

GEOCON LTD

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Rexdale, Ontario,
October 4th, 1963.

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

Attention: Mr. A. Rutka, P. Eng.,
Materials and Research Engineer.

Re: Soil Conditions,
Highway 403,
Stations 19+00 to 27+00 and 41+00 to 43+00,
Hamilton, Ontario.

Dear Sirs:

This letter accompanies our detailed factual report on the above soil investigation.

We find that both areas investigated are underlain by alternate strata of stiff to very stiff sandy to clayey silt and dense to very dense silty sand. The thickness of the strata generally ranged from 1.5 to 13 feet. A layer of poorly graded sand of about 15 foot thickness also exists between stations 19+00 and 23+00 and at a depth of 14 feet below the ground surface. The groundwater table at the time of the investigation was at about elevation 249 between stations 19+00 and 27+00 and at about elevation 260 between stations 41+00 and 43+00.

The actual soil conditions encountered, together with significant field and laboratory test results, are given in detail in the report.

We believe that this report contains all the information required from the investigation. However, should you require further information, or if we can be of assistance otherwise, we would be pleased if you would give us a call.

Yours very truly,

GEOCON LTD

F. J. Heffernan

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

FJH/dw
T7535



T7535
REPORT
TO
DEPARTMENT OF HIGHWAYS, ONTARIO
ON
SOIL CONDITIONS
HIGHWAY 403
STATIONS 19+00 TO 27+00 AND 41+00 TO 43+00
HAMILTON ONTARIO

Distribution:

- 10 copies - Department of Highways, Ontario,
Downsview, Ontario.
- 3 copies - Geocon Ltd,
Rexdale, Ontario.

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INTRODUCTION

Geocon Ltd has been retained by Department of Highways, Ontario in accordance with their letter of August 13th, 1963 to carry out an investigation of soil conditions along the route of the two proposed sewer cut areas along Highway 403, Contract 62-109 in Hamilton, Ontario. The site is located between Longwood Road on the north and King Street on the south.

The report describes the soil conditions encountered along the proposed sewer cut areas located between stations 19+00 to 27+00 and stations 40+00 to 45+00.

PROCEDURE

A total of 13 boreholes was put down in the section under consideration during the periods from August 16th to August 29th and September 9th to September 17th, 1963. The boreholes were advanced by dry augering methods until caving of the hole occurred at about the water table at which time BX casing was installed to keep the holes open. Seven of the boreholes did not require BX casing. Conventional 2 inch drive open samples were obtained continuously in all boreholes. Five of the boreholes were put down with a mobile power auger and eight boreholes with a skid-mounted diamond drillrig adapted for continuous flight augering. The depth of the boreholes varied from 16 feet in borehole 8 (20+00) to 36 feet in borehole 2 (21+00).

The moisture content of the soil was determined at frequent intervals in the field on the samples recovered. Piezometers were installed in boreholes 8 (20+00), 10 (24+00), and 13 (42+00) to a depth of from 17 to 25 feet below the ground level; readings of the water level in these piezometers were

taken on September 19th, 1963. Bulk samples were obtained from the auger flights in six of the boreholes and Standard Proctor compaction tests were undertaken on twelve samples.

All elevations in this report are referred to Geodetic datum and were supplied to us by your field survey personnel.

The locations of the boreholes are shown on Drawing T7535-1 in Appendix IV together with the inferred soil stratigraphy along the two sewer cut areas. Detailed logs of the various boreholes are given on the Office Reports on Soil Exploration in Appendix I. The results of laboratory testing are plotted on the Office Reports and on the Figures in Appendix II and Appendix III.

All soil samples obtained during the investigation and remaining after testing have been stored and will be retained until March 30th, 1964, at which time you will be contacted regarding their disposal.

SITE AND GEOLOGY

The sites investigated for the two proposed sewer cuts on the Chedoke Expressway are located east and parallel to Longwood Road, north of King Street West and south of Cootes Paradise. The areas of investigation are between station 19+00 to 27+00 and between 41+00 and 43+00 inclusive.

From available geological information, it is known that the area is part of the Dundas Valley which is the most noticeable break in the southern part of the Niagara Escarpment.

The Dundas Valley is a valley of a pre-glacial river which joined the basins of Lake Erie and Lake Ontario. The soil conditions composing the valley now is a drift supplied by the surrounding regions of higher relief. The soil is composed of interlayered sands and silts with some localized areas of clay, all of which were probably laid down during an interglacial period.

The bedrock is believed to be a reddish brown shale of the Queenston formation of the Paleozoic era.

SOIL CONDITIONS

General

A detailed description of the various soil types encountered in each borehole is shown on the Office Reports in Appendix I of this report. The inferred stratigraphical profile for sewer cut areas 19+00 to 27+00 and 41+00 to 43+00 is shown on Drawing T7535-1 at the rear of this report. The soil and water conditions will be considered separately for each area. The soil strata are described in detail below, in the order in which they occur with depth. All soil classifications are made according to the Unified Soil Classification System.

Sewer Cut Area 19+00 to 27+00

Loose to Dense Fill

Underlying the ground surface at boreholes 4, 9, and 12 is a layer of brown fill. The thickness of the fill ranges from 2.5 to 9.6 feet. The grain size dis-

Loose to Dense Fill (continued)

tribution tests are shown on Figure 1 of Appendix II. The results indicate that the material is composed of 10 percent clay sizes, 30 percent silt sizes, 33 percent sand sizes and 27 percent gravel sizes.

Standard penetration resistances vary from an "N" value of 7 to 47 blows per foot with an average of 24 blows per foot and therefore the relative density of the material is loose to dense.

The natural moisture contents vary from 8.5 percent to 20.5 percent with the average being 11.8 percent. The results of a Standard Proctor compaction test run on this material are shown on Figure 8A of Appendix II, and indicates a maximum dry unit weight of 124.6 pounds per cubic foot at an optimum moisture content of 10.3 percent. This indicates that the moisture content is generally below the optimum moisture content except for some thin wet layers.

Compact Organic Fill

A black and brown highly organic fill underlies the brown fill in borehole 9. This fill contains coal, wood chips, and other highly organic materials. The thickness of the fill at the borehole location was 6.4 feet.

Standard penetration resistances gave "N" values ranging from 16 to 21 blows per foot with an average of 19 blows per foot. Based on these values the relative density is estimated to be compact.

Compact Organic Fill (continued)

A moisture content of 14.5 percent was obtained from a sample of the fill.

Very Dense or Stiff Sandy to Clayey Silt (ML, ML-CL)

Outcropping at the surface in boreholes 2, 3, 8, 10 and 11 is a stratum of sandy to clayey silt. The stratum varies in surface elevation from 264.4 at borehole 2 (21+00) to elevation 260.4 at borehole 3 (19+00) and the depth of the stratum ranges from 5.7 feet to 8.1 feet.

The results of grain size distribution tests are shown on Figure 2 in Appendix II. The results indicate that the material is composed of 0 to 14 percent clay sizes, 52 to 66 percent silt sizes and 20 to 48 percent sand sizes.

The standard penetration resistance or "N" values vary from 13 to 62 blows per foot with an average of 35 blows per foot. The consistency of the clayey portions is estimated to range from stiff to very stiff and the sandy portions range in density from compact to very dense.

The moisture contents in this stratum vary from 6.6 percent to 16.1 percent with an average of 13.8 percent. The results of a Standard Proctor compaction test are shown on Figure 8B of Appendix II and give a maximum dry unit weight of 121.7 pounds per cubic foot with an optimum moisture content of 12.4 percent. Therefore the in place material in this stratum will be, on the average, approximately 2 percent wet of optimum moisture content.

Very Dense Silty Sand (SM)

Underlying the fill and the sandy silt is a stratum of brown silty sand ranging from surface elevation 259.4 in borehole 6 (27+00) to elevation 253.9 in borehole 3 (19+00) with the depth of the stratum varying from 2.0 to 5.0 feet.

The results of grain size distribution tests are shown on Figure 3 of Appendix II. The results indicate that the material contains 0 to 5 percent clay sizes, 18 to 43 percent silt sizes, and 66 to 82 percent sand sizes.

The standard penetration resistance or "N" values varied from 46 to 100 blows per foot with an average of 85 blows per foot. The relative density is estimated to be very dense.

The moisture contents of this stratum vary from 8.5 percent to 10.7 percent with an average of 10 percent. The results of the Standard Proctor compaction tests on this material are shown on Figure 9A of Appendix II. The results give maximum dry unit weights of 124.5 and 126.7 pounds per cubic foot at corresponding optimum moisture contents of 10.2 percent and 9.2 percent. The material is therefore approximately on the average about optimum moisture content.

Sandy to Clayey Silt with Clay Laminae (ML, ML-CL)

Directly underlying the silty sand stratum is a stratum of brown sandy to clayey silt with silty clay seams. The surface elevation ranges from 255.9 in

Sandy to Clayey Silt with Clay Laminae (ML, ML-CL) (cont'd)

borehole 10 (24+00) to 251.4 in borehole 3 (19+00) and the depth ranges from 1.3 to 6.0 feet.

The results of the grain size distribution tests are shown on Figure 4 of Appendix II and indicate that the material was composed of 0 to 12 percent clay sizes, 44 to 59 percent silt sizes and 43 to 48 percent sand sizes.

Atterberg limits run on a sample from this stratum gave a liquid limit of 23.6 and a plastic limit of 18.8 with a corresponding natural moisture content of 18.6 percent. When plotted on the Unified Soil Classification Chart the material is classified as a ML-CL material.

The standard penetration resistances or "N" values varied from 40 to greater than 100 blows per foot with an average of 55 blows per foot. The clayey silt has a hard consistency and the sandy silt has a dense to very dense relative density.

The moisture contents vary from 10.4 percent to 20.7 percent with an average of 15.6 percent. The results of two Standard Proctor compaction tests carried out on this material are shown on Figure 8C of Appendix II. The results give maximum dry unit weights of 122.1 and 122.5 pounds per cubic foot with corresponding optimum moisture contents of 12.6 percent and 10.5 percent respectively. This indicates that the material in this stratum is, on the average, approximately 4 percent wet of optimum moisture content.

Very Dense Silty Sand (SM)

Underlying the sandy to clayey silt is a stratum of brown silty sand with laminae of silty clay spaced throughout. The surface elevation ranges from elevation 249.3 in borehole 6 (27+00) to elevation 254.0 in borehole 12 (26+00) with the depth of the stratum varying from 1.3 to 4.6 feet.

The results of the grain size distribution tests are shown on Figure 3 of Appendix II and indicates that the material contains 0 to 4 percent clay sizes, 32 to 48 percent silt sizes and 52 to 64 percent sand sizes.

The standard penetration resistance, or "N" values varied from 19 to 100 blows per foot with an average of 59 blows per foot. The relative density is estimated to range from compact to very dense and to be generally very dense.

The moisture contents vary from 10.5 percent to 22.3 percent with an average of 17.0 percent. The results of Standard Proctor compaction tests carried out on three bulk samples from this stratum are shown on Figure 10A of Appendix II. The results give maximum dry unit weights that varied between 120.0 and 125.1 pounds per cubic foot with corresponding optimum moisture contents ranging from 8.7 percent to 11.7 percent with an average of 10.0 percent. The material is therefore, on the average, approximately 7 percent wet of optimum moisture content.

Very Dense Sand (SP)

Underlying the sandy to clayey silt in boreholes 2, 3, 8 and 11 is a stratum of brown medium to fine sand with laminae of clayey silt approximately 1/4 inch thick spaced about every 6 inches throughout the stratum. The surface elevation varies from 250.7 in borehole 11 (22+00) to elevation 249.2 in borehole 8 (20+00) with the depth of the stratum ranging from 6.5 to 15.0 feet.

The results of the grain size distribution tests are shown on Figure 6 of Appendix II. The results indicate that the material contains 0 to 5 percent silt sizes, 54 to 63 percent fine sand sizes and 34 to 42 percent medium sand sizes and 0 to 6 percent coarse sand sizes.

The standard penetration resistances or "N" values vary from 37 to greater than 100 blows per foot with an average of 68 blows per foot. The relative density is estimated to be dense to very dense and to be generally very dense.

The moisture contents vary from 9.8 percent to 16.9 percent with an average of 13.3 percent. The results of a Standard Proctor compaction test on this material is shown on Figure 11A of Appendix II and indicates that the maximum dry unit weight is 113.8 pounds per cubic foot at an optimum moisture content of 10.3 percent. The material is therefore, on the average, approximately 3 percent wet of optimum moisture content.

Sandy to Clayey Silt (ML, ML-CL)

Underlying the silty sand stratum in boreholes 4, 6, 10 and 12 is a stratum of brown silty sand and clayey silt with laminae of clay. The surface elevation ranges from 251.3 in borehole 10 (24+00) to elevation 247.3 in borehole 6 (27+00) with the depth of stratum ranging from 4.0 to 5.5 feet.

The results of grain size distribution tests are shown on Figure 2 of Appendix II. The results indicate that the material contains 0 to 12 percent clay sizes, 44 to 58 percent silt sizes, and 36 to 44 percent sand sizes.

The standard penetration resistances or "N" values vary from 27 to 58 blows per foot with an average of 40 blows per foot. The consistency of the clayey silt is estimated to be very stiff. The relative density of the sandy silt is estimated to range from compact to very dense and to be generally dense.

The natural moisture contents vary from 18.9 percent to 24.0 percent with an average of 21.8 percent.

No bulk samples could be obtained below the water table by augering methods and the drive open samples did not supply sufficient material for compaction testing. Also, it is believed that the results would be similar to that of the upper sandy to clayey silt stratum because of the similarity in grain size distribution.

Dense Silty Sand (SM)

Underlying the sandy to clayey silt in boreholes 4, 6, 10 and 12 and the medium to fine sand in borehole 2 and the fill in borehole 9, is a stratum of brown silty sand. Laminae of silty clay exist within the stratum at some locations. The surface elevation ranges from 248.5 in borehole 9 (23+00) to elevation 234.9 in borehole 2 (21+00) with the depth of the stratum varying from 6.0 to 12.0 feet.

The results of the grain size distribution tests are plotted on Figure 7 of Appendix II. The results indicate that the material contains 0 to 6 percent clay sizes, 17 to 32 percent silt sizes and 60 to 80 percent sand sizes.

The standard penetration resistances or "N" values vary from 15 to greater than 100 blows per foot with an average of 43 blows per foot. The relative density is estimated to be dense.

The natural moisture contents vary from 18.6 percent to 23.2 percent with an average of 20.4 percent.

No bulk samples could be obtained below the water table by augering methods and the drive open samples did not supply sufficient material for compaction testing. Also, it is believed that the results would be similar to that of the upper silty sand stratum because of the similarity in grain size distribution.

Dense to Very Dense Sandy Silt (ML)

Underlying the silty sand is a stratum of brown sandy silt varying from surface elevation 239.3 in borehole 10 (24+00) to elevation 232.8 in borehole 6 (27+00). Boreholes 3, 4, 6 and 10 were terminated in this stratum after penetrating a maximum depth of 5.0 feet.

The results of the grain size distribution tests are shown on Figure 5 of Appendix II. The results indicate that the material contains 0 to 6 percent clay sizes, 5 to 65 percent silt sizes, 32 to 36 percent sand sizes and 0 to 9 percent gravel sizes.

The standard penetration resistance or "N" values vary from 31 to 78 blows per foot with an average of 49 blows per foot. The density of the stratum is estimated to range from dense to very dense.

The natural moisture contents vary from 17.9 to 24.5 percent with an average of 21.1 percent.

No bulk samples could be obtained below the water table by augering methods. Also, it is believed that the results would be similar to that of the upper sandy silt strata because of the similarity in grain size distribution.

WATER CONDITIONS

The groundwater levels observed in the various boreholes during the investigation are plotted on the Office Reports in Appendix I. Piezometers were installed in borehole 12 (26+00) and borehole 10 (24+00) and readings were taken on September 19th, 1963. At this time the water level was observed

at elevation 249.2 in borehole 12 (26+00) and elevation 249.8 in borehole 10 (24+00). Generally, the groundwater levels in the boreholes in this area were approximately 14 feet below ground surface at about elevation 249.

Sewer Cut Area 41+00 to 43+00

SOIL CONDITIONS

Compact to Dense Silty Sand (SM)

Outcropping at the surface in borehole 7 (43+00) and borehole 13 (42+00) is a stratum of brown silty sand. The surface elevation varies from 269.9 in borehole 7 (43+00) to elevation 269.2 in borehole 13 (42+00) with the depth of the stratum ranging from 5.2 to 2.5 feet.

The results of the grain size distribution tests are shown on Figure 2 of Appendix III and indicates that the material contains 4 to 5 percent clay sizes, 9 to 49 percent silt sizes, and 51 to 81 percent sand sizes.

The standard penetration resistance or "N" values vary from 21 to 51 blows per foot with an average of 32 blows per foot. The relative density is estimated to be compact to dense.

The natural moisture contents vary from 7.2 to 18.2 percent with an average of 14.4 percent. The results of two Standard Proctor compaction tests on this material are found on Figures 4 and 4A in Appendix II and indicate that the maximum dry unit weight is 119.0 and 115.5 pounds per cubic foot with corresponding optimum moisture contents

Compact to Dense Silty Sand (SM) (continued)

of 11.3 and 10.5 percent. This indicates that the soil is, on the average, approximately 3 percent wet of optimum moisture content.

Sandy to Clayey Silt (ML)

Outcropping at the surface in borehole 5 (41+00) and directly underlying the silty sand in the other two boreholes is a stratum of brown sandy to clayey silt with layers of silty clay. The surface elevation ranges from 268.2 in borehole 5 (41+00) to 264.6 in borehole 7 (43+00) with the depth of stratum varying from 3.7 to 7.5 feet.

The results of the grain size distribution tests are shown on Figure 1 of Appendix III and indicate that the material contains 0 to 18 percent clay sizes, 51 to 73 percent silt sizes and 9 to 47 percent sand sizes.

The standard penetration resistance or "N" values varied from 14 to 51 blows per foot with an average of 32 blows per foot. The consistency of the clayey silt is estimated to be stiff. The relative density of the sandy silt is estimated to be compact to dense.

The natural moisture contents vary from 7.3 to 20.5 percent with an average of 16.1 percent.

No bulk samples could be obtained below the water table by augering methods and the drive open samples did not supply sufficient material for compaction testing. Also, it is believed that the results would be similar to that of the sandy to clayey silt at the other sewer cut area because of the similarity in grain size distribution.

Dense Silty Sand (SM)

Underlying the sandy silt and clayey silt is a stratum of brown silty sand with random layers of silt and clay. The surface elevation varies from 265.6 in borehole 13 (42+00) to elevation 260.8 in borehole 5 (41+00) with the depth of stratum varying from 5.1 to 13.0 feet.

The results of the grain size distribution tests are shown on Figure 2 of Appendix III and indicate that the material consists of 0 to 8 percent clay sizes, 22 to 43 percent silt sizes and 57 to 78 percent sand sizes.

The standard penetration resistance or "N" values vary from 23 to 93 blows per foot with an average of 47 blows per foot. The relative density of the stratum is estimated to range from compact to very dense and to be generally dense.

The natural moisture contents vary from 12.6 to 24.6 percent with an average of 18.9 percent. The results of two Standard Proctor compaction tests are shown on Figures 4 and 4A of Appendix III and indicate that the maximum dry unit weight is 119.0 and 115.5 pounds per cubic foot for the samples with corresponding optimum moisture contents of 11.3 percent and 10.5 percent. This indicates that the in-situ soil is, on the average, approximately 8 percent wet of optimum moisture content.

Sandy to Clayey Silt with Clay Layers (ML, ML-CL, CL)

Underlying the silty sand is a stratum of layered brown to grey sandy to clayey silt with silty clay layers. The surface elevation varies from 262.1 in borehole 13 (42+00) to elevation 250.0 in borehole 5 (41+00) with the depth of the stratum ranging from 5.0 to 13.1 feet.

The results of the grain size distribution tests are shown on Figure 1 of Appendix III and indicate that the material contains 5 to 11 percent clay sizes, 63 to 67 percent silt sizes and 26 to 28 percent sand sizes.

Atterberg limits run on a sample from this stratum gave a liquid limit of 24.9 and a plastic limit of 21.2 with a corresponding natural moisture content of 19.9 percent. When plotted on the Unified Soil Classification Chart the results indicate that the material should be classified as a sandy silt (ML) material.

