FHA

ENGINEERING SOIL CLASSIFICATION for RESIDENTIAL DEVELOPMENTS

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ENGINEERING SOIL CLASSIFICATION FOR RESIDENTIAL DEVELOPMENTS

Compiled and edited by the

FEDERAL HOUSING ADMINISTRATION
Architectural Standards Division
Technical Studies Staff

from data prepared by the

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PREFACE

The technical studies staff of the Federal Housing Administration initiated the development of a soils engineering program with emphasis on obtaining uniformity in the procedures to be used by the Sanitary Engineering Section of FHA in evaluating, testing, and reporting. It was thought that ultimately a more comprehensive soils engineering program could be developed from this foundation to provide engineering data on the behavior of soils with respect to foundations, streets, and roads, and for other structural, mechanical, and site engineering purposes.

The Technical Studies Advisory Committee of the National Academy of Sciences recommended that FHA adopt the Unified Soil Classification System for this soils engineering program. It also recommended the development of guides to applicable physical characteristics of the fifteen soils groups in this system.

Accordingly, the Federal Housing Administration contracted with the Virginia Polytechnic Institute for preparation by the Institute of a report to amplify and adopt the basic concepts of the Unified Soil Classification System with respect to general suitability of soils for residential building sites. This revised report was prepared by the Virginia Engineering Experiment Station of the Virginia Polytechnic Institute and constitutes Section I of this manual.

Concurrently, the Federal Housing Administration contracted with the National Academy of Sciences, through its Building Research Advisory Board for designation by the Board of a group of regional soil scientists and engineers to guide the development of the original V. P. I. report.

To broaden the scope and usefulness of the manual, FHA entered into an agreement with the Bureau of Public Roads, Division of Physical Research, for compilation by the Division of pertinent engineering test data prepared in its laboratory on representative agricultural soil series throughout the country, as sampled and correlated by the Soil Conservation service of the U.S. Department of Agriculture. Additional soil test data has been prepared in a cooperative program involving state highway departments, universities or colleges and the Bureau of Public Roads.

These test data in tabular form and alphabetical order comprise Section II of this manual. They provide a practical method of utilizing existing agricultural soil survey information. In addition, they provide a basis for interpreting agricultural soil classification series and types in terms of the Unified Soil Classification System and the American Association of Highway Officials classification system for practical engineering uses.

James R. Simpson, Elvin F. Henry, and Bernard T. Craun of the FHA Architectural Standards Division conceived the idea of this type of manual and supervised the selection and preparation of the material.

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Acknowledgments

This section was prepared at the Virginia Polytechnic Institute, Blacksburg, Virginia, by Mr. J. H. Hunter, associate professor of civil engineering, as project No. 367, Virginia Engineering Experiment Station. The project was under the administrative direction of Dr. H. M. Morris, professor of civil engineering and head of the civil engineering department. Suggestions and comments were contributed by members of the faculty of Virginia Polytechnic Institute, especially those of the department of civil engineering. Messrs. R. W. Spangler, J. E. Strickland, and J. E. Moore, graduate students in that department, were most helpful in the literature search and in assembling data.

With the approval of the president of the National Academy of Sciences, the following special advisory committee was appointed to consult with the Virginia Polytechnic Institute during the preparation of this report and to review and evaluate it upon completion:

Mr. W. G. Shockley, Corps of Engineers, U. S. Army (chairman)

Mr. T. W. Bendixen, Robert A. Taft Engineering Center,
U. S. Public Health Service
Mr. W. A. Clevenger, Woodward-Clyde-Sherard & Associates
Professor R. F. Dawson, University of Texas
Mr. D. M. Greer, Greer Engineering Associates
Professor R. G. Hennes, University of Washington
Professor G. A. Leonards, Purdue University
Professor G. F. Sowers, Georgia Institute of Technology

Robert M. Dillon, executive director of the Building Research Advisory Board, directed the activities of the committee.

Section I, as originally prepared by the Virginia Polytechnic Institute during 1958, was approved by the Buildings Research Advisory Board of the National Academy of Sciences as treating all items in an authoritative manner. Minor revisions were made to Section I by Virginia Polytechnic Institute during 1960.

The Unified Soil Classification System developed by the Corps of Engineers, U. S. Army, and published as Technical Memorandum No. 3-357 prepared by the Waterways Experiment Station, Vicksburg, Mississippi, March 1953, provided the basic data for this report.

SECTION I

ENGINEERING SOIL CLASSIFICATION FOR RESIDENTIAL DEVELOPMENTS

PART I: INTRODUCTION

1. Uniform soil classification has its principal value as an aid to communication between engineers. The homebuilding industry is so widespread geographically that a common language is an important objective for anyone associated with the industry. As a step towards that objective, this report presents a brief review of the Unified Soil Classification System with generalized guides for application to soils at residential building sites.

2. The report has two purposes: First, it is intended that by use of the guides in the report the more troublesome soils at residential building sites will be better recognized; and, second, it is intended that the report will aid in establishing the Unified Soil Classification System as the uniform system of engineering soil classification to be used by the Federal Housing Administration in administering its real estate mortgage insurance programs.

Soils at the Site

3. If the soils at a residential building site are classified according to the Unified Soil Classification System, then they must be placed in one or more of the fifteen groups which comprise the system. At any one site many soil groups, both in the disturbed and in the undisturbed condition, may be found; or perhaps only two or three of the groups may be encountered. The range in engineering properties in any one soil group in the undisturbed state may be large or relatively small, depending on past geologic history and present density or consistency and moisture content, and whether or not these factors are constant throughout the site.

4. Undisturbed soils in different groups but with similar geologic history and hydrologic conditions often will have more engineering characteristics in common than two samples of the same group with different geologic history. In the disturbed state, soils in any one group may have widely varying characteristics but, in general, the characteristics resulting from controlled placing and compaction are reasonably consistent in any one group.

5. For example, fills occur that have been carefully designed and closely controlled during construction and, as a result, they have fairly well defined characteristics. These characteristics are consistent from point to point in any one fill and they are also consistent from one fill to

another in a different location, provided the same methods of construction were used on soils classified as coming from the same soil group. Fills also occur, made from essentially the same soil, that have been dumped into place without engineering supervision and, consequently, the properties are widely variable even though the soil grouping is known.

6. Residential areas, then, may be developed on soils that comprise the whole range of soil groups with variations in characteristics within any one soil group and with wider variations in characteristics between different soil groups.

7. Even though the soil groups at a building site may be identified according to the Unified Soil Classification System, the characteristics of any one group cannot be considered to have definite numerical values. The factors that influence strength, consolidation, expansion, and other engineering characteristics depend as much on in situ consistency or density and geologic factors as on texture and remolded plasticity qualities; consequently, it is impossible to evaluate these features on the basis of identification alone. The soils in a given group, however, do have generally similar behavior characteristics, since behavior is one of the criteria for classification in the Unified System. This is especially true in controlled fills, where past geologic and hydrologic influences are greatly reduced in importance.

8. While classification of the soils according to the Unified Soil Classification System does not provide sufficient information for design purposes, it will give the engineer an indication of the behavior of the soil when it is found at a residential site. This information may be sufficient to serve as a broad outline for accepting a proposed soil used or for requiring investigations and evaluation by a competent engineer before acceptance. Classification in the Unified Soil Classification System with an adequate and complete soil description, including in-place condition description, enables an engineer to utilize his judgment and experience.

Limitations of Applicability of Classification Systems

General

9. The Unified Soil Classification System will not solve soil engineering problems, nor will any other classification system. Classification per se cannot possibly give anything more than a general idea of the materials that must be dealt with, and classification of the soils at a building site should be considered as the starting point for pertinent investigations. These investigations may be no more extensive than the application of engineering experience and judgment to the problem, or they may require field and laboratory tests and evaluations in addition to engineering experience and judgment. Stated another way, classification alone cannot be used to do design. In order that this may be clearly un-

derstood, the following paragraphs mention a few situations and problems that occur at residential building sites and cannot be solved by identification alone.

10. The major limitations of the applicability of the Unified Soil Classification System are indicated by the basis of the system; texture, plasticity, and behavior in recompacted condition. The Unified System does not indicate the variation in a soil formation, although it permits the logging of variation produced by different soil layers or lenses.

11. In using the Unified System or any other system of classification it is not sufficient to identify a soil formation from the examination of a sample from one point in the soil mass, for a formation will vary in both a horizontal and a vertical direction and at times will be entirely different within a few feet either vertically or horizontally from the point examined. Usually the vertical variation is much more marked than the horizontal variation. Adjacent or nearby strata or lenses may so affect any related structure that the soil in intimate contact with the structure may possibly be of secondary importance.

12. While the Unified System requires description of the moisture condition of the soil and description of the soil at the particular moisture condition at the time of examination, it is not intended to provide for the profound effects that changes in moisture may have on some soil groups. These changes may be the result of climatic conditions, of the existance of nearby vegetation, or of such man-made influences as drainage ditches or watering devices for lawns and plants; whatever the source of change in the hydrologic conditions, the results are about the same. In delineating a soil group the Unified System does not take into account the wide range of densities or consistencies that may exist in situ. An adequate description, as required by the Unified System, includes adjectives describing density or consistency along with the group symbol.

13. In many regions the possibility of landslides is a major concern. Among many factors related to slides are surface topography, ground water, water pressure, and the physical properties of the soils that make up the soil profile. The Unified System can be used to describe the complexities of a given soil profile, but the System by itself cannot be used to predict possible landslides.

14. The major limitations of the applicability of the Unified Soil Classification System are, then, those that are imposed by variations in soil formations, by hydrologic changes, by conditions not included in a given soil description, and by the complex factors related to such mass phenomena as landslides. Among other items which are of importance in some cases and may, therefore, be considered to be related to limitations of the applicability of the System are such factors as mineral composition of grains, grain shape, type of exchangeable ions, and secondary structure. These factors are not considered when a soil is identified as belonging to a particular group in the Unified Soil Classi-

fication System, but they should be included in the word description when it is expected that they will influence a planned soil use.

Limitations for
residential building sites

15. The general limitations listed in paragraph 9 apply to residential building sites. Since loads are relatively low in residential developments, hydrologic change effects probably are of greater immediate concern than variations in soil deposits and in density or consistency; but each case must be examined on its own merits. For sewage disposal fields, variations in soil formations are of considerable importance. In regions susceptible to landslides, the limitations imposed by related factors are probably of paramount importance.

PART II: SOIL CLASSIFICATION SYSTEM

16. The soil classification system adopted by the Federal Housing Administration and presented in this report is the Unified Soil Classification System. This classification system is described and explained in Waterways Experiment Station technical memorandum 3 - 357, The Unified Soil Classification System, with two appendices. These appendices give the classification of the soils in groups which compose the system according to their engineering behavior for various types of construction of interest to the Corps of Engineers, such as embankments and foundations for roads and airfields.

17. When the system was published in March 1953, the Bureau of Reclamation published a parallel document, the Unified Soil Classification System, A Supplement to the Earth Manual, with a table showing relative desirability of the groups for various uses of interest to the Bureau of Reclamation in the construction of earth dams and embankments, canals, foundations, and roadways. In both publications the Unified System is applied primarily to conditions in which the soils are used as construction materials.

Basis of the Unified Soil Classification System

18. The Unified Soil Classification System is based on the identification of soils according to the textural and plasticity qualities of their ingredients and on the grouping of soils with respect to their behavior in a remolded or reworked condition. It is not intended to delineate precisely a soil for a specific purpose, for this is the function of the soils engineer who evaluates a particular soil for a particular purpose in terms of its past history as well as the present conditions and anticipated future conditions imposed by the construction and operation of a structure or system of structures. This, however, does not prevent the classification of the soils in these groups according to their general engineering behavior for various uses.

19. While this system of classification is based on qualities of the soil ingredients and on behavior in the remolded condition, this does not mean that the Unified System cannot be used for undisturbed soils. See part IV for a discussion of undisturbed soils. Disturbed soils are discussed in part III.

Field and Laboratory Identification

20. The publications noted in paragraphs 16 and 17 contain the necessary information for properly classifying soils into soil groups. Selections from the Waterways Experiment Station document are included as appendix A for convenient reference. Only portions concerning general identification with appropriate tables and charts are included; for laboratory identification, the reader is referred to the original publication.

21. When the identification determinants for a soil have been ascertained with satisfactory accuracy by either field or laboratory examination the soil is assigned a letter symbol from the fifteen available groups in the USCS. This symbol accompanies the word description for the soil. the previously mentioned publications of the Waterways Experiment Station and the Bureau of Reclamation define the Unified System, but other publications report suggestions and techniques which aid in processing the identification determinants for classification purposes. One of these aids is the Unified Soil Classification triangle, a partially graphic means of classifying soils in this system. This triangle simplifies the purely mechanical steps necessary for selecting the proper group symbol. It may be particularly convenient for use in laboratory classification procedures. Appendix B contains the triangle and portions of the paper from ASTM Special Technical Publication No. 254 which reported the development and use of this device.

Review of Soil Groups

22. The Unified Soil Classification System places soils in fifteen groups which are represented by letter symbols. The coarse-grained soils (over 50 percent coarser than No. 200 sieve size) are first given the symbol G (gravel) or S (sand), depending on which predominates. If more than 50 percent of the part that is coarser than the No. 200 sieve size is larger than the No. 4 sieve size, it is given the symbol G; and if more than 50 percent is smaller than the No. 4 sieve size it is given the symbol S. This is followed by a second letter that denotes the gradation or the amount and kind of fines present: W, well graded with little or no fines; P, poorly graded with little or no fines; M, appreciable amount of silty fines; and C, appreciable amount of clayey fines.

23. The fine-grained soils (over 50 percent smaller than the No. 200 sieve size) are divided into groups based on whether they have a relatively low (L) or high (H) liquid limit. These two groups are subdivided into M, meaning predominantly inorganic silty materials and very fine sands with little to no plasticity and low dry strength; C, meaning primarily inorganic clays with plasticity and toughness and medium to high dry strength; and O, meaning organic silts and clays with a plasticity range that corresponds with the silty inorganic materials.

24. Examples of these symbols as used in the Unified System are MH, CL, and OH. A separate symbol, Pt, is used for peat and other highly organic soils. In addition to these combinations of symbols, the system provides for dual groupings under certain conditions. The different symbols and the soils they represent are shown in table A1, appendix A, and in tables 2 and 3.

Word Description

25. An adequate word description of a soil is an essential part of the Unified Soil Classification System, not an addition to the System. Soils

may be distinguished from other soils in the same group by the use of descriptive words and phrases. Locally coined words and geological or pedological terms and phrases are often helpful in localized areas and may be given in addition to but not as a substitute for the required description.

26. The group symbols will indicate typical soils, but there are important characteristics of soils which are not fully designated by symbols yet are easily ascertained by the investigator. This is particularly important for soils that are being investigated for use in place as foundations for structures. Here the natural condition of the soil, such as its consistency or degree of compactness, its structure, and its moisture content, are of equal importance to the classification of its constituents.

Use categories

27. For residential site developments, the main purposes for which soils are investigated can be divided into three categories: (1) borrow materials for fills beneath foundations and for subgrades for roadways; (2) foundations for structures; and (3) residential sewage absorption systems.

28. The emphasis of various features to be described depends on which of the categories is involved. For such structures as streets and roads, and in the general grading of a construction site, significant quantities of soil may be excavated to reach a desired grade. In the interest of economy, use should be made of this excavated material in the construction of fills. Such areas, therefore, often become sources of materials and the investigation must take into account the dual purpose. Descriptions of soils encountered in such explorations must contain the essential information required, both for borrow material and for foundation soils.

29. Borrow materials. Soils that are potential sources of borrow material must be described adequately in the log of the exploratory test pit or auger hole. Since these materials are destined to be disturbed by excavation, transportation, and compaction in a fill, their structure (except as it relates to difficulty of excavation) is less important than the amounts and characteristics of the soil constituents. The recording of their natural moisture content is important. Very dry borrow materials require the addition of water for compaction control, and very wet soils containing appreciable fines may require expensive processing in order to be usable.

30. In many soils, excavation for borrow materials beneath the water table is difficult or requires special equipment and methods, and, consequently, logging of the position of the water table is of considerable practical importance. If cementation of the grains is present, it should be noted in the log, for cementation can present excavation difficulties. Borrow pit holes are logged so as to indicate divisions between soils of different classification groups. Within the same soil group, however, significant changes in moisture, density, and other conditions are logged.

31. Foundations for structures. When soils are explored as foundations for structures, their natural structure, compactness, and moisture content are of outstanding importance. The position of the ground water table is extremely important and should not be omitted from the log of the investigation. Logs of foundation explorations must emphasize the in-place condition of the soil in addition to describing its constituents.

32. The natural state of foundation soils is significant because ultimate bearing capacity, settlement, and swelling are subject to wide variations with conditions. Information that a clay is hard and dry, or soft and moist, is important. Differences in consistency from point to point in an area where a building is to be constructed should be shown so that these variations can be recognized in the design of the foundations.

33. Correct field classification, including a complete word description, is needed so that effects such as swelling and heave which are the result of changes in soil conditions can be anticipated. If a building is to be founded on fill on soft clay, the weight of the fill material may cause settlement of the fill under the action of the building loads and the load imposed by the fill. It is necessary, consequently, to investigate and describe the undisturbed soil at the site even though the structure will not be in immediate contact with the underlying formation.

34. Information concerning density and consistency (in both the undisturbed and the disturbed states for clays) is of such importance in many phases of soils engineering as applied to residential site developments that adjectives describing them should always be used in descriptions. Several scales are available for rating density and consistency. Appendix C, giving several examples of these scales, is included for convenient reference.

35. Residential sewage absorption systems. Soils that are potentially the absorption phase of a residential sewage system must be adequately described so that sustained absorption capacity of the soil for effluent can be predicted. Test pits or auger holes must penetrate to a depth sufficient for a reliable prediction of the absorption capacity of the area. The holes are logged so as to describe each soil group and to indicate the divisions between soils of different groups.

36. Permeable layers which are desirable for this use can be identified adequately by soil groups and supplemental descriptions. These layers must extend sufficiently either horizontally or vertically so that the quantity of effluent can be absorbed and dissipated, and the water table at its highest level must be at such a level that the soil can handle the added liquids. The description of these soils must, therefore, contain information on the extent of permeable layers, the position of these layers relative to the water table and to impermeable layers, and an estimate of the changes in water table level with the seasons of the year. In soils with an appreciable amount of binder, a description of the secondary structure is important. Soil color, particularly if mottled, should be described.

37. Certain pedologic terms relating to structure are included in appendix D, a short glossary of terms relating to soil mechanics. The use of pedologic terminology is helpful in describing the structure of soils that are potentially the absorption phase of residential sewage systems, for it is of considerable aid in interpreting percolation test data.

Tabulation of Descriptive Data

38. Table 1 lists data that are needed to describe soils for borrow materials, for foundations, and for residential sewage absorption systems. All of these descriptive data are not always needed. Judgment should be used to include pertinent information, to avoid negative information, and to eliminate repetition. The items that are indicated by R should always be reported, while those that are marked as D are usually desirable. Examples of soil descriptions are given in the classification chart, table A1, appendix A.

[illegible]

[illegible]

[illegible]

Table 1

DESCRIPTION OF SOILS

Items of Descriptive Data (1)	Coarse-grained Soils[1] (2)	Fine-grained Soils[1] (3)
Typical name (examples are shown in classification chart, table A1, appendix A)	R	R
Approximate percentage of gravel and sand	D	
Maximum size of particles (especially for soils containing cobble and boulder sizes)	R	R
Shape of the coarse grains; angularity	D	
Surface condition of the coarse grains; coatings	D	
Hardness of the coarse grains; possible breakdown into smaller sizes	D	
Color (in moist condition for fine-grained soils)	D	R
Moisture conditions (dry, moist, wet, saturated)	R	R
Drainage conditions (combined effect of runoff, soil permeability, and internal soil drainage)	R	R
Position relative to water table[2]	R	R
Percolation test results[3] (if site is in non-sewer area)	R	R
Organic content	D	D
Plasticity (of fine fraction in coarse-grained soils; degree and character for fine-grained soils)	D	R
Amount and maximum size of coarse grains (for fine-grained soils only)		D
Structure and stratification (give dip and strike; root holes; slickensides; angular blocky; etc.)	R	R
Cementation; type	R	R
Degree of compactness; loose or dense (excepting clays)	R	R
Consistency in undisturbed and remolded states (cohesive only)		R
Local or geologic name	D	D
Group symbol	R	R

Note:
1. In columns 2 and 3: R = Required information; and D = Desired information (not always required)
2. When the water table position is not determined by exploration because it exists below the elevation of the bottom of the test pit or auger hole this should be so stated. If the position of the water table is not determined because of the existence of impervious soils this should be stated. If the water table is known to exist at some general elevation in the area that is below the depth of exploration then this information may be given but must be clearly shown as only an estimate.
3. The results of percolation tests are not intended as a part of the description of a soil for routine classification in the Unified Soil Classification System. However, in a residential area without sewers these tests are nearly always necessary and a soil description without this information would be incomplete.

[illegible]

PART III: CHARACTERISTICS AND PROPERTIES OF DISTURBED SOILS

39. As was stated in the introduction, when soil groups at a building site have been identified according to the Unified Soil Classification System the characteristics of any one group cannot be considered to have definite values. Certain properties, if only poorly suited soils are available, may be improved by proper construction methods.

40. In constructing a road or a low fill as a foundation for a house slab, good percolation (internal drainage) characteristics are desirable; but, if such materials are not available locally, adequate drainage may be designed and installed if necessary, although the cost may be excessive. If soil strength is low, this may be compensated for by proper design of a fill or of the structure on the fill. If chemicals in a soil will cause certain kinds of underground conduits to deteriorate rapidly, it is possible to use some other resistant type of conduit.

41. From these examples and from the admitted variations in properties within any one soil group it is evident that the proper design of any portion of a residential building development may require evaluation of soil properties and soil uses in more detail than is possible by reference to a general soils classification system. However, the grouping of soils in the Unified Soil Classification System is such that a general indication of their behavior in residential site development problems may be obtained. This is especially true when it is applied to controlled fills, where the effects of past geologic and hydrologic influences are usually greatly reduced. It is on this basis that the behavior characteristics of soils are presented in the following paragraphs and in the classification table. When all the significant variables affecting engineering properties are identified and understood, it will then be possible to predict and control the engineering behavior of soils with more confidence and greater accuracy.

42. Controlled compaction is commonly used to vary such conditions as degree of saturation, water content, and density, each of which affects the engineering characteristics of a soil. When the fundamental properties of clay and other fine particles are altered by ion exchange, another type of change has taken place. Ion exchange with its accompanying effect on engineering characteristics is seldom attempted in residential site developments. Chemical stabilization of large masses of soil has about the same present status. In this report ion exchange and chemical stabilization of large masses are not considered. They are, nevertheless, important possibilities and should be kept in mind for the future.

General Engineering Characteristics of Soil Components

Gravel and sand

43. Both of the coarse-grained components of soil (gravel and sand) have many similar engineering properties when disturbed, differing mainly in degree. Well-graded, compact gravels or sands are stable materials. The coarse-grained soils when devoid of fines are pervious, easy to compact, little affected by hydrologic conditions, and not subject to frost action. Although grain shape and gradation as well as size affect these properties, for the same amount of fines gravels are generally more pervious, more stable, and less affected by water or frost than are sands.

44. As a sand becomes finer and more uniform, it approaches the characteristics of silt with a corresponding decrease in permeability and reduction in stability in the presence of excess water. Fine sands are more subject to bulking (increase in volume due to manipulation) than gravels.

Silt and clay

45. Even small amounts of fines may have important effects on engineering properties of the soils in which they are found. As little as 2 to 5 percent of particles smaller than the No. 200 sieve size in sand and gravel may make the soil virtually impervious, especially when the coarse grains are well graded. Less than 10 percent of fines in well-graded sands and gravels may result in serious frost heaving. Small quantities of clay added to coarse-grained materials act as a binder and improve the gravels and sands for use as a surfacing material for roads.

46. Silt. Silts are soils in which nonplastic fines predominate. They may be unstable in the presence of water and have a tendency to become "quick" when saturated in a loose condition. Silts are fairly impervious, difficult to compact, and are highly susceptible to frost heaving. Some silts or clays, such as loess, have very low density with a slight cementation holding the soil grains apart which is destroyed when the soil is saturated or compacted. A loess that has been modified by temporary immersion, erosion, and subsequent deposition may support substantial loads satisfactorily. Silts, when compacted and saturated, usually have some compressibility, and the higher the liquid limit of a silt the more compressible it is likely to be.

47. Clay. Clays are soils in which plastic fines predominate. They have low resistance to deformation when wet, and when dry they form hard cohesive masses. Clays are generally impervious, difficult to compact when excessively wet, and impossible to drain by ordinary means.

48. Permeability and drainage characteristics are modified by macrostructure in some clay formations. Macrostructure is usually of little importance in a clay that has been compacted in a fill.

49. Large expansion and contraction with changes in hydrologic conditions are characteristics of many clays. The small size, flat shape, and mineral composition of clay particles combine to produce a material that is both compressible and plastic.

50. In the Unified Soil Classification System the liquid limit is used to distinguish between clays of high compressibility (symbol H) and those of low compressibility (symbol L). Differences in plasticity of clays are reflected by their plasticity indexes. At the same liquid limit, the higher the plasticity index the more cohesive is the clay. Soft clays often exert high lateral pressures.

Organic matter

51. Organic matter in the form of partly decomposed vegetation is the primary constituent of peaty soils. Varying amounts of finely divided vegetable matter, or organic carbons resulting from decomposition are found in plastic and nonplastic sediments and have major effects on their properties. This results in organic silts and silt-clays of low plasticity, and organic clays of medium to high plasticity.

52. It is most important that organic matter be recognized in classification. Organic soils are usually dark brown or black in color and often have a noticeable odor. If a soil is suspected of being organic in nature and has no odor, heat applied to a small sample with a match will often bring out the odor. Soil samples suspected of being organic but not definitely determined as such in the field should be sent to a soils laboraory for further investigation.

53. High compressibility is the major problem where organic soils are encountered. Fibrous soils like peat cannot be compacted by any feasible means and are not usually utilized as foundation material. Fills are frequently placed over compressible, soft organic layers, and the combined weight of the fill material and the building may result in serious settlement. Structures on organic soils or on fills over organic soils must be designed with these unfavorable characteristics very clearly in mind.

