Mr. A. M. Toye,

Bridge Engineer,

Materials & Research Division,

(Foundation Section)

April 26, 1962.

FOUNDATION INVESTIGATION REPORT

By: Geocon, Limited.

<u>Attention: Mr. [illegible] McCeable.</u>

Re: Proposed Widening Highway #401,
C.N.R. Overpass - East of Keele St.,
<u>Downsview, Ont. - W.P. 230-60, Site 46.</u>

Attached, we are sending you the report on soil conditions and foundations for the above project, prepared by the consultant, Geocon, Ltd. of Toronto.

We have reviewed the report and found the factual information well presented, and we also agree with the conclusions and recommendations contained in the report except for the value of earth pressure coefficient. We see no reason why a value $K_o = 0.5$ should be used for the design since movements of the retaining wall are possible. A value of $K_a = 0.3$ is recommended for the design.

If further information is required in connection with this project, please feel free to contact our Office.

for A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

[illegible]
Attach.
cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
J. C. Campbell
C. Fraser
T. J. Kovich
J. Roy
R. R. Saint
J. T. Gruspier
F. Norman
A. Watt
Foundations Office -- Gen. Files.

cc: Foundations Office (Rm. 110)

Materials and Research Division

March 30, 1962

Geocon, Limited,
14 Haas Road,
Rexdale, Ontario.

Attention: Mr. K. King.

Re: W.P. 230-60, Hwy. 401, C.N.R. O'Head,
E. of Keele St., District #6, Toronto.

Dear Sir:-

Please consider this your authority to carry out a foundation investigation at the above site. Plans and profiles were provided to your representative, March 26, 1962.

It is understood that a qualified Soils Engineer will be in charge of the field work at all times.

Fourteen copies of the completed foundation report should be submitted to the Foundation Section as soon as possible. Previous requirements as to preliminary borehole information and Laboratory testing program, should be followed.

Charges for the work performed will be in accordance with your Schedule of Rates, dated October, 1960, and invoice to be addressed to the attention of the undersigned.

We would also advise that we now require that borehole locations be confirmed by District personnel. Would you therefore, advise this office before completion of the drilling, in order that this may be arranged and undertaken while your Engineer is still at the site.

NDS/MdeF

Yours very truly,

A. Rutka
MATERIALS & RESEARCH ENGINEER

cc: Messrs. S. McCombie
I. C. Campbell
C. Fraser
T. J. Kovich
N. D. Smith (2)
Mrs. T. Tate
Foundations Office
Gen. Files (2)

ONTARIO

DEPARTMENT OF HIGHWAYS

Bridge Division.

Memo to	Mr. A. Stermac, Principal Foundation Engineer, Room 107, Lab. Building	Date	March 27, 1962.
		Subject	W.P. 230-60 C.N.R. Overpass (Widening) Toronto By-Pass Hwy. #401 - District #6
From	F. DeVisser		

Enclosed please find one print of the Preliminary Plan for the subject structure. Would you let us have your comments.

F. DeVisser

FDeV/ea

F. DeVisser,
Bridge Location Engineer.

Investigation along retaining wall under way (Geocon). Comments should be made when results of investigation are known

March 29. 1962.

AGS

Mr. A. M. Toye,

Bridge Engineer.

Materials & Research Division,

(Foundation Section)

Attention: Mr. C. Grebski

May 24, 1962.

ADDITIONAL REVIEW OF SOILS REPORT BY GEOCON, LTD.

Re: Allowable Bearing Capacity,
Retaining Walls and Bridge Abutments,
C.N.R. Overpass - East of Keele Street,
W.P. 230-60, District No. 6.

The above report was reviewed again and it was concluded that a sharp division of bearing capacities along a certain elevation is unjustified because the surface of the till layer is not horizontal. The proposed elevation of 590 is in places, even within the fill material and certainly 4.0 T/sq.ft. would not be allowable in such a material. It is therefore concluded that the footings should be placed on top of the dense till layer as it appears - i.e., the footings should follow the contours of this contact. The designer has followed this approach.

Because of the unusual height of the retaining wall (40 ft.) even small differential settlements of the footing will be noticeable on the wall and it is therefore recommended that a greater factor of safety - i.e., a smaller bearing value be used. A value of 3.0 T/sq.ft. is recommended. However, the above-mentioned has a much smaller effect where the height of the wall is smaller and a higher bearing value can therefore be used. It is recommended that 4.0 T/sq.ft. be used for retaining wall footings wherever the height of the wall is 15 feet or less. The value of 15 feet is chosen arbitrarily.

Some of the above conclusions were already incorporated in the preliminary design and the rest was agreed upon with the designer over the telephone on May 23, 1962.

A. G. Stermac

A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

AGS/MdeF

cc: Foundations Office
Gen. Files.

Rexdale, Ontario,
May 22nd, 1962.

Department of Highways, Ontario,
Bridge Design Office,
Downsview, Ontario.

Attention: Mr. C. S. Grebski, P. Eng.,
Senior Engineer.

Re: Allowable Bearing Capacity,
Retaining Walls and Bridge Abutments,
C.N.R. Overpass - East of Keele Street,
W.P. 230-60,
Downsview, Ontario.

Dear Sirs:

Further to our report S7350 dated April 24th, 1962 and our telephone conversation of May 18th, 1962, this letter discusses how the given allowable bearing values were determined and considers the possiblity of increasing these values for footings founded within the compact to very dense silty till below elevation 590: Most of the footing length will be founded above elevation 590 at 4.0 tons per square foot, the maximum value generally allowed on the Toronto area tills. However, it is understood that considerable savings could be effected by any increase of the allowable bearing value for footings founded below elevation 590.

The results of the laboratory strength testing are plotted on Figure 2 of Appendix II in report S7350 in terms of compressive strength versus elevation and there appears to be a trend for a strength decrease with depth. The presence of a stiff crust and the colour change from brown to grey in the till, suggests that the higher strengths near the surface are due to desiccation.

With a design strength line as shown on Figure 2 of Appendix II, the allowable bearing capacity would depend on both footing elevation and width. In our report, we considered the more critical case of footings of the order of 20 to 25 feet, that is, very wide footings. A sophisticated analysis of bearing capacity would ensure that on the basis of Boussinesq stress distribution, the available design strength below the footing was not exceeded at any depth. However, the strength of the till can not be determined accurately enough either in-situ or in the laboratory to justify this approach. The more approximate method, of the allowable bearing value equal to the average compressive strength for a depth below the footing equal to the width of the footing, was then used. Using this method and referring to Figure 2 of Appendix II the allowable bearing values for wide footings founded between elevation 580 and 590 would be from about 3 to 4 tons per square foot. The following tabulation gives the values obtained by this approximate method.

Footing Elevation	Footing Width (ft.)	Allowable Bearing Value (tons/sq. ft.)
590	10	4.0
"	20	4.0
"	30	4.0
585	10	4.0
"	20	3.7
"	30	3.2
580	10	3.5
"	20	2.9
"	30	2.6

Intermediate values can be obtained by interpolation of both footing elevation and width.

We trust that this letter details all the additional information that you require. However, if we can be of any further assistance, please do not hesitate to call on us.

Yours very truly,

GEOCON LTD

F. J. Heffernan

F. J. Heffernan, P. Eng.,
Senior Soils Engineer.

FJH/dw
S-7350

c.c. Mr. A. G. Stermac,
Materials and Research Section,
Department of Highways, Ontario.

180 VALLEE ST., MONTREAL 18, QUEBEC
TELEPHONE UN. 6-7632

1425 WEST PENDER ST.
VANCOUVER 5, B.C.
TEL. MU. 1-8926

Rexdale, Ontario,
May 3rd, 1962.

Department of Highways, Ontario,
Materials and Research Section,
Downsview, Ontario.

Attention: Mr. A. G. Stermac, P. Eng.,
Principal Foundation Engineer.

Re: Allowable Bearing Capacity of Fill,
Proposed Retaining Walls,
C.N.R. Overpass - East of Keele Street,
W.P. 230-60,
Downsview, Ontario.

Dear Sirs:

Further to the telephone conversation of April 27th, 1962 between your Mr. Stermac and the writer, we have, as requested, looked into the possibility of increasing the allowable bearing capacity of the fill at the subject site above 1 ton per square foot. We understand that consideration is now being given to founding the proposed retaining wall in the fill 5 feet below present ground level.

The resistances to the dynamic penetration test were generally slight to moderate in the fill and increased rapidly with penetration into the natural till stratum. The "N" values as obtained in the fill ranged from 5 to 25 with an average value of 15 blows per foot. Based on these resistances and assuming the material to be cohesionless, an allowable bearing value of 1 ton per square foot was assigned to the fill.

As a further check the strength properties of the fill have been examined by carrying out unconfined compression tests on intact portions of the fill. The results are given below together with the corresponding "N" value obtained for the sample:

Borehole Number	Sample Number	Depth (feet)	M_c %	(lbs/cu.ft.)	U_c (tons/sq.ft.)	"N" Value (blows/ft.)
1	2	4	13.0	128	2.0	25
1	3	5	12.4	138	1.0	24
9	1	5	14.0	135	4.0	24
10	1	5	23.8	130	0.60	7
13	1	5	25.6	118	0.58	8

These tests show that the consistency of the fill is variable, and even allowing for the inevitable disturbance during sampling there are areas where the strength of the fill stratum is relatively low. For footings founded within the fill stratum at a depth of 5 feet below ground level as proposed, the strength tests confirm the over-all allowable bearing value of one ton per square foot already given for design. Both the penetration tests and the compression tests show that there are obviously areas in the fill stratum where an allowable bearing value greater than 1 ton per square foot can be used. An approach whereby these areas of higher bearing value are delineated during construction may be considered.

However, considering the close proximity of the compact to very dense till stratum to the underside of the footings, another approach would be to consider the possibility of removing all of the fill and backfilling to proposed footing elevation with re-compacted fill. If this fill is placed in horizontal lifts and compacted to 95 percent of modified AASHO density, an allowable bearing value of 2 tons per square foot can be used.

We trust that this letter gives the information required at this time. If we can be of further assistance now or during construction, please do not hesitate to call on us.

Yours very truly,

GEOCON LTD

F. J. Heffernan, P. Eng.,
Senior Soils Engineer.

FJH/dw
S-7350

GEOCON LTD

HEAD OFFICE
180 VALLÉE ST., MONTREAL 18, QUEBEC
TELEPHONE UN. 6-7632

DISTRICT OFFICES
14 HAAS ROAD
REXDALE, TORONTO, ONT.
TEL. 244-6476

1425 WEST PENDER ST.
VANCOUVER 5, B.C.
TEL. MU. 1-8923

Rexdale, Ontario,
April 24th, 1962.

Department of Highways, Ontario,
Materials and Research Section,
Downsview, Ontario.

Attention: Mr. A. G. Stermac, P. Eng.,
Principal Foundation Engineer.

Re: Soil Conditions and Foundations,
Proposed Widening Highway #401,
~~C.N.R. Overpass~~ - East of Keele Street,
W.P. 230-60,
Downsview, Ontario.

Dear Sirs:

This letter accompanies our detailed report covering the investigation carried out at the above site.

We find that the site is covered by 4 to 9 feet of loose to compact silty till fill which is underlain by compact to dense silty till to the depths investigated. The groundwater table at the time of the investigation was within 4 feet of ground surface.

As discussed in the report, the silty till stratum is suitable for the founding of the retaining walls and abutments at the recommended bearing capacities. The resulting settlements should be within tolerable limits. Recommendations are also given in the report for the lateral forces to be used in design of the retaining walls.

We believe that this report gives all the information necessary for safe and economical foundation design. If we can be of any further service, however, please do not hesitate to call on us.

Yours very truly,

GEOCON LTD

J. C. Osler for J. J. H.

J. C. Osler, P. Eng.,
Division Engineer.

JCO/dw
S7350

S7350

REPORT

TO

DEPARTMENT OF HIGHWAYS, ONTARIO

ON

SOIL CONDITIONS AND FOUNDATIONS

PROPOSED WIDENING HIGHWAY #401

C.N.R. OVERPASS - EAST OF KEELE STREET

W.P. 230-60

DOWNSVIEW ONTARIO

Distribution:

14 copies - Department of Highways, Ontario, Downsview, Ontario.

2 copies - Geocon Ltd, Rexdale, Ontario.

