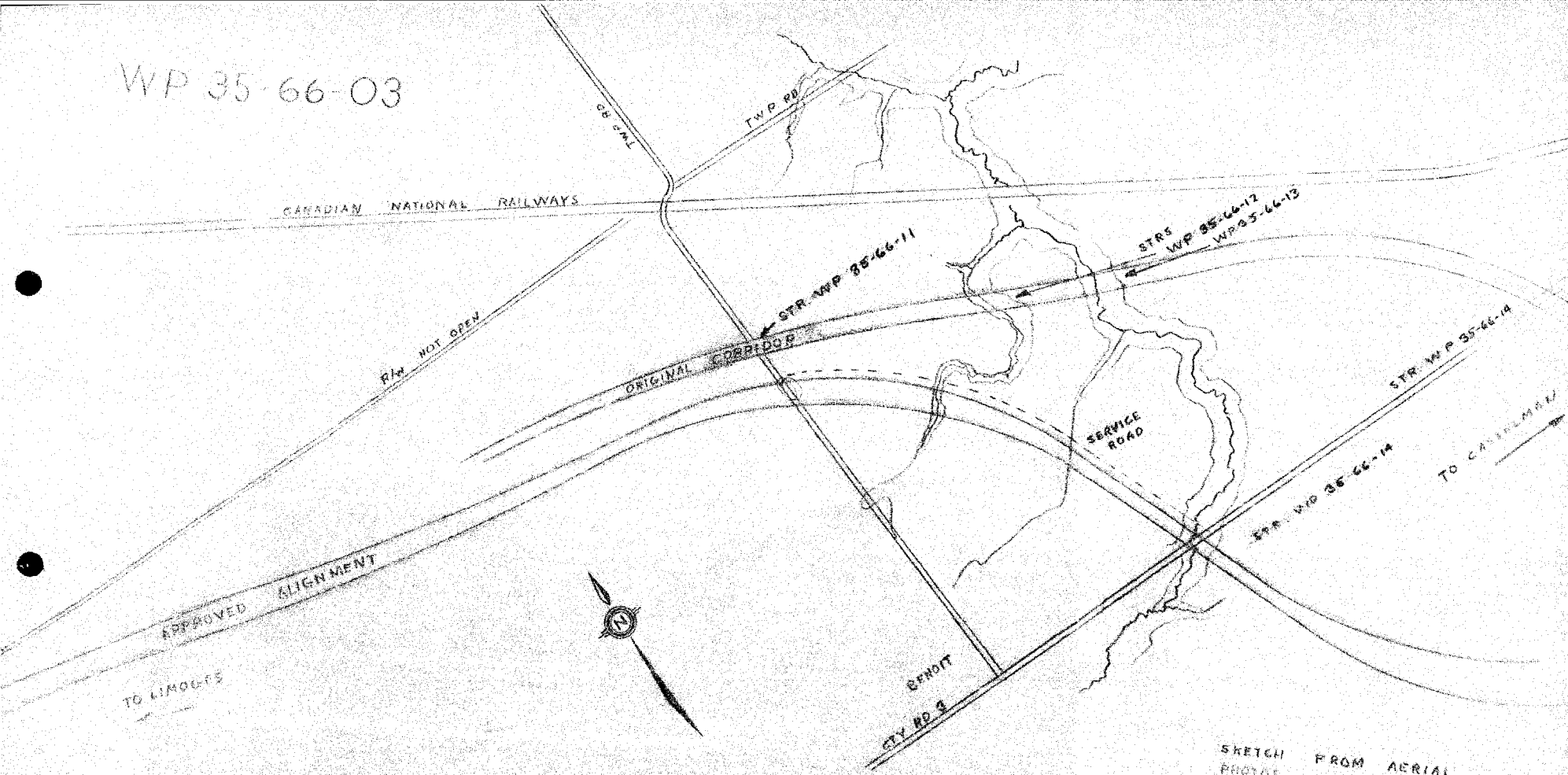
Please refer to the attached sketch.

A. J. Percy,
for: M. R. Ernesaks,
Regional Functional Planning Engineer

AJP/mjh
Att.

c.c. J.E. Gruspier
S.J. Markiewicz
T.C. Kingsland
A.G. Stermac
C.R. Roberston

WP 35-66-03



SKETCH FROM AERIAL PHOTOS

SCALE 1" = 1000'

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

Department of Highways Ontario
Copy for the information of

Mr. K. Westerby,
District Construction Engineer,
District 9, Ottawa.

Materials and Testing Office,
Kingston.

August 19, 1969.

Re: Hwy. 417, Contract No. 69-28,
Ramsayville to 8th Line Road. WP 34-66-1

This will confirm our discussion this morning with your project supervisor, Mr. R. Graham regarding possible "long-term" stability problems at the approaches to the structures at Ramsay Creek and Bearbrook.

Material should not be stockpiled near the top of the creek banks (structure abutments). Vertical walled excavations for the structure abutments should be avoided, or, at most, tolerated only for a minimum length of time.

The following measures are therefore recommended:

(1) Excavate for the granular backfill wedges as soon as possible after the excavation for the abutment footings.

(2) Remove stockpiled material (if any) in the vicinity of the structure abutment excavations.

Should you have any queries regarding the above, please contact this office.

H.A. Meyer,

For: J.A. Cruickshank,
Senior Project Soils Engineer.

HAM/hl

c.c. H.B. McKay
A.G. Stermac
G.A. Wrong

1969 SEP 23 AM 11:40

68-F-88

MX KINR SEPT 23/69 11.25 AM

OTTA A TOC R ROBERTSON DIST ENGR

DOWNA COPIES TO R FORREST PROGRAM SECTION

A G STERMAC FOUNDATION SECTION

KINR COPIES TO S J MARKIEWICZ ROAD DESIGN

A G BOUCHER ENG SURVEYS

J E GRUSPIER MATERIALS AND TESTING

T C KINGSLAND BRIDGE OFFICE

J S TREW TRAFFIC SECTION

L TIMSON PHOTOGRAMMETRY

H ARON REG SVCS MGR

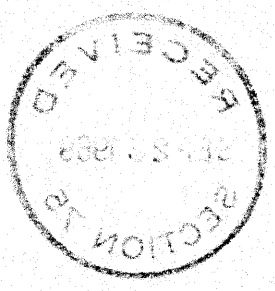
RE WP 35-66-05 AND WP 36-66-01

WE HAVE ONLY RECENTLY HAD THE PROFILE FOR THE ABOVE PROJECTS RETURNED FROMOUR HEAD OFFICE. CONSEQUENTLY WE WILL BE UNABLE TO ISSUETHIS BEFORE THE FIELD MEETING ON THURSDAY SEPT 25TH, 1969.

THE PROFILE WILL BE AVAILABLE FOR PERUSAL IN THE REGIONAL OFFICE BEFORE THE FIELD MEETING, AND WILLBE DISCUSSED DURING THE MEETING.