Disturbed Soils at Residential Building Sites

54. General characteristics of the soil groups of the Unified Soil Classification System pertinent to disturbed soils at a residential building site are presented in table 2. Based on these characteristics and on experience, table 2 also compares the soil groups in desirability for various pertinent uses. The numeral "1" is used for the group or groups usually considered most desirable; higher numbers indicate desirability decreasing with the magnitude of the numbers. The symbols "NS" indicate that a soil group is not generally suitable for the use shown or that, in the rating of characteristics, its quality is so poor that no relative rating is assigned.

55. In the columns stating the relative ratings of the soil groups with reference to unfavorable characteristics, such as compressibility and potential frost action, it should be kept in mind that the groups which show little evidence of these unfavorable characteristics are given the lower numerical ratings; on the other hand, where groups are compared with reference to favorable characteristics, such as workability and shearing strength, the groups which show greater evidence of these features are given the lower numerical ratings. It should be clearly recognized that the numerical ratings given in the table are approximate and are intended only as a guide to aid the investigator in comparing soils for various purposes. Numerical comparisons apply only within a single vertical column.

56. It should be noted that with advantageous conditions and proper design almost any soil could be used for almost any purpose, especially for road construction and for fills for structures. An exception is in the case of a soil that is potentially the absorption phase of domestic sewage systems; here, it is difficult if not impossible to make an unsuitable soil adequate for this purpose through design. It is impossible to cover all possible considerations in the brief description of pertinent soil characteristics and uses contained in this report.

57. The various features presented in the table are discussed in the following paragraphs.

System nomenclature

58. Major divisions, group symbols, and typical names shown in the first four columns follow those assigned in the original publications defining the system. They are repeated in table 2 for convenience.

Workability and
compaction characteristics

59. Workability as a construction material. Workability of a soil is defined as a measure of the ease with which a soil is handled and traversed by ordinary construction equipment. There are many conditions that affect the workability of a soil as a construction material. Among these conditions are water content, structure, consistency, cementation and sensitivity of the soil, and such other factors as the equipment used and the position of the water table.

60. Generally the coarse-grained soils are easy to handle and equipment can traverse these soils with little difficulty. An exception to this is any fine, dry, uncemented sand, which may have undesirable trafficability characteristics.

61. The fine-grained soils, especially at high water contents, may prove difficult to traverse, for example, in excavation operations. The fine-grained soils may have good handling characteristics and trafficability at low water contents if their liquid limits are low (ML, CL and OL). Fat clays (CH) may prove to be stiff or even hard at low water

contents. The soil groups are compared for desirable workability characteristics in column 5, the more desirable ratings being the lower numbers.

62. Compaction characteristics. Some soils compact best with a crawler type tractor, some with a rubber-tired roller, some with a sheepsfoot roller, and some with a heavy vibrating roller. In some backfills, space may be so limited that smaller types of compaction equipment must be used. The selection of the proper equipment for compaction is not discussed, nor is the equipment rated. The ratings given in column 6 differentiate the soil groups with reference to the ease with which proper compaction can be obtained, with the assumption of reasonably suitable compaction equipment being used and with proper control of moisture being exercised.

63. Granular soils with little or no fines generally are easily compacted, with the well-graded soils, GW and SW, usually furnishing higher densities than the poorly-graded soils, GP and SP. Coarse-grained soils with fines of low plasticity are easily compacted with proper equipment; however, the range of moisture contents for effective compaction may be narrow, and close moisture control may be desirable for economic field operations. This is also generally true of the silty soils in the ML group. Gravels and sands with plastic fines, groups GC and SC, are fairly easy to compact, although this quality may vary somewhat with the character and amount of fines.

64. The compaction characteristics of fine-grained soils are variable. Lean clays and sandy clays (CL) are usually the better of the fine-grained soils. Fat clays and lean organic clays or silts (OL and CH) are usually fair to poor, and organic or micaceous soils (MH and OH) are usually poor.

65. The compaction characteristics of the highly organic soils, Pt, are such that compaction of these soils is not feasible.

66. In column 6, the lower numbers indicate the more desirable soils with compaction characteristics being the basis of comparison.

67. Unit dry weight. In column 7 of table 2 are shown ranges of unit dry weight of the soil groups for the standard AASHO[1] (Proctor, 3 layers - 25 blows each layer - 5.5 lb hammer - 12 in. drop) compactive effort and for the Modified AASHO[2] (5 layers - 25 blows each layer - 10 lb hammer - 18 in. drop) compactive effort. It is emphasized that these values are for guidance only and that design or construction control should be based on laboratory test results.

Shearing strength when compacted and saturated

68. Shearing strength is not an intrinsic property of a given soil, but varies over a considerable range with varying conditions, such as den-

1 ASTM Designation D 698-42 T
2 ASTM Designation D 1557-58 T

sity, moisture content, and degree of consolidation. In controlled fills, constructed from specific soil groups, such conditions as density and moisture content are fairly uniform. The shear strengths of some groups vary with the magnitude of the confining pressures and in other groups are nearly independent of confining pressures in most design situations. Other groups fall somewhere between these two extremes; at low confining pressures the shear strength is little affected and at higher confining pressures the effect of the pressures on shear strength become more pronounced.

69. Shearing strength is important in such problems as stability of slopes and in arriving at a value for the ultimate bearing capacity of soils for foundation purposes. The coarse-grained soils (G and S) have sufficient shearing strength for most purposes except in the case of excessive neutral stresses (water pressure). The fine-grained soils (M and C) when moist usually have less shearing strength than coarse-grained soils. In column 8, shearing strengths are rated so that the groups with higher shearing strengths have the lower numbers. The nature of shearing strength does not permit a numerical evaluation of the range for each soil group.

Compressibility when
compacted and saturated

70. Compressibility of a soil pertains to its susceptibility to decrease in volume when subjected to load. Volume decrease of a soil may be of two types. The first is the relatively long-term (for fine-grained soils) compression or consolidation under dead load such as the weight of a structure or the weight of the fill itself. The second is the short-term deformation and subsequent rebound which occurs under moving wheel loads when fill material is used under a roadway. Usually the long-term consolidation is not a problem within a properly designed and constructed fill; a compressible soil under a heavy fill is another matter. Even in the case of layers of compressible soil beneath a fill, if adequate provision is made for settlement of the fill during construction it will usually have little influence on the load-carrying capacity of the surface layers of the fill.

71. Some soils are elastic and will deflect under moving loads. This, of course, is seldom a problem under structures such as residences but may be a problem in road maintenance. It is fortunate that the free-draining, coarse-grained soils (GW, GP, SW, and SP), which in general make the best subbase and base materials, exhibit almost no tendency toward high compressibility or elasticity. In general, compressibility of fine-grained soils increases with increasing liquid limit, especially in disturbed soils.

72. Column 9 in table 2 shows the relative compressibility of compacted and saturated soils with lower numbers indicating soils of lesser compressibility. Soils rated 1 and 2 have negligible compressibility; 5 indicates a soil of medium compressibility; and 7 indicates a soil of high compressibility.

Expansion
potential when compacted

73. Expansion potential is related to shrinkage potential. Volume changes associated with swelling and shrinkage are likely to cause considerable distress to structures, especially to the walls and foundations of houses, and to roads in areas where large moisture variations occur in soils. Several factors influence the expansion potential of soils. The most important of these is moisture variation. Other important factors a are density, structure, and mineralogic composition. For example, some clay minerals are known to be more active than others.

74. Most investigations of swelling soils have been made on compacted samples at various initial water contents and as moisture was absorbed either the expansion or the developed pressure was measured. These investigations, as reported, are not conveniently related to the USCS except in a general way.[1]

75. Swelling pressures can be very large. Values for some expansive clays are over 10 tons per sq. ft. Controlled placement of fill will reduce the expansion potential. For the least expansion, fills of expansive clays should be placed in a wet condition and compacted lightly. However, a suitable balance should be maintained between design of a fill for minimum expansion potential and design for permissible settlement and for adequate strength.

76. If moisture conditions in a fill could be kept constant, no trouble from this source should be expected. Since this is impossible, some volume change is probable if a soil is susceptible to volume change with changing moisture content. The coarse-grained soils are usually least affected by changes in moisture content. The clays are usually most susceptible, and silts may be susceptible. Since a moisture content change is necessary for expansion to take place, soils with high liquid limits and high moisture content may have reduced activity because of reduced permeability.

77. In column 10, expansion potential for compacted soils is rated by three numbers only. Soils with little or no expansion potential are rated as 1; soils that may be susceptible to a moderate degree are rated as 2; and soils which should be suspected of possible volume change are rated as 3. It is expected that in the future it will be possible to differentiate more closely between different groups, and then additional numbers can be added to indicate the degree of differentiation.

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1 The FHA Soil PVC Meter TS 5:6 is a convenient device for determining the potential volume change (PVC) of a soil.

Permeability and percolation characteristics when compacted

78. The percolation (internal drainage) characteristics of soils are a direct reflection of their permeability. The presence of excess moisture in fill material, except for free-draining, coarse-grained soils, may cause loss of strength. The moisture may come from the infiltration of rain water or as a result of capillary rise from an underlying water table, or the moisture used in compaction may cause excess water pressures under certain conditions. While free-draining materials permit rapid draining of water, they permit rapid ingress of water also, and if such materials are adjacent to less pervious materials and have free access to water they may serve as reservoirs to saturate the less pervious materials.

79. It is obvious, therefore, that in certain circumstances adequate drainage systems should be provided. In situations where high permeability is desired, the gravelly and sandy soils with little or no fines (groups GW, GP, SW, and SP) have excellent percolation characteristics. The GM and SM groups have fair to poor percolation characteristics, whereas GC and SC groups may be practically impervious. Soils of the ML, MH, and Pt groups have medium to low permeability. All of the other groups have medium to low permeability or are practically impervious. Drainage systems become increasingly important for the less pervious soils.

80. The ranges or lower limits of the coefficient of permeability for the soil groups are given in column 11, in addition to a word description of the permeability rating. The permeability of a soil depends on several factors, including the size and shape of the soil grains, grain orientation, soil structure, degree of compaction, and the viscosity of the fluid. In compacted fills, natural grain orientation and soil structure are presumably destroyed, but the layers of soil which make up the fill are likely to give a different permeability in the horizontal direction than that which might be measured in the vertical direction. The permeability in the direction parallel to the layers is usually larger than that in the direction perpendicular to the bedding.

81. Percolation characteristics and coefficients of permeability have general applications to all phases of construction at a residential building site, but perhaps the most direct use is in selecting soils for the absorption phase in a domestic sewage disposal system. These characteristics are the paramount ones to be considered for this use.

Potential frost action

82. Frost action includes the heave caused by ice lenses forming in a soil and the subsequent loss of strength as a result of excess moisture during thawing periods. Some soils are more susceptible to frost action than others.

83. In addition to a susceptible soil, two other conditions must exist for frost action to become a major consideration. These are a source of water during the freezing period and a suitable temperature gradient which exists long enough for freezing temperatures to penetrate the ground. Water necessary for the formation of ice lenses may become available from a high ground-water table, capillary supply, water held within the voids of the soil, or through infiltration.

84. The degree of ice formation that will occur in any given case is markedly influenced by environmental factors such as surrounding topography, elevation, cyclic repetition of the freezing process, available supply of water, and drainage conditions. Temperature variations induced by various insulators and sources of heat may reduce frost action in a given case.

85. In general, the silts and fine silty sands are the worst offenders as far as frost is concerned. Coarse-grained materials with little or no fines are affected only slightly if at all. Clays (CL and CH) are subject to frost action, but the loss of strength of such materials may not be as great as for silty soils. Inorganic soils containing less than three percent of grains finer than 0.02 mm. in diameter by weight are generally nonfrost-susceptible. Fines with low plasticity indexes are usually more susceptible than those with high indexes.

86. If conditions are expected that would make frost action possible, the most desirable procedure is to remove any susceptible soil and replace it, to the depth of frost penetration, by a soil which is not susceptible. If this is uneconomical the design of any associated structure should be based on the reduced strengths and on the heave that must be expected. For residential buildings, susceptibility of the soil to frost action may indicate that a house with a basement is preferable to one constructed on a slab foundation; foundations that are below the frost line should not heave in any soil except under unusual conditions. In many cases, proper drainage methods to prevent the accumulation of water in the soil pores will greatly reduce frost action potential.

87. Column 12 rates the soil groups according to potential frost action. If the potential is non-existent or very slight the rating is 1; if it is very high the rating is 5.

Corrosion potential

88. Some soils tend to cause corrosion in underground conduits or pipes placed in them. The corrosion potential depends on chemicals in the soil, usually dissolved in the soil moisture, and on the material from which the conduits are made. The presence of these chemicals cannot always be predicted, but experience has shown that it is influenced by the composition of the grains, among other things. If the grains of a soil are composed of organic material, then organic acids in the soil water should be expected. Other chemicals that are undesirable because of corrosive abilities on some conduits are dissolved sulfate and chloride salts.

89. Among the tests that are available for testing for corrosive chemicals in soils are electrical resistivity tests and pH tests (acidity or alkalinity tests). Corrosion potential is usually associated with the plastic fines in a soil, with the organic soils having a higher potential than other plastic soils.

90. In column 13, soils that are ranked as 1 have a low potential and those ranked as 4 are considered to have high potential for corrosion of underground conduits.

Relative desirability
<u>of fills for roadways</u>

91. <u>Subbase or base materials</u>. In columns 14 and 15 the soil groups are rated as to relative desirability as subbase and base materials, provided they are not subject to frost action. In areas where frost heaving is a problem, the value of materials as subbases will be reduced, depending on the potential frost action of the material, and the relative desirability changes to those shown in column 16. In each of these columns the smaller numbers indicate the more desirable soils.

92. Usually non-frost susceptible soils are preferred for base courses in areas where frost heave is a problem. Proper design procedures should be used in such situations. The coarse-grained soils in general are the best subbase and base materials. Poorly-graded gravels and some silty gravels, group GP and some soils in the GM group, are usually only slightly less desirable as subbase materials, and under favorable conditions are usable as base materials; however, poor gradation and other factors sometimes reduce the value of such soils to such an extent that they offer only moderate strength and their value as a base material is less. The light loading expected on residential streets does not make this a serious defect.

93. The GC and SW groups are reasonably good subbase materials but are not as desirable as base materials as other groups. The SP and SM soils usually are considered good to adequate subbase materials and under favorable conditions may be used as base materials. The SC soils are fairly good subbase materials. With proper design, pavements may be constructed on any of the remaining soils, including SC, but they are much less desirable as base courses than are the groups mentioned above.

94. The fine-grained soils range from a fair relative desirability rating to that of the least desirable; the highly organic soils, Pt, are not suitable for use in a fill. The lower qualities represented by the fine-grained soils are compensated for in flexible pavement design by increasing the thickness of overlying base material, and in rigid pavement design by increasing the pavement thickness or by the addition of a base course layer.

95. <u>Wearing surface (untreated)</u>. For wearing surfaces on unsurfaced roads sand-clay-gravel mixtures (GC) are generally considered the most satisfactory. However, for best results they should not contain too

large a percentage of fines and the plasticity index should be in the range of 5 to about 10. Other soil groups are rated in column 17 in order of decreasing desirability for this use.

Surface stabilization with additives

96. The stabilization of surface soils, as in low-cost road construction or underneath a foundation slab, makes the effect of mechanical stabilization through compaction more lasting. Untreated fills may abrade more or less rapidly under traffic or soften and disintegrate as a result of wetting and drying or freezing and thawing. Stabilization by additives usually adds materially to the strength of the treated layers. Some additives, such as Portland cement, lime, and bitumen, are often economically feasible, while others, such as resins and gels, are at present usually expensive. However, with technological improvements these additives may become more useful under ordinary conditions. In general, soils that are predominantly coarse-grained show very marked hardening under proper chemical treatments; silty soils show marked hardening; clayey soils show substantial hardening; and peaty, highly organic clays and fat clays cannot be economically treated.

97. Difficulties of mixing additives in the soil become more pronounced with the more clayey soils. The relative effectiveness of stabilization with additives of the surface of fills is rated in column 18 with the soil groups most effectively stabilized given the rating of 1. It should be noted that ratings are based almost entirely on stabilization with Portland cement.

Fill as foundations for low buildings

98. Suitability of properly compacted soils for foundations of low buildings (up to and including three stories are considered as low buildings) is primarily dependent on the strength and consolidation characteristics of the fill material, but the effects of the characteristics of the subsoil on which the fill is placed may control.

99. The ability of the subsoil to satisfactorily carry the load imposed by the building and the fill should be given due consideration. For the average residence it will be found that roughly each 2 ft. of fill depth beneath the house weighs as much as the house itself. For deep fills, it will be found that the weight of the residence is only a small percentage of the total weight on the subsoil and foundation rock. Landslides involving the fill, the subsoil, and the foundation rock are often associated with deep fills. The effects of the subsoil on fill behavior and the possibilities of landslides associated with fills are beyond the scope of this report. See paragraph 163.

100. Usually properly compacted fills will have sufficient strength to support the relatively light loads from low buildings. Even though a fill may be properly compacted and have sufficient strength for its purpose, there may be some subsidence as a result of consolidation. For most

soil groups subsidence as a result of consolidation is usually of a tolerable magnitude; however, organic soils, OL and OH, may have large settlements as a result of consolidation even though they were compacted in the filling operation and are usually unsuitable for use in fills.

101. When disturbed soils of the CL, CH, and OH types are compacted in fills and used as foundations for low buildings, there is danger of expansion under unfavorable climatic conditions. Discussions under paragraphs 73 through 77 should be given careful consideration when these soils are used.

102. Some of the other soil groups have other peculiarities that should be considered when contemplating their use as fills to support low buildings. Uniformly graded soils of the SP and SM groups and some soils in the ML group, if below the water table, may become "quick" or liquify during construction operations if they are loose. Highly organic soils, Pt, are so difficult to compact that they are seldom, if ever, suitable for load supporting fills.

103. In column 19 the soil groups are rated according to relative desirability as foundation materials with the most desirable soils being given the rating of 1. Each soil group is assigned a different number, but the difference between the desirability of the GW group (1) and the SC group (5) is small, whereas the difference in desirability increases rapidly for higher numerical ratings. These ratings cannot take into account the effects of subsoils and slope stability factors.

Relative desirability for water and sewerage purposes

104. Columns 20, 21, and 22 of table 2 carry ratings of the relative desirability of the soil groups for several uses of interest in sanitary engineering problems. The ratings given in column 19 for low buildings apply equally as well for sanitary engineering structures such as water and sewage treatment plants of the dimensions ordinarily found in residential site developments. In the case of exceptionally heavy loads, such as might occur under stand-pipes and water storage tanks, the ratings apply in a general way but the type of structure and the type of foundation have such a large influence that the soils in the groups cannot be successfully rated. Each case must be analyzed individually.

105. Low berm for sewage lagoons. Low berms (usually less than 6 ft. in height) for sewage lagoons are usually constructed of more or less homogeneous materials found at the site. For satisfactory functioning of a sewage stabilization pond the evaporation and seepage losses must not exceed the total amount of incoming sewage; consequently, the embankment (as well as the bottom of the pond) should be relatively impervious for economical construction. Almost any soil can be used if the embankment is made wide enough. Since a reasonable width is desirable (a minimum crest width is often taken as that width which will permit the passage of a vehicle for convenient maintenance), permeability and percolation characteristics as well as stability or strength are important in rating soil groups for this use. The natural soil underneath

a proposed embankment should be considered in planning and design, for seepage may occur through this region even though the berm is constructed of relatively impervious materials. Natural, undisturbed soils as related to sewage lagoons are discussed in part IV.

106. Again, the important factors in rating soil groups for use in a berm are stability and permeability. Compaction characteristics are not as important for this use as they might be for other purposes since density requirements for lagoon embankments are seldom as stringent as those for, say a load-carrying fill. Controlled compaction is desirable, but uncontrolled compaction is not uncommon. Some groups with good stability are pervious. Those groups having a combination of good stability and low permeability are most desirable. The soils which best fulfill these requirements are the GC, SC, GM, and SM groups. The ML, MH, CL, and CH groups should be satisfactory when used in combination with the above groups. The clay and silt groups, when used alone, may be found lacking in stability and subject to erosion, and consequently they may require excessive maintenance.

107. If it is found that the commonly available soils at a site are so permeable that a core of impermeable material is required for economical construction, then the GC, SC, CL, and CH groups may be expected to be suitable core material.

108. Lack of stability and organic content generally decrease the desirability of the organic and highly organic soil groups so that they are seldom used for sewage stabilization pond embankments, except under special circumstances.

109. Column 20 gives the relative desirability of the soil groups for use as low berms for sewage lagoons. Permeability and stability are both considered. In this column, as in pervious columns, the lower the numerical rating the higher the relative desirability is.

110. Compacted earth lining for water storage reservoirs and sewage lagoons. Water storage reservoirs and sewage lagoons constructed on pervious soils, such as those from the GW, GP, SW, and SP groups, may lose large quantities of liquids as a result of seepage through the bottoms and sides of the storage areas. The quantity of seepage usually can be materially reduced by compacted linings of less pervious materials. The effectiveness of such linings is related, of course, to the permeability of the soil which is lined or sealed. For example, if the bottom of a storage area was composed of silt soils, sealing it with one of the gravelly soils would not have much effect on seepage but it might be quite useful in preventing erosion.

111. In situations where sealing a storage area against seepage is the most important consideration, the GC, SC, CL, and CH groups will usually be the most desirable soils for lining purposes. If reduction in seepage quantities and protection from erosion are of equal consequence, then the GC and SC groups will be found to be best suited for these purposes. If protection from erosion with a lesser reduction in seepage is a satisfactory aim, then the GM and SM groups may be utilized in addition to the GC and SC groups.

112. The relative desirability of the soil groups for compacted linings is based on both permeability and resistance to erosion. These ratings are shown in column 21, with the more desirable soils for this purpose having the lower numbers.

113. Domestic sewage disposal area. In column 22 the soil groups are rated according to relative desirability for use as the absorption phase of a domestic sewage disposal system. Such installations as disposal beds or trenches for the disposal of the effluent of septic tanks are considered. Disposal pits, while unlikely in a fill area, may be necessary because of unsuitable permeability of the fill material combined with advantageous characteristics of the subsoil. Disposal pits must be designed on the basis of a thorough site investigation which may include a test boring at the proposed site, and pits are not considered in this rating.

114. Fill areas are generally not suitable for use as a domestic sewage disposal area, but when a development is to be on disturbed soil in a non-sewer area some well designed and well constructed fills of coarse-grained, free-draining soils (GW, GP, SW, and SP) may be suitable for this purpose, provided the underlying formations are at least as permeable as the soil in the fill. These soils are rated 1 in the table.

115. It is unlikely that fills constructed of fine-grained soils can be used as a domestic sewage disposal area, and these are rated as not suitable in column 22. Some groups will require appropriate tests before it can be determined whether or not they are suitable. These soils are rated 2 in the table. In deciding upon the desirability of a particular fill for a disposal area such conditions as position and fluctuations of the water table, characteristics of the soil under the fill, and topography must be considered.

Additional Site Problems Involving Disturbed Soils

116. Many site problems involving fill material do not lend themselves to tabulation in the Unified Soil Classification System. Generally they are problems of engineering analysis.

117. Two of these problems are mentioned here as examples. First, the effects which may be attributed to a composite system of a fill placed on undisturbed soil must be analyzed from the point of view of the combined effects of the two materials. Structures which are located partly on a fill material and partly on undisturbed material present another facet of this same problem. Second, the stability of slopes and criteria for recommended stable slopes require engineering analysis. Conditions are so important here that they overshadow the characteristics attributable to the soil components which are the basis of the Unified Classification System. Then, again, this second problem cannot be entirely divorced from the first mentioned above.

118. Existing fills constructed with uncontrolled compaction must, of course, be individually investigated and the properties of the fill determined therefrom. The investigation is usually expensive, and the properties are usually poor.

PART IV: CHARACTERISTICS AND PROPERTIES OF UNDISTURBED SOILS

Influence of Conditions and Environment

119.The characteristics and properties of natural, undisturbed soils depend so much on local conditions, environment, and past geological history of the formations that any attempt to tabulate or rate them is fraught with great difficulties. Such an attempt would be apt to result in an exceedingly cumbersome text and in tables that would be of limited value because of wide variations in properties and numerous exceptions which would exist as a result of influences not directly accounted for by the Unified Soil Classification System.

120. As an alternative approach, the following paragraphs point out the critical situations that can occur as a result of combinations of condition and environment for each of the soil groups in the Unified Soil Classification System. This does not mean that the Unified System cannot be used with undisturbed soils. It can and should be used to classify the soils, and the adequate word description is most necessary in communicating information about the soil profile.

Characteristics of Uniform Formations

Coarse-grained soils

121. The coarse-grained soils are usually the most desirable soils for most engineering purposes at a residential site development. The value of these soils depends a great deal on the relative density of the formations. Loose soils can settle dangerously if vibrated. Non-uniform density can cause unequal settlements. Usually, with moderate density, the strength of these soils is sufficient to carry any load from structures ordinarily found in residential areas; if there is a limit on loads it will usually be imposed by allowable settlement.

122. Poorly graded fine sands and silty sands (SP and SM) are more affected by density than others in the coarse-grained groups; if below the water table and loose they may become "quick" and flow during excavation operations and may result in lost ground in the surrounding area if proper dewatering techniques are not utilized.

123. Usually a simple penetration test will yield sufficient results for evaluating the density of coarse-grained soils. Sometimes a portion of the resistance to penetration can be attributed to cementation of the grains. The density of loose formations can usually be increased by any one of several methods which involve vibration of the formation. Position of the water table and degree of saturation are also desirable information if excavation is contemplated

124. When the free-draining soils (GW, GP, SW, and SP) are to be used for sewage disposal areas, a high water table can prevent effici-

ent absorption and distribution of effluents unless the groundwater has noticeable velocity. In the silty or clayey sands and gravels (GM, GC, SM, and SC) cementation is not unusual, and this impairs their use for sewage disposal purposes. Percolation tests are needed to determine the value of these less permeable coarse-grained soils.

125. The clayey gravels and sands (GC and SC) are generally sufficiently impermeable for use as the bottom of water storage reservoirs or sewage stabilization ponds. The silty gravels and sands (GM and SM) may be suitable for this purpose but excessive seepage may be a problem in the more pervious of these soils.