The standard penetration resistance or "N" values vary from 24 to 59 blows per foot with an average of 39 blows per foot. The consistency of the stratum is estimated to be very stiff.

The natural moisture contents vary from 18.4 percent to 21.5 percent with an average of 19.6 percent.

No bulk samples could be obtained by practical methods for reasons given previously. Also, it is believed that the results would be similar to that of the sandy to clayey silt at the other sewer cut area because of the similarity in grain size distribution.

Very Dense Silty Sand (SM)

Underlying the sandy silt and clayey silt is a stratum of brown silty sand. The surface elevation varies from 249.1 to 244.9 with the depth ranging from 3.5 to 7.6 feet.

The results of the grain size distribution tests are shown on Figure 2 of Appendix III and indicate that the material contains 3 to 8 percent clay sizes, 14 to 17 percent silt sizes and 76 to 80 percent sand sizes.

The standard penetration resistance, or "N" values vary from 20 to 85 blows per foot with an average of 51 blows per foot. The relative density of the stratum is estimated to range from compact to very dense and to be generally very dense.

The natural moisture contents vary from 14.8 percent to 18.5 percent with an average of 17.2 percent.

No bulk samples could be obtained for compaction testing by practical methods for reasons given previously. Also, it is believed that the results would be similar to that of the upper silty sand stratum because of the similarity in grain size distribution.

Sandy to Clayey Silt with Silty Clay Layers (ML, ML-CL, CL)

Underlying the silty sand is a stratum of brown and grey sandy to clayey silt with silty clay layers. The surface elevation varies from 241.7 in borehole 13 (42+00) to elevation 240.7 in borehole 7 (43+00). This stratum was penetrated in borehole 7 only, where it was 3.4 feet thick.

Compact Reddish Brown Silty Sand (SM)

Underlying the silty clay in borehole 7 (43+00) is a stratum of reddish brown silty sand. The surface elevation is 237.7. The stratum was not penetrated in this borehole.

The results of a grain size distribution test is shown on Figure 2 of Appendix III and indicate that the material obtained from borehole 7 (43+00) contains 4 percent clay sizes, 41 percent silt sizes and 55 percent fine sand sizes.

The standard penetration resistance or "N" value for this stratum was 21 blows per foot. The relative density of the silty sand is estimated to be compact.

The natural moisture content of the silty sand is 12.0 percent.

No bulk samples could be obtained from this stratum for compaction testing by practical methods for reasons given previously. Also, it is believed that the results would be similar to that of the upper silty sand strata because of the similarity in grain size distribution.

WATER CONDITIONS

The groundwater levels observed in the various boreholes during the investigation are plotted on the Office Reports in Appendix I. A piezometer was installed in borehole 13 (42+00) and a reading taken on September 19th, 1963. At the time of the investigation the water level was observed at elevation 260.5, that is about 8.7 feet below the existing ground surface.

PERSONNEL

19.

The field work for this investigation was carried out under the technical supervision of Mr. B. Darch. The report was written by Messrs. B. Darch and F.J. Heffernan, and reviewed by Mr. M.A.J. Matich, P. Eng.

BD/dw
T7535

B. Darch

B. Darch,
Soils Engineer.

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APPENDIX I

OFFICE REPORTS ON SOIL EXPLORATION

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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".

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OFFICE REPORT ON SOIL EXPLORATION

SAMPLE CONDITION

SAMPLE TYPES

	DISTURBED	A.S. - AUGER SAMPLE
	FAIR	S.T. - SLOTTED TUBE
	GOOD	W.S. - WASHED SAMPLE
	LOST	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	γ	- WET UNIT WEIGHT
M	- MECHANICAL ANALYSIS	K	- PERMEABILITY
U	- UNCONFINED COMPRESSION	C	- CONSOLIDATION
OC	- TRIAXIAL CONSOLIDATED QUICK		
Q	- TRIAXIAL QUICK	WL	- WATER LEVEL IN CASING
S	- TRIAXIAL SLOW	WT	- WATER TABLE IN SOIL

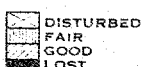
SOIL PROFILE				SAMPLES								
ELEV. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLT	ELEVATION SCALE	WATER CONTENT W _p			OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
					NAT	TLW	Pw					
					DYNAMIC PENETRATION TEST BLOWS PER FOOT							
ELEV. 254.00 1 OF CHANNEL												
254.0		GROUND LEVEL		254	BH#1							
253.5		DENSE BROWN CLAY (CL-M)		253.5							1	64
253.0		STIFF BROWN CLAY (CL-M)		253.0							2	26
252.5		VERY DENSE LIGHT BROWN SILTY SAND (SM)		252.5							3	>100
252.0		VERY DENSE LIGHT BROWN SILTY SAND (SM)		252.0							4	79
251.5		END OF HOLE		251.5								
ELEV. 2400 2 OF CHANNEL												
240.0		GROUND LEVEL		240	BH#2							
239.5		STIFF BROWN CLAY (CL-M)		239.5							1	31
239.0		STIFF BROWN CLAY (CL-M)		239.0							2	31
238.5		VERY DENSE LIGHT BROWN SILTY SAND (SM)		238.5							3	43
238.0		VERY DENSE LIGHT BROWN SILTY SAND (SM)		238.0							4	>100
237.5		STIFF BROWN CLAY (CL-M)		237.5							5	>100
237.0		STIFF BROWN CLAY (CL-M)		237.0							6	58
236.5		STIFF BROWN CLAY (CL-M)		236.5							7	33
236.0		STIFF BROWN CLAY (CL-M)		236.0							8	68
235.5		STIFF BROWN CLAY (CL-M)		235.5							9	38
235.0		STIFF BROWN CLAY (CL-M)		235.0							10	65
234.5		STIFF BROWN CLAY (CL-M)		234.5							11	54
234.0		STIFF BROWN CLAY (CL-M)		234.0							12	77
233.5		STIFF BROWN CLAY (CL-M)		233.5							13	78
233.0		STIFF BROWN CLAY (CL-M)		233.0							14	50
232.5		STIFF BROWN CLAY (CL-M)		232.5							15	64
232.0		STIFF BROWN CLAY (CL-M)		232.0							16	>100
231.5		STIFF BROWN CLAY (CL-M)		231.5							17	58
231.0		STIFF BROWN CLAY (CL-M)		231.0							18	34
230.5		STIFF BROWN CLAY (CL-M)		230.5								
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229.5		STIFF BROWN CLAY (CL-M)		229.5								
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227.5		STIFF BROWN CLAY (CL-M)		227.5								
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226.5		STIFF BROWN CLAY (CL-M)		226.5								
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222.5		STIFF BROWN CLAY (CL-M)		222.5								
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172.5		STIFF BROWN CLAY (CL-M)		172.5								
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171.0		STIFF BROWN CLAY (CL-M)		171.0								
170.5		STIFF BROWN CLAY (CL-M)		170.5								
170.0		STIFF BROWN CLAY (CL-M)		170.0								
169.5		STIFF BROWN CLAY (CL-M)		169.5								
169.0		STIFF BROWN CLAY (CL-M)		169.0								
168.5		STIFF BROWN CLAY (CL-M)		168.5								
168.0		STIFF BROWN CLAY (CL-M)		168.0								
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167.0		STIFF BROWN CLAY (CL-M)		167.0								
166.5		STIFF BROWN CLAY (CL-M)		166.5								
166.0		STIFF BROWN CLAY (CL-M)		166.0								
165.5		STIFF BROWN CLAY (CL-M)		165.5								
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163.5		STIFF BROWN CLAY (CL-M)		163.5								
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162.5		STIFF BROWN CLAY (CL-M)		162.5								
162.0		STIFF BROWN CLAY (CL-M)		162.0								
161.5		STIFF BROWN CLAY (CL-M)		161.5								

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 17535 BORING # 3 STA. 13+00 DATUM GEODETIC CASING 3X
 BORING DATE AUG. 22, 1963 REPORT DATE SEPT. 4, 1963 COMPILED BY AEL CHECKED BY E.L.D.
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS. ENERGY)

SAMPLE CONDITION



A.S. - AUGER SAMPLE
 ST - 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

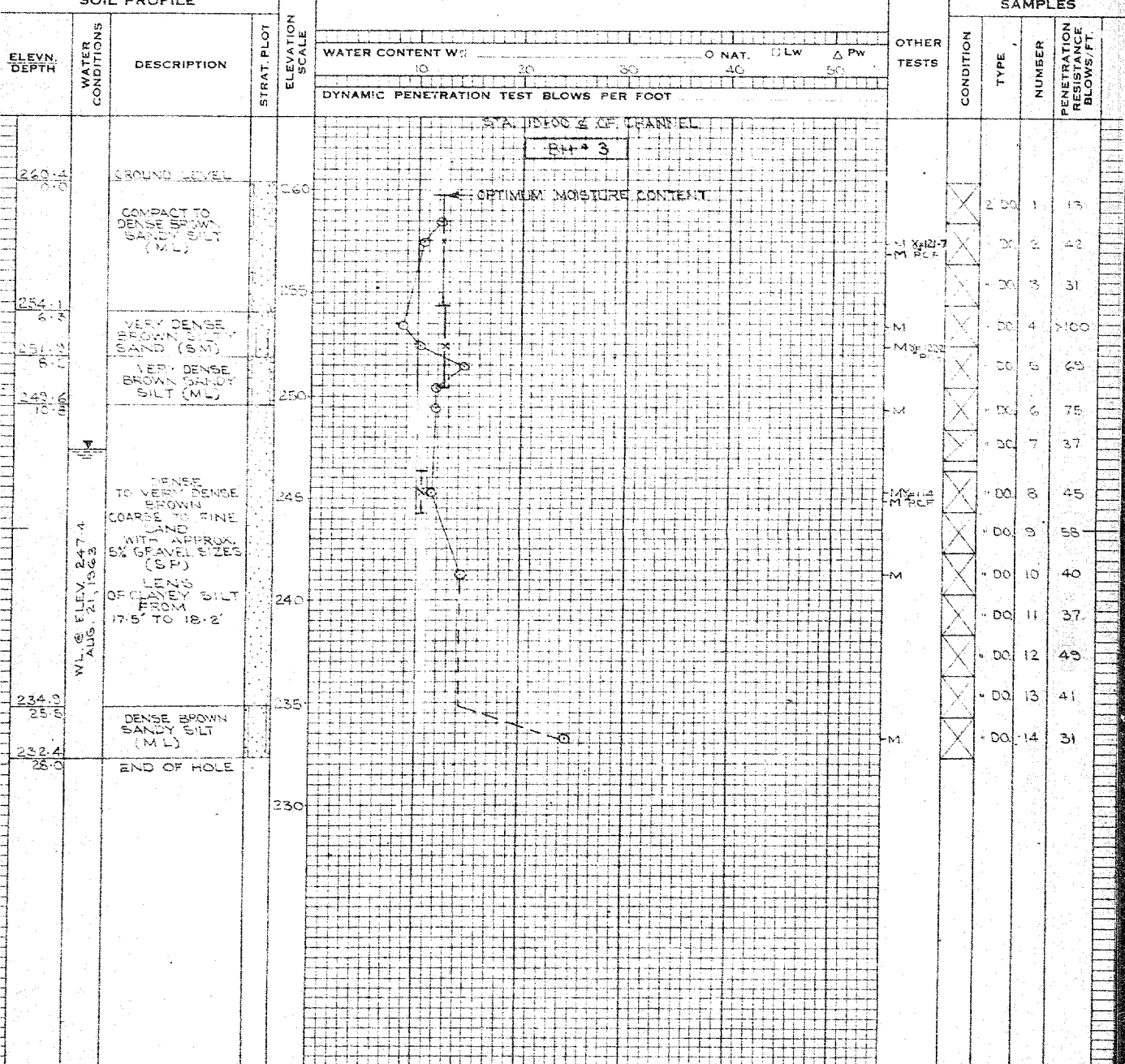
ABBREVIATIONS

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
 X - OPT. MOISTURE CONTENT

SOIL PROFILE

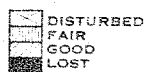


GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 17535 BORING # 4 STA. 25+00 DATUM GEODETIC CASING BX
 BORING DATE AUG 26 1963 REPORT DATE SEP 4 1963 COMPILED BY AEC CHECKED BY
 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

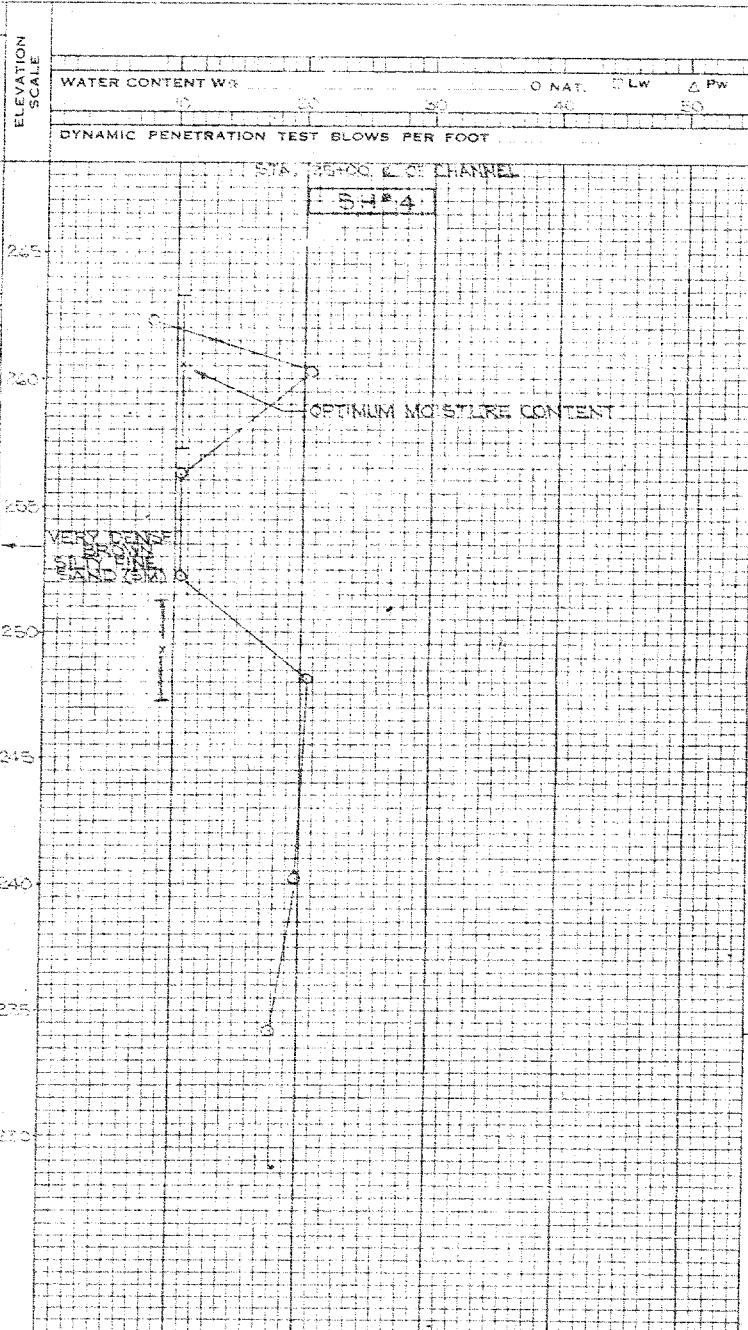
F.S. - FOIL SAMPLE
 S.O. - SLEEVE-OPEN
 S.F. - SLEEVE-FOOT VALVE
 T.O. - THIN WALLED OPEN
 R.C. - ROCK CORE

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
 X. - SET MOISTURE CONTENT

SOIL PROFILE

ELEV. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
257.0		GROUND LEVEL		255
256.0		100% BROWN FILL (MEDIUM GRAVEL 5% CLAY)		250
255.0		DENSE BROWN SILTY FINE SAND (1.5M)		245
254.0		VERY DENSE BROWN CLAYED SILT (CL)		240
253.0		VERY DENSE BROWN MEDIUM TO FINE SAND (1.5M)		235
252.0		TO COMPACT BROWN SAND (1.5M) (12% CLAY)		230
251.0		COMPACT TO DENSE BROWN SILTY SAND (1.5M)		225
250.0		LAMINAE OF SILT AND CLAY 2" THICK AND SPACED APPROX. 1" (25.0 TO 27.5)		220
249.0		VERY DENSE BROWN SANDY SILT (1.5M)		215
248.0		END OF HOLE		210



OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
		DO	1	44
		DO	2	12
		DO	3	7
		DO	4	57
		DO	5	74
		DO	6	58
		DO	7	58
		DO	8	27
		DO	9	15
		DO	10	45
		DO	11	20
		DO	12	60
		DO	13	7100
		DO	14	7100
		DO	15	61

OFFICE REPORT ON SOIL EXPLORATION

SAMPLE CONDITION

SAMPLE TYPES

ABBREVIATIONS

<input type="checkbox"/>	DISTURBED
<input type="checkbox"/>	FAIR
<input type="checkbox"/>	GOOD
<input checked="" type="checkbox"/>	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

7 - WET UNIT WEIGHT
8 - PERMEABILITY
C - CONSOLIDATION

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

[illegible]

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT I7535 BORING # 2 STA. 27+00 DATUM GEODETIC CASING ---
 BORING DATE AUG. 27, 1962 REPORT DATE SEPT. 10, 1962 COMPILED BY A.E.L. CHECKED BY E.D.
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION



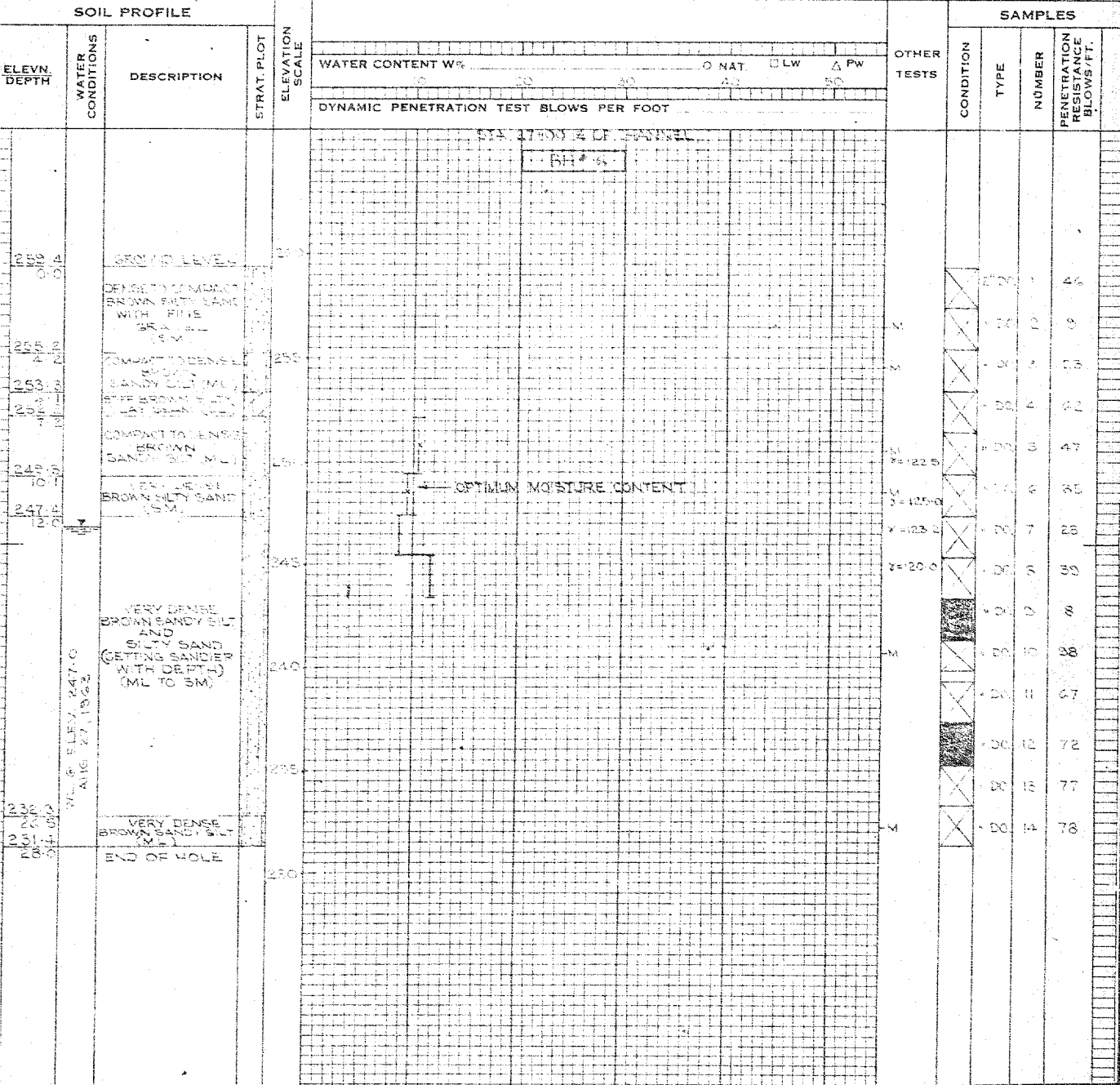
A.S. - AUGER SAMPLE
 S.T. - SLOTTED TUBE
 W.S. - WASHED SAMPLE
 D.O. - DRIVE-OPEN
 D.F. - DRIVE-FOOT VALVE
 C.S. - CHUNK SAMPLE

