

Foundations
S w y . 401 & Keele St
Downsview, Ontario.

Materials & Testing Division

April 4, 1966.

Mr. R. C. Fraser,
County Engineer,
County of Wentworth,
Court House,
Hamilton, Ontario.

65-T-128 R

Subject - Slope Indicator Installation - New Mountain Road
- County Suburban Road No. 25.

Following our installation of two slope indicators at the above-mentioned site and the subsequent readings taken over a number of weeks we are now in a position to inform you of the following:-

Lateral earth movements of magnitude 2.5-3.5 inches have been recorded in the slope indicators during the period March 2nd to March 29th '66. The maximum movement occurred in a zone some 20-25 feet below ground surface. It has also been reported that a 4 1/2-inch lateral movement of the T.H. & S Hwy. track took place or was observed on March 22nd. This displacement was immediately corrected but on March 24th a further movement of 2 inches took place.

It is believed that the above observations show that a potentially dangerous condition exists at this site and therefore remedial measures should be carried out with the utmost expediency. Whilst it cannot be concluded with certainty that the road fill is the sole cause of the slope movements and the escarpment itself is not inherently unstable it must be assumed that the fill is a definite contributing factor and that removal of the latter can have only beneficial effects.

Based on the foregoing our recommendations are as follows:-

(1) The road should be realigned so as to be founded entirely on bedrock over the whole length of the affected zone.

(2) All fill material already existing on the escarpment side should be removed, and sufficient levelling and grading carried out to ensure adequate drainage of surface water.

Enclosed is Drawing #65-F-128A which shows the locations and elevations of the slope indicators and the soil stratigraphy at a section through Sta. 20+50 and Drawing 65-F-128B which shows a graphical representation of the earth movements recorded in the slope indicators.

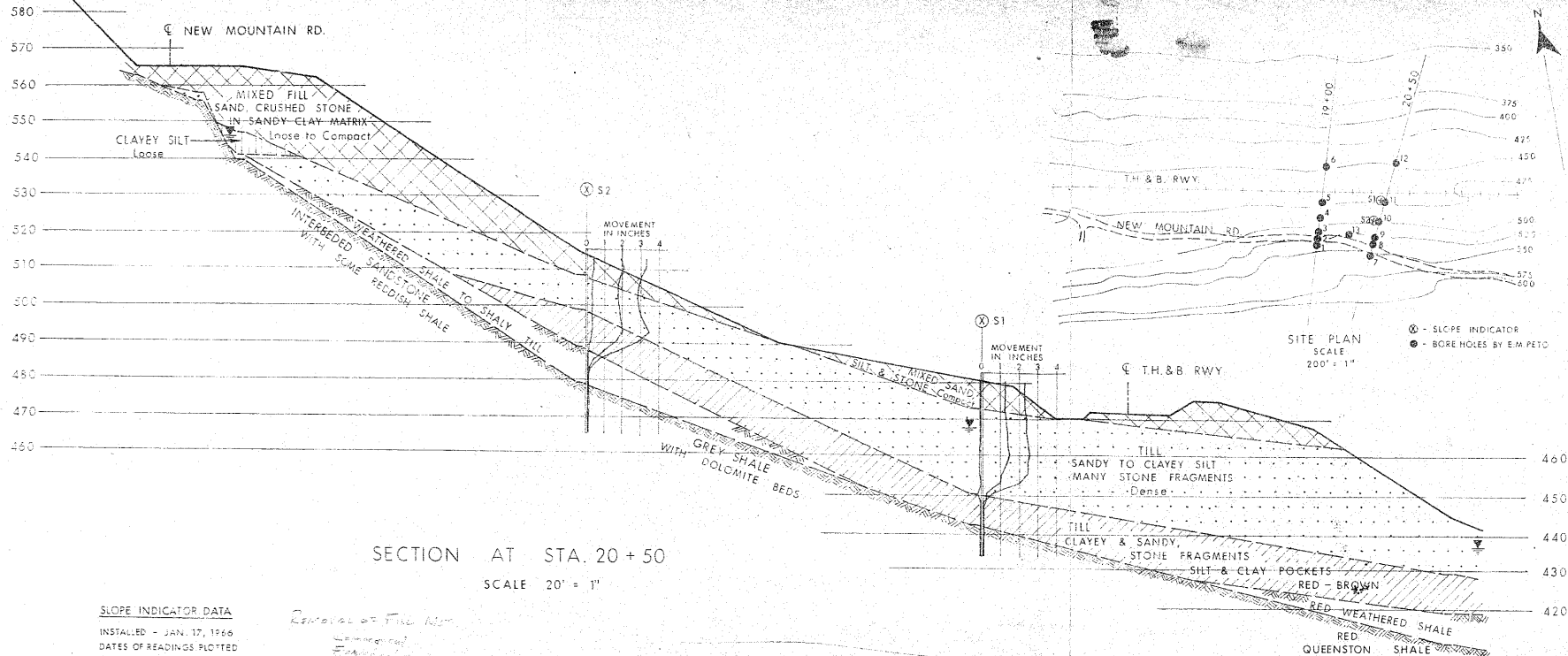
We will continue to read the slope indicators and from time to time report our observations to you.

If you have any further queries relating to this project please do not hesitate to contact this Office.

Enclosure
KGS/tt

K. G. Selby
K. G. Selby
Senior Foundation Engineer

For: A. G. Sternac
Principal Foundation Engineer



SLOPE INDICATOR DATA

INSTALLED - JAN. 17, 1966
 DATES OF READINGS PLOTTED
 MARCH 2, 22 & 29, 1966

REMOVAL OF FILL NOT

REMOVED

REMOVAL OF FILL NOT

REMOVED

NOTE: SECTION & SOIL DESCRIPTION
 TAKEN FROM E.M. PETO DRAWING.
 REPORT NO 65188 FEB. 3, 1966



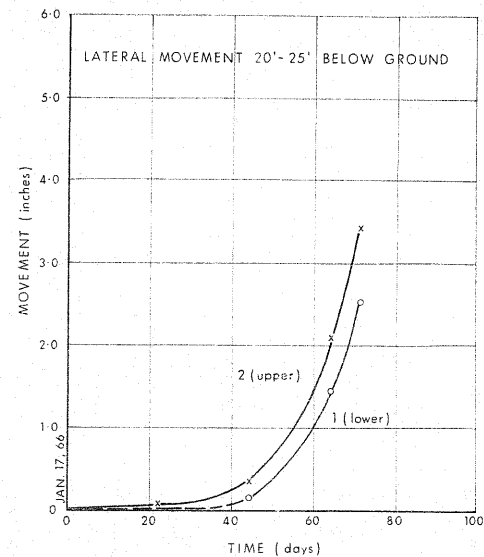
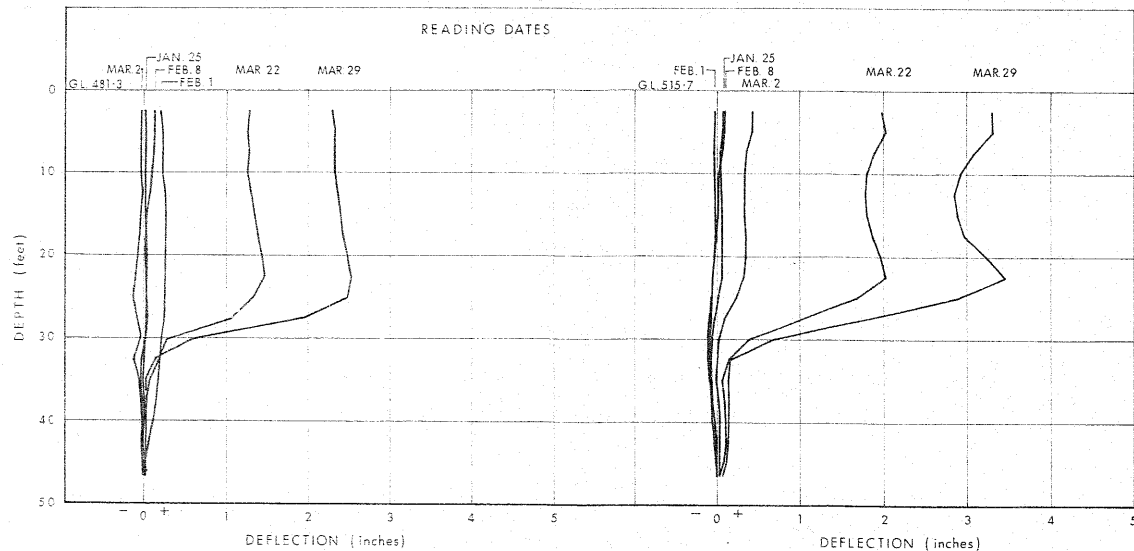
DEPARTMENT OF HIGHWAYS
 MATERIALS and
 TESTING
 DIVISION

NEW MOUNTAIN ROAD - STONEY CREEK
 SLOPE INDICATOR LOCATIONS
 SUB - SOIL STRATIGRAPHY

DATE 1 APR. 1966

APPROVED

DRAWING NO. 65-F-128A



DATE APRIL 4, 1966

APPROVED *[Signature]*

DRAWING NO. 65-F-128B

NEW MOUNTAIN ROAD - STONEY CREEK
EARTH MOVEMENTS RECORDED
BY SLOPE INDICATOR

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 65188

1287 caledonia road,

TORONTO 19, ONTARIO

Telephone: 788-1126

February 3, 1966

County of Wentworth,
County Engineer's Office,
Court House,
Hamilton, Ontario.

Attention: Mr. R.C. Fraser,
County Engineer

Gentlemen:

Re: New Mountain Road
Stoney Creek, Ontario

We submit herewith our report of the slope stability investigation performed on this site under authority of your letter dated the 9th June 1965.

The soil conditions arising over this site consist broadly of a deposit of granular fill on a partial rock shelf, with the fill spilling down the slope in order to provide the full road width required. The fill is generally compact to loose with depth, particularly on the northern shoulder where the thickness exceeds 10 ft. Along the inner or southern edge, the road is resting on bedrock whilst the northern edge is resting partly on till, and partly on a random deposit of soft, slightly organic, clayey silt to silty clay, as well as weathered shale and bedrock. Below the fill and down the slope, the overburden consists essentially of various till layers, as well as a zone of mixed till and talus material in the vicinity of the rail tracks. The main features of the till layers are the heterogeneous, over-consolidated, dense and stony or bouldery characteristics.

The water table below the fill zones supporting the road appears to follow the interface between the overburden and the bedrock, whilst further downhill it was established at depths of between 3 ft. and 25 ft. below grade depending on location.

The report analyzes the stability conditions below the road fill and the overall slope, but does not consider the stability problems arising at the railway alignment. From these analyses, the report concludes that the placing of the fill on the existing slope has tended to decrease the factor of safety of the slope to some extent but not critically; however, the road fill itself, because of the configuration of the ground is in itself unstable.

Furthermore, it appears that the failures that have taken place in the road fill do not affect the railway line directly, however, the continual loading of the slope is a practice which is not recommended since such action leads to eventual unbalance of the existing restraining forces, which are subject to change from natural causes.

The existing slope has been instrumented on the section passing through chainage 20+50, and no sign of movement is indicated by the readings available to date. Nevertheless, it must be pointed out that sufficient information is not, as yet, available to enable a definite conclusion to be drawn regarding the movement of the slope.

Certain remedial measures are discussed and all have certain disadvantages, many of which are common to each of the schemes presented; however, scheme A, which involves cutting back into the bedrock and placing the road completely on a rock shelf is favoured in preference to the other alternatives, since this scheme is easier to drain and has the advantage of removing any surcharge from the existing fill overburden.

County of Wentworth

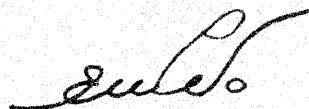
-3-

Whichever scheme is finally adopted, further exploratory work is recommended in order to define more accurately the interface profile between the bedrock and/or the till along the length of the road proposed for reconstruction.

We believe the report to be complete within your terms of reference, however, we shall be pleased to discuss any points you may wish to raise.

Yours very truly,

E.M. PETO ASSOCIATES LTD.,

A handwritten signature in dark ink, appearing to read 'E.M. Peto', with a stylized flourish at the end.

E.M. Peto, P.Eng.

CFF/hf

E. M. PETO ASSOCIATES LIMITED

STABILITY INVESTIGATION

For

NEW MOUNTAIN ROAD
STONEY CREEK, ONTARIO.

For

COUNTY OF WENTWORTH

Distribution

5cc. Client
1cc. File

Job Number: 65188

February, 1966

TABLE OF CONTENTS

	<u>PAGE NO.</u>
1. INTRODUCTION	1
2. GENERAL	1
3. THE SITE	3
4. SOIL CONDITIONS	4
5. GROUND WATER	8
6. OBSERVATIONS	9
7. STABILITY ANALYSES	11
8. INSTRUMENTATION	13
9. CONCLUSIONS	13
10. REMEDIAL MEASURES	14

APPENDIX A	Correspondence referred to:
APPENDIX B	Site Photographs
TABLE A	Summary of Soil Properties

Mechanical Analyses

FIG. 1	Fill layer (1)
FIG. 2	Till & Talus Matrix (2)
FIG. 3	Till - Sandy Clay - Clayey Silt (3)
FIG. 4	Till - Clayey Silt (4)
FIG. 5	Piezometric Levels versus Time & Rainfall

Consolidated Undrained Triaxial Tests with Pore Water Pressure Measurements

FIG. 6	Borehole 6, Sample 8 - 25'-26'6"
FIG. 7	Borehole 12, Sample 8 - 25'-26'4"

Stability Analyses

In terms of total stress

FIG. 8	Location of critical failure circle for upper slope Ch. 19+00
FIG. 10	Stability Analysis of the Total Slope Along Ch. 19+00

TABLE OF CONTENTS - cont'd.

-2-

In terms of effective stress

FIG. 9 Effective Stress Stability Analysis for
Critical Circle in the Upper Slope (Ch. 19+00)

FIG. 11 Contour Lines of Factors of Safety For
Upper Slope (CH. 20+50)

FIG. 12 Diagrammatic Outline of Remedial Measures

BOREHOLE LOGS

FIG. 13 SITE PLAN AND PROFILES

1. INTRODUCTION

The work described in this report was authorized verbally by Mr. R.C. Fraser, County Road Engineer for the County of Wentworth in June 1965, and confirmed subsequently by letter dated 9 June 1965.

The New Mountain Road leads southwards, from King Street in Stoney Creek, passing below the T.H. and B Railway, which is carried by a small bridge at this point, and then swings almost east to climb the remainder of the escarpment to join the Scenic Route which runs east and west along the cuesta which overlooks the Town of Stoney Creek. A section of the New Mountain Road to the south of the T.H. and B Railway had been a source of trouble over a period of years because of continuing failures arising below the north shoulder of the road. The investigation reported herein was required to determine the cause of these failures and to make recommendations in respect of remedial work necessary to overcome the instability.

2. GENERAL

The section of the New Mountain Road shown on Figure 13 and lying between chainage 21+50 approximately and chainage 16+00 approximately was a continuing source of instability requiring sustained maintenance, and major repair work usually following the spring thaw period. At one stage a serious effort had been made to excavate the fill down to bedrock in an attempt to stabilize the troublesome area with granular material; despite this work, the instability persisted, and resulted in continually increasing the amounts of material being dumped on the slope, thereby increasing the surcharge as time went on.

Apart from a local inconvenience and a recurring maintenance expense, this situation continued and was accepted until the spring of 1965 when in addition to the failure of the road, a separate failure, involving the T.H. and B track took place, in an area more or less north of that part of the road which had manifested unstable conditions. Exact details of the failure arising on the railroad are not known to us since at the time this company was retained for this work the railway authority had restored the track to its former working condition (but subject to a slow order); however, it is understood that the track was subject to lateral movement in a southerly direction amounting to some 12 to 15 inches.

2. GENERAL - cont'd.

-2-

We understand some lateral movement had occurred previously usually during the spring thaw period, and because of this, careful and vigilant inspection was carried out by the Road Master throughout the year, but more especially during the season referred to. It is understood that during the spring thaw period of 1965 the trackage, in addition to moving laterally, also heaved up some few inches in an area little more than 10 to 15 ft. in diameter. This more serious disturbance of the railroad led the Railway to advise formally, the Suburban Road Commission that it would hold them responsible for subsequent failures of the track if the unstable conditions arising on the New Mountain Road at the general location shown on Figure 13 were not restored on a permanent basis.

On the 20th October 1965 a meeting with the Suburban Roads Commission was held in the County Courthouse. At that time the findings arising from the investigation to that date on New Mountain Road, were presented to the members. A letter dated 21st October 1965 confirming the points discussed is included in the Appendix.

On the 12th November 1965 a meeting was held with Mr. Fraser, on the site to discuss certain aspects of the proposal to widen the road by excavating to the south into the bedrock and thereby placing the road completely on a rock shelf. A copy of our letter dated the 15th November 1965 is also included in the Appendix A, which confirmed the site discussion.

A further meeting was held on the site on the 18th November 1965, attended by Department of Highways Engineers, and it was agreed, at that time, to instrument the slope by the installation of slope indicators. Since E.M. Peto Associates Ltd. did not have equipment available at short notice to prepare the holes for the insertion of the slope indicators, this work was performed by others, under direction of the Foundations Section of the Department of Highways, Ontario.