Fine-grained soils

126. Silts. The density, water content, degree of saturation, and position of the water table are of extreme importance in silt formations and deposits. The density of these formations can be fairly well determined by simple penetration tests. Loose or soft silts are often unsatisfactory for the direct support of foundations. Deep beds of silt, often more or less organic, are encountered near the present or former shores of oceans and lakes and in the beds of present or ancient rivers. Formations of residual silts are common in some areas. When these formations are below the water table and have never had the opportunity to become dried, they are likely to be as soft and compressible as normally loaded clays near the liquid limit.

127. The non-plastic silts and silts of low plasticity (ML) may liquify easily if saturated and flow as a viscous liquid. Some silts, on the other hand, are relatively stable even with a low density if there is a clay binder present. Silts requiring stabilization during excavation operations of a temporary nature may sometimes be stabilized by the well-point method or even by freezing, but this is expensive.

128. Erosion is a major problem for slopes on silts. Slopes on loose silt or cuts made in silts are subject to slides if they become saturated. The difficulties of excavation increase with decreasing plasticity of the silt, if saturated. Some rock flours (non-plastic, inorganic silts) have become notorious for their troublesome characteristics and are known locally as "bull's liver."

129. Excavation below the water table in loose plastic silts (both ML and MH) is likely to result in considerable loss of ground and settlement of the adjacent ground surface caused by drainage of the silt and the accompanying consolidation. This may not be serious in shallow excavations. Silt deposits are the most susceptible of all soil deposits to frost heave and subsequent loss of strength on thawing, provided sources or water and low temperatures are available.

130. Silts vary widely in their desirability as soils for domestic sewage disposal areas. The presence of a well developed, water-table structure greatly improves their value, particularly if the structure is of a blocky nature. Loose or soft silts may be troublesome from a trench construction viewpoint, and they often give trouble by infiltration of silt into the prepared gravel beds of the disposal area.

131. Loess is silt or clay deposited as a result of wind action. The characteristics of true loess deposits are likely to be extremely different from those of waterlaid silts. On account of the calcareous binder present (a clay binder sometimes occurs) in most loess deposits, the material is likely to have appreciable cohesion with a relatively low density. It may be capable of sustaining loads of several tons per square foot without appreciable settlement. However, the quality of the binder or cementing material is likely to differ from point to point, partly on account of erratic variations in the leaching action of groundwater. Hence, the strength of the deposit is likely to vary widely within short distances.

132. Deep profiles of loess have a tendency towards a well developed pedological structure and are often permeated by roots and root holes. Under these conditions loess may make a good sewage disposal area.

133. Deposits of true loess are unsaturated. If they become saturated some of the binder is likely to dissolve or soften, and the deposit may lose its cohesion. In this event the structure of the soil collapses, and the void ratio (see appendix D) decreases significantly. This is likely to cause settlement of the ground surface irrespective of the loads on the soil and failure of sewage absorption fields in the loess. Cuts in loess require special consideration. They should be made almost vertical, otherwise they will slough to an almost vertical face with subsequent weathering.

134. Once the characteristics of undisturbed, wind deposited, true loess have been destroyed, the material behaves like an ordinary slightly plastic silt. Upon completion of a footing or slab foundation on loess, special precautions must be taken to insure that the water table will not be raised or the loess become saturated by any subsequent activities. In a number of instances, small structures founded on loess in semi-arid climates have settled on account of saturation of the subsoil caused by sprinkling or irrigation required to maintain lawns or landscaping. In other instances accumulation of water from other sources beneath structures have led to large subsidences.

135. Ordinary silts (including re-deposited modified loess) can be used for foundations in a residential site development even though they require closer attention than the coarse-grained soils. Footings and slabs with design bearing values of several tons per square foot have been successfully constructed. Silts, in general, are less desirable for foundation soils than are the coarse-grained soils. Some silts require expert investigation and analysis.

136. Inorganic clays. The ultimate bearing capacity of clay formations depends primarily on the shearing resistance of the clay. Secondary structural characteristics such as hair cracks and slickensides will reduce the overall shearing strength of a formation in soils where they occur. These same characteristics indicate increased permeability (at least until swelling occurs which would close the channels), and this may result in increased value of the soils for domestic sewage disposal areas. The unconfined compressive strengths and the shearing strengths of clays can be roughly estimated on the basis of penetration tests (see appendix C) or vane tests.

137. Medium to hard clays usually can be used in a residential development as a foundation material without concern for its load-bearing capacities. With the relatively low loadings associated with residences there may be some consolidation of the clay with consequent subsidence; with proper design of the foundation it is not likely to be intolerable.

138. Deep fills on clays may result in high loadings from the weight of the fill and the structures on it. In this case engineering analysis may be required.

139. Clays in the CL group will generally compress less than the clays in the CH group if the two groups have similar loading histories. For clays identified as belonging to the same group, those with very soft or soft consistencies in the undisturbed state may be expected to compress more than those with stiffer consistencies. With proper design of the foundations of a structure a clay of almost any consistency can be used.

140. If channels exist for the flow of fluids in a clay formation as a result of its structure, these channels may be sealed off by the fine-grained ingredients of the formation if the soil is manipulated such as when a cut is made in the excavation of a trench or bed for a sewage absorption area. The highly plastic clays with high moisture content are most susceptible to this type of action. Clays that originally may have had appreciable absorption capacity may become almost impermeable after slight surface disturbance at an interface. This characteristic, along with generally low permeability, limits the value of such soils for use as the absorption phase of a domestic sewage disposal system, but it increases the desirability of these soils for use as the bottom of water storage reservoirs or sewage lagoons.

141. Clays of the CL group with a low degree of saturation may be expansive if they are subject to wide fluctuations in moisture content. It is noted that merely placing a structure on a soil will induce a change in the moisture content.

142. Soils that are hard and dry are potentially the most expansive of any of the soils in the CL group. Clays with a high moisture content are not as subject to expansion but they may be subject to shrinking. Any clay that has a plasticity index greater than 15 may be an expansive clay if it is subjected to wide changes in moisture content. Clays of high compressibility (CH) are nearly all potentially expansive clays but reduced permeability may decrease the magnitude of moisture change and thus reduce the tendency for rapid swelling or shrinking.

143. In expansion and shrinking as in other types of movement small differential movement is usually more damaging than larger uniform movement. A system of surface drainage that will insure uniform drainage and will carry off surface water rapidly is usually most desirable. In the usual residential site development it is not economical to try to improve the consistency of a clay deposit, but adequate drainage systems help.

144. Percolation tests for appraising expansive soils for use as the absorption phase of a domestic sewage disposal system must be carefully conducted. The soils must be at a moisture content and in an expanded condition similar to that which will exist under use conditions. This

means that generally they must be saturated and the saturated condition must be maintained for a sufficient time for expansion to take place.

145. The color of clay subsoils is an excellent clue to their value for sewage disposal. Mottled coloring or dull grey coloring of a clay is a strong indication of poor internal drainage and thus poor soils for use as an absorption area for a domestic sewage disposal system.

146. Organic clays. The comments contained in the above paragraph generally apply to organic clay formations (OL and OH). In general, organic clays are more compressible than inorganic clays and foundations of these formations must be designed to take this into account. If a formation of organic clay of high compressibility is shallow it may be economical to remove such soils from the foundation area and use a more desirable subsoil or backfill with more suitable soils. It is not unusual for organic soils to be covered with a fill of other soil in order to distribute building loads evenly through the organic soils. In this case the combined weight of the fill and building loads must be considered in estimating settlements. These soils are not likely to be suitable for use as the absorption phase of a domestic sewage absorption system because of their low permeability and poor internal drainage.

Highly organic soils

147. The highly organic soils (Pt) are generally very poor foundation materials. However, if a soil of the Pt group is well consolidated it is possible to design satisfactory foundations for it. Usually the peaty soils are so compressible that large settlements should be anticipated unless loads are transmitted through these soils to some more resistant layer. Highly organic soils are often found in low, swampy areas and, as a result, they may be filled over to bring the area up to grade. Here the peat must carry not only the load of the buildings but also the weight of the fill, and large settlements may be expected. If possible, it is advisable to avoid highly organic soils for foundations.

Characteristics of Nonuniform Formations

148. Many formations consist either of definite strata or of more or less lenticular elements. Some of the components of the formation may consist of fairly desirable material, whereas others may be relatively undersirable because of some of the conditions mentioned above. On the basis of preliminary investigations one can usually conclude at once whether some parts of the deposit are of such quality as to be of no further concern. Attention can then be focused on the weaker, more compressible or otherwise less desirable members. Nonuniform formations can be investigated and identified according to the Unified Soil Classification System. The characteristics of the individual strata can be estimated on the basis of the descriptions given above for uniform deposits and the results combined and modified to indicate the behavior of nonuniform deposits.

Word Description of Undisturbed Soils

149. An adequate word description as outlined in part II and tabulated in table 1 is a basic step in classifying undisturbed soils. An adequate description will permit the trained observer to anticipate many of the problems that can arise with undisturbed soils.

Undisturbed Soils at Residential Building Sites

150. General characteristics of the soil groups of the Unified Soil Classification System pertinent to undisturbed soils at a residential building site are indicated in table 3. Based on these characteristics and experience, table 3 also compares the soil groups according to desirability for various pertinent uses. The numeral "1" is used for the group or groups usually considered most desirable; higher numbers indicate desirability decreasing with the magnitude of the numbers. Numerical comparisons apply only within a single vertical column. It should be clearly recognized that the numerical ratings are highly approximate and are intended only as a guide to aid the investigator in comparing soils for various purposes; conditions and environment will often make different numerical sequences not only desirable but necessary.

151. In table 3, columns 1 and 2 show the group symbols and the names of the soil types. Column 3 refers to text paragraphs which are applicable to various soil formations. Columns 4 through 9 rate the relative desirability of the soils for various uses at a residential building site and show the following: column 4, roadway subgrade when not subject to frost action; column 5, roadway subgrade when subject to frost action; column 6, foundations for low buildings when the soil formation is either dense or hard; column 7, foundations for low buildings when the soil formation is either loose or soft; and column 8, domestic sewage disposal area (absorption phase for liquid effluent from septic tanks); and colum 9, site for unlined reservoir or unlined sewage lagoon. The various features presented are discussed briefly in the following paragraphs.

Significant features

152. The influence of conditions and environment and an indication of the characteristics of the various soil groups when found in uniform formations are indicated in column 3 by references to applicable paragraphs in the text. The characteristics of the soil groups in the disturbed state (part III) should be reviewed for comparison.

Relative desirability for roadway sub-grade

153. Columns 4 and 5 rate formations of the various soil groups as subgrades for roadways under conditions where frost action is not possible and where frost action is possible. The more desirable soils under each condition are given the lower numerical ratings.

Relative desirability for foundations

154. Columns 6 and 7 rate deposits of the various soil groups as foundations for low buildings (up to and including three-story buildings). Column 6 shows the relative desirability of dense noncohesive soils or hard cohesive soils while column 7 rates the groups when they are loose or soft. The relative ratings are greatly influenced by conditions as will be noted by referring to the references listed in column 3. The relative ratings apply to low buildings for sanitary engineering structures as well as they do to residences.

Domestic sewage disposal area

155. In column 8 of table 3 the soil groups are rated according to relative desirability when formations of these soils are used as the absorption phase of domestic sewage disposal systems. Such installations as disposal beds or trenches are considered. Pits are not included in this rating. If a formation is uniform and is of a free-draining material, a shallow pit may be quite satisfactory. If the formation is nonuniform and the top layer is not suitable for other common methods of disposal then a site investigation must be made. It is noted that the successful use of pits in the local area may be sufficient indication but this can not be depended on in many cases.

156. The various conditions that affect permeability of natural formations will affect the value of a formation for use for absorption of liquids. The permeability in a direction parallel to the bedding may be many times that in directions perpendicular to the bedding. Such secondary structural features as root holes, shrinkage cracks and tension or shear cracks may give misleading values of the permeability when the soil is tested in place.

157. The coarse-grained soils (GW, GP, SW, and SP) which are rated 1 in the table are probably suitable as disposal areas. Those soils rated 2 will probably require percolation tests to determine whether or not they will be satisfactory. Such tests should be conducted by experienced personnel who are able to take into account the condition of the soil at the time of the test. Formations that are rated NS (CH, OH, and Pt) are not likely to be satisfactory for use as the absorption phase of a domestic sewage disposal system.

Reservoir or sewage lagoon site

158. The most desirable soils on which to construct an unlined water reservoir or an unlined sewage lagoon are formations composed of the GC, SC, CL, or CH soil groups. These are likely to be impervious enough to prevent damage to the functioning of the storage area which can occur as a result of seepage. These soils are usually satisfactory when they occur as uniform deposits or when they occur in combination

with each other. These impervious soils are assigned the lower numbers in the rating given by column 9.

159. Formations composed of groups with a silt component (MH, ML, GM, or SM) are less desirable than more impervious groups for use as the bottom of ponds or reservoirs, but they may be satisfactory when they occur in conjunction with layers of less permeable soils. The GM and SM soil groups have generally better resistance to erosion than do the ML and MH groups.

160. Layers which are composed of the GP, GW, SP, or SW soil groups are usually quite permeable and are not suitable for the average installation unless some means is provided for reducing seepage, such as a liner or sealer of impervious materials. These soil groups are rated not suitable, NS, in column 9 of table 3.

161. Organic content combined with questionable permeability cause deposits of organic and highly organic soils to be relatively undesirable for reservoir or lagoon installations. They are seldom used for this purpose except under special circumstances.

162. Numerical ratings are approximate and are intended only as a guide to aid the investigator in comparing various soils for a stated purpose. For example, a few instances have been reported where sewage stabilization ponds have been constructed on "sand and gravel" (sic) areas with the anticipation that the algae growths and sewage solids would in time cover the sides and bottom of the pond and would thereby considerably reduce the seepage losses. One such installation did in fact perform as anticipated, but the reduction in seepage was not sufficient to prevent contamination of the local ground water with undesirable chemicals. This statement should be clarified, perhaps, by adding that at this installation the seepage was gradually decreased to a point such that essential biological processes could be successfully maintained, but the quantity of seepage was not reduced to a rate that would preclude noticeable contamination of the local ground water by certain chemicals that are commonly found in household wastes. This particular installation was abandoned after about a year of operation. Can formations with semi-pervious drainage characteristics be used as the site for a storage area? They might be successfully used under certain special conditions; ratings of soil for this use must be tempered by engineering experience and judgment.

Additional Site Problems Involving Undisturbed Soils

163. There are many site problems involving undisturbed soils that are problems in soil mechanics and do not lend themselves to tabulation in the Unified Soil Classification System. These are soil problems of design and analysis. The complications of nonuniform deposits, which is a widespread problem, have already been mentioned in paragraph 148. The stability of slopes, either natural slopes or slopes that are the result of cuts, requires engineering analysis. Usually if cuts are made at slopes which are common in the local area there will be no trouble with slides; there may be many exceptions to this rule as a result of localized conditions. Landslides on natural slopes are a pressing problem in many areas. This, too, is a problem of engineering analysis.

TABLE 2

DISTURBED SOILS AT RESIDENTIAL BUILDING SITES

MAJOR DIVISIONS (1)	(2)	GROUP SYMBOLS (3)	TYPICAL NAMES OF SOIL GROUPS (4)	GENERAL CHARACTERISTICS[1]: Workability as a Construction Material (5)	Compaction Characteristics (6)	Unit Dry Weight lb per cu ft (7) Std.AASHO	(7) Mod.AASHO	Shearing Strength when Compacted and Saturated (8)	Compressibility when Compacted and Saturated (9)	Expansion Potential when Compacted (10)	Permeability and Percolation Characteristics when Compacted cm per sec (11)	Potential Frost Action (12)	Corrosion Potential (13)	RELATIVE DESIRABILITY FOR VARIOUS USES[1]: Roadways: Sub-base when not Subject to Frost Action (14)	Roadways: Base when not Subject to Frost Action (15)	Roadways: Sub-base when Subject to Frost Action (16)	Roadways: Wearing Surface (untreated) (17)	Surface Stabilization with Additives (18)	Foundations: Low Buildings on Compacted Fill (19)	Water and Sewage Purposes: Low Berm for Sewage Lagoons (less than 6 ft) (20)	Water and Sewage Purposes: Compacted Earth Lining for Water Storage Reservoirs and Sewage Lagoons (21)	Domestic Sewage Disposal Area[2] (22)
COARSE-GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	1	1	125-135	125-140	1	1	1	$K > 10^{-2}$ Pervious	1	1	1	1	1	3	1	1	NS	NS	1
		GP	Poorly graded gravels or gravel-sand mixtures little or no fines.	2	2	110-125	110-140	2	1	1	$K > 10^{-2}$ Very pervious	1	1	3	2	3	4	2	2	NS	NS	1
		GM	Silty gravels, gravel-sand-silt mixtures.	2	4	115-135	115-145	5	2	1	$K = 10^{-3}$ to 10^{-6} Semi-pervious to impervious	2-3	1	4	2-4	6	5	1	3	2	4	2
		GC	Clayey gravels, gravel-sand-clay mixtures.	2	3	115-130	120-145	6	3	2	$K = 10^{-6}$ to 10^{-8} Impervious	2-3	2	4	3-4	5	1	2	4	1	1	2
	SANDS AND SANDY SOILS	SW	Well-graded sands, gravelly sands, little or no fines.	1	1	105-120	110-130	3	1	1	$K > 10^{-3}$ Pervious	1	1	2	2	2	5	1	2	NS	NS	1
		SP	Poorly graded sands or gravelly sands, little or no fines.	3	2	100-120	105-135	4	1	1	$K > 10^{-3}$ Pervious	1	1	5	2-4	4	5	1	4	NS	NS	1
		SM	Silty sand, sand-silt mixtures.	3	4	100-125	100-135	7	3	1	$K = 10^{-3}$ to 10^{-6} Semi-pervious to impervious	4	1	6	3-5	8	6	2	4	4	5	2
		SC	Clayey sands, sand-clay mixtures.	2	3	105-125	110-135	8	3	2	$K = 10^{-6}$ to 10^{-8} Impervious	4	2	6	5	6	2	2	5	3	2	NS
FINE-GRAINED SOILS	SILTS AND CLAYS LL IS LESS THAN 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	3-4	4-6	85-115	90-125	9	4	2	$K = 10^{-3}$ to 10^{-6} Semi-pervious to impervious	3-5	2	8	NS	10	NS	3	7	6	6	NS
		CL	Inorganic clays of low to medium plasticity gravelly clays, sandy clays, silty clays, lean clays.	3	4	90-120	90-130	9	5	3	$K = 10^{-6}$ to 10^{-8} Impervious	3-4	3	7	NS	7	7	4	6	5	3	NS
		OL	Organic silts and organic silty clays of low plasticity.	4	7	80-100	90-105	9	6	3	$K = 10^{-4}$ to 10^{-6} Semi-pervious to impervious	3-4	4	9	NS	11	NS	5	8	8	7	NS
	SILTS AND CLAYS LL IS GREATER THAN 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	4	4-8	70-95	80-105	10	6	2	$K = 10^{-4}$ to 10^{-6} Semi-pervious to impervious	3-5	2	10	NS	12	NS	5	9	9	8	NS
		CH	Inorganic clays of high plasticity, fat clays.	5	4-7	75-105	85-115	10	7	3	$K = 10^{-6}$ to 10^{-8} Impervious	3	3	11	NS	9	NS	6	8	7	7	NS
		OH	Organic clays of medium to high plasticity, organic silts.	5	8	65-100	75-110	10	7	3	$K = 10^{-6}$ to 10^{-8} Impervious	3	4	12	NS	13	NS	6	10	10	NS	NS
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.	NS	NS	NS	NS	NS	NS	NS	NS	2	5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TEXT REFERENCE (Paragraph Number)				59 through 61	62 through 66	67		68, 69	70 through 72	73 through 77	78 through 81	82 through 87	88 through 90	91 through 94	91 through 94	91 through 94	95	96, 97	98 through 104	105 through 109	110 through 112	113 through 115

Notes: 1. Numbers in each column indicate relative desirability. The numeral "1" is used for the group or groups usually considered most desirable; higher numbers indicate desirability decreasing with the magnitude of the numbers. The symbols "NS" indicate that a soil group is not generally suitable for the use shown or, in the rating of characteristics, its quality is so poor that no relative rating is assigned. In the columns stating the relative ratings of the soil groups with reference to unfavorable characteristics, such as compressibility and potential frost action, it should be kept in mind that the groups which show little evidence of these unfavorable characteristics are given the lower numerical ratings; on the other hand, where groups are compared with reference to favorable characteristics, such as workability and shearing strength, the groups which show greater evidence of these features are given the lower numerical ratings. Numerical comparisons apply only within a single vertical column. It should be clearly recognized that the numerical ratings given are approximate and are intended only as a guide to aid the investigator in comparing soils for various purposes.

2. Fills are not generally suitable for use as domestic sewage disposal areas except for coarse-grained soils on coarse-grained subgrades with favorable topography, and the fills that are used should be large, well designed and properly compacted.

TABLE 3

UNDISTURBED SOILS AT RESIDENTIAL BUILDING SITES

GROUP SYMBOLS (1)	TYPICAL NAMES OF SOIL GROUPS (2)	CRITICAL FEATURES Text Paragraphs (3)	RELATIVE DESIRABILITY FOR VARIOUS USES					
			Roadway Sub-grade		Foundations for Low Buildings		Domestic Sewage Disposal Area (8)	Reservoir or Lagoon Site (9)
			Not Subject to Frost Action (4)	Subject to Frost Action (5)	Dense or Hard (6)	Loose or Soft (7)		
GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	121 through 125 148, 149	1	1	1	1	1	NS
GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.	121 through 125 148, 149	3	3	1	2	1	NS
GM	Silty gravels, gravel-sand-silt mixtures.	121 through 125 148, 149	4	9	2	2	2	5
GC	Clayey gravels, gravel-sand-clay mixtures.	121 through 125 148, 149	6	5	3	1	2	1
SW	Well-graded sands, gravelly sands, little or no fines.	121 through 125 148, 149	2	2	1	1	1	NS
SP	Poorly graded sands or gravelly sands, little or no fines.	121 through 125 148, 149	5	4	1	2	1	NS
SM	Silty sand, sand silt mixtures.	121 through 125 148, 149	6	10	2	2	2	6
SC	Clayey sands, sand-clay mixtures.	121 through 125 148, 149	7	6	3	2	2	2
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	126 through 130 132 through 135 148, 149	8	11	3	3	2	8
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	136 through 145 148, 149	8	7	3 Expansion very dangerous, if dry	3-5	2	3
OL	Organic silts, and organic silty clays of low plasticity.	146, 148, 149	9	12	4 Expansion dangerous	4	2	9
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	126 through 130 132 through 135 148, 149	10	13	5	4	2	7
CH	Inorganic clays of high plasticity, fat clays.	136 through 145 148, 149	11	8	5 Expansion very dangerous, if dry	4 Expansion might be dangerous	NS	4
OH	Organic clays of medium to high plasticity, organic silts.	146, 148, 149	12	14	6 Expansion dangerous	5	NS	9
Pt	Peat and other highly organic soils.	147, 148, 149	NS	NS	7	NS	NS	NS
TEXT REFERENCE (Paragraph Number)			153	153	154	154	155 through 157	158 through 162

Note: Numbers in each column indicate relative desirability. The numeral "1" is used for the group or groups usually considered most desirable; higher numbers indicate desirability decreasing with the magnitude of the numbers. Numerical comparisons apply only within a single vertical column. The symbols "NS" indicate that a soil group is not generally suitable for the use shown. It should be clearly understood that the numerical ratings given are approximate and are intended only as a guide to aid the investigator in comparing soils for various purposes; conditions and environment will often make different numerical sequences not only desirable but necessary.

APPENDIX A

FIELD IDENTIFICATION

Quoted from Unified Soil Classification System, Volume 1, March, 1953, Technical Memorandum No. 3-357, Office of the Chief of Engineers, Waterways Experiment Station, Vicksburg, Mississippi.

Identification of Soil Groups

17. The unified soil classification is so arranged that most soils may be classified into at least the three primary groups (coarse grained, fine grained, and highly organic) by means of visual examination and simple field tests. Classification into the subdivisions can also be made by visual examination with some degree of success. More positive identification may be made by means of laboratory tests on the materials. However, in many instances a tentative classification determined in the field is of great benefit and may be all the identification that is necessary, depending on the purposes for which the soils in question are to be used. Methods of general identification of soils are discussed in the following paragraphs, and a laboratory testing procedure is presented. It is emphasized that the two methods of identification are never entirely separated. Certain characteristics can only be estimated by visual examination, and in borderline cases it may be necessary to verify the classification by laboratory tests. Conversely, the field methods are entirely practical for preliminary laboratory identification and may be used to advantage in grouping soils in such a manner that only a minimum number of laboratory tests need be run.

General Identification

18. The easiest way of learning field identification of soils is under the guidance of experienced personnel. Without such assistance, field identification may be learned by systematically comparing the numerical test results for typical soils in each group with the "feel" of the material while field identification procedures are being performed.

Coarse-grained soils

19. Texture and composition. In field identification of coarse-grained materials a dry sample is spread on a flat surface and examined to determine gradation, grain size and shape, and mineral composition. Considerable experience is required to differentiate, on the basis of a visual examination, between well-graded and poorly-graded soils. The durability of the grains of a coarse-grained soil may require a careful examination, depending on the use to which the soil is to be put. Pebbles and sand grains consisting of sound rock are easily identified. Weathered material is recognized from its discolorations and the relative ease with which the grains can be crushed. Gravels consisting of weathered granitic rocks, quartzite, etc., are not necessarily objectionable for construction purposes. On the other hand, coarse-grained soils containing

fragments of shaley rock may be unsuitable because alternate wetting and drying may result in their partial or complete disintegration. This property can be identified by a slaking test. The particles are first thoroughly oven- or sun-dried, then submerged in water for al least 24 hours, and finally their strength is tested and compared with the original strength. Some types of shales will completely disintegrate when subjected to such a slaking test.