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



GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7835 BORING # STA 20-0043 23+00 DATUM GEODET C CASING
 BORING DATE SEPT. 10, 1963 REPORT DATE SEPT. 10, 1963 COMPILED BY AE1 CHECKED BY 2
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

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

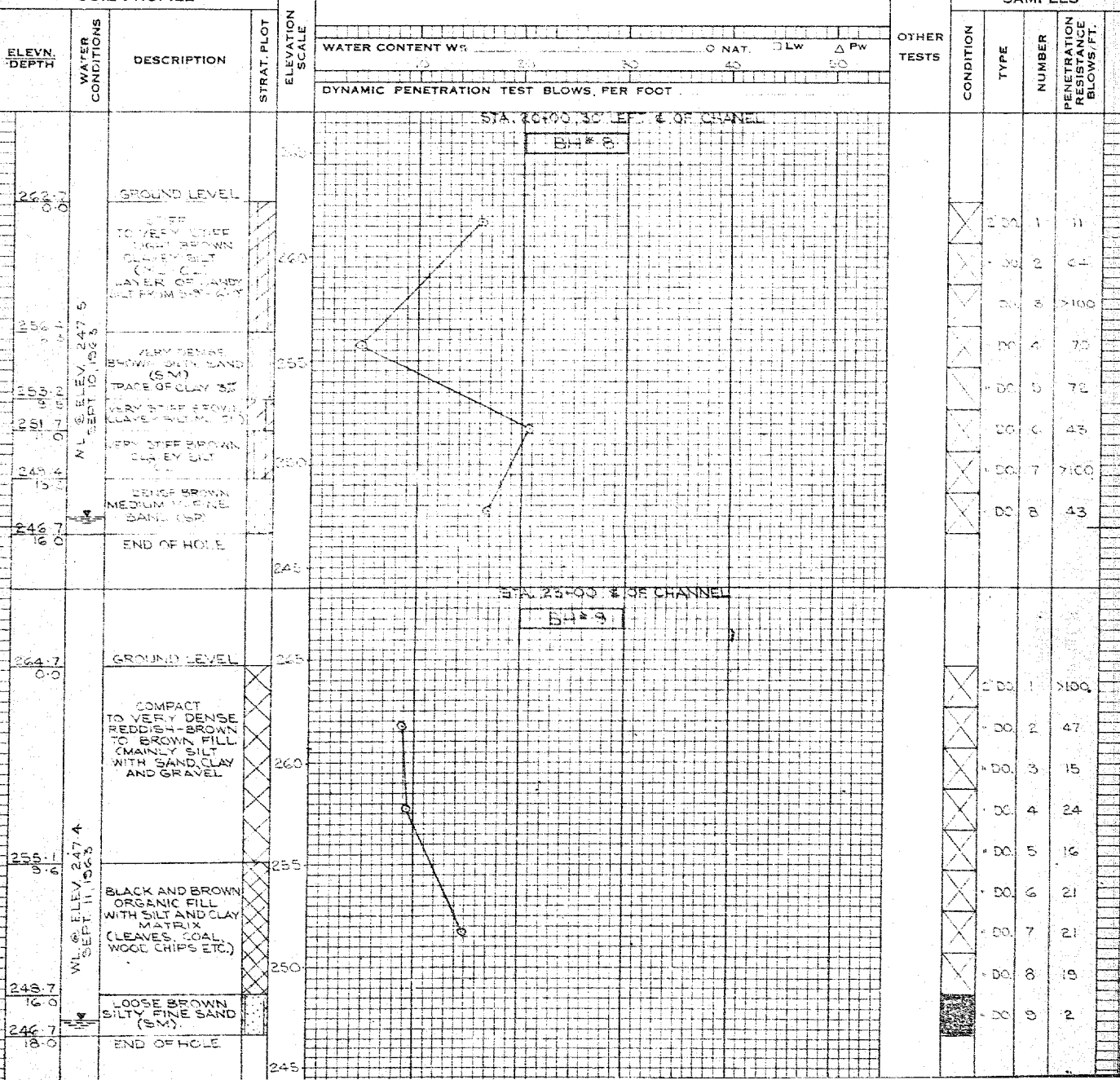
V - IN-SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
QC - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW

γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION

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

SOIL PROFILE

SAMPLES



GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 17535 BORING # 10 STA 24+00 DATUM GEODETIC CASING
 BORING DATE SEPT. 11, 1963 REPORT DATE SEPT. 20, 1963 COMPILED BY AEL CHECKED BY P.D.
 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

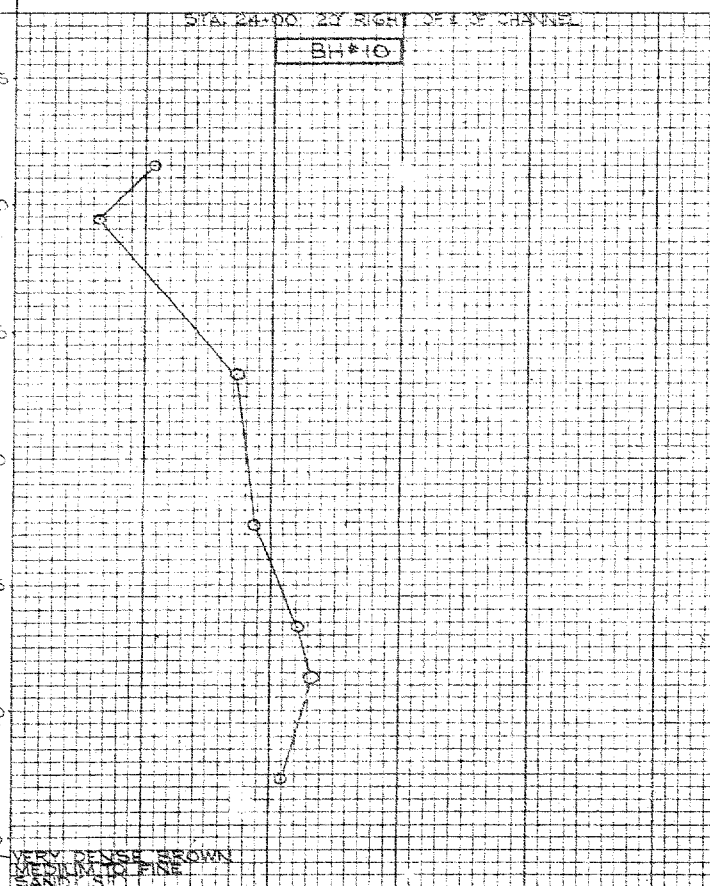
γ - WET UNIT WEIGHT
 K - PERMEABILITY
 C - CONSOLIDATION

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

SOIL PROFILE

ELEV. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
254.4	0.0	GROUND LEVEL		255
258.2	5.0	VERY STIFF BROWN SLIGHTLY ORGANIC CLAYEY SILT (ML)		260
256.1	8.0	VERY DENSE SILTY SAND (SM)		255
252.0	11.0	VERY STIFF BROWN CLAYEY SILT (ML)		250
251.0	13.0	VERY DENSE BROWN SILTY SAND (SM)		250
251.0	13.0	VERY STIFF SILTY CLAY (CL)		250
247.4	17.0	VERY DENSE BROWN SANDY SILT (ML)		245
239.4	25.0	COMPACT BROWN SILTY SAND (SM)		240
234.0	30.0	DENSE BROWN SANDY SILT (ML)		235
234.0	30.0	END OF HOLE		235

WATER CONTENT W% O NAT. ELW Δ PW
 10 20 30 40 50
 DYNAMIC PENETRATION TEST BLOWS PER FOOT



OTHER TESTS

SAMPLES





CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
DO	1	30	
DO	2	62	
DO	3	52	
DO	4	70	
DO	5	40	
DO	6	34	
DO	7	76	
DO	8	66	
DO	9	63	
DO	10	23	
DO	11	19	
DO	12	25	
DO	13	33	
DO	14	39	
DO	15	48	

OFFICE REPORT ON SOIL EXPLORATION

SAMPLE CONDITION

SAMPLE TYPES

ABBREVIATIONS

	DISTURBED	A.S. - AUGER SAMPLE
	FAIR	S.T. - SLOTTED TUBE
	GOOD	W.S. - WASHED SAMPLE
	LOST	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

Y - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

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OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 77535 BORING # 13 STA. 42+00 DATUM GEODETIC CASING BX.
BORING DATE SEPT. 16, 1963 REPORT DATE SEPT. 20, 1963 COMPILED BY AEL CHECKED BY P.D.
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

[illegible]

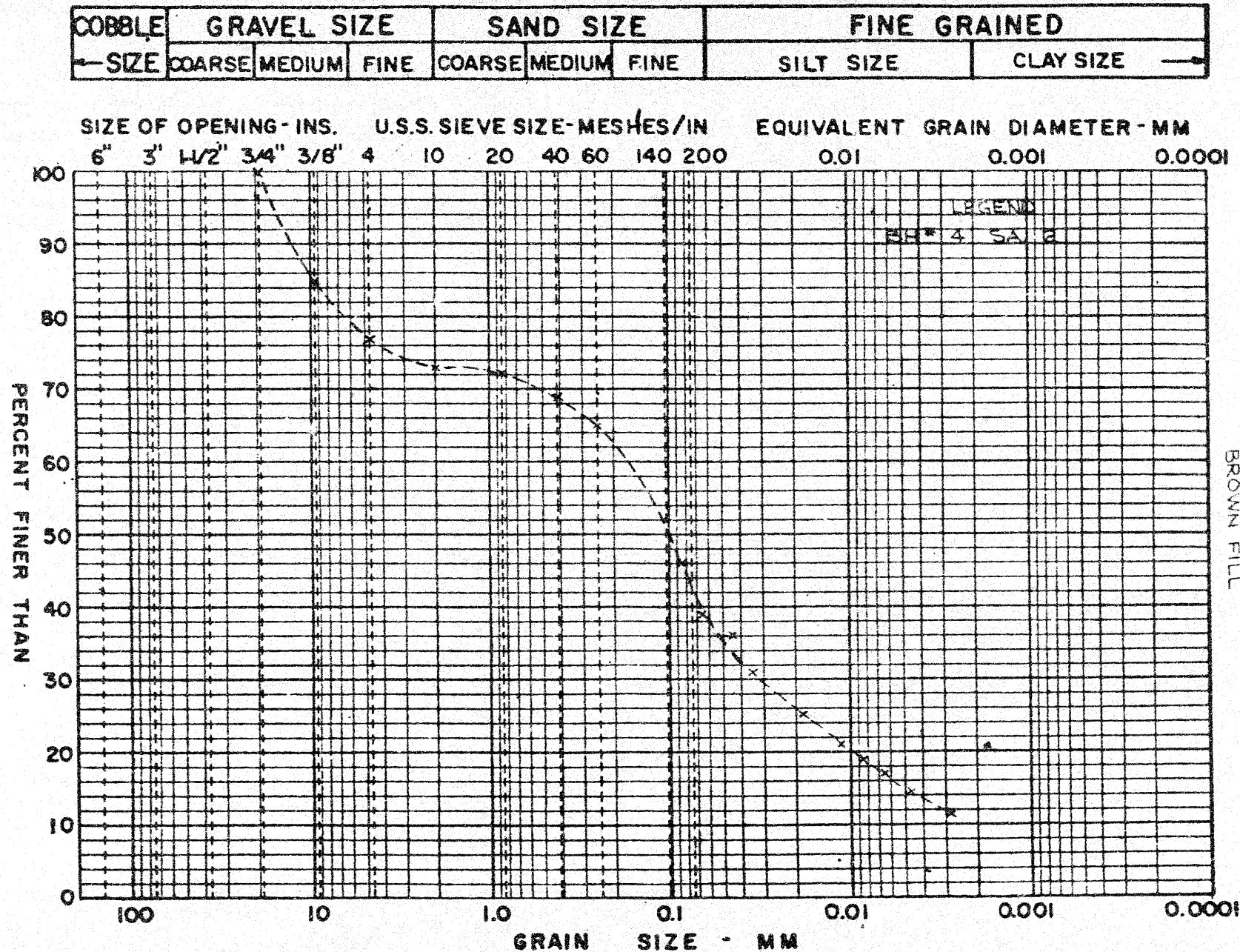
APPENDIX II

FIGURES - LABORATORY TESTING

Sewer Cut Area 19+00 to 27+00

APPENDIX II

FIGURE 1
PROJECT T7535



GRAIN SIZE DISTRIBUTION

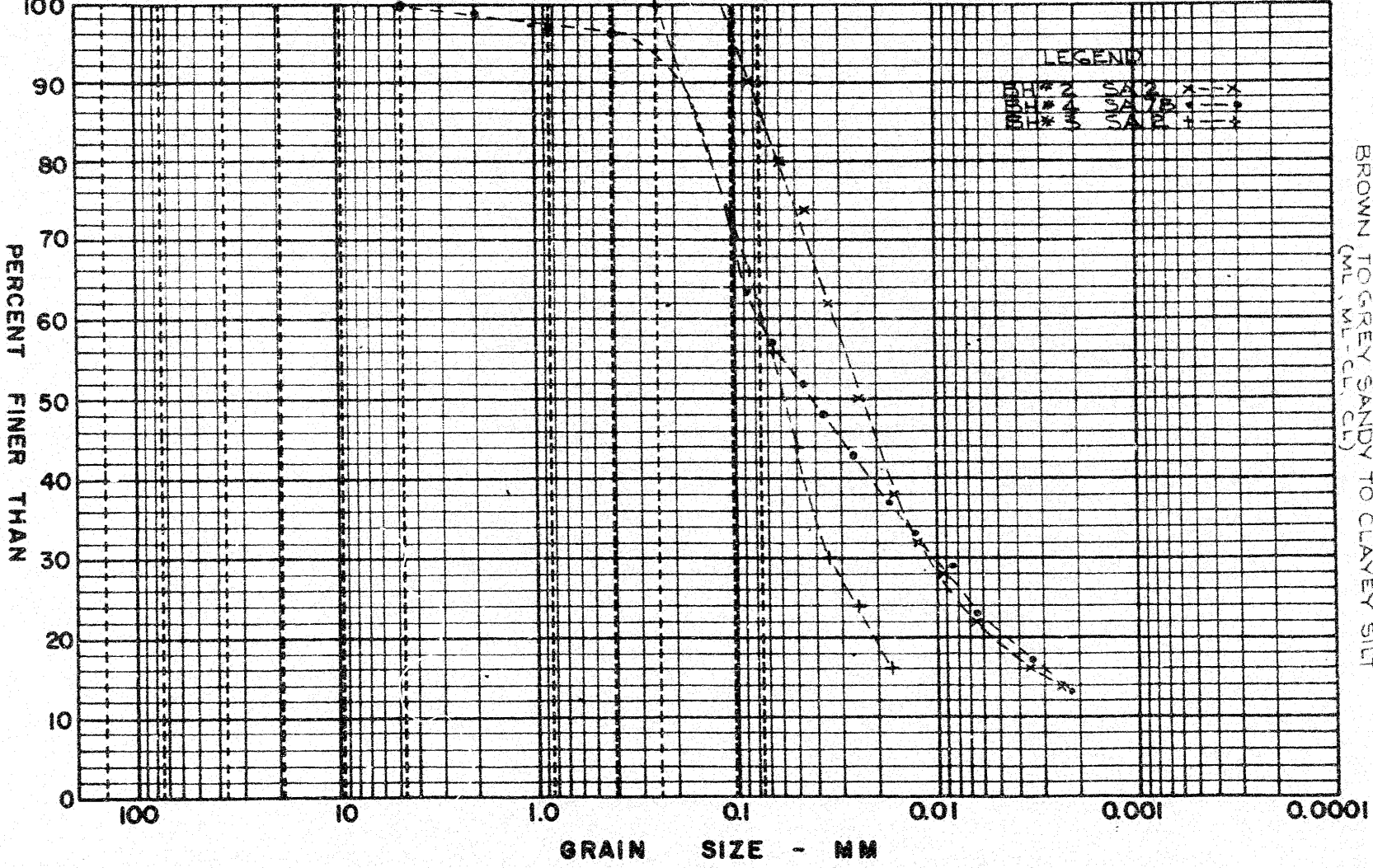
APPENDIX II
FIGURE 2
PROJECT T7535

BROWN TO GREY SANDY TO CLAYEY SILT
(ML, ML-CL, CL)

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

6" 3" 1-1/2" 3/4" 3/8" 4 10 20 40 60 140 200 0.01 0.001 0.0001



GEOCON

GRAIN SIZE DISTRIBUTION

APPENDIX II

FIGURE 3

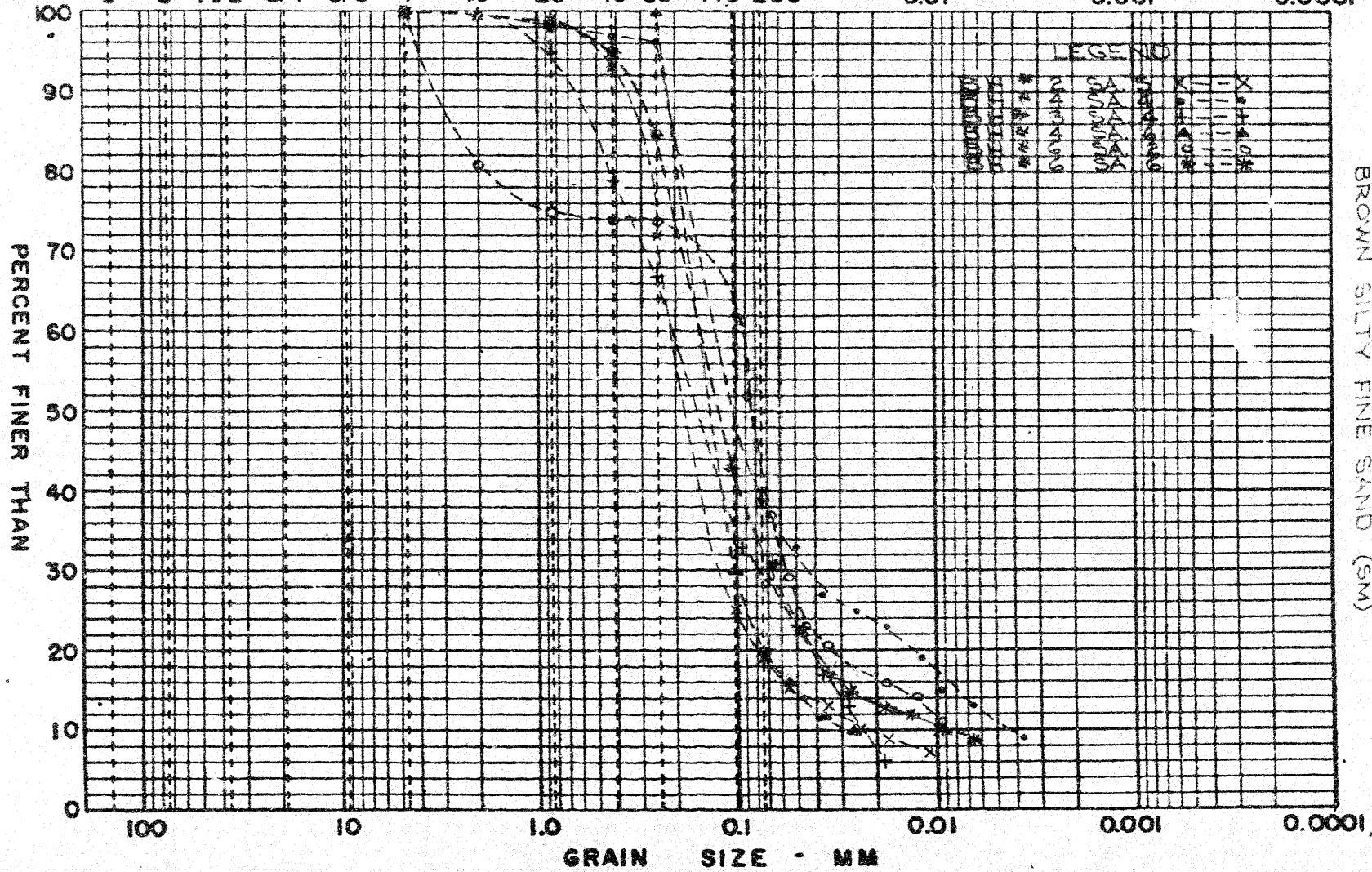
PROJECT, T7535

BROWN SILTY FINE SAND (SM)