A J PERCY FUNCTIONAL PLANNING

JM



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68-F-88

OK

MK DOWN MARCH 12/70 10.20 AM PRIORITY

KINR 2 M R ERNESAKS REG FUNCT PLANNING ATT A J PERCY

CC: J TREW, H ARON, S J MARKIEWICZ, T KINGSLAND, J GRUSPIER, L TIMSON

OTTA 2 C R ROBERTSON

DOWN - A STERMAC AND L R EADIE

RE HWY. 417, OTTAWA TO QUEBEC BOUNDARY.

WITH REFERENCE TO YOUR MEMO TO R FORREST DATED DEC. 17/69,
THE STAGING OF THIS HIGHWAY HAS BEEN DISCUSSED WITH MR EADIE AND
MR ADCOCK. THE FIRST SECTION WILL BE OPENED TO TRAFFIC UPON
COMPLETION OF CONSTRUCTION AT THE VARS SIDE RD., AND WILL
CONTINUE TO OPEN AT THE COMPLETION OF EACH SUBSEQUENT CONTRACT.

W G WIGLE PROGRAM ENGR 3551

RB

TELETYPE TELETYPE TELETYPE TELETYPE TELETYPE

ARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

68-F-88

To: Mr. C. R. Robertson,
District Engineer,
Ottawa, Ontario.

From: Functional Planning Section,
Kingston, Ontario.

Attention:

Date: October 20, 1969.

Our File Ref.

In reply to

Subject: W.P. 34-66 to 37-66
Ottawa to Quebec Border
Hwy. 417, District 9-Ottawa

We have arranged to make a presentation of the alignment for the above projects to the various provincial and conservation authorities as listed below:

1.	Mr. W. E. Burton	Chairman, South Nation River Conservation Authority
2.	Mr. G. K. Bain	Supervisor Official Plans Section, Department of Municipal Affairs
3.	Mr. R. M. Christie	District Forester, Department of Lands and Forests
4.	Mr. L. G. South	District Engineer, Ontario Water Resources Commission
5.	Mr. D. C. Miller	Agricultural Representative, Department of Agriculture, Cornwall
6.	Mr. F.J.G. Millette	Agricultural Representative, Department of Agriculture, Rockland
7.	Mr. R. L. Farmer	Agricultural Representative, Department of Agriculture, Plantagenet
8.	Mr. J. Y. Humphries	Agricultural Representative, Department of Agriculture, Alexandria
9.	Mr. N. B. Sinclair	Agricultural Eng. Extension Specialist, Department of Agriculture, Ottawa
10.	Mr. M. Slater	Agricultural Eng. Extension Specialist, Department of Agriculture, Alexandria
11.	Mr. A. W. Chalk	Resources Manager, Department of Energy and Resources, Cornwall
12.	Mr. K. Burton	Chairman, Raisin River Conservation Authority

The time and location will be as follows:

Time - 2:00 p.m., November 19, 1969

Location - Boardrooms 1 and 2 - Kingston Regional Office

.....2

Possibly you or the recipients of copies of this memo wish to be represented. If so, please confirm as early as possible.

A. J. Percy
Project Planning Engineer

AJP/hl

c.c. H. A. Aron
A. G. Boucher
J. E. Gruspier
T. C. Kingsland
S. J. Markiewicz
L. Timson
J. S. Trew

A. G. Sterman

cc: Foundations File (Rm. 110)

Mr. J. L. Forster,
Regional Functional Planning Engineer,
Regional Office,
KINGSTON, Ont.

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

June 13, 1968

..c. 34-68, Hwy. 417, Ramsayville to Vars
-- District No. 9 (Ottawa) --

With reference to your memos of May 22nd and June 10th, but without the information which you had requested on June 3rd from Mr. H. Aron, Regional Services Manager, we herewith submit our comments.

It is estimated that the quantity of water seeping from the surface granular layer into the excavation will be small. This estimate refers to the long-term problem. During construction, depending on the time, somewhat larger quantities could be encountered, but these conditions can very easily be coped with.

The quantity of water from rainfalls and snow melting will be much larger, and it will mainly govern the drainage and pumping facilities.

The above estimates are based on our own understanding of the problem area and, also, on the information gathered from the National Research Council. According to their knowledge, the sand layer is at times devoid of water. However, this information or finding may not apply to all our sites. The location of wells, their depths and water quantities in the vicinity of our structures will certainly shed more light on this problem.

Shortly we will submit our preliminary recommendations regarding the overpass alternatives.

A. J. Stirmac,
PRINCIPAL FOUNDATION ENGINEER

AJS/hdef

cc: Messrs. G. Scott
J. E. Gruspier
C. S. Crabbe
S. J. Markiewicz
S. McCombie
W. Sigle
Foundations Files
Gen. Files

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A.G. Stermac,
Principal Foundation Engineer,
Materials & Testing Division,
Downsview, Ontario.

From: Functional Planning Section,
Kingston, Ontario.

Attention:

Date: April 3/69

Our File Ref.

In reply to

Subject:

Re: W.P. 34-66-16, Site 27-198,
Vars Sideroad Underpass, Hwy.
417, District 9 - Ottawa.

With reference to your memo of March 28th, 1969, attached is a plan showing the four alternative lines for the above structure. Also shown is a profile along the alignment for Scheme 'C'. Since the ground is quite flat in this area this profile should closely approximate the profiles of the other schemes.

It has been suggested by Mr. Scott that the foundation problems appear improved to the east. It may, therefore, be worthwhile doing additional preliminary work in the area where line 'D' crosses the freeway.

I expect to call a meeting of the Hwy. 417 Co-ordinating Committee in the near future and possibly this problem could be discussed in detail at that time.

A.J. Percy,
Project Planning Engineer.

AJP/fl.
Att'd

cc: G. Scott
J.E. Gruspier
B.R. Davis
S.J. Markiewicz
C.R. Robertson
R.J. Forrest

Structure Site #1

68-F-88

The above statements are no doubt correct because the till plain encountered at Structure Site 2 is encountered just east of Structure Site #1. B.T.D.

cc: Foundations Files (Rm. 110)

Mr. A. J. Percy,
Project Planning Engineer,
Functional Planning Section,
KINGSTON, Ontario.

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

March 28, 1969

68-F-88

W.P. 34-66-16, Site 27-198,
Mars Siderosd Underpass,
Highway #17, District 99 (Ottawa).

With reference to your memorandum of March 26, 1969, to Mr. C. Scott regarding the above subject, we wish to make the following comment:

Our investigation has disclosed the presence of a soft layer between 17 and 19 ft. thick underlain by a very competent layer. It would appear that the best solution from both the technical and economic point of view, can be achieved by sub-excavating the soft layer and replacing it with a suitable granular material.

The practicability of such a measure depends mainly on the thickness of the soft layer to be subexcavated and replaced. We would like to emphasize that the investigation we have carried out was of a preliminary nature and, consequently, not enough information is available to make the final decision. All the available evidence indicates that subexcavation is the solution; however, we feel that more information is needed in order to define the precise excavation extent and depth.