GEOCON

INDEX

INTRODUCTION

Geocon Ltd has been retained by the Department of Highways, Ontario, by letter dated March 30th 1962, to investigate and report on the soil conditions north and south of Highway 401 in the vicinity of the C.N.R. underpass, east of Keele Street in the Township of North York, Ontario.

The object of the investigation was to determine and interpret the soil conditions as they affect the design of foundations for the proposed retaining walls and bridge abutments necessitated by the widening of Highway 401 in this area.

PROCEDURE

The field work was carried out between March 27th and April 2nd, 1962 and between April 6th and April 9th, 1962. A total of fourteen boreholes, each with an accompanying dynamic penetration test, was put down using a mobile power auger. The location of the borings and the inferred soil stratigraphy are shown on Drawing S7350-1 located in the pocket at the rear of this report. Detailed logs of the borings are given on the Office Reports on Soil Exploration in Appendix I.

The laboratory testing was carried out in the Toronto Soil Mechanics Laboratory of Geocon Ltd and the results are plotted on the Office Reports in Appendix I and on the Figures in Appendix II. The soil samples remaining after testing will be stored until November 1st, 1962 at which time you will be contacted for instructions regarding their disposal.

The elevations of the boreholes are referred to a bench mark cut in the northwest corner of the concrete bridge sidewalk 49 feet left of Station 177+91. The elevation of this bench mark was given as 622.89, referred to Geodetic datum. The boreholes were located by our field personnel and checked by District personnel of the Department of Highways, Ontario.

SITE AND GEOLOGY

The C.N.R. underpass is located about 1/2 mile east of Keele Street along Highway 401, in the Township of North York, Ontario. The ground surface in the region is relatively flat to the north, east, and south and drops off to the west of the underpass.

From available geological information and previous work in the area, it is known that the area is covered by a deep deposit of glacial drift consisting of several till sheets separated by interglacial or interstage sands, silts and clays.

SOIL CONDITIONS

The principal soil strata as encountered in the boreholes are as follows:

Topsoil and Peat

The ground surface at the toe of the present embankments and within the highway right-of-way is generally covered by a thin layer of topsoil from 2 to 4 inches in thickness. At borehole 10, which was put down in a marshy area, the uppermost stratum is peat, being composed mainly

Topsoil and Peat (continued)

of decaying organic matter. The thickness of the peat at the location of borehole 10 was 10 inches.

Loose to Compact Silty Till Fill

Underlying the peat in borehole 10 and the topsoil in all the other boreholes except number 11 is a deposit of brown till fill. The fill is believed to have been placed during the general grading of the right-of-way. The fill is basically a reworked silty till and as such is quite similar to the underlying material in grain size distribution. The fill is quite uniform in composition with very little foreign or organic matter present, though lenses of sand frequently occur. The fill is generally brown in colour except for some locations where mixing of grey and brown till has produced a mottled colouring. The thickness of the deposit as encountered ranged from 4 to 9 feet.

Standard penetration tests performed in the fill gave "N" values ranging from 5 to 25 blows per foot with an average value of 15 blows per foot. Based on these "N" values and the results of the dynamic penetration tests the relative density of the fill is estimated to range from loose to compact.

For design purposes, the fill can be considered as cohesionless with an angle of shearing resistance of 30 degrees. The wet and submerged unit weights are estimated to be 125 and 63 pounds per cubic foot. Considering a

Loose to Compact Silty Fill (continued)

wall friction of 10 degrees the coefficients of earth pressure for the "active", "at-rest" and "passive" cases can be taken as 0.3, 0.5, and 4.0 respectively.

Soft Organic Clay

A culvert, which is fed from ditches running in east and west directions passes below the embankment between boreholes 10 and 11 as shown on Drawing S7350-1. Borehole 11 was put down in the vicinity of the ditch and a layer of dark grey organic clay was encountered immediately below the topsoil. A similar deposit may be encountered along the rest of the ditches. The thickness of the stratum as encountered in the borehole was 8 feet.

An Atterberg limit test was carried out on a sample from the organic clay and gave a liquid limit of 82 and plasticity index of 46. The corresponding natural moisture content was 45 percent. These results indicate that the clay is highly plastic and highly compressible.

One standard penetration test carried out in the clay gave an "N" value of 4 blows per foot. Based on these "N" value and the results of the dynamic penetration test the consistency of the clay is estimated to be soft.

Compact to Very Dense Silty Till

The principal soil stratum at the site is a brown to grey silty till. The till was found immediately below the till fill in all the boreholes except number 11 where

Compact to Very Dense Silty Till (continued)

it was encountered below the organic clay. The till is brown at the top of the stratum and changes to grey with depth, except in borehole 12 where the colour is brown for the full depth investigated. Elsewhere the change in colour occurs at depths within the stratum ranging from 1.5 to 15 feet. The brown colour is believed to be due to weathering of that part of the till which is above the water table at certain times of the year. As the brown and grey tills are similar in composition they have been described here as one stratum. The full thickness was not determined as all boreholes were terminated within this stratum at a maximum depth of 43 feet.

Two mechanical analyses were performed on samples from either end of the site investigated and the results are shown on Figure 1 of Appendix II. These till samples proved very similar in grading, containing about 35 percent sand and gravel sizes, 45 percent silt sizes and 20 percent clay sizes. The samples tested are believed to be typical of the till stratum as a whole.

Four Atterberg limit tests were carried out on the fine grained portion of typical samples from widely spaced locations, both horizontally and vertically, and the liquid limits were found to range from 19 to 22 while the plasticity indices ranged from 6 to 9. The corresponding natural moisture contents ranged from 10 to 12 percent. These test results indicate further the very regular composition of the till stratum across the site.

Compact to Very Dense Silty Till (continued)

The wet unit weight of the material was found to range from 142 to 149 pounds per cubic foot with an average value of 144 pounds per cubic foot.

Standard penetration tests carried out in the stratum gave "N" values ranging from 12 to 73 blows per foot with an average value of 38 blows per foot. The low value of 12 was obtained at depth in borehole 1 while the high value of 73 was obtained in the brown desiccated till in borehole 5. The general trend is that the blow count is high in the brown till and decreases with depth. However, several of the boreholes show no decrease in "N" values with depth. On the basis of these "N" values the relative density is estimated to range from compact to very dense and to be generally dense.

Unconfined compression tests were carried out on 12 samples of the silty till and gave a maximum compressive strength of 7.4 tons per square foot near the top of the stratum, decreasing to 1.4 tons per square foot with depth. The results are plotted on the borehole logs and on the strength versus elevation plot of Figure 2 Appendix II, together with a design strength line. The results clearly indicate the presence of a desiccated crust about 25 feet thick. Representative stress strain curves are shown on Figures 3 and 4 of Appendix II. Generally failure took place at high values of strain as a result of unavoidable disturbance during sampling.

Compact to Very Dense Silty Till (continued)

One consolidation test was performed on a typical sample from the till and the results are shown on Figure 5 of Appendix II. The compression index (C_c) is 0.05 which is very low, indicating that the till is relatively incompressible. This result is consistent with the low liquid limit of the till. The e-log p curve also suggests that the till sample was consolidated in the past to a pressure 1 to 5 tons per square foot in excess of the present overburden pressure.

For design purposes the silty till can be considered cohesionless with an angle of shearing resistance of 35 degrees. The wet and submerged unit weights can be taken as 140 and 78 pounds per cubic foot. Considering a wall friction of 10 degrees the coefficients of lateral earth pressure for the till may be taken as 0.25, 0.5 and 5.0 for the "active", "at-rest" and "passive" conditions respectively.

WATER CONDITIONS

During the period of the investigation, the groundwater level in the boreholes was observed to be generally at 2 to 4 feet below the ground surface. However, the colour change from brown to grey, which probably indicates the low water level, occurs considerably deeper than this, at 10 to 25 feet below ground level though generally about 15 feet. It is believed that the water levels observed in the boreholes indicate the groundwater table at the time of the investigation.

DISCUSSION

It is understood that because of the limited width of the right-of-way, the proposed widening of Highway 401 will necessitate the construction of retaining walls in the vicinity of the C.N.R. underpass east of Keele Street. The location of these structures as given to us are shown on Drawing S7350-1, at the rear of the report. It is also understood that the height of the retaining walls will range from about 8 to 32 feet and that they will be continuous except in the north east section where for a section 212 feet long, sufficient right-of-way will be available to allow the embankment to be constructed without the use of a retaining wall.

The brown to grey silty till stratum is suitable for the founding of the proposed retaining walls and bridge piers. The foundation level would then be immediately below the fill and thus would range from about elevation 583 to 599 or 4 to 9 feet below ground level. For adequate frost protection all footings and piers should be provided with at least 4.0 feet of earth cover below final grade. Based on the "N" values and the measured shear strengths at and below the above foundation elevations, a net allowable bearing pressure of 4.0 tons per square foot may be used in design for footings founded at or above elevation 590 and 3.0 tons per square foot for footings founded below elevation 590 and above elevation 570.

Settlements, resulting from the widening of the embankment, have been calculated for below the shoulder of the extended embankment and at the centreline of the highway. For calculation purposes, the compressible till layer has been assumed to be 100 feet thick and to be preconsolidated to 2.0 tons per square foot for its full depth. The calculated total consolidation settlements for the full width of proposed embankment are 3/4 and 1-1/2 inches at the shoulder and centreline respectively. However, from past instrumentation of a similar embankment, it has been observed that the calculations overestimate the settlements that actually occur, probably due to the spreading effect of the stiff crust. In any case, much of this settlement will have taken place already at the centreline of the existing bridge abutments and the effect of widening the embankment fill at the same height would be to reduce the differential settlements along the abutments. However, examination of the underpass and wing walls has revealed several hairline vertical or near vertical cracks. These existing cracks suggest that some movement of the abutments and wing walls has taken place and it is recommended that a structural inspection be carried out before design.

Provision should be made to accommodate differential movements between the old and new portions of the overpass.

It is recommended that a careful inspection of the base of the excavation be made to guard against the possible presence of deep fill deposits between the locations at which the boreholes were put down. If any such deposits are encountered they should be excavated and replaced by lean concrete or well-compacted granular fill to required footing elevation.

Where the retaining wall height is relatively low and the depth of the existing fill is large, consideration could be given to the economics of founding the retaining walls on the inorganic silty till fill at a lower allowable bearing capacity. A net allowable bearing capacity of 1.0 tons per square foot may be used for the design of footings in the loose to compact silty till fill. Adequate construction joints should be provided between adjoining portions of a wall founded partly on fill and partly on the natural till. Again, a cover of 4.0 feet should be provided for frost protection. In no case should foundations be constructed on organic soil such as the organic clay encountered in borehole 11.

Due to the generally low permeability of the till stratum and of the existing fill, no major difficulty is anticipated with inflow of groundwater during excavation. However, it is recommended that a thin layer of lean concrete be poured immediately the excavation is down to grade to prevent softening of the underlying till.

It is recommended that a drainage layer be provided behind the retaining walls consisting of a clean granular material lightly compacted in 12 inch lifts. Provision should be made to ensure drainage of the fill at the footing elevations. For design of retaining walls and abutments it is suggested that a value of the coefficient of earth pressure, Ko, of 0.5 be used for the backfill.

It is recommended that the organic soil which occurs in the vicinity of boreholes 10 and 11 be stripped before construction of the embankment in this locality.

CONCLUSIONS AND RECOMMENDATIONS

1. The site is generally covered by a 4 to 9 foot thick deposit of loose to compact brown silty till fill. The fill is underlain by a stratum of compact to very dense brown to grey silty till which exists to the depths investigated.

2. At the time of the investigation, the groundwater table existed within the fill material, generally at a depth of 2 to 4 feet below ground level.

3. The silty till stratum is suitable for the founding of the retaining walls and bridge piers. A net allowable bearing capacity of 4.0 tons per square foot is recommended above elevation 590 and 3.0 tons per square foot below elevation 590.

4. Some additional settlement will occur as a result of the widening of the embankment. As discussed the estimated total settlements should be within tolerable limits. The effect of widening the embankment should be to reduce the differential settlement.

5. Recommendations for the lateral forces to be used in design of the retaining walls and the abutments are given in the report.

6. The organic soils encountered between stations 179+00 and 181+50 on the north side should be removed from beneath the proposed embankments.