2. GENERAL - cont'd.

-3-

The object of this instrumentation was to ascertain whether long term creep was taking place, an aspect of the problem arising on this site, which could not be covered by the soil investigation. An advantage arising from the installation of these slope indicators was that it would satisfactorily establish whether movement was taking place in a downhill direction. In the event the instrumentation established that no movement was taking place, especially during the spring thaw period, it was felt this would demonstrate fairly conclusively that instability of the road above had not been the cause of the problems arising on the railroad.

On the 22nd November 1965 a telephone discussion was held with the County Road Engineer in connection with the various methods of reopening the New Mountain Road. A copy of this letter, dated 23rd November 1965, is also included in the Appendix.

The field work for the soil investigation consisted of driving two lines of testholes shown on Figure 13 at chainage 19+00 and 20+50. The testholes were put down by means of a standard diamond drilling rig adapted for soils sampling, the testholes being lined in BX casing as necessary; each testhole being cored into the bedrock using a BX core barrel.

Subsequently, piezometer tubes were installed in all the testholes, except Nos. 1,2,7,8 and 13 which were located approximately in the ditch line and on the centre line of the road.

3. THE SITE

The New Mountain Road connects Highway 8 in Stoney Creek with the Scenic Route which runs east and west along the top of the Niagara escarpment overlooking the Town of Stoney Creek. Shortly after leaving King Street (Highway 8), in Stoney Creek, in a southeasterly direction the New Mountain Road starts to rise over the lower slopes of the Niagara escarpment; approximately half way up corresponding to

3. THE SITE - cont'd.

-4-

elevation \pm 460, the road passes under the T.H. and B Railway and swings eastward to traverse the remainder of the escarpment slope before reaching the high ground at elevation 620 approximately.

The section under investigation lies just below the brow of the escarpment and is shown on Figure 13 as lying between chainage 21+50 and chainage 16+00 approximately. A series of photographs which are suitably annotated to be self-explanatory are attached as Appendix B. It will be observed from the photographs that the road is formed as a shelf in the face of the escarpment, and the portion which has failed consists essentially of the outer or northern half of the road. The inner portion, so far as is known, has not given trouble or shown signs of instability.

It is of interest to note that the trees on the filled section of the road lean, showing clear signs of movement, whereas the trees below the fill slopes do not.

From the drainage aspect the two pictures of the culverts, which discharge water downhill are worthy of note: in this respect, a spring is located on the south ditch line in the vicinity of chainage 19+00; this spring is a constant source of seepage which flows down the rather rudimentary ditch line and in so doing seeps and soaks under the road pavement, and eventually along the interface between the overburden and the bedrock.

4. SOIL CONDITIONS

4.1 Fill (1): This arises in holes 1,2,3,7,8 and 9, in the road alignment, and also at holes 11 and 13. The depth ranges from 2 ft. to 18 ft., with the deeper portion arising below the northern or downhill edge of the road.

4. SOIL CONDITIONS - cont'd.

-5-

It is a heterogeneous, grey, compact, to loose mixture of crushed limestone of varying gauge from 3 inches down, with sand and sandy clay, but also containing asphalt, wood and ashes. The N-values range from 54 to 3, with an average value of about 16, in the upper 10 to 13 ft., but decreasing to 3 blows/foot at the lower boundary in holes 3 and 9 on the downhill side or outer portion of the road.

A casing sample of the soft, wet organic clayey silt material at the lower boundary of the fill in hole 9 had Atterberg Limits of: Liquid Limit 33, Plastic Limit 23, and Plasticity Index 10 with a natural water content of 27%. Generally the moisture contents were variable, ranging from moist to wet at the lower boundary. Typical grading analyses are shown on Figure 1.

The upper layer or stratum in hole 11, extending to a depth of 7 ft. 3 inches below ground surface has also been classified as a fill. Here the material is a mixed brown and grey, compact assortment of sand and 2½ inch gauge down crushed limestone fragments with some organic matter. The N-values range from 19 to 41 with the lower value being more representative of the general state of compaction. It was in a moist condition only. The disturbed and mixed condition of the soil in this area is possibly due to maintenance work and/or construction of the T.H. and B Railway.

4.2 Till and Talus (2): This layer was considered to be a mixture of the till arising in the area, and talus or rock debris, because of its very stony content of an angular nature. It occurred at holes 5 and 6 only, extending from surface to depths of 18 and 7 ft., respectively. The soil matrix was a mottled yellowish brown, and red brown to light brown, sandy clay to clayey silt material; the particle distribution of a sample from about 13 ft. in hole 5 is shown on Figure 2.

4. SOIL CONDITIONS - cont'd.

-6-

The whole mass was heavily over consolidated being in a very stiff to dense state of packing, with an average N-value of about 40, and an average water content of 9% within a range of 5 to 11%.

- 4.3 - Till, Sandy Clay - Clayey Silt (3): This stratum underlies the whole area investigated north or downhill of the road. It does not arise below the road itself, except for a thin layer some 2 ft. thick sandwiched between the road fill and the underlying bedrock in hole No. 8.

The thickness ranges from 9 and 15 ft. at holes 10 and 12, respectively and to between about 21 and 25 ft. at holes 4, 5, 6 and 11. The material consists of a reddish brown to light brown with some grey, hard or dense, sandy clay to clayey silt till with many stones and boulders.

The boulder content was particularly noticeable at hole 5 where the layer had to be diamond drilled to achieve complete penetration. The average N-values at the holes (except Nos. 8 and 5) was about 50.

Typical Atterberg Limits were:

<u>Hole No.</u>	<u>Sample No.</u>	<u>Depth</u>	<u>L.L.</u>	<u>P.L.</u>	<u>P.I.</u>	<u>W.</u>
4	3	7'-8'6"	33	18	15	15
6	8	25'-26'6"	26	17	9	10
10	5	12'-13'6"	22	19	3	6
12	5	12'-13'6"	33	17	16	14

4. SOIL CONDITIONS - cont'd.

-7-

The water contents in each case are appreciably less than the plastic limit, indicating a highly over-consolidated condition.

Typical grading curves of representative samples are given on Figure 3.

Consolidated undrained triaxial tests with pore water pressure measurements were carried out on two good intact split spoon samples with the following results:

Hole #	Sample #	Depth	γ	γ_d	w	C'	ϕ'
6	8	25'-26'6"	144.5	131.7	9.7	31 ⁰	120 lbs/sq.in.
12	8	25'-26'6"	138.5	124.8	11.0	31.5 ⁰	430 lbs/sq.in.

4.4 Till, Clayey Silt Till (4): This till layer arises at holes 10, 11 and 12 only, where it underlies the mixed brown sandy clay till described above. The thickness lies between 11 and 8 ft. It is a dense, heavily over consolidated, reddish brown to grey, clayey silt till with stones, shale fragments, some silt and clay pockets. The N-values range from 32 to 62 with water contents in the range of 6 to 17%. Typical grading curves are shown on Figure 4. The Atterberg Limits for two samples were:

<u>Hole No.</u>	<u>Sample No.</u>	<u>Depth</u>	<u>L.L.</u>	<u>P.L.</u>	<u>P.I.</u>	<u>W</u>
12	7	20'-21'6"	27	15	12	11
	8	25'-26'6"	26	17	9	13

4. SOIL CONDITIONS - cont'd.

-8-

- 4.5 Weathered Shale to Shaly Till (5): This stratum was encountered in holes 3, 4, 6, 9, 10 and 12, where, (except in hole No. 9), it acts as a hard or dense transition zone between the overlying till and the underlying bedrock. It is a reddish brown to grey silt and clay shale or till. The thickness ranges from about 1 ft. to 10 ft.
- 4.6 Silty Clay to Clayey Silt (6): Underlying the fill at holes 9 and 13 there is a layer of red brown to grey silty clay, to clayey silt, with some organic matter in the form of topsoil. It is soft and wet with N-values of 7. The thicknesses range from 6 ft. to 4 ft. 8 inches at holes 9 and 13 respectively.
- 4.7 Bedrock (7): Bedrock was proved by obtaining a drilled core in every testhole, with varying recovery. The bedrock underlies the fill, the till strata, including the weathered shale to the shaly till layer. South of the railway tracks, and generally below the upper middle reaches of the slope it consists of buff sandstone interbedded with red shale and grey shale with dolomite beds. North of the railway in the vicinity of holes 6 and 12 it is a red Queenston shale.

5. GROUND WATER

Ground water conditions obtained during the field work were erratic, and difficult to interpret; subsequently piezometer tubes were installed and read weekly over a two month period. The maximum reading obtained at each location is tabulated as follows:

5. GROUND WATER - cont'd.

-9-

<u>Hole No.</u>	<u>Installed Depth of Tubes Below Grade</u>		<u>Maximum Reading Depth Below Grade in Ft.</u>	
	<u>Deep</u>	<u>Shallow</u>	<u>Deep</u>	<u>Shallow</u>
3	21.0	11.0	Dry	Dry
4	24.0	17.5	21.7	Dry
5	44.5	14.5	24.4	Dry
6	28.0	7.0	10.7	Dry
9	24.0	20.5	18.7	18.3
10	26.5	6.0	Dry	Dry
11	25.0	-	13.7	-
12	26.0	10.5	8.2	3.2

The series of readings taken during the period November 1965 to January 1966 are shown plotted against time, and the incidence of rainfall obtained from the D.O.T. Meteorological Station at the Royal Botanical Gardens in Hamilton. This plot does not show any discernible pattern between the incidence of rainfall and the readings obtained in the piezometer tubes. See Figure 5.

6. OBSERVATIONS

The soil properties of the various layers have been summarized on Table "A".

6.1 Fill: This layer is generally a granular material with only a small proportion of silt, see Figure 1, however, there was some clay content as shown by the Atterberg Limit tests on one of the samples. It is evident that the fill becomes looser with depth especially at holes 3, 9, and 13 where the thickness of the fill exceeds 10 ft. This condition points to aggravation by poor drainage conditions, but it probably originated from poor compaction when the fill was placed; this latter characteristic was further enhanced by the omission to remove the soft, weathered transitional material, including some topsoil, overlying the weathered shale.

Bearing in mind the type and granular nature of the fill it was impossible to recover a sample which could be regarded as representative of the general condition of the soil, for this reason the angle of internal friction ϕ' for the fill has been assumed, for the purpose of the stability analyses, as 35 degrees, with an average in situ density of 125 lbs./cu.ft.

6.2 Till: Basically it is difficult to differentiate between the talus - till stratum, the sandy clay to clayey silt till stratum and the clayey silt till stratum; the mechanical analyses shown on Figures 2, 3 and 4 indicate the very heterogeneous composition of this material, and apart from its colour variation, the essential properties are the dense, over consolidated, and stony or bouldery condition of the various tills as a whole. The undrained shear strength and effective stress parameters selected for the analyses are based on the test results available, and on the nature and geological history of the material.

6. OBSERVATIONS - cont'd.

-11-

6.3 Ground Water: The data available on the ground water suggest :-

1. At the upper slope the water level is below or just at the interface between the overburden and the weathered shale.
2. The ground water arises in the overburden at at the lower reaches of the main slope; however, the analyses do not show that this has had any direct affect on the stability of the road fill.
3. There is insufficient evidence to relate the rise in pore pressure with the incidence of rainfall. However, since it is known that the rainfall has a harmful trend on the stability of slopes, it follows that effective drainage is an important requisite for the maintenance of stable conditions on slopes.

7. STABILITY ANALYSES

The effective stress stability analyses have been carried out using the simplified method, whereby the factor of safety is calculated from the expression

$$F = \frac{\sum c'.l + \sum (W.\cos \alpha - u.l) \tan \phi'}{\sum W \sin \alpha}$$

The results of the various stability analyses, both total stress and effective stress, are given on Figures 8, 9, 10 and 11.

Figure 8 shows the total stress analyses for the upper portion of the slope, and deals in particular with the fill resting upon the over consolidated till at chainage 19+00. Here it is seen that for a factor of safety of 1 the critical circle requires a minimum undrained shear strength of 411 lbs./sq.ft. in order to maintain minimum equilibrium conditions. On the basis of this information a detailed effective stress analysis was performed on the same fill section, and is shown on Figure 9. It can be argued that the critical circle for the total stress condition is not necessarily the same as the effective stress critical circle, and that this is an over simplification; however, in view of the large factors of safety obtained for the critical circle passing through the fill and tangential to the underlying till, and for the critical circle tangential to the underlying weathered shale, it becomes apparent that any failure in terms of effective stress must occur in the fill, and not in the till or the underlying weathered shale. It was to establish this point that this particular type of approach was adopted. It is of interest to note that in terms of effective stress the failure along the till surface has a factor of safety of 1.65 whilst the failure along the surface of the weathered shale has a factor of 1.74.

Turning now to Figure 10, where the whole slope has been analyzed in terms of total stress to determine the critical circle, it can be seen that the average maximum undrained shear strength that must be maintained along the surface of the critical circle is 922 lbs./sq.ft.; such an undrained shear strength is well within the capacity of the soils arising on this site except possibly in the fill at the top of the slope.

The effective stress analysis was then performed along this same circle adopting the water levels obtained from the stand pipe readings; as a result the factor of safety for this circle is 1.94, a figure which can be considered as more than adequate, and an indication that failure under effective stress conditions is most unlikely to occur in the main till stratum (3).

7. STABILITY ANALYSES - cont'd.

-13-

Furthermore this result taken in conjunction with the effective stress analyses referred to above, and shown on Figure 9, suggests that any failure which has taken place cannot have taken place within the till, and must be confined to the upper portion of the slope which consists mainly of filled material.

This observation is confirmed by the stability analyses of the upper slope along chainage 20+50, see Figure 11, where the critical circle, in terms of effective stress conditions, was found to be in the fill material and tangential to the underlying dense till. The theoretical factor of safety here is reduced to 1.02, which suggests very strongly, critical and unstable conditions. By extending the failure surface downwards to become tangential to the weathered shale the factor of safety is increased to 1.36 confirming increased stability when the critical circle penetrates deeper.

8. INSTRUMENTATION

Slope indicators have been installed by others at two points on the section through Chainage 20+50; one being located near hole No. 10 and one near hole No. 11.

It is understood that to date three readings have been taken, and although there is no evidence of movement yet, it must be understood that insufficient time has elapsed to draw any precise conclusions from this.

The readings on these indicators will be continued through the change of season to enable a finite conclusion to be made.

9. CONCLUSIONS

Accordingly, it has been concluded that the placing of fill on the existing slope has tended to decrease the factor of safety of the existing slope to some extent but not critically; however, the road fill because of the configuration of the ground is in itself unstable.

9. CONCLUSIONS - cont'd.

-14-

Furthermore, it appears that the failures that have taken place in the road fill do not affect the railway line directly, however, the continual loading of the slope of the supporting over consolidated till is to be deprecated since such action leads to eventual unbalance of the existing restraining forces, which are subject to change from natural causes.

10. REMEDIAL MEASURES

The remedial measures which may be taken to prevent further failures along the shoulders of the existing road may consist of one of the following proposals:

- a) Cutting the road back into the rock face to the south, and regrading the down-slope of the fill in conjunction with the relocation of the road, see Figure 12A.
- b) Constructing a retaining wall on the underlying till, or the rock, and thereby supporting the outer failed portion of the road, see Figure 12B.
- c) A compromise of schemes A and B consisting of a partial cutting back of the road into the rock to the south, combined with a smaller retaining wall founded on either the underlying till or the rock.
- d) Lowering the road grade to place the road on a rock bed. This scheme is not illustrated on Figure 12 since it consists essentially of realignment of the road, and extending the length of the road in order to achieve a satisfactory grade with the lower elevation.

Included in all the reconstruction work would be :-

1. Effective drainage to collect water at present draining onto the road, and which is now discharged down the slope, together with such other normal drainage works necessary to reduce the amount of water discharged down the face of the slope to a minimum.
2. Of the four methods outlined solutions B and C will both require the construction of fairly extensive retaining walls possibly as much as 35 ft. high, and, whilst solution C presents some reduction in height of wall; this is of only a minor extent in view of the rapid fall of the bedrock below the north shoulder of the existing fill. Furthermore, the drainage requirements for these schemes would be more involved than for the more direct method outlined in solution A. Solution D, whilst being feasible will involve complete relocation of the road, together with the necessary ancillary work involved.

Whichever scheme is adopted further exploratory work will be necessary in order to enable a representative profile of the rock and/or till interfaces to be obtained; furthermore, any scheme having recourse to the use of retaining walls will need the overall stability of the proposed wall to be established.

The use of explosives may have adverse effects on the general ground water pattern, including local wells above the present grade.

-16-

These various aspects affect virtually every scheme to some degree; however, in view of the positive approach of scheme A it is to be preferred, especially as it removes the load from the till, and places it directly on the rock; even though additional land may be required at the brow of the slope to accommodate the Scenic Route more securely.

Yours very truly,

E.M. PETO ASSOCIATES LTD.,

C.F. Freeman

CFF/hf

C.F. Freeman, P.Eng.,
Chief Engineer.

APPENDIX A

Correspondence Referred to:

Letter dated 21st OCTOBER 1965

Letter dated 15th NOVEMBER 1965

Letter dated 23rd NOVEMBER 1965

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE: 65188

1287 caledon~~a~~ road

TORONTO 19, ONTARIO

Telephone: 788-1128

October 21st, 1965.

County of Wentworth,
County Engineer's Office,
Court House,
Hamilton, Ontario.

