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G.I.-30 SEPT. 1976

GEOCRES No. 30M11-80

DIST. 6 REGION

W.P. No.

CONT. No.

W. O. No. 83-22-331

STR. SITE No.

HWY. No. 401

LOCATION HWY 401 & BATHURST ST
STORM SEWER RELOCATION

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

memorandum



To: Mr. M. Devata,
Chief Foundations Engineer,
Foundation Design Section,
Room 315, Central Building,
Downsview.

Date: 1984-08-30

Central Region

Atten: Mr. B.E. Ruck

RE: 30" Diameter Storm Sewer Relocation,
Hwy. 401 and Bathurst Street,
District 6



As discussed with you in your office yesterday, the proposed 30" diameter storm sewer relocation as indicated in the drawing is o.k. provided:

- (1) Where the section of sewer is located beyond the 30° boundary as defined in the letter dated 84-08-23, the sewer should be made of reinforced concrete so that it can withstand any possible pressure from the retaining wall footing.
- (2) The trench must be excavated in short sections (maximum 20' each section), strutted and then backfilled shortly after the pipe has been laid.

A handwritten signature in cursive script, appearing to read "T. C. Tam".

TT:gj

T. Tam,
Structural Engineer,
for:
G.C.E. Burkhardt,
Head, Structural Section.

c.c. P.K. Roy

memorandum



To: G.C.E. Burkhardt
Head, Structural Section
Central Region
5000 Yonge Street

Date: 1984 08 23

Atten: T.C. Tam

From: Foundation Design Section
Room 315, Central Building

RE: W.O. 83-22331
30" Diameter Storm Sewer Relocation
Hwy. 401 and Bathurst Street

As per your request of 84 08 08, we provide the following comments:

- i) The sewer should be located so that the pipe will not be located within the influence area of the existing retaining wall footing. This influence area is bounded by a line drawn at 30° below the horizontal from the bottom edge of the footing. Sections 1 and 2 on the drawing do not meet this criteria.
- ii) In order to ensure stability of the retaining wall during the relocation of the sewer, the trench must be excavated in short sections, strutted and then backfilled shortly after the pipe has been laid.

Should you have any further questions, please contact the undersigned.

A handwritten signature in cursive script that reads "Brian Ruck".

B.E. Ruck
Project Foundations Engineer
for

M. Devata, P. Eng.
Chief Foundations Engineer

BER/MD/mmj

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Division,
(Foundation Section)

May 28, 1962.

FOUNDATION INVESTIGATION REPORT
By: GEOCON, LIMITED,
CONSULTING ENGINEERS.

Attention: Mr. S. McCombie.

Re: Proposed Widening Highway #401,
Bathurst Street and Avenue Road,
W.P. 146-58 -- District #6.

The report on the foundation investigation of the above site has been reviewed and the following recommendations are made:

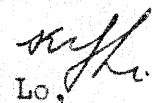
(1) The coefficient of active earth pressure may be taken as 0.3 for granular backfill with adequate drainage provided.

(2) Flexible joints should be provided between the existing and proposed structures to minimize the effect of differential settlements.

We believe you will find the contents of this report, together with the above comments, adequate for your future design work. Should further information be required, please feel free to contact our Office.

KYL/MdeF
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
I. C. Campbell
C. Fraser
T. J. Kovich
J. Roy
J. E. Graspier
E. R. Sairt
F. Norman
A. Watt


K. Y. Lo,
SUPERVISING FOUNDATION ENGR.
For:

A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

Foundations Office -- Gen. Files.

Materials and Research Division

April 13, 1962

Geocor, Limited,
Consulting Engineers,
14 Haas Road,
Rexdale, Ontario.

Attention: Mr. E. King

Re: M.P. 146-58, Hwy. #401, Bathurst Street,
Retaining Wall, 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 on April 13, 1962.

It is understood that a qualified Soils Engineer will be in charge of the field work at all times. This Engineer will be responsible for the accurate location of the boreholes.

Fourteen copies of the completed foundation report should be submitted to the Foundation Section prior to May 25, 1962. 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.

RDB/McC

Yours very truly,

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


A. Rutka,
MATERIALS & RESEARCH ENGINEER

ONTARIO
DEPARTMENT OF HIGHWAYS


Memo to Mr. A. Stermac Date April 10, 1962.
Principal Foundation Engr. Subject Borings for Wilson Ave.,
From Mr. C. S. Grebski Bathurst St. & Retaining Wall
Hwy. 401 Toronto By-Pass,
District #6, W.P. 146-58.

We are sending herewith a preliminary plan for this work. Both Wilson Ave. and Bathurst St. are being widened and extended retaining walls added from Sta. 284+00 + to 320+00 +. Kindly carry out a soil investigation for this project.

The green lines indicate property lines of property now owned by D.H.O. Red lines indicate future property lines.

Due to the fact that we do not own property where walls will go in some areas you may have to skip these areas or get permission from property owners. We leave this to your discretion.

CSG:go
c.c. S. McCombie


C. S. Grebski,
Sr. Br. Project Engineer.

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Division,
(Foundation Section)
Attention: Mr. J. McGeahie.

May 23, 1962.

FOUNDATION INVESTIGATION REPORT
By: GECOR, LIMITED,
CONSULTING ENGINEERS.

Re: Proposed Widening Highway #401,
Bathurst Street and Avenue Road,
W.Y. 146-58 -- District #6.

The report on the foundation investigation of the above site has been reviewed and the following recommendations are made:

(1) The coefficient of active earth pressure may be taken as 0.3 for granular backfill with adequate drainage provided.

(2) Flexible joints should be provided between the existing and proposed structures to minimize the effect of differential settlements.

We believe you will find the contents of this report, together with the above comments, adequate for your future design work. Should further information be required, please feel free to contact our office.

LYL/Mef
Attach.

cc: Metars. A. M. Toye (2)
R. A. Tregaskes
H. D. McMillan
J. C. Campbell
C. Fraser
T. J. Kovich
J. Roy
J. S. Crispier
C. B. Saint
P. Norman
A. Watt

KyLo
K. Y. Lo,
SUPERVISING FOUNDATION ENG.
For:
A. G. Sternac,
PRINCIPAL FOUNDATION ENG.

Foundations Office -- Gen. Files.

GEOCON LTD

HEAD OFFICE

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

Rexdale, Ontario,
May 24th, 1962.

DISTRICT OFFICES

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

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

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,
Bathurst Street and Avenue Road,
W.P. 146-58,
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 2 to 7 feet of very loose to dense silty till fill which is underlain by compact to very dense silty till. At the locations, where the boreholes penetrated through the silty till stratum, strata of very dense silty sand and hard silty clay were encountered. A perched groundwater table was found to exist in the silty till at the time of investigation and was observed between elevations 586 and 599.

As discussed in the report, the silty till stratum is suitable for the founding of the retaining walls and abutments at the recommended bearing capacity. The resulting settlements should be within tolerable limits. Recommendations are also given in the report for the lateral forces to be used in the 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
J. C. Osler, P. Eng.,
Division Engineer.

JCO/dw
S7358

ST. JOHN'S

HALIFAX

MONTREAL

TORONTO

VANCOUVER

S7358
REPORT
TO
DEPARTMENT OF HIGHWAYS, ONTARIO
ON
SOIL CONDITIONS AND FOUNDATIONS
PROPOSED WIDENING HIGHWAY #401
BATHURST STREET AND AVENUE ROAD
W.P. 146-58
DOWNSVIEW ONTARIO

Distribution:

- 14 copies - Department of Highways, Ontario,
Downsview, Ontario.
- 2 copies - Geocon Ltd,
Rexdale, Ontario.

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Appendix I

Office Reports on Soil Exploration

Appendix II

Figures - Laboratory Testing

Drawing in pocket at rear:

S7358-1 Boring Plan and Soil Stratigraphy

INTRODUCTION

Geocon Ltd has been retained by the Department of Highways, Ontario, by letter dated April 13th, 1962, to investigate and report on the soil conditions north and south of Highway 401 between Avenue Road and Bathurst 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. All the factual information obtained is reported in detail herein.

PROCEDURE

The field work was carried out between April 19th and May 1st, 1962. Eighteen boreholes, each with an accompanying dynamic penetration test, were put down using a mobile power auger. The location of the borings and the inferred soil stratigraphy are shown on Drawing S7358-1 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 obtained and remaining after testing will be stored until November 1st, 1962 at which time you will be contacted for instructions regarding their disposal.

PROCEDURE (continued)

2.

The elevations of the boreholes are referred to a bench mark cut in the southwest corner of the concrete bridge sidewalk 40 feet right of Station 289+55. The elevation of this bench mark was given as 620.95 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 site covers the immediate area north and south of Highway 401 between the western approaches to the intersections at Bathurst Street and Avenue Road. The ground surface is generally flat.

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

The ground surface at the toe of the present embankment and within the highway right-of-way is generally covered by a thin layer of topsoil from 2 to 15 inches in thickness. No topsoil was encountered in boreholes 3, 7, 10, 14 and 16. Boreholes 3, 7, and 16 are adjacent to

Topsoil (continued)

sidewalks and in each case the topsoil has been removed and the surface covered by a maximum of 2 inches of granular fill. Borehole 14, in a school yard encountered about 3 inches of asphalt.