A. C. Stermac
PRINCIPAL FOUNDATION ENGINEER

ACS/Mic?

cc: Messrs. G. Scott
B. R. Davis
J. E. Gruspier
S. J. Markiewicz
C. E. Robertson
R. J. Forrest

Foundations Files ✓
Gen. Files

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

68-F-88 ags

To: Mr. G. Scott,
Bridge Location Engineer,
Kingston, Ontario.

From: Functional Planning Section,
Kingston, Ontario.

Attention:

Date: March 26th, 1969

Our File Ref.

In reply to

Subject: W.P. 34-66-16, Site 27-198,
Kars Sideroad Underpass,
Highway #417, District #9, Ottawa

With reference to your memo of March 20th, 1969, and our recent discussion, I understand that the cost estimate of the above structure was based on a desire to limit fills to 15' in height for settlement and stability purposes and therefore resulted in a structure in the order of 760' in length.

From discussion with the Foundation Section, I understand that there is 17' of marine clay at this site which is overlain with 2' of topsoil and underlain by a dense gravel and glacial till.

It would seem that serious consideration should be given to the sub-excavation of this marine clay and backfilling the excavation with select sub-grade material. It may not be necessary to excavate to the bottom of the clay layer.

This procedure should eliminate the settlement and stability problem and result in a substantial saving in the structure cost.

Your comments and those of the recipients of copies of this memo on the above would be appreciated. Perhaps you would wish to reserve comment until you receive the foundation report for this site.

A.J. Percy,
Project Planning Engineer

AJP/mjs
c.c. J.E. Gruspier
A. Stermac
S.J. Markiewicz
R.J. Forrest
C.R. Robertson
B.R. Davis

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. J. L. Forster,
Regional Functional Planning Engineer,
Kingston, Ontario.

From: Bridge Section,
Kingston, Ontario.

Attention: Mr. A. J. Percy

Date: March 20, 1969.

Our File Ref.

In reply to

Subject: W.P. 34-66-16, Site 27-198
Underpass 1.8 Miles West of Vars
Highway 417, District 9

In reply to your letter of March 14, 1969, please be advised that we would estimate the costs of the structures as follows:

Location	Estimated Clear Span over Traffic	Estimated Cost
Crossing 'A' (West)	64 ft.	$ 419,000
Crossing 'B'	62 ft.	415,000
Crossing 'C'	106 ft.	554,000
Crossing 'D' (East)	77 ft.	436,000

Settlements in this area still present a problem. However, conditions appear to be improving towards the east. No allowance has been made for this improvement in these cost estimates.

Gavin Scott

Gavin Scott, P. Eng.
Regional Bridge Location Engineer

GS/hl
c. c.
Mr. B. R. Davis
Mr. W. Lin
Bridge Office Files Section

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. G. Stermac, P. Eng.,
Principal Foundation Engineer,
Laboratory Building,
Downsview, Ontario.

From: Bridge Section,
Kingston, Ontario.

Attention: Mr. M. Devata, P. Eng.

Date: December 23, 1968.

Our File Ref.

In reply to

Subject: W.P. 35-66, 36-66, 37-66 and 38-66, Hwy. 417,
Vars to Quebec Border, District 9

We are sending to you herewith the following 1:50,000 topographic maps on which the Photogrammetry Section have marked the location and log obtained from well drilling records:

1) Russell (West)
2) Russell (East)
3) Alexandria (West)
4) Alexandria (East)
5) Hawkesbury (East)
6) LaChute (West)
7) Vaudreuil (West)

These should prove useful in conjunction with your present investigation of the alignment of the proposed highway.

On our recent visit to the area, the writer noted that the gully at Site #5 was comparatively deep. I believe your boreholes at Sites #3 and #4 are indicating considerable depth of clay and if this is to prove a troublesome area, perhaps we should be considering having the highway approximately one concession farther south.

We suggest that you get in touch with Mr. Jim Percy concerning other possible locations.

Gavin Scott

Gavin Scott, P. Eng.
Regional Bridge Location Engineer

GS/hl
Encls.
c.c. (no encls.)
Mr. J. L. Forster
Attention: Mr. J. Percy

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

68-F-88

To: Mr. L. Forrest,
Scheduling Expeditor,
Program Section,
DOWNSVIEW, Ontario.

From: Functional Planning Section,
KINGSTON, Ontario.

Attention:

Date: December 17, 1969.

Our File Ref.

In reply to

Subject: Highway #417 - District #9 Ottawa - W.P. 34-66 to 37-66

Attached for your information and necessary action is a copy of a memo to file with regard to the meeting held in the District Office on December 15, 1969 at which time the staging for the opening of Highway #417 was discussed.

It would be appreciated if early approval of the recommended staging would be received since it may mean the temporary connection at the Vars sideroad may not be required. As you know some of the property required for the connection belongs to a Mr. Demers who has recently requested a hearing of necessity.

A. J. Percy,
FOR: M. R. Ernesaks,
REGIONAL FUNCTIONAL PLANNING ENGINEER.

AJP/MRE/mac
Att'd.

Copy to - C. R. Robertson
J. Trew
H. Aron
J. E. Gruspier
S. J. Markiewicz
T. Kingsland
A. Stermac
L. Timson

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Memo to File

From: Functional Planning Section, KINGSTON, Ontario.

Attention:

Date: December 17, 1969.

Our File Ref.

In reply to 68 F 88

Subject: Highway #417 - District #9 Ottawa - W.P. 34-66 to 37-66 68-F-91

A meeting was held in the District Office on December 15, 1969 to discuss the opening in stages of the above freeway. Those in attendance were as follows:

Mr. C. R. Robertson
Mr. K. Westerby
Mr. E. Barrie
Mr. J. Trew
Mr. R. Forrest
Mr. A. Laughren
Mr. A. J. Percy

After considerable discussion it was agreed that the freeway should be opened as follows:

STAGE I

The section from the Quebec border westerly 5.8 miles (W.P. 37-66-05) should be opened upon completion as this will cause no maintenance problems and the traffic volumes will be relatively high.

STAGE II

The section from Ramsayville easterly to County Road #7 south of Casselman (W.P. 34-66-01 to W.P. 35-66-03) should be opened as a unit upon completion of W.P. 35-66-04 the follow-up paving project for W.P. 35-66-03. It was felt that due to the low traffic volumes and high annual maintenance costs it was not feasible to open the freeway between Ramsayville and Vars as originally planned.

STAGE III

This would be the section from Casselman easterly to Highway #34 south of Vankleek Hill (W.P. 35-66-05, W.P. 36-66-01 and -03). It was agreed that three work projects could be opened upon completion for this section utilizing the interchange at Hwy. #34 for the temporary connection. The three projects are presently scheduled for completion at the same time.

Cont'd.....

It was also recommended that Highway #138 between Highway #43 and Highway #417 be completed at the same time as W.P. 35-66-05 is completed. This would serve the Ottawa to Cornwall traffic better.

STAGE IV

This would be the section between Highway #34 and Highway #17. This would be the last section opened. It was felt however, that the section of freeway within the City of Ottawa (W.P. 13-69 and W.P. 10-69) should be opened at the same time as Stage IV.