Attention: Mr. R.C. Fraser,
County Engineer

Gentlemen:

Re: New Mountain Road-Stoney Creek
Stability Investigation

We refer to the meeting with the Suburban Roads Commission and the County Road Committee, yesterday, the 20th October 1965 in the Court House Building of the County of Wentworth.

At the meeting the findings arising from our work to that date on the new Mountain Road were presented to the Commission. These findings were:

- (a) The road could be reconstructed provided it was supported by the bedrock by-
1. cutting the road back into the rock face to the south
 2. constructing a retaining wall on the rock and thereby supporting the outer failed portion of the road,
 3. a compromise of (1) and (2) and (4) lowering the road grade to place the road on a rock bed.

.....2

- (b) Included in the reconstruction work were-
1. Regrading of the fill and slopes below the north edge of the road so as to flatten the slope and thereby reduce the loading on the slope.
 2. the provision of effective drainage measures
- (c) The present continued failure of the road was due to the loose condition of the stony fill, combined with poor foundation and drainage conditions.
- (d) There was no obvious evidence at present that the work performed to that time was directly responsible for the failure of the railway below, although loading of the slope above the railway could be regarded as a contributory cause given suitable adverse conditions, the most important of these being drainage.
- (e) The cause of the movement of the railway tracks was not within our terms of reference, and could not be determined without a lot of additional work and study.

In the light of these findings, we are concerned with the decision of the Commission to reconstruct the road, albeit temporarily, by replacing the fill and thereby re-loading the slope above the railway.

Our concern springs from the fact that this course of action, while possibly politically expedient, cannot be supported by the engineering findings of our report, and furthermore in the event of another movement of the railway in the spring it is felt that the Commission would be placed in a position which it is believed would be legally indefensible.

The fact that the railway may or may not move irrespective of whether temporary remedial work is performed or not, does not affect the issue, which is that loading the soil slope can be regarded as a contributory cause of the movement.

We trust you will understand that we are writing you on these lines in order to be sure that all concerned are aware of the possible consequences of the decision made at the meeting.

Yours very truly

E. M. PETO ASSOCIATES LIMITED,

C. F. Freeman.

C. F. Freeman, P.Eng.
Chief Engineer.

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE: 65188

1287 caledonia road,

TORONTO 19, ONTARIO

Telephone: 789-1126

November 15th, 1965.

The County of Wentworth,
Road Department,
Court House,
Hamilton, Ontario.

Attention: Mr. R.C. Fraser,
County Road Engineer

Gentlemen:

Re: New Mountain Road,
Temporary Widening

We are pleased to confirm the general observations made to Mr. R. Fraser on the site by our Mr. D.H. Hitchins on 12th November 1965.

It is our understanding the Suburban Road Committee are anxious to widen the road on the south side, in the vicinity of the failure, by some 13 to 20 ft. The purpose is to provide two way traffic on this road during the winter months. From our standpoint we agree the proposal is feasible, but we do feel the following points should be carefully borne in mind by the Committee in arriving at a decision.

- (a) Although the proposed widening is only 10 ft. for traffic requirements it will be closer to 20 ft. at the base when allowance is made for the ditch, and the bench beyond the ditch to act as a ledge on which to catch minor spalling from the newly excavated rock face to the south.
- (b) This widening may affect the ground water flow pattern above and below the excavation. This could have an adverse effect above the excavation in so far as wells in the vicinity are concerned, and below the excavation in connection with the failure area.

- (c) Blasting should be kept to a minimum as far as possible. Small charges only should be used.
- (d) There is no guarantee the widened length will rest on rock throughout. There may be areas where soft soils will be encountered, requiring special treatment.
- (e) It is understood that all excavated material will be removed from the site completely. No material will be placed on the slope to the north.
- (f) It is entirely possible that when the road has been widened, there will be little width left to support the road overlooking the mountain brow. The travelled surface here is very close to the edge now in one place and a reduction in the support may cause some failure here. This would necessitate widening the road on the upper level on the south side, and may require some land acquisition for this purpose.
- (g) This work, in our opinion, will not have any adverse affect on the situation on the Railway Line, although it is impossible to predict any possible changes in the drainage pattern, which may arise as a result from the use of explosives in the rock.

Yours very truly,

E. M. PETO ASSOCIATES LIMITED,

C. F. Freeman

C. F. Freeman, P.Eng.
Chief Engineer.

2cc. Addressee
1cc. File

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 65188

1287 caledonia road,

TORONTO 15, ONTARIO

Telephone: 789-1128

November 23rd, 1965.

The County of Wentworth,
Road Department,
Court House,
Hamilton, Ontario.

Attention: Mr. R.C. Fraser,
County Road Engineer

Gentlemen:

Re: New Mountain Road

We refer to the telephone discussion yesterday in respect of the method proposed for reopening the road.

You will recall that four possible methods were put forward in our letter dated the 21st. of October 1965. In our letter dated the 15th November 1965 we commented further on the proposal to cut back into the rock face to the south with the object of supporting the road on a rock shelf or bed.

Despite the qualifications made in that letter we favour this method as providing an effective solution to the problem of reopening the road.

This opinion is based on the belief that the road will thereby be supported on rock; this belief is reinforced by the behaviour of the road itself where the southern half has not given trouble, this being confined to the outer or northern half of the pavement.

The equilibrium ground water levels are necessary in attempting to determine the cause of the failure, and thus aiding in providing a solution to the problem, as well as assisting in the provision of drainage. However, since the variation in ground water level directly affects the soil overburden rather than the rock portion of the slope, this aspect is not of major importance where the road is supported on rock, provided normal drainage measures are included in the scheme.

The County of Wentworth

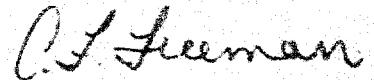
- 2 -

The scheme to cut the road back into the rock face to the south should include regrading the down hill fill below the northern edge of the road so as to reduce the quantity of fill loading the down hill slope.

A copy of the borehole logs, and the profiles arising on the slope at CH 19 + 00 and 20 + 50 are included for your information.

Yours very truly,

E. M. PETO ASSOCIATES LIMITED,



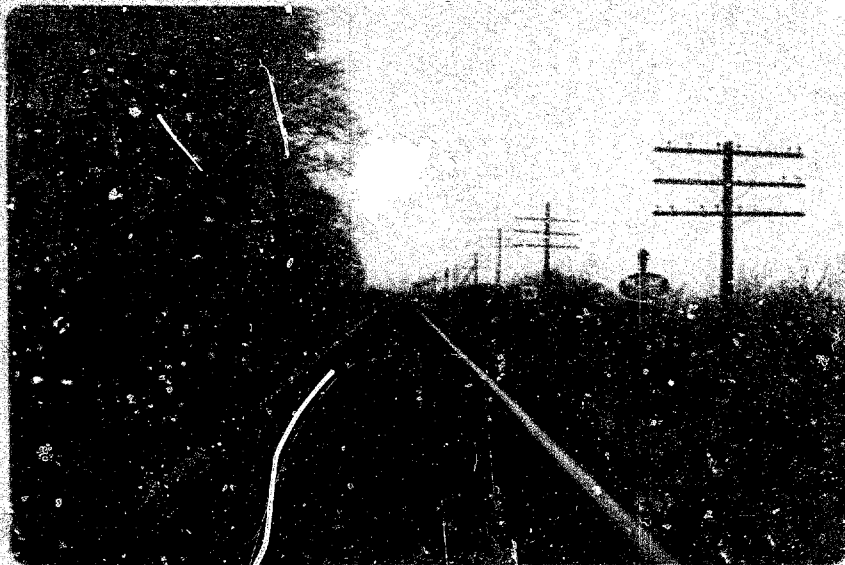
C. F. Freeman, P.Eng.
Chief Engineer.

CFF/hf
Encl.

lcc. Addressee
lcc. File

APPENDIX B

SITE PHOTOGRAPHS

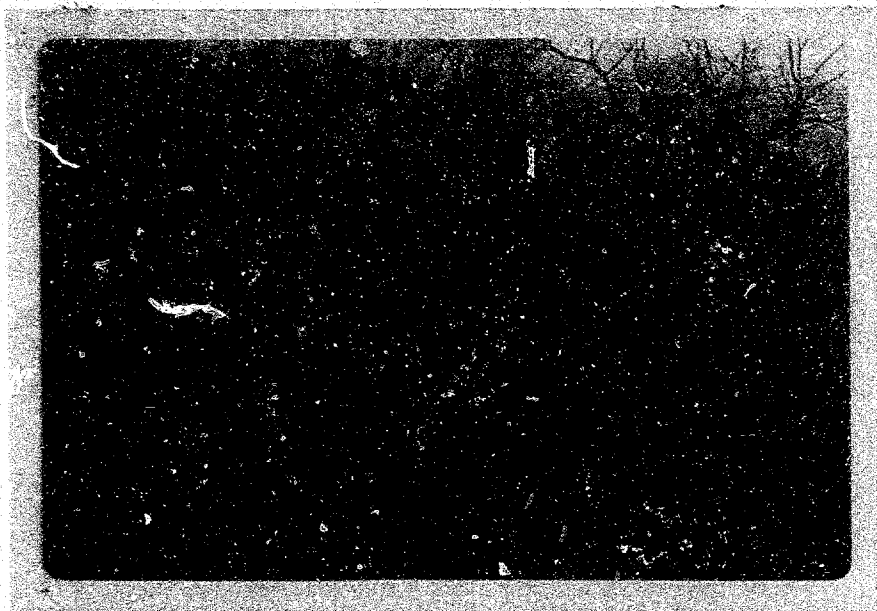


Taken south of rail track where section 20+50 crosses track and is looking west. Note this is the restored area of the rail track where instability occurred in early 1965.



Taken at a point on top of the escarpment, looking west and 150 ft. east of junction of New Mountain Rd. and Scenic Route.





Taken from Scenic Route and overlooks slide area.
Looking northwest.

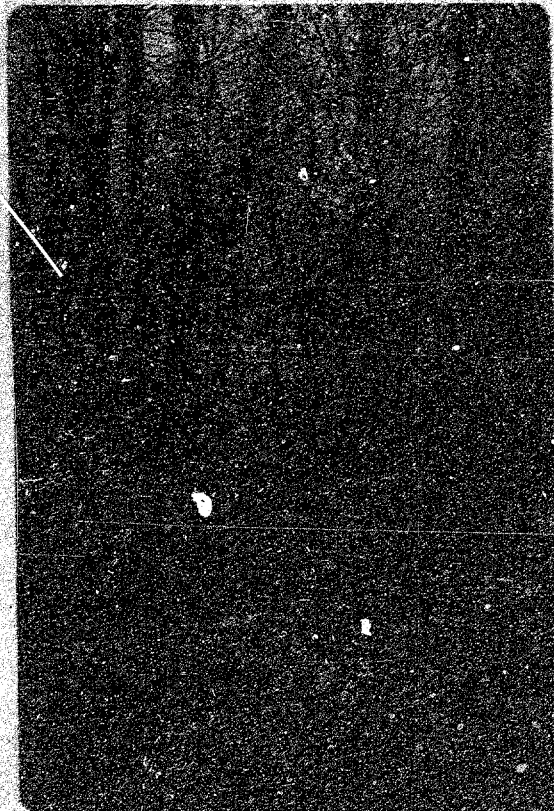


Looking east and uphill from Chainage 18+00, approx.
and just south of old guard rail.

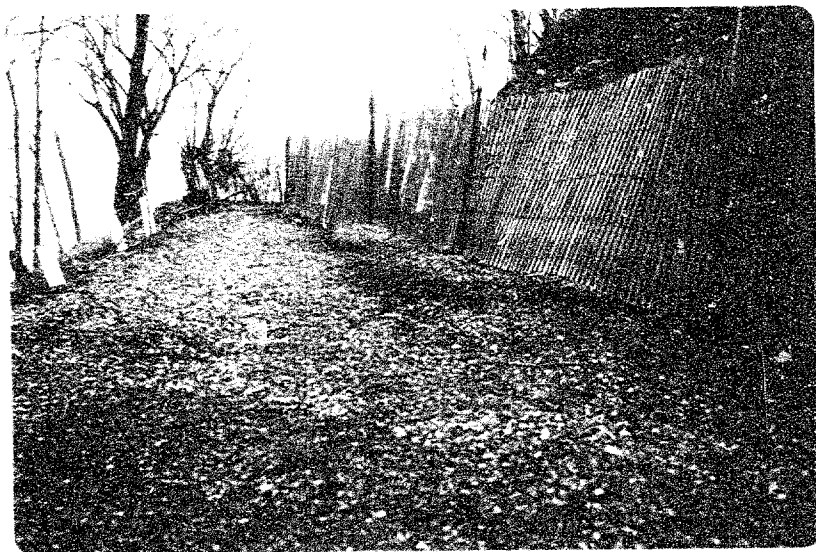


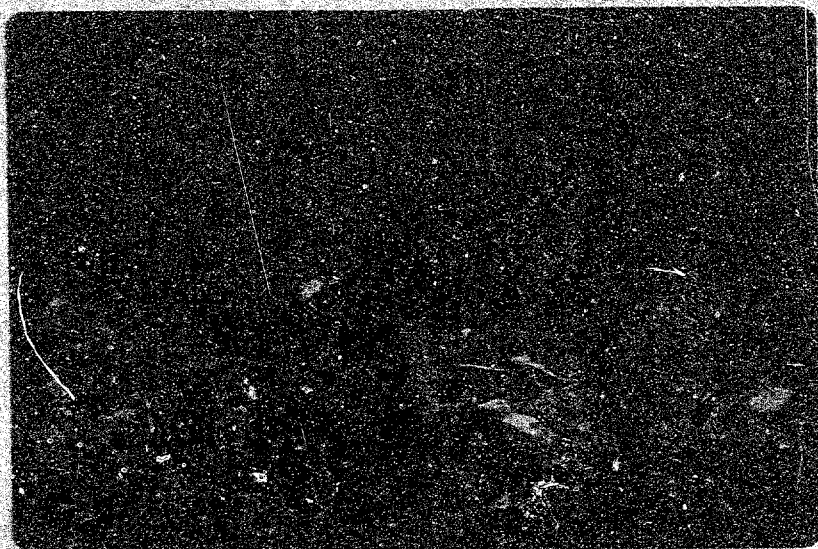


Taken from point between barracade and line of white guard posts, chainage 19+50 approximately, looking east and uphill.

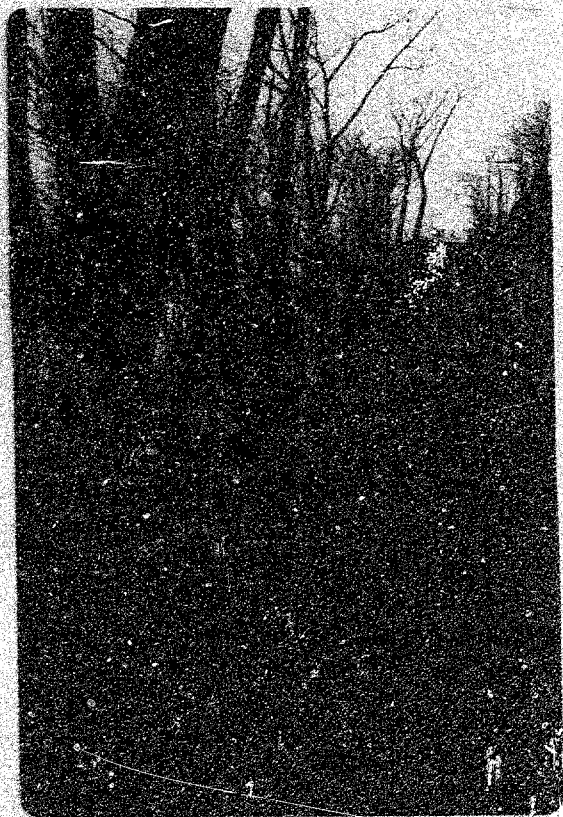


Looking northwards towards section 19+00. Taken from chainage 19+50 approximately. Note upright trees.





Looking west downhill just south of old guard rail at about Chainage 22+50. Note trickle of water discharging down slope face.

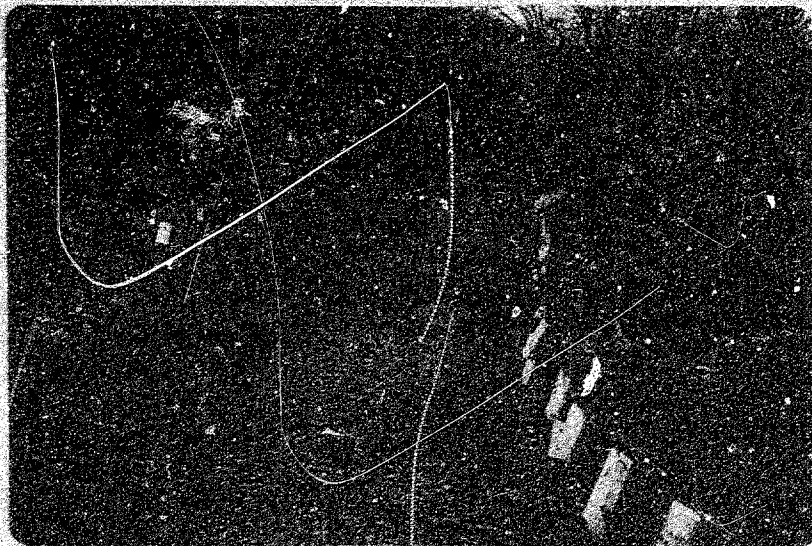


Looking east and uphill, north of guard rail and shows culvert under the road. Taken from Chainage 18+00 approximately.