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

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

6" 3" 1 1/2" 3/4" 3/8" 4 10 20 40 60 140 200 0.01 0.001 0.0001



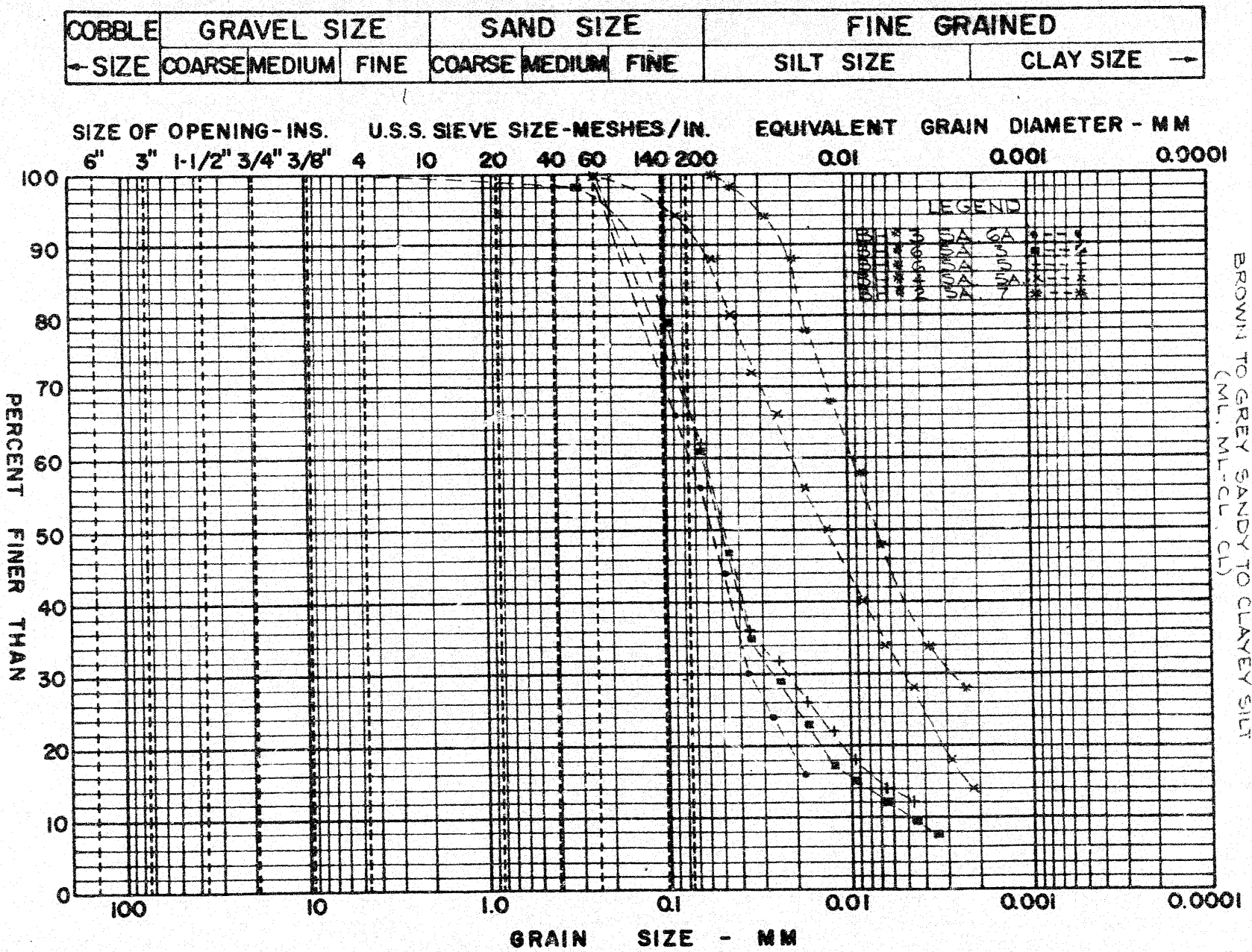
GEOCON

M.I.T. GRAIN SIZE SCALE

GRAIN SIZE DISTRIBUTION

APPENDIX II
FIGURE 4
PROJECT T7535

BROWN TO GREY SANDY TO CLAYEY SILT
(ML, ML-CL, CL)



GEOCON

M.I.T. GRAIN SIZE SCALE

GRAIN SIZE DISTRIBUTION

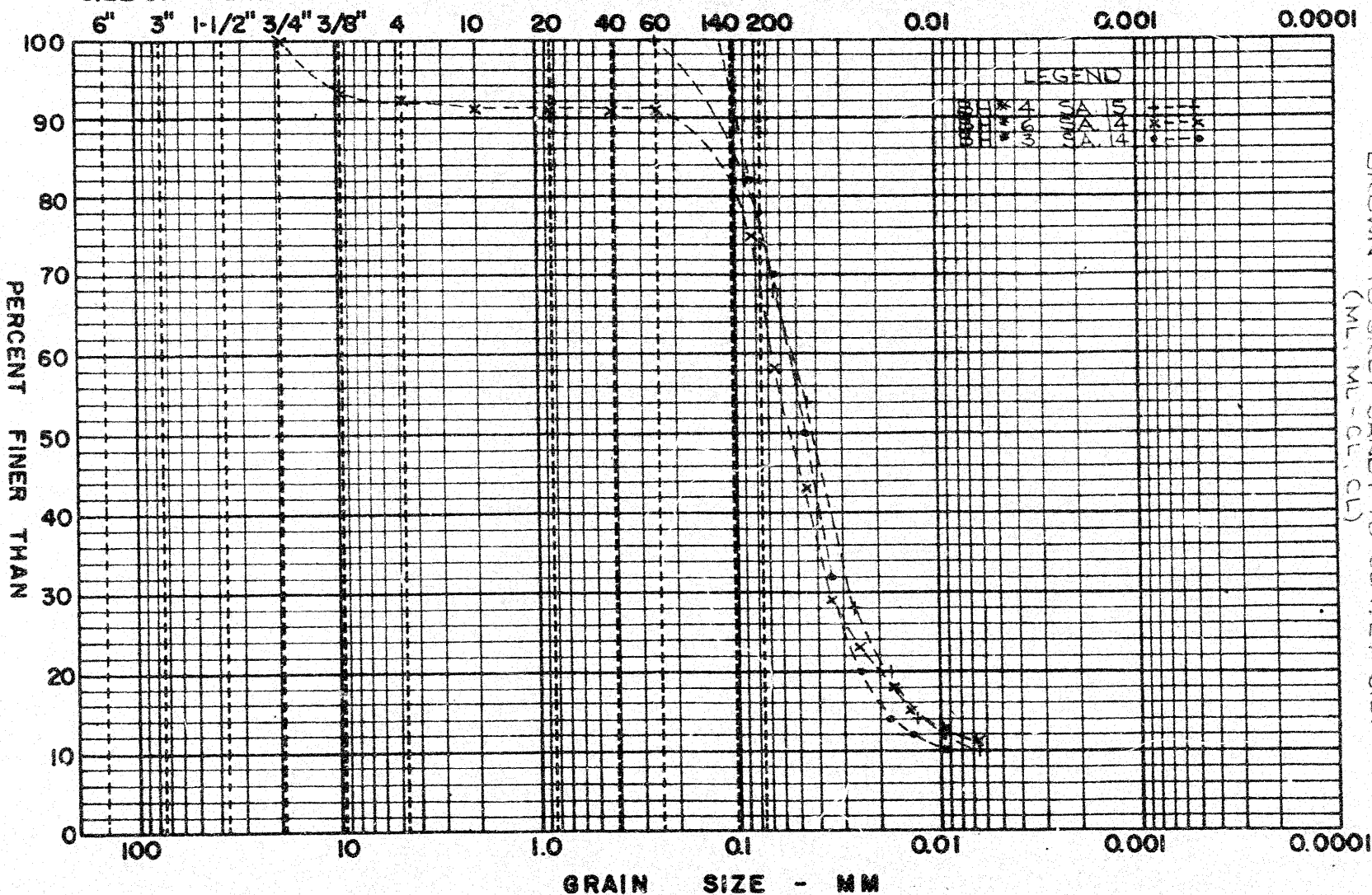
APPENDIX II
FIGURE 5

PROJECT 17535

BROWN TO GREY SANDY TO CLAYEY SILT
(ML, ML-CL, CL)

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



M.I.T. GRAIN SIZE SCALE

GEOCON

GRAIN SIZE DISTRIBUTION

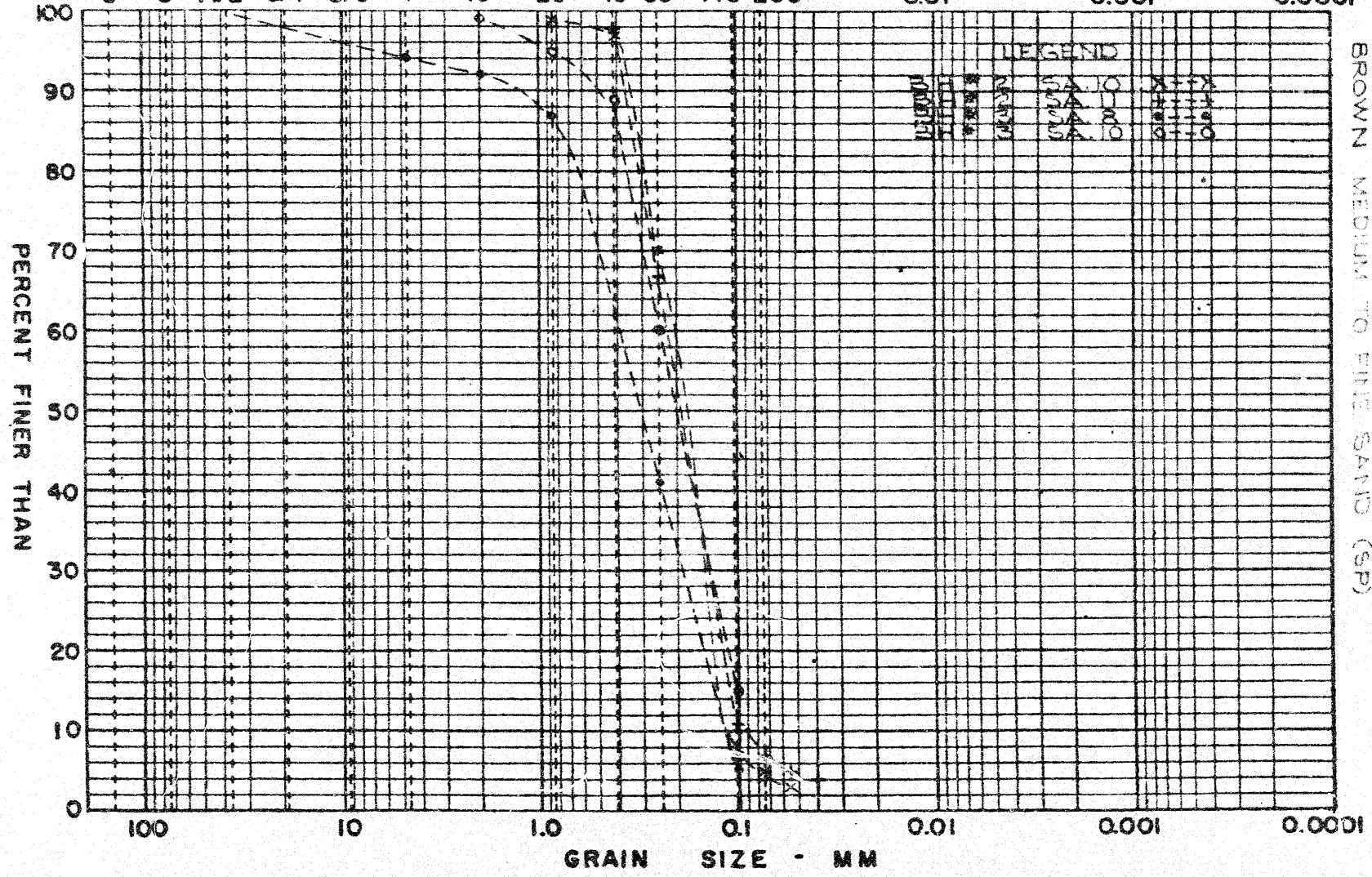
APPENDIX II
FIGURE 6
PROJECT T7535

BROWN MEDIUM TO FINE SAND (SP)

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

6" 3" 1 1/2" 3/4" 3/8" 4 10 20 40 60 140 200 0.01 0.001 0.0001



GEOCON

GRAIN SIZE DISTRIBUTION

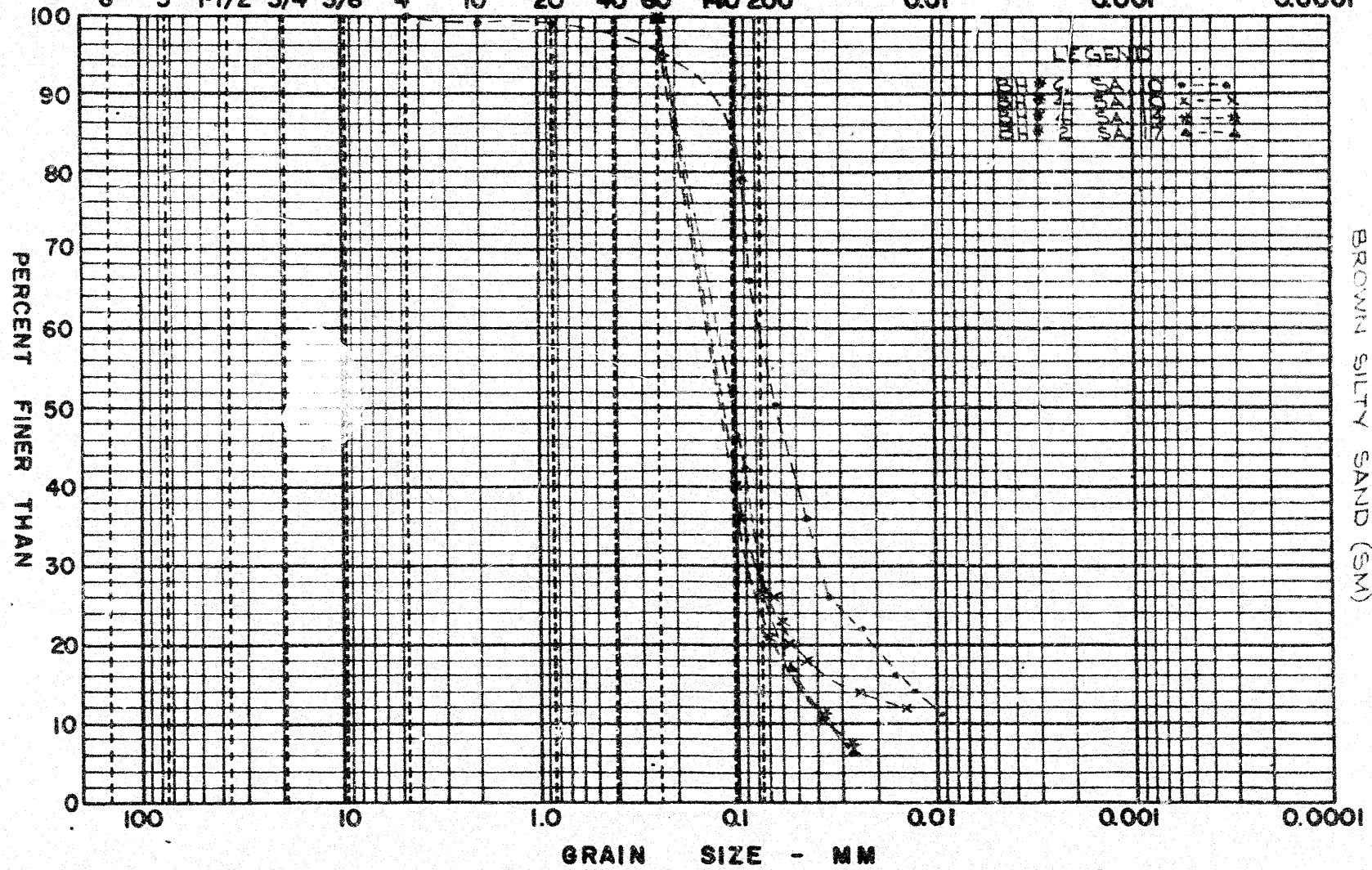
APPENDIX II
FIGURE 7
PROJECT T7535

BROWN SILTY SAND (SM)

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

6" 3" 1-1/2" 3/4" 3/8" 4 10 20 40 60 140 200 0.01 0.001 0.0001



GEOCON

M.I.T. GRAIN SIZE SCALE

COMPACTION SAMPLES

FIGURE 8

PROJECT 17535

BROWN TO GREY SANDY TO CLAYEY SILT
(ML, ML-CL, CL)



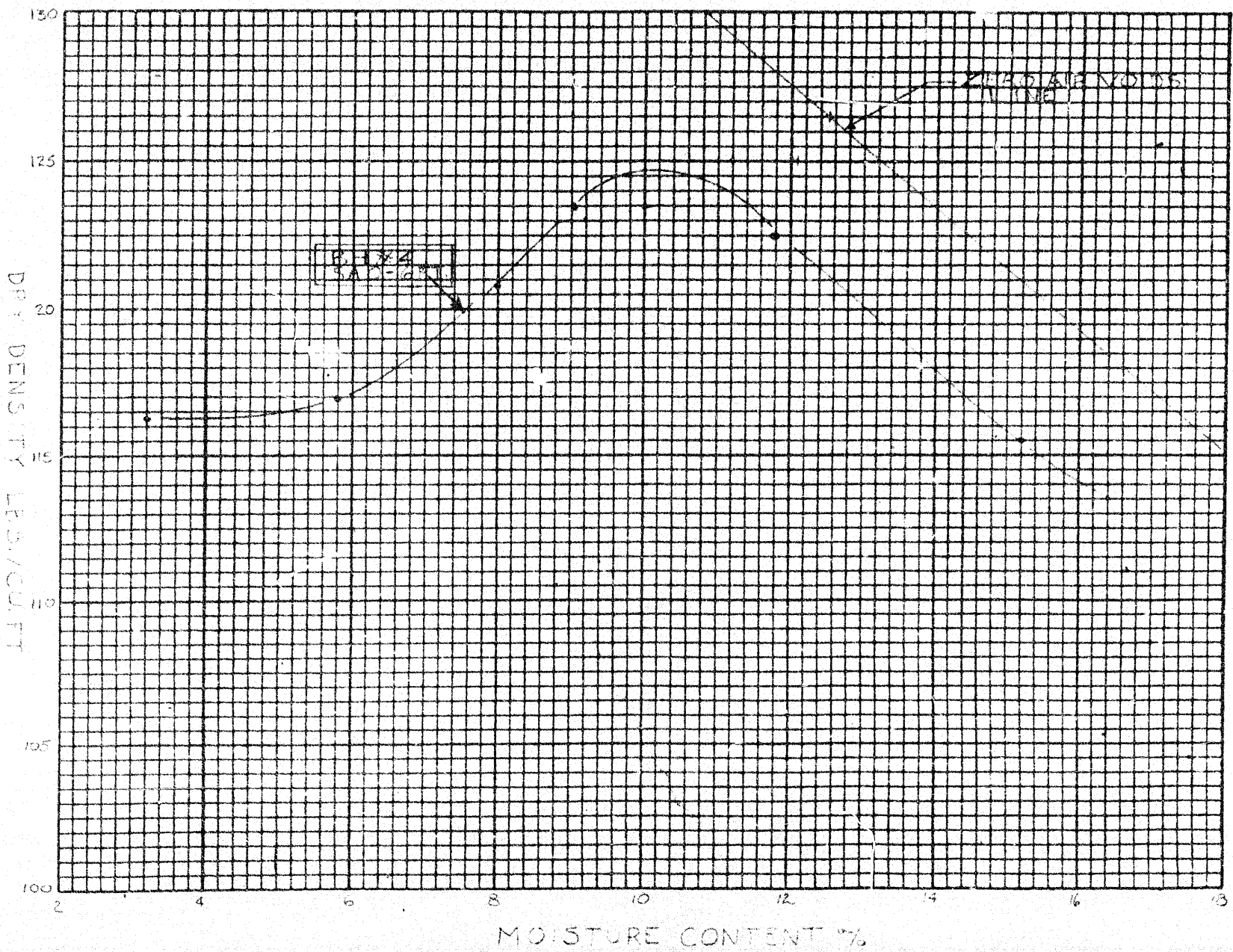
GECON

STANDARD PROCTOR COMPACTION TEST

MOISTURE CONTENT VS. DRY DENSITY

APPENDIX II
FIGURE 8A
PROJECT T 7535

BROWN TO GREY SANDY TO CLAYEY SILT
(ML, ML-CL, CL)