20. Examination of fine fraction. Reference to the identification sheet (table 1 [1]) shows that classification criteria of the various coarse-grained soil groups are based on the amount of material passing the No. 200 sieve and the plasticity characteristics of the binder fraction (passing the No. 40 sieve). Various methods may be used to estimate the percentage of material passing the No. 200 sieve; the choice of method will depend on the skill of the technician, the equipment at hand, and the time available. One method, decantation, consists of mixing the soil with water in a suitable container and pouring off the turbid mixture of water and fine soil; successive decantations will remove practically all of the fines and leave only the sand and gravel sizes in the container. A visual comparison of the residue with the original material will give some idea of the amount of fines present. Another useful method is to put a mixture of soil and water in a test tube, shake it thoroughly, and allow the mixture to settle. The coarse particles will fall to the bottom and successively finer particles will be deposited with increasing time; the sand sizes will fall out of suspension in 20 to 30 seconds. If the assumption is made that the soil weight is proportional to its volume, this method may be used to estimate the amount of fines present. A rough estimate of the amount of fines may be made by spreading the sample out on a level surface and making a visual estimate of the percentage of fine particles present. The presence of fine sand can usually be detected by rubbing a sample between the fingers; silt or clay particles feel smooth and stain the fingers, whereas the sand feels gritty and does not leave a stain. The "teeth test" is sometimes used for this purpose, and consists of biting a portion of the sample between the teeth. Sand feels gritty whereas silt and clay do not; clay tends to stick to the teeth while silt does not. If there appears to be more than about 12 per cent of the material passing the No. 200 sieve, the sample should be separated as well as possible by hand, or by decantation and evaporation, removing all of the gravel and coarse sand, and the characteristics of the fine fraction determined. The binder is mixed with water and its dry strength and plasticity characteristics are examined. Criteria for dry strength are shown in column 5 of the classification sheet, table 1 [1] ; evaluation of soils according to dry strength and plasticity criteria is discussed in succeeding paragraphs in connection with fine-grained soils. Identification of active cementing agents other than clay usually is not possible by visual and manual examination, since such agents may require a curing period of days or even weeks. In the absence of such experience the soils should be classified tentatively into their apparent groups, neglecting any possible development of strength because of cementation.

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1 Table A1 in this report

Fine-grained soils

21. The principal procedures for field identification of fine-grained soils are the test for dilatancy (reaction to shaking), the examination of plasticity characteristics, and the determination of dry strength. In addition, observations of color and odor are of value, particularly for organic soils. Descriptions of the field identification procedures are presented in the following paragraphs. The dilatancy, plasticity, and dry strength tests are performed on the fraction of the soil finer than the No. 40 sieve. Separation of particles coarse than the No. 40 sieve is done most expediently in the field by hand. However, separation by hand probably will be most effective for particles coarser than the No. 10 sieve. Some effort should be made to remove the No. 10 to No. 40 fraction but it is believed that any particles in this size range remaining after hand separation would have little effect on the field identification procedures.

22. Dilantancy. The soil is prepared for test by removing particles larger than about the No. 40 sieve size (by hand) and adding enough water if necessary, to make the soil soft but not sticky. The pat of moist soil should have a volume of about 1/2 cubic inch. The pat of soil is alternately shaken horizontally in the open palm of one hand, which is struck vigorously against the other hand several times, and then squeezed between the fingers. A fine-grained soil that is nonplastic or exhibits very low plasticity will become livery and show free water on the surface while being shaken. Squeezing will cause the water to disappear from the surface and the sample to stiffen and finally crumble under increasing finger pressure, like a brittle material. If the water content is just right, shaking the broken pieces will cause them to liquefy again and flow together. A distinction may be made between rapid, slow, or no reaction to the shaking test, depending on the speed with which the pat changes its consistency and the water on the surface appears or disappears. Rapid reaction to the shaking test is typical for nonplastic, uniform fine sand, silty sand (SP, SM), and inorganic silts (ML) particularly of the rock-flour type, also for diatomaceous earth (MH). The reaction becomes somewhat more sluggish with decreasing uniformity of gradation (and increase in plasticity up to a certain degree). Even a slight content of colloidal clay will impart to the soil some plasticity and slow up materially the reaction to the shaking test. Soils which react in this manner are somewhat plastic inorganic and organic silts (ML, OL), very lean clays (CL), and some kaolin-type clays (ML, MH). Extremely slow or no reaction to the shaking test is characteristic of all typical clays (CL, CH) as well as of highly plastic organic clays (OH).

23. Plasticity characteristics. Examination of the plasticity characteristics of fine-grained soils or of the fine fraction of coarse-grained soils is made with a small moist sample of the material. Particles larger than about the No. 40 sieve size are removed (by hand) and a specimen of soil about the size of a 1/2-in. cube is molded to the consistency of putty. If the soil is too dry, water must be added and if it is sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. The sample is rolled by hand on a smooth surface or between the palms into a thread about 1/8 in. in

diameter. The thread is then folded and rerolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached. After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles. The higher the position of a soil above the "A" line on the plasticity chart, plate 2 (CL, CH), the stiffer are the threads as their water content approaches the plastic limit and the tougher are the lumps as the soil is remolded after rolling. Soils slightly above the "A" line (CL, CH) form a medium tough thread (easy to roll) as the plastic limit is approached but when the threads are formed into a lump and kneaded below the plastic limit, the soil crumbles readily. Soils below the "A" line (ML, MH, OL, OH) form a weak thread and, with the exception of the OH soils, cannot be lumped together into a coherent mass below the plastic limit. Plastic soils containing organic material or much mica (well below the "A" line) form threads that are very soft and spongy near the plastic limit. The binder fraction of coarse-grained soils may be examined in the same manner as fine-grained soils. In general, the binder fraction of coarse-grained soils with silty fines (GM, SM) will exhibit plasticity characteristics similar to the ML soils, and that of coarse-grained soils with clayey fined (GC, SC) will be similar to the CL soils.

24. Dry strength. The resistance of a piece of dried soil to crushing by finger pressure is an indication of the character of the colloidal fraction of a soil. To initiate the test, particles larger than the No. 40 sieve size are removed from the soil (by hand) and a specimen is molded to the consistency of putty, adding water if necessary. The moist pat of soil is allowed to dry (in oven, sun, or air) and is then crumbled between the fingers. Soils with slight dry strength crumble readily with very little finger pressure. All nonplastic ML and MH soils have almost no dry strength. Organic silts and lean organic clays of low plasticity (OL), as well as very fine sandy soils (SM), have slight dry strength. Soils of medium dry strength require considerable finger pressure to powder the sample. Most clays of the CL group and some OH soils exhibit medium dry strength. This is also true of the fine fraction of gravelly and sandy soils having a clay binder (GC and SC). Soils with high dry strength can be broken but cannot be powdered by finger pressure. High dry strength is indicative of most CH clays, as well as some organic clays of the OH group having very high liquid limits and located near the A-line. In some instances high dry strength in the undisturbed state may be furnished by a cementing material such as calcium carbonate or iron oxide.

25. Color. In field soil surveys color is often helpful in distinguishing between various soil strata, and to an engineer with sufficient preliminary experience with the local soils, color may also be useful for identifying individual soils. The color of the moist soil should be used in identification as soil color may change markedly on drying. To the experienced eye certain dark or drab shades of gray or brown, including almost black colors, are indicative of fine-grained soils containing organic colloidal matter (OL, OH). In contrast, brighter colors, including medium and light gray, olive green, brown, red, yellow, and white, are generally associated with inorganic soils. Use of the Munsell soil

color charts and plates, prepared for the U. S. Department of Agriculture by the Munsell Color Company, Baltimore, Maryland, is suggested in the event more precise soil color descriptions are desired or to facilitate uniform naming of soil colors.

26. Odor. Organic soils of the OL and OH groups usually have a distinctive odor which, with experience, can be used as an aid in the identification of such materials. This odor is especially apparent from fresh samples. It gradually diminishes on exposure to air, but can be revived by heating a wet sample.

Highly organic soils

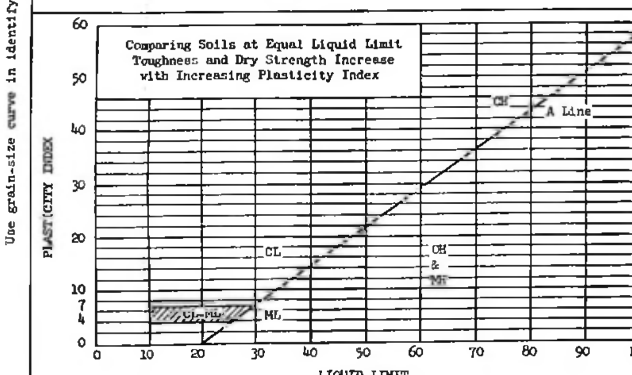
27. The field identification of highly organic soils (group Pt) is relatively easy inasmuch as these soils are characterized by undecayed or partially carbonized particles of leaves, sticks, grass, and other vegetable matter which impart to the soil a typical fibrous texture. The color ranges generally from various shades of dull brown to black. A distinct organic odor is also characteristic of the soil. The water content is usually very high. Another aid in identification of these soils may be the location of the soil with respect to topography: low-lying, swampy areas usually contain highly organic soils.

Table A 1

Unified Soil Classification System

UNIFIED SOIL CLASSIFICATION
(Including Identification and Description)

Major Divisions (1)	(2)	(2)	Group Symbols (3)	Typical Names (4)	Field Identification Procedures (Excluding particles larger than 3 in. and basing fractions on estimated weights) (5)			Information Required for Describing Soils (6)	Laboratory Classification Criteria (7)
Coarse-grained Soils. More than half of material is larger than No. 200 sieve size. (The No. 200 sieve size is about the smallest particle visible to the naked eye.)	Gravels. More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size)	Clean Gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.			For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions, and drainage characteristics.	Use grain-size curve in identifying the fractions as given under field identification. Determine percentages of gravel and sand from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse-grained soils are classified as follows: Less than 5% = GW, GP, SW, SP, More than 12% = GM, GC, SM, SC. 5% to 12% = Borderline cases requiring use of dual symbols. GW: $C_u = \frac{D_{60}}{D_{10}}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.				Not meeting all gradation requirements for GW
		Gravels with Fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixture.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).			Give typical name; indicate approximate percentages of sand and gravel, maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbol in parentheses.	Atterberg limits below "A" line or PI less than 4. Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixtures.	Plastic fines (for identification procedures see CL below).				Atterberg limits above "A" line with PI greater than 7
	Sands. More than half of coarse fraction is smaller than No. 4 sieve size.	Clean Sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain size and substantial amounts of all intermediate particle sizes.				$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			SP	Poorly graded sands or gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.			Example: Silty sand, gravelly; about 20% hard, angular gravel particles 1/2-in. maximum size; rounded and subangular sand grains, course to fine; about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM).	Not meeting all gradation requirements for SW
		Sands with Fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).				Atterberg limits below "A" line or PI less than 4. Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below).				Atterberg limits above "A" line with PI greater than 7
					Identification Procedures on Fraction Smaller than No. 40 Sieve Size				
					Dry Strength (Crushing characteristics)	Dilatancy (Reaction to shaking)	Toughness (Consistency near PL)		
Fine-grained Soils. More than half of material is smaller than No. 200 sieve size.	Silts and Clays	Liquid limit is less than 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	None to slight	Quick to slow	None	For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions.	(see Plasticity Chart)
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium		
			OL	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight	Give typical name; indicate degree and character of plasticity; amount and maximum size of coarse grains; color in wet condition; odor, if any; local or geologic name and other pertinent descriptive information; and symbol in parentheses.	
	Silts and Clays	Liquid limit is greater than 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium		
			CH	Inorganic clays of high plasticity, fat clays.	High to very high	None	High		
			OH	Organic clays of medium to high plasticity, organic silts.	Medium to high	None to very slow	Slight to medium	Example: Clayey silt, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (ML).	
Highly Organic Soils			Pt	Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture.				



PLASTICITY CHART

For laboratory classification of fine-grained soils

(1) Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well-graded gravel-sand mixture with clay binder. (2) All sieve sizes on this chart are U. S. standard.

FIELD IDENTIFICATION PROCEDURES FOR FINE-GRAINED SOILS OR FRACTIONS

These procedures are to be performed on the minus No. 40 sieve size particles, approximately 1/64 in. For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests.

Dilatancy (reaction to shaking)

After removing particles larger than No. 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky.

Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens, and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

Dry Strength (crushing characteristics)

After removing particles larger than No. 40 sieve size, mold a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun, or air-drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.

High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Toughness (consistency near plastic limit)

After particles larger than the No. 40 sieve size are removed, a specimen of soil about one-half inch cube in size, is molded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eighth inch in diameter. The thread is then folded and rerolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.

Highly organic clays have a very weak and spongy feel at the plastic limit.

Adopted by Corps of Engineers and Bureau of Reclamation, January 1952.

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APPENDIX B

IDENTIFYING SOILS BY A TRIANGLE BASED ON UNIFIED SOIL CLASSIFICATION SYSTEM

1. Appendix B contains selected quotations from "Identifying Soils by a Triangle Based on Unified Soil Classification System", by Jack McMinn, along with portions of the discussion which were published with this paper.

2. Mr. McMinn's paper with its accompanying discussion can be found complete and in its original published form in ASTM Special Technical Publication No. 254, dated 1960. STP 254 is a publication of the American Society for Testing Materials, and the following quotations are made with the permission of this Society.

. . . The USCS makes no grain "size" distinction between silts and clay particles. Rather the grain size distinction is between gravel, sand and fines. Fines include both clay and silt particles. Further identification of this fraction of the sample is based on plasticity characteristics.

UNIFIED SOIL CLASSIFICATION TRIANGLE

Purpose:

The USCS triangel Table B5 gives a more graphic, and hence more direct, means of identifying soils under USCS than the original organization chart type presentation of the same material. The triangle is useful as a training aid to soils engineers and technicians who are required to learn USCS procedures, and it also serves as an abbreviated reference for persons already familiar with the system . . .

Salient Features:

The USCS is basically a trilinear textural classification system with the further refinements of (a) determination of the physical (plasticity) characteristics of the fine-grained fraction and (b) determination of the gradation characteristics of the coarse-grained fraction. The percentages by weight of gravel (3 in. to No. 4 sieve), sand (passing No. 4 to No. 200 sieve) and fines (passing No. 200 sieve) are first determined. When the sample contains 5 per cent or more fines, the liquid and plastic limits of the portion passing the No. 40 sieve are determined. When the sample contains 12 per cent or less fines, the gradation coefficients (for uniformity and curvature) are determined. From this, the final classification is made and a letter symbol assigned.

The letter symbols used with this system are as follows:

G = Gravel
S = Sand
M = Silt
C = Clay
O = Organic
Pt = Peat
W = Well graded
P = Poorly graded
H = High liquid limit (50 per cent or greater)
L = Low liquid limit (less than 50 per cent)

Any soil identified by the USCS can be represented by a combination of two or more of these letter symbols.

Procedure for Using Triangle:

Table B6 presents various soil types along with their identification determinants. As an illustration of the use of the USCS triangle B5 take, for example, the identification determinants shown for the second soil in B5. The intersection of the gradation coordinates indicates that this material is represented by one of the following four symbols: GW-GM, GP-GM, GW-GC or GP-GC.

As shown by the gradation curve No. 3 in Table B6, this material is poorly graded. In addition, the plasticity chart shows that the plasticity indices of the portion of the material passing No. 40 sieve plot below the "A line" and the fine fraction is therefore of a silty nature. The symbol for this material must then be GP-GM and the name under USCS is "poorly-graded-silty-sandy-gravel."

This identification should then in all cases be further refined by supplementary characteristics are listed below:

Fine Grained Soils:

Consistency (in situ)

Description	Unconfined Compressive Strength, or Approximate Allowable Foundation Pressure, tons per sq ft or kg per sq cm
Very soft	$<1/4$
Soft	1/4 to 1/2
Medium	1/2 to 1
Stiff	1 to 2
Very stiff	2 to 4
Hard	>4

Sensitivity $\left(\text{Ratio} = \frac{\text{undisturbed } p_c}{\text{remolded } p_c}\right)^{a}$:

Description	Sensitivity Ratio
Insensitive	<1
Slight	1 to 2
Medium.	2 to 4
High	>4

[a] p_c = Unconfined compressive strength

Coarse Grained Soils:

Relative Density (in situ)

Description	Standard Penetration Resistance, blows per ft
Loose	<10
Medium dense	10 to 30
Dense	>30

Grain Size (coarse, medium, fine)

Modifying Constituents or Characteristics (self explanatory):

Roots, fibrous organic, burnt organic, debris, rubble, cementation, roots, worm holes, chemical ingredients, porous structures, permeability.

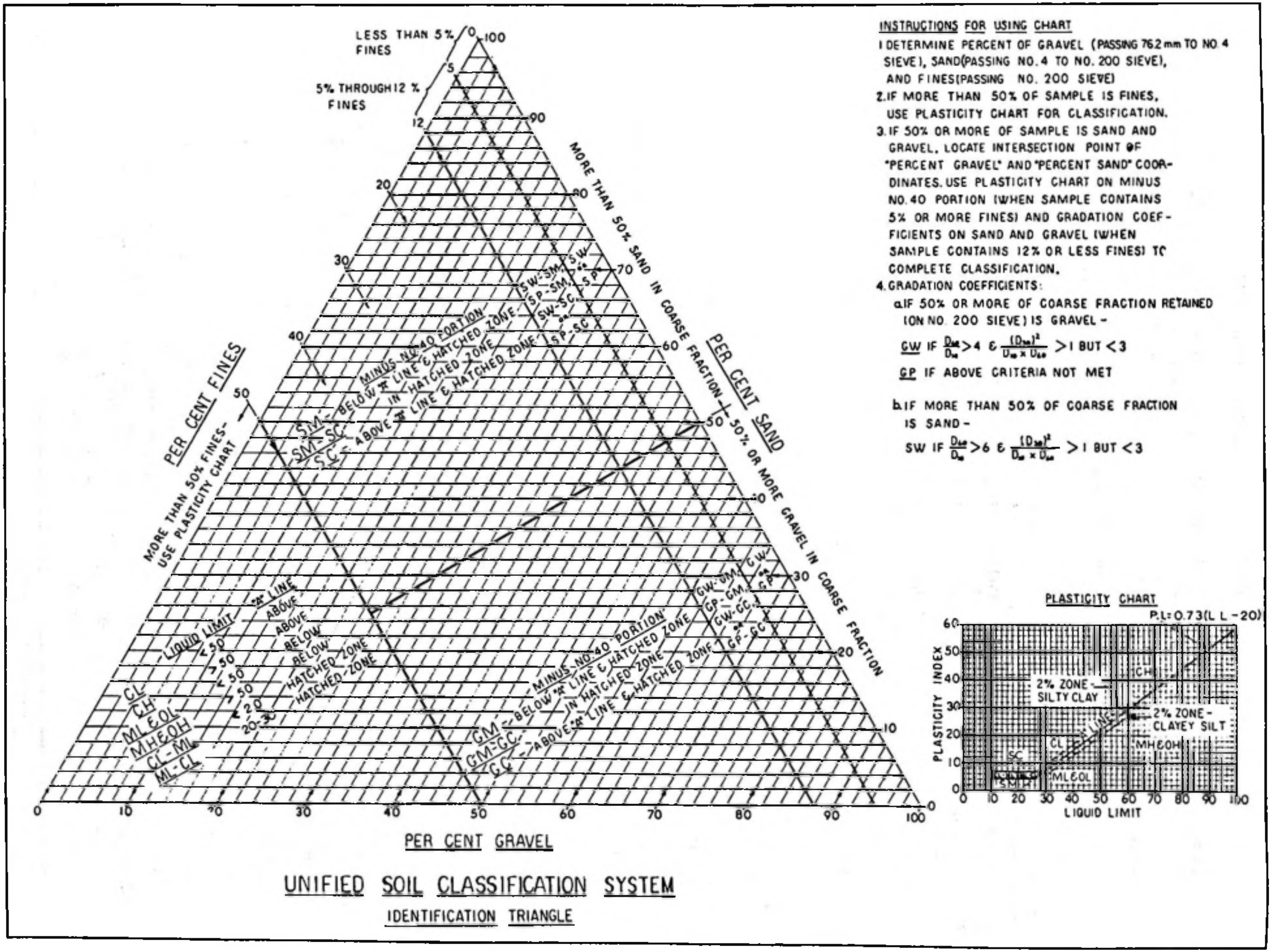
Moisture Characteristics (in situ)

Dry, damp, moist, wet (limits for these vary with individual soils and selection of a particular description depends on personal judgment).

Other Characteristics:

Color
Geological data (particularly information as to origin or type of deposition)
Provincial descriptive information (caliche, Chicago clay, Boston blue clay, San Francisco bay mud)

As a result of work now being carried on in the field of "Soil Technology" it should be possible in the near future to elaborate further on the properties of fine-grained soils. When such things as clay mineral content, ion exchange properties, and soil-water system characteristics can be expressed in simple terms, these properties can be appended to the soil description as additional identifying information.



USCS Triangle.

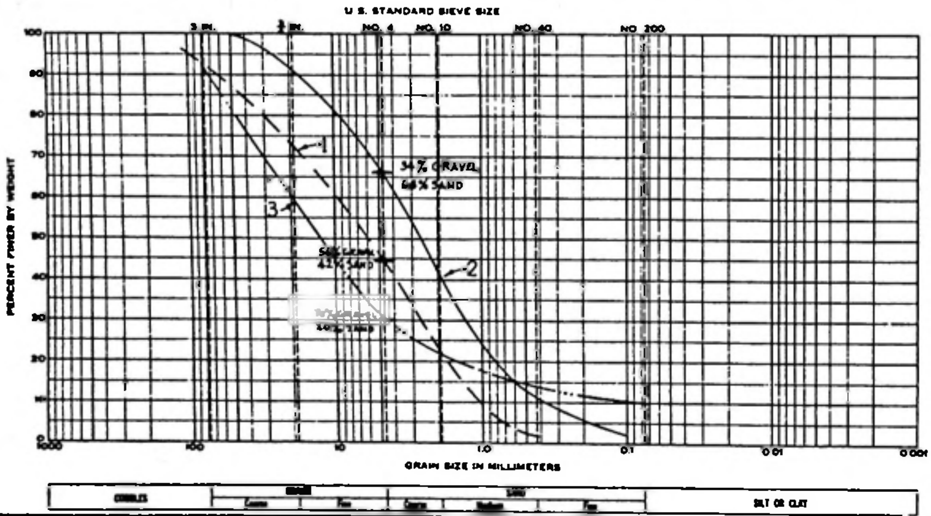
Symposium on Soil for Engineering Purposes

VARIOUS SOIL TYPES WITH IDENTIFICATION DETERMINANTS (USCS)

Soil Name*	Symbol	Gravel, per cent	Sand, per cent	Fines, per cent	Gradation Characteristics of Coarse Fraction		Plasticity Characteristics of Fines	
					D60/ D10	(D30)²/ D10 × D60	Plasticity Index	Liquid Limits
Gravelly sand, well graded	SW	34	64	2	10	1.2	...	...
Silty sandy gravel, poorly graded	GP-GM	70	20	10	260	16	5	34
Silty sand	SM	10	70	20	...	...	10	40
Silty, clayey sand	SM-SC	10	70	20	...	...	6	16
Clayey sandy gravel	GC	50	20	30	...	...	13	30
Inorganic silt, low plasticity	ML	5	35	60	...	...	8	35
Inorganic sandy clay, high plasticity	CL	2	30	68	...	...	22	42
Organic clay, high plasticity	OH	0	10	90	...	...	24	60

* *Other Factors to be Included in Soil Description:*

1. Fine grained soils
   (*a*) Consistency (soft, medium, stiff, very stiff, hard)
   (*b*) Sensitivity
2. Coarse grained soils
   (*a*) Relative density (loose, medium dense, dense)
   (*b*) Grain size (coarse, medium, fine).
3. Modifying or secondary constituent (roots, worm holes, debris, rubble, fibrous organic, cementation)
4. Moisture characteristics (dry, damp, moist, wet)
5. Color, geological data (origin or type of deposition)
6. Provincial descriptive information (caliche, San Francisco bay mud, Boston blue clay, Chicago clay)



Sample No.	Elev or Depth	Classification	Symbol	D_{60}	D_{30}	D_{10}	$D_{60} \div D_{10}$	$(D_{30})^2 \div (D_{60} \times D_{10})$
1		SANDY GRAVEL, POORLY GRADED	GP	9.9	2.6	1.1	9.0	0.62
2		GRAVELLY SAND, WELL GRADED	SW	3.7	1.3	0.37	10.0	1.2
3		SILTY SANDY GRAVEL, POORLY GRADED	GP-GM	19	4.8	0.074	260	16

GRADATION CURVES

Project UNIFIED SOIL CLASSIFICATION CHART
Area
Boring No.
Date

Gradation Curves—Coarse Grained Soils (USCS).

SUMMARY AND CONCLUSIONS

1. This paper presents a simple, graphic means of identifying soils in accordance with USCS.

2. The soils triangle presented herein was developed for the following reasons:

(a) To serve as a training aid for soil engineers and technicians interested in learning the details of the USCS.

(b) To serve as an abbreviated reference for persons already familiar with the USCS.

(c) To stimulate interest in and encourage use of the USCS as a common denominator for soil identification.

DISCUSSION

MR. ARTHUR A. WAGNER - The author has developed a graphical presentation of the procedure for classifying soils by the use of the laboratory classification criteria . . . .

To those not familiar with the system, this paper may create a misconception in that it did not discuss or mention the "field method" for classifying soils. The discussion and example given in the paper may give the impression that it is necessary to have the results of detailed laboratory tests, gradation and Atterberg limits, and to compute the values of C_u and C_c in order to classify a soil. This is not entirely correct . . . . The basic purpose of the system is to define the potential engineering properties of a soil; the provision for identification of soil properties and cataloging them in accordance with the basic soil groups is just a means to that end.

The greatest value of the system is the provision for classifying soils in the "field" by identifying the gradation and plasticity characteristics by visual observations and simple hand tests. To keep the system within the same order of accuracy as the methods employed, only 15 basic groups were established to cover the range of soils from peat to gravel. Although the groups are broad, the limits were selected so that the engineering properties of each are significantly different. It was recognized that a wide variety of soils may fall within one group. To distinguish between these, a description is required in addition to assigning a group symbol.

The field method is used for logging soils. If the field description and classification are adequate, the amount of sampling and laboratory testing required to analyze a borrow area or foundation will be limited to only testing samples of the poorest, most critical, average or the best material as the case may be . . . .