Looking east and uphill on south side of road in ditch line, about chainage 17+50.



Looking west and downhill, from a point just east of intersection with Scenic Route.





Looking East - Southeast uphill and from above
chainage 17+50 and to the North of guard rails.
Note leaning trees.



TABLE A
SUMMARY OF SOIL PROPERTIES

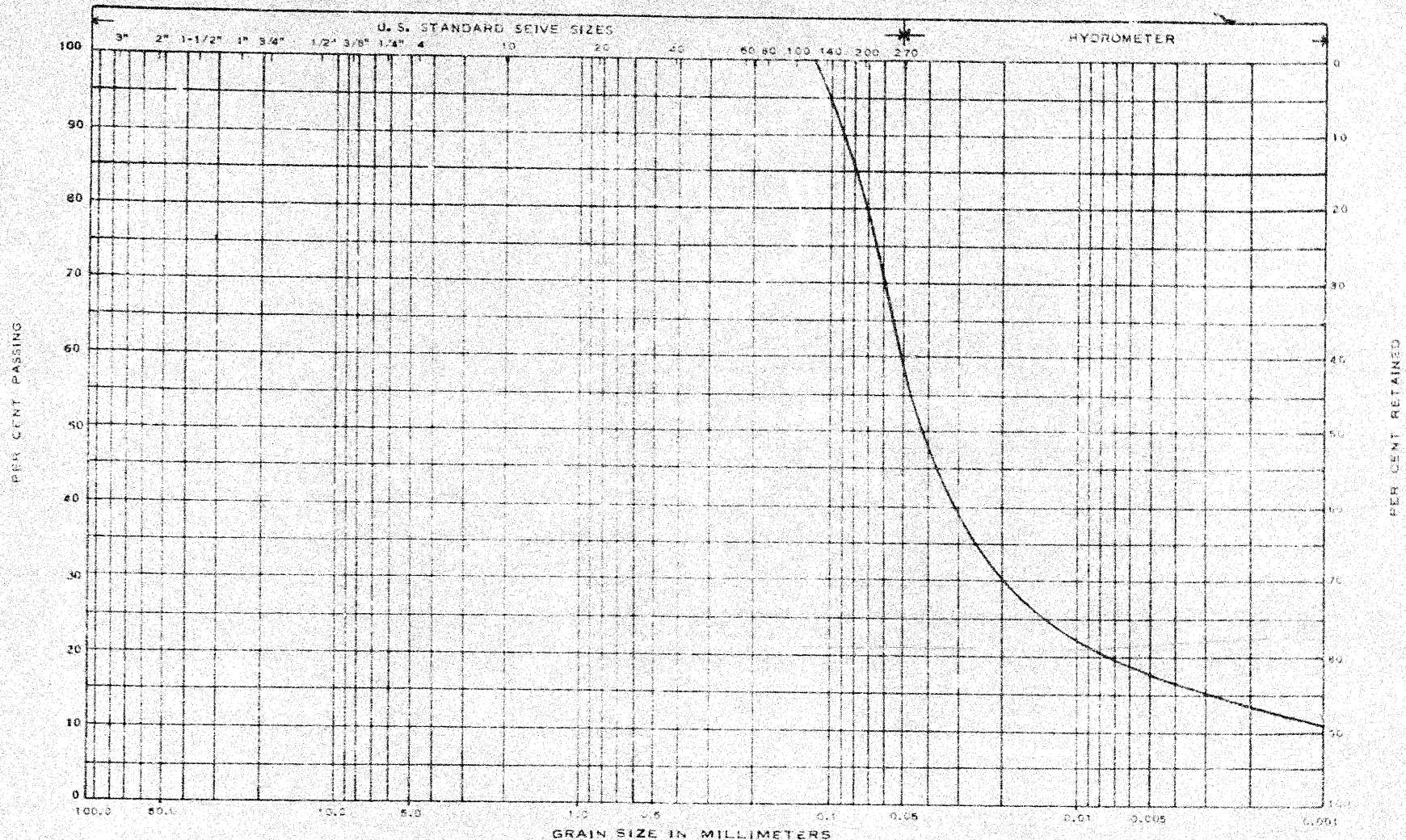
Soil Type	Average N-value	Atterberg Limits			Average Grading				Effective Shear Parameters		Undrained Shear Strength	Bulk Density
		L.L.	P.L.	P.I.	Gravel	Sand	Silt	Clay	C'	Ø'		
1. Fill	16	33 ⁱ	23 ⁱ	10 ⁱ	54	23	19	4	0*	35.0*	-	125.0*
2. Till & Talus	74	-	-	-	-	30	57	13	100*	31.0*	7000*	135.0*
3. Till-Sandy to Clayey Silt	58	29	18	11	14	25	45	16	150	31.0	6000*	143.0
4. Till-Clayey & Sandy	64	26	16	10	25	24	34	17	400	31.5	6500*	140.0

Note: (i) Test on clayey sample

* Assumed values

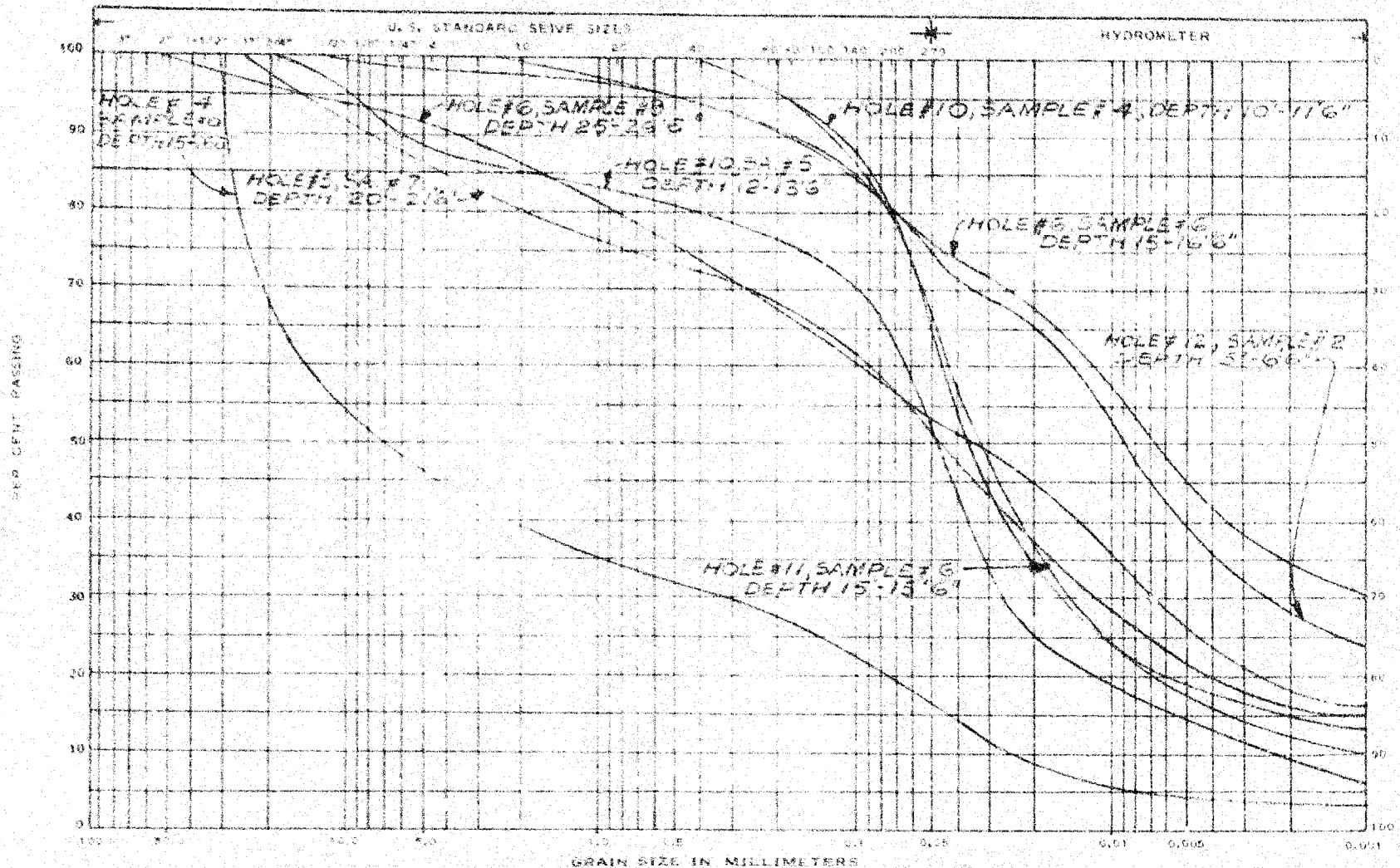
e. m. peto associates ltd.

Toronto 19, Ontario



e. m. peto associates ltd.

Toronto 19, Ontario



MASS. INST. OF TECH. CLASSIFICATION

Job Name New Mountain Rd., Stoney Creek Job No. 65188 Hole No. Sample No.

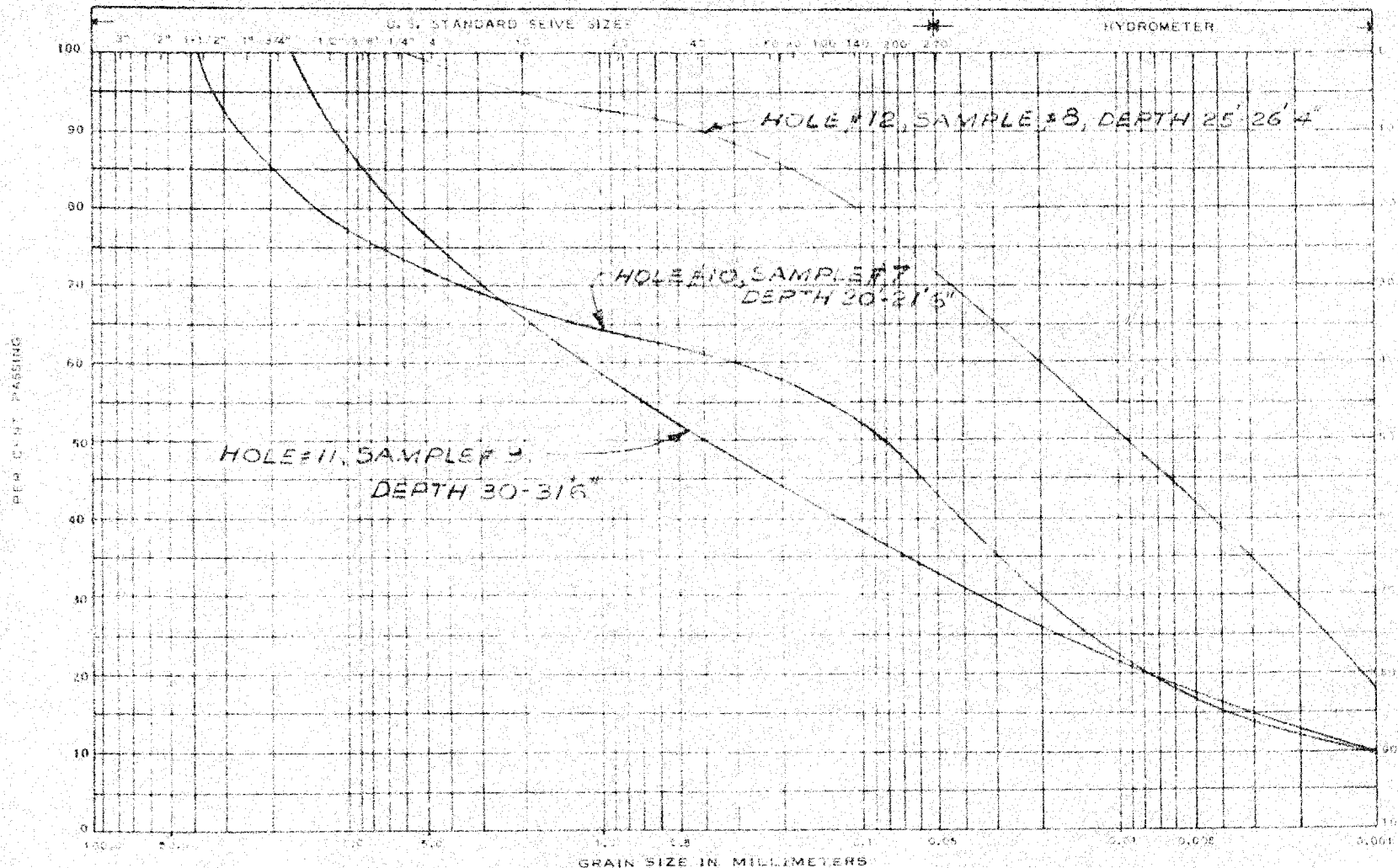
Depth Elevation Remarks Sandy to clayey silt till stratum (3)

GRAIN SIZE DISTRIBUTION

Fig 3

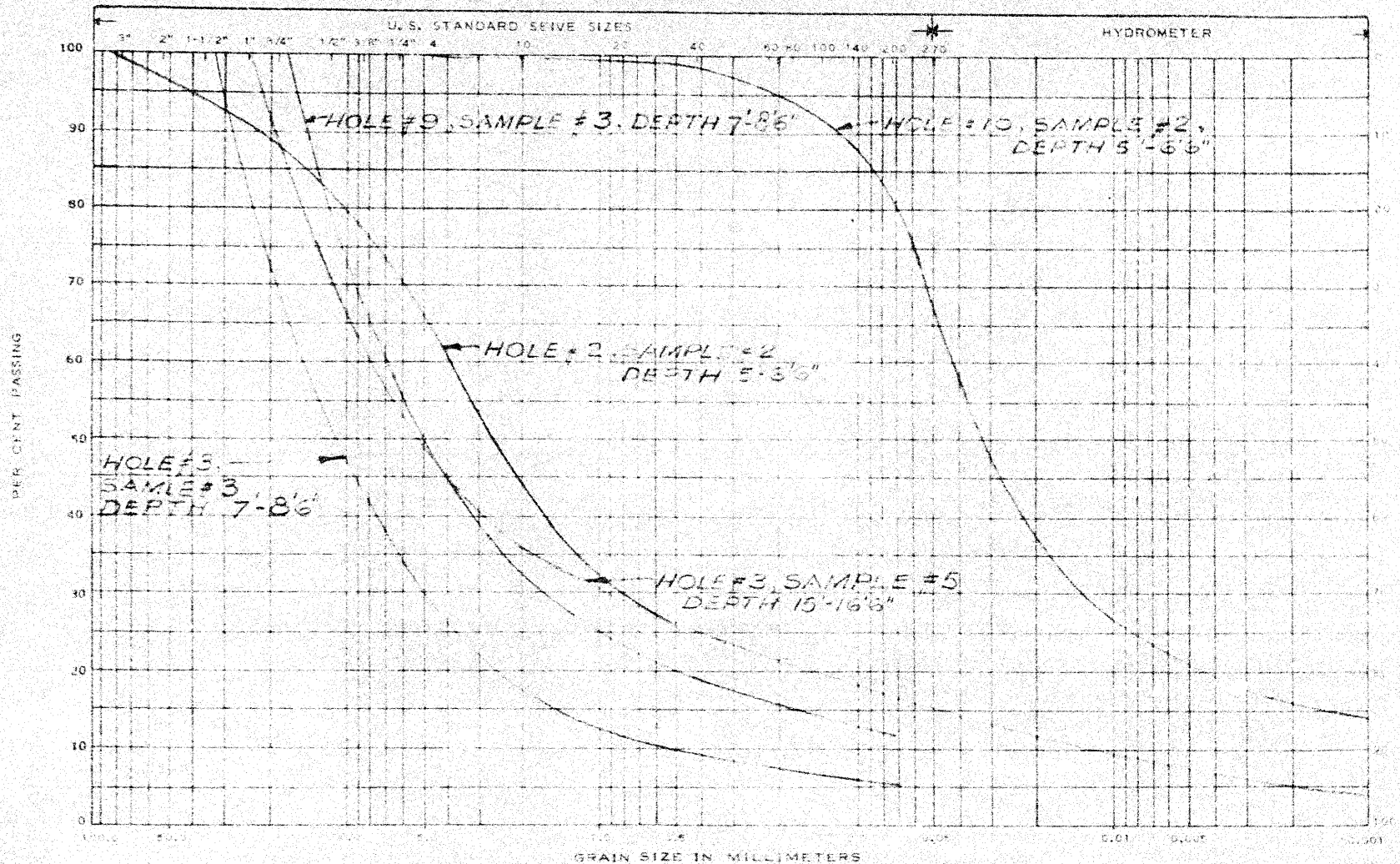
e. m. peto associates ltd.

Toronto 19, Ontario



e. m. peto associates ltd.

Toronto 19, Ontario



PER CENT RETAINED

Fig. 1

STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS INST. OF TECH. CLASSIFICATION

New Mountain Rd., Stoney Creek

JOB NAME _____ JOB NO. 65188 HOLE NO. _____ SAMPLE NO. _____

DEPTH _____ ELEVATION _____ REMARKS _____ Fill Stratum (1)

GRAIN SIZE DISTRIBUTION



CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

TESTING METHOD: SAMPLE # 5
DEPTH: 25' 100'
SAMPLE NO. 1
WATER CONTENT: 37%
LIQUID LIMIT: 31%
PLASTICITY INDEX: 12.0

SHEAR STRESS P.S.I.

EFFECTIVE STRESS P.S.I.