Mr. J. Trew agreed to provide the following traffic assignments for the freeway as soon as possible.

1) It is opened between Ramsayville and Highway #138.

2) It is opened between Ramsayville and Vars.

The meeting then adjourned.

A. J. Percy,
PROJECT PLANNING ENGINEER.

AJP/mac

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

From: Functional Planning Office,
Kingston, Ontario.

Attention:

Date: December 10, 1968.

Our File Ref.

In reply to

Subject: W.P. 35-66 to 37-66, Hwy. 417, Vars to Quebec Border, District 9 - Ottawa

At a meeting on December 3rd, 1968, at this office with Mr. M. Devata and the Regional staff concerning the above projects, it was agreed that preliminary foundation information is required for the structure sites on the recommended corridor. This will assist this section in establishing the final alignment in detail.

Please accept this memo as our request to have the preliminary investigations carried out.

Mr. Devata advised that he would prefer to start the investigation at Vars immediately and proceed eastward to Casselman to complete as much as possible prior to the New Year. We are in agreement with this procedure and would suggest a schedule as follows, which is based on the present construction program.

1st Priority	-	Structure Sites 1 to 8 inclusive – 8 SITES Structure Sites 79, 80 and 81 – 3
2nd Priority	-	Structure Sites 29, 30, 31 & 88 – 4
3rd Priority	-	Structure Sites 82 to 83 inclusive – 2 85 to 87 inclusive – 3 22 to 28 inclusive – 7 + 84 – 1 28 SITES

The site numbers referred to are shown on the mosaic which was forwarded to you on November 14th, 1968 with the exception of Site #88 which is at the intersection of Highway 17 and the County Road at the Quebec Border.

We have arranged to have Engineering Surveys stake out and tie in the structure sites with existing landmarks and establish assumed bench mark elevations for future reference.

W.J. 68-F-88
68-F-89
68-F-90
68-F-89 91

...../2

Mr. W. Hutton of your office was in this office on December 9th, 1968, at which time he was given a mosaic for his reference and introduced to Engineering Surveys staff working on the project.

We trust the above meets with your approval.

A. J. Percy,
For: J. L. Forster,
Regional Functional Planning Engineer.

AJP/mjh
c. c.
S. J. Markiewicz
G. Scott
J. E. Gruspier
A. G. Boucher
L. Timson
H. A. Aron
K. M. Williams

DEPARTMENT OF HIGHWAYS ONTARIO

DESIGN BRANCH – ENGINEERING SURVEYS DIVISION

SURVEY REQUEST

Job Name VARS TO CASSELMAN — Cumberland Russell TWP. CAMBRIDGE

Hwy. No. 417 — District # 1 - OTTAWA — Region KINGSTON

W.P. No. 32-66-1103 — Work Schedule — Priority (If Not a W.P.)

Date DEC 9/68 — Date of Previous Request (If Any)

Req'd. By — Title PROJECT PLANNING ENG — Section FUNCT. PLANNING

Signature

Future Design Standards

Hwy. Class No. — Design Speed — Median Width — R/W Width

Survey Information

Limits of Survey VICINITY VARS & CASSELMAN

Bridge Site Plans Req'd. At

Railway Crossing Plans Req'd. At

Pipe Line Crossing Plans Req'd. At

Instructions (Note Any Special Requirements or Drafting Instructions)

1. START OUT FUTURE STRUCTURE SITES # 1, 2, 3, 4, 5, 6, 7, 8, 9 & 30 FOR PRELIMINARY FOUNDATION INVESTIGATION IN CO-OPERATION WITH FOUNDATION SECTION.
2. TIE IN STRUCTURE SITES TO EXISTING LANDMARKS
3. SET UP ASSUMED BENCHMARKS TO TIE IN SITE ELEVATIONS FOR FUTURE CORRELATION WITH GEODETIC B.M.'S ESTABLISHED.
4. ~~ESTABLISH FOLLOWING INFORMATION FOR HEAD OFFICE~~
   (a) ~~ROUGH PROFILE REPRESENTATIVE OF RIVER CROSSINGS AT SITES # 5, 7, 8 & 30~~
   (b) ~~REFERENCE B.M. ASSUMED AT SITE # 4 WITH SITE # 5~~
   ~~ALSO AT SITE # 6 WITH SITES # 7 & 8~~
5. SITES SHOWN ON ACCOMPANYING AERIAL PHOTOS & MOSAIC

PLEASE RETURN AERIAL PHOTOS AS SOON AS POSSIBLE

(4) Copy

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

December 12/68.

MEMO: TO FILES 68-F-86.
68-F-87.
68-F-88.
68-F-89.

RE PRELIMINARY FOUNDATION INVESTIGATIONS
HWY. # 417 – 28 STRUCTURE SITES.

BECAUSE OF PHYSIOGRAPHIC AND GEOLOGIC SIMILARITIES IT IS RECOMMENDED THAT THE SITES BE SUB-DIVIDED INTO THE FOLLOWING WORK PROJECT Nos.

1/ W.J. 68-F-88 W.P. 35-66 SITES 1 to 8, inclusive
(VARS TO SOUTH NATION RIVER) 79 and 80

2/ W.J. 68-F-89 W.P. 35-66 SITE 81
W.P. 37-66 SITES 82, 83, 84, 85, 86, 87
(SOUTH NATION RIVER EAST TO MC CRIMMON)

3/ W.J. 68-F-90 W.P. 37-66 SITES 22 to 28 inclusive.
(MC CRIMMON EAST TO NEW HWY #17.)

4/ W.J. 68-F-91 W.P. 36-66 SITES 29, 30, 31 and 88.
(ALONG NEW HWY #17 to QUEBEC BORDER)

B.T.D.

Hwy. 417, W.P. 34-66-03 & 34-66-04
Eighth Line Road Easterly to Vars
Side Road, 4.5 Miles
District 9, Ottawa

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. C. J. Markiewicz
Regional Road Design Engineer
Road Design Office, Kingston

From: Materials and Testing Office
Kingston

Date: January 15, 1969

Our File Ref.

In reply to

Subject:

Re: Hwy. 417, W.P. 34-66-03 and 34-66-04
Eighth Line Road Easterly to Vars
Side Road, 4.5 Miles
District 9, Ottawa.

Attached is the Soils Section design report for the abovenoted grading and paving projects of the second of several projects located between Ottawa and the Quebec Border. Prints of the soils profile 417K9-2 are enclosed for your information as well.

This project is very similar to the project reported on earlier to the west with the major difference being that the sand mantle overlying the clay becomes thinner as work progresses from the middle of this job to the east end of the project. The water table throughout this area remains high due to the lack of proper drainage. The gradation of the fine sands overlying the clay becomes finer and the acceptability of the materials for borrow becomes borderline to unacceptable on the basis of some of the samples tested. The field moisture of the clay is generally considerably in excess of its plastic limit. Earth borrow will likely be obtained from the sand mantle overlying the clay in the west half of this project. The material for the east half of the project might also be obtained from the till material located at Vars at a 2 mile average haul distance. Granular material suitable for sand cushion and modified G.B.C. 'A' is located in the esker complex north of Vars at an approximate 8 mile haul distance. Standard G.B.C. Class 'A' would have to be obtained from limestone quarries located at an approximate haul distance of 8 miles to the south-west of the project from which asphalt aggregate might also be acquired.