MR. W. G. SHOCKLEY - In soil mechanics there are at least two schools of thought concerning soil classification systems. One is that soils are so diverse in nature that it is practically impossible to fit them into rigid categories from which their potential engineering properties may be deduced. Therefore, the soils engineer must examine each soil individually and classify it in terms of its potential use for the project under consideration. The other is that some system of classifying soils must be established in order for soil mechanics engineers to communicate intelligently with one another. This is especially true in a large organization where engineering soils data may be reviewed by several echelons, some of which may be far removed from the site of the work. At the operating level, the soils technician in the laboratory who is charged with classifying soils feels a strong need for firm rules of identification so that he is not faced with decisions involving judgment every time he must classify a given soil. Furthermore, in a large laboratory it is seldom possible for the soils engineer on a project to assume the role of technician and classify all the soils on the project with which he must be concerned.

The writer tends to subscribe to the concept of a formal classification system for soils in the interest of communication between engineers. However, the soils engineer working on a project should familiarize himself with the soils to the extent that he recognizes and takes into account the limitations of a classification system and the potential engineering properties of the soils with which he is working. Mr. McMinn's paper provides a useful tool for the laboratory technician to classify soils according to the Unified Soil Classification System. For those who have need for such a device as his soil triangle, it adequately represents the breakdown of categories in the Unified System, and as such it can be used to advantage in the laboratory or office. Nonetheless, the writer wishes to re-emphasize the fallacy of prediction of engineering properties of soils from the blind use of this or any soil classification system, and the need for judgment on the part of soils engineers in evaluting the properties of the soils with which he is dealing.

MR. JOHN P. GNAEDINGER - It is unfortunate that the engineering profession has not universally agreed on the terminology and systems for the classification and identification of soils. One need only study building codes in various cities to observe the variation in systems. The Unified Soils Classification System, however, is the closest to being accepted by all engineers. Since the Soil Triangle presented in this paper should greatly simplify the use of the system, it is an important step in establishing the Unified Soil Classification System in the profession.

My only suggestion is that the importance of density for coarse-grained soils and the importance of density, cohension, and compressibility for fine-grained soils should be emphasized. Except for selection of borrow material and placement of compacted fills, most engineering problems are associated with in situ soils. The importance of these properties warrants a conspicuous mention of these properties beside the Soil Classification, rather than treating these important properties as optional in a particular classification . . . .

MR. JACK McMINN (author) - With regard to Mr. Wagner's comments, it is certainly true that visual and simple hand test methods play an extremely important role in soil identification. In some private firms, visual methods are relied on almost exclusively for soil identification. . . An at least partially identifying name when accompanied by other verbal descriptive information, such as that suggested by Mr. Gnaedinger in his discussion, would seem quite adequate to make possible easy and accurate communication between soils engineers.

Mr. Shockley's comments describe quite well the purpose and limitations of the proposed soil identification triangle. The intent is to simplify the purely mechanical steps necessary to categorize a particular soil under the Unified Soil Classification System and thus encourage use of the system by those firms and agencies which have not yet adopted it.

The author wishes to thank all the discussors for reviewing and commenting on this paper. Also, special thanks are due Mr. Earl B. Hall, Chief, Soils Section, U.S. Army Corps of Engineers, South Pacific Division Laboratory, for suggestions and guidance at the time this identification triangle was developed.

APPENDIX C

CONSISTENCY AND RELATIVE DENSITY TABULATIONS

Consistency

Table C 1

Consistency of Undisturbed Cohesive Soils

Consistency (1)	q_u (Tsf)[1] (2)	Rule-of-Thumb (3)	Blows[2] per Foot (4)
Very soft	0.25	Core (Height = twice diameter) sags under own weight	0 - 1
Soft	0.25 - 0.50	Can be pinched in two between thumb and forefinger	2 - 4
Firm (medium)	0.50 - 1.00	Can be imprinted easily with fingers	5 - 8
Stiff	1.00 - 2.00	Can be imprinted with considerable pressure from fingers	9 - 15
Very stiff	2.00 - 4.00	Barely can be imprinted by pressure from fingers	16 - 30
Hard	4.00	Cannot be imprinted by fingers	Over 30

[1] q_u is unconfined compressive strength in tons/sq ft.

[2] Blows as measured with 2-in. OD, 1 3/8-in. ID sampler driven 1 ft by 140-lb hammer falling 30 in. See Tentative Method for Penetration Test and Split-Barrel Sampling of Soils, ASTM Designation: D1586-58T.

Note: The rules-of-thumb and the results of the penetration test given in columns 3 and 4 are used only to determine the consistency of soils as described by the terms in column 1. The values in column 2, unconfined compressive strength, are given only to serve as a means of checking the field methods against laboratory methods, and this should be done from time to time. The values from column 2 must not be used for design without laboratory verification. It is noted that unconfined compressive strength is not synonymous with ultimate bearing capacity.

Relative Density

Table C 2

Relative Density of Cohesionless Soils

Term (1)	Rule-of-Thumb (2)	Blows[1] per Foot (3)
Very loose	---	0 - 4
Loose	Easily penetrated with 1/2 in. reinforcing rod pushed by hand	5 - 10
Firm (medium)	Easily penetrated with 1/2 in. reinforcing rod driven with 5-lb hammer	11 - 30
Dense	Penetrated a foot with 1/2 in. reinforcing rod driven with 5-lb hammer	31 - 50
Very dense	Penetrated only a few inches with a 1/2 in. reinforcing rod driven with 5-lb hammer	Over 50

[1] Blows as measured with 2-in. OD, 1 3/8-in. ID sampler driven 1 ft by 140-lb hammer falling 30 in. See Tentative Method for Penetration Test and Split-Barrel Sampling of Soils, ASTM Designation: D1586-58T.

Note: The rules of thumb shown in column 2 are given merely as an example of one of numerous simple field procedures that are in current use for selecting an adjective to describe density. Many other procedures are equally as good and column 2 is not intended to establish a preferred method. The results of the penetration test, as shown in column 3, are widely accepted as a standard for the terms shown in column 1.

APPENDIX D

SHORT GLOSSARY OF SOIL MECHANICS AND PEDOLOGICAL TERMINOLOGY

1. A few of the terms used in the body of this report are defined on the following pages. Terms not used in this report are included if it is believed that they will be useful in formulating a word description of a soil group. Terms from the field of soil mechanics and from the field of pedology are used.

2. Terms and definitions are not identified as belonging to a particular field except in cases where terms are used in both fields but with distinctly different definitions. When such an exception occurs, the term is listed twice, once with the pedological definition, and once with the soil mechanics definition.

3. Several glossaries that are commonly available are longer and more complete. Many of the definitions stated in this appendix are from "Glossary of Terms and Definitions in Soil Mechanics", from the Journal of the Soil Mechanics and Foundations Division, Proceedings of the American Society of Civil Engineers, Paper 1826, dated October, 1958; and from "Glossary of Pedologic (Soils) and Landform Terminology for Soil Engineers", Highway Research Board Special Report 25, National Academy of Sciences - National Research Council Publication 481, dated 1957.

"A" Horizon

The uppermost layer of the soil profile from which inorganic colloids and other soluble materials have been leached. Usually contains remnants of organic life.

Alluvium

Soil the constituents of which have been transported in suspension by flowing water and subsequently deposited by sedimentation.

Atterberg Limits

The water contents that correspond to the boundaries between the states of consistency of a remolded, cohesive soil. See Liquid Limit, Plastic Limit, and Shrinkage Limit.

"B" Horizon

The layer of a soil profile in which material leached from the overlying "A" horizon is accumulated.

Binder (Soil Binder)

Portion of soil passing No. 40 U.S. standard sieve.

Blocky (or Block-Like) Structure

The soil aggregates have a blocky shape, irregularly six-faced, and with the three dimensions nearly equal. The size of these aggregates ranges from a fraction of an inch to 3 or 4 in. in thickness. This structure is found in the B horizon of many soils. When the edges of the cube are sharp and rectangular faces are distinct, the type is identified as blocky or angular blocky. If sub-rounding is apparent, the aggregates are identified as nut-like, nuciform, or subangular blocky. See Structure, Soil (Pedologic definition).

Bulking

The increase in volume of a material due to manipulation. Rock bulks upon being excavated; damp sand bulks if loosely deposited, as by dumping, because the apparent cohension prevents movement of the soil particles to form a reduced volume.

"C" Horizon

Undisturbed parent material from which the overlying soil profile has been developed.

Calcareous

A term used to describe soils containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with hydrochloric acid.

Catena

A group of soil series within any one soil zone developed from similar parent material, but with contrasting characteristics of the solum due to differences in relief or drainage.

Coefficient of Permeability (Permeability) (Soil Mechanics definition)

The rate of discharge of water under laminar flow conditions through a unit cross-sectional area of a porous medium under a unit hydraulic gradient and standard temperature conditions (usually 20^{o} C).

Note: Where the term Permeability is used in this report it is intented that the Soil Mechanics definition is applicable. Contrast with Permeability (Pedologic definition).

Columnar Structure

Structure with the vertical axis of aggregates longer than the horizontal and with rounded tops. When the tops are level and clean cut, the structure is identified as prismatic. Found in the B horizon when present. See Structure, Soil (Pedologic definition).

Compaction

The densification of a soil by means of mechanical manipulation.

Compaction Curve (Proctor Curve) (Moisture-Density Curve)

The curve showing the relationship between the dry unit weight (density) and the water content of a soil for a given compactive effort.

Compressibility

Property of a soil pertaining to its susceptibility to decrease in volume when subjected to load.

Concretions

Hardened local concentrations of certain chemical compounds, such as calcium carbonate, and iron and manganese oxides, that form indurated grains or nodules of various sizes, shapes, and colors.

Consolidation

The gradual reduction in volume of a soil mass resulting from an increase in compressive stress.

Crumb Structure

Small, soft, porous aggregates irregular in shape and rarely larger than 1/3 in. in size. If the aggregates are relatively nonporous, they are identified as granular. Both types are found in surface soils, especially those high in organic matter. See Structure, Soil (Pedologic definition).

Degree of Saturation (Per Cent Saturation)

The ratio, expressed as a percentage, of (1) the volume of water in a given soil mass to (2) the total volume of intergranular space (voids).

Density

See Unit Weight. Usually means dry unit weight or unit dry weight.

Note: Although it is recognized that "density" is defined as mass per unit volume, in the field of soil mechanics the term is frequently used in place of unit weight.

Drainage, Soil

Refers to the rapidity and extent of the removal of water from a soil, in relation to additions, especially by surface runoff and by flow through the soil.

Drift

Material of any sort deposited by geological processes after having been removed from another. Glacial drift includes the material deposited by glaciers and by the streams and lakes associated with them.

Dry Density

See Dry Unit Weight.

Dry Unit Weight

The weight of soil solids per unit of total volume of soil mass.

Field Moisture Equivalent

The minimum water content, expressed as a percentage of the weight of the oven-dried soil, at which a drop of water placed on a smoothed surface of the soil will not immediately be absorbed by the soil but will spread out over the surface and give it a shiny appearance.

Flocculent Structure

An arrangement composed of flocs of soil particles instead of individual soil particles. See Structure, Soil (Soil Mechanics definition).

Free Water

See Ground Water

Frost Action

Freezing and thawing of moisture in materials and the resultant effects on these materials and on structures of which they are a part or with which they are in contact.

Granular Structure

Small, soft, relatively nonporous aggregates of soil particles irregular in shape and rarely larger than 1/3 in. in size. This type of structure is found in surface soils, especially those high in organic matter. See Structure, Soil (Pedologic definition).

Ground Water (Free Water) (Gravitational Water) (Phreatic Water)

Water that is free to move through a soil mass under the influence of gravity.

Honeycomb Structure

An arrangement of soil particles having a comparatively loose, stable structure resembling a honeycomb. See Structure, Soil (Soil Mechanics definition) and Primary Structure.

Horizon (Soil Horizon)

One of the layers of the soil profile, distinguished principally by its texture, color, structure, and chemical content. See A horizon, B horizon, and C horizon.

Laminated Structure

Platy structure with the plates or very thin layers lying horizontal or parallel to the surface. See Plate-Like Structure and Structure, Soil (Pedologic definition).

Liquefaction

The sudden large decrease of the shearing resistance of a cohesionless soil. It is caused by shock or other type of strain and is associated with a sudden but temporary increase of the porefluid pressure. It involves a temporary transformation of the material into a fluid mass.

Liquid Limit

a. The water content corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil.

b. The water content at which a pat of soil, cut by a groove of standard dimensions, will flow together for a distance of 1/2 in. under the impact of 25 blows in a standard liquid limit apparatus.

Loess

A uniform aeolian deposit of silty material having an open structure and relatively high cohesion due to cementation of clay or calcareous material at grain contacts. A characteristic of loess deposits is that they can stand with nearly vertical slopes.

Macrostructure

Structural features of a soil that are visible to the naked eye.

Massive Structure

Large uniform masses of cohesive soil, structureless. See Structure, Soil (Pedologic definition).

Maximum Density (Maximum Unit Weight)

The dry unit weight defined by the peak of a compaction curve.

Maximum Unit Weight

See Maximum Density.

Modified Loess

A soil that is a loess that has lost its typical characteristics by secondary processes, including immersion, erosion, and subsequent deposition; chemical changes involving the destruction of the bond between the particles; or chemical decomposition of the more perishable constituents such as feldspar.

Moisture Content (Water Content)

The ratio, expressed as a percentage, of (1) the weight of water in a given soil mass to (2) the weight of solid particles.

Mottled

Irregularly marked with spots of different colors.

Neutral Stress (Pore Pressure) (Pore Water Pressure)

Stress transmitted through the pore water (water filling the voids of the soil).

Nut or Nuciform Structure

A block-like structure with apparent sub-rounding. About 75 mm in size, usually. See Block-Like Structure and Structure, Soil (Pedologic definition).

Parent Material

The relatively unaltered, unconsolidated mass of material from which a soil profile developes.

Pedology

The science dealing with the soil as a natural body.

Per Cent Compaction

The ratio, expressed as a percentage, of (1) dry unit weight of a soil to (2) maximum unit weight obtained in a laboratory compaction test.

Percolation

The movement of gravitational water through soil. See Seepage.

Permeability (Pedologic definition)

That quality of the soil that enables it to transmit water or air. It is measured in terms of rate of flow through a unit cross-section of saturated soil in unit time.

Permeability (Coefficient of Permeability) (Soil Mechanics definition)

The rate of discharge of water under laminar flow conditions through a unit cross-sectional area of a porous medium under a unit hydraulic gradient and standard temperature conditions (usually 20° C).

Note: Where the term Permeability is used in this report it is intended that the Soil Mechanics definition is applicable.

Plastic Limit

a. The water content corresponding to an arbitrary limit between the plastic and the semisolid states of consistency of a soil.

b. Water content at which a soil will just begin to crumble when rolled into a thread approximately 1/8 in. in diameter.

Plasticity

The property of a soil which allows it to be deformed beyond the point of recovery without cracking or appreciable volume change.

Plasticity Index

Numerical difference between the liquid limit and the plastic limit.

Plate-Like (Platy) Structure

Flat aggregates of soil particles with vertical dimension much less than the horizontal dimensions, found most often in surface horizons, but may be found in the subsoil as it is often inherited from the parent materials. See Structure, Soil (Pedologic definition).

Primary Structure

The arrangement of the particles in a soil is the primary structure. See Flocculent Structure, Honeycomb Structure, and Single-Grained Structure. Compare with Secondary Structure. Also see Structure, Soil (Soil Mechanics definition).

Prismatic Structure

Elongated column structure with level and clean-cut tops. If the tops are rounded, the structure is identified as columnar. Found in the B horizon when present. See Structure, Soil (Pedologic definition).

Profile (Soil Profile) (Pedological definition)

A vertical section of the soil through all its horizons and extending into the parent material.

Profile (Soil Profile) (Soil Mechanics definition)

Vertical section of a soil, showing the nature and sequence of the various layers, as developed by deposition or weathering, or both.

Quick Condition (Quicksand)

Condition in which water is flowing upwards with sufficient velocity to reduce significantly the bearing capacity of the soil through a decrease in intergranular pressure.

Relative Density

The ratio of (1) the difference between the void ratio of a cohesionless soil in the loosest state and any given void ratio to (2) the difference between its void ratio in the loosest and in the densest states.

Residual Soil

Soil derived in place by weathering of the underlying material.

Saturated Unit Weight

The wet unit weight of a soil mass when saturated.

Secondary Structure

Structure that developes after a soil is deposited. This structure is often produced by shrinkage, caused by drying of cohesive soils. Cracks form which separate the soil into irregular or more or less regular blocks which are secondary particles. The cracks may later fill with some other soil to form a monolithic but non-homogeneous mass. Faulting, brought about by landslides, also may produce a secondary structure. Compare with Primary Structure. See Structure, Soil (Soil Mechanics definition).

Seepage (Percolation)

The slow movement of ground water through the soil.

Sensitivity

The effect of remolding on the consistency of a cohesive soil.

Series (Soil Series)

A group of soils developed from the same parent material, having similar soil horizons, and having essentially the same characteristics throughout the profile except for the texture of the A, or surface horizon.

Shrinkage Limit

The maximum water content at which a reduction in water content will not cause a decrease in volume of the soil mass.

Single-Grain Structure (Pedologic definition)

No aggregation of the particles, such as in dune sand. (Other pedologic terms for structure are for aggregations of particles. See, for example, Granular Structure and Crumb Structure).

Single-Grained Structure (Soil Mechanics definition)

An arrangement composed of individual soil particles; characteristic structure of coarse-grained soils. See Primary Structure.

Slickensided

A secondary structural feature of some soils that is produced by movements along the walls of joints. A soil is slickensided if it has inclined planes of weakness that are slick and glossy in appearance. See Secondary Structure.

Soil-Forming Factors

Factors, such as parent material, climate, vegetation, topography, organisms, and time involved in the transformation of an original geologic deposit into a soil profile.

Soil Stabilization

Chemical or mechanical treatment designed to increase or maintain the stability of a mass of soil or otherwise to improve its engineering properties.

Solum

That part of the soil profile, above the parent material, in which the processes of soil formation are taking place. In mature soils, this includes the A and B horizons, and the character of the material may be greatly unlike that of the parent material.

Stratified (Pedologic definition)

Composed of, or arranged in, layers. The term is applied to geological materials, as stratified alluvium. Those layers in soils that are produced by the soil-forming processes are called horizons, while those inherited from the parent material are called strata.

Stratified (Soil Mechanics definition)

Composed of, or arranged in, layers. Stratification is typical of soils deposited under water. If the individual layers are not thicker than about 1 in. and are of roughly equal thickness, the soil is called laminated

Structure, Soil (Pedologic definition)

The aggregation of soil particles into clusters of particles, which are separated from adjoining aggregates by surfaces of weakness. Structure is judged by observation, by breaking of clods, or by dropping of clods. If the clods are easily broken with cleavage planes visible the soil is structured. If there is difficulty in breaking the clods and an irregular surface results then the soil is non-structured. See Block-Like, Columnar, Crumb, Granular, Laminated, Massive, Nut or Nuci-form, Prismatic, Single-Grain, and Vesicular Structure.

Structure, Soil (Soil Mechanics definition)

The arrangement and state of aggregation of soil particles in a soil mass. See Primary Structure and Secondary Structure.

Submerged Unit Weight

The weight of the solids in air minus the weight of water displaced by the solids per unit of volume of soil mass; the saturated unit weight minus the unit weight of water.

Subsoil

a. A soil which lies beneath another soil and is unlike the upper soil in some distinctive way. For example, the natural or undis-turbed soil on which a fill is placed is often called the subsoil.

b. In pedology, subsoil refers to the B horizon of soils with dis-tinct profiles. In soils with weak profiles, it is the soil below the surface soil. For pedologic uses, it is considered an undesirable term.

Surface Water

Refers to water that occurs on the surface of the earth as opposed to water that occurs within the voids of a soil mass.

Transported Soil

Soil transported from the place of its origin by wind, water, or ice and redeposited.

Ultimate Bearing Capacity

The average load per unit of area required to produce failure by rupture of a supporting soil mass.

Unconfined Compressive Strength

The load per unit area at which an unconfined prismatic or cylin-drical specimen of soil will fail in a simple compression test.

Unit Weight

Weight per unit of volume. See Dry Unit Weight, Maximum Unit Weight, Saturated Unit Weight, Submerged Unit Weight, and Wet Unit Weight.

Vesicular Structure

A soil structure containing many small cavities, or pores, smooth on the inside as though formed by gas bubbles. See Structure, Soil (Pedologic definition).

Vane Test (Vane Shear Test)

An in-place shear test in which a rod with thin radial vanes at the end is forced into the soil and the resistance to rotation of the rod is determined.

Void

Space in a soil mass not occupied by solid mineral matter. This space may be occupied by air, water, or other gaseous or liquid material.

Void Ratio

The ratio of (1) the volume of void space to (2) the volume of solid particles in a given soil mass.

Water Content (Moisture Content)

The ratio, expressed as a percentage, of (1) the weight of water in a given soil mass to (2) the weight of solid particles.

Water Table (Pedologic definition)

The upper surface of a zone of saturation in the soil or parent material.

Water Table (Free Water Elevation) (Ground Water Surface) (Free Water Surface) (Ground Water Elevation) (Soil Mechanics definition)

Elevations at which the pressure in the water is zero with respect to the atmospheric pressure.

Note: Where the term Water Table is used in this report, it is intended that the Soil Mechanics definition is applicable.

Wet Unit Weight

The weight (solids plus water) per unit of total volume of soil mass, irrespective of the degree of saturation.

SECTION II

Acknowledgments

Section II of this manual was prepared by J. R. Chaves and J. F. Koca, research engineers, under the direction of Harold Allen, Chief, Division of Physical Research, and P. C. Smith, Chief, Soils Branch, of the Bureau of Public Roads.

It includes a compilation of soils engineering test data made on soil samples taken from all sections of the country by soil scientists from the Soil Conservation Service in cooperation with the various State Agricultural Experiment Stations.

Samples were taken in accordance with standard procedures of the American Association of Highway Officials (AASHO) in a cooperative program involving state highway departments, universities and colleges, and the Bureau of Public Roads.

ENGINEERING SOIL TEST DATA FOR SOME SOIL SERIES

PART I: INTRODUCTION

The data in this tabulation were obtained by the Division of Physical Research, Bureau of Public Roads, U. S. Department of Commerce, by testing soil samples collected by Soil Survey, Soil Conservation Service, U. S. Department of Agriculture, in county or area soil surveys. The soil samples were obtained and tested primarily so that adequate engineering interpretations could be included in the specific soil survey reports. Consolidation of the soil test data into one table was made by request of the Technical Studies Program, Architectural Standards Division, Federal Housing Administration, for use in evaluating the physical properties of soils on which buildings are constructed.

It is anticipated that the table of data will be of interest to many engineers and scientists, and some of these persons may not be familiar with all the types of information given in the table. Consequently, this introduction contains a brief description of pedologic concepts.

Figure 1 is a generalized soil profile showing the principal horizons or layers in a typical soil. Such profiles develop from parent materials, such as weathered granite, sandstone, or stratified alluvial deposits, that are subjected to various types of weathering. The type of soil profile that develops is dependent upon the climate (rainfall and temperature), vegetative cover, topography, and the length of time that the materials have been subjected to weathering.

Figure 1 shows that the surface layer or A horizon represents a zone of leaching and also accumulation of organic material while the subsoil, or B horizon, consists of a zone of accumulation of material (clay, colloidal organic matter or chemical substances) removed from the A horizon due to the action of percolating water. The C horizon represents weathered rock or other material that has contributed to the A and B horizons. The D horizon is composed of any material that has some influence on profile development but is not the parent material of the soil.

Since soil profiles are developed with definite describable characteristics, soil scientists are able to identify, classify, and map the various kinds of soils. A name such as "Charlton" is applied to soils that are similar in characteristics and occur in similar environments. Such a mappable unit is known as a soil series. The soil type is a subdivision of the soil series based on the texture (particle-size distribution) of the surface horizon. Thus the Charlton series may be subdivided into two soil types, such as Charlton fine sandy loam and Charlton loam.

Samples have been collected from a variety of soils throughout the United States, hence, special symbols are used to designate certain conditions or characteristics in the soil profile. The following are subscripts used with the principal soil horizon symbols A, B, C, and D to indicate special conditions or characteristics. The subscripts are used alone or in combination, always with one of the principal soil horizon symbols. For example: (1) B_b indicates a buried B horizon, (2) B_{bca} indicates a layer of accumulated calcium carbonate in the B horizon, and B_{ca} means that this horizon is buried.

b. - buried soil horizon

ca. - a layer of accumulated calcium carbonate

cs. - a layer of accumulated calcium sulfate

g. - a layer of reduction characterized by the presence of ferrous iron and neutral gray colors produced by a process involving saturation of the soil with water for long periods in the presence of organic matter. "G" indicates intense reduction.

m. - a horizon that is indurated. "M" is used to indicate an irreversibly indurated horizon or layer.

r. - applied to D layer of hard rock like that from which the C horizon has developed.

t. - outstanding accumulation of clay in the B horizon

Additional information on formation, classification, and mapping of soils is given in the Soil Survey Manual, U. S. Department of Agriculture Handbook No. 18, 1951.

Most of the samples that have been obtained and tested were taken from the principal soil horizons of the more extensive soil series occurring in the various counties. Wherever a single profile has been sampled for a specific soil type, some departure from the test data may be expected at other localities. Where the soil type has been sampled at two or more localities, the test data usually show a considerable range in physical properties, but the data may not represent the maximum variation for the soil in that county.

The soil samples were tested by the Soils laboratory, Bureau of Public Roads, in accordance with standard procedures of the American Association of State Highway Officials. The test procedures are described in "Standard Specifications for Highway Materials and Methods of Sampling and Testing, Part II," The American Association of State Highway Officials, Washington, D. C., 1955. The moisture-density data were obtained in accordance with A.A.S.H.O. Designation T 99-49, which is the same as the current (1959) Method A of "Standard Method of Test for The Moisture-Density Relations of Soils Using a 5.5-lb. Rammer and a 12-in. Drop," A.A.S.H.O. Designation T 99-57.

Horizon of maximum biological activity, of eluviation (removal of materials dissolved or suspended in water), or both	A	SURFACE SOIL
Horizons of illuviation (of accumulation of suspended material from A horizon) or of maximum clay accumulation. Blocky or prismatic structure.	B	SUBSOIL
The weathered parent material. Occasionally absent.	C	SUBSTRATUM
Any stratum underneath the soil, such as hard rock or layers of clay or sand that are not parent material but which may have significance to the overlying soil. Frequently absent.	D	

Figure 1. - Generalized soil profile showing principal horizons.