Job # 6513E

compagnie associates inc

Fig. 0

CONSOLIDATED UNDRAIN TRIAXIAL WITH PWP MEASUREMENTS

BORE HOLE #12 SAMPLE #
DEPTH 25'-26.4"
 $\gamma = 139.5$ P.C.F.
 $w = 11.0\%$
 $\phi = 31.5^\circ$
 $C = 430$ P.S.F.

SHEAR STRESS P.S.I. \uparrow

EFFECTIVE STRESS P.S.I. \rightarrow

Job # 65188

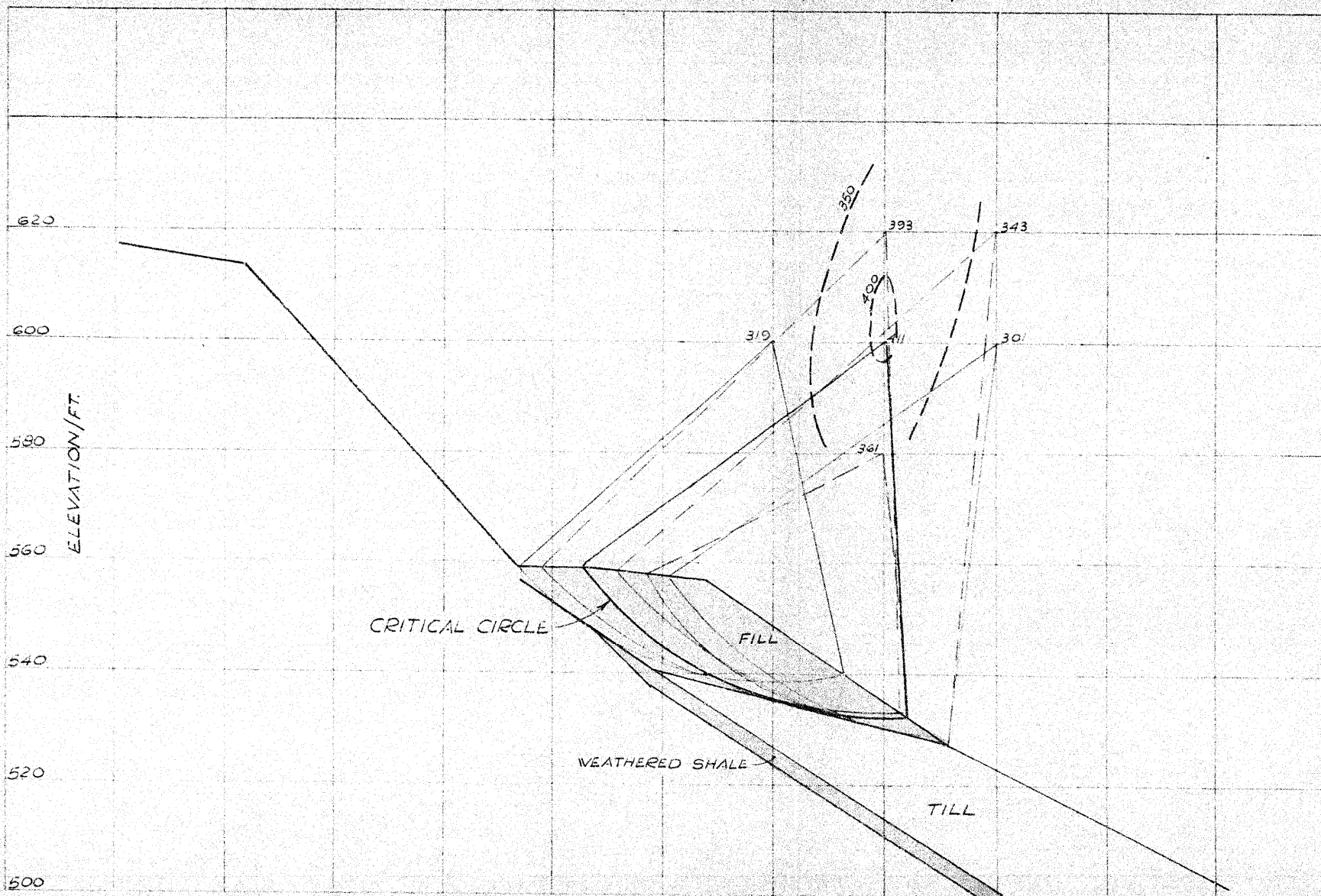
e.m. petro associates /td

Fig. 1

LOCATION OF CRITICAL FAILURE CIRCLE FOR UPPER SLOPE CH. 19+00

(BASED ON TOTAL STRESS ANALYSES - CONTOUR LINES REPRESENT THE REQUIRED MINIMUM UNDRAINED SHEAR STRENGTH IN lb/sq.ft FOR F-1)

FIG. 8



SECTION THROUGH HOLES 1, 2, 3, 4, 5 & 6
SCALE: 20' TO 1" (NATURAL)

JOB # 65188
e.m. peto associates ltd.
FEB. 1966
K.K.

STABILITY ANALYSIS OF THE TOTAL SLOPE ALONG CH. 19+00

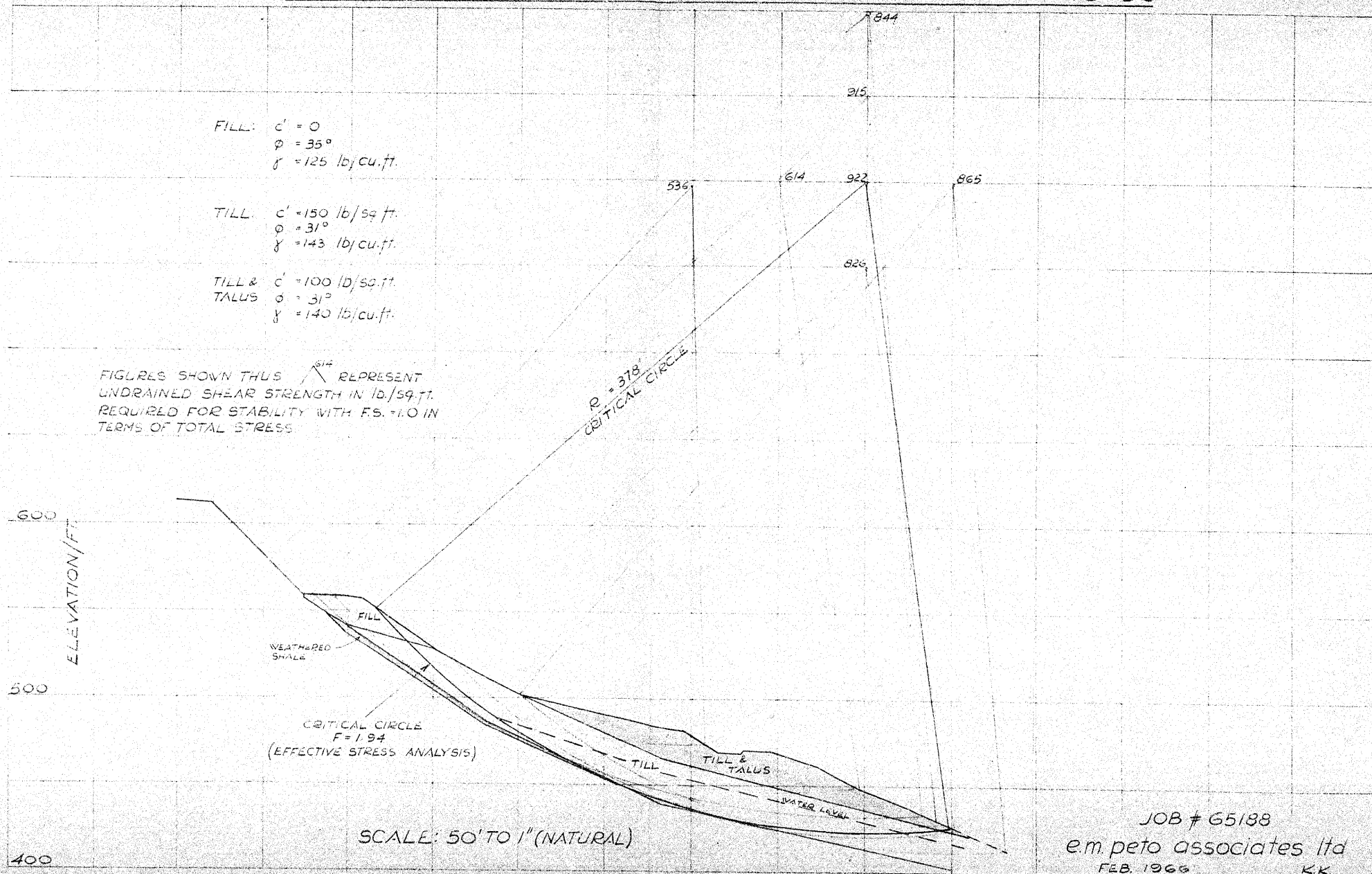
FIG. 10

FILL: $c' = 0$
 $\phi = 35^\circ$
 $\gamma = 125 \text{ lb/cu.ft.}$

TILL: $c' = 150 \text{ lb/sq.ft.}$
 $\phi = 31^\circ$
 $\gamma = 143 \text{ lb/cu.ft.}$

TILL & TALUS: $c' = 100 \text{ lb/sq.ft.}$
 $\phi = 31^\circ$
 $\gamma = 140 \text{ lb/cu.ft.}$

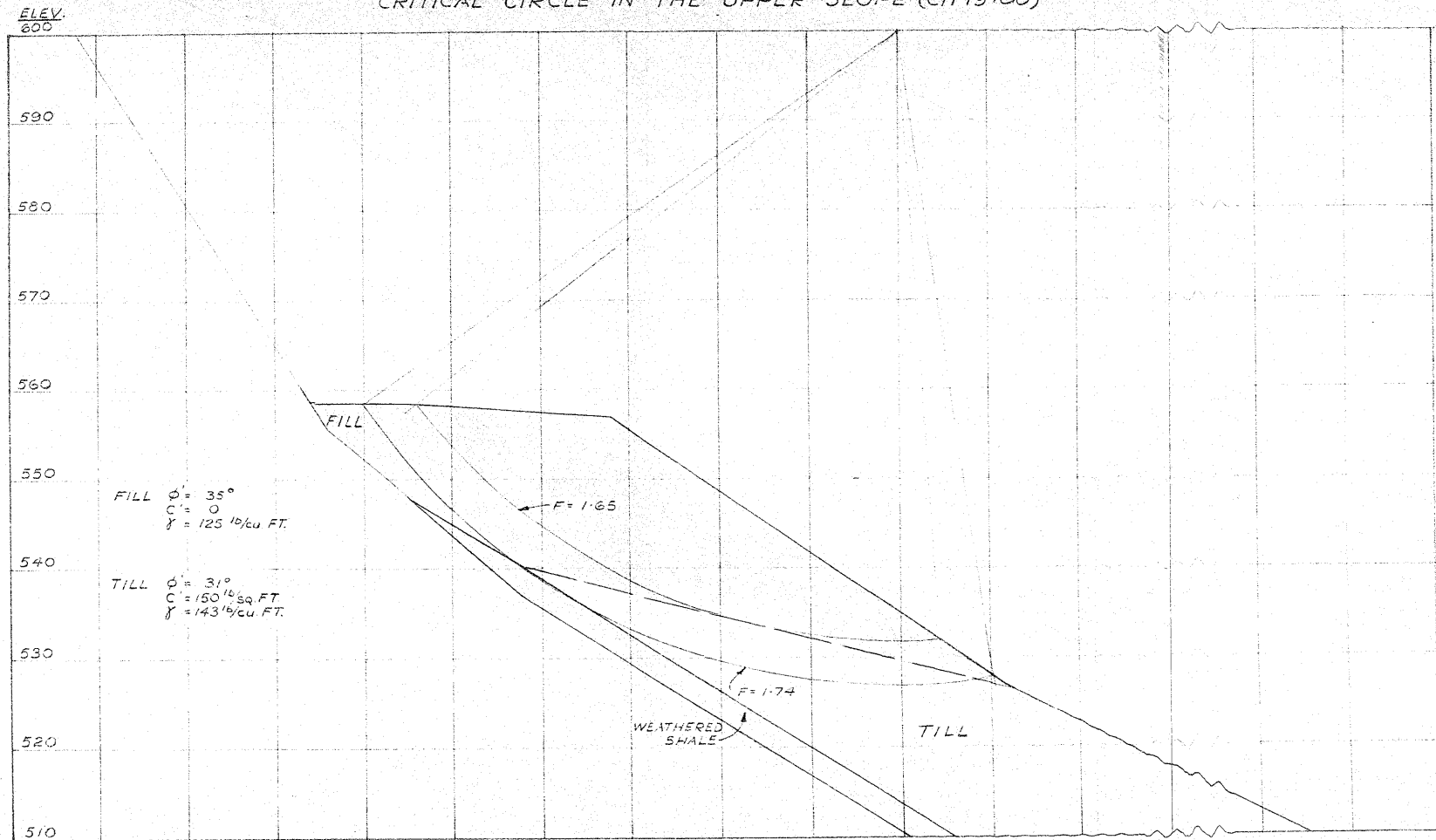
FIGURES SHOWN THUS γ REPRESENT
 UNDRAINED SHEAR STRENGTH IN lb/sq.ft.
 REQUIRED FOR STABILITY WITH $F.S. = 1.0$ IN
 TERMS OF TOTAL STRESS



JOB # 65188
 e.m. peto associates ltd
 FEB. 1966
 KK

EFFECTIVE STRESS STABILITY ANALYSIS FOR CRITICAL CIRCLE IN THE UPPER SLOPE (CH 19+00)

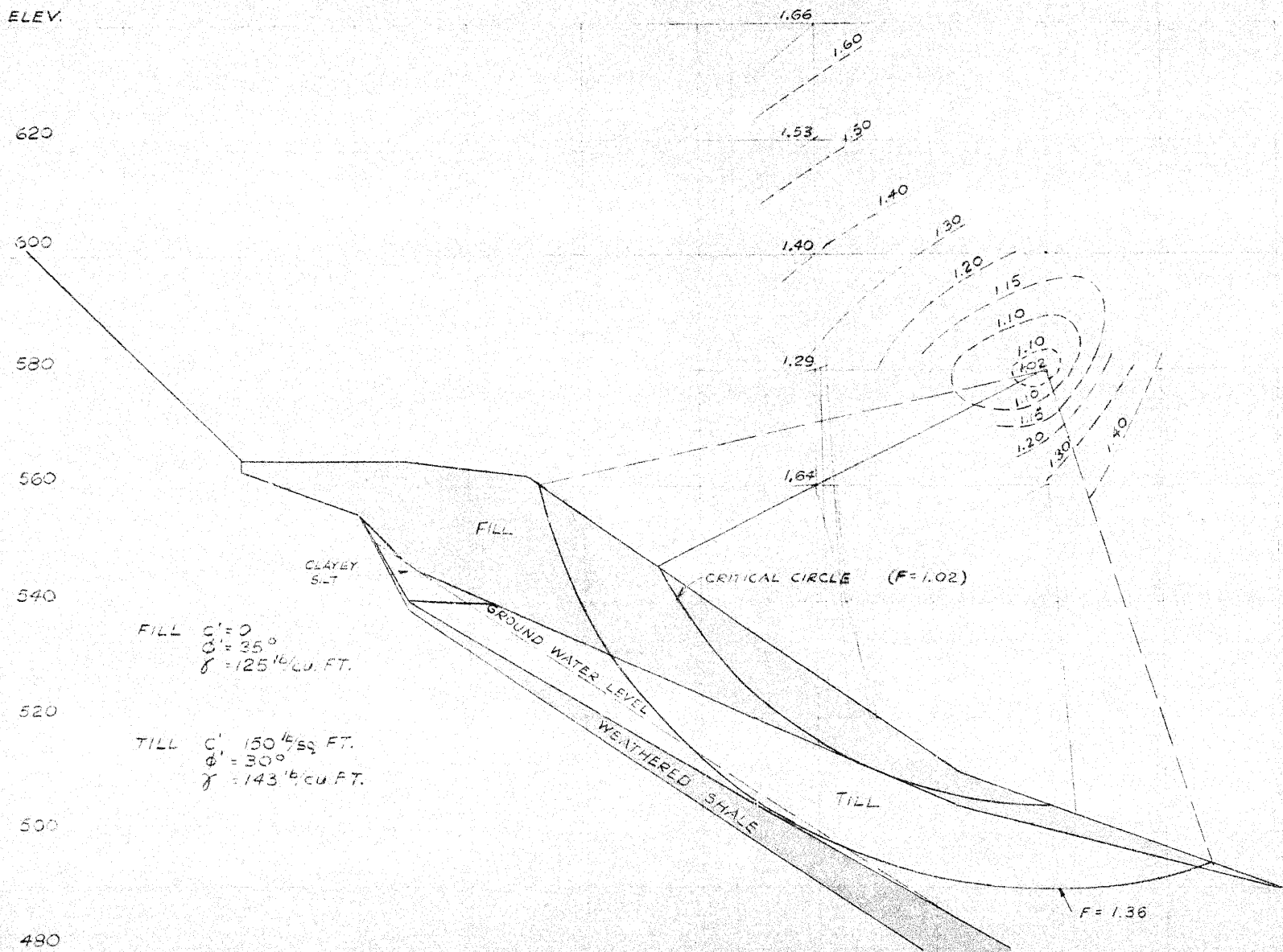
Fig. 9



SECTION THROUGH HOLES 1, 2, 3 & 4
SCALE 10' TO 1" (NATURAL)

JOB # 65188
R. A. Oeto Associates, Inc.
FEBRUARY 1966, Q.