It is likely that a bituminous stabilized base will be used on this project but consideration will have to be given to the use of the aggregates for this purpose, i.e., whether a Standard C.B.C. 'A' material or a gravelly

Continued /2

material from the Vars area with the P.N. modified to 300 will be used for this purpose. Pavement depths to be placed under the initial paving project are included in the report with the exception of the interchange area for which no D.M. drawings are available as yet.

Should you have any queries as the design work progresses, please contact this office.

J. E. Gruspier
Regional Materials Engineer

JEG:mgm

cc: D. W. Farren
H. A. Tregaskes
T. C. Muir
W. Wigle
C. R. Robertson
G. Scott
M. Stoyanoff
J. L. Forster
Z. L. Katona
C. Fraser
G. A. Wrong
A. G. Stermac

SOILS DESIGN REPORT

Hwy. 417 Eighth Line Road Easterly to Vers Side Road 4.5 Miles

W.P. 34-66-03 and 34-66-04

Proposed Grading, Drainage, Granular Base, Paving, Structure and Approaches Projects

Surveys Profile	Soils Plan and Profile	Station to Station	Line	Township	Surveys Plan
C-56-22	417K9-2 EBL	451+05 to 521+75.92 (521+75.92 = 521+55.04 A'HD)	'B'	Gloucester	B-56-23
C-56-19	417K9-2 EBL	521+55.04 to 580+00		Gloucester	B-56-23
C-57-12	417K9-2 EBL	0+00 to 123+30		Cumberland	B-57-15
C-56-21	417K9-2 WBL	453+65 to 525+41.34 (525+41.34 = 525+63.44 A'HD)	'A'	Gloucester	B-56-23
C-56-20	417K9-2 WBL	525+63.44 to 580+00		Gloucester	B-56-23
C-57-13	417K9-2 WBL	0+00 to 126+00		Cumberland	B-57-15

Profiles for the following are included with that for 417K9-2 (EBL).

Boundary Road	-	15+00	to	50+00
Gravel Road Relocation South	-	0+00	to	19+00
Gravel Road Relocation North	-	0+00	to	13+00
Township Road	-	20+00	to	46+00
Proposed Temporary Connection East	-	0+00	to	42+10
Proposed Temporary Connection West	-	0+00	to	5+36

An approved profile for relocated Ninth Line Road has not as yet been received by this section.

GENERAL DATA

The structure and interchange at Boundary Road is presently scheduled with the grading project (W.P. 34-66-03). Placement of

Continued /2

the approach fills under the grading project is advantageous, however, the Foundation Section and the Bridge Office may recommend that the structure be delayed until the follow up paving project (W.P. 34-66-04).

Since details of the interchange are not yet available, no recommendations have been made in the report regarding granular requirements on the interchange legs and paving in the interchange area.

When information becomes available, with regard to the use of paved shoulders and/or curb and gutter in this area, additional recommendations will be made as required.

PHYSIOGRAPHY AND SOILS DATA

This project traverses the Prescott and Russell Sand Plain. A sand mantle varying in thickness from 15 feet at Eighth Line Road to practically nil at the east end of the project overlies silty clay, known locally as "Leda Clay". The water table remains high in the sand mantle due to the lack of substantial drainage channels.

Typical gradations for the sand mantle are attached. This material is classified as a uniformly graded silty fine sand.

The Atterberg limits of the silty clay immediately below the sand are typically as follows:

L.L.	-	44.9
P.L.	-	19.3
P.I.	-	25.6
Field Moisture Content	-	37.9

Continued /3

INVESTIGATION

A soils investigation was carried out in the spring and summer of 1968. A truck mounted power auger was used as much as possible to recover samples of the sand mantle and underlying clay. Hand auger borings were placed in inaccessible areas, wet areas and at culvert sites. Vane tests were carried out at three culvert sites.

EARTH BORROW

The most likely source of earth borrow for this project is the sand mantle overlying the silty clay in the west half of the project. It will be noted from the typical gradations of the silty sand that some of the samples are borderline to unacceptable due to very fine sand and silt content. Since the gradeline is generally set for approximately 5' of fill, it is felt that some borrow material of borderline frost susceptibility could be used. This material can be readily excavated although compaction in fills may be difficult to maintain during and after placing. It is expected that the depth of excavation in borrow pits will be limited to about 4' due to the high water table. Some of the borrow areas may require clearing and grubbing. An average haul distance of 1 mile should be assumed for the westerly half of the project and 2 miles for the easterly half of the project.

The alternative source of earth borrow is the till area at Vars. This material is a silty sand to sandy clay till at an average haul distance of 2 miles for the easterly half of the project.

Continued /4

We have been advised by Road Design Office that a Special Provision will be included which will not permit borrow pits within 1000' of the right-of-way to avoid unsightly pits close to the right-of-way.

GRANULAR MATERIALS

The esker complex north of Vars contains large quantities of fine sand to coarse granular which would be suitable for use as Sand Cushion, modified G.B.C. Class 'B' and modified G.B.C. Class 'A' for use in cement treated base. This material is generally unsuitable for use as Standard G.B.C. Class 'A' and 'B' due to poor stone quality.

Standard G.B.C. Class 'A' would likely be acquired from limestone quarries approximately 8 miles south-west of the project. It is expected that asphalt aggregate will also be acquired from these limestone quarries.

The haul distance for all these materials is approximately 8 miles.

GRADELINE

The gradeline for Hwy. 417 and Boundary Road has been set by Functional Planning.

If Boundary Road is reconstructed by the County beyond the limits of this project, a granular lift of approximately 12" would likely be placed. It is suggested that the gradeline for the section within this project be set accordingly.

Continued / 5

Gradelines for the connections and the relocated township roads at the east end of the project have not been provided by Functional Planning on the profiles issued to this section. Since it is expected that all of these gradelines will be in 3' - 4' fill, revisions will not likely be recommended by this section.

RECOMMENDATIONS AND CONSTRUCTION FEATURES

1.1 Type of Granular Materials

It is recommended that the base course for the through lanes of Hwy. 417 and the speed change lanes up to the bullnose, consist of bituminous stabilized G.B.C. Class 'A'. All other base course materials should consist of plain G.B.C. Class 'A'. The sub-base material on Hwy. 417 (portion with stabilized base) should consist of G.B.C. Class 'A', to tie down the underlying sandy subgrade rior to placing of the stabilized base. All other sub-base material should consist of Sand Cushion.

1.2 Depth and Width of Granular Materials

It is recommended that all granular materials be placed full width except for the bituminous stabilized base which should be placed one foot wider on both sides than the proposed pavement width on Hwy. 417.