Very Loose to Dense Silty Till Fill

Underlying the topsoil, granular fill and asphalt 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 generally brown in colour; however, in some locations, where brown and grey till has been used, the resulting mixture has produced a mottled colouring. The thickness of the fill deposit as encountered ranges from 2 to 7 feet with an average thickness of about 4 feet.

A wet unit weight determination on one sample from this stratum gave a value of 125 pounds per cubic foot.

Standard penetration tests performed in the fill gave "N" values ranging from 5 to 45 blows per foot with an average value of 18 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 very loose to dense.

Very Loose to Dense Silty Till Fill (continued)

An undrained triaxial test on a sample from this stratum gave a value of compressive strength of 1.9 tons per square foot.

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 can be taken as 125 and 63 pounds per cubic foot. The coefficients of lateral earth pressure for the fill may be taken as 0.33, 0.5 and 3.0 for the "active", "at rest" and "passive" conditions respectively.

Compact to Very Dense Silty Till

The principal soil stratum at the site is a brown to grey silty till. The till was encountered immediately below the till fill in all the boreholes. The till is brown at the top of the stratum and generally changes to grey with depth. 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. Where encountered the colour change varied in depth from 13 to 18 feet below ground level. As the brown and grey till are similar in composition they have been described here and on the Drawing at the rear of this report as one stratum although on the Office Reports in Appendix I the colour boundary is shown. Eight boreholes penetrated through the silty till stratum giving an average thickness of about 18 feet with a minimum of 10 feet. The remaining boreholes were terminated within either the brown or the grey silty till.

Compact to Very Dense Silty Till (continued)

Two mechanical analyses were performed on samples from this stratum. The samples were taken from either end of the site investigated and from each side of the colour boundary. The results are shown on Figure 1 of Appendix II and suggests that within the silty till stratum the grain size distribution is relatively similar. The samples tested are believed to be typical of the till stratum as a whole and show it to contain about 40 percent sand and gravel sizes, 38 percent silt sizes and 22 percent clay sizes.

Atterberg limit tests were carried out on samples of the stratum from either end of the site investigated. The liquid limits were found to be 21 and 24 while the plasticity indices were 7 and 11. The corresponding natural moisture contents were 9 and 10 percent. These test results indicate further the homogeneous nature of the till stratum across the site.

The wet unit weight of the material was found to range from 131 to 151 pounds per cubic foot with an average value of 140 pounds per cubic foot.

Standard penetration tests carried out in the stratum gave "N" values ranging from 18 to greater than 100 blows per foot with an average of 62 blows per foot. The general trend is that the blow count is high near the surface of the stratum and increases with depth. A low value of 18 was obtained at a depth of 30 feet in borehole 3. The results of the standard penetration tests

Compact to Very Dense Silty Till (continued)

are plotted on the Office Reports and on Figure 2 in Appendix II. On the basis of the "N" values the relative density is estimated to range from compact to very dense and to be generally very dense.

Unconfined compression tests and undrained triaxial tests were carried out on 12 samples of the silty till. The results, plotted against elevation on Figure 3 in Appendix II, show values of compressive strength ranging from 3.5 to 7.6 tons per square foot with an average of 5.0 tons per square foot above elevation 575. From depths of 30 and 40 feet in borehole 3, values of 1.2 and 2.4 tons per square foot were obtained. Because of the high strain at failure in the case of the value of 1.2 tons per square foot this test is believed to have been affected by disturbance due to sampling.

For design purposes the silty till may be considered cohesionless with an angle of shearing resistance of 40 degrees. The wet and submerged unit weights may be taken as 140 and 78 pounds per cubic foot. The coefficients of lateral earth pressure for the till may be taken as .22, 0.5 and 4.5 for the "active", "at rest" and "passive" conditions respectively.

Very Dense Brown and Grey Silty Sand

Underlying the silty till stratum in boreholes 3, 6 and 7 a stratum of silty sand was encountered. The colour of the stratum is the same as that of the immediate

Very Dense Brown and Grey Silty Sand (continued)

overlying till stratum. In borehole 14 the stratum underlying the brown silty till is, by visual inspection, a brown coarse sand and gravel and contains only a small percentage of fine sand and silt sizes. However, for convenience, its description is included in this stratum. The full thickness was not determined as all boreholes that encountered the silty sand were terminated within this stratum.

Two mechanical analyses were performed on samples from this stratum. The two results plotted on Figure 4 of Appendix II show that the material is essentially the same except for a slight clay content in one of the samples. The material consists of 66 and 80 percent sand and gravel sizes, 12 and 34 percent silt sizes and 8 percent clay sizes in the one sample mentioned previously. The gravel sizes made up less than 5 percent of the total sample.

Standard penetration tests carried out in the stratum gave "N" values ranging from 88 to greater than 100 blows per foot. On the basis of these "N" values the relative density is estimated to be very dense.

For design purposes the silty sand should be considered cohesionless with an angle of shearing resistance of 35 degrees. The wet and submerged unit weights can be taken as 130 and 70 pounds per cubic foot. The coefficients of lateral earth pressure for the silty sand may be taken as 0.27, 0.5, and 3.5 for the "active", "at rest" and "passive" conditions respectively.

Hard Grey Silty Clay

Underlying the silty till stratum in some locations is a stratum of grey silty clay. Where encountered, the depth of this stratum below ground level ranged from 18 to 27 feet with an average of 21 feet. The boreholes that penetrated to the silty clay were terminated within the stratum and the full thickness of the stratum was not determined. The material consists of silty clay with occasional thin layers of silt and clayey silt.

Atterberg limits were carried out on two samples from this stratum. The liquid limits were 41 and 47 with an average of 44, the plasticity indices were 22 and 26, and the corresponding moisture contents were 16 and 18 percent with an average of 17.

The wet unit weight, as determined on one sample from this stratum, was 127 pounds per cubic foot at a natural moisture content of 17 percent.

An undrained triaxial test was carried out on a sample from this stratum and gave a value of compressive strength of 8.3 tons per square foot. Based on this strength value, together with the results of standard penetration tests which gave "N" values ranging from 46 to greater than 100 blows per foot with an average of 71 blows per foot the consistency is estimated to be hard.

For design purposes the silty clay can be considered to have a shear strength of 4000 pounds per square foot and wet and submerged unit weights of 125 and 63 pounds per cubic foot respectively.

WATER CONDITIONS

9.

Water level observation pipes were installed in the majority of the boreholes. The groundwater levels observed in the boreholes on May 5th, 1962 are shown on the Office Reports on Soil Exploration in Appendix I and are believed to represent the groundwater table at that time.

The water levels in those boreholes which terminated in the silty till or in the silty clay were observed to range from elevation 586 to 599 and to be generally at elevation 592. The water levels in those boreholes which penetrated into the silty sand stratum were observed to range from 579 to 587, and generally at elevation 583. The higher water in the till and clay suggest that a perched water table exists in the silty till stratum at the time of the investigation. In borehole 16 the water level was observed at a low elevation of 577.

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, extending from the western approaches to Bathurst Street to Avenue Road. The location of these structures as given to us are shown on Drawing S7358-1, at the rear of the report. It is also understood that the height of the retaining walls will range up to about 25 feet and that the walls will be continuous except at the bridge sites.

The brown to grey silty till stratum is suitable for the founding of the proposed retaining walls and bridge abutments. Footing foundations, carried down through the fill,

would range in elevation from about 586 to 601, or 2 to 7 feet below existing ground level. Based on the "N" values and the measured compressive strengths at and within a significant depth below foundation level, a net allowable bearing pressure of 4.0 tons per square foot may be used in the design of the footings. All footings should be provided with at least 4 feet of earth cover for adequate frost protection.

Because of the relatively incompressible nature of the silty till, total settlements of the retaining walls should be less than 1.0 inches and therefore within tolerable limits. The increased width of the embankment will cause further settlements of the existing Bathurst Street and Wilson Avenue bridges. However, the effects of this settlement would be to reduce any differential settlements in the existing bridge abutments. The bridge extensions, if designed as discussed above, should also experience total settlements of less than 1.0 inches, which should also be within tolerable limits. Provision should be made to accommodate differential movements between the existing and proposed portions of the bridges.

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; in particular the locations of culverts and ditches, which have been shown in their approximate positions on the plan, should be checked. 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 should 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 silty till fill. Adequate construction joints should be provided between adjoining portions of any wall founded partly on fill and partly on the natural till. Again, a cover of 4.0 feet should be provided for frost protection. All topsoil should be removed from beneath embankment footing locations.

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 elevation 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 the design of the retaining walls a value of the coefficient of earth pressure of 0.5 is recommended for a fill of granular or partly granular nature. For the design of the abutments a value of the coefficient of earth pressure of 0.5 should also be used.

CONCLUSIONS AND RECOMMENDATIONS

12.

1. The site is covered by a 2 to 7 foot thick deposit of very loose to dense silty till fill. The fill is underlain by a stratum of compact to very dense brown to grey silty till. The silty till where penetrated is underlain by interglacial deposits of hard grey silty clay or very dense brown and grey silty sand. The minimum thickness of the silty till as encountered is 10 feet.

2. At the time of investigation, the groundwater table in the silty sand lies between elevations 579 and 587 and is generally at elevation 583. A perched water table exists in the till stratum and was observed between elevations 586 and 599 and generally at elevation 592.