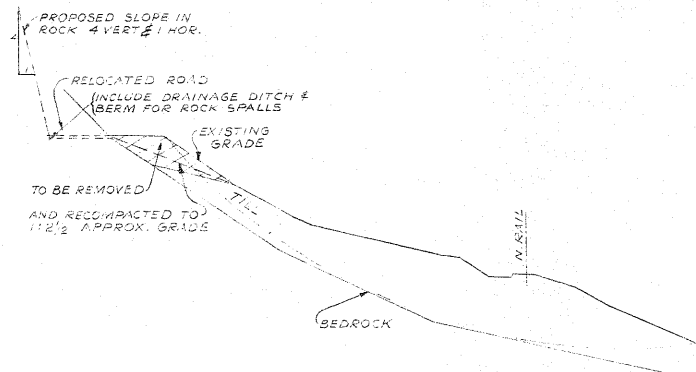
CONTOUR LINES OF FACTORS OF SAFETY FOR UPPER SLOPE (CH. 20 + 50) (EFFECTIVE STRESS SLOPE STABILITY ANALYSIS)



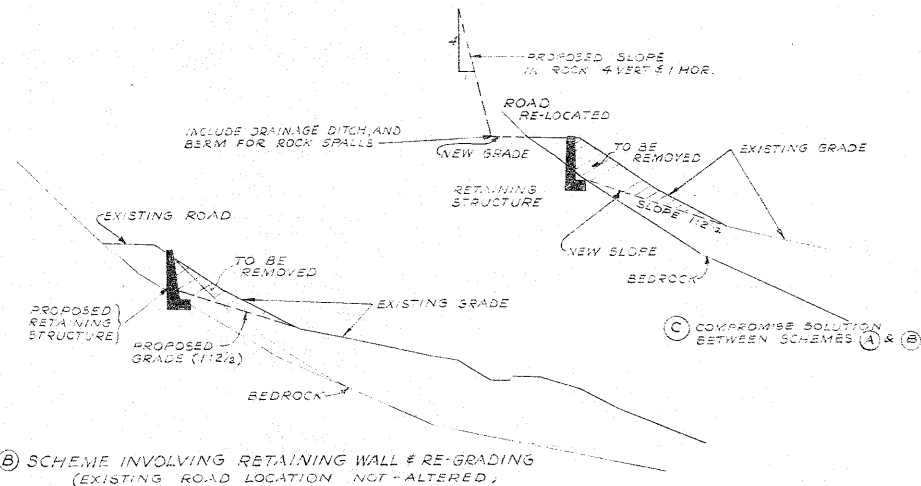
SECTION THROUGH HOLES # 7, 8, 9 & 10
SCALE 20' TO 1" (NATURAL)

JOB # 65188
e.m.peto associates ltd.
FEBRUARY 1966, K.

DIAGRAMMATIC OUTLINE OF REMEDIAL MEASURES



SECTION ON TESTHOLES 1-2-3-4&5
 (A) SCHEME INVOLVING RE-GRADING AND RE-LOCATION



(B) SCHEME INVOLVING RETAINING WALL & RE-GRADING
 (EXISTING ROAD LOCATION NOT ALTERED)

SCALE 50' TO 1" (NATURAL)

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

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

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

DESCRIPTION OF SOIL

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

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

W.T.P.L. WETTER THAN PLASTIC LIMIT

D.T.P.L. DRIER THAN PLASTIC LIMIT

A.P.L. ABOUT PLASTIC LIMIT

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.N.		SAMPLE ADVANCED HYDRAULICALLY
	P.M.		SAMPLE ADVANCED MANUALLY

SOIL TESTS

Q _u	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Q _{cu}	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q _d	DRAINED TRIAXIAL		

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

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

GENERAL

π	≈ 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF σ
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF σ TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

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

EARTH PRESSURE

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

FOUNDATIONS

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

SLOPES

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

e.m.peto associates ltd.

Consulting soil engineers

RECORD OF BOREHOLE NO. 1

JOB NO. 65188

JOB NAME

New Mountain Rd., Stoney Creek

TECHNICIAN AJ

BORING DATE June 29/65

CLIENT

County of Wentworth

ENGINEER C. F. F.

DATUM 559.2

BOREHOLE TYPE

BX casing

TYPED BY H. F.

[illegible]

e. m. peto associates ltd.

RECORD OF BOREHOLE NO. 2

Consulting soil engineers

JOB NO. 65188

JOB NAME New Mountain Rd., Stoney Creek

TECHNICIAN A. J.

BORING DATE June 29/65

CLIENT County of Wentworth

ENGINEER C. F. F.

DATUM 559.2

BOREHOLE TYPE

BX casing

TYPED BY H. F.

SOIL PROFILE		SAMPLES			ELEVSCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT W_L PLASTIC LIMIT W_p WATER CONTENT W			REMARKS
ELEV. DEPTH	DESCRIPTION	LEGEND	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P. S. F. N-Values	W_p	W	W_L	
2'0"	Asphalt Crushed stones		1	SS	18						
	FILL, sandy clay and clayey sand, stone fragments, some wood fragments Moist to wet VERY LOOSE TO COMPACT		2	SS	3						
			3	SS	20						
10'3"	BEDROCK, interbedded buff sandstone and red shale, good to moderately good										
	Red shale below about 17'			RC							
21'0"	Hole terminated at 21'0"										
	GROUNDWATER 1. lost wash water at 12 ft.										

about 12'

Recovery
82%

66%

e.m. peto associates ltd.

RECORD OF BOREHOLE NO. 3

Consulting soil engineers

JOB NO. 65188

JOB NAME New Mountain Rd., Stoney Creek

TECHNICIAN AT

BORING DATE June 30/65

CLIENT County of Wentworth

ENGINEER CFF

DATUM 558.9

BOREHOLE TYPE 4" and BX casing

TYPED BY HF

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— WL PLASTIC LIMIT ——— Wp WATER CONTENT ——— W			REMARKS		
ELEV. DEPTH	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS / FOOT	ELEV.SCALE	SHEAR STRENGTH P. S. F.					Wp		W	WL
							N-Values					WATER CONTENT %			
							20	40	60	80	100	5		10	15
	FILL, crushed limestone with sandy matrix, some mixed ashes and silt.		1	SS	16										Piezometer
	MOIST TO WET		2	SS	11										
	VERY LOOSE TO DENSE		3	SS	14										
			4	SS	33										
					SS	3									
	Seam of red organic SILTY CLAY		5	SS	54										
17'2"	SHAPE, weathered, reddish brown		6	SS	50/8"										
20'8"	BEDROCK, interbedded sandstone and shale			RC											
	Buff to red			RC											
25'0"	POOR CORE														
30'0"															
35'0"					RC										
40'0"					RC										
45'0"					RC										
50'0"	BEDROCK, dark grey shale with some layers of dolomite				RC										
	GOOD CORE														
					RC										
59'4"															
	Hole terminated at 59'4"														

GROUNDWATER, with hole at 59'4" and casing at 35 ft., the water level was at 40'2" below surface

JOB NO. 65188

JOB NAME

New Mountain Rd., Stoney Creek

TECHNICIAN AJ

BORING DATE Aug. 5, 9/65

CLIENT

County of Wentworth

ENGINEER CFF

DATUM 436.1

BOREHOLE TYPE

4" and BX casing

TYPED BY HF

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT W_L PLASTIC LIMIT W_p WATER CONTENT W			REMARKS			
ELEV. DEPTH	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	SHEAR STRENGTH P. S. F. N-Values					W_p W W_L WATER CONTENT %				
							20	40	60	80	100	10		20	30	
	SANDY GRAVEL, mixed with silty clay, sand seams, stones, pebbles, Moist, Very Stiff		1	SS	14										Piezometer	
			2	SS	40											Dry-7.0
7'0"	TILL, sandy clay to clayey silt to very silty clay till. Pebbles, sand pockets, Mixed brown, D.T.P.L. to WTPL		3	SS	14											10.8
			4	SS	49											
			5	SS	77											
15'0"	VERY STIFF TO HARD		6	SS	68											WL 15'6"
20'0"			7	SS	48											
25'0"			8	SS	65											
28'4"																
29'6"	SHALY TILL, Hard															
	BEDROCK, red medium hard shale, good core															

$\gamma = 144.5$
 $\gamma_d = 131.7$
 $w = 9.7$
 $\phi = 31^\circ$
 $C^1 = 120 \text{pcf}$

e.m. peto associates ltd.

RECORD OF BOREHOLE NO. 8

Consulting soil engineers

JOB NO. 65188

JOB NAME New Mountain Rd., Stoney Creek

TECHNICIAN AJ

BORING DATE July 12/65

CLIENT County of Wentworth

ENGINEER CFF

DATUM 564.7

BOREHOLE TYPE 4" Casing

TYPED BY HF

SOIL PROFILE		SAMPLES			ELEVSCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			REMARKS				
ELEV DEPTH	DESCRIPTION	LEGEND	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P. S. F.					WATER CONTENT %			
							N-Values 20 40 60 80 100					W_P W W_L 5 10 15			
	FILL, sandy, stony, with asphalt pieces and crushed stones Wet COMPACT Somey clayey portions		1	SS	20										
			2	SS	12										
7'0"	TILL, clayey silt, wet brown, compact		3	SS	24										
9'11"	BEDROCK, grey, buff dolomite with thin shale partings, GOOD CORE			RC											
17'8"	Hole terminated at 17'8"														Hole virtually dry

e.m.peto associates ltd.

RECORD OF BOREHOLE NO.

Consulting soil engineers

JOB NO. 65188

JOB NAME

New Mountain Rd., Stoney Creek

TECHNICIAN AJ

BORING DATE July 13/65

CLIENT

County of Wentworth

ENGINEER CFF

DATUM 564.5

BOREHOLE TYPE

4" Casing

TYPED BY HF

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT <u> </u> W _L PLASTIC LIMIT <u> </u> W _p WATER CONTENT <u> </u> W			REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
ELEV DEPTH	DESCRIPTION	LEGEND	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P. S. F. N - Values					W _p <u> </u> W <u> </u> W _L <u> </u> WATER CONTENT %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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	FILL, sandy clay matrix with crushed stones, asphalt pieces, pebbles, and stone fragments Mixed grey Moist to very moist		1	SS	21																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

Consulting soil engineers

New Mountain Rd., Stoney Creek

TECHNICIAN AJ

County of Wentworth

ENGINEER CFF

4" and BX casing

TYPED BY HF

[illegible]

e.m.peto associates ltd.

RECORD OF BOREHOLE NO.

11

Consulting soil engineers

JOB NO. 65188

JOB NAME

New Mountain Rd., Stoney Creek

TECHNICIAN AJ

BORING DATE July 28/65

CLIENT

County of Wentworth

ENGINEER CFF

DATUM 481.3

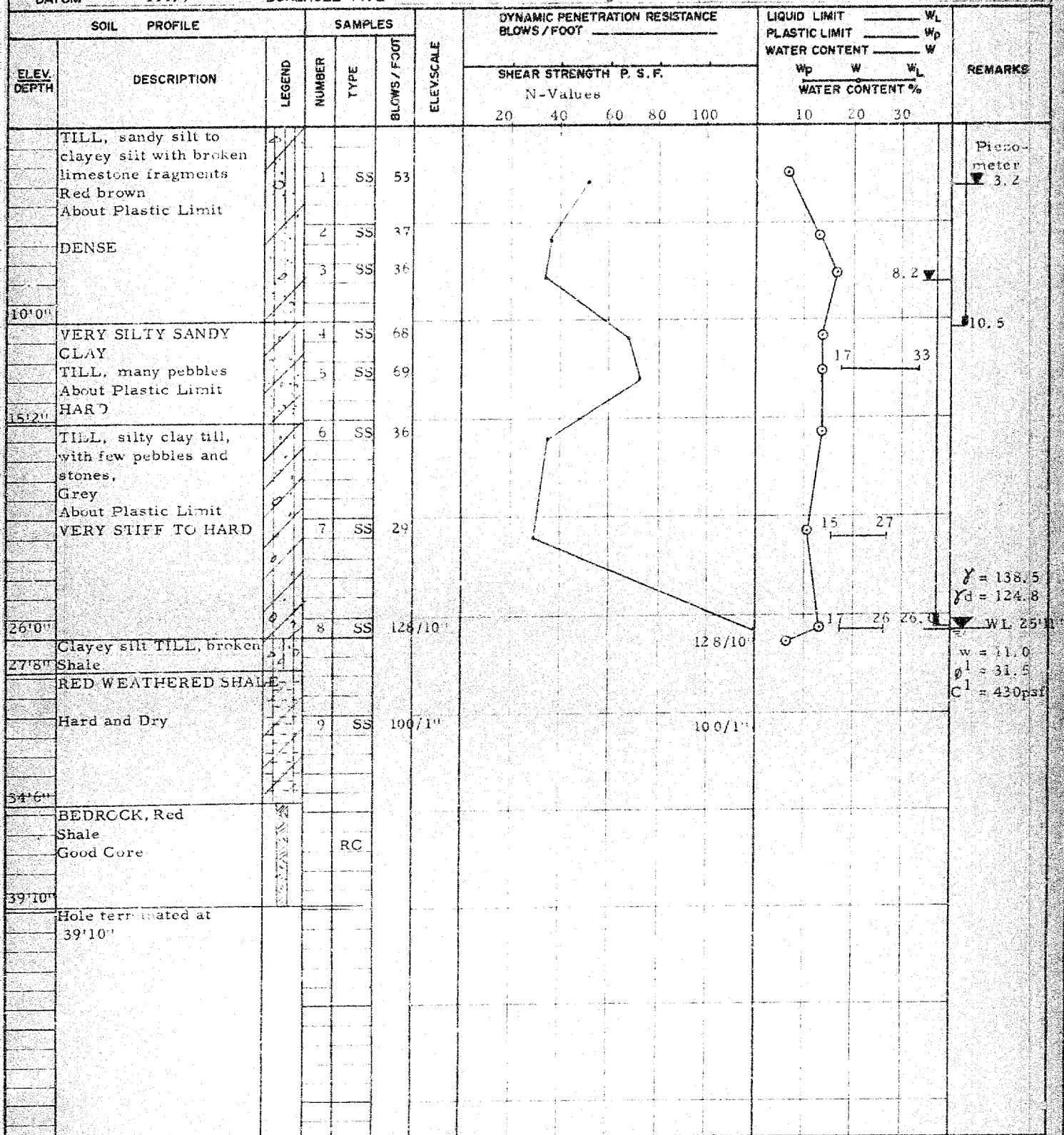
BOREHOLE TYPE

4" and BX casing

TYPED BY HF

[illegible]

TECHNICIAN AJ
ENGINEER CFF
TYPED BY HF



67128 # 13

e. m. peto associates ltd.

Consulting soil engineers

RECORD OF BOREHOLE NO. 13

JOB NO. 65188 JOB NAME New Mountain Rd., Stoney Creek TECHNICIAN AJ
 BORING DATE July 15/65 CLIENT County of Wentworth ENGINEER CFF
 DATUM 564.9 BOREHOLE TYPE 4" and BX casing TYPED BY HE

SOIL PROFILE		SAMPLES		BLOWS / FOOT	ELEM SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT W_L PLASTIC LIMIT W_p WATER CONTENT W			REMARKS
ELEV. DEPTH	DESCRIPTION	LEGEND	NUMBER	TYPE		SHEAR STRENGTH P. S. F. N-Values					W_p	W	W_L	
						20	40	60	80	100	5	10	15	
	FILL, sandy and silty and stony fill, with crushed stones, asphalt mix and some sandy clay		1	SS	20									
			2	SS	17									
12'0"			3	SS	5									
13'0"	SANDY CLAY, ORGANIC CLAY, silty to clayey silt. Grey - at Plastic Limit, Stone layers		4	SS	7									
16'8"			5	SS	107									Lost Wash Water Recovery 62% 67%
	BEDROCK, interbedded sandstone, with some shale, FAIR TO GOOD CORE			RC										
22'5"				RC										
	Hole terminated at 22'5"													Virtually no water in hole

MEMORANDUM

To: Mr. A. Rutka
Materials and Testing Engineer
Downsview, Ontario

From: H. Greenland
District Engineer
Hamilton, Ontario

Date: February 10, 1966

Our File Ref.

In Reply To

Subject: Subsoil Investigation -
New Mountain Road
Wentworth County Suburban
Road #25

Herewith, a copy of the above-noted report which has been prepared for the Suburban Commission by E.M. Peto Associates Ltd. We would be obliged if you would review this report and let us have your comments.

You will note that the Consultant advises three schemes although he does make a definite recommendation that it would be preferable to move the road southerly into the rock rather than to construct retaining walls, which would be required in either of the other schemes. However, he goes on to state whatever scheme is adopted further exploratory work is recommended and we would appreciate having your comments particularly in this respect.

H. Greenland
District Engineer

per

B. H. Newington

Attach.
BHN/sl

B.H. Newington
District Municipal Engineer

Ken
Please review & return with comments.
AR

Mr. H. Greenland,
District Engineer,
District #4 (Hamilton).

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

Attention: Mr. B. H. Newington,
District Municipal
Engineer.