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]

Figure [illegible]

SECTION II

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu. ft.	Percent													
Abilene clay loam	Haskell, Tex.	Unconsolidated sediments over 'Red Beds'	0-6	A	108	27				100	87	79	32	28	29	11	A-6 (8)	CL	
			24-40	B_{ca}	104	21			100	99	92	87	47	41	46	25	A-7-6 (15)	CL	
			40-54	C_{ca}	116	14			100	99	91	85	52	38	33	19	A-6 (12)	CL	
			54-72+	C	118	13			100	99	90	82	47	37	32	16	A-6 (10)	CL	
	Haskell, Tex.	Same	0-8	A	108	18				100	79	71	33	27	28	11	A-6 (8)	CL	
			20-56	B_{ca}	109	17			100	98	80	74	45	36	43	27	A-7-6 (15)	CL	
			56-138	C_{ca}	120	13			100	98	84	80	54	31	30	17	A-6 (11)	CL	
			138-156+	D	113	15			100	98	87	80	45	30	43	27	A-7-6 (15)	CL	
	Haskell, Tex.	Same	0-8	A	107	17			100	99	86	79	38	32	30	12	A-6 (9)	CL	
			26-58	B	102	20			100	98	88	83	51	45	50	30	A-7-6 (18)	CL	
			58-80	C_{ca}	110	17			100	96	82	77	50	38	38	21	A-6 (12)	CL	
			80-96+	D	111	17			100	93	83	80	56	38	34	17	A-6 (11)	CL	
	Haskell, Tex.	Same	0-11	A	110	16			100	99	76	64	27	22	28	11	A-6 (8)	CL	
			19-33	B	109	17			100	99	80	74	42	35	47	28	A-7-6 (17)	CL	
			33-52	B	108	18			100	99	80	73	41	35	46	29	A-7-6 (17)	CL	
			52-72+	C_{ca}	115	15			100	97	74	67	42	34	35	19	A-6 (11)	CL	
Alamance silt loam	Alamance, N. C.	Slate	1-5	A	105	16	100	94	93	89	81	78	18	9	NP	NP	A-4 (8)	ML	
			15-23	B	112	15	100	98	96	91	84	81	30	20	32	10	A-4 (8)	ML-CL	
			32+	C	110	16			100	88	67	64	20	13	32	5	A-4 (6)	ML	
Albaton clay	Monona, Iowa	Alluvium	12-20		88	27				100	99	98	80	63	78	46	A-7-5 (20)	CH	
Alexandria silt loam	Fairfield, Ohio	Wisconsin glacial till	0-7	A	113	14	100	94	93	88	70	62	24	17	24	6	A-4 (7)	ML-CL	
			12-20	B	117	14	100	99	98	93	71	63	31	25	32	14	A-6 (9)	CL	
			20-34	B	114	15	100	88	86	80	59	54	28	23	35	16	A-6 (7)	CL	
			40+	C	123	11	100	83	80	74	55	48	16	12	21	6	A-4 (4)	ML-CL	
Allen loam	De Kalb, Ala.	Colluvium	1-11		122	11	100	92	87	80	55	49	18	13	20	4	A-4 (4)	ML-CL	
			11-32	B	122	12	100	97	94	88	66	61	29	23	27	10	A-4 (6)	CL	
			32-48		116	15	100	93	89	83	58	55	34	28	38	17	A-6 (7)	CL	
Alligator clay	Humphreys, Miss.	Alluvium	0-3	A	91	23				100	99	91	63	52	71	40	A-7-5 (20)	CH	
			3-30		92	25				100	99	88	65	54	85	54	A-7-5 (20)	CH	
			30-55+		93	25				100	99	85	61	50	94	64	A-7-5 (20)	CH	
Almo silt loam	Henderson, Tenn.	Loessal and Coastal Plain	0-4		107	16			100	99	93	87	21	15	27	5	A-4 (8)	ML-CL	
			4-14		107	15			100	99	93	87	22	14	27	5	A-4 (8)	ML-CL	
			14+		112	14			100	99	88	83	28	21	27	8	A-4 (8)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

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							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu. ft.	Percent													
Amarillo fine sandy loam	Lynn, Tex.	Unconsolidated alluvial and aeolian sediments	0-6	A	123	11				100	55	33	16	13	18	5	A-4 (4)	ML-CL	
			6-46	B	116	14			100	99	42	48	28	25	29	14	A-6 (2)	SC	
			46-94	Cca	120	13		100	99	96	67	60	41	27	24	12	A-6 (7)	CL	
			94-120+	C	119	14			100	98	67	60	39	28	36	23	A-6 (12)	CL	
	Lynn, Tex.	Same	0-11	A	123	10				100	43	33	14	12	18	5	A-4 (2)	SM-SC	
			15-36	B	117	14				100	53	44	26	23	25	12	A-6 (4)	CL	
			56-120	Cca	121	12	100	48	46	40	23	20	12	9	23	9	A-2-4 (0)	SC	
	Lynn, Tex.	Same	0-11	A	120	10			100	99	29	25	13	10	NP	NP	A-2-4 (0)	SM	
			15-56	B	120	12				100	58	45	21	20	25	11	A-6 (5)	CL	
			96-140+	Cca	122	12			100	97	71	67	49	31	23	10	A-4 (7)	CL	
Amarillo sandy clay loam	Lynn, Tex.	Same	0-10	A	110	17			100	99	69	63	31	26	32	16	A-6 (9)	CL	
			10-40	B	108	18				100	76	67	38	34	38	19	A-6 (12)	CL	
			40-68	Cca	114	15	100	99	98	95	78	74	48	29	30	14	A-6 (10)	CL	
			68-108	C	108	18	100	93	91	83	56	52	37	30	42	24	A-7-6 (10)	CL	
	Lynn, Tex.	Same	0-9	A	116	14			100	99	59	49	24	23	28	13	A-6 (6)	CL	
			9-30	B	109	17			100	99	63	54	32	30	33	16	A-6 (8)	CL	
			30-60	Cca	115	15	100	98	97	93	72	67	47	33	28	13	A-6 (9)	CL	
			60-80	C	115	15	100	98	97	94	61	55	35	28	35	19	A-6 (9)	CL	
	Lynn, Tex.	Same	0-6	A	116	13			100	99	65	53	24	21	25	10	A-4 (6)	CL	
			6-38	B	110	16			100	99	65	60	37	32	36	19	A-6 (10)	CL	
			38-80	Cca	118	14			100	98	81	75	51	35	30	16	A-6 (10)	CL	
			80-110+	C	111	16			100	98	76	72	54	35	41	24	A-7-6 (14)	CL	
Amenia silt loam	Lewis, N. Y.	Aeolian material over glacial till	0-8	A	95	23			100	98	88	81	28	18	40	9	A-4 (8)	ML	
			14-22	B	118	14	100	97	96	91	72	64	23	16	26	8	A-4 (7)	CL	
			28-34+	C	133	8	95	73	69	60	36	32	14	9	14	3	A-4 (1)	SM	
Anoka loamy fine sand	Isanti, Minn.	Glacial outwash	0-8	A	110	13			100	99	39	29	9	7	NP	NP	A-4 (1)	SM	
			32-54	Bt	118	12			100	96	28	20	10	9	NP	NP	A-2-4 (0)	SM	
			54+	C	107	14			100	95	12	9	3	3	NP	NP	A-2-4 (0)	SP-SM	
	Isanti, Minn.	Same	0-4	A	105	14			100	98	29	18	4	3	NP	NP	A-2-4 (0)	SM	
			20-45	Bt	112	13			100	99	32	22	12	12	NP	NP	A-2-4 (0)	SM	
			56-70+	C	104	16			100	99	32	20	4	4	NP	NP	A-2-4 (0)	SM	
Apison loam	De Kalb, Ala.	Clay shale	0-7		112	15	100	99	99	98	77	64	15	11	19	2	A-4 (8)	ML	
			7-22		105	20				100	93	82	41	33	42	16	A-7-6 (11)	ML-CL	
			22-35		98	24				100	96	86	50	42	57	22	A-7-5 (16)	MH	
	De Kalb, Ala.	Sandy shale	2-9	A	112	13	100	98	97	96	49	43	16	12	21	4	A-4 (3)	SM-SC	
			9-25	B	116	14	100	89	86	85	57	52	26	21	31	10	A-4 (4)	ML-CL	
			25-45	C	108	18				100	93	82	34	25	35	11	A-6 (8)	ML-CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE - DENSITY: Maximum Dry Density	MOISTURE - DENSITY: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3 in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	CLASSIFICATION: Unified 4/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Appling loam	Fairfax, Va.	Granite gneiss	1-7	A	116	12		100	98	86	59	56	21	14	22	3	A-4 (5)	ML	
			12-20	B	106	18	100	99	93	82	64	61	46	39	54	26	A-7-6 (14)	MH-CH	
			32-40	C	106	18	100	98	89	76	55	52	29	25	54	20	A-7-5 (9)	MH	
Appling sandy loam	Nottoway, Va.	Granite	0-5	A	121	10			100	80	35	31	11	8	18	2	A-2-4 (0)	SM	
			12-27	B	102	21			100	92	71	70	54	48	55	26	A-7-6 (16)	MH-CH	
			43-59+	C	93	27			100	97	69	68	46	40	63	23	A-7-5 (15)	MH	
Armour silt loam	Maury, Tenn.	Alluvium and colluvium	0-12	A	100	20			100	98	95	93	32	23	37	11	A-6 (8)	ML-CL	
			12-60	B	109	18			100	97	95	94	42	31	38	17	A-6 (11)	CL	
			60+	C	95	27	100	80	78	74	62	61	42	35	53	26	A-7-6 (4)	MH-CH	
	Coffee, Tenn	Alluvium	0-9	A	107	17	100	99	98	94	90	87	36	23	31	9	A-4 (8)	ML-CL	
			15-32	B	109	17		100	99	95	92	91	42	29	33	12	A-6 (9)	CL	
			42+	C	108	18	100	97	95	88	84	81	43	33	39	19	A-6 (12)	CL	
	Coffee, Tenn.	Same	0-8	A	104	19	100	84	77	66	61	60	24	17	34	9	A-4 (5)	ML-CL	
			16-38	B	107	19	100	77	71	62	58	56	31	23	41	19	A-7-6 (8)	CL	
			42-56	C	104	19	95	40	33	25	22	22	15	12	50	27	A-2-7 (1)	GC	
Ashkum silty clay loam	Will, Ill.	Local wash over glacial till	0-12	A	93	21				100	98	95	52	39	54	21	A-7-5 (15)	MH	
			12-26	B	97	23					100	98	57	47	59	33	A-7-6 (20)	CH	
Atkins silt loam	De Kalb, Ala.	Alluvium	0-14		99	22				100	92	90	41	27	38	12	A-6 (9)	ML-CL	
			14-32		112	14			106	99	63	59	22	15	26	7	A-4 (6)	ML-CL	
Austin silty clay	McLennan, Tex.	Austin chalk interbedded with marl	0-30	A	99	21				100	99	97	70	51	69	42	A-7-6 (20)	CH	
			46-72	C	111	17				100	99	98	75	51	59	38	A-7-6 (20)	CH	
	McLennan, Tex.	Austin chalk	0-15	A	95	25			100	99	94	90	66	51	59	31	A-7-6 (20)	CH	
			36-46	C	116	15	100	34	30	23	20	20	12	7	35	14	A-2-6 (0)	CL	
	McLennan, Tex.	Same	0-24	A	97	22			100	99	98	97	69	53	66	36	A-7-5 (20)	CH	
			50-66	C	111	17				100	98	97	68	47	51	31	A-7-6 (18)	CH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE - DENSITY: Maximum Dry Density	MOISTURE - DENSITY: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	CLASSIFICATION: Unified 4/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Barnes loam	Sargent, N. D.	Glacial till	0-8	A	95	22	100	95	93	88	69	65	36	28	44	17	A-7-6 (10)	ML-CL	
			8-14	B	100	20	100	98	97	90	70	65	39	32	41	17	A-7-6 (10)	ML-CL	
			17-26	C_{ca}	118	13	100	97	94	86	67	62	37	28	33	17	A-6 (9)	CL	
	Wells, N. D.	Glacial till (Mankato)	0-5	A	110	15	100	98	96	89	62	53	19	14	29	9	A-4 (5)	CL	
			5-14	B	111	15			100	96	77	70	24	19	31	11	A-6 (8)	CL	
			14-26	C_{ca}	121	11	100	94	89	72	45	40	20	14	26	7	A-4 (2)	SM-SC	
			45-60	C	120	13	100	97	95	87	57	49	18	13	24	7	A-4 (4)	ML-CL	
	Steele, N. D.	Same	0-6	A	95	22	100	98	97	90	70	63	33	26	42	14	A-7-6 (9)	ML	
			6-16	B	108	17			100	92	65	60	33	28	37	17	A-6 (9)	CL	
			16-26	C_{ca}	115	16	100	96	94	86	66	61	38	32	36	20	A-6 (10)	CL	
			44-60	C	119	13	100	94	91	81	59	55	32	25	31	17	A-6 (8)	CL	
Baxter cherty silt loam	Coffee, Tenn.	Cherty limestone	0-7	A	101	18	95	62	56	52	47	46	16	10	34	6	A-4 (3)	GM	
			10-32	B	108	18	100	95	94	89	81	78	48	36	49	28	A-7-6 (17)	CL	
			32+	C	98	23	100	94	92	91	88	87	60	50	72	45	A-7-6 (20)	CH	
	Coffee, Tenn.	Same	1-6	A	108	16	99	80	75	70	63	60	19	11	27	4	A-4 (6)	ML-CL	
			13-33	B	100	22	94	85	83	79	75	71	40	32	52	25	A-7-6 (16)	MH-CH	
			48+	C	101	22	90	72	70	68	65	64	39	31	56	29	A-7-6 (18)	CH	
Bayboro mucky loam	Norfolk, Va.	Coastal Plain sediments	0-10	A	57	50			100	91	78	68	20	14	72	6	A-5 (12)	OH	
			17-52	B	106	18				100	94	84	38	30	33	13	A-6 (9)	CL	
			64-74	D	112	14				100	80	72	32	24	32	15	A-6 (10)	CL	
Beltsville loam	Fairfax, Va.	Coastal Plain terrace	0-8	A	116	13			100	95	64	61	21	12	20	2	A-4 (6)	ML	
			8-19	A & B	116	15			100	96	70	67	34	24	30	12	A-6 (8)	CL	
			19-27	B_m	125	10			100	93	52	48	22	15	17	4	A-4 (3)	ML-CL	
			27-56	B_m	117	14			100	92	54	51	33	27	30	11	A-6 (4)	CL	
			56-74	D	113	15			100	94	44	41	29	26	32	12	A-6 (2)	SC	
Bennington silt loam	Fairfield, Ohio	Wisconsin glacial till	0-8	A	105	18	100	99	98	94	82	77	30	21	33	10	A-4 (8)	ML-CL	
			15-26	B	106	18			100	96	86	83	53	42	47	23	A-7-6 (15)	CL	
			28+	C	117	14	100	93	91	86	76	71	35	26	32	14	A-6 (10)	CL	
Bertie very fine sandy loam	Norfolk, Va.	Coastal Plain sediments	0-8	A	102	15				100	93	72	8	6	NP	NP	A-4 (8)	ML	
			8-30	B	117	13				100	96	83	27	21	29	13	A-6 (9)	CL	
			35-45	C	109	14				100	88	73	12	11	22	3	A-4 (8)	ML	
Blount silt loam	Will, Ill.	Glacial till	0-10	A	108	17	100	98	98	96	87	84	30	17	29	8	A-4 (8)	ML-CL	
			15-27	B	104	22	100	96	96	95	90	88	58	48	52	28	A-7-6 (18)	CH	
			27+	C	113	15	100	98	97	94	88	85	46	32	33	14	A-6 (10)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE - DENSITY: Maximum Dry Density	MOISTURE - DENSITY: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	CLASSIFICATION: Unified 4/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Bluffton silty clay loam	Isanti, Minn.	Glacial till (Mankato)	0-16	A	84	30			100	99	95	85	30	21	58	20	A-7-5 (16)	MH or OH	
			16-30	C	106	17			100	99	95	87	31	26	40	19	A-6 (12)	CL	
			30-42	C	120	13	100	92	90	81	55	46	19	15	30	14	A-6 (6)	CL	
	Isanti, Minn.	Lacustrine clays (Mankato)	0-8	A	77	33			100	98	93	89	40	29	64	16	A-7-5 (14)	MH or OH	
			8-34	C	68	40			100	98	92	88	43	33	76	17	A-7-5 (15)	MH	
			34-45+	C	110	17			100	99	87	78	37	30	44	24	A-7-6 (14)	CL	
Bodine cherty silt loam	Coffee, Tenn.	Cherty limestone	1-9	A	100	18	92	70	66	59	53	51	16	9	31	5	A-4 (4)	ML	
			9-20	C	107	17	62	36	33	29	26	24	11	8	28	6	A-4 (2)	GM-GC	
	Coffee, Tenn.	Same	0-6	A	104	18	98	72	63	55	49	46	16	10	29	4	A-4 (3)	GM	
			6-14	C	103	17	70	40	36	32	29	28	10	6	27	3	A-4 (1)	GM	
			14-24	C	97	21	40	26	25	24	23	22	9	6	33	4	A-4 (5)	ML	
Bradenton fine sand	Sarasota, Fla.	Sand over clayey material and marl	0-9		102	14			100	94	16	10	3	2	NP	NP	A-2-4 (0)	SM	
			9-20		106	14			100	95	8	7	2	1	NP	NP	A-3 (0)	SP-SM	
			24-32		115	13			100	96	24	20	18	16	26	10	A-2-4 (0)	SC	
			36-60		119	12			100	92	22	18	12	11	20	4	A-2-4 (0)	SM-SC	
Bradenton fine sand (variation)	Sarasota, Fla.	Same	18-40		115	13			100	98	24	19	13	12	24	4	A-2-4 (0)	SM-SC	
			44-50		113	15			100	93	35	29	21	16	24	7	A-2-4 (0)	SM-SC	
			50-65		114	14			100	97	24	17	10	9	20	2	A-2-4 (0)	SM	
Brandon silt loam	De Soto, Miss.	Loess over Coastal Plain	1-8	A	105	16			100	99	97	87	17	12	27	5	A-4 (8)	ML-CL	
			8-25	B	110	17	100	99	99	96	91	85	28	24	36	14	A-6 (10)	CL	
			25+	C	121	12	100	69	66	59	47	44	15	12	28	11	A-6 (3)	GC	
Brickton silt loam	Isanti, Minn.	Lacustrine silts & clays	4-10	A	105	17			100	98	93	86	21	11	24	4	A-4 (8)	ML-CL	
			15-30	B	96	22			100	99	95	94	57	46	61	35	A-7-6 (20)	CH	
			30-45+	C	100	22					100	99	46	33	43	21	A-7-6 (13)	CL	
	Isanti, Minn.	Same	3-9	A	103	19				100	99	90	25	17	32	9	A-4 (8)	ML-CL	
			17-35	B	106	20				100	98	92	42	29	43	23	A-7-6 (14)	CL	
			35-50+	C	113	16				100	94	80	22	16	30	11	A-6 (8)	CL	
Brookside silt loam	Marshall, W.Va.	Colluvium	14-28	B	109	19	100	96	92	87	79	76	41	29	40	16	A-6 (10)	ML-CL	
			36-50	B	112	17	100	97	93	87	78	75	40	26	33	11	A-6 (8)	ML-CL	
	Marshall, W. Va.	Same	20-30	B	110	16	92	86	82	77	69	66	40	29	40	16	A-6 (10)	ML-CL	
			39-65+	B	113	15	97	89	84	78	70	68	35	23	36	15	A-6 (9)	CL	
Broward fine sand, shallow phase	Sarasota, Fla.	Sand over limestone	0-4		104	14			100	94	7	7	3	2	NP	NP	A-3 (0)	SP-SM	
			4-12		106	13			100	91	4	4	2	1	NP	NP	A-3 (0)	SP	
			12-20		112	11			100	89	4	4	3	3	NP	NP	A-3 (0)	SP	