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 for the design of footings founded within the silty till stratum.

4. The retaining walls and bridge abutments will experience settlements which, as discussed in the report, should be within tolerable limits.

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

PERSONNEL

The field work was carried out under the technical supervision of Messrs. D. B. Oates and F. J. Heffernan. This report was written by Mr. Oates, checked by Mr. Heffernan, P. Eng., and reviewed by Mr. J. C. Osler, P. Eng.

GEOCON

D. B. Oates
D. B. Oates, P. Eng.

APPENDIX I

OFFICE REPORTS ON SOIL EXPLORATION

GEOCON

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. | Relative Density | Standard Penetration Resistance. Blows/ft. |
|-------------|----------------------------|------------------|---|
| Very soft | 0.03 to 0.25 | Very loose | 0 to 4 |
| Soft | 0.25 to 0.5 | Loose | 4 to 10 |
| Firm | 0.5 to 1.0 | Compact | 10 to 30 |
| Stiff | 1.0 to 2.0 | Dense | 30 to 50 |
| Very stiff | 2.0 to 4.0 | Very dense | over 50 |
| Hard | over 4.0 | | |

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 57358 BORING # 1 & 2 DATUM GEODETIC CASING
 BORING DATE APRIL 18 1961 REPORT DATE APRIL 28 1962 COMPILED BY A.E.L. CHECKED BY D.B.D.
 SAMPLER HAMMER WT. 14.2 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION



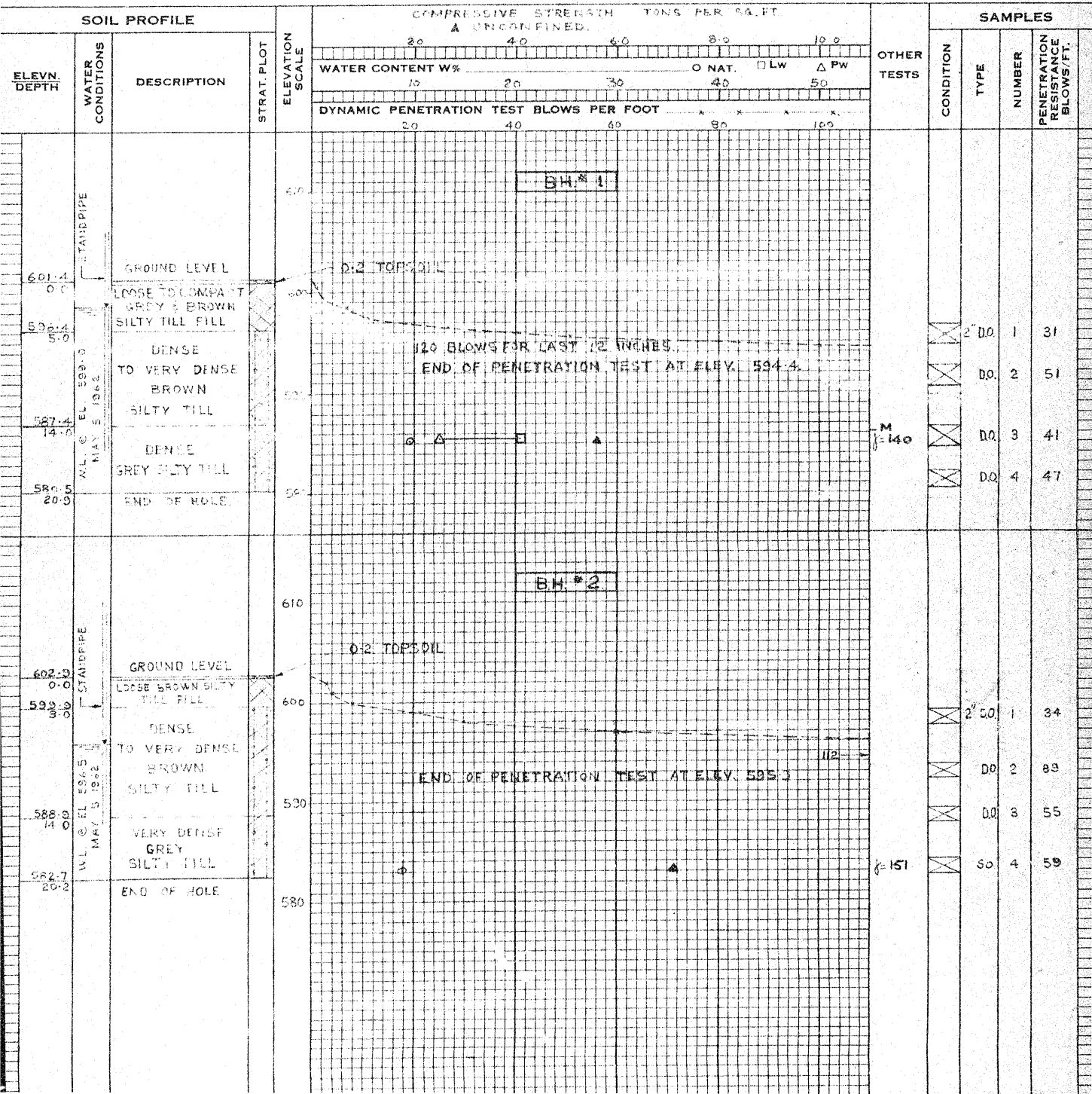
A.S. - AUGER SAMPLE
 S.T. - SLOTTED TUBE
 W.S. - WASHED SAMPLE
 D.O. - DRIVE-OPEN
 D.F. - DRIVE-FOOT VALVE
 C.S. - CHUNK SAMPLE

SAMPLE TYPES

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
 7 - WET UNIT WEIGHT P.C.F.
 K - PERMEABILITY
 C - CONSOLIDATION
 WL - WATER LEVEL IN CASING
 WT - WATER TABLE IN SOIL



OFFICE REPORT ON SOIL EXPLORATION

SAMPLE CONDITION

SAMPLE TYPES

ABBREVIATIONS

DISTURBED
FAIR
GOOD
LOST

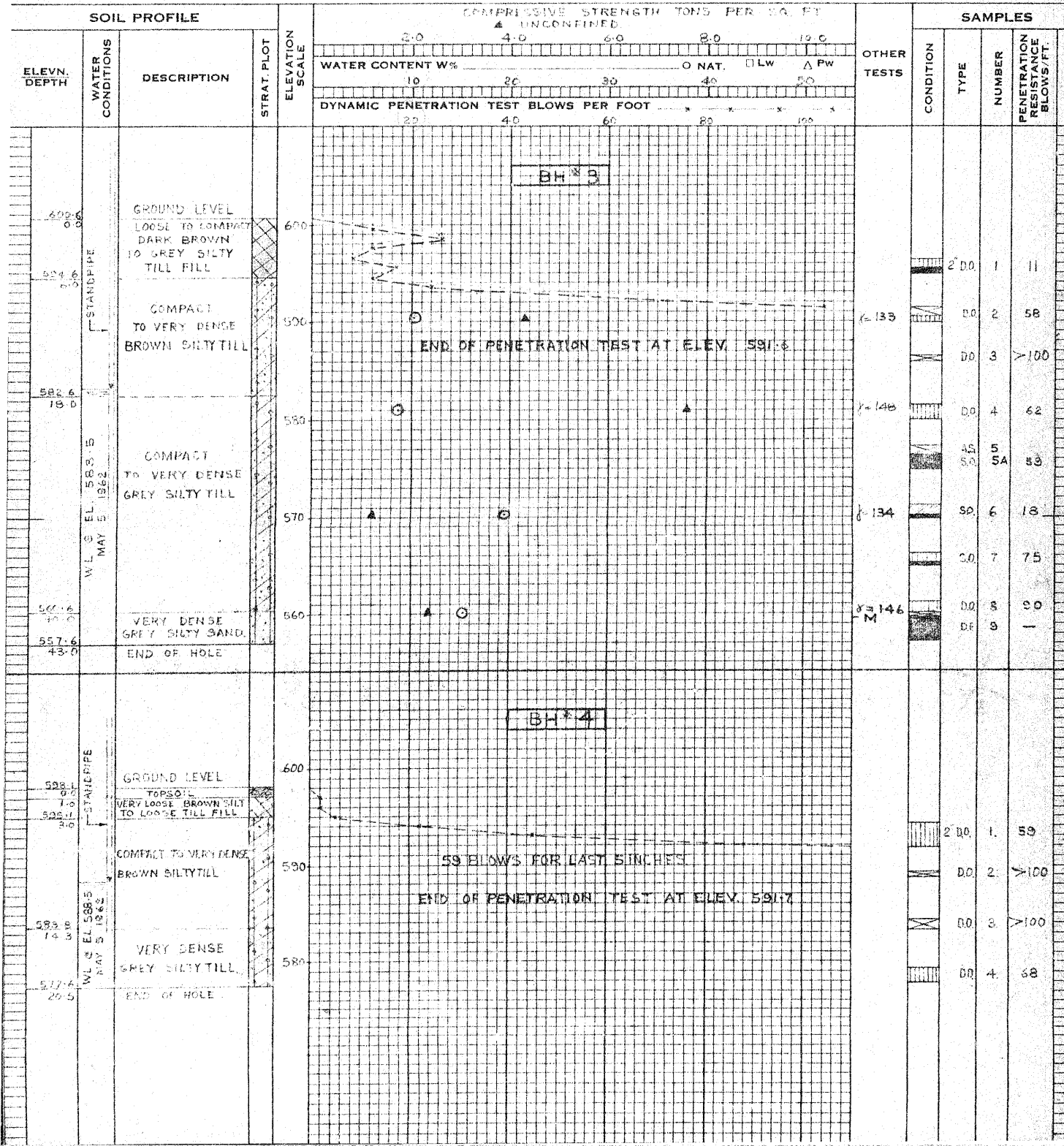
A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE

F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

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 PCF
 K - PERMEABILITY
 C - CONSOLIDATION
 WL - WATER LEVEL IN CASING
 WT - WATER TABLE IN SOIL

WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL



GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 57352 BORING # 546 DATUM GEODETIC CASING -
 BORING DATE APRIL 24 1962 REPORT DATE APRIL 30 1962 COMPILED BY AEL CHECKED BY DBO
 SAMPLER HAMMER WT. 147 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION



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

SAMPLE TYPES

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 PCF
 K - PERMEABILITY
 C - CONSOLIDATION
 WL - WATER LEVEL IN CASING
 WT - WATER TABLE IN SOIL

SOIL PROFILE

COMPRESSIVE STRENGTH TONS PER SQ FT

2.0 4.0 6.0 8.0 10.0
 ▲ UNCONFINED

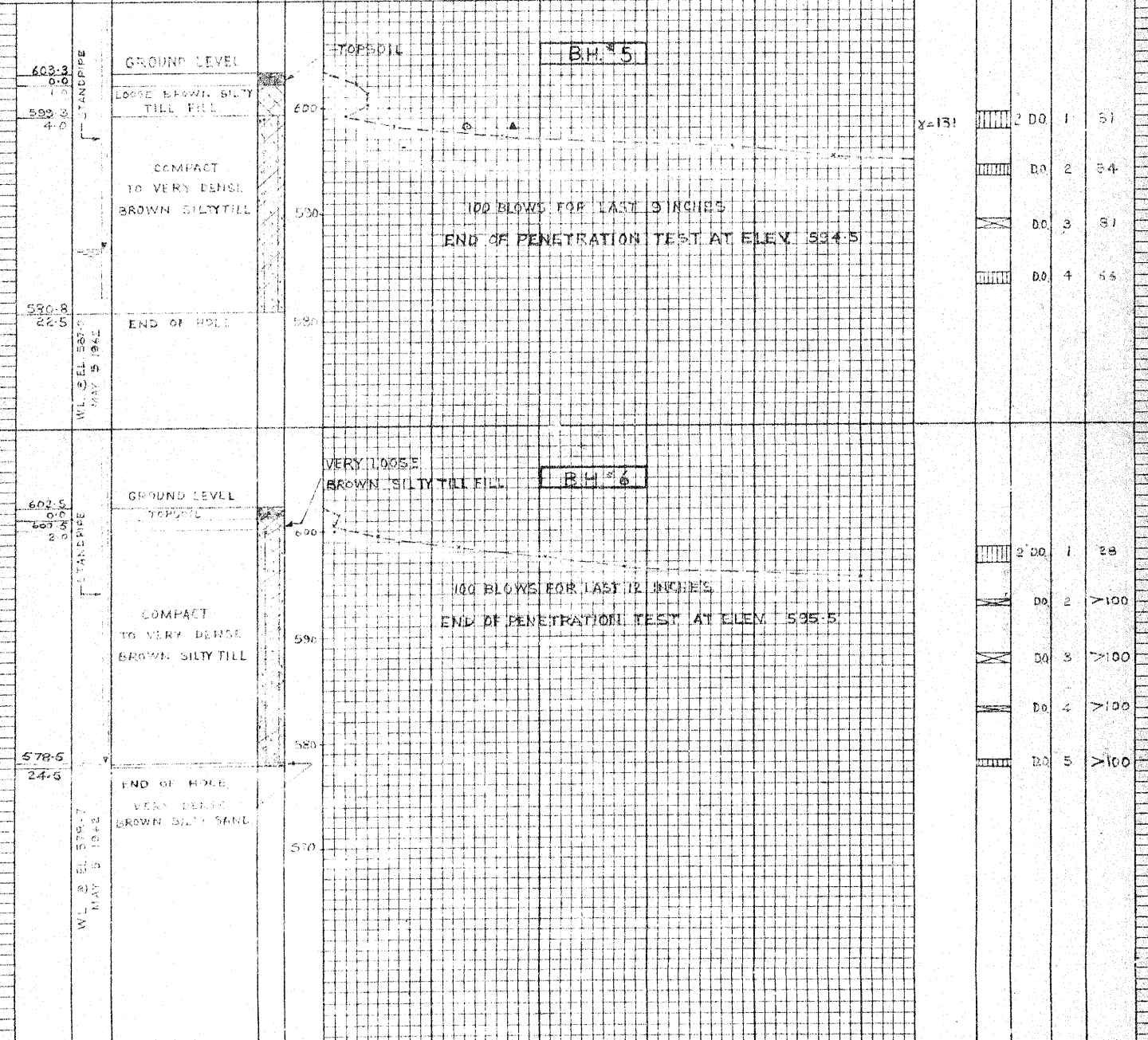
WATER CONTENT W% 10 20 30 40 50

0 NAT. 10 LW 20 PW

DYNAMIC PENETRATION TEST BLOWS PER FOOT 20 40 60 80 100

SAMPLES

CONDITION TYPE NUMBER PENETRATION RESISTANCE BLOWS/FT.



GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT S7358 BORING # 7 1.8 DATUM GEODETIC CASING -
 BORING DATE MAY 1 5 APR 1962 REPORT DATE APRIL 30 1962 COMPILED BY AEL CHECKED BY DBO
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS. ENERGY)

SAMPLE CONDITION



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

SAMPLE TYPES

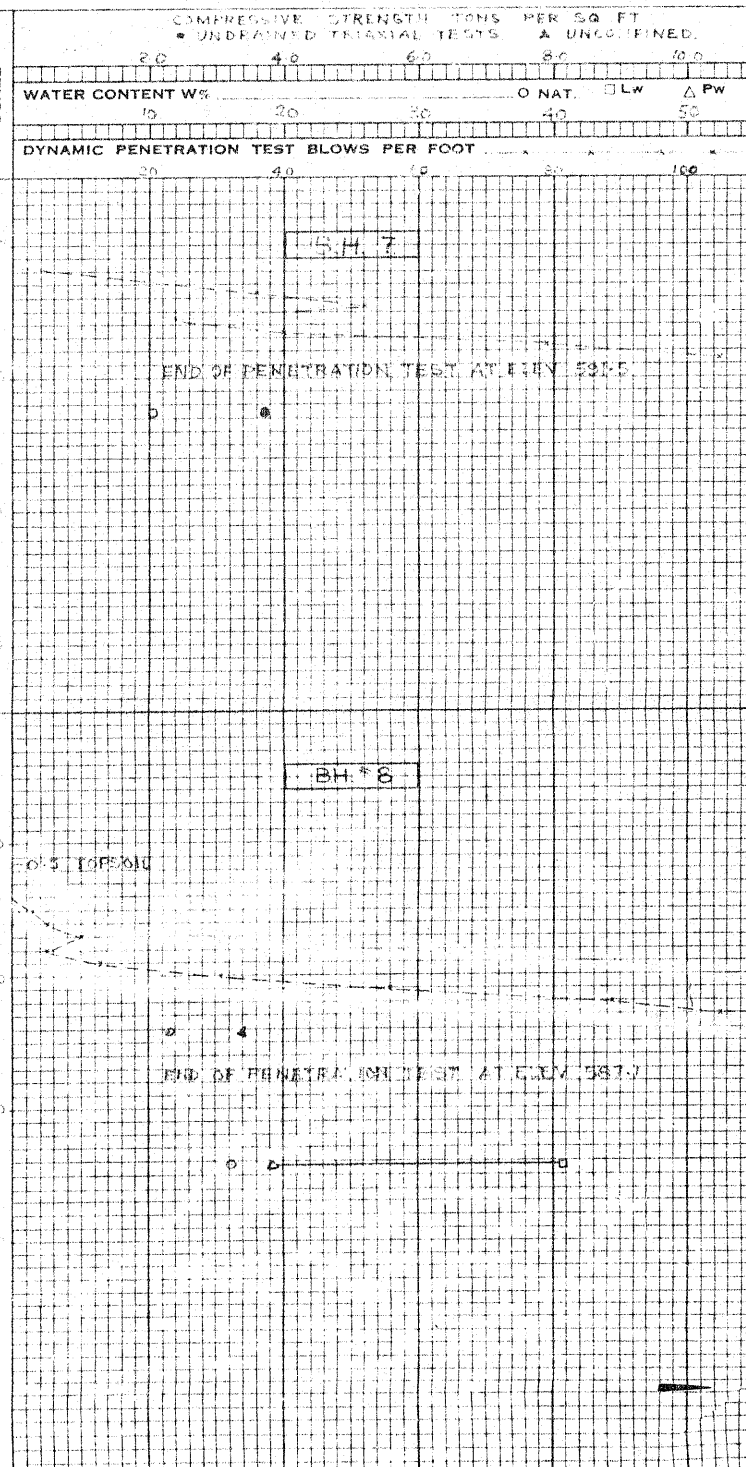
F.S. - FOIL SAMPLE
 S.O. - SLEEVE-OPEN
 S.F. - SLEEVE-FOOT VALVE
 T.O. - THIN WALLED OPEN
 R.C. - ROCK CORE