The depths should be as follows:

(i) Hwy. 417 and Speed Change Lanes Up To The Bullnose
6" bituminous stabilized base over 3" plain G.B.C. Class 'A'. Shoulders to be constructed using plain G.B.C. Class 'A'.

Continued /6

(ii) Connections, Intersecting Roads and Service Roads

6" G.B.C. Class 'A' over 9" Sand Cushion.

(iii) Turn-abouts, Detours and Other Minor Roads To Remain With A Loose-Top Surface

6" G.B.C. Class 'A' over 6" Sand Cushion.

1.3 Backfill To Structures and Culverts

It is recommended that the backfill to culverts within the zone of frost penetration, and to structures, consist of Sand Cushion.

2.1 Stockpiling Of Materials

A Special Provision should be inserted in the contract documents to limit the height of stockpiled material, due to the underlying weak clays along the project.

Stockpiles of topsoil, etc., may have very steep slopes and the critical height may be quite low. The safe heights may be interpolated from the foundation investigation reports for the closest structure sites. It is suggested that this office or the Foundation Section be advised before any stockpiles are commenced within the right-of-way limits.

2.2 Placing Of High Fills

It is recommended that a Special Provision be inserted to require the contractor to place all fills over 8' high as one of the initial operations so that as much settlement as possible can be attained before follow up paving.

It is suggested that these higher fills be completed within 10 weeks of the awarding of the contract.

Continued /7

3.1 Pavement Depths

The ultimate asphalt pavement depth intended for Hwy. 417 is 6". Stage paving as outlined in the preliminary pavement design report for W.P. 34-66-02 is also recommended for W.P. 34-66-04.

The asphalt pavement to be placed under the initial paving project should be as follows:

(a) Stage Paving On Hwy. 417 and Speed Change Lanes Up To The Bullnose (no curb and gutter)

Binder Course	- H.L.8	-	2"
Surface Course	- H.L.4	-	1¼"
	Total		3¼"

(b) Connections On Hwy. 417 And Intersecting Roads With Curb and Gutter

Binder Course	- H.L.8	-	2"
Surface Course	- H.L.4	-	1¼"
	Total		3¼"

(c) Intersecting Roads Without Curb and Gutter

Surface Course Only	- H.L.4	-	2"

It is recommended that the placement of curb and gutter on intersecting roads be deferred where possible until the second phase of paving, when additional asphalt will be placed on Hwy. 417 and on intersecting roads where necessary.

Continued /8

4.1 Culvert Types and Foundation Conditions

The conditions at most culvert locations are compact silty sand over soft to firm silty clay. It is recommended that culverts at all these locations be C.S.P. or box-type concrete.

If the invert of C.S.P's or the bottom of the slab of box-type concrete culverts is above the clay stratum within the sand, no special bedding treatment is required. If the culvert is in clay excavation, provision should be made for an 18" thick sand pad as a working platform in order to protect the sensitive underlying clay from disturbance during construction.

5.1 Transition Point Treatment

It is recommended that all transitions be treated to a depth of 3' except on roads which are to remain with a loose top, where slight differential performance can be tolerated. The total depth 't' of soil horizons should be assumed to be 24" for estimating purposes.

A few sand knolls are located along the proposed alignment of the westbound and eastbound lanes. These are generally about 100' long. Rather than applying transition transition treatments to these sand knolls, it is felt that it would be more feasible to excavate them to 3' and backfill them to normal subgrade level (9" below profile grade) with the sandy earth fill which is anticipated for the adjacent fills.

Continued /9

5.2 Treatment Of Intersecting Road Fills

Existing side road fills are compacted to a higher degree than the adjacent ground. It is recommended that side road fills which are crossed by Hwy. 417 be excavated as shown on the soils profile in order that they can be backfilled with earth fill as the adjacent fills are placed and therefore produce more uniform performance.

6.1 Compaction Equipment

The following distribution of time is recommended:

Wobble Wheel Rollers	-	75%
Sheepsfoot Rollers	-	25%

7.1 Ditching In Advance Of Cut Excavations

Attention is drawn to the moisture conditions of the cuts on both the E.B.L. and W.B.L. at Eighth Line Road. Ditching to a minimum depth of 4.5' below profile grade in the sand cut is recommended. All ditches through these cuts should be excavated well in advance of the remainder of the excavation to provide better moisture conditions for final trimming and shaping of the cuts.

PREPARED BY:

H. A. Meyer
Project Soils Engineer

REVIEWED BY:

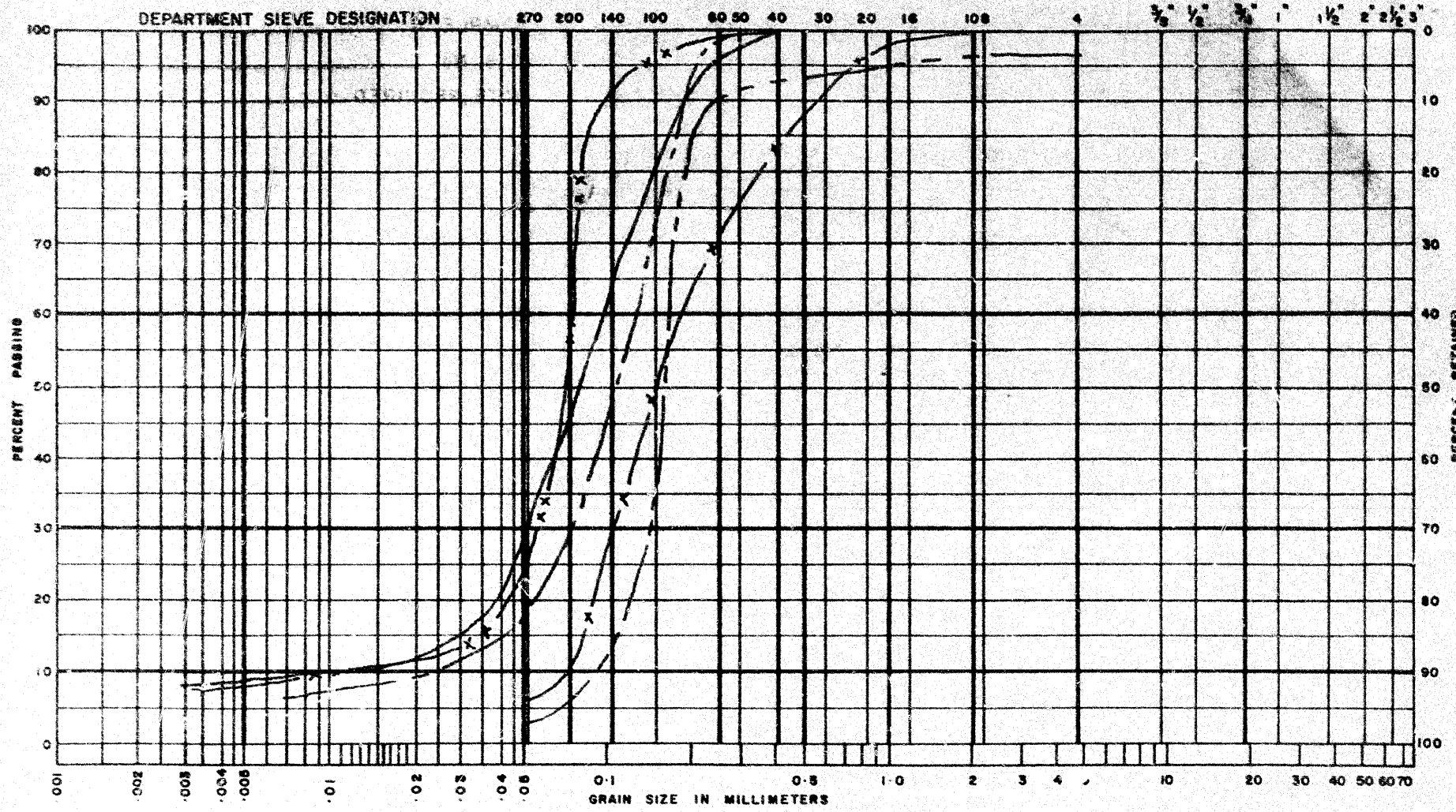
J. A. Cruickshank
Senior Project Soils Engineer