PERSONNEL

The field work was carried out under the technical supervision of Messrs. J. Wong and F. J. Heffernan. This report was written by Mr. Heffernan, checked by Mr. K. H. King, and reviewed by Mr. J. C. Osler.

REGISTERED PROFESSIONAL ENGINEER
F. J. HEFFERNAN
PROVINCE OF ONTARIO

F. J. Heffernan

F. J. Heffernan, P.Eng.,
Senior Soils Engineer.

FJH/dw
S7350

GEOCON

APPENDIX I

OFFICE REPORTS ON SOIL EXPLORATION

EXPLANATION OF THE FORM "OFFICE REPORT ON SOIL EXPLORATION"

The object of this form is to enable a comprehensive study of the soil to be made by combining on one sheet all of the information obtained from the boring. An explanation of the various columns of the report follows.

ELEVATION AND DEPTH

This column gives the elevation and depth of boundaries between the various soil strata. The elevation is referred to the datum shown in the general heading.

WATER CONDITIONS

In this column the water level in the casing at the time of boring or the water table in the ground, determined by a series of observations in a piezometer or standpipe, is indicated to scale by a horizontal line with the symbol W.L. or W.T. above the line. A notation of any complicated groundwater conditions will be made in this column.

DESCRIPTION

A description of the soil, using standard terminology, is contained in this column. The consistency of cohesive soils and the relative density of non-cohesive soils are described by the following terms.

Consistency	U-Strength Tons/sq. ft.
Very soft	0.03 to 0.25
Soft	0.25 to 0.5
Firm	0.5 to 1.0
Stiff	1.0 to 2.0
Very stiff	2.0 to 4.0
Hard	over 4.0

Relative Density	Standard Penetration Resistance Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

STRATIGRAPHIC PLOT

The stratigraphic plot follows the standard symbols of the National Research Council, Canada.

ELEVATION SCALE

The information in all columns is plotted to a true elevation scale which is shown in this column.

GRAPHS

The main body of the report forms a graph which is used to plot to correct elevation the important soil properties which are obtained through field and laboratory tests. The scales and symbols for the plotting are shown at the head of the column.

OTHER TESTS

In this column are shown, by symbol, the other field or laboratory tests which have been performed on the soil and for which the results have not been plotted on the above graph.

SAMPLES

The first three columns describe the condition, type and number of each sample obtained from the boring. The location and extent of each sample is plotted to scale.

In the last column is shown the penetration resistance in blows of 4200 inch-pounds required to drive one foot of the sampler into the ground. When a 2 inch Drive Sampler is used the result obtained is termed the "Standard Penetration Resistance".

GEOCON

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 27350 BORING # 1 DATUM GEODETIC CASING

BORING DATE MARCH 27, 1962 REPORT DATE APRIL 2, 1962 COMPILED BY M.S. CHECKED BY F.

SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE
F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

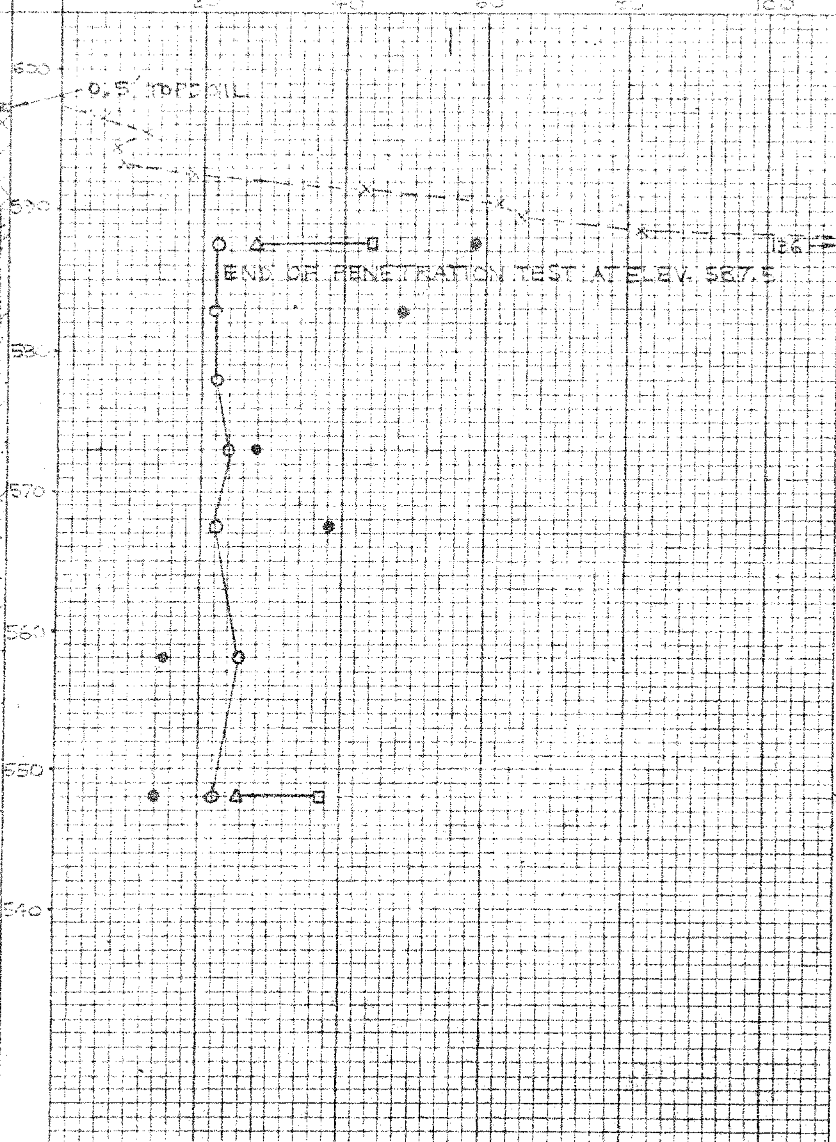
ABBREVIATIONS

V - IN-SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Qc - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

SOIL PROFILE

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION
597.5 / 0.0	WATER LEVEL @ EL. 595.0 APRIL 2, 1962	GROUND LEVEL
		0.5' TOPSOIL
		COMPACT BROWN SILTY TILL FILL
590.0 / 7.5		VERY DENSE BROWN SILTY TILL
586.5 / 11.0		DENSE TO COMPACT GREY SILTY TILL
547.0 / 50.5		END OF HOLE

SHEAR STRENGTH - TONS/SQ.FT. 2.0 4.0 6.0 8.0 10.0
WATER CONTENT W% ○ NAT □ Lw △ Pw 10 20 30 40 50
DYNAMIC PENETRATION TEST BLOWS PER FOOT 20 40 60 80 100



SAMPLES

OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
		2"DO	1	13
		DO	2	25
		DO	3	24
γ=145		TO	4	59
γ=142		SO	5	37
γ=143 C		TO	6	HYD. PUSH
γ=142		SO	7	27
γ=146		SO	8	33
		TO	9	HYD. PUSH
γ=145		SO	10	12
		SO	11	22
γ=144		SO	12	20

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT [illegible] BORING # [illegible] DATUM GEODETIC CASING [illegible]
BORING DATE MARCH 28 1962 REPORT DATE APRIL 2, 1962 COMPILED BY [illegible] CHECKED BY [illegible]
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

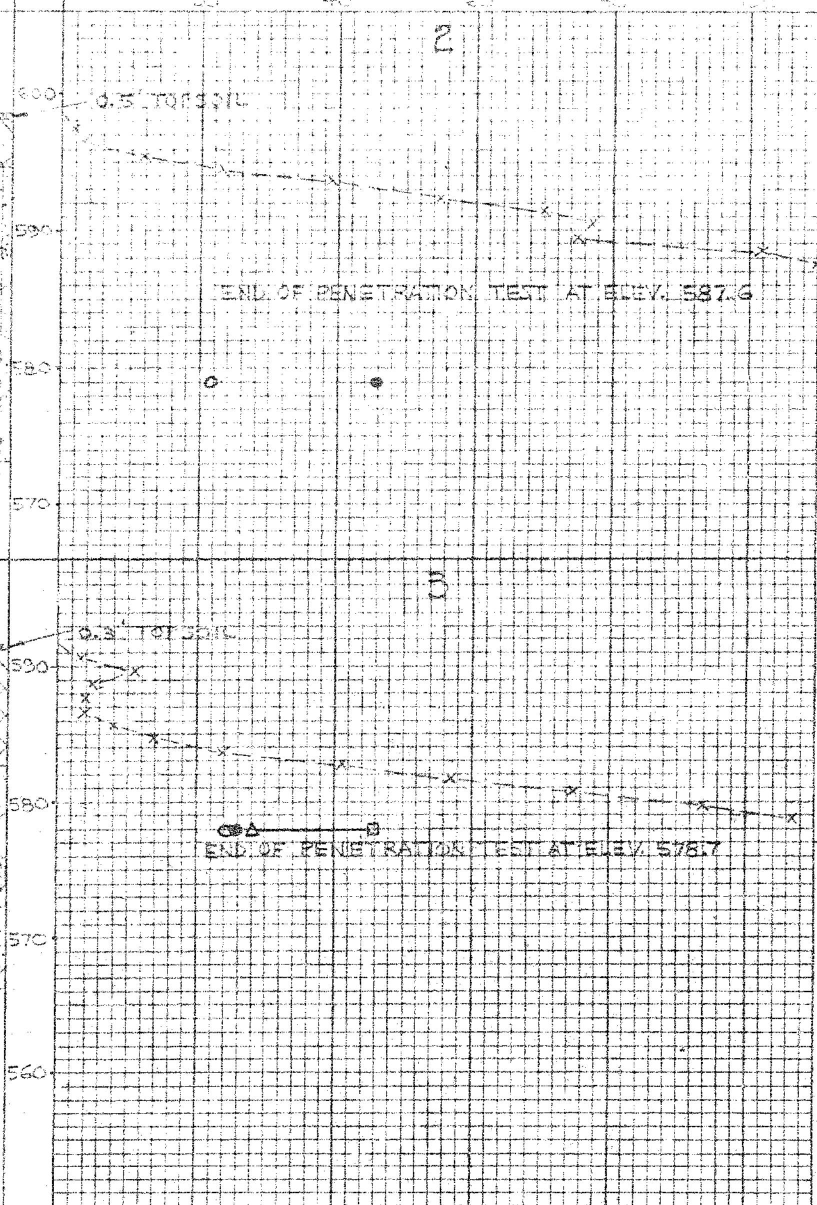
SAMPLE TYPES

- A.S. - AUGER SAMPLE
- S.T. - SLOTTED TUBE
- W.S. - WASHED SAMPLE
- D.O. - DRIVE-OPEN
- D.F. - DRIVE-FOOT VALVE
- C.S. - CHUNK SAMPLE
- F.S. - FOIL SAMPLE
- S.O. - SLEEVE-OPEN
- S.F. - SLEEVE-FOOT VALVE
- T.O. - THIN WALLED OPEN
- R.C. - ROCK CORE

ABBREVIATIONS

- V - IN-SITU VANE TEST
- M - MECHANICAL ANALYSIS
- U - UNCONFINED COMPRESSION
- Qc - TRIAXIAL CONSOLIDATED QUICK
- Q - TRIAXIAL QUICK
- S - TRIAXIAL SLOW
- γ - WET UNIT WEIGHT
- K - PERMEABILITY
- C - CONSOLIDATION
- WL - WATER LEVEL IN CASING
- WT - WATER TABLE IN SOIL

SOIL PROFILE | ELEVN. DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT. PLOT | ELEVATION SCALE | COMPRESSIVE STRENGTH - TONS/SQ. FT. ● UNCONFINED 2.0 4.0 6.0 8.0 10.0 | WATER CONTENT W% ○ NAT. □ Lw △ Pw 10 20 30 40 50 | DYNAMIC PENETRATION TEST BLOWS PER FOOT 20 40 60 80 100 | OTHER TESTS | SAMPLES: CONDITION, TYPE, NUMBER, PENETRATION RESISTANCE BLOWS FT.