March 1, 1966

Subsoil Investigation
New Mountain Road
Wentworth County
Suburban Road No. 25

With reference to your memo of February 10, 1966, to Mr. A. Rutka, Materials and Testing Engineer, and the telephone discussion with the undersigned on February 28, 1966, we wish to make the following comments:

In the consultant's report, due to the nature of the subsoil in the problem area, a number of assumptions regarding soil properties and ground water levels, had to be made in order that certain stability analyses could be carried out. Useful as they may be, in view of the above mentioned, we feel that it would be unwarranted to place too much emphasis on these analyses.

Failures or instabilities such as that described in the report, are encountered quite frequently in areas of comparable topography and subsoil stratification. In some instances, the placing of the road embankment fill causes overstressing of the slope material and consequently, failure results. Such failures usually occur during or immediately after construction. However, many times failures occur after some time - often after a number of years of satisfactory performance. It is obvious that during these years a certain influence or action must have been developing that eventually caused the failure. In most of the cases, this unfavourable influence is due to water action.

Whenever water action is the triggering factor, two logical alternatives for the restoration of stability present themselves:

- (a) either to prevent the water from entering the problem area; or
- (b) move the structure out of the problem area to a new location where there is little or no detrimental water influence.

Mr. H. Greenland,
District Engr., Dist. 4
Attn: Mr. B. H. Newington,
Dist. Mun. Engr.

- 2 -

March 1, 1966

It is our opinion that water action is the deciding factor in the case in question. Ever since the first failure, conditions have been further aggravated by the placing of additional fill material at a location where it contributed to the instability. All this was done without any attempt to remove the real cause of failure.

In the consultant's report, a number of alternatives for the restoration of stable conditions are put forth, with preference given to the moving of the road to the south, thus placing it on rock. Provided that the stability of the rock slope and the structures on top are not jeopardized, this is by far the best solution.

We understand that at present, the alternative being adopted, calls for only a partial moving of the road. It is also intended to remove that part of the road fill which will become superfluous due to the shift of the centre-line of the road.

In addition to the above described moving of the road, we would suggest that a cut-off drain be built that would run across the road on the east side of the problem area. The purpose of this drain would be to intercept and lead away any water coming down from higher ground through the road fill.

The trench for the drain should be as deep as practically possible, should have a perforated pipe at the bottom, and should be backfilled with coarse gravel. In case significant quantities of water should pass through the pipe, provisions should be made to take care of this water to prevent erosion along the slope.

With the above described arrangement, and with proper and effective drainage on both sides of the road - especially on the south (rock) side - most of the water previously entering the unstable area will now be taken care of and its detrimental influence eliminated.

It would appear to us that for the proposed work there is sufficient information available, and that no additional investigation at this stage is necessary.

AGS/MdeF

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

cc: Foundations Office
Gen. Files

2000 10 10 1000
Hwy. 401 & Keele St
Downsview, Ontario.

Materials & Testing Division

April 4, 1966.

Mr. R. C. Fraser,
County Engineer,
County of Wentworth,
Court House,
Hamilton, Ontario.

Subject - Slope Indicator Installation - New Mountain Road
- County Suburban Road No. 25.

Following our installation of two slope indicators at the above-mentioned site and the subsequent readings taken over a number of weeks we are now in a position to inform you of the following:-

Lateral earth movements of magnitude 2.5-3.5 inches have been recorded in the slope indicators during the period March 2nd to March 29th '66. The maximum movement occurred in a zone some 20-25 feet below ground surface. It has also been reported that a 4½-inch lateral movement of the T.H. & B Hwy. track took place or was observed on March 22nd. This displacement was immediately corrected but on March 24th a further movement of 2 inches took place.

It is believed that the above observations show that a potentially dangerous condition exists at this site and therefore remedial measures should be carried out with the utmost expediency. Whilst it cannot be concluded with certainty that the road fill is the sole cause of the slope movements and the escarpment itself is not inherently unstable it must be assumed that the fill is a definite contributing factor and that removal of the latter can have only beneficial effects.

Based on the foregoing our recommendations are as follows:-

- (1) The road should be realigned so as to be founded entirely on bedrock over the whole length of the affected zone.

(2) All fill material already existing on the escarpment side should be removed, and sufficient levelling and grading carried out to ensure adequate drainage of surface water.

Enclosed is Drawing #65-F-128A which shows the locations and elevations of the slope indicators and the soil stratigraphy at a section through Sta. 20+50 and Drawing 65-F-128B which shows a graphical representation of the earth movements recorded in the slope indicators.

We will continue to read the slope indicators and from time to time report our observations to you.

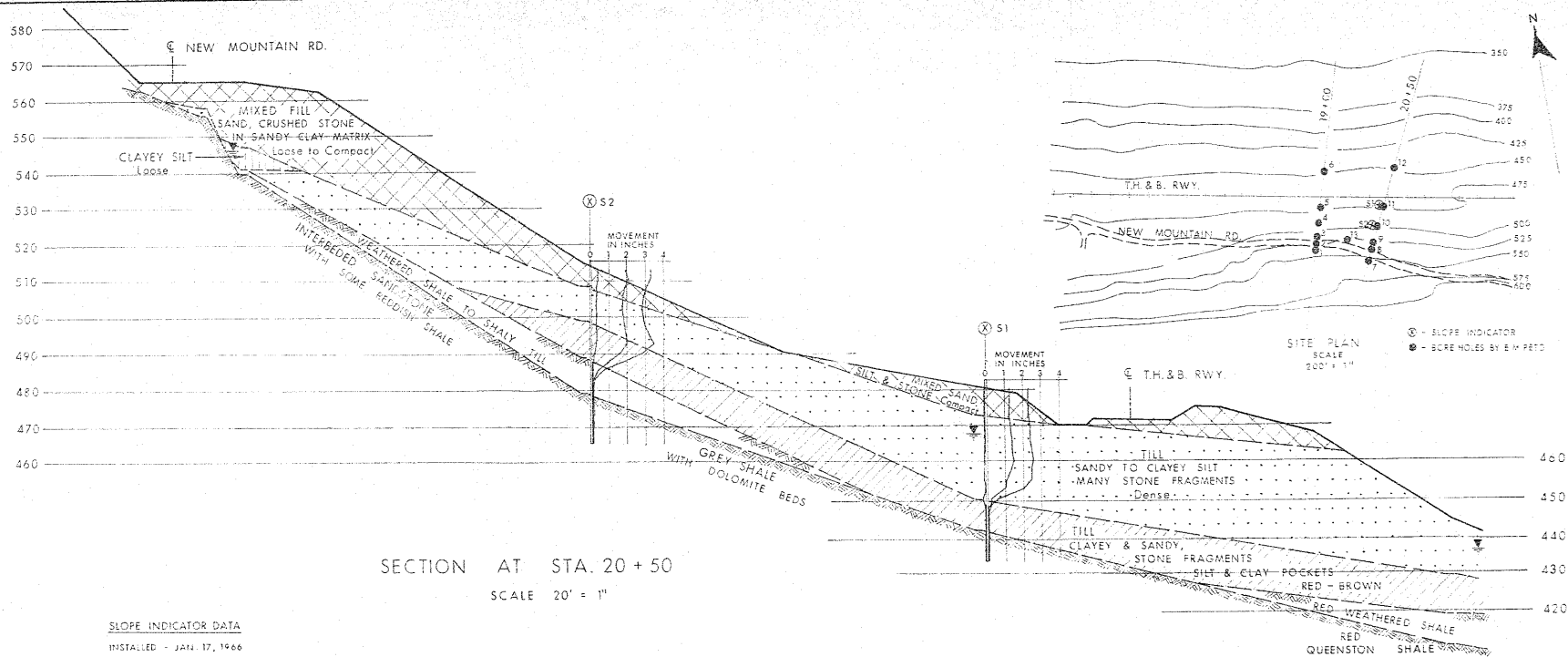
If you have any further queries relating to this project please do not hesitate to contact this Office.

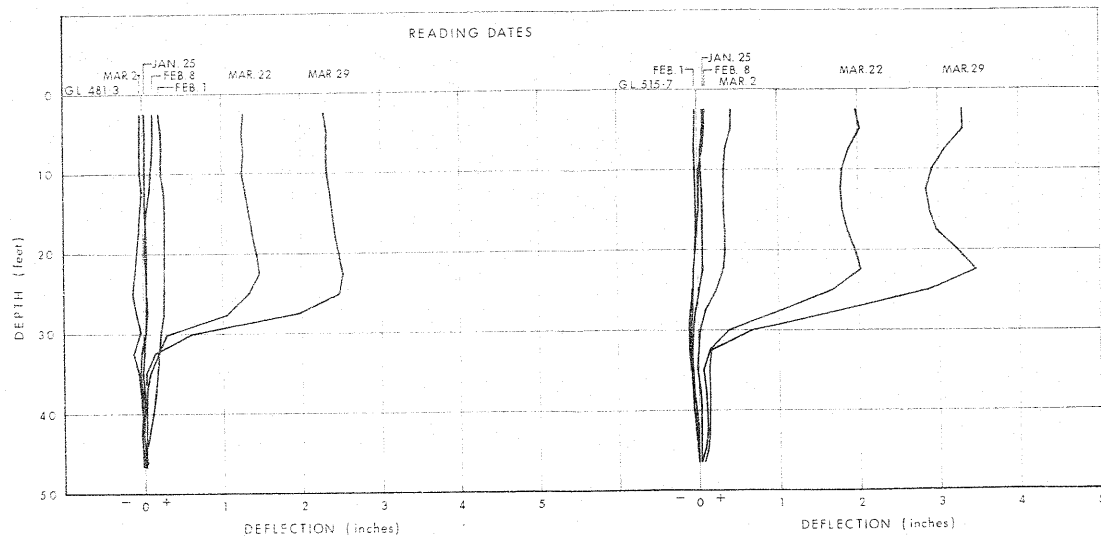
Enclosure
KCS/tt

H. G. Selby

K. G. Selby
Senior Foundation Engineer

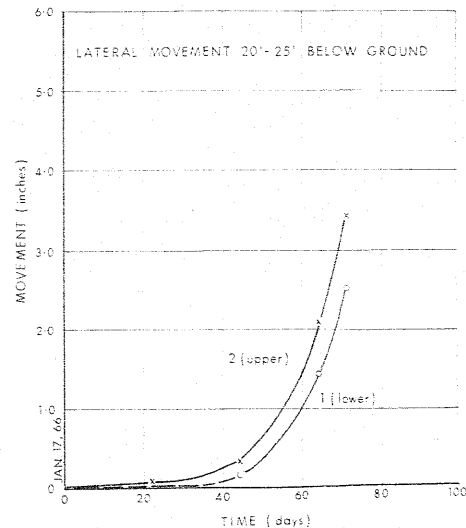
For: A. G. Sternac
Principal Foundation Engineer






SLOPE INDICATOR NO 1 (LOWER)

SLOPE INDICATOR NO 2 (UPPER)



MOVEMENT OF SLOPE INDICATOR VS TIME

 ONTARIO	DEPARTMENT OF HIGHWAYS MATERIALS and TESTING DIVISION	NEW MOUNTAIN ROAD - STONEY CREEK EARTH MOVEMENTS RECORDED BY SLOPE INDICATOR	
	DATE APRIL 4, 1966	APPROVED <i>[Signature]</i>	DRAWING NO 65-F-128B

THE TORONTO, HAMILTON AND BUFFALO RAILWAY COMPANY

LAW DEPARTMENT

F. S. WEATHERSTON, O.C.

GENERAL SOLICITOR

HAMILTON, CANADA

7th May, 1965.

Mr. A. F. Stewart,
County Clerk,
County of Wentworth,
Courthouse,
Hamilton, Ontario.

Dear Mr. Stewart:

A very serious and dangerous condition exists on the Railway line between Mileages 30.28 and 30.34, which is due north and approximately 80' below the level of the New Mountain Road, in the Township of Saltfleet, whereby the track is constantly being shifted to the north. I enclose copy of a plan showing the location.

In the opinion of the Railway Engineers, this is due to the subsidence of part of the New Mountain Road, which causes the whole surface to be pushed downhill and across the Railway right-of-way.

The condition first appeared in the year 1963 when, I understand, a considerable amount of work was done by the County on the New Mountain Road. Since that time, the track has had to be realigned once in 1963 and twice in 1964. Already this year the track has had to be realigned five times, as follows:

1st week of April	Spike lined approximately 3" (unable to throw track account frozen ballast).
April 5th	Track was out of line approximately 3" to the north and was lined over so that it was approximately 3" out of line to the south.
April 26th	Ditto
May 4th	Ditto
May 7th	Ditto

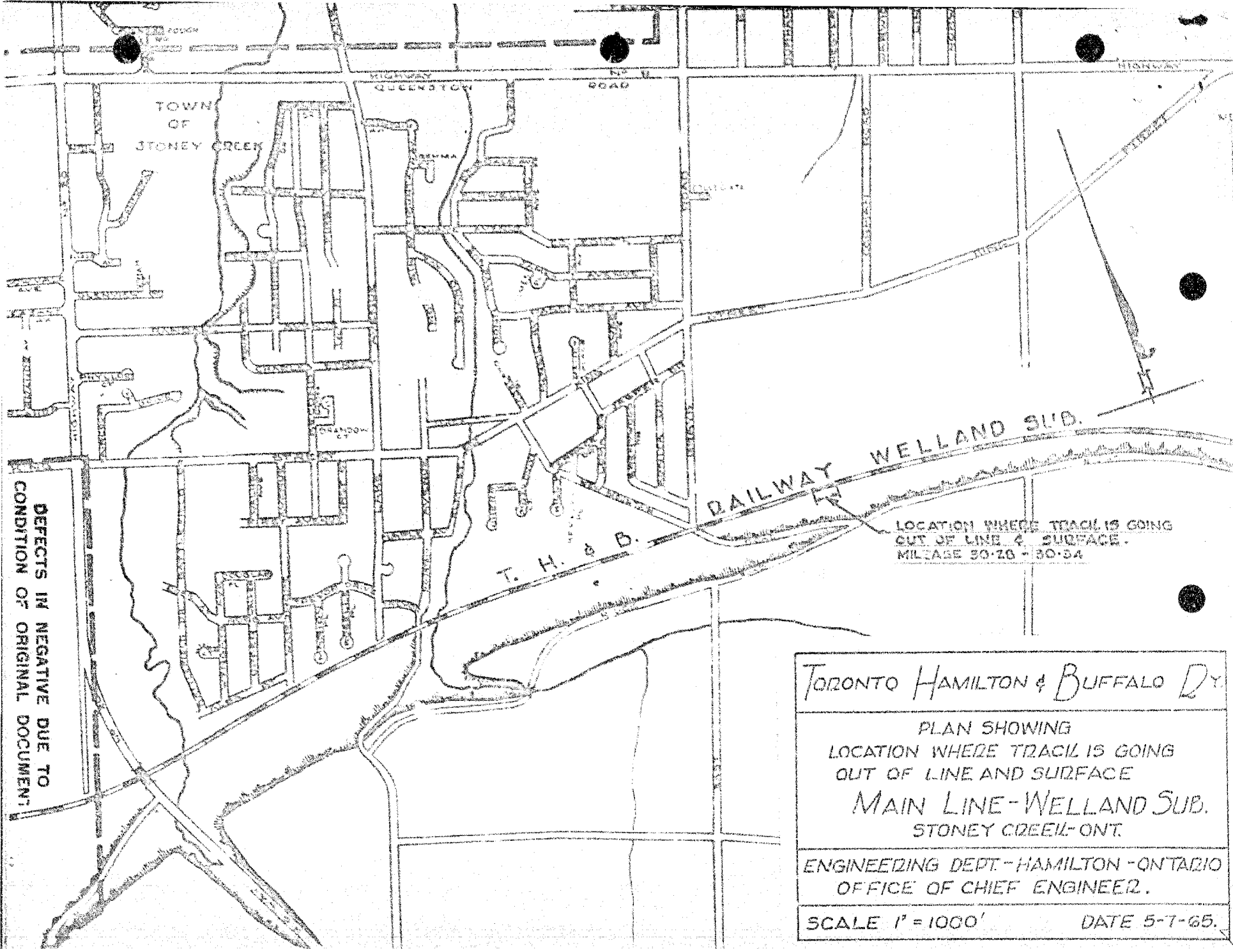
Clearly, this condition must not be allowed to continue. The Railway is having the track patrolled twice each day, in the interests of safety, but there is always a danger of derailment and consequent hazard to human life. We would therefore ask that the County take immediate steps to remedy the situation and that, in the meantime, the road be closed to vehicular traffic.

Yours truly,


General Solicitor.

W:s
Enc.

c.c. PWH
NVB
JAH
R. Fraser, County Engineer.



DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

TORONTO HAMILTON & BUFFALO RY.	
PLAN SHOWING LOCATION WHERE TRACK IS GOING OUT OF LINE AND SURFACE	
MAIN LINE - WELLAND SUB. STONEY CREEK - ONT.	
ENGINEERING DEPT. - HAMILTON - ONTARIO OFFICE OF CHIEF ENGINEER.	
SCALE 1" = 1000'	DATE 5-7-65.

October 21st, 1965

County of Westworth,
County Engineer's Office,
Court House,
Hamilton, Ontario.

Attention: Mr. R. C. Fraser,
County Engineer

Dear Sir:

Re: New Mountain Road - Stoney Creek
Stability Investigation

We refer to the meeting with the Suburban Roads Commission and the County Road Committee, yesterday, the 28th October 1965 in the Court House Building of the County of Westworth.