ABBREVIATIONS

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

SOIL PROFILE

| ELEV. DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT. PLOT | ELEVATION SCALE |
|---------------|--------------------------|---|-------------|-----------------|
| 592.5 0.0 | STANDPIPE | CONTACT TO VERY DENSE BROWN SILTY TILL FILL | | 600 |
| 591.5 1.0 | | DENSE TO VERY DENSE BROWN SILTY TILL | | 590 |
| 585.5 13.0 | WL @ EL 581.5 MAY 5 1962 | VERY DENSE BROWN SILTY SAND | | 580 |
| 580.0 20.0 | | | | 570 |
| 596.1 0.0 | STANDPIPE | GROUND LEVEL | | 600 |
| 592.1 4.0 | | LOOSE BROWN SILTY TILL FILL | | 590 |
| 587.1 10.0 | WL @ EL 590.8 MAY 5 1962 | CONTACT TO VERY DENSE BROWN SILTY TILL | | 580 |
| 578.1 18.0 | | DENSE TO VERY DENSE GREY SILTY TILL | | 570 |
| 575.6 20.5 | | HAZEL GREY SILTY CLAY | | 560 |
| | | END OF HOLE | | 550 |



SAMPLES

| CONDITION | TYPE | NUMBER | PENETRATION RESISTANCE BLOWS/FT. |
|-----------|------|--------|----------------------------------|
| DO | 1 | 44 | |
| DO | 2 | 75 | |
| DO | 3 | 100 | |
| AS | 4 | | |
| DO | 5 | 100 | |
| DO | 6 | 92 | |
| AS | 7 | | |
| DO | 1 | 22 | |
| DO | 2 | 60 | |
| DO | 3 | 86 | |
| DO | 4 | 53 | |

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 57358 BORING # 9 4 10 DATUM GEODETIC CASING -
 BORING DATE APRIL 29 1962 REPORT DATE APRIL 30 1962 COMPILED BY A.E.L. CHECKED BY D.B.O.
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION



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

SAMPLE TYPES

F.S. - FOIL SAMPLE
 S.O. - SLEEVE-OPEN
 S.F. - SLEEVE-FOOT VALVE
 T.O. - THIN WALLED OPEN
 R.C. - ROCK CORE

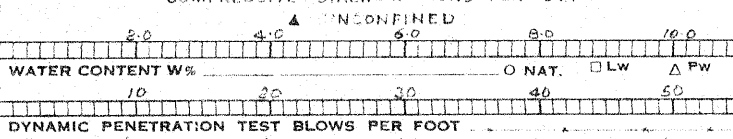
ABBREVIATIONS

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

| ELEV. DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT. PLOT | ELEVATION SCALE |
|---------------|-----------------------------|---------------------------------------|-------------|-----------------|
| 591.1 0.0 | STANDPIPE | GROUND LEVEL | | 590 |
| 589.5 1.5 | WL @ EL 587.3 MAY 5 1962 | VERY LOOSE TO LOOSE BROWN SILTYTILL | | 580 |
| 575.4 15.6 | | COMPACT TO VERY DENSE BROWN SILTYTILL | | 570 |
| | | END OF HOLE | | |
| 583.7 0.0 | STANDPIPE | GROUND LEVEL | | 580 |
| 587.7 4.0 | WL @ EL 586.4 MAY 5 1962 | LOOSE TO DENSE SILTY TILL FILL | | 570 |
| 579.7 14.0 | | DENSE TO VERY DENSE BROWN SILTYTILL | | |
| 575.7 18.0 | | COMPACT GREY SILTY TILL | | |
| 569.3 24.5 | | HARD GREY SILTY CLAY | | |
| | | END OF HOLE | | |

COMPRESSION STRENGTH TONS PER SQ. FT.



OTHER TESTS

SAMPLES

| CONDITION | TYPE | NUMBER | PENETRATION RESISTANCE BLOWS/FT. |
|-----------|------|--------|----------------------------------|
| | | 2'00 | 1 20 |
| | | D.O. | 2 30 |
| | | D.O. | 3 72 |
| | | 2'00 | 1 45 |
| | | D.O. | 2 37 |
| | | D.O. | 3 25 |
| | | D.F. | 4 71 |
| | | D.O. | 5 >100 |

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 57358 BORING # 11 & 12 DATUM GEODETIC CASING -
 BORING DATE APRIL 26 1962 REPORT DATE APRIL 30 1962 COMPILED BY AEL CHECKED BY D.B.O.
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION



DISTURBED
FAIR
GOOD
LOST

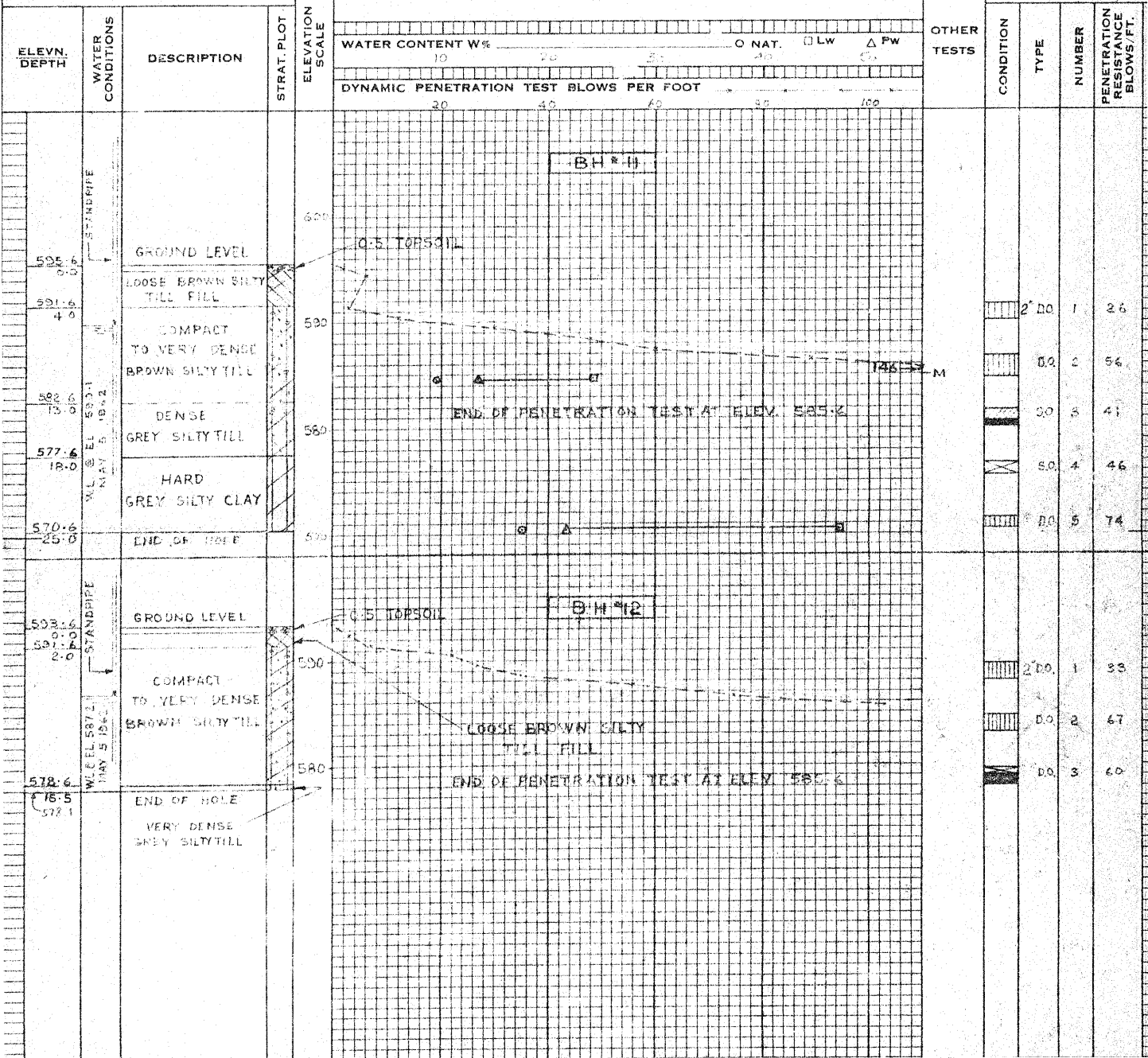
SAMPLE TYPES

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



GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 57258 BORING # 13 & 14 DATUM GEODTIC CASING -
 BORING DATE APRIL 27 1962 REPORT DATE MAY 1 1962 COMPILED BY AEL CHECKED BY DBO
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION



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

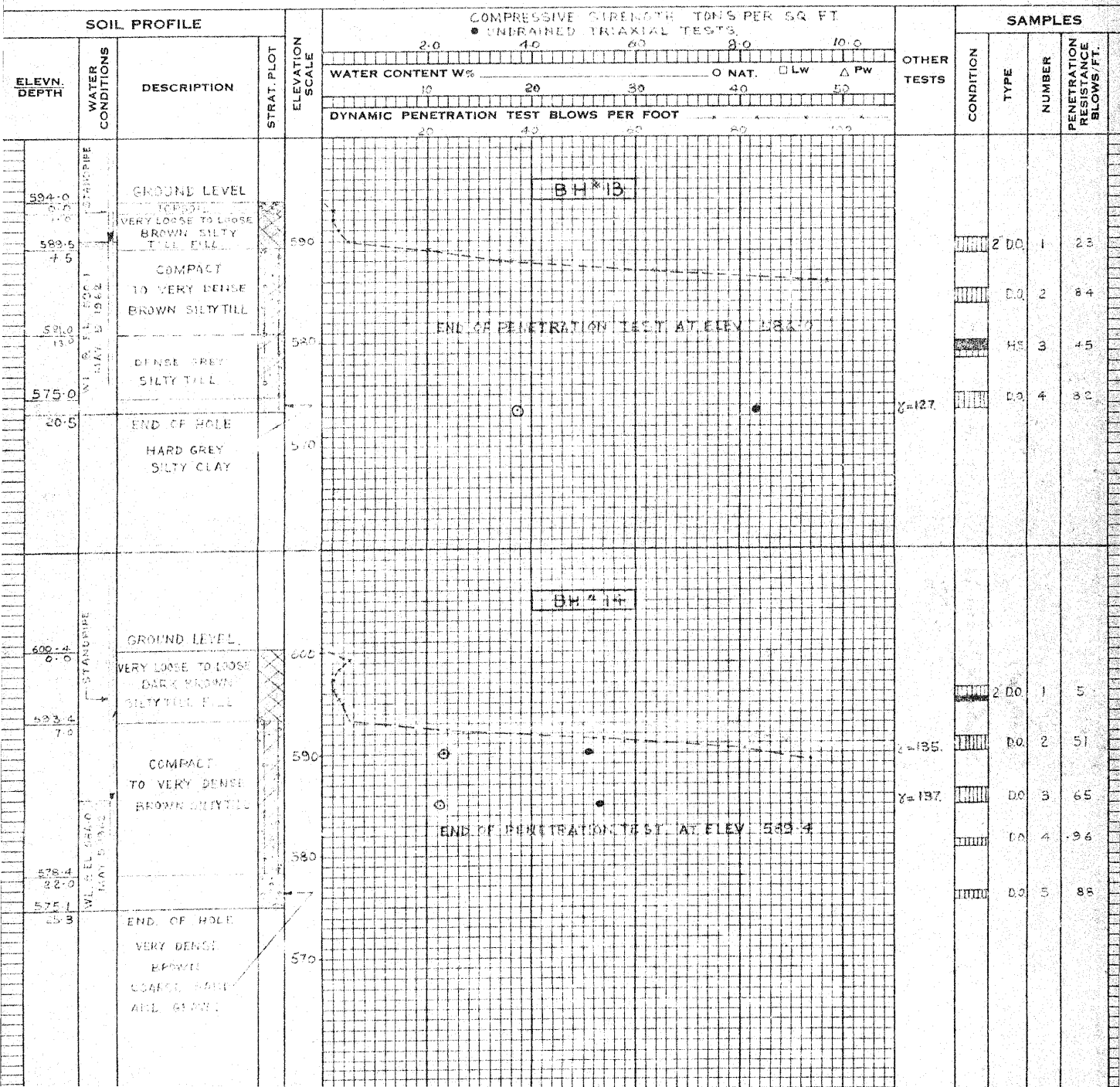
SAMPLE TYPES

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 PCF
 K - PERMEABILITY
 C - CONSOLIDATION
 WL - WATER LEVEL IN CASING
 WT - WATER TABLE IN SOIL

SOIL PROFILE



GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 5712 BORING # 15 DATUM GEOD. T. CASING -
 BORING DATE APRIL 30 1962 REPORT DATE MAY 1 1962 COMPILED BY ALL CHECKED BY D B O
 SAMPLER HAMMER WT. 110 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION



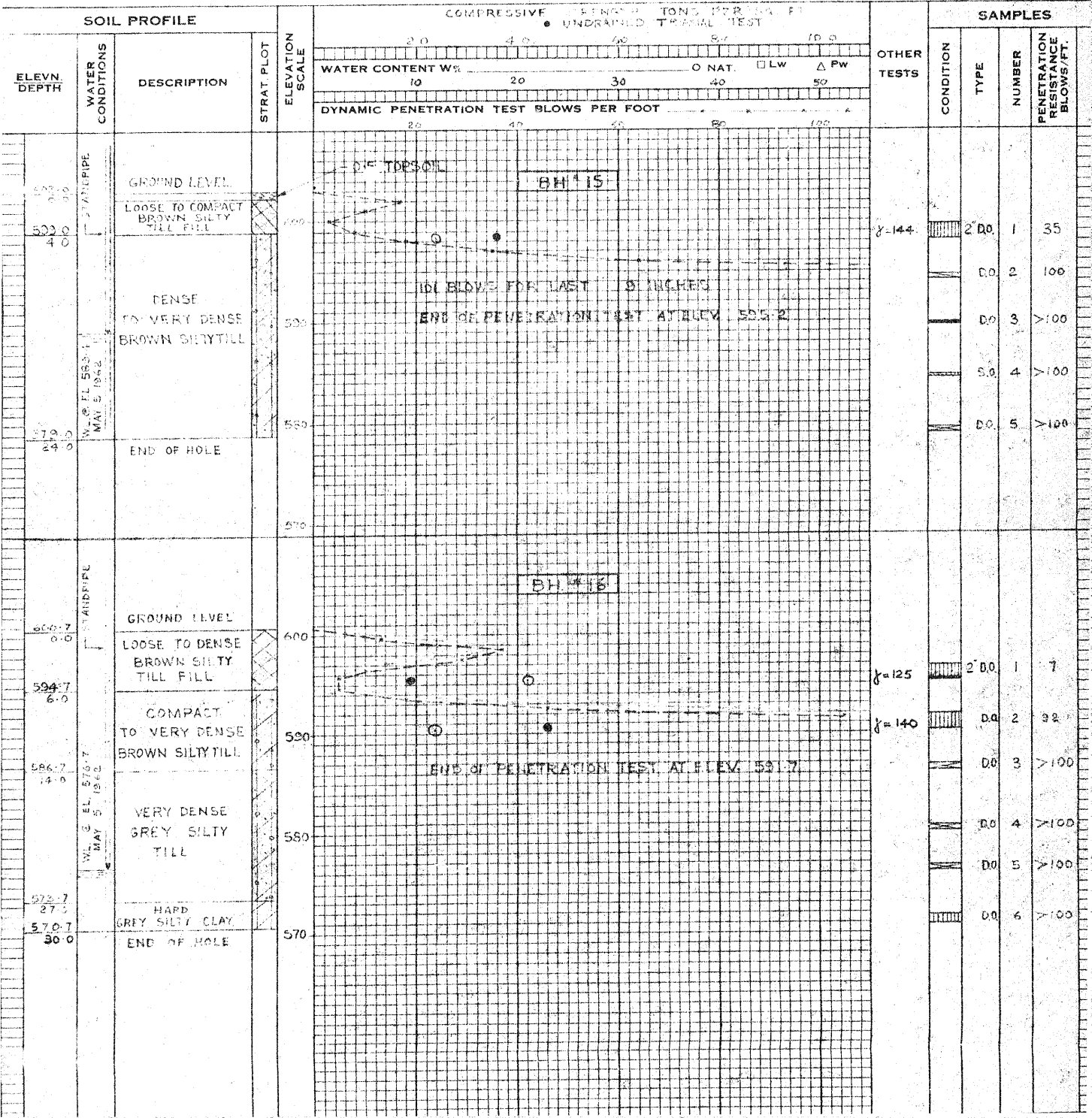
A.S. - AUGER SAMPLE
 S.T. - SLOTTED TUBE
 W.S. - WASHED SAMPLE
 D.O. - DRIVE-OPEN
 D.F. - DRIVE-FOOT VALVE
 C.S. - CHUNK SAMPLE

SAMPLE TYPES

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 PCF
 K - PERMEABILITY
 C - CONSOLIDATION
 WL - WATER LEVEL IN CASING
 WT - WATER TABLE IN SOIL