Boring 2

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION
598.6		GROUND LEVEL
0.0	WATER LEVEL @ ELEV. [illegible] APRIL 2, 1962	LOOSE TO COMPACT BROWN SILTY TILL FILL
594.6 / 4.0		COMPACT TO DENSE BROWN SILTY TILL
585.6 / 13.0		DENSE TO COMPACT GREY SILTY TILL
573.1 / 25.5		END OF HOLE

OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS FT.
		2"SO	1	24
		SO	2	24
		SO	3	35
		SO	4	46
		SO	5	36
γ=144		TO	6	HYD. PUSH
		SO	7	25

Boring 3

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION
591.7 / 0.0		GROUND LEVEL
	WATER LEVEL @ EL. 589.9 APRIL 2, 1962	LOOSE TO COMPACT BROWN SILTY TILL FILL
582.7 / 9.0		DENSE BROWN SILTY TILL
578.7 / 13.0		COMPACT TO DENSE GREY SILTY TILL
566.2 / 25.5		END OF HOLE

OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS FT.
		2"SO	1	5
		SO	2	17
		SO	3	39
γ=146 M		SO	4	30
		TO	5	HYD. PUSH
		SO	6	44

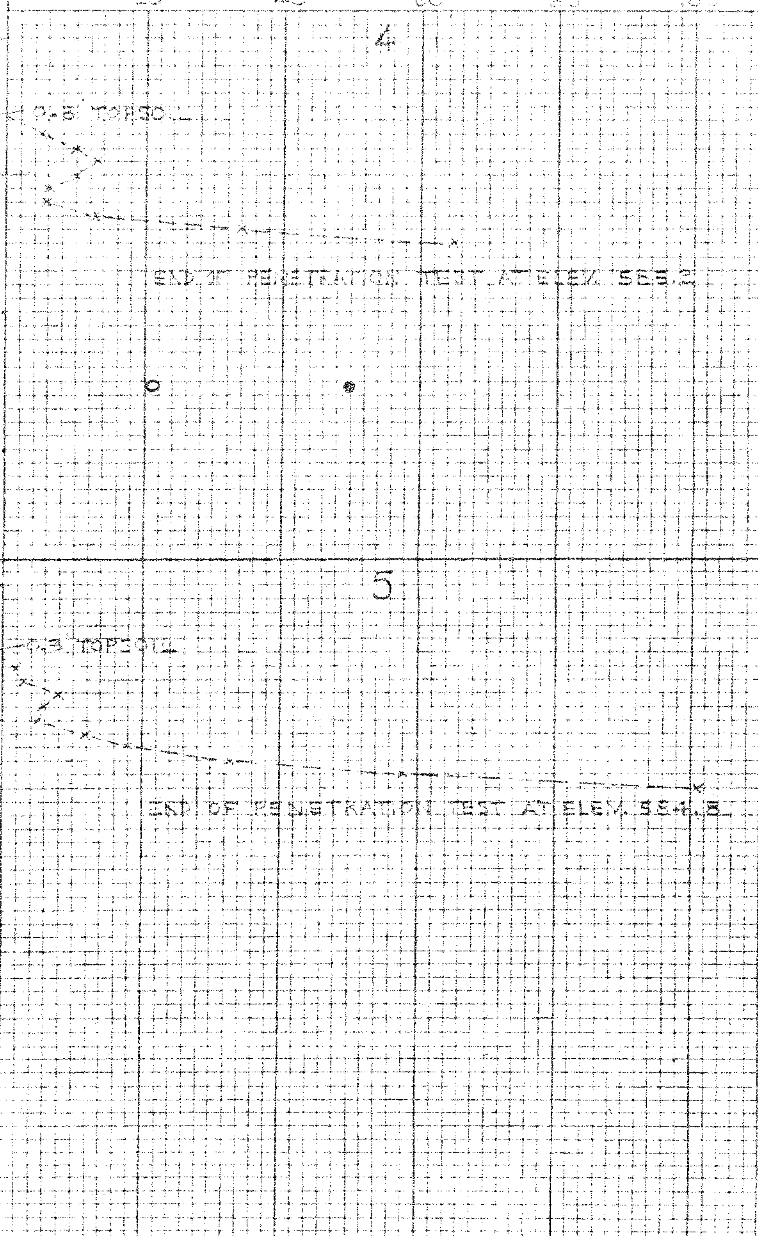
GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT [illegible] BORING # 4 AND 5 DATUM [illegible] CASING —
BORING DATE [illegible] REPORT DATE [illegible] COMPILED BY [illegible] CHECKED BY F. J. H.
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION	SAMPLE TYPES		ABBREVIATIONS	
DISTURBED	A.S. - AUGER SAMPLE	F.S. - FOIL SAMPLE	V - IN-SITU VANE TEST	γ - WET UNIT WEIGHT
FAIR	S.T. - SLOTTED TUBE	S.O. - SLEEVE-OPEN	M - MECHANICAL ANALYSIS	K - PERMEABILITY
GOOD	W.S. - WASHED SAMPLE	S.F. - SLEEVE-FOOT VALVE	U - UNCONFINED COMPRESSION	C - CONSOLIDATION
LOST	D.O. - DRIVE-OPEN	T.O. - THIN WALLED OPEN	QC - TRIAXIAL CONSOLIDATED QUICK	
	D.F. - DRIVE-FOOT VALVE	R.C. - ROCK CORE	Q - TRIAXIAL QUICK	WL - WATER LEVEL IN CASING
	C.S. - CHUNK SAMPLE		S - TRIAXIAL SLOW	WT - WATER TABLE IN SOIL

SOIL PROFILE | COMPRESSIVE STRENGTH TONS/SQ FT (● UNCONFINED) 2.0 4.0 6.0 8.0 10.0 | WATER CONTENT W% (O NAT. □ Lw △ Pw) 10 20 30 40 50 | DYNAMIC PENETRATION TEST BLOWS PER FOOT (×) 20 40 60 80 100 | OTHER TESTS | SAMPLES



Boring 4

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	ELEVATION SCALE
594.2 / 0.0	WATER LEVEL @ EL. 589.9 APRIL 2, 1962	GROUND LEVEL	600
		LOOSE TO COMPACT BROWN SILTY TILL FILL	590
586.7 / 7.5		DENSE TO VERY DENSE BROWN SILTY TILL	
581.2 / 13.0		COMPACT TO DENSE GREY SILTY TILL	580
568.7 / 25.5		END OF HOLE	570

OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
		2"SO	1	6
		SO	2	43
		SO	3	51
		SO	4	27
γ=142		TO	5	HYD. PUSH
		SO	6	42

Boring 5

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	ELEVATION SCALE
594.8 / 0.0	WATER LEVEL @ EL. 590.3 APRIL 2, 1962	GROUND LEVEL	600
		LOOSE TO COMPACT BROWN SILTY TILL FILL	590
587.3 / 7.5		VERY DENSE BROWN SILTY TILL	
582.8 / 12.0		DENSE TO VERY DENSE GREY SILTY TILL	580
569.3 / 25.5		END OF HOLE	570

OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
		2"SO	1	24
		SO	2	35
		SO	3	73
		SO	4	43
		SO	5	52
		SO	6	47

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT [illegible] BORING # 6 AND 7 DATUM [illegible] CASING —
BORING DATE MARCH [illegible] REPORT DATE APRIL 2, [illegible] COMPILED BY [illegible] CHECKED BY F. J. H.
SAMPLER HAMMER WT. 140 LBS. DROP [illegible] INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

- A.S. - AUGER SAMPLE
- S.T. - SLOTTED TUBE
- W.S. - WASHED SAMPLE
- D.O. - DRIVE-OPEN
- D.F. - DRIVE-FOOT VALVE
- C.S. - CHUNK SAMPLE
- F.S. - FOIL SAMPLE
- S.O. - SLEEVE-OPEN
- S.F. - SLEEVE-FOOT VALVE
- T.O. - THIN WALLED OPEN
- R.C. - ROCK CORE

ABBREVIATIONS

- V - IN-SITU VANE TEST
- M - MECHANICAL ANALYSIS
- U - UNCONFINED COMPRESSION
- Qc - TRIAXIAL CONSOLIDATED QUICK
- Q - TRIAXIAL QUICK
- S - TRIAXIAL SLOW
- γ - WET UNIT WEIGHT
- K - PERMEABILITY
- C - CONSOLIDATION
- WL - WATER LEVEL IN CASING
- WT - WATER TABLE IN SOIL

SOIL PROFILE — COMPRESSIVE STRENGTH - TONS/SQ.FT. (● UNCONFINED) 2.0 4.0 6.0 8.0 10.0 — WATER CONTENT W% ○ NAT ⊢ Lw △ Pw 10 20 30 40 50 — DYNAMIC PENETRATION TEST BLOWS PER FOOT × 20 40 60 80 100 — OTHER TESTS — SAMPLES

6

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
601.9 / 0.0	WATER LEVEL @ EL. 593.7 APRIL 2, 1962	GROUND LEVEL					
		LOOSE TO COMPACT BROWN SILTY TILL FILL			2"SO	1	11
594.4 / 7.5		VERY DENSE BROWN SILTY TILL			SO	2	46
588.4 / 13.5		DENSE GREY SILTY TILL	γ=149		SO	3	49
					SO	4	39
					SO	5	4[illegible]
576.4 / 25.5		END OF HOLE					

0.3' TOPSOIL

END OF PENETRATION TEST AT ELEV. 591.5

7

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
595.1 / 0.0	WATER LEVEL @ EL. 592.9 APRIL 2, 1962	GROUND LEVEL					
		LOOSE BROWN SILTY TILL FILL					
591.1 / 4.0		COMPACT TO DENSE BROWN SILTY TILL			2"DO	1	18
					DO	2	21
					SO	3	5[illegible]
576.1 / 19.0		COMPACT GREY SILTY TILL			SO	4	25
			γ=143		TO	5	HYD. PUSH
					SO	6	29
565.1 / 30.0		END OF HOLE					

0.3' TOPSOIL

END OF PENETRATION TEST AT ELEV. 586.1

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT [illegible] BORING # [illegible] DATUM [illegible] CASING [illegible]
BORING DATE MARCH [illegible] REPORT DATE APRIL [illegible] COMPILED BY [illegible] CHECKED BY F. J. H.
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION	SAMPLE TYPES		ABBREVIATIONS	
DISTURBED	A.S. - AUGER SAMPLE	F.S. - FOIL SAMPLE	V - IN SITU VANE TEST	γ - WET UNIT WEIGHT
FAIR	S.T. - SLOTTED TUBE	S.O. - SLEEVE-OPEN	M - MECHANICAL ANALYSIS	K - PERMEABILITY
GOOD	W.S. - WASHED SAMPLE	S.F. - SLEEVE-FOOT VALVE	U - UNCONFINED COMPRESSION	C - CONSOLIDATION
LOST	D.O. - DRIVE-OPEN	T.O. - THIN WALLED OPEN	Qc - TRIAXIAL CONSOLIDATED QUICK	WL - WATER LEVEL IN CASING
	D.F. - DRIVE-FOOT VALVE	R.C. - ROCK CORE	Q - TRIAXIAL QUICK	WT - WATER TABLE IN SOIL
	C.S. - CHUNK SAMPLE		S - TRIAXIAL SLOW	

SOIL PROFILE | ELEVATION SCALE | COMPRESSIVE STRENGTH TONS/SQ. FT. (• UNCONFINED) 2.0 4.0 6.0 8.0 10.0 | WATER CONTENT W% ○ NAT. ▫ Lw △ Pw 10 20 30 40 50 | DYNAMIC PENETRATION TEST BLOWS PER FOOT × 20 40 60 80 100 | OTHER TESTS | SAMPLES

8

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS FT.
6[illegible]0.4 / 0.0		GROUND LEVEL (0.[illegible] TOPSOIL)					
	WATER LEVEL @ EL. [illegible] APRIL [illegible] 1963	LOOSE TO COMPACT BROWN SILTY TILL FILL			2" DO	1	25
591.4 / 9.0		DENSE BROWN SILTY TILL			DO	2	45
586.4 / 14.0					DO	3	52
		DENSE GREY SILTY TILL			SO	4	56
					SO	5	41
574.[illegible] / 25.5		END OF HOLE					