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SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE - DENSITY: Maximum Dry Density	MOISTURE - DENSITY: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm.)	No. 10 (2.0mm.)	No. 40 (.42mm.)	No. 200 (.074mm.)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 2/	Unified 3/	REMARKS
			Inches		Lb./cu. ft.	Percent													
Brownfield fine sand	Lynn, Tex.	Aeolian sandy sediments	0-18	A	109	12				100	16	12	4	4	NP	NP	A-2-4 (0)	SM	
			18-64	B	118	13				100	42	37	25	24	30	15	A-6 (3)	SC	
	Lynn, Tex.	Same	1-30	A	107	12				100	12	8	2	2	NP	NP	A-2-4 (0)	SP-SM	
			34-86	B	119	13				100	39	31	20	19	26	12	A-6 (1)	SC	
	Lynn, Tex.	Same	0-13	A	114	11			100	99	21	14	6	5	NP	NP	A-2-4 (0)	SM	
			15-84	B	117	14			100	99	36	31	24	24	30	15	A-6 (1)	SC	
Bryce silty clay	Will, Ill.	Wash on till or lakebed sediments	0-12	A	94	23				100	99	97	53	38	54	22	A-7-5 (16)	MH	
			12-36	Bg	97	23			100	98	93	93	65	52	56	28	A-7-6 (18)	MH-CH	
Bucks loam	Fairfax, Va.	Sandstone & shaly sandstone	0-9	A	116	13			100	98	60	51	22	16	23	3	A-4 (5)	ML	
			9-19	B	116	14			100	98	62	55	29	23	29	9	A-4 (5)	CL	
			19-54	B	114	15			100	97	52	45	23	16	28	7	A-4 (3)	ML-CL	
			54-74	C	107	19			100	97	88	83	35	26	38	11	A-6 (8)	ML	
Bucks silt loam	Fairfax, Va.	Same	0-8	A	111	16		100	95	86	83	81	31	23	32	9	A-4 (8)	ML-CL	
			8-55	B	101	22			100	98	97	95	53	41	54	24	A-7-5 (16)	MH-OH	
Calloway silt loam	De Soto, Miss	Loess over Coastal Plain	0-8	A	104	17			100	97	95	92	23	17	31	8	A-4 (8)	ML-CL	
			8-22	B	105	19			100	99	98	94	33	27	41	18	A-7-6 (11)	CL	
			22-42	M	106	19				100	99	95	30	25	42	20	A-7-6 (12)	CL	
			42+	C	109	17					100	94	24	19	37	15	A-6 (10)	CL	
	Henderson, Tenn.	Loess	0-6		110	14			100	96	82	77	22	17	26	6	A-4 (8)	ML-CL	
			6-15		113	14			100	97	85	81	30	24	30	11	A-6 (8)	CL	
			15-36		110	15			100	98	87	84	33	26	35	15	A-6 (10)	CL	
			36+		110	16			100	97	83	74	32	27	38	18	A-6 (11)	CL	
Calverton silt loam	Fairfax, Va	Shaly sandstone	0-9	A	104	18			100	97	95	92	37	24	33	8	A-4 (8)	ML-CL	
			9-24	B	102	23			100	98	97	96	57	44	50	23	A-7-6 (15)	ML-CL	
			24-30	Bm	97	26		100	98	93	91	90	63	51	58	28	A-7-5 (19)	MH-CH	
			30-37	C	100	23	100	74	52	48	45	44	30	23	48	22	A-7-6 (6)	SC	
Camroden silt loam	Lewis, N. Y.	Glacial till	0-7	A	87	29	100	92	88	84	77	74	29	21	51	12	A-7-5 (11)	MH	
			15-27	Bbg	120	13	95	87	83	76	64	59	21	12	23	5	A-4 (6)	ML-CL	
			47-62	C	124	12	95	75	74	63	50	48	18	10	20	4	A-4 (4)	ML-CL	
Capshaw silt loam	De Kalb, Ala.	Alluvium (terrace)	0-8		116	12	100	99	96	91	65	58	18	12	21	4	A-4 (6)	ML-CL	
			8-25		121	12		100	99	95	78	72	30	22	25	10	A-4 (8)	CL	
			25-38		116	15		100	99	93	74	71	37	27	32	12	A-6 (9)	CL	
	De Kalb, Ala.	Same	0-5		115	15	100	98	97	91	80	73	36	30	32	13	A-6 (9)	CL	
			5-16		113	16	100	97	96	90	79	72	37	31	37	17	A-6 (11)	CL	
			16-36		99	24	100	97	97	95	89	85	60	50	64	34	A-7-5 (20)	MH-CH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLAS-TICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu. ft.	Percent													
Cardington silt loam	Fairfield, Ohio	Wisconsin glacial till	2-7	A	107	16			100	97	86	80	31	20	32	10	A-4 (8)	ML-CL	
			11-22	B	107	19			100	98	90	86	53	40	46	23	A-7-6 (14)	CL	
			30+	C	118	13	100	82	80	77	66	61	33	24	32	14	A-6 (8)	CL	
Carnegie fine sandy loam	Escambia, Fla.	Coastal Plain sediments	0-7	A	116	12	100	78	75	71	31	24	8	4	18	2	A-2-4 (0)	SM	
			11-29	B	112	18	100	90	89	86	55	52	37	34	37	14	A-6 (6)	ML-CL	
			29+	C	104	20			100	96	56	52	40	36	45	17	A-7-6 (8)	ML-CL	
Caroline fine sandy loam	Duplin, N. C.	Coastal Plain sandy clay & clay	5-12	A	122	8	100	98	98	90	41	30	9	4	NP	NP	A-4 (1)	SM	
			14-22	B	105	19			100	94	65	58	45	38	53	26	A-7-6 (14)	MH-CH	
			31-42+	C	101	23			100	97	79	71	52	46	66	37	A-7-6 (20)	CH	
Cattaraugus channery loam	Potter, Pa.	Glacial till	3-5	A	98	22	100	82	80	77	57	50	20	13	40	10	A-4 (6)	ML	10-20% discarded in sampling.
			8-16	B	102	20	100	76	75	72	56	52	24	16	35	10	A-4 (6)	ML-CL	20-30% discarded in sampling.
			70-80	C	129	10	100	48	42	34	25	22	8	5	21	5	A-2-4 (0)	GM-GC	40-50% discarded in sampling.
							(Cattaraugus samples not corrected for material discarded larger than 3 in.)												
Cavode silt loam	Potter, Pa.	Shale	0-3	A	84	29	100	88	86	80	74	72	36	22	56	13	A-7-5 (12)	MH or CH	0-5% discarded in sampling.
			6-10	B	108	19	100	86	81	75	68	67	39	22	36	11	A-6 (8)	ML-CL	0-5% discarded in sampling.
			20-30	C	118	14	100	54	46	41	38	37	21	12	34	12	A-6 (3)	GC	5-10% discarded in sampling.
							(Cavode samples not corrected for material discarded larger than 3 in.)												
Cecil coarse sandy loam	Elbert, Ga.	Gneisses, schists & granites	0-8	A	125	9	100	97	93	55	25	24	13	8	17	1	A-2-4 (0)	SM	
			8-12	B	125	10	100	97	92	66	42	40	23	17	20	6	A-4 (1)	SM-SC	
			12-30	B	100	22		100	97	80	68	68	55	50	68	34	A-7-5 (20)	MH-CH	
			30-50	B	104	22		100	95	72	57	56	46	43	58	26	A-7-5 (13)	MH-CH	
			50-60+	C	108	18		100	96	65	38	36	20	17	40	6	A-4 (1)	SM	
Cecil fine sandy loam	Jackson, Ga.	Gneissoid schist	0-8	A	105	17		100	99	88	55	53	30	21	33	7	A-4 (4)	ML	
			8-15	B	110	17			100	90	59	57	41	35	41	18	A-7-6 (8)	CL	
			15-58	B	104	21			100	90	66	65	47	38	52	22	A-7-5 (13)	MH-CH	
			58-68	B	100	24			100	91	63	62	37	31	53	16	A-7-5 (10)	MH	
			68+	C	100	21			100	92	55	51	26	21	50	10	A-5 (5)	ML	
	Nottoway, Va.	Granite gneiss	0-7	A	120	11		100	98	83	41	37	15	9	20	3	A-4 (1)	SM	
			12-23	B	102	21			100	95	74	63	41	39	51	25	A-7-6 (16)	CH	
			39-47	C	104	19			100	89	55	49	27	25	42	12	A-7-5 (5)	ML	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu.ft.	Percent													
Charlton fine sandy loam	Rockingham, N.H.	Glacial till over schistose rock	1-8	B	94	22	90	65	59	53	41	36	8	5	NP	NP	A-4 (3)	GM-SM	
			8-18	B	104	18	90	66	61	54	41	34	7	4	NP	NP	A-4 (2)	SM	
			28-38	C	116	13	90	64	56	45	29	24	7	4	NP	NP	A-2-4 (0)	SM	
Charlton loam	Rockingham, N.H.	Glacial till	0-7	A	93	23	90	73	71	60	38	32	11	7	43	5	A-5 (1)	SM	
			13-24	B	112	14	90	58	54	48	26	21	7	4	NP	NP	A-2-4 (0)	GM	
			24+	C	118	12	90	62	58	49	26	20	7	4	NP	NP	A-2-4 (0)	SM	
Chester silt loam	Lancaster, Pa.	Schist	4-11	A	104	20	100	94	92	89	79	75	38	26	39	11	A-6 (8)	ML	
			18-27	B	109	19	100	93	91	86	74	71	39	31	44	17	A-7-6 (11)	ML-CL	
			50-70+	C	104	20	100	82	78	71	54	52	30	26	47	16	A-7-5 (7)	ML	
	Lancaster, Pa.	Same	3-10	A	100	21	100	75	70	64	55	53	27	18	41	11	A-7-5 (4)	ML	
			19-27	B	110	17	100	90	86	79	67	64	28	21	38	13	A-6 (8)	ML-CL	
			38-50+	C	120	13	100	81	72	58	40	37	16	10	28	1	A-4 (1)	SM	
Chippewa channery silt loam	Cortland, N.Y.	Glacial till	0-2	A	75	37	100	97	96	92	84	80	30	20	60	14	A-7-5 (14)	MH	
			13-23	Bxgm	118	14	95	79	75	72	66	63	20	13	24	5	A-4 (7)	ML-CL	
			23-34	Bxgm	121	12	100	85	79	72	64	60	26	17	25	7	A-4 (6)	ML-CL	
			34-44	C	124	12	90	77	67	58	53	49	22	14	24	6	A-4 (5)	ML-CL	
	Cortland, N. Y.	Same	0-4	A	71	42			100	98	89	87	42	29	69	13	A-7-5 (13)	MH	
			14-25	Bxgm	121	13	90	78	72	67	60	58	27	19	27	8	A-4 (6)	CL	
			33-43	C	123	12	100	84	75	66	59	56	29	20	26	8	A-4 (5)	CL	
	Cortland, N. Y.	Alluvium over glacial till	5-13	B2 or Bxgm	109	18	100	96	95	94	92	89	35	24	33	10	A-4 (8)	ML-CL	
			13-28	Bxgm or D	121	13	90	66	57	51	49	47	22	14	30	9	A-4 (4)	ML-CL	
			28-34	D	121	13	88	65	60	55	49	48	22	14	30	8	A-4 (4)	ML-CL	
Oisne silt loam	Perry, Ill.	Loess over glacial till	8-21	A	108	16			100	97	95	93	27	17	27	5	A-4 (8)	ML-CL	
			21-39	B	96	25			100	99	98	97	53	47	57	28	A-7-6 (19)	MH-CH	
			44-55	C	105	20			100	99	97	96	40	34	49	26	A-7-6 (16)	CL	
	Perry, Ill.	Same	8-15	A	110	16			100	97	95	94	32	22	29	7	A-4 (8)	ML-CL	
			15-26	B	96	22			100	99	98	97	53	46	59	30	A-7-6 (20)	MH-CH	
			26-39	B	106	19			100	99	98	96	36	29	45	22	A-7-6 (14)	CL	
			39-58	C	115	15			100	99	93	90	27	21	31	12	A-6 (9)	CL	
	Perry, Ill.	Same	7-17	A	109	16			100	97	94	93	28	18	25	5	A-4 (8)	ML-CL	
			17-33	B	98	23			100	99	98	97	53	45	54	27	A-7-6 (18)	CH	
			43-59	C	108	20			100	99	98	97	38	30	47	24	A-7-6 (15)	CL	
Clarksville cherty silt loam	De Kalb, Ala.	Cherty dolomitic limestone	1-9		102	21	100	85	78	67	60	58	21	13	27	4	A-4 (5)	ML-CL	
			9-25		113	14	100	55	47	37	32	31	11	8	24	4	A-2-4 (0)	GM-GC	
			25-40		120	12	95	41	26	14	10	10	2	2	21	2	A-1-a (0)	GP-GM	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density: Maximum Dry Density	Moisture-density: Optimum Moisture	Mechanical analysis 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Colbert silty clay loam	De Kalb, Ala.	Clayey limestone & shale	0-6		117	13		100	99	88	76	69	23	18	23	5	A-4 (8)	ML-CL	
			6-20		-	-			100	95	89	85	43	33	37	16	A-6 (10)	CL	
			20-36		113	17			100	94	86	83	54	47	55	27	A-7-6 (18)	MH-CH	
	London, Tenn.	Argillaceous limestone	0-5	A	91	29				100	98	97	80	69	77	42	A-7-5 (20)	MH-CH	
			5-18	B	83	32			100	99	92	89	62	48	69	27	A-7-5 (19)	MH	
			18-31	B or C	97	26	100	95	95	92	90	90	74	62	69	35	A-7-5 (20)	MH-CH	
	London, Tenn.	Same	1-6	A	107	19			100	98	92	89	42	30	33	11	A-6 (8)	ML-CL	
			6-15	B	88	31				100	99	97	79	70	86	50	A-7-5 (20)	MH-CH	
			15-23	C	90	28				100	99	97	78	70	80	45	A-7-5 (20)	MH-CH	
	London, Tenn.	Same	0-4	A	101	22			100	97	87	85	48	35	46	19	A-7-6 (13)	ML-CL	
			4-12	B	89	30			100	99	93	92	74	66	80	44	A-7-5 (20)	MH-CH	
			16-24	B or C	93	29				100	98	96	77	68	75	40	A-7-5 (20)	MH-CH	
Colfax sandy loam	Nottoway, Va.	Granite	7-14	A	122	10			100	78	52	45	16	10	18	2	A-4 (3)	ML	
			14-19	B	115	14			100	80	58	54	30	24	33	13	A-6 (6)	CL	
			19-28	B_m	113	15			100	83	60	54	32	26	34	14	A-6 (7)	CL	
			28-32+	C	113	15			100	70	47	42	25	18	31	10	A-4 (2)	SC	
Collins silt loam	De Soto, Miss.	Alluvium	10-24		106	16					100	95	19	13	27	5	A-4 (8)	ML-CL	
Conestoga silt loam	Lancaster, Pa.	Limestone	3-11	A	105	18		100	98	96	88	84	35	22	33	8	A-4 (8)	ML-CL	
			20-30	B	107	18		100	99	97	90	87	42	33	45	20	A-7-6 (13)	ML-CL	
			43-56+	C	104	21	100	99	98	96	86	82	52	44	50	22	A-7-6 (15)	ML-CL	
	Lancaster, Pa.	Metamorphic micaceous limestone schist	4-10	A	98	22	100	98	97	95	85	81	40	24	42	10	A-5 (8)	ML	
			23-29	B	100	23	100	99	98	94	89	86	47	31	52	18	A-7-5 (14)	MH	
			34-45+	C	100	23	100	99	98	95	83	78	36	21	48	14	A-7-5 (11)	ML	
Cookeville silt loam	Coffee, Tenn.	Limestone	2-8	A	111	14			100	97	89	84	29	18	24	6	A-4 (8)	ML-CL	
			13-32	B	102	21	100	99	99	98	92	89	54	45	54	26	A-7-6 (17)	MH-CH	
			32+	C	94	26			100	99	92	89	67	58	74	37	A-7-5 (20)	MH	
	Coffee, Tenn.	Same	0-6	A	105	16	100	96	94	89	77	68	22	13	28	5	A-4 (8)	ML-CL	
			14-32	B	91	29	100	98	96	94	90	88	63	55	70	34	A-7-5 (20)	MH	
			32-45	B	91	28		100	99	97	93	92	65	53	68	34	A-7-5 (20)	MH-CH	
			45+	C	93	28			100	98	93	92	65	54	66	30	A-7-5 (20)	MH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu. ft.	Percent													
Covington loam	Grand Isle, Vt.	Marine sediments	0-6	A	89	26	100	99	98	95	66	64	42	31	47	15	A-7-5 (9)	ML or OL	
			12-20	B_g	92	27	100	99	95	94	89	88	78	70	66	36	A-7-5 (20)	OH	
			24+	D_g	124	11	100	91	87	79	59	53	22	14	20	5	A-4 (5)	ML-CL	
Covington loam or silt loam	Grand Isle, Vt.	Same	0-8	A	97	21				100	85	70	24	20	41	12	A-7-6 (9)	ML or OL	
			18-31	B_g	117	14				100	91	74	21	17	24	4	A-4 (8)	ML-CL	
			31-55	D_g	117	14			100	99	85	69	24	20	27	8	A-4 (8)	CL	
Covington silt loam	Grand Isle, Vt.	Same	0-7	A	95	23	100	99	98	94	79	76	47	33	48	17	A-7-5 (12)	ML or OL	
			9-21	B_g	91	29			100	99	96	96	82	72	66	34	A-7-5 (20)	MH-CH	
			28+	C	87	32			100	99	97	96	88	82	80	46	A-7-5 (20)	MH-CH	
Covington silty clay loam	Franklin, N. Y.	Glacial lacustrine	0-8	A	90	27			100	98	85	78	44	36	53	18	A-7-5 (14)	MH	
			12-19	B_g	94	28			100	99	97	95	75	62	63	32	A-7-5 (20)	MH-CH	
			40-68+	C_g	94	28				100	99	97	80	68	70	40	A-7-5 (20)	OH	
Craig silt loam	Moniteau, Mo.	Cherty limestone & shale	0-10	A	108	16			100	98	93	87	24	18	30	9	A-4 (8)	ML-CL	
			12-18	B	109	16	100	99	98	94	89	88	30	24	35	14	A-6 (10)	CL	
Craig silt loam, deep phase	Moniteau, Mo.	Same	0-10	A	97	22			100	99	99	97	37	29	41	13	A-7-6 (9)	ML	
			14-22	B	99	22			100	99	98	97	45	37	47	21	A-7-6 (14)	ML-CL	
			36-42	C	98	23			100	99	98	97	47	39	55	27	A-7-6 (18)	MH-CH	
Crete silt loam	Gage, Nebr.	Loess	0-6	A	104	18				100	99	95	34	30	34	12	A-6 (9)	ML-CL	
			15-23	B	96	25					100	98	53	47	61	35	A-7-6 (20)	CH	
			47-60	C	103	21					100	97	41	35	41	18	A-7-6 (11)	CL	
	Saline, Nebr.	Same	0-5	A	102	19					100	96	34	30	34	11	A-6 (8)	ML-CL	
			11-21	B	93	27					100	97	53	47	60	31	A-7-6 (20)	MH-CH	
			42-53	B_{ca}	102	21					100	97	41	34	44	21	A-7-6 (13)	CL	
Crockett fine sandy loam	Brazos, Tex.	Clay, sandy clay & shale	0-7	A	124	11	100	98	94	89	54	43	17	13	22	7	A-4 (4)	CL-ML	
			9-27	B	102	21	100	98	92	88	68	62	43	40	56	32	A-7-6 (17)	CH	
			54-80	C	112	17		100	98	94	72	66	42	36	50	32	A-7-6 (17)	CL-CH	
	Brazos, Tex.	Same	0-6	A	118	12		100	99	97	67	50	13	11	20	3	A-4 (6)	ML	
			6-30	B	104	19			100	99	87	80	49	45	53	27	A-7-6 (17)	CH	
			56-80	C	114	15			100	97	94	87	36	31	50	30	A-7-6 (18)	CL-CH	
	Brazos, Tex.	Same	0-5	A	120	12	100	99	97	94	68	53	17	15	20	4	A-4 (7)	CL-ML	
			5-42	B	105	19		100	99	97	84	79	46	40	54	34	A-7-6 (19)	CH	
			60-84	C	100	23			100	99	94	90	62	54	70	43	A-7-6 (20)	CH	
Croghan loamy fine sand	Lewis, N. Y.	Sandy glacial outwash	0-7	A	105	17			100	90	23	20	8	5	NP	NP	A-2-4 (0)	SM	
			7-13	B	109	15			100	87	15	12	5	4	NP	NP	A-2-4 (0)	SM	
			53-67	B_b	107	15			100	75	2	2	2	1	NP	NP	A-3 (0)	SP	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture - density: Maximum Dry Density	Moisture - density: Optimum Moisture	Mechanical analysis 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm.)	No. 10 (2.0mm.)	No. 40 (.42mm.)	No. 200 (.074mm.)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Crossville loam	De Kalb, Ala.	Sandstone	0-14		106	19	100	98	97	93	63	63	39	34	36	11	A-6 (6)	ML-CL	
			14-27		105	18	100	86	83	79	52	52	35	31	37	11	A-6 (4)	ML-CL	
Culvers channery silt loam	Potter, Pa.	Glacial till	8-20	B	118	13	100	64	59	51	36	32	12	8	25	6	A-4 (1)	SM-SC	30-40% discarded in sampling.
			38-52	Cg	129	9	100	68	67	55	34	27	8	5	19	3	A-2-4 (0)	SM	40-50% discarded in sampling.
			70-80	C	126	11	100	58	53	47	35	29	9	6	22	6	A-4 (1)	GM-GC	60-70% discarded in sampling.
							(Culvers samples not corrected for material discarded larger than 3 in.)												
Cumberland silt loam	Blount, Tenn.	Alluvium	1-8	A	112	15	100	99	98	92	68	65	29	22	29	12	A-6 (8)	CL	
			8-72	B	100	23	100	99	98	94	78	78	57	52	50	18	A-7-5 (13)	ML	
			72-84		96	27			100	97	87	86	65	58	58	20	A-7-5 (16)	MH	
	Blount, Tenn.	Same	0-8	A	103	20	100	99	98	92	74	72	39	33	40	17	A-6 (11)	CL	
			8-19	B	107	19	100	99	98	93	80	79	53	47	45	22	A-7-6 (14)	CL	
			19-50	B	101	24		100	99	93	78	76	54	51	49	20	A-7-6 (14)	ML-CL	
Cuthbert-Silerton soils	Henderson, Tenn.	Loess over Coastal Plain	0-4		109	14			100	98	80	72	18	13	22	3	A-4 (8)	ML	
			4-12		114	13			100	98	83	77	23	16	22	4	A-4 (8)	ML-CL	
			12+		109	16			100	98	90	85	39	33	41	19	A-7-6 (12)	CL	
	Henderson, Tenn.	Coastal Plain	2-9		119	12	100	94	89	86	46	39	13	10	18	2	A-4 (2)	SM	
			9+		99	24			100	99	80	74	56	52	63	37	A-7-6 (20)	CH	
Dalbo silt loam	Isanti, Minn.	Lacustrine silts & clays	4-10	A	105	19	100	98	97	91	58	53	23	17	22	9	A-4 (5)	CL	
			17-32	B	107	17	100	85	83	74	36	31	13	11	22	9	A-4 (0)	SC	
			32-44+	C	107	19				100	99	98	31	18	33	11	A-6 (8)	ML-CL	
	Isanti, Minn.	Same	5-9	A	101	19			100	99	95	86	19	13	33	7	A-4 (8)	ML	
			9-18	B	106	19			100	99	95	90	32	28	37	15	A-6 (10)	CL	
			25+	C	108	18				100	99	85	15	11	26	4	A-4 (8)	ML-CL	
Davidson clay loam	Alamance, N. C.	Diorite	0-2	A	97	21	100	98	97	89	77	72	35	25	41	12	A-7-6 (9)	ML	
			20-58	B	93	27	100	99	98	95	91	89	67	60	70	32	A-7-5 (20)	MH	
			58+	B	87	31				100	98	95	73	63	84	40	A-7-5 (20)	MH	
Davidson clay loam	Albemarle, Va.	Greenstone	0-7	A	108	18	100	99	98	94	83	79	45	32	32	11	A-6 (8)	CL	
			7-24	B	89	31			100	99	95	94	82	78	72	35	A-7-5 (20)	MH	
			66-72+	C	84	35			100	98	95	93	76	71	75	25	A-7-5 (18)	MH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE - DENSITY: Maximum Dry Density	MOISTURE - DENSITY: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	Unified 4/	REMARKS
			Inches		Lb./cu. ft.	Percent													
Decatur silt loam	Blount, Tenn.	Dolomitic limestone	1-8	A	113	16	100	98	96	92	77	74	35	28	30	13	A-6 (9)	CL	
			8-34	B	105	20		100	95	92	83	82	52	45	47	28	A-7-6 (17)	CL	
			34-48	C	91	28			100	98	91	90	71	65	62	24	A-7-5 (18)	MH	
Decatur silty clay loam	Loudon, Tenn.	Limestone	1-6	A	110	17	100	99	97	91	78	76	35	23	32	11	A-6 (8)	CL	
			26-46	B	99	25			100	97	89	87	65	57	62	35	A-7-6 (20)	CH	
			46-60	B	86	34			100	99	96	96	83	78	83	40	A-7-5 (20)	MH	
	Loudon, Tenn.	Same	0-6	A	112	17	100	97	95	92	79	77	46	38	36	18	A-6 (11)	CL	
			24-45	B	100	23			100	98	87	86	63	58	55	25	A-7-5 (17)	MH-CH	
			69-78	B	103	21			100	97	83	82	57	49	51	23	A-7-6 (15)	MH-CH	
	Loudon, Tenn.	Same	0-6	A	105	20			100	98	92	90	52	43	41	19	A-7-6 (12)	CL	
			26-48	B	97	25			100	99	95	93	70	64	57	25	A-7-5 (17)	MH	
			48-75	B	98	25			100	99	94	93	68	61	57	28	A-7-6 (19)	MH-CH	
Dellrose cherty silt loam	Maury, Tenn.	Alluvium & colluvium	0-10	A	101	19	100	71	66	56	53	53	17	11	32	7	A-4 (4)	ML-CL	
			10-36	B	109	18	100	62	58	52	50	49	22	16	32	13	A-6 (4)	GC	
			36-60	C	110	17	81	31	27	22	21	21	9	7	32	13	A-2-4 (0)	GC	
			60+	D	97	23		100	99	98	97	97	79	62	65	39	A-7-6 (20)	CH	
Delray fine sand	Sarasota, Fla.	Fine sand (Coastal Plain)	0-12		-	-			100	92	38	32	8	5	NP	NP	A-4 (1)	SM	
			12-38		118	11			100	96	18	15	10	9	NP	NP	A-2-4 (0)	SM	
			38-52		116	12			100	98	15	13	10	9	NP	NP	A-2-4 (0)	SM	
Delray fine sand, shallow phase	Sarasota, Fla.	Same	0-15		112	11			100	89	10	8	4	4	NP	NP	A-3 (0)	SP-SM	
			15-25		113	12			100	90	8	8	5	3	NP	NP	A-3 (0)	SP-SM	
			25-34		116	11			100	89	10	9	7	6	NP	NP	A-3 (0)	SP-SM	
			34-50		121	13			100	91	19	17	14	12	23	8	A-2-4 (0)	SC	
Dennis loam	Pawnee, Okla.	Shales & sandstone	0-8	A	110	14			100	99	86	73	24	20	30	10	A-4 (8)	CL	
			18-36	B	106	20			100	99	89	82	42	37	50	29	A-7-6 (18)	CL	
			48-72+	C	105	20			100	99	87	79	47	43	56	36	A-7-6 (19)	CH	
	Pawnee, Okla.	Same	0-8	A	106	17			100	99	82	70	27	22	34	12	A-6 (9)	ML-CL	
			18-48	B	106	19			100	99	87	80	43	38	49	27	A-7-6(17)	CL	
			48-80+	C	115	15			100	99	84	75	34	28	31	15	A-6 (10)	CL	
	Pawnee, Okla.	Siltstone & sandstone	0-10	A	110	15				100	64	53	16	14	26	7	A-4 (6)	ML-CL	
			18-44	B	106	19				100	80	73	44	39	51	33	A-7-6 (18)	CH	
			44-78+	C	117	14	100	90	84	83	71	62	30	21	27	11	A-6 (8)	CL	
Denton clay	McLennan, Tex.	Limestone	0-15	A	90	27				100	96	92	61	54	73	40	A-7-5 (20)	MH-CH	
			15-30	A	96	23			100	98	94	90	62	52	69	41	A-7-6 (20)	CH	
	McLennan, Tex.	Same	0-14	A	92	26			100	98	94	90	63	55	67	37	A-7-5 (20)	CH	
			14-29	A & C:	102	20			100	97	93	89	61	47	60	34	A-7-6 (20)	CH	
	McLennan, Tex.	Same	0-12	A	94	25			100	98	94	90	61	55	69	37	A-7-5 (20)	CH	