At the meeting the findings arising from our work to that date on the new Mountain Road were presented to the Commission. These findings were:

- (a) The road could be reconstructed provided it was supported by the bedrock by -
 - 1. cutting the road back into the rock face to the south
 - 2. constructing a retaining wall on the rock and thereby supporting the outer failed portion of the road,
 - 3. a compromise of (1) and (2) and (4) lowering the road grade to place the road on a rock bed.
- (b) Included in the reconstruction work were -
 - 1. Regrading of the fill and slopes below the north edge of the road so as to flatten the slope and thereby reduce the loading on the slope,
 - 2. the provision of effective drainage measures

- (c) The present continued failure of the road was due to the loose condition of the stony fill, combined with poor foundation and drainage conditions.
- (d) There was no obvious evidence at present that the work performed to that time was directly responsible for the failure of the railway below, although loading of the slope above the railway could be regarded as a contributory cause given suitable adverse conditions, the most important of these being drainage.
- (e) The cause of the movement of the railway tracks was not within our terms of reference, and could not be determined without a lot of additional work and study.

In the light of these findings, we are concerned with the decision of the Commission to reconstruct the road, albeit temporarily, by replacing the fill and thereby reloading the slope above the railway.


Our concern springs from the fact that this course of action, while possibly politically expedient, cannot be supported by the engineering findings of our report, and furthermore in the event of another movement of the railway in the spring it is felt that the Commission would be placed in a position which it is believed would be legally indefensible.

The fact that the railway may or may not move irrespective of whether temporary remedial work is performed or not, does not affect the issue, which is that loading the soil slope can be regarded as a contributory cause of the movement.

We trust you will understand that we are writing you on these lines in order to be sure that all concerned are aware of the possible consequences of the decision made at the meeting.

Yours very truly

E.M. PETO ASSOCIATES LTD.,


C.F. Freeman, P.Eng.,
Chief Engineer.

CFF/hf

4 c.c. Addressee
1 c.c. File

November 15th, 1965

The County of Wentworth,
Road Department,
Court House,
Hamilton, Ontario.

Attention: Mr. R. G. Fraser
County Road Engineer

Gentlemen:

Re: New Mountain Road,
Temporary Widening.

We are pleased to confirm the general observations made to Mr. R. Fraser on the site by our Mr. D. H. Hitchins on 12th November 1965.

It is our understanding the Suburban Road Committee are anxious to widen the road on the south side, in the vicinity of the failure, by some 13 to 20 ft. The purpose is to provide two way traffic on this road during the winter months. From our standpoint we agree the proposal is feasible, but we do feel the following points should be carefully borne in mind by the Committee in arriving at a decision.

- (a) Although the proposed widening is only 10 ft. for traffic requirements it will be closer to 20 ft. at the base when allowance is made for the ditch, and the bench beyond the ditch to act as a ledge on which to catch minor spalling from the newly excavated rock face to the south.
- (b) This widening may affect the ground water flow pattern above and below the excavation. This could have an adverse effect above the excavation in so far as wells in the vicinity are concerned, and below the excavation in connection with the failure area.

- (c) Blasting should be kept to a minimum as far as possible. Small charges only should be used.
- (d) There is no guarantee the widened length will rest on rock throughout. There may be areas where soft soils will be encountered, requiring special treatment.
- (e) It is understood that all excavated material will be removed from the site completely. No material will be placed on the slope to the north.
- (f) It is entirely possible that when the road has been widened there will be little width left to support the road overlooking the mountain brow. The travelled surface here is very close to the edge now in one place, and a reduction in the support may cause some failure here. This would necessitate widening the road on the upper level on the south side, and may require some land acquisition for this purpose.
- (g) This work, in our opinion, will not have any adverse affect on the situation in the Railway Line, although it is impossible to predict any possible changes in the drainage pattern, which may arise as a result from the use of explosives in the rock.

Yours very truly,

E.M. PETO ASSOCIATES LTD.,



C.F. Freeman, P. Eng.,
Chief Engineer.

CFF/h

2 c.c. Addressee
1 c.c. File

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 65188

1287 caledonia road.

TORONTO 19, ONTARIO

Telephone: 789-1126

November 19, 1965

The Department of Highways, Ontario,
Foundation Section,
Downsview, Ontario.

Attention: Mr. K.Y. Lo, P.Eng.

Dear Sir:

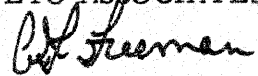
Re: New Mountain Road,
Stoney Creek
County of Wentworth

We refer to the meeting on the above site yesterday, Thursday, 18 November 1965.

In accordance with your request we are forwarding herewith a copy of the soil sections taken on chainage 19 + 00 and 20 + 50 on this site, together with copies of two letters dated the 21st October and the 15 November 1965, both addressed to Mr. R.C. Fraser, the County Engineer.

Yours very truly,

E. M. PETO ASSOCIATES LTD.,


C.F. Freeman, P.Eng.,
Chief Engineer.

CFF/hf
Encls.

1 c.c. Addressee
1 c.c. File

MEMORANDUM

To: Mr. A. Stermac
Principal Foundation Engr.
Materials and Testing Section
Downsview, Ontario

FROM:

H. Greenland
District Engineer
Hamilton, Ontario

Att: K. Lo

DATE:

November 19, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT: New Mountain Road -
Wentworth County Suburban
Road No. 25

I am writing further to our recent meeting with Mr. R.C. Fraser, Wentworth County Engineer, and Mr. C. Freeman of E.M. Peto & Assoc., at which time a Field Inspection of the failure area south of Stoney Creek was made.

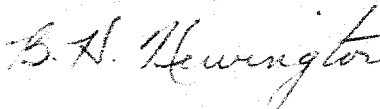
Since it is possible that in the future the Hamilton-Wentworth Suburban Roads Commission or the County could be faced with legal action on the part of the T.H. & B. Railway Co., it would appear advisable that slope indicators should be installed in the general area of the failure in order that we may ascertain if there is movement of the entire slope as opposed to local movement in the failure area itself.

The County Engineer, Mr. Fraser, has indicated that he would welcome the installation of slope indicators and your early attention to this installation would be very much appreciated. I believe the area between the County Road and the Railway track to the north is owned by others and while Mr. Fraser anticipates no difficulty in obtaining permission to make the installation, I would recommend that you check this matter with him before proceeding. I understand that these indicators would cost somewhere in the neighbourhood of \$400.00 per unit installed and have so informed Mr. Fraser.

Should you desire the Commission to share some part of the cost, I am quite sure that they would be willing to do so.

H. Greenland
District Engineer

per



BHN/sl

B.H. Newington
District Municipal Engineer

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 65188

1287 caledonia road,
TORONTO 19, ONTARIO
Telephone: 789-1126

November 22nd, 1965.

The Department of Highways, Ontario,
Foundation Section,
Downsview, Ontario.

Attention: Mr. K.Y. Lo, P.Eng.

Dear Sir:

Re: New Mountain Road,
Stoney Creek,
County of Wentworth

Further to our letter of November 19th, 1965, we enclose a set of borehole logs for the testholes put down on this site.

Yours very truly,

E. M. PETO ASSOCIATES LIMITED,



C. F. Freeman, P.Eng.
Chief Engineer.

CCf/dc

1cc. Addressee
1cc. File

HAMILTON-WENTWORTH SUBURBAN ROAD COMMISSION

Committee Room #1, Court House
Hamilton, November 25, 1965

The Commission met at 9.30 a.m. on the above date with Commissioners Dymont, Fletcher, Green, Lumsden, and McDonough; Mr. R. C. Fraser, Engineer, and Mr. B. H. Newington, District Municipal Engineer present.

Commissioner Fletcher, Chairman, presiding.

This was a special meeting of the Commission called to consider primarily New Mountain Road.

- 1) New Mountain Road. The Secretary read a letter from Commissioner Green to the Chairman of the Commission advising that he is opposed to action taken at the Joint Road Committee-Commission meeting to open New Mountain Road by cutting into the mountain, and a letter from Peto and Associates confirming their opinion that it is feasible to widen the road by cutting into the rock on the south. Mr. Farnan, County and Commission Insurance Agent was present at our request to review our insurance coverage as it pertains to work on New Mountain Road. Mr. Farnan advised that all of our operations are covered providing we follow engineering advice.

After discussion it was moved by Commissioner Green, seconded by Commissioner Lumsden that we instruct Mr. Farnan to issue an endorsement to cover the operation of the Suburban Road Commission on an occurrence basis.

Carried.

Also that the Road Committee be requested to concur with this decision. Mr. Fraser advised that the Joint Committee had recommended expropriation of land from New Mountain Road southerly to Ridge Road.

It was moved by Commissioner Green, seconded by Commissioner Dymont that the Engineer be authorized to make an offer of three times the assessed value of the land to be expropriated, to the owner.

Carried.

(At the request of the Engineer it was moved by Commissioner Dymont, seconded by Commissioner Lumsden that the Engineer be authorized to employ Peto and Associates to install casings for slope indicators to be supplied by the Department of Highways.)

Carried.

- 2) Solicitors' accounts re expropriation proceedings. It was moved by Commissioner Lumsden, seconded by Commissioner Green that the following legal accounts be approved for payment in view of the O.M.B.'s order for costs:

Mr. H. Greenland,
District Engineer,
Hamilton (District #4).

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

Attention: Mr. E. H. Newington,
Dist. Mun. Engr.

December 30, 1965

-- New Mountain Road --
Wentworth County Suburban Road #25 -
Slope Indicator Installation

This is to advise you that the Department will be billing Wentworth County for the total cost of the two slope indicators installed at New Mountain Road.

Due to the extremely dense and bouldery nature of the subsoil, it is now evident that the final cost of the installation will greatly exceed our original estimate of \$400.00 per unit. The actual cost will probably be in the order of \$1,500.00 per unit. Part of the extra cost has been due to 'vandalism' during the weekend of December 18 - 19, when about \$800.00 damage was done. Four days' work had to be repeated, and extra diamond bits were used up.

Since the original request from the County was verbal only, we would like to have from you, a Local Work Order confirming this.

A. G. Stermac

KGS/ndef

K. G. Selby,
SENIOR FOUNDATION ENGINEER
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

cc: Foundations Office ✓
Gen. Files

10 11 1965

Box 279, Burlington
January 4, 1966

Mr. R.C. Fraser
County Engineer
County of Kentworth
Court House
Hamilton, Ontario

Re: Slope Indicator Installation - New Mountain Road - County
Suburban Road No. 25

Dear Sir:

I have been advised by our Foundation Section that the Department will be billing the County for the total cost of the two slope indicators installed at the New Mountain Road. Further, I have been advised that the final cost of the installation, due to the extremely dense and bouldery nature of the subsoil will greatly exceed the original estimate of \$400.00 per unit.

It is expected that the actual cost will be in the order of \$1500.00 per unit. Part of the extra cost has been due to vandalism on the weekend of December 18-19 which caused about \$800.00 damage. It was necessary to repeat four days work and extra diamond bits were used up.

It would be appreciated if we could have a resolution of the Commission indicating that they are willing to assume this cost which, of course, is eligible for subsidy at the normal rate.

Any comments you may have will be welcomed.

Yours truly

H. Greenland
District Engineer

per:

B. A. Newington
District Municipal Engineer

BAH:cr

M. A. FLETCHER, CHAIRMAN
R. E. BRIDGMAN
C. P. GREEN
H. A. LUSKIN
W. C. STONEY

R. C. FRASER, B.A. MC. P. ENG.
COUNTY ENGINEER

HAMILTON - WENTWORTH SUBURBAN ROADS COMMISSION

COURT HOUSE HAMILTON, ONTARIO . 885-9111

January 27, 1966

Mr. B. M. Newington
District Municipal Engineer
Department of Highways
Box 214
Burlington, Ontario

Dear Mr. Newington:

Re: Slope Indicator Installation-New Mountain Road-
County Suburban Road No. 25

Your letter to Mr. R. C. Fraser, County Engineer, advising that the actual cost of the two slope indicators installed at New Mountain Road will be considerably greater than the original estimate of \$100 per unit and will be in the order of \$1,500 per unit, was considered by the Hamilton-Wentworth Suburban Road Commission at their meeting on January 27th.

The following motion was passed:

"That the Commission assume the extra cost of installing slope indicators to New Mountain Road as outlined in Mr. Newington's letter."

Yours very truly,



A. F. Stewart, Secretary
Hamilton-Wentworth Suburban Roads
Commission

REE:AFS:jld

MEMORANDUM

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

From: H. Greenland
District Engineer
Hamilton, Ontario

Att: K.G. Selby

Date: January 24, 1966

Our File Ref.

In Reply To

SUBJECT:

New Mountain Road -
Wentworth County Suburban Road No. 25 -
Slope Indicator Installation

Further to your letter of December 30, 1965, I am forwarding a copy of a letter from the Secretary of the Hamilton-Wentworth Suburban Roads Commission in which he quotes the Commission's motion at their meeting on January 17, 1966, in which they agreed to assume the cost of installing slope indicators at the New Mountain Road failure location.

While in your letter of December 30, 1965, you request a local purchase order confirming this installation, it would appear to me that under the procedure laid down in Circular No. 64-100 your Section should be able to bill the Commission directly provided you have a copy of the Commission's motion to accept such cost. I believe in this case, the direct billing procedure could be followed and the process of a branch transfer to the District could be avoided.

If you have any further questions or should I prove to be in error in this regard, I would be pleased to hear from you further.

H. Greenland
District Engineer

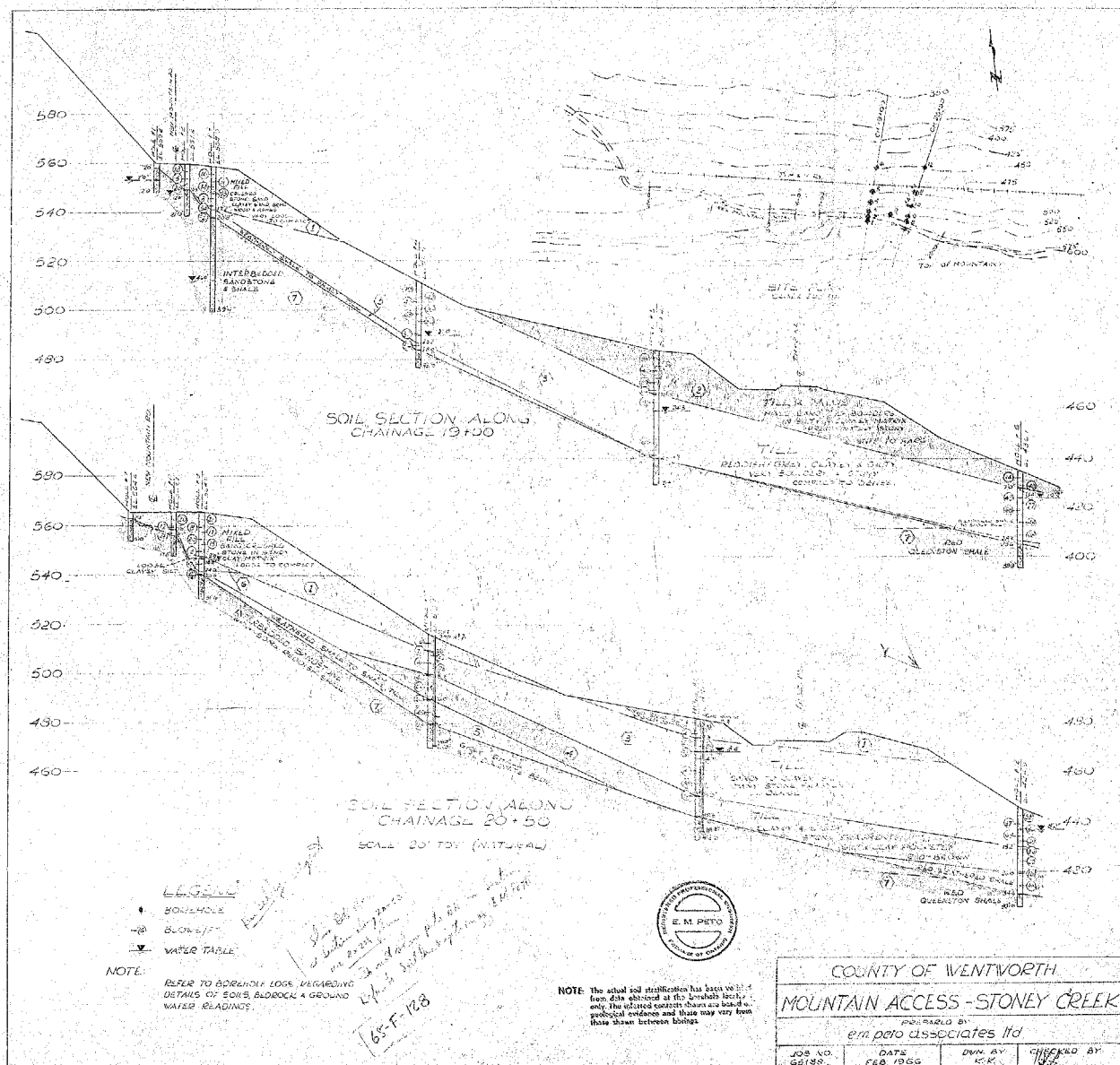
per

B. H. Newington

Attach.
BHN/sl

B.H. Newington
District Municipal Engineer

65-F-(R)-128
COUNTY
SUBURBAN RD.
25
NEW MOUNTAIN RD.
STONE
CREEK



65-F-128A