Elevation scale: 600, 590, 580, 570

END OF PENETRATION TEST AT ELEV. 588.4

9

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS FT.
5[illegible].8 / 0.0		GROUND LEVEL (0.3' TOPSOIL)					
	BOREHOLE BLOCKED	LOOSE TO COMPACT BROWN SILTY TILL FILL			2" DO	1	24
591.8 / 6.0		DENSE BROWN SILTY TILL			DO	2	26
[illegible].8 / 11.0					DO	3	37
					DO	4	20
		COMPACT GREY SILTY TILL	γ=142		TO	5	HYD. PUSH
					DO	6	22
57[illegible].8 / 25.5		END OF HOLE					

Elevation scale: 600, 590, 580, 570

END OF PENETRATION TEST AT ELEV. 585.8

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 37 [illegible] BORING # [illegible] DATUM [illegible] CASING [illegible]

BORING DATE [illegible] REPORT DATE APRIL [illegible] COMPILED BY [illegible] CHECKED BY F. J. [illegible]

SAMPLER HAMMER WT [illegible] LBS. DROP [illegible] INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION	SAMPLE TYPES		ABBREVIATIONS	
DISTURBED	A.S. - AUGER SAMPLE	F.S. - FOIL SAMPLE	V - IN SITU VANE TEST	γ - WET UNIT WEIGHT
FAIR	S.T. - SLOTTED TUBE	S.O. - SLEEVE-OPEN	M - MECHANICAL ANALYSIS	K - PERMEABILITY
GOOD	W.S. - WASHED SAMPLE	S.F. - SLEEVE-FOOT VALVE	U - UNCONFINED COMPRESSION	C - CONSOLIDATION
LOST	D.O. - DRIVE OPEN	T.O. - THIN WALLED OPEN	Qc - TRIAXIAL CONSOLIDATED QUICK	
	D.F. - DRIVE-FOOT VALVE	R.C. - ROCK CORE	Q - TRIAXIAL QUICK	WL - WATER LEVEL IN CASING
	C.S. - CHUNK SAMPLE		S - TRIAXIAL SLOW	WT - WATER TABLE IN SOIL

SOIL PROFILE							SAMPLES			
ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W% ○ NAT ⊓ Lw △ Pw / DYNAMIC PENETRATION TEST BLOWS PER FOOT 20 40 60 80 100	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS FT.
5[illegible] 0.0	WATER LEVEL @ EL. 551.2 APPL [illegible]	GROUND LEVEL		5[illegible]0	6" PEAT					
		LOOSE TO COMPACT BROWN SILTY TILL FILL						DO	1	7
558.0 8.0 9.5					END OF PENETRATION TEST AT ELEV. 582.0			DO	2	65
		DENSE TO VERY DENSE GREY SILTY TILL		560	VERY DENSE BROWN SILTY TILL			DO	3	39
								DO	4	54
				570				DO	5	46
565.5 25.5		END OF HOLE								
				580						

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 57350 BORING # 11 & 12 DATUM GEODETIC CASING —

BORING DATE APRIL 4 [illegible] REPORT DATE APRIL 13 [illegible] COMPILED B A.E.L. CHECKED BY F.J.H.

SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION	SAMPLE TYPES		ABBREVIATIONS	
DISTURBED	A.S. - AUGER SAMPLE	F.S. - FOIL SAMPLE	V - IN-SITU VANE TEST	γ - WET UNIT WEIGHT
FAIR	S.T. - SLOTTED TUBE	S.O. - SLEEVE-OPEN	M - MECHANICAL ANALYSIS	K - PERMEABILITY
GOOD	W.S. - WASHED SAMPLE	S.F. - SLEEVE-FOOT VALVE	U - UNCONFINED COMPRESSION	C - CONSOLIDATION
LOST	D.O. - DRIVE-OPEN	T.O. - THIN WALLED OPEN	Qc - TRIAXIAL CONSOLIDATED QUICK	
	D.F. - DRIVE-FOOT VALVE	R.C. - ROCK CORE	Q - TRIAXIAL QUICK	WL - WATER LEVEL IN CASING
	C.S. - CHUNK SAMPLE		S - TRIAXIAL SLOW	WT - WATER TABLE IN SOIL

SOIL PROFILE

Boring 11

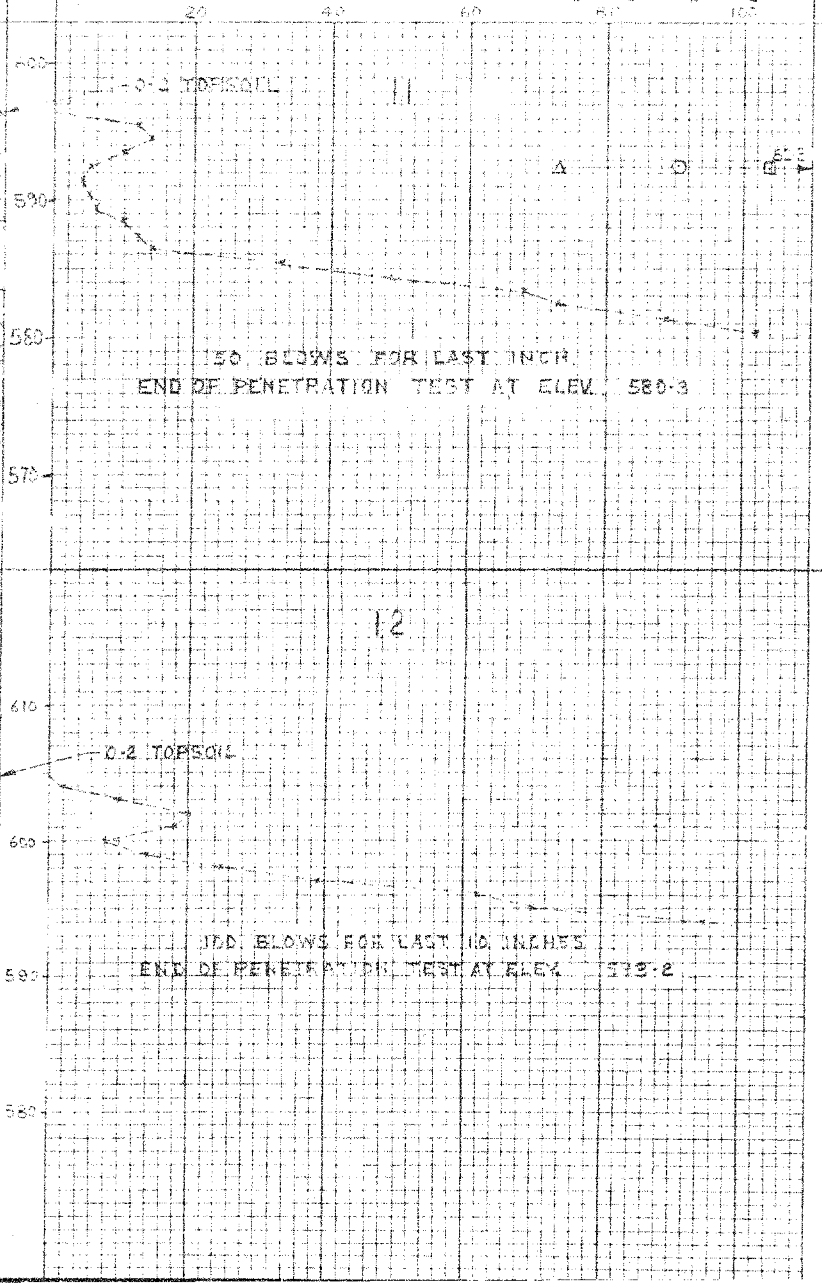
ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION
594.[illegible] 0.0		GROUND LEVEL
		[illegible] CLAY
588.4 8.0	WATER LEVEL @ ELEV. 584.[illegible] APRIL 8 - 1962	COMPACT [illegible] DENSE BROWN [illegible]
583.4 13.0		DENSE [illegible] SILTY [illegible]
57[illegible] 2[illegible]		END OF HOLE

Boring 12

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION
605.0 0.0		GROUND LEVEL
		LOOSE [illegible] COMPACT BROWN SILTY [illegible] FILL
599.0 6.0		DENSE [illegible] VERY DENSE BROWN SILTY [illegible]
[illegible] 25.0	[illegible] ELEV. 600.5 [illegible]	END OF HOLE

WATER CONTENT W% ○ NAT. ⊓ LW △ PW: 10, 20, 30, 40, 50

DYNAMIC PENETRATION TEST BLOWS PER FOOT: 20, 40, 60, 80, 100



OTHER TESTS

SAMPLES

Boring 11

CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
	2" D.O.	1	4
	D.O.	2	27
	D.O.	3	31
	D.O.	4	44
	D.O.	5	39

Boring 12

CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
	2" D.O.	1	12
	D.O.	2	35
	D.O.	3	54
	D.O.	4	60
	[illegible]	5	56

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT [illegible] BORING # 13 & 14 DATUM [illegible] CASING [illegible]
BORING DATE APR. [illegible] REPORT DATE APR. [illegible] COMPILED BY [illegible] CHECKED BY [illegible]
SAMPLER HAMMER WT. [illegible] LBS. DROP [illegible] INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

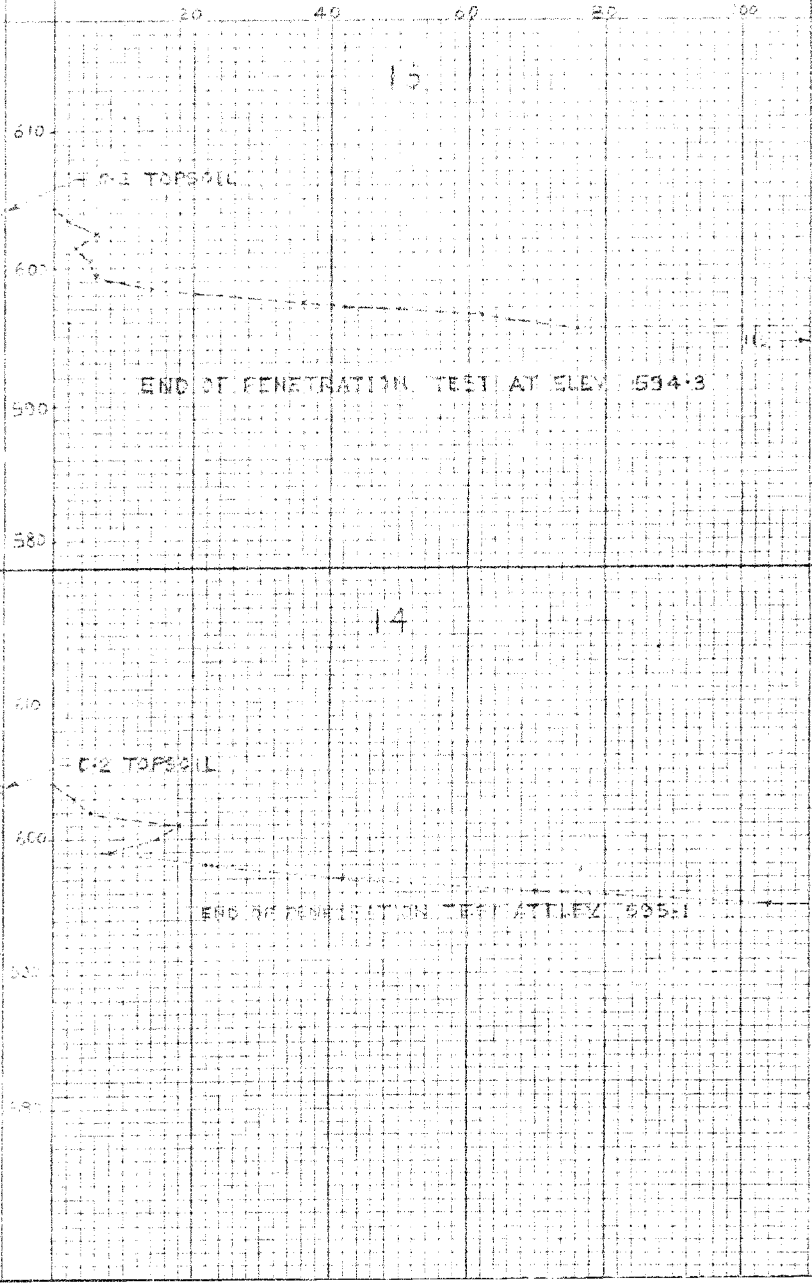
SAMPLE TYPES

- A.S. - AUGER SAMPLE
- S.T. - SLOTTED TUBE
- W.S. - WASHED SAMPLE
- D.O. - DRIVE-OPEN
- D.F. - DRIVE-FOOT VALVE
- C.S. - CHUNK SAMPLE
- F.S. - FOIL SAMPLE
- S.O. - SLEEVE-OPEN
- S.F. - SLEEVE-FOOT VALVE
- T.O. - THIN WALLED OPEN
- R.C. - ROCK CORE

ABBREVIATIONS

- V - IN-SITU VANE TEST
- M - MECHANICAL ANALYSIS
- U - UNCONFINED COMPRESSION
- Qc - TRIAXIAL CONSOLIDATED QUICK
- Q - TRIAXIAL QUICK
- S - TRIAXIAL SLOW
- γ - WET UNIT WEIGHT
- K - PERMEABILITY
- C - CONSOLIDATION
- WL - WATER LEVEL IN CASING
- WT - WATER TABLE IN SOIL

SOIL PROFILE: ELEVN. DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT PLOT | ELEVATION SCALE
WATER CONTENT W% ○ NAT ⊢ LW △ PW
DYNAMIC PENETRATION TEST BLOWS PER FOOT 20 40 60 80 100
OTHER TESTS
SAMPLES: CONDITION | TYPE | NUMBER | PENETRATION RESISTANCE BLOWS/FT.