OFFICE REPORT ON SOIL EXPLORATION

SAMPLE CONDITION

SAMPLE TYPES

ABBREVIATIONS

DISTURBED
FAIR
GOOD
LOST

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

- 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 | | | | OTHER TESTS | | SAMPLES | | | |
|---|------------------|-------------|------------|-----------------|--|-----------|------|--------|----------------------------------|
| ELEV. DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT. PLT | ELEVATION SCALE | WATER CONTENT W% O NAT. □ LW ▲ Pw | CONDITION | TYPE | NUMBER | PENETRATION RESISTANCE BLOWS/FT. |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 25%;"> <p>GROUND LEVEL</p> <p>TOPSOIL</p> <p>LOOSE BROWN SILTY TILL FILL</p> <p>DENSE TO VERY DENSE BROWN SILTYTILL</p> <p>VERY DENSE GREY SILTYTILL</p> <p>END OF HOLE.</p> </div> <div style="width: 50%;"> <p>64 * 17</p> <p>100 BLOWS FOR LAST 3 INCHES</p> <p>END OF PENETRATION TEST AT ELEV. 594.2</p> </div> <div style="width: 20%;"> <p>200</p> <p>1</p> <p>46</p> <p>00</p> <p>2</p> <p>64</p> <p>00</p> <p>3</p> <p>73</p> <p>00</p> <p>4</p> <p>69</p> </div> </div> | | | | | | | | | |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 25%;"> <p>GROUND LEVEL</p> <p>TOPSOIL</p> <p>LOOSE BROWN SILTY TILL FILL</p> <p>COMPACT TO VERY DENSE BROWN SILTYTILL</p> <p>END OF HOLE</p> <p>VERY DENSE GREY SILTYTILL</p> </div> <div style="width: 50%;"> <p>64 * 18</p> <p>100 BLOWS FOR LAST 10 INCHES</p> <p>END OF PENETRATION TEST AT ELEV. 587.5</p> </div> <div style="width: 20%;"> <p>200</p> <p>1</p> <p>38</p> <p>00</p> <p>2</p> <p>70</p> <p>00</p> <p>3</p> <p>67</p> </div> </div> | | | | | | | | | |

APPENDIX II

FIGURES - LABORATORY TESTING

GRAIN SIZE DISTRIBUTION

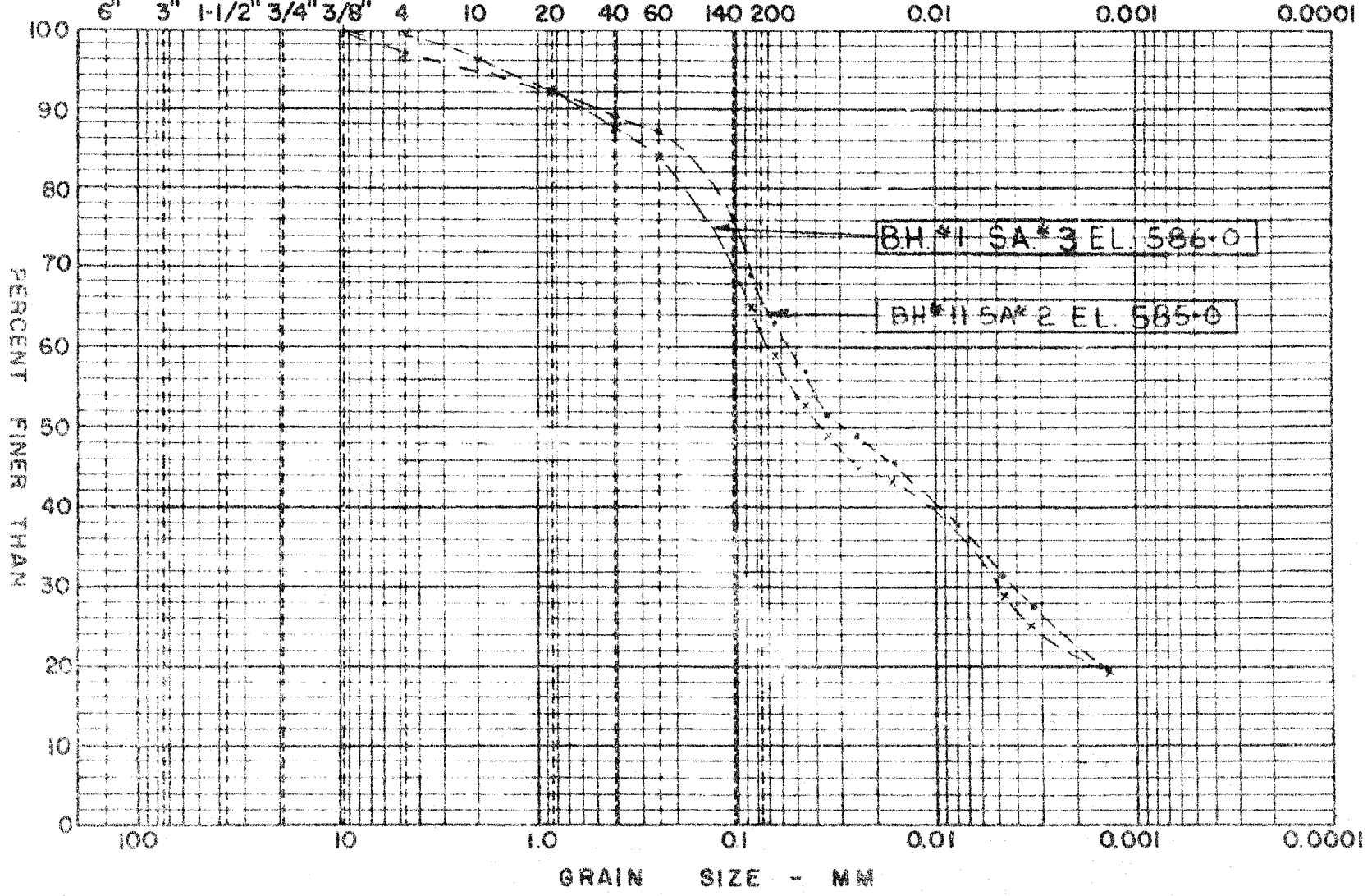
APPENDIX II
FIGURE 1

PROJECT 67358

SILTY TILL

| | | | | | | | | |
|--------|-------------|--------|------|-----------|--------|------|--------------|-------------|
| COBBLE | GRAVEL SIZE | | | SAND SIZE | | | FINE GRAINED | |
| ← SIZE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | SILT SIZE | CLAY SIZE → |