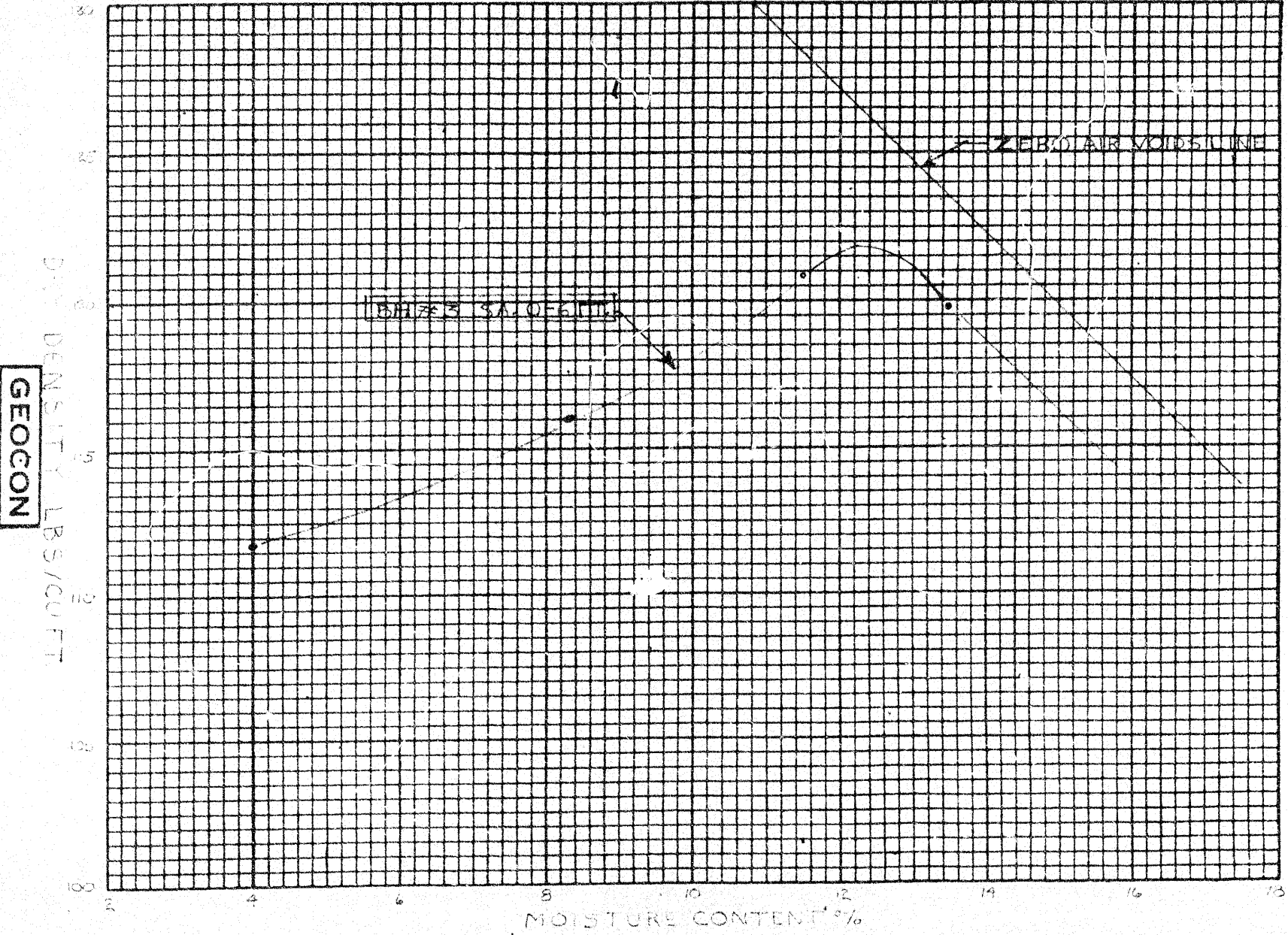
GEOCON

STANDARD PROCTOR COMPACTION TEST

MOISTURE CONTENT VS. DRY DENSITY

APPENDIX I
FIGURE 8B
PROJECT T7535

BROWN TO 50% SANDY TO 60% CLAY
(ML, NL, CL, LL)



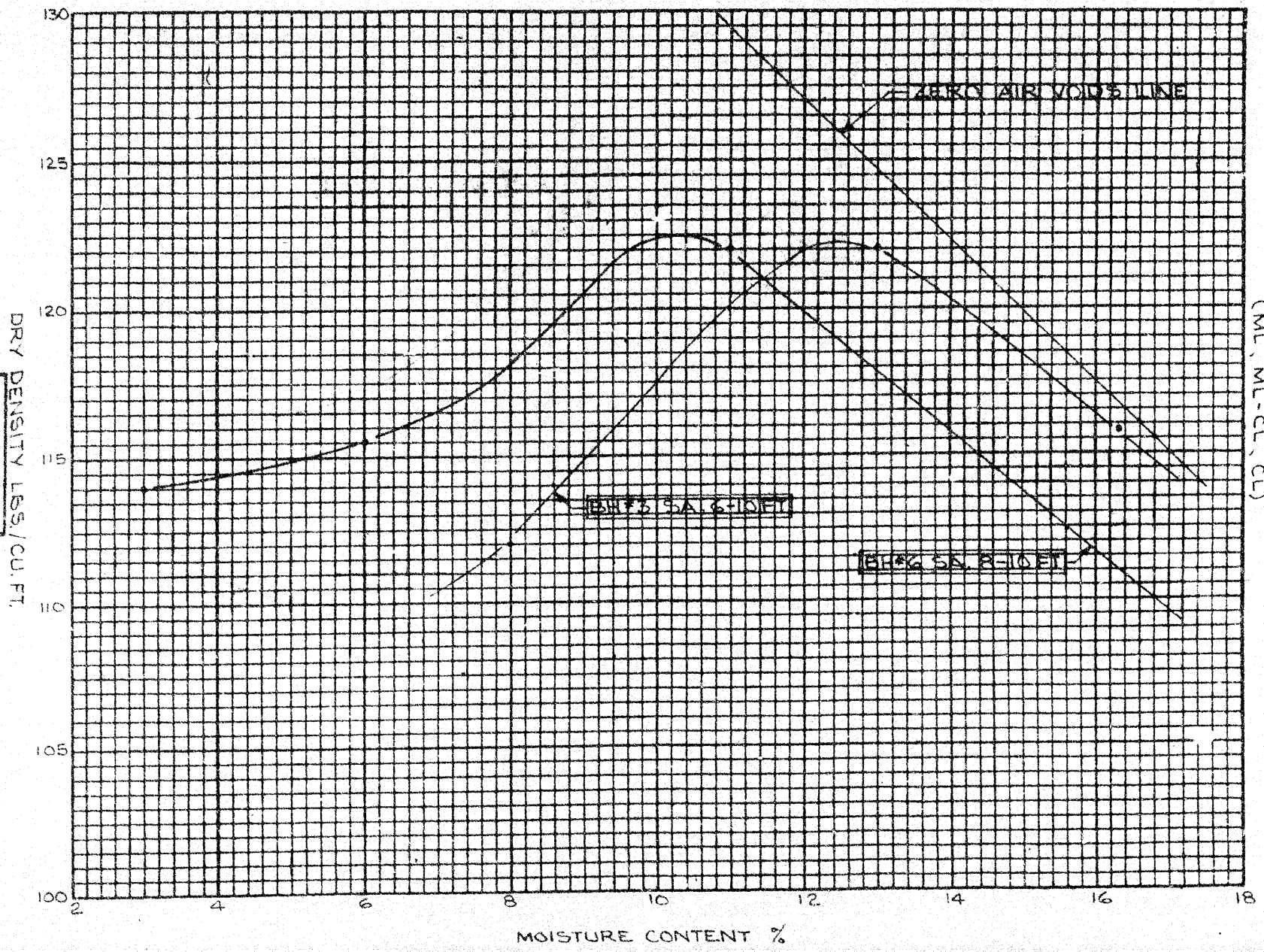
Dry Density (lbs/cuft)
GEOCON

STANDARD PROCTOR COMPACTION TEST MOISTURE CONTENT VS. DRY DENSITY

BOREHOLE 3 (13+00)

BOREHOLE 6 (27+00)

BROWN TO GREY SANDY TO CLAYEY SILT
(ML, ML-CL, CL)



GEOCON

GRAIN SIZE DISTRIBUTION

COMPACTION SAMPLES

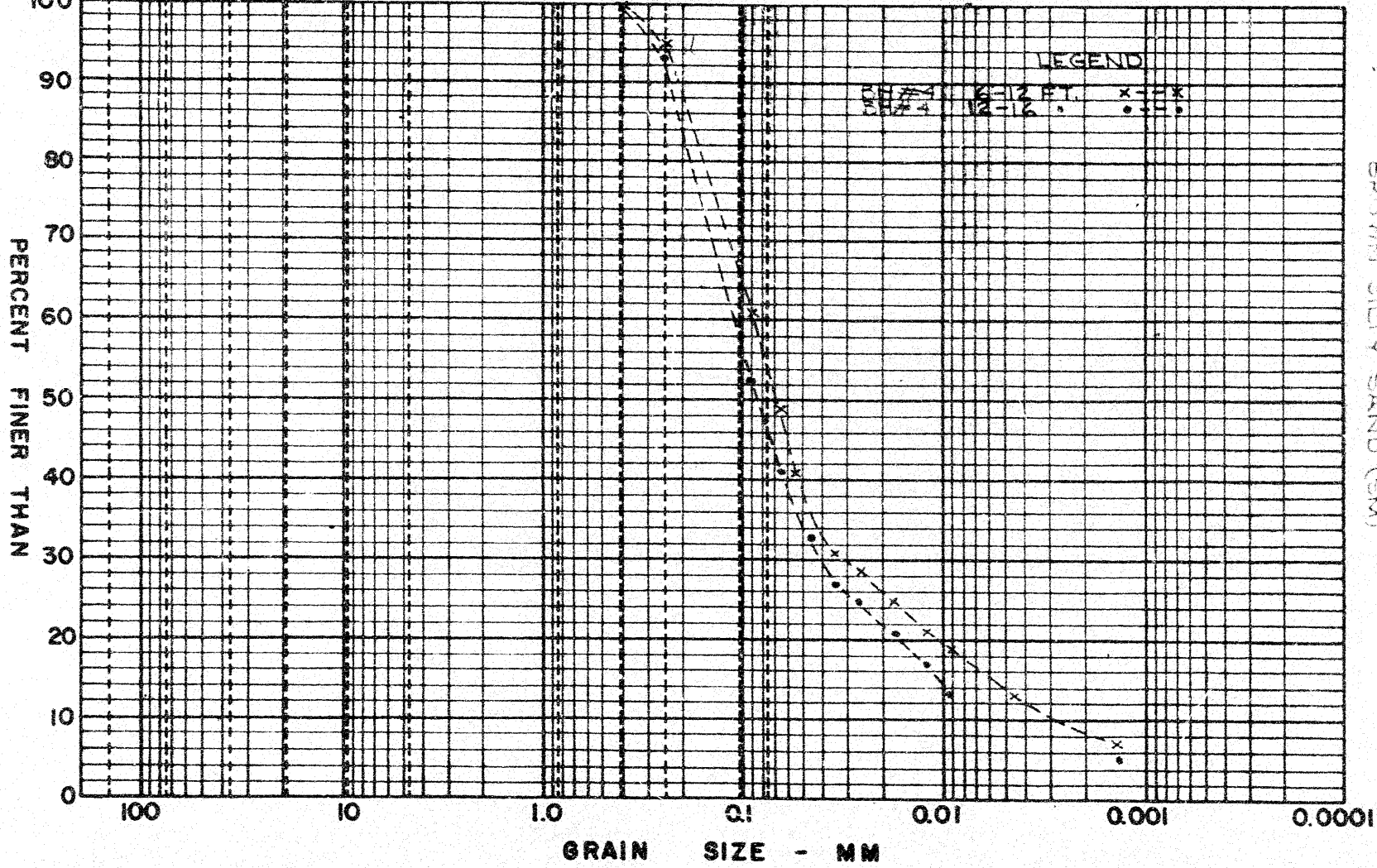
APPENDIX II
FIGURE 9
PROJECT T7535

BROWN SILTY SAND (SM)

COBBLE ← SIZE	GRAVEL SIZE			SAND SIZE			FINE GRAINED	
	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

6" 3" 1-1/2" 3/4" 3/8" 4 10 20 40 60 140 200 0.01 0.001 0.0001

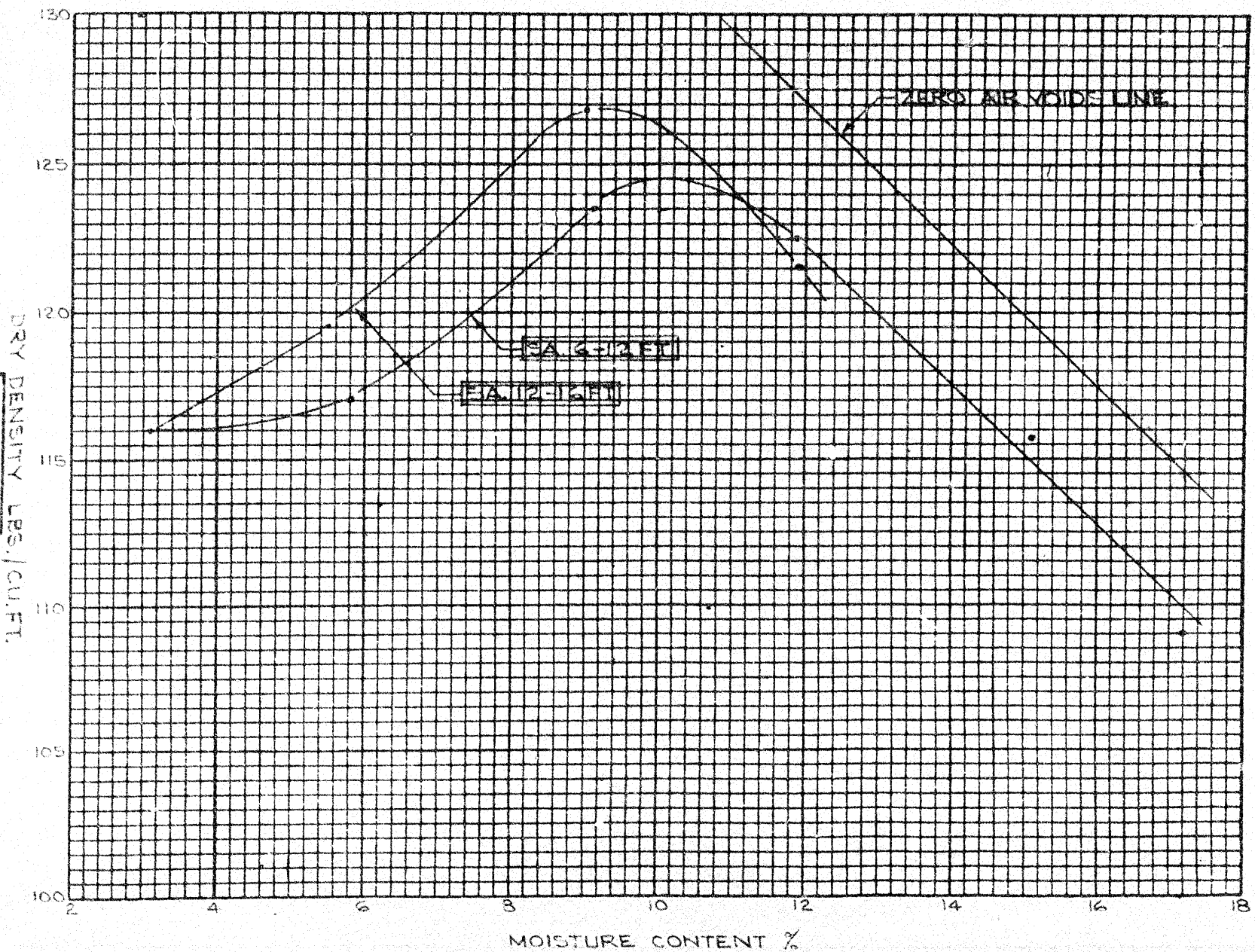


STANDARD PROCTOR COMPACTION TEST
 MOISTURE CONTENT vs. DRY DENSITY

BOREHOLE 4 (25+00)

APPENDIX II
 FIGURE 9A
 PROJECT 17535

BROWN SILTY SAND (SM)