January 14, 1969

HAM:mgm

U. S. BUREAU OF SOILS CLASSIFICATION

Clay	Silt	Very Fine Sand	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Gravel



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse

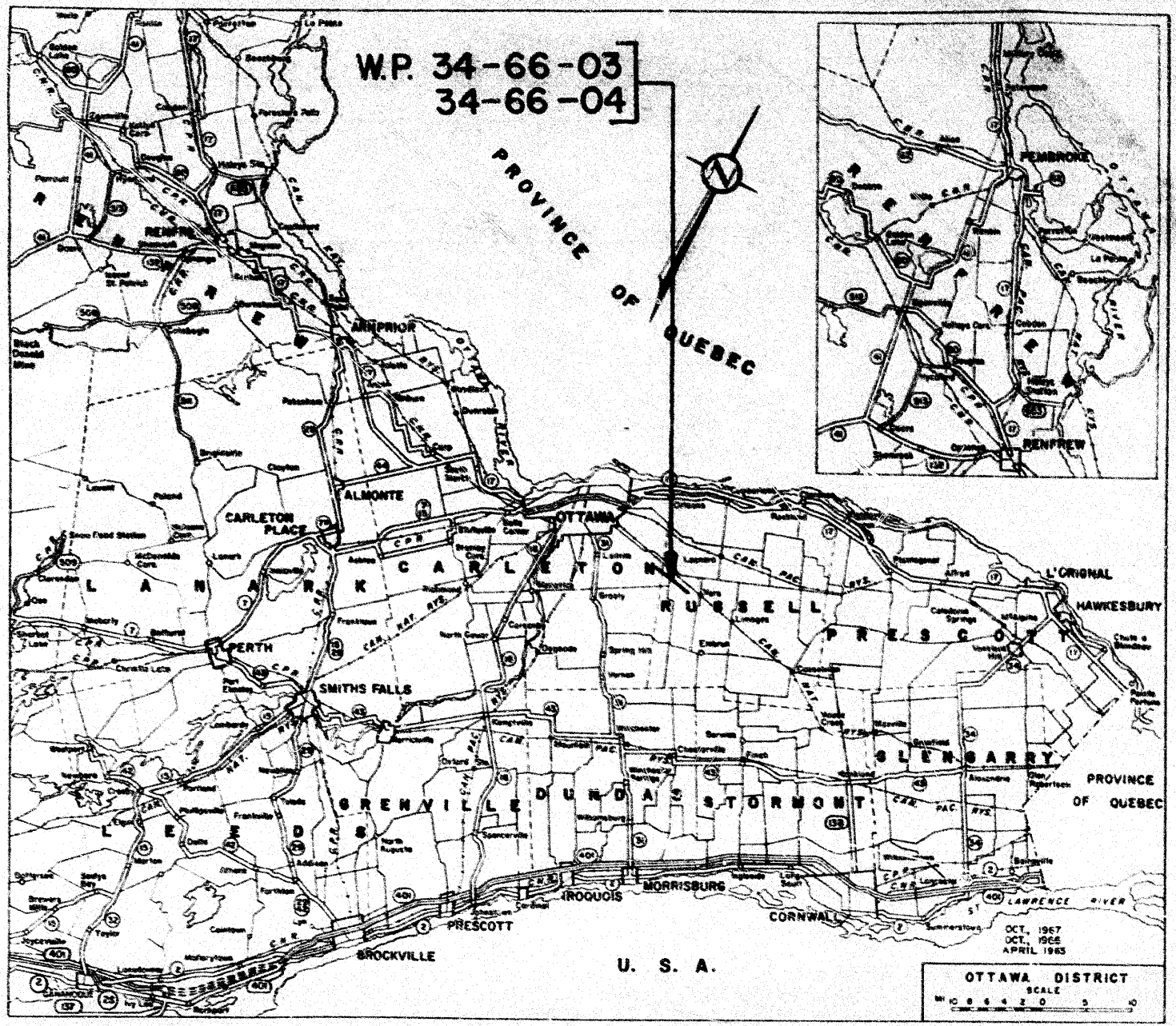
UNIFIED SOIL CLASSIFICATION SYSTEM

REMARKS Typical Gradations of Silty Sand

DATE

W.P. 34-6-03

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT


W.P. 34-66-03
34-66-04
PROVINCE OF QUEBEC
PEMBROKE
RENFREW
ARNPRIOR
ALMONTE
CARLETON PLACE
OTTAWA
L'ORIGNAL
HAWKESBURY
PERTH
SMITHS FALLS
PRESCOTT
RUSSELL
GLENGARRY
PROVINCE OF QUEBEC
IROQUOIS
MORRISBURG
CORNWALL
BROCKVILLE
U. S. A.
OCT., 1967
OCT., 1966
APRIL 1965
OTTAWA DISTRICT
SCALE

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

WJ 68-F-880

To: Mr. A.G. Stermac,
Principal Foundation Engineer,
Materials and Testing Office.

From: Materials and Testing Office,
Kingston.

Attention: Mr. M. Devata

Date: November 18, 1969.

Our File Ref.

In reply to

Subject:

Re: Hwy. 417,
W.P. 34-66-03, W.P. 35-66-01
Vicinity of Vars
District of Ottawa

Attached are portions of the soils profiles for these projects at two culvert sites.

You will note that approximately 10' of fill is proposed at each of these sites.

It is requested that you provide us with an estimate of the settlement due to consolidation at these two culvert sites based on any relevant information you may have at adjacent structure sites.