Boring 13

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
60[illegible]		GROUND LEVEL					
	WATER LEVEL [illegible] APRIL 16	LOOSE TO COMPACT BROWN SILTY TILL FILL			2 D.O.	1	3
596.[illegible]		VERY DENSE TO COMPACT BROWN SILTY TILL			D.O.	2	50
					D.O.	3	27
[illegible]		[illegible]	M		D.O.	4	[illegible]

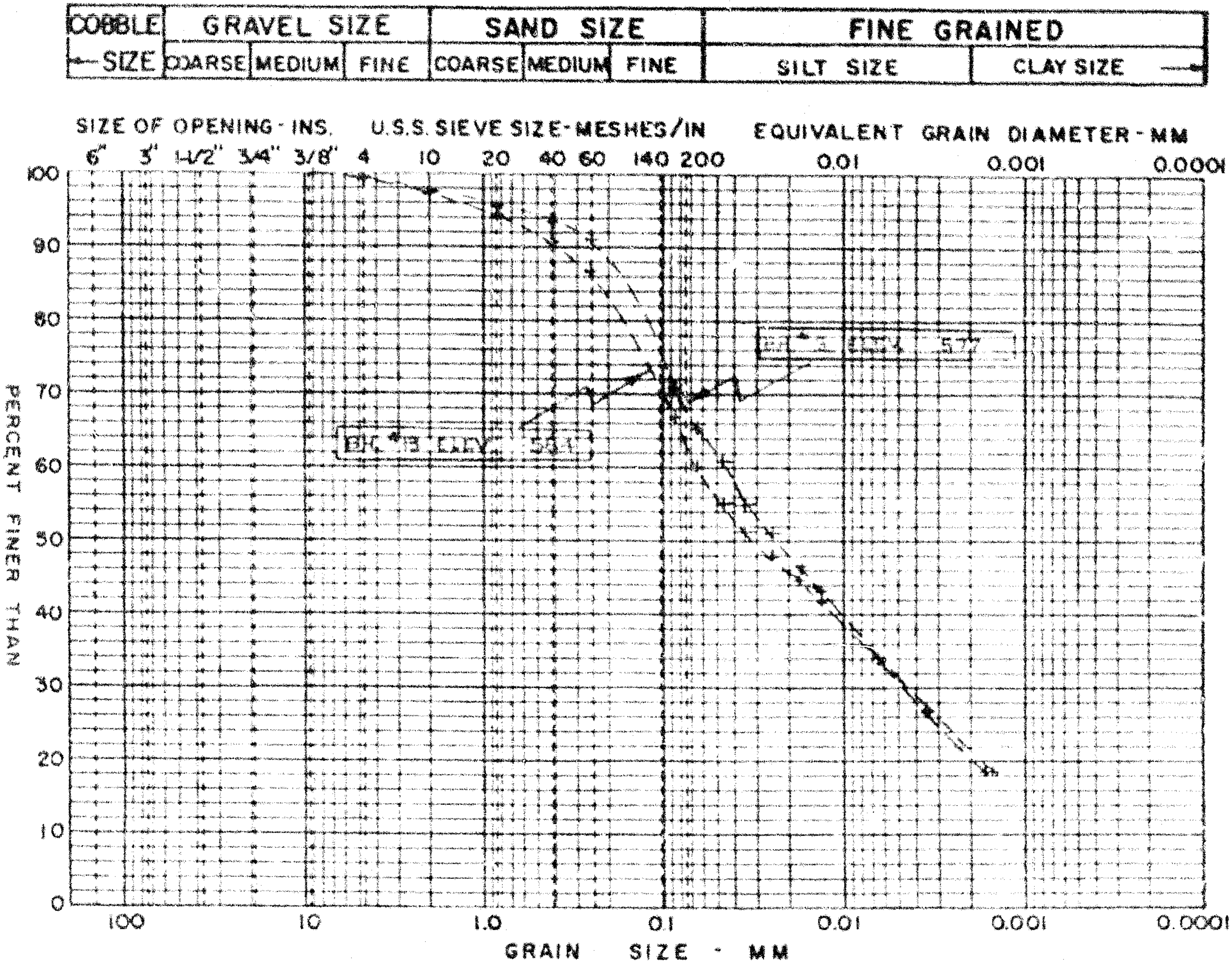
Boring 14

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
[illegible]		GROUND LEVEL					
		[illegible] BROWN [illegible] TILL FILL			2 D.O.	1	22
598.9		COMPACT TO DENSE BROWN [illegible]			D.O.	2	50
59[illegible]		DENSE TO VERY DENSE [illegible] SILTY TILL			D.O.	3	49
[illegible]	WATER LEVEL [illegible]	END OF HOLE			D.O.	4	54