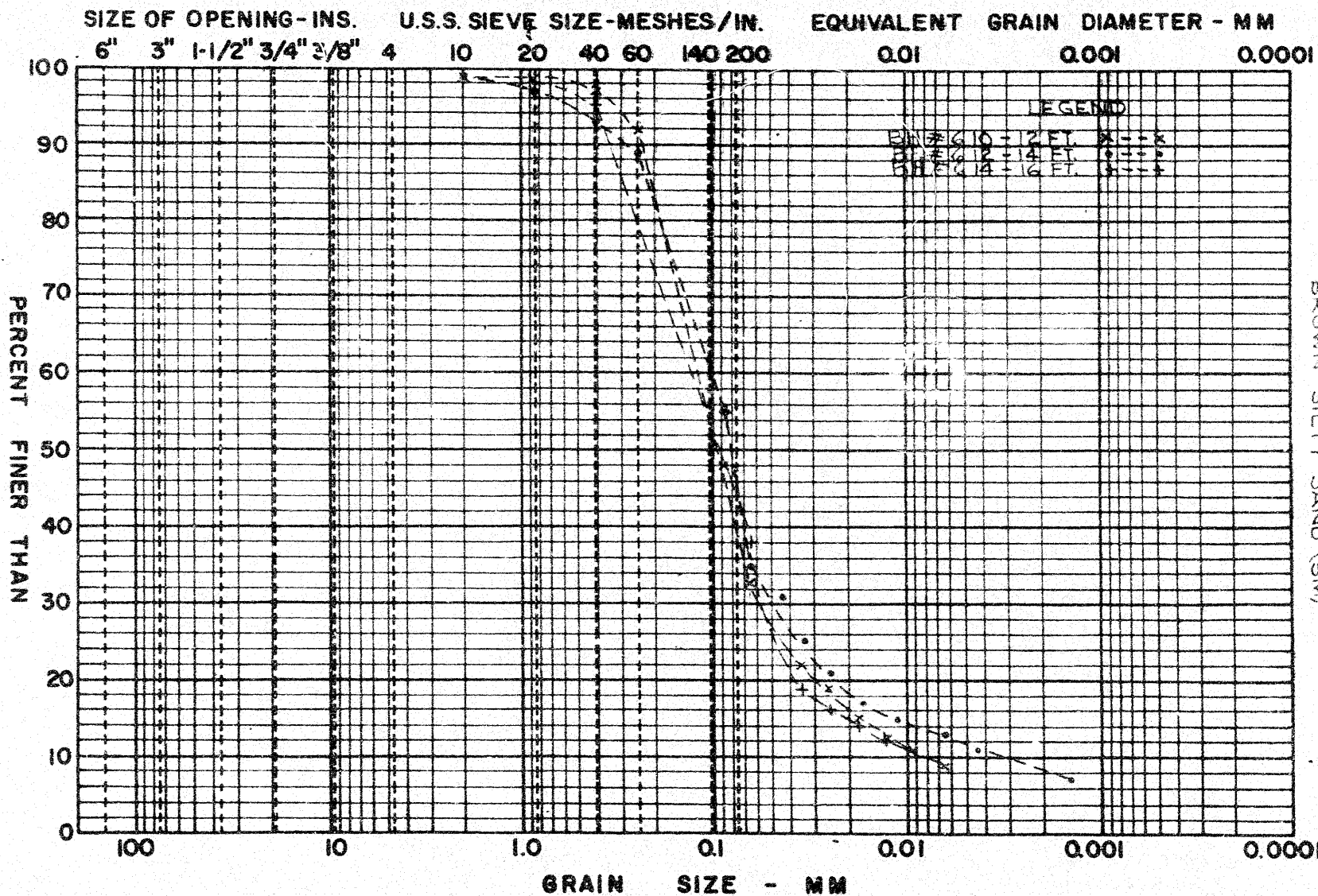
GEOCON

GRAIN SIZE DISTRIBUTION

COMPACTION SAMPLES

APPENDIX II
FIGURE 10
PROJECT T7535

BROWN SILTY SAND (SM)



M.I.T. GRAIN SIZE SCALE

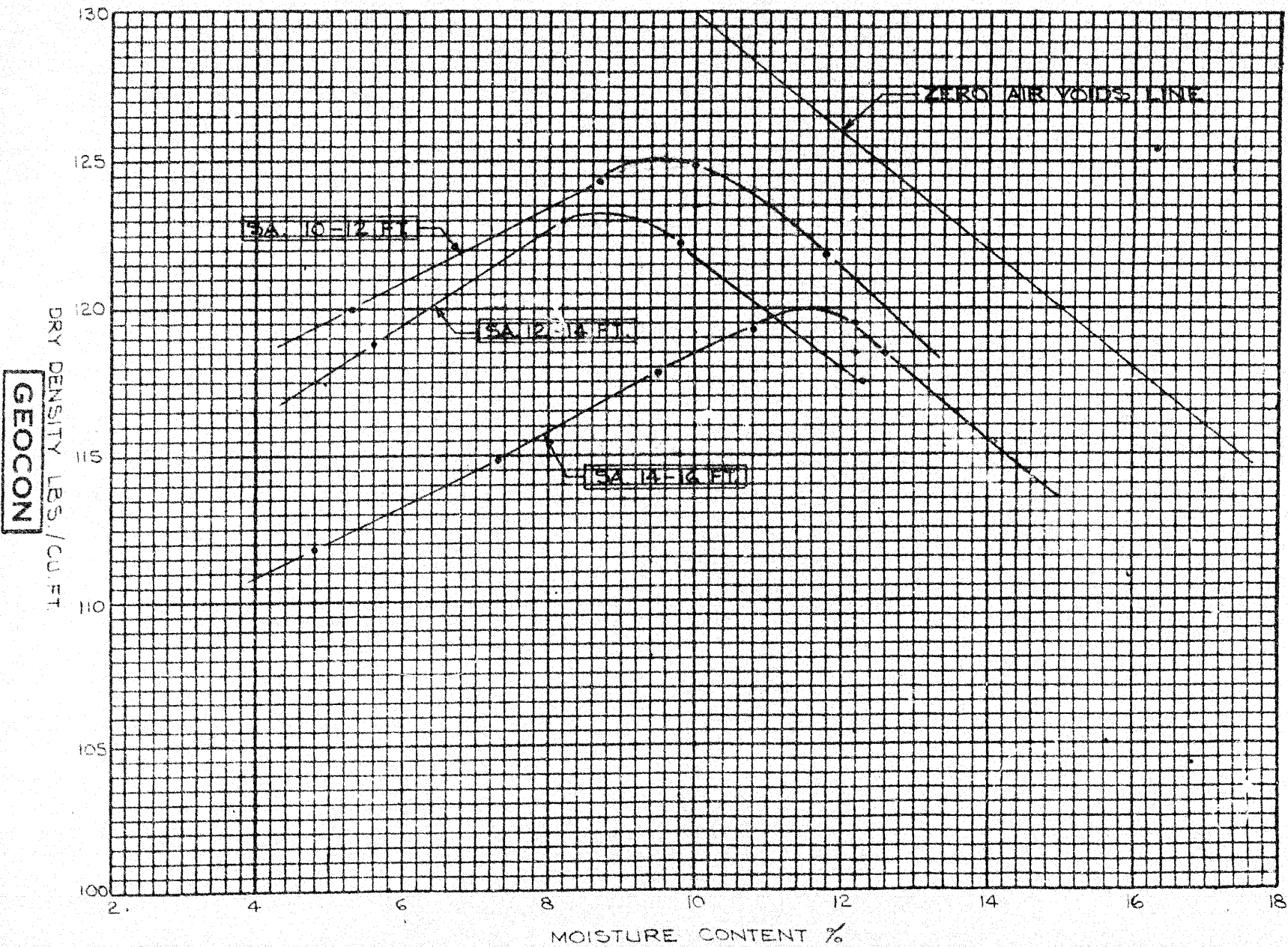
GEOCON

STANDARD PROCTOR COMPACTION TEST
MOISTURE CONTENT vs. DRY DENSITY

BOREHOLE 6(27+00)

APPENDIX II
FIGURE 10A.
PROJECT 17535

BROWN SILTY SAND (SM)



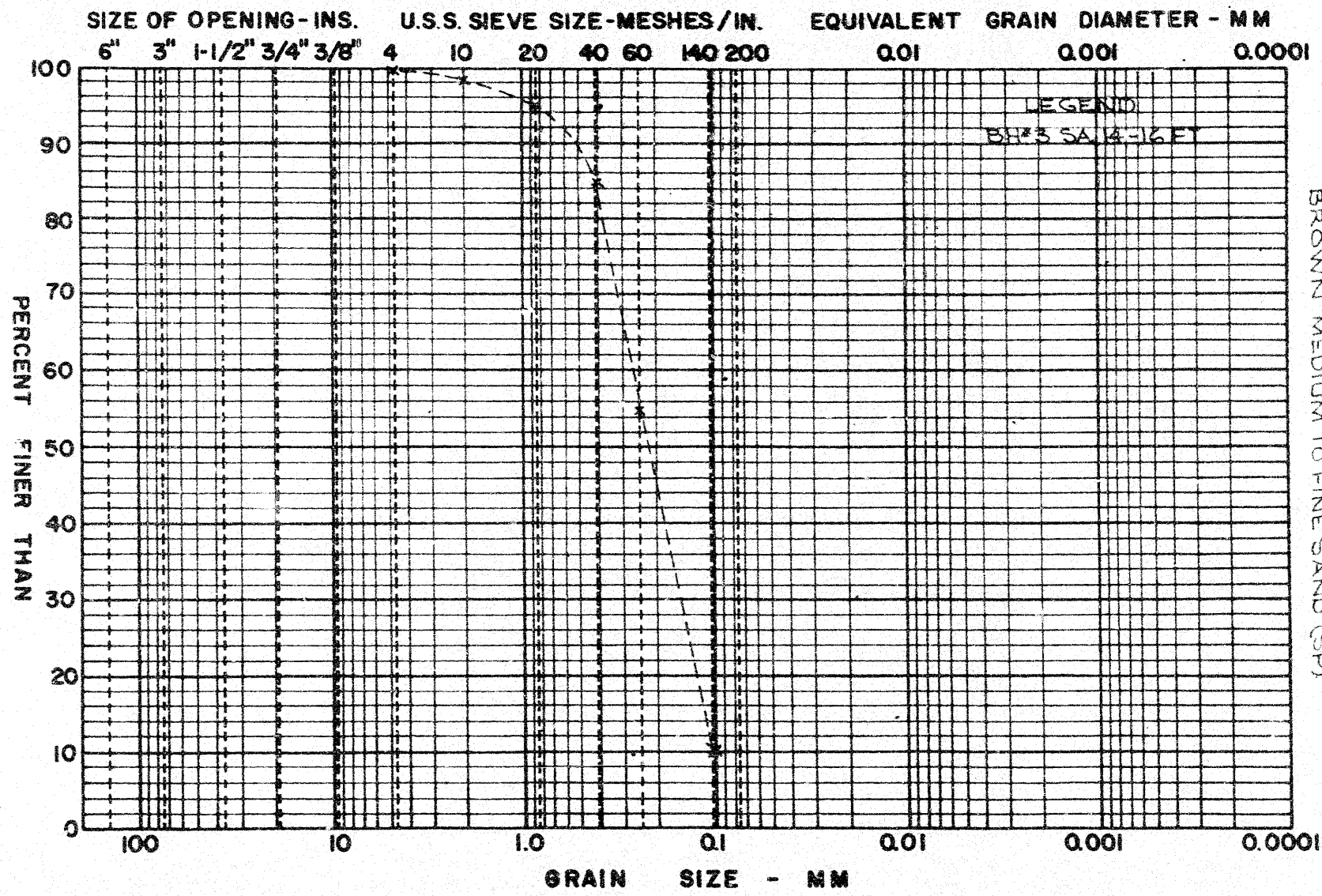
GRAIN SIZE DISTRIBUTION

COMPACTION SAMPLE

APPENDIX II
FIGURE 11
PROJECT 17535

BROWN MEDIUM TO FINE SAND (SP)

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

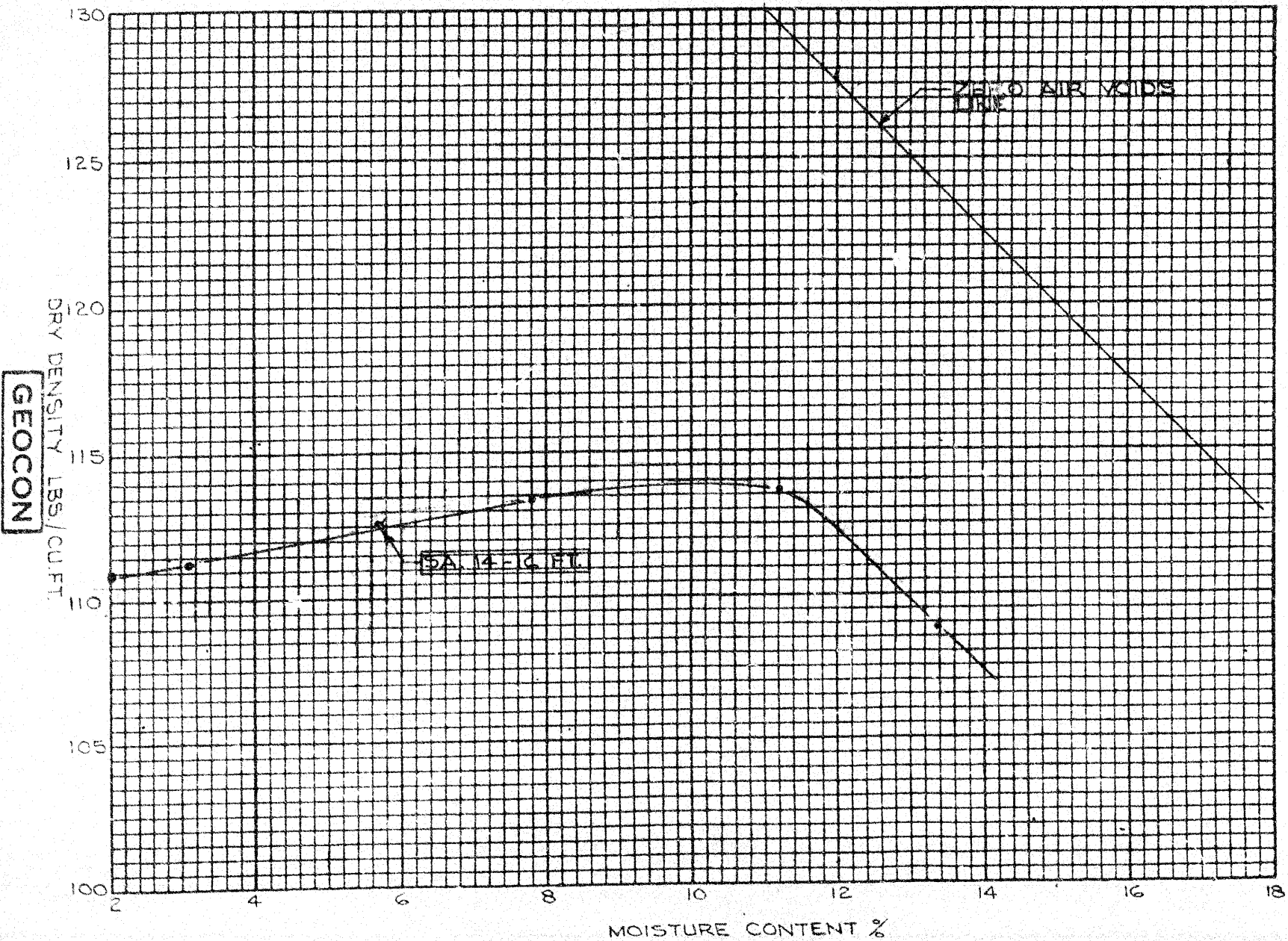


GEOCON

STANDARD PROCTOR COMPACTION TEST
MOISTURE CONTENT vs. DRY DENSITY
BOREHOLE 3 (19+00)

APPENDIX II
FIGURE 11A
PROJECT T7535

BROWN MEDIUM TO FINE SAND (SP)