SIZE OF OPENING - INS. U.S.S. SIEVE SIZE - MESHES / IN. EQUIVALENT GRAIN DIAMETER - MM

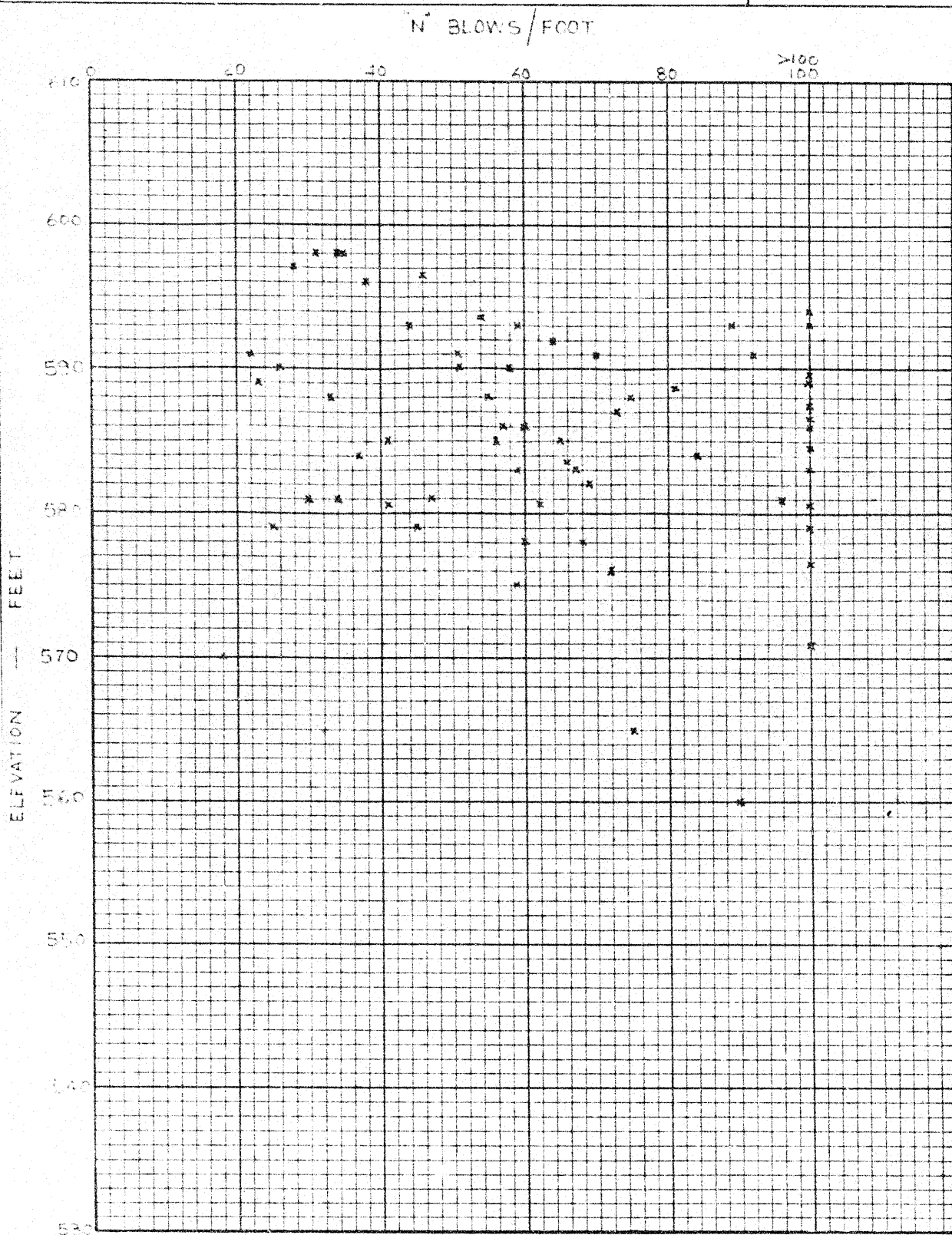


GEOCOM

M.I.T. GRAIN SIZE SCALE

"N" VALUES VS. ELEVATION

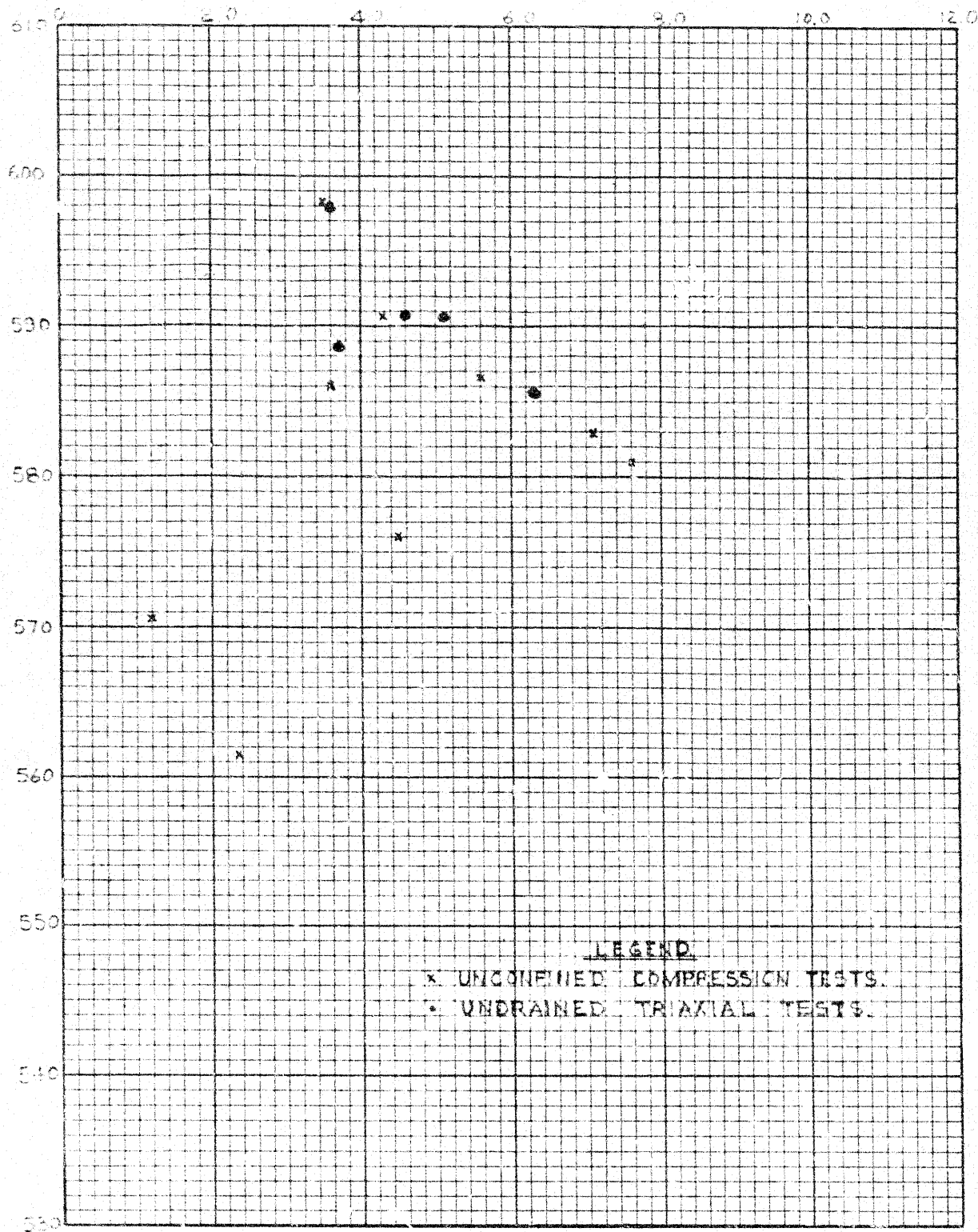
APPENDIX II
FIGURE 2
PROJECT S7358



COMPRESSIVE STRENGTH VS. ELEVATION

APPENDIX II
FIGURE 3
PROJECT S 7858

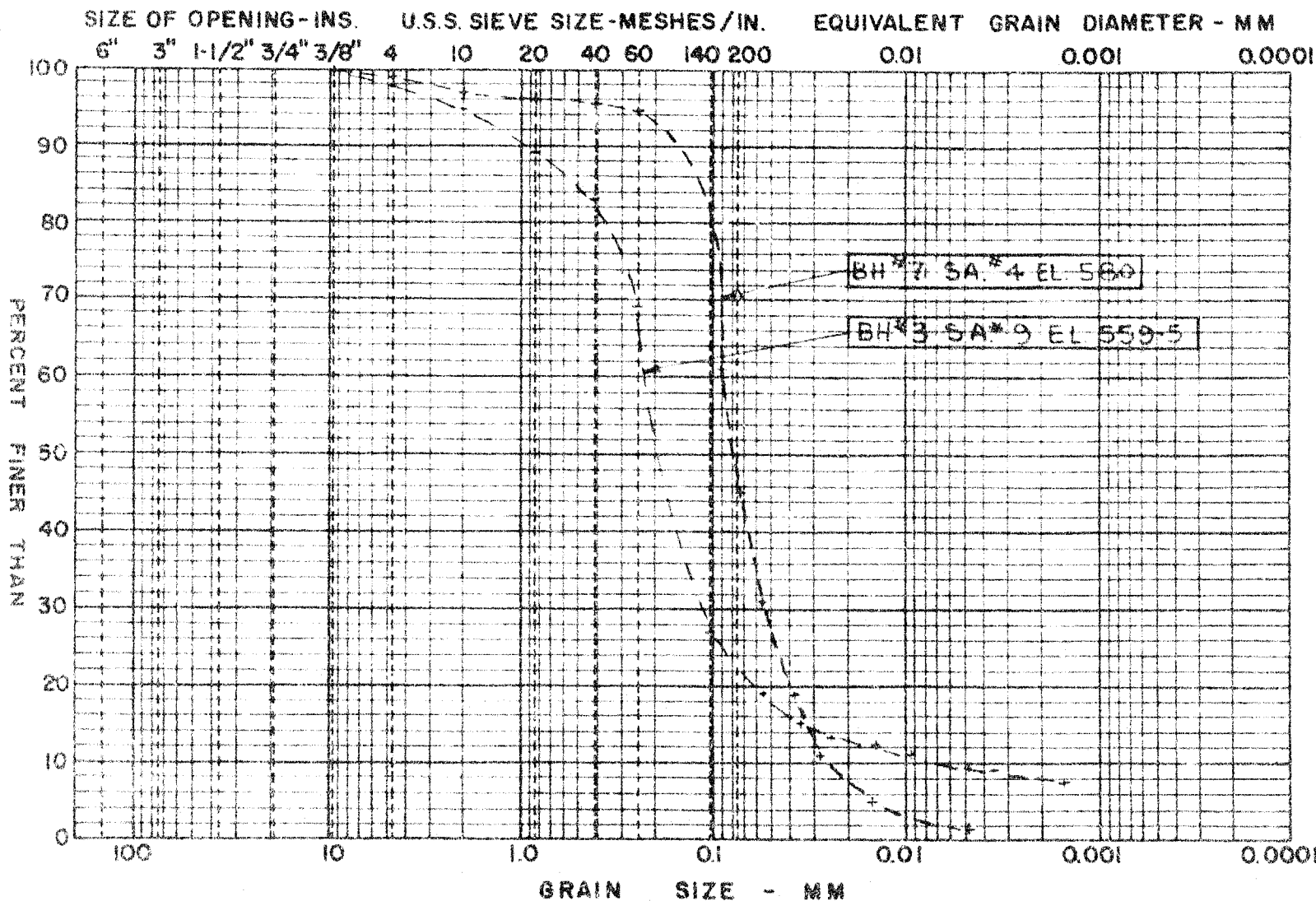
COMPRESSIVE STRENGTH - TONS/ SQ. FT.



GRAIN SIZE DISTRIBUTION

APPENDIX II
FIGURE 4
PROJECT 50576

SILTY SAND



M.I.T. GRAIN SIZE SCALE

GEOCON

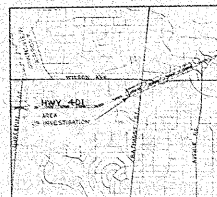
62-F-217-C

W.P. # 146-58

HWY. # 401 &

BATHURST ST.

RET. WALL



SPECIAL NOTE: DATA CONCERNING C&D VARIOUS STRATA HAVE BEEN OBTAINED AT BOREHOLE LOCATIONS ONLY. THE BASIC STRATIGRAPHY BETWEEN BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THE FOREGOING.

GEOCON LTD

DATE MAY 16 1962 SCALE AS SHOWN

| | | | |
|------|-------|-------|-------------|
| MADE | CHECK | APPRO | No. 57358-1 |
| JET | USO | ELH | |