APPENDIX II

FIGURES - LABORATORY TESTING

GEOCON



M.I.T. GRAIN SIZE SCALE

GEOCON

GRAIN SIZE DISTRIBUTION

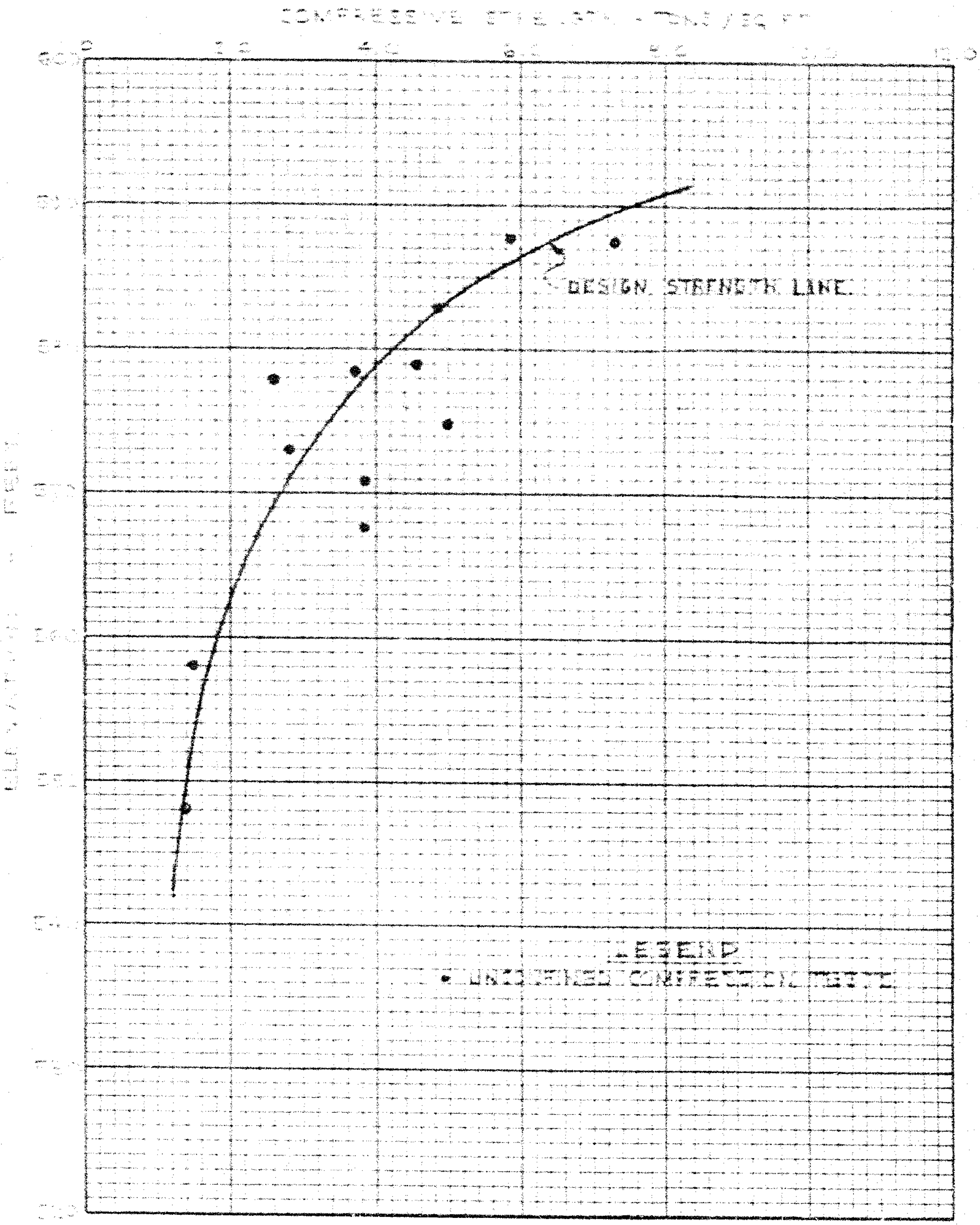
APPENDIX II

FIGURE I

PROJECT

COMPRESSIVE STRENGTH VS ELEVATION

APPENDIX II
FIGURE 2
PROJECT



GEOCON

UNCONFINED COMPRESSION TESTS

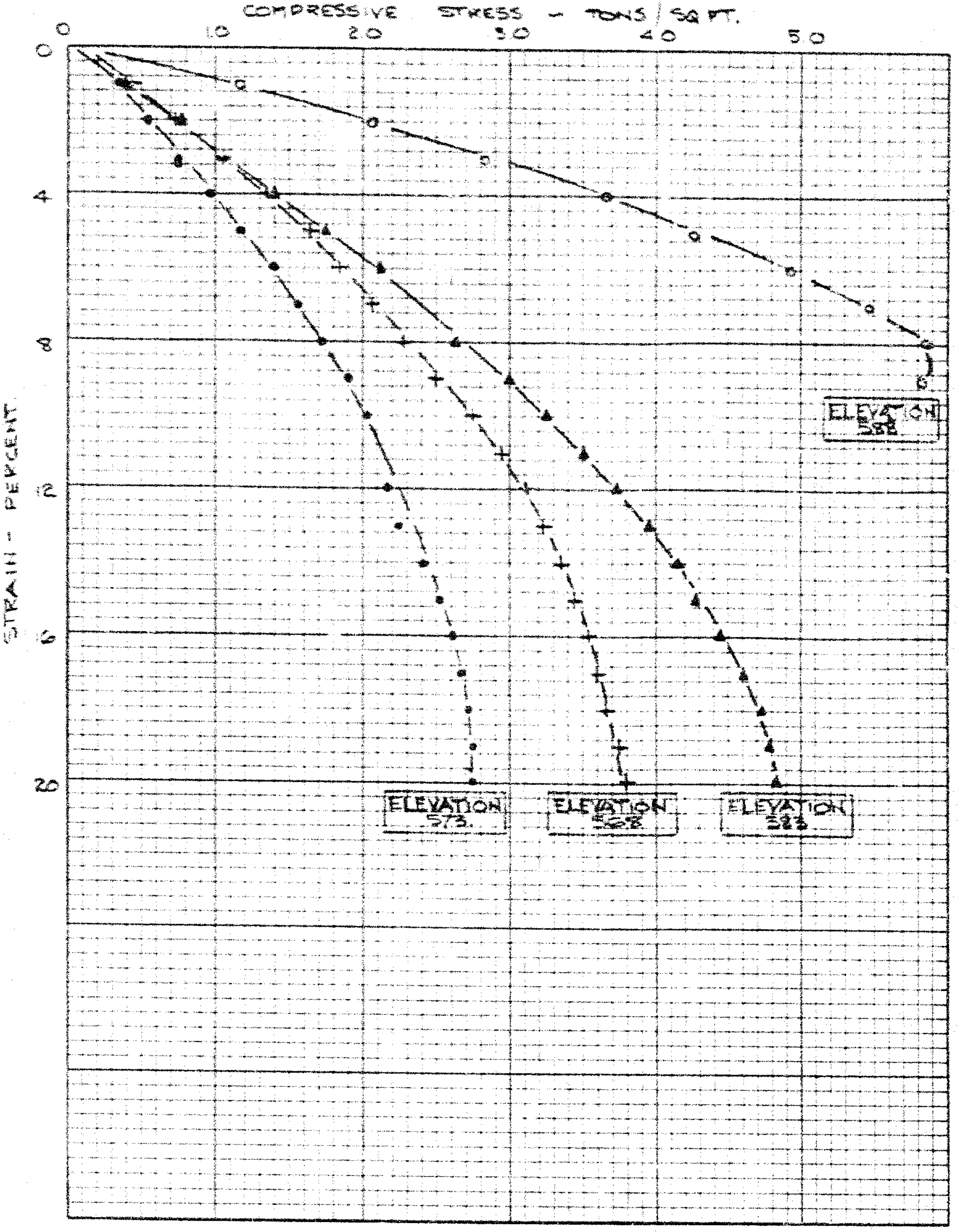
BOREHOLE Nº 1 - STRESS-STRAIN CURVES

VERY DENSE TO DENSE SILTY TILL

APPENDIX II

FIGURE 3

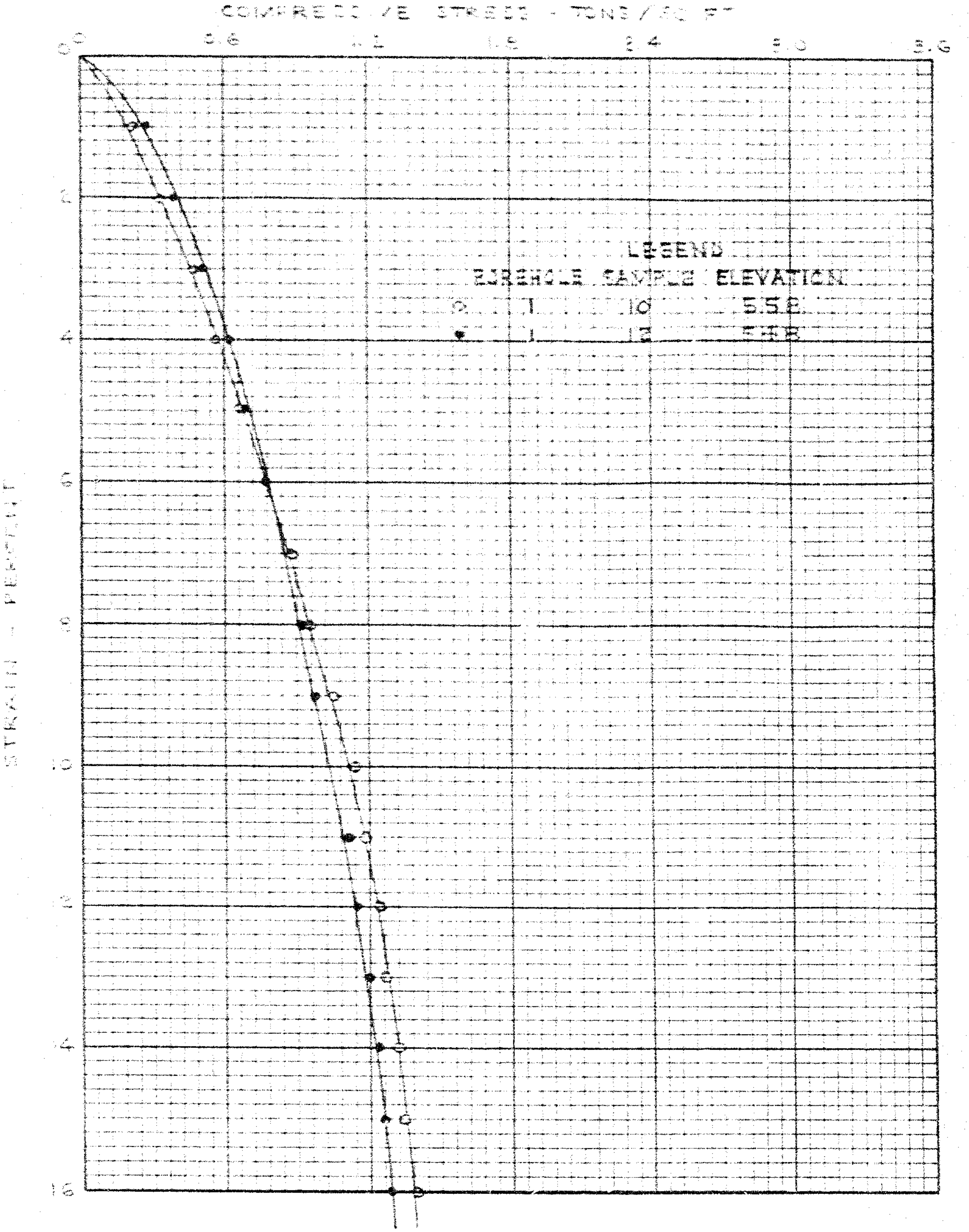
PROJECT 5 7350



GEOCON

UNCONFINED COMPRESSION TESTS
TYPICAL STRESS-STRAIN CURVES
COMPACT SILT TILL

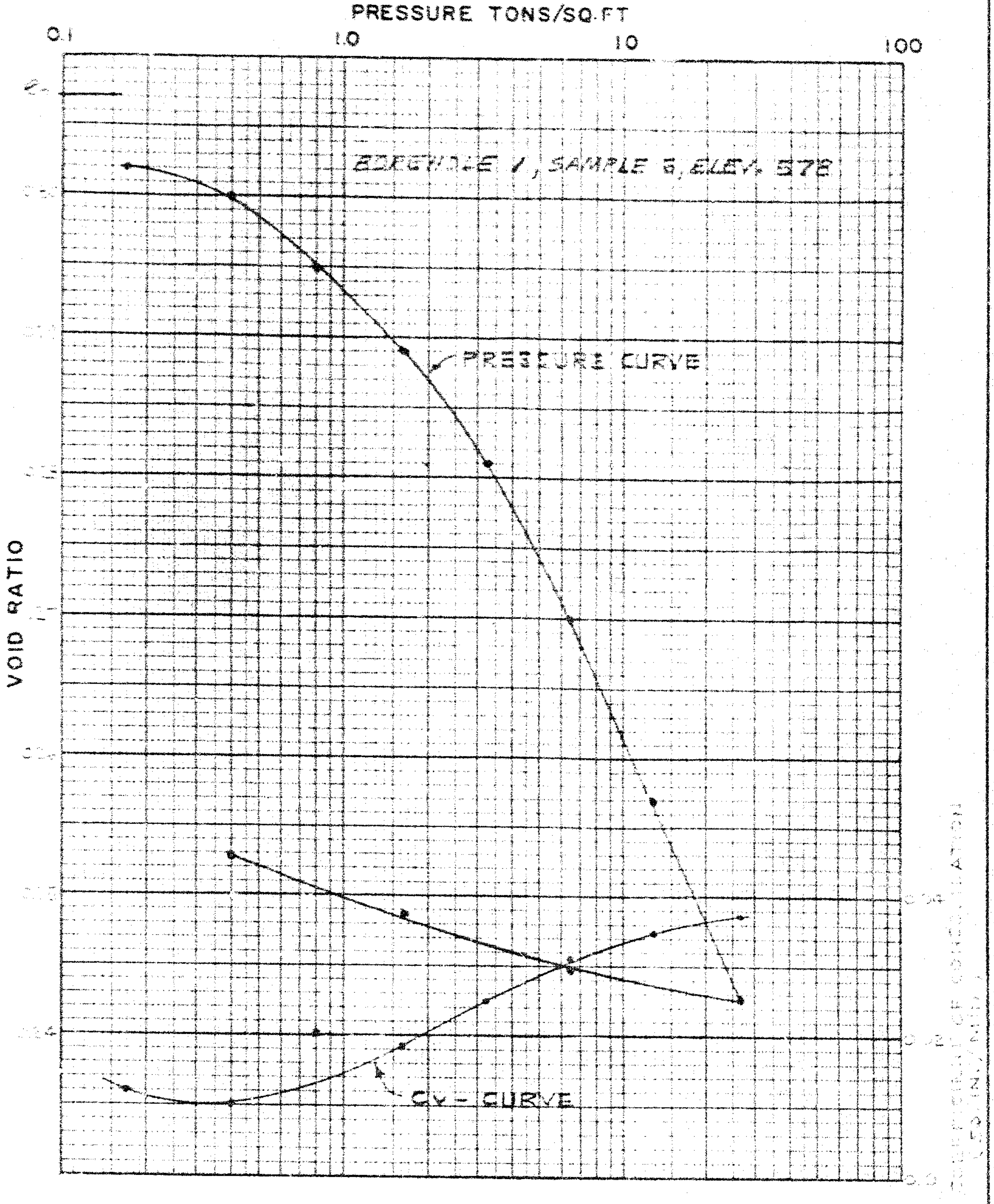
APPENDIX II
FIGURE 4
PROJECT 57550



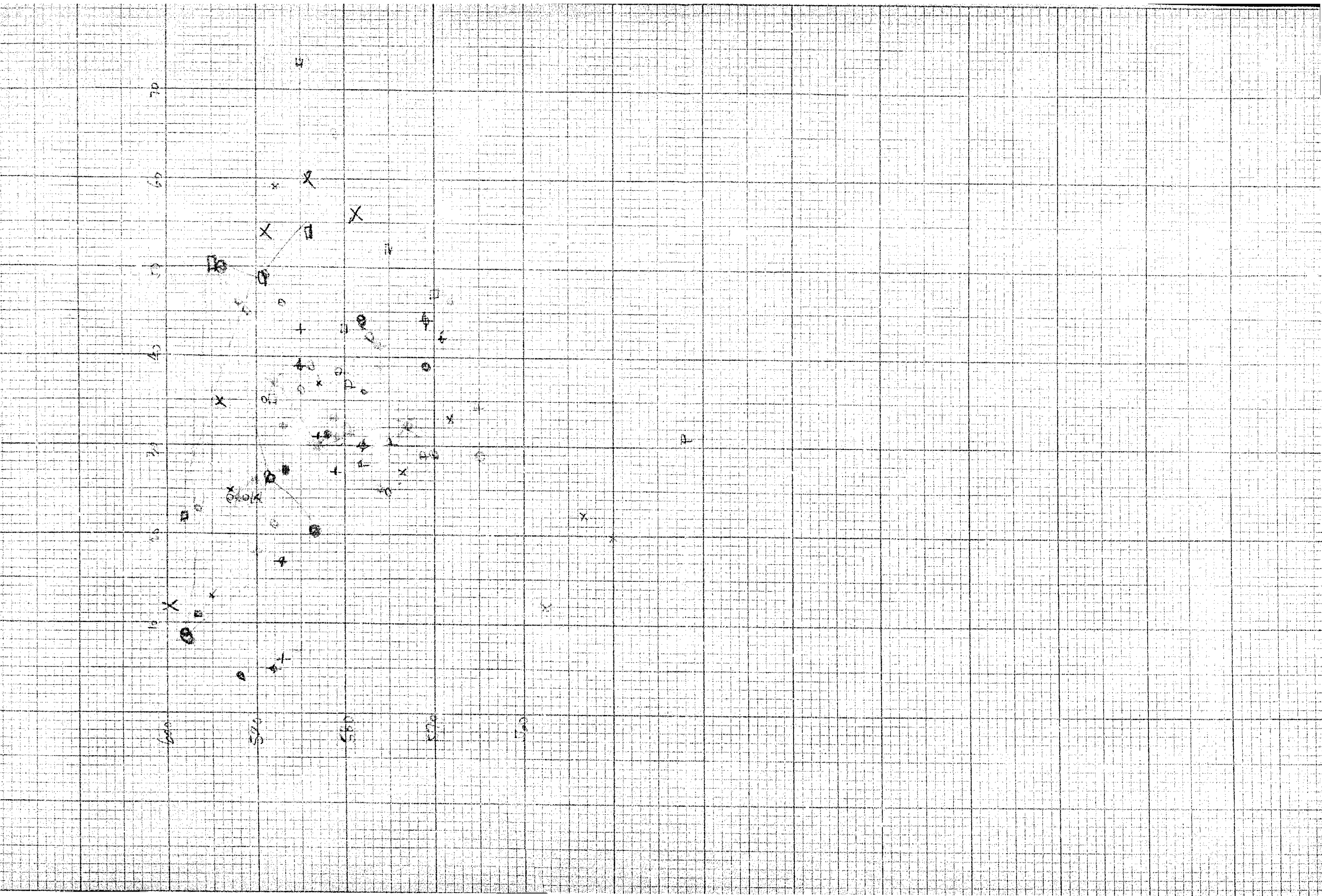
GEOCON

VOID RATIO-PRESSURE DIAGRAM
CONSOLIDATION TEST

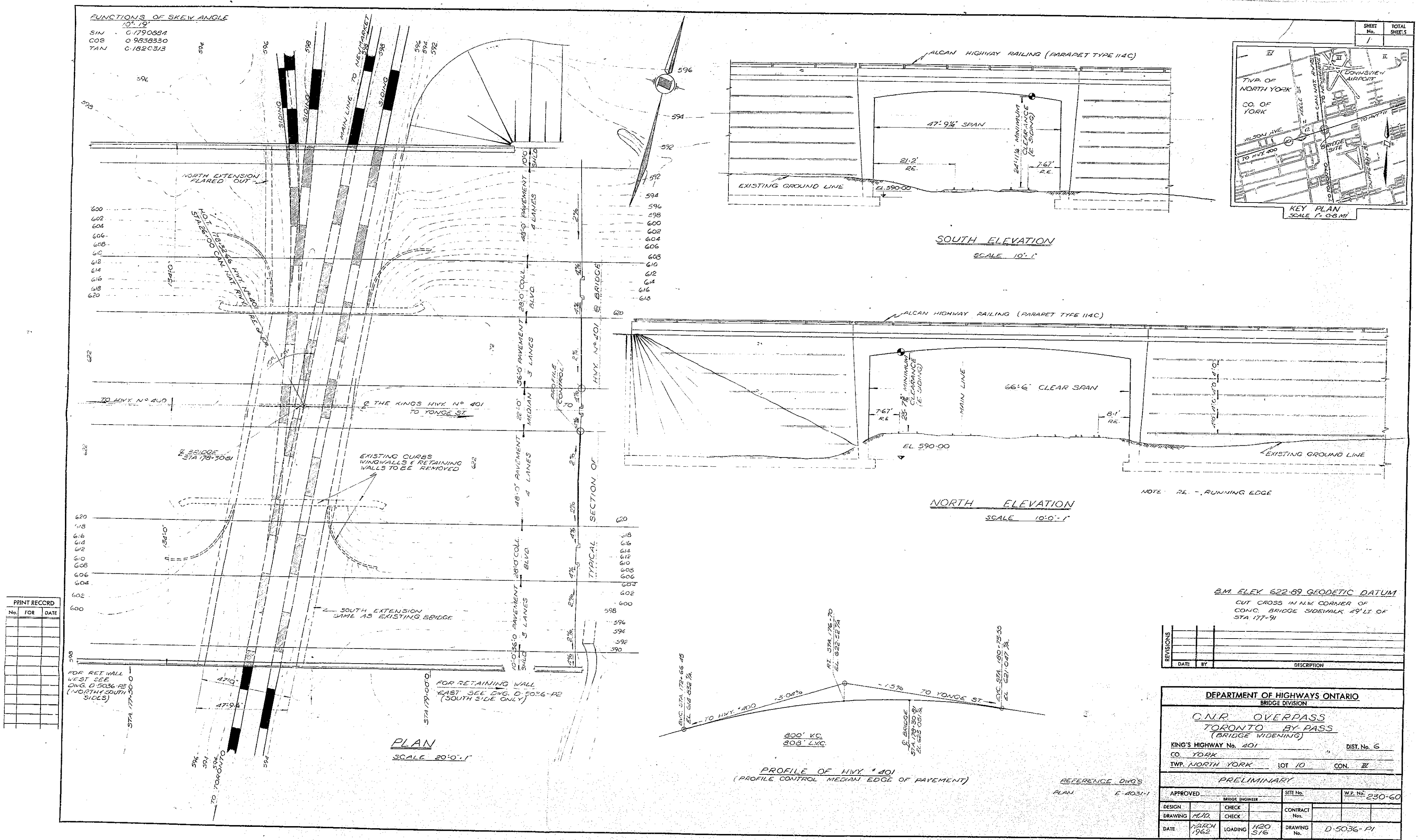
APPENDIX II
FIGURE 5
PROJECT

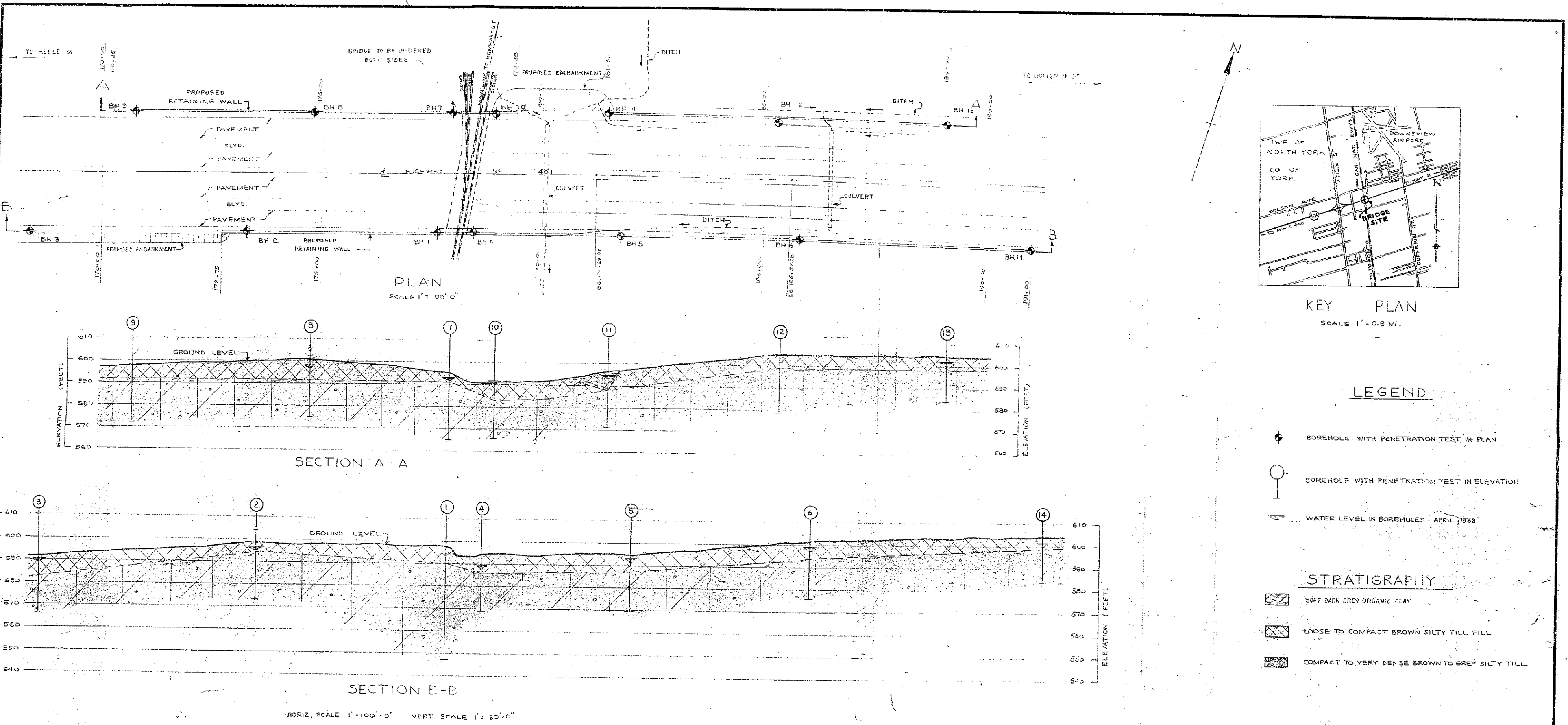


GEOCON



#62-F-219-C
W.P. #230-60
HWY. #401
C.N.R.


FUNCTIONS OF SKEW ANGLE
10°19'
SIN 0.1790884
COS 0.9838330
TAN 0.1820313
SIDING
MAIN LINE TO NEWMARKET
NORTH EXTENSION FLARED OUT
48'0" PAVEMENT 4 LANES
28'0" COLL BLVD.
36'0" PAVEMENT 3 LANES
22'0" MEDIAN
PROFILE CONTROL
HWY. No 401 @ BRIDGE
TYPICAL SECTION OF
TO HWY No 400
℄ THE KINGS HWY. No 401 TO YONGE ST
℄ BRIDGE STA 178+30.81
EXISTING CURBS WINGWALLS & RETAINING WALLS TO BE REMOVED
SOUTH EXTENSION SAME AS EXISTING BRIDGE
FOR RET. WALL WEST SEE DWG. D-5036-P2 (NORTH & SOUTH SIDES)
FOR RETAINING WALL EAST SEE DWG. D-5036-P2 (SOUTH SIDE ONLY)
STA 177+50.0
STA 179+00.0
TO TORONTO
PLAN
SCALE 20'-0" = 1"