APPENDIX III

FIGURES - LABORATORY TESTING

Sewer Cut Area 41+00 to 43+00

APPENDIX III
FIGURE 1
PROJECT T7535



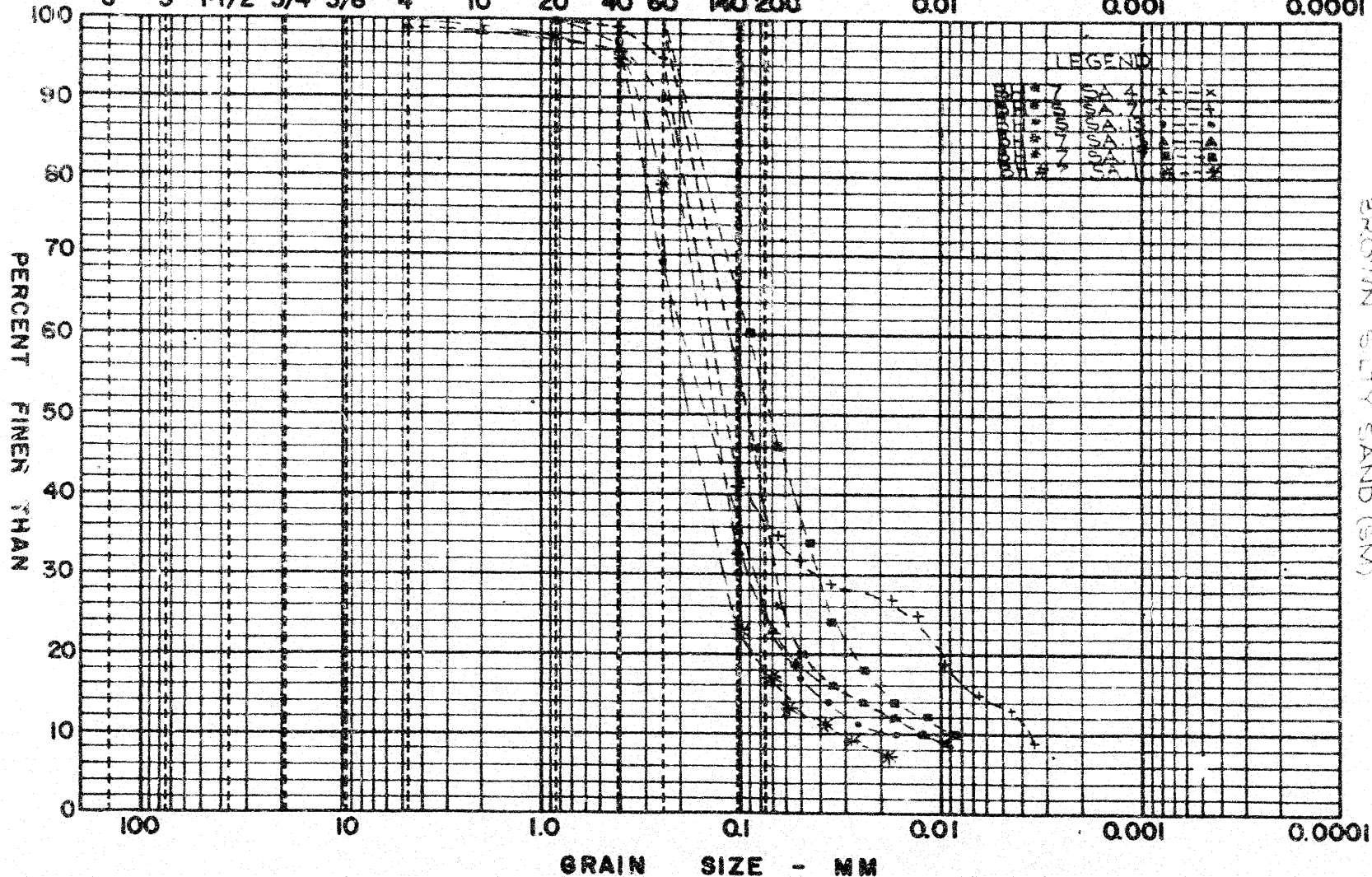
GRAIN SIZE DISTRIBUTION

APPENDIX III
FIGURE 2
PROJECT T 7535

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

6" 3" 1-1/2" 3/4" 3/8" 4 10 20 40 60 140 200 0.01 0.001 0.0001



M.I.T. GRAIN SIZE SCALE

GEOCON

GRAIN SIZE DISTRIBUTION

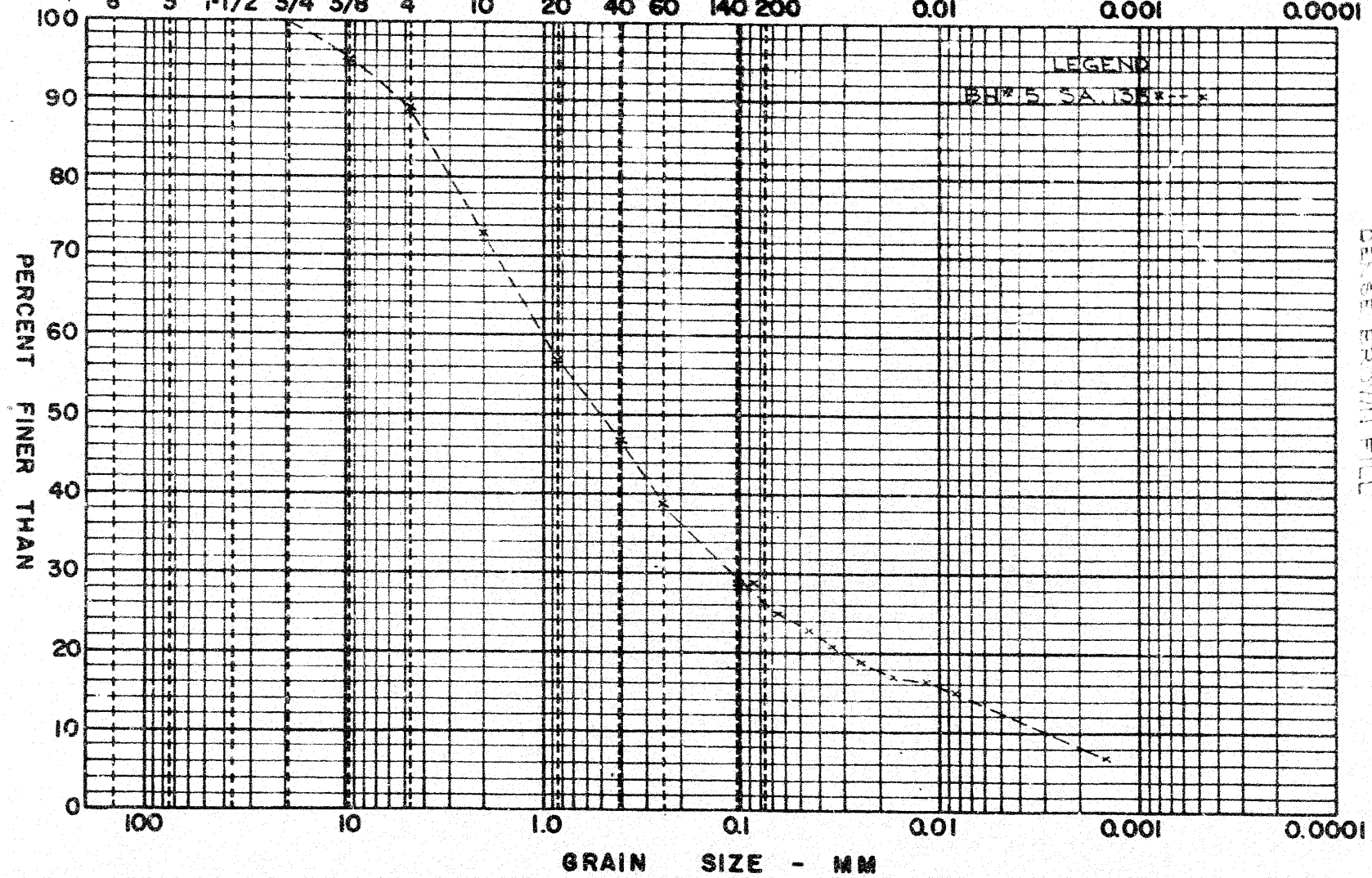
APPENDIX III
FIGURE 3
PROJECT T 7535

DEEP BROWN FILL

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

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

6" 3" 1-1/2" 3/4" 3/8" 4 10 20 40 60 140 200 0.01 0.001 0.0001



GRAIN SIZE DISTRIBUTION

COMPACTION SAMPLES

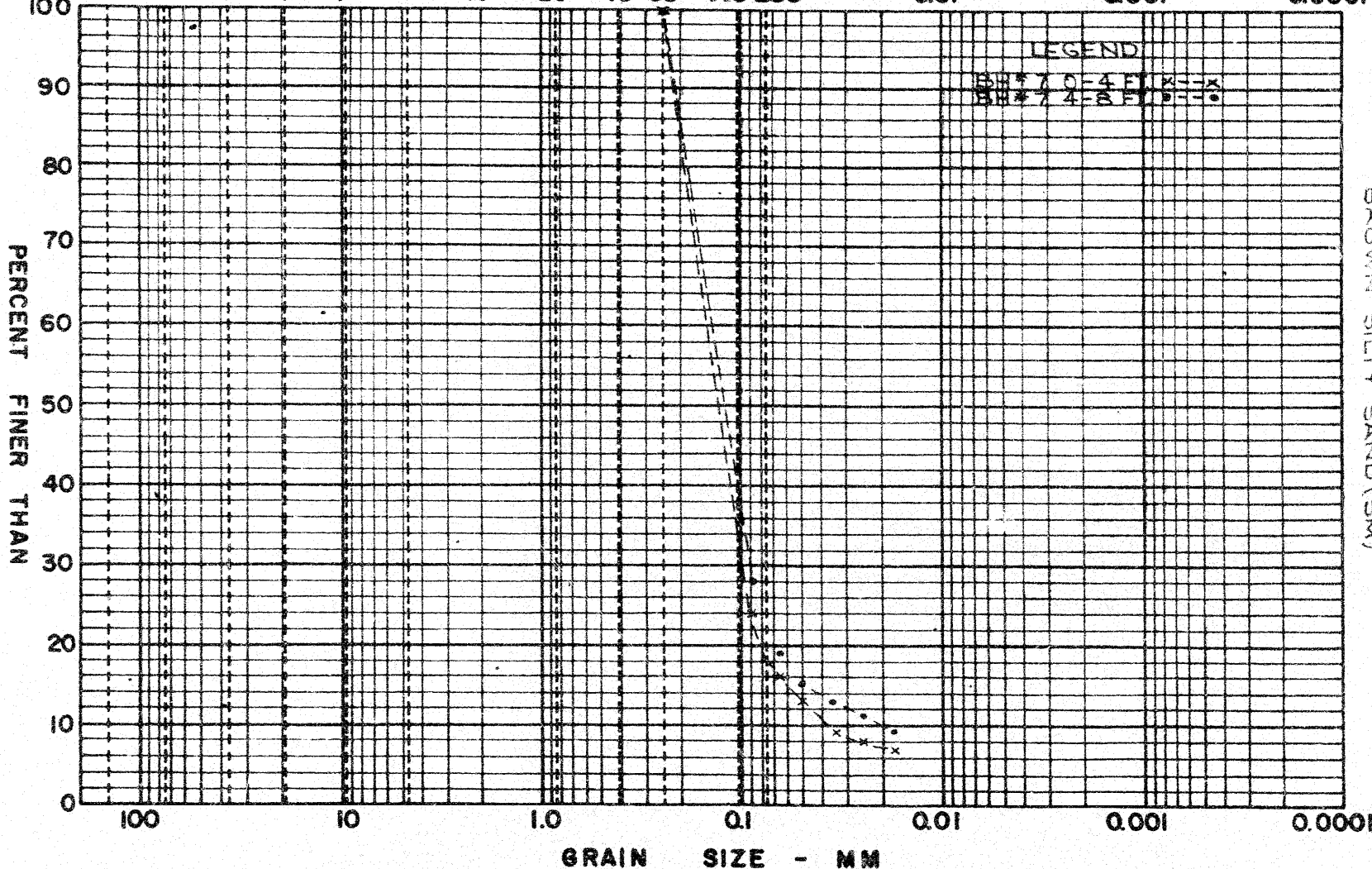
APPENDIX III
FIGURE 4
PROJECT T7535

BROWN SILTY SAND (SM)

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

6" 3" 1-1/2" 3/4" 3/8" 4 10 20 40 60 140 200 0.01 0.001 0.0001



N.I.T. GRAIN SIZE SCALE

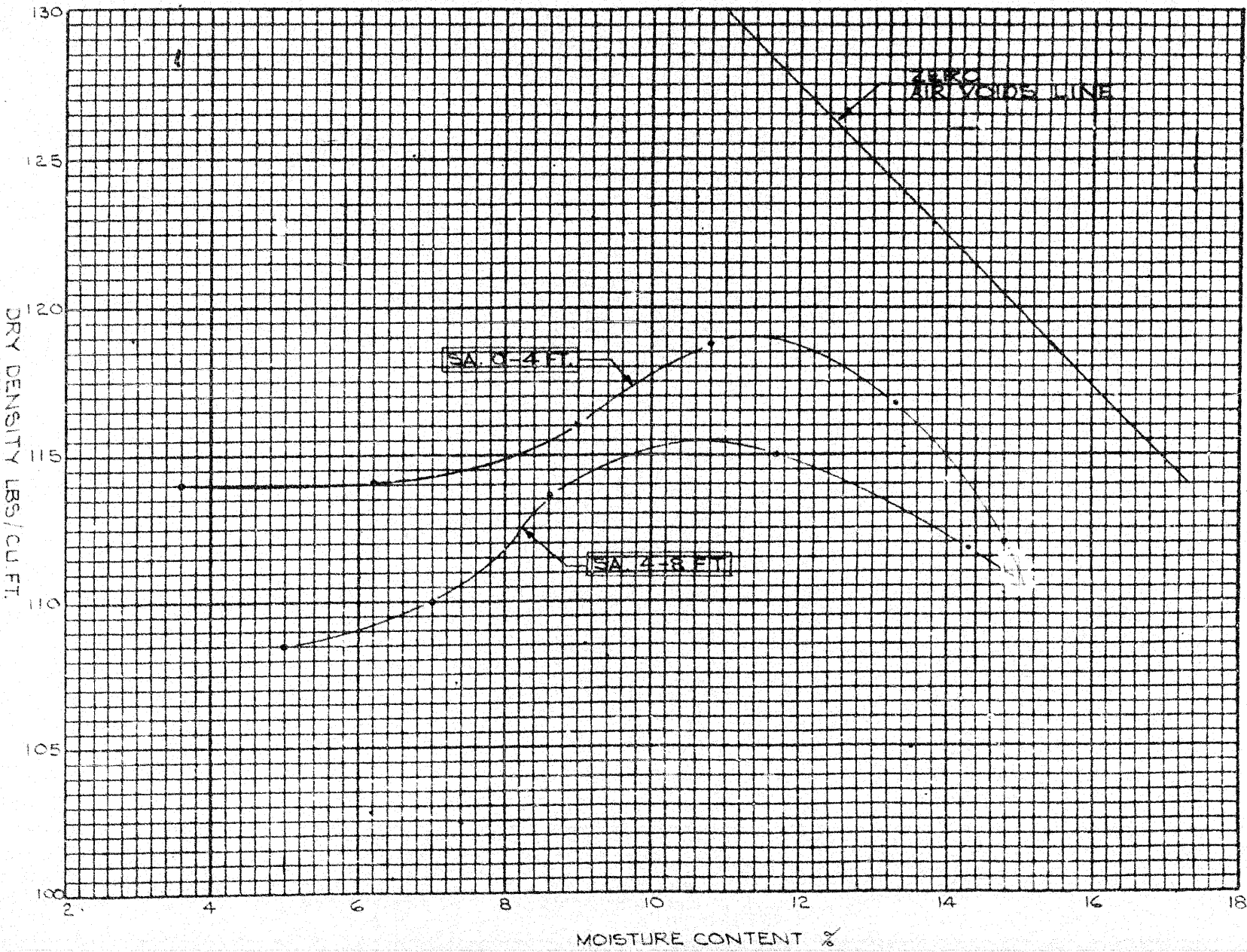
GEOCON

STANDARD PROCTOR COMPACTION TEST
MOISTURE CONTENT vs. DRY DENSITY

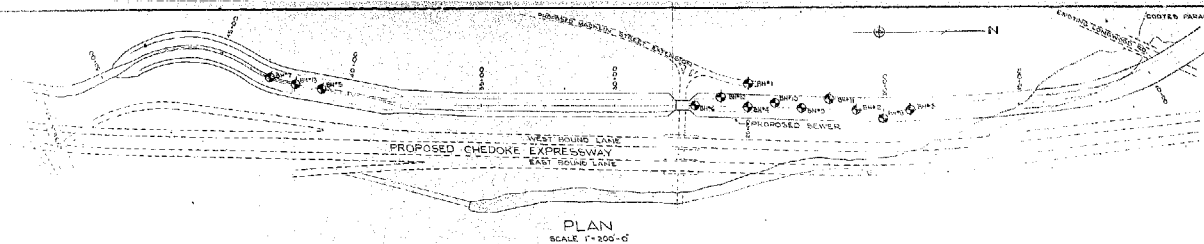
BOREHOLE 7 (43+00)

APPENDIX III
FIGURE 4A
PROJECT T7535

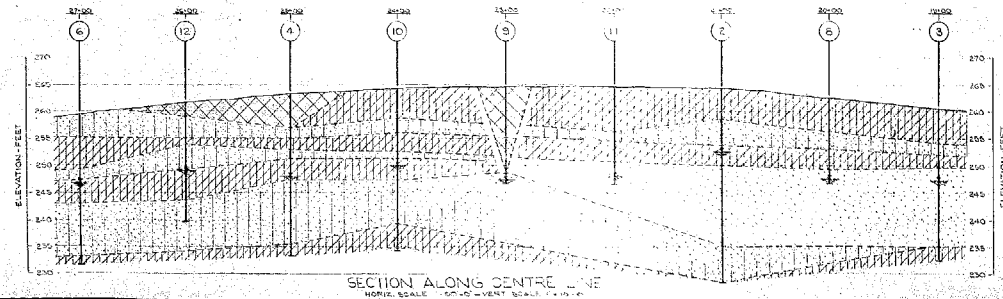
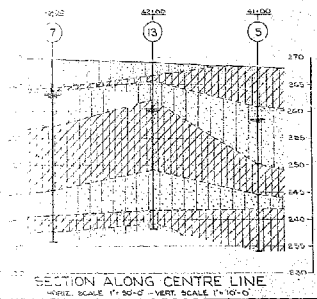
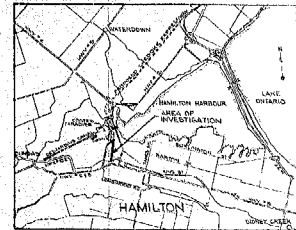
BROWN SILTY SAND (SM)



GEOCON



- LEGEND
- ◆ BOREHOLE IN PLAN
 - ⑨ BOREHOLE IN ELEVATION
 - WATER LEVEL SEPT. 1963



STRATIGRAPHY

- LOOSE TO VERY DENSE BROWN FILL (WELL GRADED)
- COMPACT BLACK AND BROWN ORGANIC FILL
- STIFF TO VERY STIFF BROWN TO GREY SANDY TO CLAYEY SILT WITH LAYERS OF SILTY CLAY (ML, ML-CL, CL)
- DENSE TO VERY DENSE BROWN SILTY SAND (SM)
- DENSE TO VERY DENSE BROWN MEDIUM TO FINE SAND WITH LITTLE FINES (SP)

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.

DWG. NO. 60-F-14-A	REFERENCE DEPARTMENT OF HIGHWAYS, ONTARIO MATERIALS & RESEARCH SECTION PROPOSED CHEDOKE STORM SEWER DATED: OCT. 15, 1960	DEPARTMENT OF HIGHWAYS, ONTARIO TORONTO PROPOSED HIGHWAY 403 CONTRACT 62-100 HAMILTON BORING PLAN AND SOIL STRATIGRAPHY	GEOCON LTD. DATE: SEPT. 28, 1963 SCALE: AS SHOWN DESIGNED BY: [] CHECKED BY: [] APPROVED BY: [] NO. T7535-1
-----------------------	--	--	---

Mr. H. Tregaskes,
Construction Engineer.

Mr. A. Rutka,
Materials & Research Engr.

October 9, 1963.

Highway 403, Contract 62-109,
Soils Investigations by Geoccon.

You will recall that Geoccon Limited were retained by the Department, to determine the soils conditions with respect to classification, moisture content and density, in the two sewer cuts located between Stations 19-27 and 41-45. Geoccon have completed this investigation, and have presented their report, a copy of which is attached.

This is a factual report, which describes the various soil layers encountered, and does not give any opinion as to the suitability of this material for construction. The stratigraphy, which is the core of the report, is shown in a plan at the back of the report. The most important considerations, as far as construction is concerned, is the water table, which you will note is generally fairly uniform in each of the two cuts. A considerable amount of material can be removed without difficulty before the water table is reached. The use of the material below the water table will be determined when the contractor has reached this stage.

There is a small organic layer located at Station 23, which Mr. Schonfeld will watch during construction. Should any difficulties arise, he will make the appropriate recommendations.

A.R. pa
c.c. H. Greenland,
H. Nixon (C.C.F.)
H. McMillan,
G. Wong,
B. Schonfeld,
T. Kovich.

A. Rutka,
Materials & Research Engineer.

Note to Gerry, Tom and Bob: Would you please review this report carefully and let me know if there is any discrepancies between the information found through this investigations and what is actually found during

construction. I am of the opinion that much of the sandy material can be used in spite of its high water content, for fill purposes. I would like to mention also that the bottom of the sewer is located at elevation 240, whereas the Lake Ontario level varies from 240 - 246.

A.R.

Mr. J. Walter,
Director,
Planning & Design Branch.

Mr. A. Rutka,

December 18, 1962.

62-109
Hwy. 403, Contract ~~62-75~~, Vibration Measurements, Homes
on Tops Crescent.

The Ontario Research Foundation have continued the vibration studies on all buildings in the vicinity of pile driving operations on the Chedoke Expressway. The attached report deals with the row of homes on Tops Crescent where a box culvert was constructed about 50' from and parallel to these homes. C. C. Parker in their letter of June 21, 1962, had noted that the residents in these homes were complaining about the vibrations set up during pile driving and pile withdrawal operations, and they had therefore requested the vibration studies.

The report concludes that while the vibrations are low and at a safe level when compared to vibrations set up by blasting, the blasting vibration criteria may not be valid. The vibrations from pile driving or pile withdrawal could still be well below the safe or caution level, yet adjoining buildings could fail in settlement. Settlement would be most severe in granular soils, as it is well known that vibrations cause densification of the soil.

Any damage to the homes could be assessed visually. The Ontario Research Foundation were at a disadvantage as they did not inspect the buildings prior to the pile driving operations, and only inspected the outside after half of the piles were withdrawn. I understand however, that the contractor, Frid Construction, made an inspection of the homes in detail, and has the necessary information.

It is unlikely that any claims will arise from these homes; however, we now have some information which might prove of value. Further vibration studies made by the Ontario Research Foundation on buildings in this area, will be submitted and distributed as the work is completed.

AR:pa

c.c. H.W. Adeock,
J.B. Wilkes
H. Greenland,
A. Toye,
H. McMillan,
C.C. Parker,
G. Wong,

A. Rutka
A. Rutka,
Materials & Research Engr.

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

PLANS AND PROFILES

DESIGN
CRITERIA
REC'D

SOILS DATA

GRANULAR DATA

PLAN No. SOILS PLAN PROFILE No. SOILS PROF. DATE REC'D

REPORT TO
H.O.PROFILE TO
H.O.SCHEDULED
DATESTRIP MAP
TO H.O.SCHEDULED
DATE

REMARKS

SOILS INVESTIG.

UNDERWAY

COMPLETED

REMARKS

GRAN. INVESTIG.

UNDERWAY

COMPLETED

REMARKS

PERFORM. SURVEY

PRELIM. CHECK

PEDO. SURVEY

POWER EQUIP.
SURVEY

SUBGRADE CHECK

STRIP MAP
PREPARATION

ADDED TO PROGRAMME

DELETED

TYPE OF CONTRACT Grading

LENGTH

CONTRACT No. 62-109

EXACT LOCATION King-Main Interchange

DISTRICT 4

W.P. 231-58-3

HWY

Chedoke
Express

LOCATION King-Main Interchange

62-109

23-62-109

May 19, 1960.

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

Attention: Mr. V. Milligan.

Re: - Chedoke Expressway --
Ramp 'G' - W.P. 231-58-3
District 4.

Dear Sir:-

Please consider this your authorization to carry out an investigation at the above location, with a view to advising the Department with respect to the properties of the upper clay layer.

It is understood that this work will be carried out under the technical advice of Dr. H. G. Bolder, who will report to the Department.

Ten copies of the completed report should be submitted to this Section.

Charges for the work performed, will be in accordance with your Schedule of Rates, dated March 4, 1960. Please address invoice to the attention of the undersigned.