H.A. Meyer

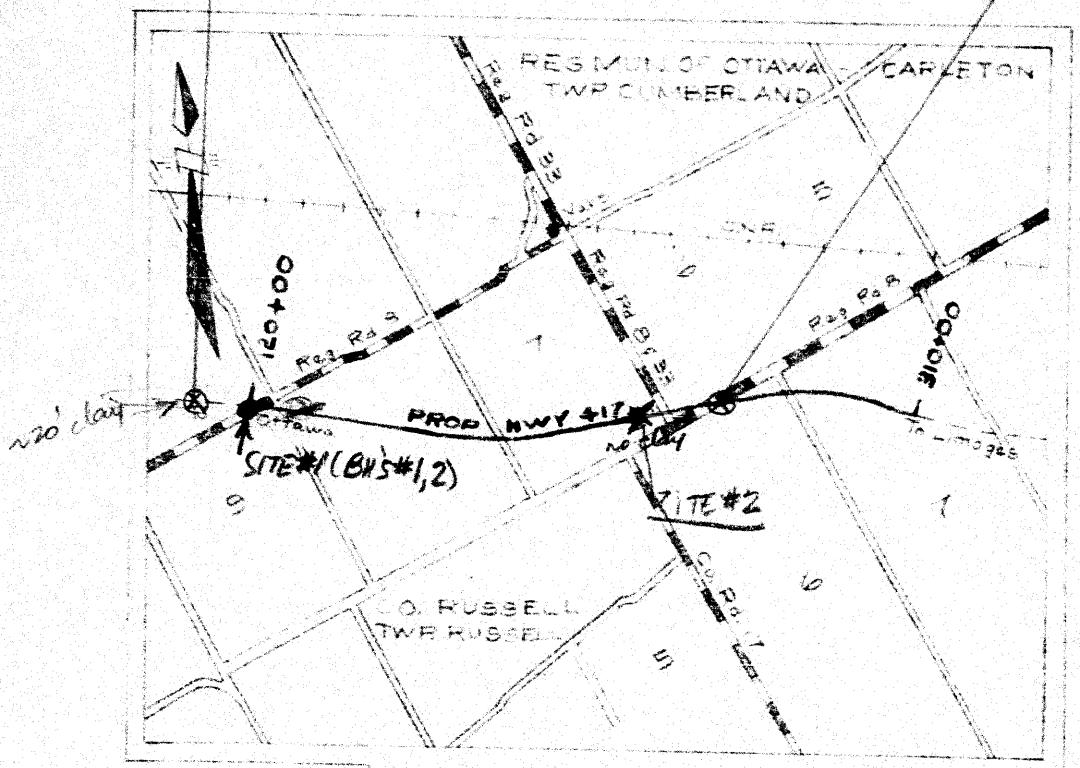
for: J.E. Gruspier,
Regional Materials Engineer.

HAM/pdc

cc: Mr. G.A. Wrong

Site No. 1

Site No. 2



KEY PLAN
SCALE - 1 IN. = 1 MI.

68-F-88

1969 NOV 20 PM 4:13

K

KINR DOWN 6 NOV 20/69 4.0 P VR

J E GRUSPIER REG MAT ENGR

ATTN M A MEYER

RE HWY 417 WP34-66-03 AND WP35-66-01 VICINITY OF VARS DISTRICT 9

OTTAWA

WJ68-F-88

FURTHER TO YOUR MEMO OF NOV 18/69 WITH REGARD TO ESTIMATED CONSOLIDATION SETTLEMENTS OUR ESTIMATED VALUES ARE AS FOLLOWS

SITE NO.1 FILLS UP TO 10 FT SETTLEMENTS 12 INCHES

SITE NO.2 FILLS UP TO 10 FT SETTLEMENTS 6 INCHES

M DEVADA SUPNG FOUNDATION ENGR

FOR A J STERMAC PNCPL FOUNDATION ENGR

M & T OFFICE

AW

31 G-41
GEOCRES No.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

WJ 68-F-8880

To: Mr. A.G. Stermac,
Principal Foundation Engineer,
Materials and Testing Office.

From: Materials and Testing Office,
Kingston.

Attention: Mr. M. Devata

Date: November 18, 1969.

Our File Ref.

In reply to

Subject:

Re: Hwy. 417,
W.P. 34-66-03, W.P. 35-66-01
Vicinity of Vars
District of Ottawa

Attached are portions of the soils profiles for these projects at two culvert sites.

You will note that approximately 10' of fill is proposed at each of these sites.

It is requested that you provide us with an estimate of the settlement due to consolidation at these two culvert sites based on any relevant information you may have at adjacent structure sites.

H.A. Meyer

for: J.E. Gruspier,
Regional Materials Engineer.

HAM/pdc

cc: Mr. G.A. Wrong

31 G - 41
GEOCRES No.

68-F-88

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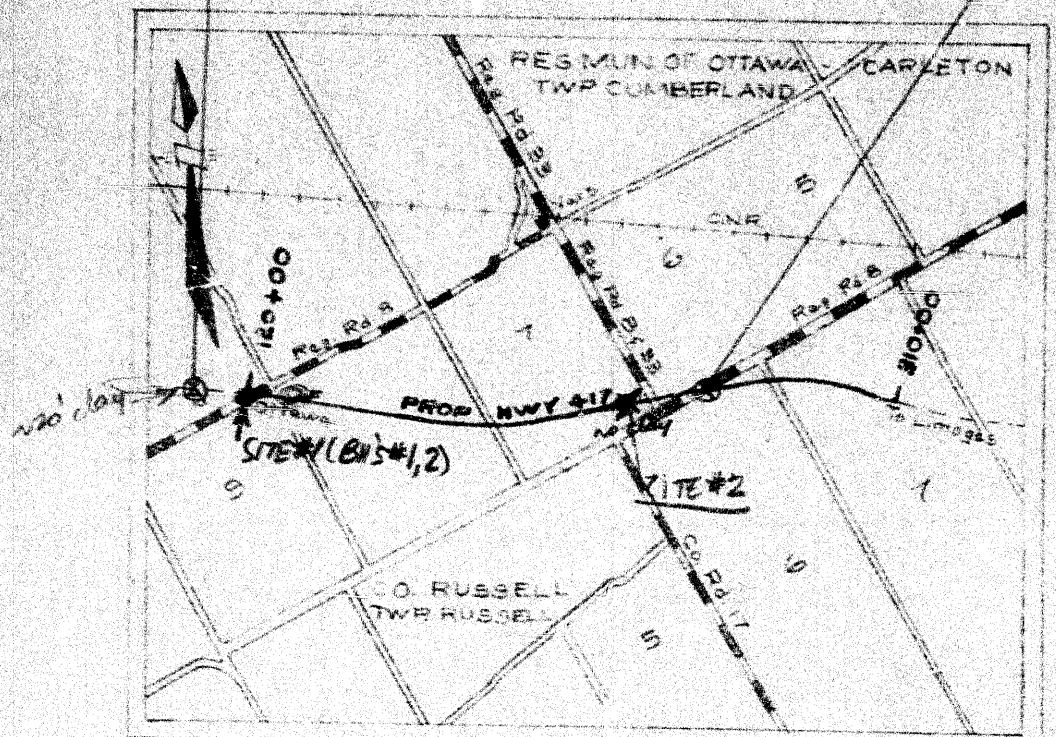
31 G-41
GEOCRES No.

Site No. 1

Site No. 2



KEY PLAN
SCALE - 1 IN. = 1 MI.