ALCAN HIGHWAY RAILING (PARAPET TYPE 114C)
47'-9¼" SPAN
MINIMUM CLEARANCE (E. SIDING)
21'-2" R.E.
7.67' R.E.
EXISTING GROUND LINE
EL. 590.00
SOUTH ELEVATION
SCALE 10' = 1"
66'-6" CLEAR SPAN
MAIN LINE
8'-1" R.E.
NORTH ELEVATION
SCALE 10'-0" = 1"
NOTE: R.E. - RUNNING EDGE
KEY PLAN
SCALE 1" = 0.8 MI.
TWP. OF NORTH YORK
CO. OF YORK
DOWNSVIEW AIRPORT
BRIDGE SITE
B.M. ELEV. 622.89 GEODETIC DATUM
CUT CROSS IN N.W. CORNER OF CONC. BRIDGE SIDEWALK 49' LT. OF STA 177+91
TO HWY. 400
+5.04%
-1.5%
TO YONGE ST.
800' V.C.
808' L.V.C.
PROFILE OF HWY. #401
(PROFILE CONTROL MEDIAN EDGE OF PAVEMENT)
REFERENCE DWG'S
PLAN E-4031-1
PRINT RECORD
No. FOR DATE
REVISIONS
DATE BY DESCRIPTION
SHEET No. 1
TOTAL SHEETS
DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION
C.N.R. OVERPASS
TORONTO BY-PASS
(BRIDGE WIDENING)
KING'S HIGHWAY No. 401
DIST. No. 6
CO. YORK
TWP. NORTH YORK LOT 10 CON. III
PRELIMINARY
APPROVED BRIDGE ENGINEER
SITE No.
W.P. No. 230-60
DESIGN
CHECK
DRAWING M.J.D.
CHECK
CONTRACT Nos.
DATE MARCH 1962
LOADING H20 S16
DRAWING No. D-5036-P1



SPECIAL NOTE: DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT BOREHOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

REFERENCE DWG. NO.	DESCRIPTION
D-5036-P1	D.H.O. DRAWING - C.N.R. OVERPASS, TORONTO BY-PASS HWY. 401 DATED: MARCH, 1962

DEPARTMENT OF HIGHWAYS, ONTARIO
TORONTO ONTARIO
PROPOSED WIDENING HIGHWAY Nº 401
C.N.R. OVERPASS - EAST OF KEELE STREET
DOWNSVIEW ONTARIO
BORING PLAN AND SOIL STRATIGRAPHY

GEOCON LTD

DATE APRIL 3, 1962 SCALE AS SHOWN
MADE M.W. CHKD. F.J.H. APPD.
No. S7350 - 1