JB/MdeF

Yours very truly,

cc: Mr. S. McCombie
" I. Campbell
" R. E. Richardson
" P. F. Weber
" W. D. Smith
Foundations Office
Gen. Files (2)

ER
A. Eutha,
A/MATERIALS & RESEARCH ENGINEER

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7535 BORING # 1 AND 2 DATUM GEODETIC CASING B/A
 BORING DATE AUG. 19 120, 1963 REPORT DATE AUG. 23, 1963 COMPILED BY A.E.L. CHECKED BY
 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

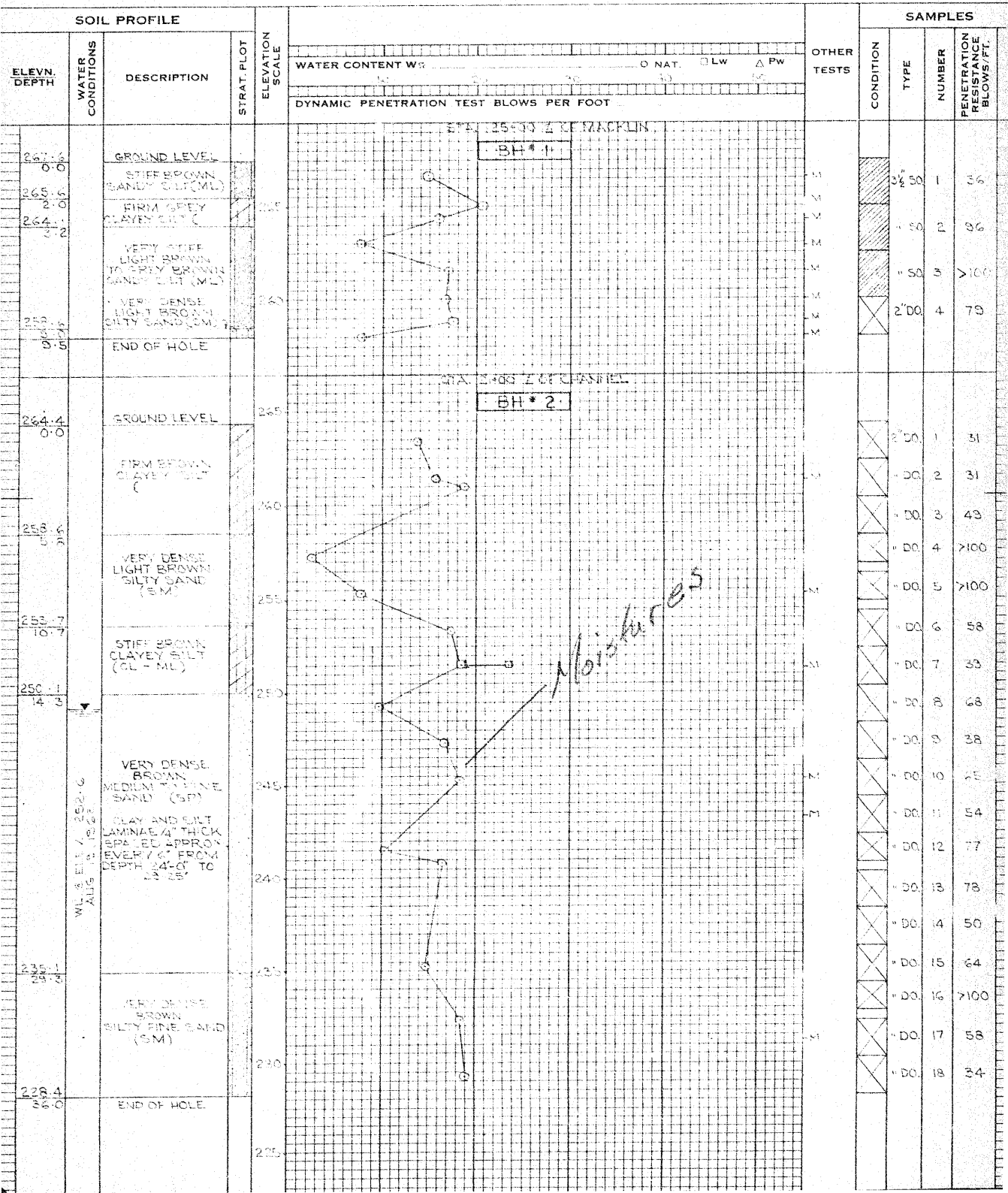
SAMPLE TYPES

F.S. - FCIL 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



OFFICE REPORT ON SOIL EXPLORATION

PRELIMINARY

CONTRACT 11635 BORING # 3 STA. 10+00 DATUM 3600' 12' CASING 24'
 BORING DATE AUG. 22, 1962 REPORT DATE SEPT. 4, 1962 COMPILED BY AEL CHECKED BY E.D.
 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.P. - SLEEVE-FOOT VALVE
 T.O. - THIN WALLED OPEN
 R.C. - ROCK CORE

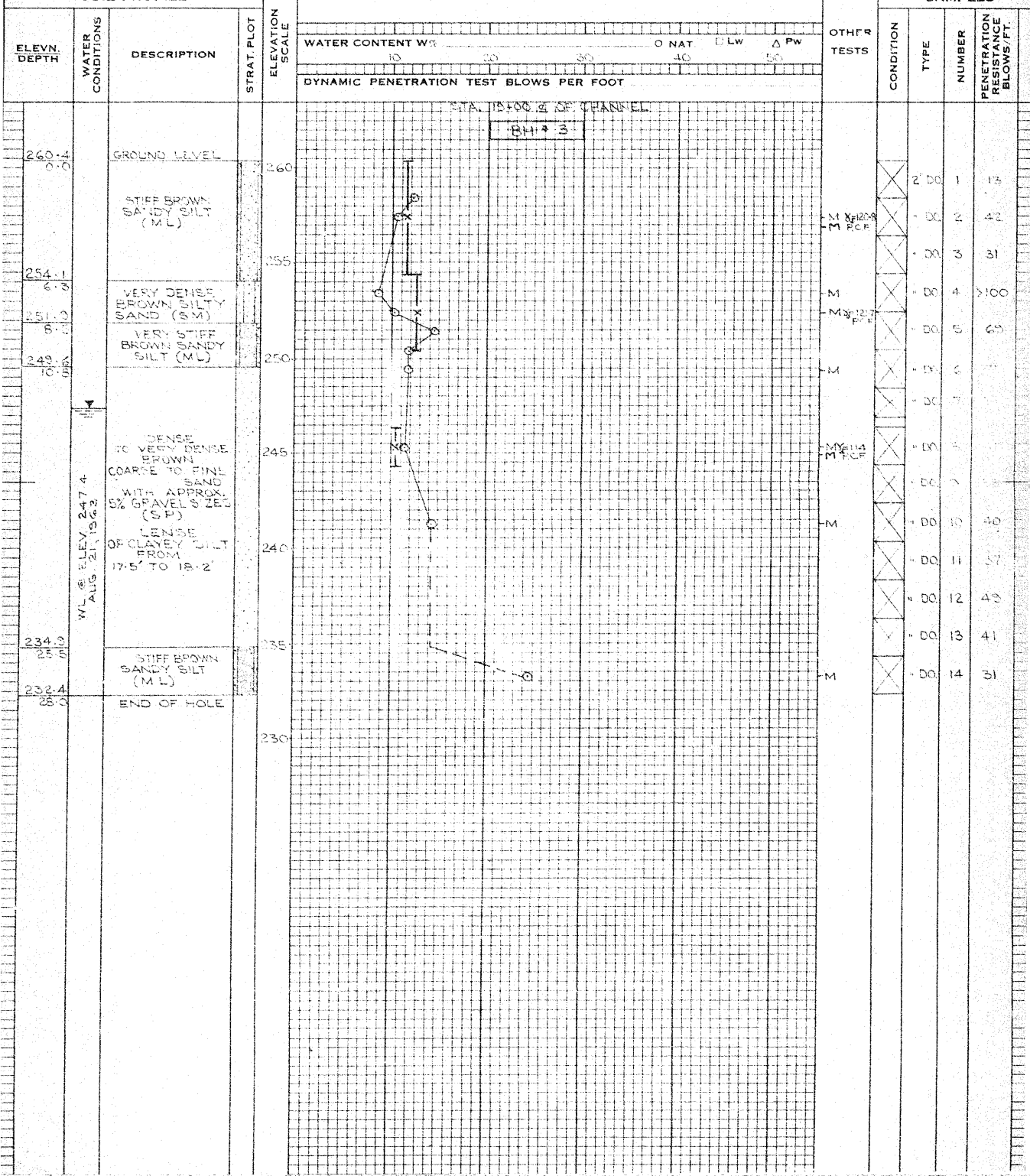
ABBREVIATIONS

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
 X - OPT. MOISTURE CONTENT

SOIL PROFILE

SAMPLES



OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 17835 BORING # 4 STA. 25+00 DATUM GEODETIC CASING BY
 BORING DATE AUG. 26, 1963 REPORT DATE SEPT. 4, 1963 COMPILED BY ALL CHECKED BY P. D.
 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

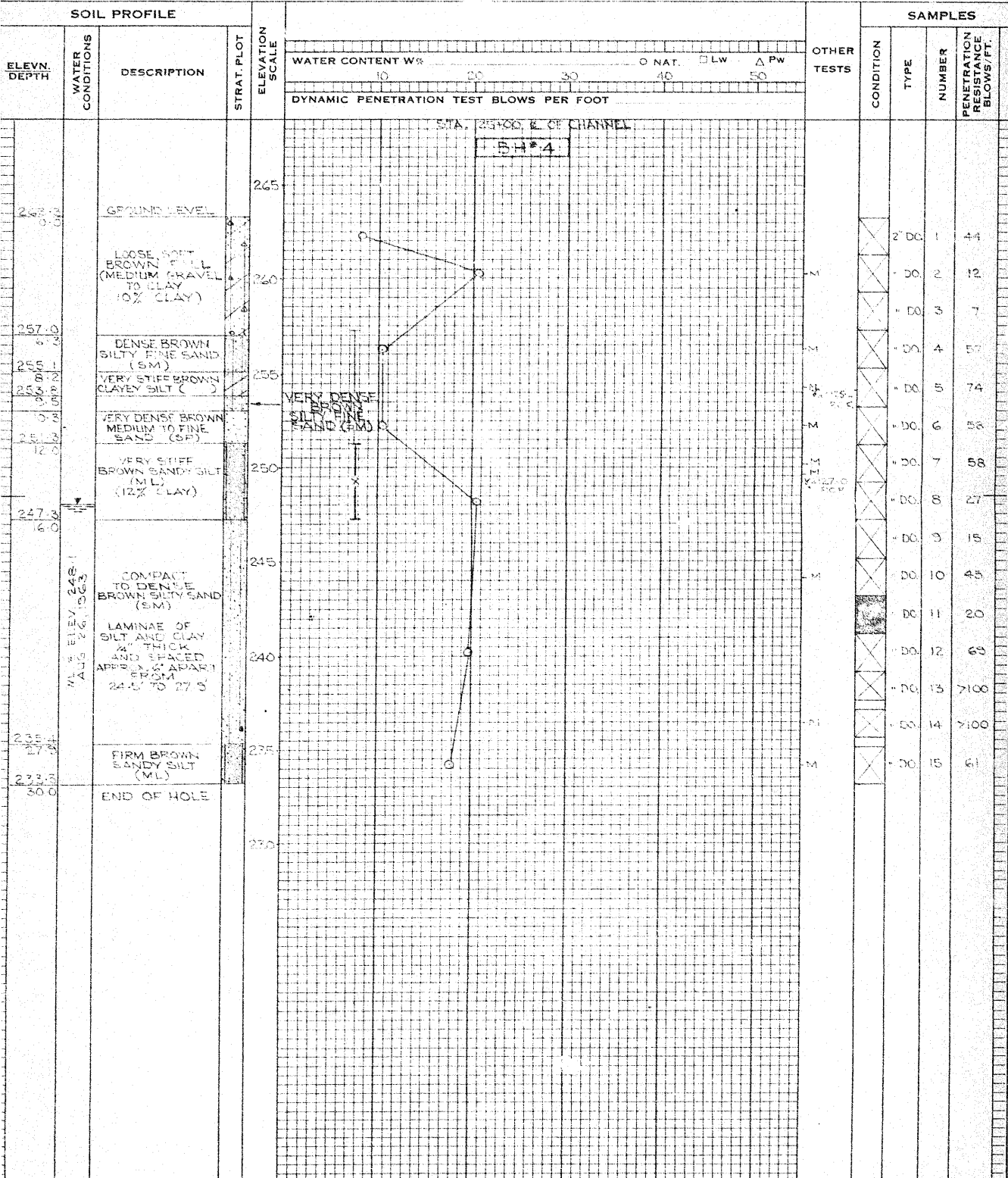
ABBREVIATIONS

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
 X - % MOISTURE CONTENT

SOIL PROFILE



OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 5773-35 BORING # 5 STA 41+00 DATUM GEOMETRIC CASING BX
 BORING DATE AUG. 26, 1962 REPORT DATE SEPT. 4, 1962 COMPILED BY AEL CHECKED BY B.D.
 SAMPLES HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS ENERGY)

SAMPLE CONDITION

☐ DISTURBED
☐ FAIR
☐ GOOD
☐ LOST

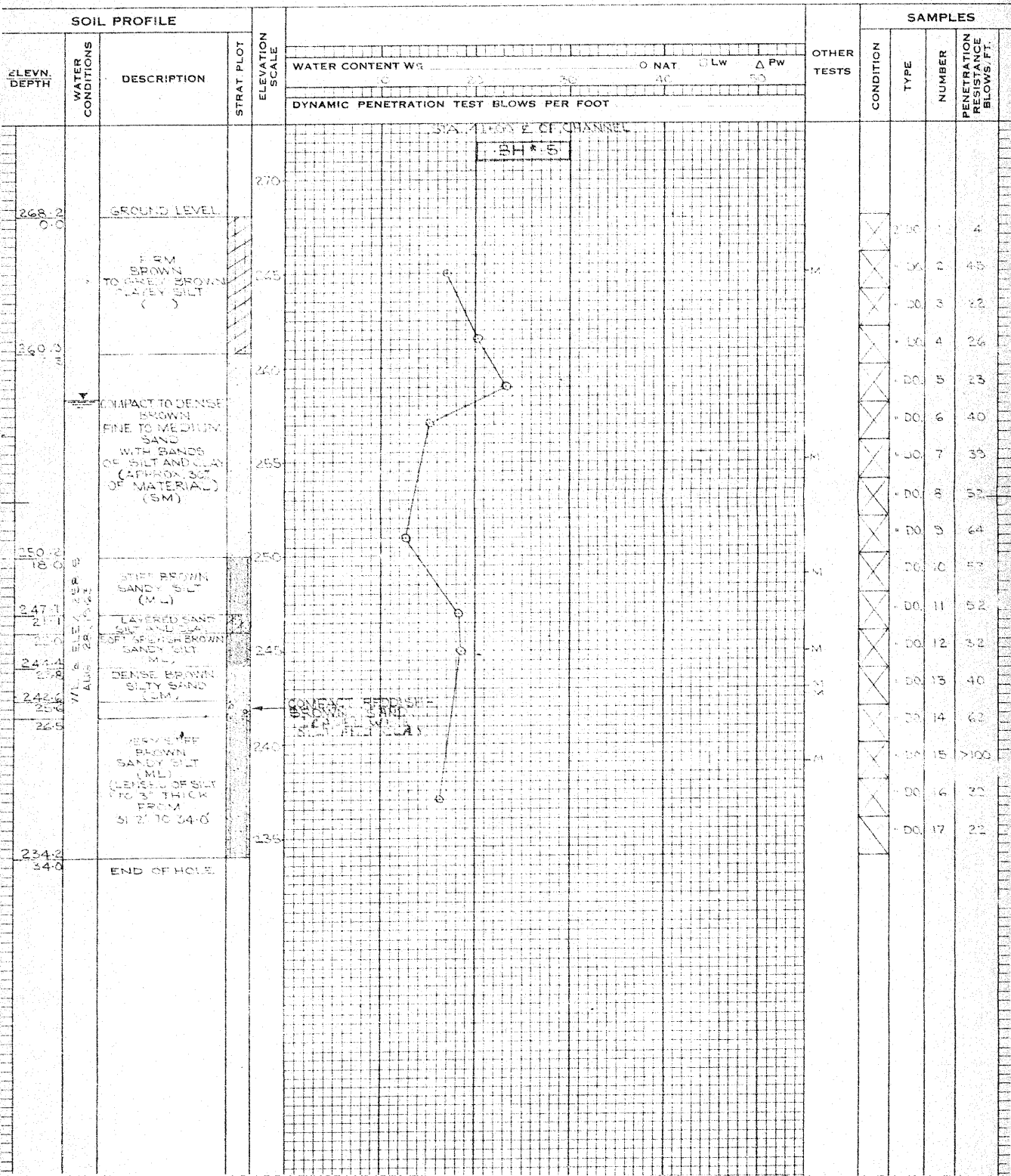
SAMPLE TYPES

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



GRAIN SIZE DISTRIBUTION PRELIMINARY

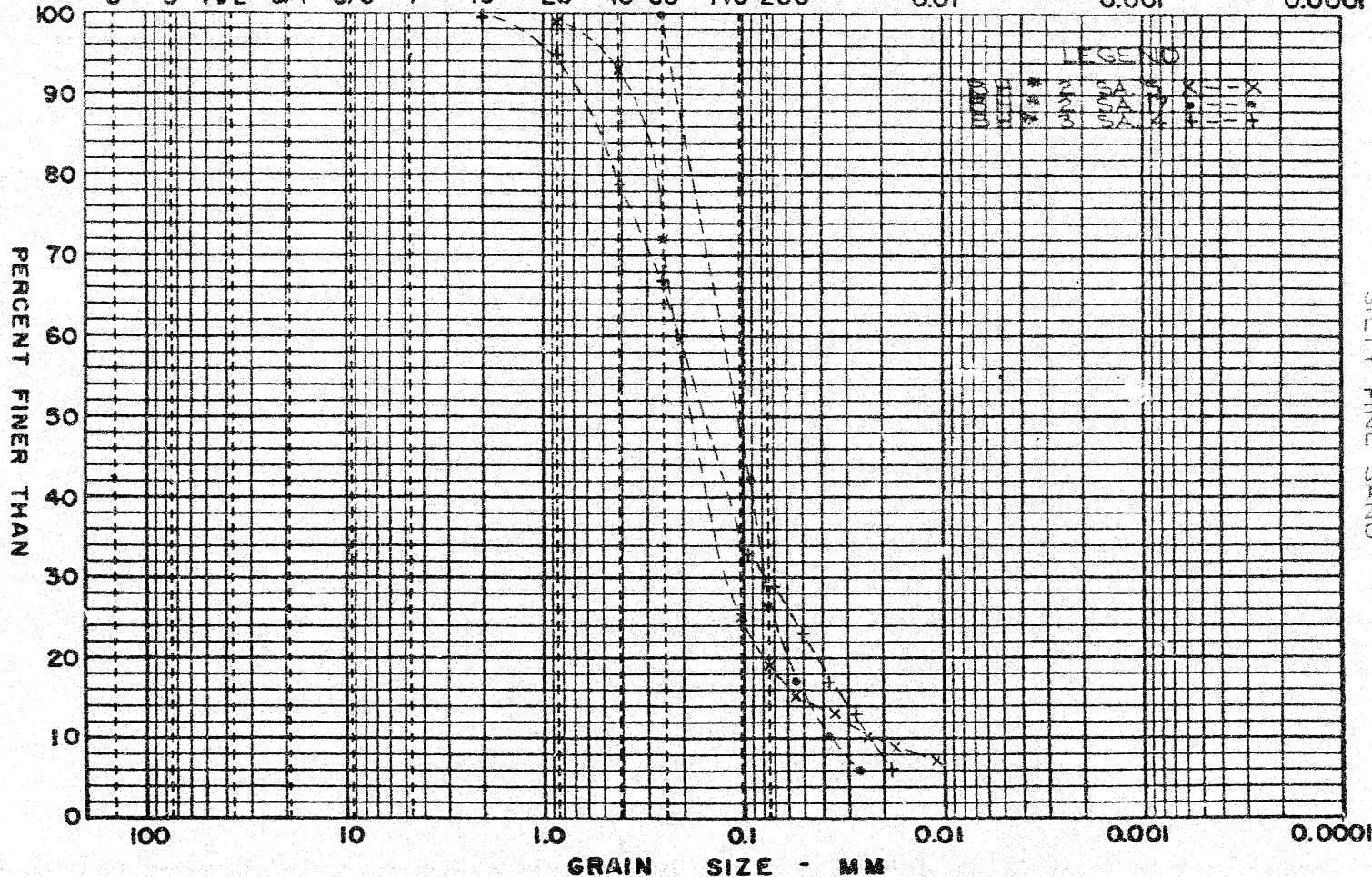
APPENDIX
FIGURE
PROJECT T7535

SILTY FINE SAND

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

6" 3" 1 1/2" 3/4" 3/8" 4 10 20 40 60 140 200 0.01 0.001 0.0001



M.I.T. GRAIN SIZE SCALE

GEOCON

APPENDIX
FIGURE
PROJECT T7535