			12-24	A	93	27			100	97	93	89	63	54	70	40	A-7-5 (20)	CH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE - DENSITY: Maximum Dry Density	MOISTURE - DENSITY: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	CLASSIFICATION: Unified 4/	REMARKS
			Inches		Lb./cu. ft.	Percent													
Dewey silt loam	Blount, Tenn.	Dolomitic limestone	0-7	A	109	15	100	92	89	85	66	65	25	15	25	7	A-4 (6)	ML-CL	
			13-37	B	113	17		100	99	97	85	84	43	32	38	20	A-6 (12)	CL	
			37-50	C	119	13	100	99	98	95	81	79	33	21	29	13	A-6 (9)	CL	
	Blount, Tenn.	Same	0-8	A	108	16	100	95	94	92	70	68	26	14	27	7	A-4 (7)	ML-CL	
			19-40	B	114	15			100	99	70	69	44	29	34	15	A-6 (9)	CL	
			40-60	B & C	96	26		100	99	96	77	77	65	57	59	27	A-7-5 (19)	MH-CH	
Dickson silt loam	Coffee, Tenn.	Loess over cherty limestone	1-6	A	110	15		100	99	97	90	87	26	17	27	6	A-4 (8)	ML-CL	
			11-23	B	114	15			100	97	91	88	32	23	31	10	A-4 (8)	ML-CL	
			27-48	B_m	112	16		100	99	97	92	88	34	25	35	13	A-6 (9)	ML-CL	
			48+	D	107	19		100	99	97	90	87	46	34	45	17	A-7-6 (12)	ML-CL	
	Coffee, Tenn.	Same	1-7	A	109	15		100	99	98	87	83	25	16	26	5	A-4 (8)	ML-CL	
			14-24	B	114	14	100	98	97	96	88	86	27	18	30	10	A-4 (8)	CL	
			28-42	B_m	113	15	100	96	95	94	86	73	29	23	33	13	A-6 (9)	CL	
			42-54	B_m	104	19	100	96	95	94	85	79	41	34	48	24	A-7-6 (15)	CL	
Dougherty fine sandy loam	Pawnee, Okla.	Unconsolidated sediments	0-7	A	112	12			100	99	33	24	6	3	NP	NP	A-2-4 (0)	SM	
			18-36	B	120	12			100	99	39	34	21	18	23	8	A-4 (1)	SM-SC	
			58-94+	C	117	12				100	71	54	16	14	21	3	A-4 (7)	ML	
	Pawnee, Okla.	Same	0-8	A	111	12			100	99	74	56	7	5	NP	NP	A-4 (8)	ML	
			24-34	B	118	14			100	98	30	27	20	19	23	7	A-2-4 (0)	SM-SC	
			42-80+	C	115	11			100	95	15	13	10	8	NP	NP	A-2-4 (0)	SM	
	Pawnee, Okla.	Same	0-7	A	108	13			100	99	62	46	9	6	NP	NP	A-4 (5)	ML	
			20-36	B	122	12			100	99	56	43	16	14	19	4	A-4 (4)	ML-CL	
			36-110+	C	118	11			100	98	24	20	10	7	NP	NP	A-2-4 (0)	SM	
Bragston fine sandy loam	Norfolk, Va.	Coastal Plain sediments	4-8	A	104	17				100	50	46	19	11	26	5	A-4 (3)	SM-SC	
			14-28	B	125	9				100	45	42	15	9	14	3	A-4 (2)	SM	
			34-64	C	114	14				100	21	19	14	13	19	3	A-2-4 (0)	SM	
Drummer silty clay loam	Will, Ill.	Alluvial sediments on till plain	0-20	A	89	25			100	98	94	92	49	36	64	25	A-7-5 (18)	MH	
			20-32	B_g	101	20			100	98	93	90	49	40	57	28	A-7-6 (19)	MH-OH	
			32+	C^g	103	20			100	98	93	91	50	41	59	34	A-7-6 (20)	OH	
Duffield silt loam	Lancaster, Pa.	Limestone	4-13	A	109	16	100	97	96	94	90	87	34	23	31	8	A-4 (8)	ML-CL	
			19-26	B	108	18	100	98	95	91	86	83	48	39	46	22	A-7-6 (14)	CL	
			37-49	B	107	19	100	98	97	94	90	87	51	41	47	21	A-7-6 (14)	ML-CL	
	Lancaster, Pa.	Same	5-14	A	99	21	100	98	97	96	92	89	35	21	37	8	A-4 (8)	ML	
			28-34	B	108	18	100	98	97	95	89	85	48	37	46	22	A-7-6 (14)	CL	
			43-56	C	106	19	100	97	96	94	86	81	45	37	44	20	A-7-6 (13)	CL	
	Frederick, Md.	Limestone and calcareous shales	0-10	A	107	17	100	99	97	91	70	67	28	16	28	6	A-4 (7)	ML-CL	
			10-33	B	110	17		100	99	94	81	78	46	36	37	16	A-6 (10)	CL	
			33-49	B	95	25		100	99	94	90	88	62	54	55	26	A-7-6 (17)	MH-CH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture - density: Maximum dry density	Moisture - density: Optimum moisture	Mechanical analysis [1] – Percentage passing sieve [2]: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than [2]: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. [3]	Unified [4]	Remarks
			Inches		Lb./cu.ft.	Percent													
Dulac & Tippah silt loams	Henderson, Tenn.	Loess over Coastal Plain	0-6		107	15			100	99	88	81	17	11	23	3	A-4 (8)	ML	
			6-22		103	20				100	93	89	41	35	47	23	A-7-6 (15)	CL	
			22-32		109	17			100	99	85	80	34	29	39	17	A-6 (11)	CL	
			32+		91	27				100	87	83	65	62	81	47	A-7-5 (20)	CH	
	Henderson, Tenn.	Same	0-6		104	15				100	95	90	18	13	24	2	A-4 (8)	ML	
			6-24		106	18				100	98	95	41	35	46	22	A-7-6 (14)	CL	
			24-42		112	15			100	99	92	87	29	24	35	15	A-6 (10)	CL	
			42+		114	15			100	99	88	82	32	27	31	14	A-6 (10)	CL	
Dundee silty clay loam	Leflore, Miss.	Old alluvium	0-5	A	104	17				100	97	85	29	21	34	11	A-6 (8)	ML-CL	
			5-18	B	103	19				100	98	83	37	32	48	24	A-7-6 (15)	CL	
			18-48	B & C	108	17				100	97	80	24	20	35	13	A-6 (9)	ML-CL	
Dundee very fine sandy loam	Humphreys, Miss.	Alluvium	0-6	A	100	17				100	91	60	10	7	23	0	A-4 (8)	ML	
			6-24	B	104	18				100	96	82	37	31	42	20	A-7-6 (12)	CL	
			24-38		106	18				100	97	78	26	23	37	14	A-6 (10)	ML-CL	
			38-56		108	17				100	98	80	23	18	34	9	A-4 (8)	ML-CL	
Dunmore silt loam	Blount, Tenn.	Dolomitic limestone	0-7	A	112	14	100	93	86	80	71	71	26	14	26	6	A-4 (7)	ML-CL	
			7-22	B	88	31		100	98	96	93	93	68	60	68	34	A-7-5 (20)	MH-CH	
			22-40	C	89	30			100	99	97	96	81	71	68	32	A-7-5 (20)	MH	
	Blount, Tenn.	Same	0-7	A	107	16	100	84	79	74	69	67	25	16	29	8	A-4 (7)	ML-CL	
			7-17	A & B	117	14	100	99	95	91	84	84	39	26	32	13	A-6 (9)	CL	
			17-33	B	93	29	100	98	96	93	90	90	72	63	60	28	A-7-5 (19)	MH-CH	
			33-48	C	91	29	100	94	90	85	83	83	72	62	65	30	A-7-5 (20)	MH	
	Blount, Tenn.	Same	0-6	A	105	17	100	85	79	73	66	65	24	13	30	8	A-4 (6)	ML-CL	
			6-19	A & B	110	19	100	99	97	94	89	88	48	31	35	16	A-6 (10)	CL	
			19-41	B	98	24	100	99	97	94	90	90	63	51	55	27	A-7-6 (18)	MH-CH	
			41-60	C	93	28			100	99	98	97	78	68	68	36	A-7-5 (20)	MH-CH	
Duplin fine sandy loam	Duplin, N. C.	Coastal Plain sandy clay	0-8	A	121	9			100	91	58	46	12	7	16	1	A-4 (5)	ML	
			10-23	B	114	15			100	92	67	58	32	29	36	16	A-6 (9)	CL	
			34-60+	C	118	11			100	91	62	52	24	22	34	17	A-6 (8)	CL	
Durham sandy loam	Nottoway, Va.	Granite	7-16	A	129	7			100	79	33	29	12	6	12	2	A-2-4 (0)	SM	
			20-29	B	114	15			100	83	51	48	34	31	40	18	A-6 (6)	CL	
			29-41	B_2	116	14			100	88	53	47	32	29	39	16	A-6 (6)	CL	
			41-78	B	119	13			100	79	45	40	27	23	34	16	A-6 (4)	SC	
			78-92+	C	119	12			100	74	34	30	22	21	34	15	A-2-6 (1)	SC	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density: Maximum dry density	Moisture-density: Optimum moisture	Mechanical analysis 1/ Percentage passing sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Edgemont very stony loam	Lancaster, Pa.	Quartzite (Chickies formation)	2-12	Ab	114	12	100	94	90	84	39	32	14	10	NP	NP	A-4 (1)	SM	
			12-25	Bb	122	11	100	78	72	63	26	20	9	8	NP	NP	A-2-4 (0)	SM	40% discarded in sampling.
			25-32	Bb	121	10	100	76	70	58	24	17	7	6	NP	NP	A-2-4 (0)	SM	55% discarded in sampling.
							(Based on material less than 3 in.)												
Edgemont channery loam	Lancaster, Pa.	Same	2-12	Ab	117	12	100	86	82	74	30	26	10	8	NP	NP	A-2-4 (0)	SM	12% discarded in sampling.
			16-24	Bb	124	9	100	86	75	58	27	19	7	6	NP	NP	A-2-4 (0)	SM	45% discarded in sampling.
			24-32+	C	122	10	100	74	65	49	21	15	5	4	NP	NP	A-1-b (0)	SM	75% discarded in sampling.
							(Based on material less than 3 in.)												
Edna fine sandy loam	Fort Bend, Tex.	Coastal Plain sediments	0-22	A	116	12				100	79	61	16	12	22	4	A-4 (8)	ML-OL	
			22-32	B	106	19				100	85	72	37	33	44	26	A-7-6 (15)	OL	
			0-6	A	118	12				100	55	45	17	12	19	2	A-4 (4)	ML	
			6-38	B	111	16				100	69	62	36	32	41	25	A-7-6 (13)	OL	
Egam silty clay loam	Maury, Tenn.	Alluvium	0-30	A	102	20				100	93	90	38	30	42	20	A-7-6 (12)	OL	
			30+	C	92	21				100	97	95	45	36	50	26	A-7-6 (16)	OL	
Elbert silt loam	Fairfax, Va.	Diabase	0-5	A	106	19		100	97	90	83	81	45	32	40	17	A-6 (11)	OL	
			5-10	AB	106	18		100	96	89	82	79	44	30	40	18	A-6 (11)	OL	
			10-20	Bm	88	29			100	99	91	89	70	62	94	60	A-7-5 (20)	CH	
			20-32	Bm	96	25			100	93	67	62	41	34	57	29	A-7-6 (17)	MH-CH	
			32-36	C	107	20		100	97	78	46	40	24	17	40	15	A-6 (4)	SO	
Elioak silt loam	Fairfax, Va.	Schist	0-9	A	106	17	100	96	94	91	82	77	33	21	30	6	A-4 (8)	ML-CL	
			12-35	B	100	23	100	95	93	91	84	83	54	46	55	22	A-7-5 (16)	MH	
			50-55	C	103	21	100	76	70	66	50	45	18	13	42	2	A-5 (3)	SM	
Elkton silt loam	Norfolk, Va.	Coastal Plain sediments	4-11	A	107	16				100	91	83	27	19	30	8	A-4 (8)	ML-CL	
			11-39	Bg	112	15				100	92	84	36	29	34	17	A-6 (11)	CL	
			49-60	Cg	116	13				100	81	62	17	15	23	6	A-4 (6)	ML-CL	
Elliot silt loam	Will, Ill.	Glacial till	0-8	A	105	18				100	95	91	39	29	34	11	A-6 (8)	ML-CL	
			18-33	B	105	19			100	99	87	85	52	40	45	23	A-7-6 (14)	CL	
Emory silt loam	Blount, Tenn.	Alluvium	0-18		102	22			100	99	96	96	59	45	45	21	A-7-6 (13)	CL	
			18-40		98	25			100	99	96	96	54	49	46	22	A-7-6 (14)	CL	
	Blount, Tenn.	Same	0-18		101	21			100	97	89	87	39	29	38	12	A-6 (9)	ML-CL	
			18-40		110	18			100	95	83	82	43	32	35	14	A-6 (10)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3 in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu. ft.	Percent													
Empeyville stony loam	Franklin, N. Y.	Glacial till	0-6	A	95	23	100	90	88	80	54	48	20	13	38	6	A-4 (4)	ML	
			20-36	B	129	8	95	74	72	62	35	30	15	10	14	2	A-4 (1)	SM	
			38-78+	C	132	8	85	64	62	48	21	19	9	7	NP	NP	A-2-4 (0)	SM	
Empeyville stony, very fine sandy loam	Franklin, N. Y.	Same	0-3	A	86	25	87	82	80	71	48	37	8	4	41	6	A-5 (4)	ML	
			3-12	B	93	22	88	82	81	72	52	41	11	7	NP	NP	A-4 (5)	ML	
			17-22	A_b	122	11	90	79	72	58	36	31	11	6	NP	NP	A-4 (1)	SM	
			22-36	B_b	126	8	92	80	77	66	37	31	10	4	NP	NP	A-4 (1)	SM	
	Franklin, N. Y.	Same	0-4	A	97	19	91	90	90	87	55	38	11	5	NP	NP	A-4 (5)	ML	
			4-9	B	92	23	91	89	88	85	59	44	13	5	NP	NP	A-4 (6)	ML	
			15-19	A_b	124	10	92	83	81	52	29	25	10	5	17	3	A-2-4 (0)	SM	
			19-35	B_b	126	11	92	82	80	73	54	48	21	13	20	6	A-4 (5)	ML-CL	
	Franklin, N. Y.	Same	0-6	A	102	18	87	68	65	58	39	30	9	5	36	6	A-4 (2)	SM	
			6-16	B	102	18	88	73	70	62	44	34	10	6	NP	NP	A-4 (3)	SM	
			20-26	A_b	128	9	90	79	77	65	38	32	11	6	NP	NP	A-4 (1)	SM	
			26-47	B_b	127	10	92	78	76	68	43	38	17	13	18	5	A-4 (2)	SM-SC	
Enon fine sandy loam	Nottoway, Va.	Granite gneiss & hornblende gneiss	0-9	A	123	10		100	99	82	36	30	12	9	18	1	A-4 (0)	SM	
			12-21	B	91	26			100	95	80	78	65	62	86	53	A-7-5 (20)	CH	
			27-40+	C	106	18			100	87	51	46	23	18	41	17	A-7-6 (6)	ML-CL	
Enon loam	Alamance, N. C.	Diorite	0-4	A	103	17		100	99	90	75	68	14	9	NP	NP	A-4 (8)	ML	
			26-29	B	102	22		100	99	95	89	86	48	44	57	31	A-7-6 (19)	CH	
			29+	C	113	16			100	99	85	79	25	21	34	12	A-6 (9)	ML-CL	
Enon silt loam	Fairfax, Va.	Schist and meta-basalt	0-6	A	114	14	100	86	78	70	58	52	18	12	27	5	A-4 (5)	ML-CL	
			9-20	B	108	19		100	98	92	84	81	49	35	48	24	A-7-6 (15)	CL	
			32-42	C	112	16	100	97	93	88	81	78	39	25	35	13	A-6 (9)	ML-CL	
Etowah silt loam	Maury, Tenn.	Alluvium	0-10	A	108	16	100	99	99	96	91	88	25	17	27	6	A-4 (8)	ML-CL	
			10-36	B	115	16		100	99	96	93	91	34	25	30	11	A-6 (8)	CL	
			36+	C	103	20	100	57	54	47	43	42	23	19	43	19	A-7-6 (4)	GC	
	Maury, Tenn.	Same	2-12	A	112	16			100	97	86	83	24	16	24	6	A-4 (8)	ML-CL	
			12-60	B	114	16			100	96	85	84	35	26	34	13	A-6 (9)	CL	
			60+	C	95	24	100	36	33	28	25	25	20	18	58	22	A-2-7 (1)	GM	
	De Kalb, Ala.	Alluvium (terrace)	3-12		116	13			100	93	81	73	24	18	24	6	A-4 (8)	ML-CL	
			12-25		119	13			100	94	87	82	35	26	29	11	A-6 (8)	CL	
			25-42		110	18			100	95	88	84	46	38	43	19	A-7-6 (12)	CL	
Eustis loamy sand	Escambia, Fla.	Coastal Plain sediments	0-6	A	118	12			100	74	21	19	8	6	NP	NP	A-2-4 (0)	SM	
			12-23	B	124	10			100	78	21	20	10	8	NP	NP	A-2-4 (0)	SM	
			30-46	C	127	10			100	79	23	23	12	8	NP	NP	A-2-4 (0)	SM	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE - DENSITY: Maximum Dry Density	MOISTURE - DENSITY: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	CLASSIFICATION: Unified 4/	REMARKS
			Inches		Lb./cu. ft.	Percent													
Butaw clay	Newton, Miss.	Marly clays	5-14	Ag	92	23			100	99	97	97	61	53	64	30	A-7-5 (20)	MH	Mapped as Vaiden-Butaw.
			22-32	B	89	29					100	97	69	64	97	58	A-7-5 (20)	MH-CH	
			40-59	C	95	26	100	99	98	97	96	95	68	63	84	46	A-7-5 (20)	MH-CH	
	Jasper, Miss.	Same	6-17	Bg	91	29			100	99	95	94	64	59	80	44	A-7-5 (20)	MH-CH	
			46-72	C	92	27			100	98	94	92	71	60	76	44	A-7-5 (20)	OH	
Wyler silt loam	Will, Ill.	Glacial till or lakebed sediments	0-6	A	106	18		100	99	97	88	85	41	28	33	13	A-6 (9)	CL	
			11-22	B	102	22	100	99	99	98	95	95	73	61	53	30	A-7-6 (19)	CH	
			22+	C	107	20			100	98	94	94	70	54	43	22	A-7-6 (13)	CL	
Faceville fine sandy loam	Escambia, Fla.	Coastal Plain sediments	0-6	A	111	14			100	95	58	53	22	17	25	7	A-4 (5)	ML-CL	
			12-28	B	121	13			100	94	57	55	30	26	30	12	A-6 (5)	CL	
			40+	C	111	17			100	96	62	58	39	36	37	13	A-6 (7)	ML-CL	
Fairfax silt loam	Fairfax, Va.	Coastal Plain terrace over schist & granite	1-7	A	112	13	100	87	83	79	63	53	19	12	23	3	A-4 (6)	ML	
			10-28	B	107	18	100	96	94	91	74	67	43	37	51	23	A-7-6 (15)	MH-CH	
			28-42	B or C	110	16	100	89	85	82	69	62	35	28	42	16	A-7-6 (10)	ML-CL	
			42-60	D	105	19				100	81	69	39	32	49	18	A-7-5 (13)	ML	
Fallsington fine sandy loam	Norfolk, Va.	Coastal Plain sediments	4-11	A	120	12			100	99	40	38	20	15	19	5	A-4 (1)	SM-SC	
			22-30	Bg	120	12			100	99	46	44	26	21	26	11	A-6 (2)	SC	
			30-50	C	112	12				100	25	22	15	11	NP	NP	A-2-4 (0)	SM	
Farragut silt loam	Blount, Tenn.	Limestone & shale	1-7	A	108	17			100	98	72	70	35	28	29	10	A-4 (7)	CL	
			7-25	B	102	22			100	99	82	78	55	48	54	25	A-7-6 (17)	MH-CH	
			25-40	C	96	27			100	99	86	85	65	56	63	28	A-7-5 (19)	MH	
Fauquier gravelly loam	Frederick, Md.	Metabasaltic schist	0-6	A	100	24	100	83	81	77	70	66	33	23	44	14	A-7-5 (9)	ML	
			6-37	B	102	22	100	92	90	83	73	70	36	26	47	18	A-7-6 (12)	ML-CL	
			60+	C	96	25		100	99	97	93	90	32	17	56	19	A-7-5 (15)	MH	
Fauquier loam	Frederick, Md.	Same	0-8	A	96	25	100	71	70	68	62	60	29	18	48	16	A-7-5 (9)	ML	
			8-46	B	101	23	100	84	82	79	73	70	40	31	60	27	A-7-5 (18)	MH	
			46-60+	C	98	24	100	99	99	97	87	82	39	26	54	18	A-7-5 (14)	MH	
Fayette silt loam	LaCrosse, Wisc.	Peorian loess over limestone	0-11	A	103	17				100	99	90	20	14	29	5	A-4 (8)	ML-CL	
			26-33	B	105	19					100	97	36	30	44	20	A-7-6 (13)	CL	
			48-60	C	107	18					100	96	30	25	38	16	A-6 (10)	CL	
		Same	0-7	A	96	21			100	99	96	94	22	15	36	7	A-4 (8)	ML	
			24-35	B	108	18			100	99	96	93	32	26	38	16	A-6 (10)	CL	
			45-50	C	113	15		100	99	96	84	81	27	24	34	14	A-6 (10)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density: Maximum dry density	Moisture-density: Optimum moisture	Mechanical analysis 1/ Percentage passing sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Unified 4/	Remarks
			Inches		Lb./cu.ft.	Percent													
Fayette silt loam	Fillmore, Minn.	Loess	2.5-8	A	103	17				100	99	96	25	16	30	6	A-4 (8)	ML-CL	
			16-26	B	106	18					100	96	34	30	41	19	A-7-6 (12)	CL	
			35-60	C	107	18				100	99	94	34	28	40	18	A-6 (11)	CL	
			4-18	A	105	16				100	98	95	25	18	29	6	A-4 (8)	ML-CL	
			19-45	B	106	18				100	99	94	34	29	41	18	A-7-6 (11)	CL	
			45+	C	106	18				100	99	94	30	26	39	16	A-6 (10)	CL	
Felda fine sand	Sarasota, Fla.	Fine sand over clayey materials containing some marl	0-4		114	14			100	95	20	16	9	7	NP	NP	A-2-4 (0)	SM	
			4-15		108	12			100	93	8	7	3	2	NP	NP	A-3 (0)	SP-SM	
			15-26		118	12			100	95	23	21	15	13	25	10	A-2-4 (0)	SC	
			26-42		120	12			100	95	24	21	15	13	24	8	A-2-4 (0)	SC	
			42-56		114	15			100	96	41	40	32	30	38	22	A-6 (4)	SC	
Felda fine sand (variation)	Sarasota, Fla.	Interbedded layers of clay & sand over sand beds	18-40		116	14			100	97	16	15	12	11	20	5	A-2-4 (0)	SM-SC	
			40-55		113	12			100	97	11	10	9	8	NP	NP	A-2-4 (0)	SP-SM	
Forestdale silty clay loam	Humphreys, Miss.	Alluvium	0-4	A	108	16				100	93	78	35	28	33	13	A-6 (9)	CL	
			4-26	B	100	22				100	97	86	50	45	63	38	A-7-6 (20)	CH	
			26-53	C	105	17			100	99	91	74	35	31	47	24	A-7-6 (15)	CL	
	Leflore, Miss.	Old alluvium	0-9	A	108	17				100	93	77	29	24	31	11	A-6 (8)	CL	
			9-27	B_g	99	21				100	98	85	39	35	50	25	A-7-6 (16)	CL	
			27-59	C_g	108	17				100	97	80	30	25	39	17	A-6 (11)	CL	
Fox silt loam	Fairfield, Ohio	Wisconsin glacial outwash	3-10	A	111	15			100	90	79	77	33	23	31	10	A-4 (8)	ML-CL	
			15-28	B	109	17	100	86	80	65	53	51	33	31	44	20	A-7-6 (8)	CL	
			40+	C	130	10	100	44	33	8	4	4	2	2	19	4	A-1-a (0)	GP	
Frankstown cherty silt loam	Maury, Tenn.	Cherty limestone & shale	2-10	A	101	20	100	72	70	64	60	58	21	13	34	9	A-4 (5)	ML-CL	
			10-30	B	113	15	100	70	69	66	63	63	26	17	27	9	A-4 (6)	CL	
			30+	C	84	30	62	33	33	28	25	25	19	17	63	25	A-7-5 (10)	MH	
Freeland silt loam	Henderson, Tenn.	Mixed loessal & Coastal Plain	0-6		107	15			100	99	94	89	21	15	25	2	A-4 (8)	ML	
			6-24		110	16				100	97	93	35	27	36	15	A-6 (10)	CL	
			24-42		109	17			100	99	93	88	33	26	40	18	A-6 (11)	CL	
			42+		115	14			100	98	89	83	27	20	30	12	A-6 (9)	CL	
Fullerton cherty silt loam	De Kalb, Ala.	Cherty dolomitic limestone	0-11		110	14	100	87	80	70	51	48	16	10	26	5	A-4 (3)	ML-CL	
			11-27		111	16	100	90	85	73	60	59	31	17	26	6	A-4 (5)	ML-CL	
			27-48		102	22	100	87	84	71	55	54	41	32	43	19	A-7-6 (8)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu.ft.	Percent													
Fullerton cherty silt loam	London, Tenn.	Dolomitic limestone (cherty)	1-6	A	107	16	100	94	88	78	62	59	28	15	25	5	A-4 (5)	ML-CL	
			22-45	B	95	26	95	79	75	71	68	67	56	48	64	33	A-7-5 (19)	MH-CH	
			56-62	C	91	30	92	80	77	75	73	73	64	57	78	42	A-7-5 (20)	MH-CH	
	London, Tenn.	Same	1-8	A	116	12	94	86	81	74	56	54	21	11	22	5	A-4 (5)	ML-CL	
			23-33	B	96	26	89	79	76	74	67	66	54	49	70	35	A-7-5 (20)	MH-CH	
			46-69	C	97	25	86	76	73	67	58	57	46	41	71	38	A-7-5 (18)	MH-CH	
	London, Tenn.	Same	2-8	A	106	17	100	90	86	78	70	69	30	18	30	8	A-4 (7)	ML-CL	
			34-50	B	105	21	92	74	71	68	65	64	45	35	48	22	A-7-6 (13)	ML-CL	
			50-65	B or C	100	23	90	61	58	55	52	52	36	30	58	28	A-7-5 (14)	MH-CH	
Galestown loamy fine sand	Fairfax, Va.	Coastal Plain	0-8	A	114	12			100	95	19	17	13	8	NP	NP	A-2-4 (0)	SM	
			8-48	B & C	112	12			100	95	18	16	10	6	NP	NP	A-2-4 (0)	SM	
Georgeville silt loam	Alamance, N. C.	Andesite	1-4	A	101	19	100	89	86	79	66	61	23	15	33	7	A-4 (6)	ML	
			18-30	B	90	29			100	99	94	92	73	65	71	34	A-7-5 (20)	MH	
			39-46	B	90	29			100	99	93	91	70	61	70	33	A-7-5 (20)	MH	
Glenelg and Chester loams	Frederick, Md.	Chlorite schist	0-8	A	110	17	100	88	85	77	66	62	21	14	37	10	A-4 (6)	ML	
			8-22	B	116	16	100	94	90	84	75	70	26	15	32	9	A-4 (8)	ML-CL	
			22-46	C	120	15			100	94	83	78	25	13	34	9	A-4 (8)	ML-CL	
Glenelg (Chester) silt loam	Frederick, Md.	Phyllitic mica schist	0-13	A	107	17	100	89	84	70	58	55	27	16	37	9	A-4 (5)	ML	Mapped as Glenelg-Chester.
			19-38	B	116	15	100	88	84	67	55	53	29	17	33	11	A-6 (4)	ML-CL	
			38-84	C	112	16	100	86	82	68	53	51	30	20	40	15	A-6 (6)	ML-CL	
Glenelg gravelly loam	Frederick, Md.	Same	0-6	A	97	22	100	60	54	46	41	40	20	13	49	12	A-7-5 (2)	GM	
			6-22	B	109	18	100	81	73	63	54	53	28	18	38	11	A-6 (4)	ML	
			22-40	C	110	18	100	65	62	54	45	43	22	12	36	9	A-4 (2)	GM	
Glenelg silt loam	Fairfax, Va.	Schist	2-7	A	108	16	100	91	89	87	70	62	24	16	30	5	A-4 (7)	ML-CL	
			13-22	B	102	21	100	97	96	94	80	74	38	29	48	17	A-7-5 (12)	ML	
			28-72	C	99	20		100	99	98	82	72	15	8	46	5	A-5 (9)	ML	
Glenstead silt loam	Moniteau, Mo.	Shale	0-9	A	108	17			100	96	92	87	24	20	31	9	A-4 (8)	ML-CL	
			12-24	B	93	23			100	99	96	95	55	49	57	27	A-7-5 (18)	MH-CH	
			24-40+	C	105	20	100	96	94	92	89	87	46	40	58	37	A-7-6 (20)	CH	
Gloucester fine sandy loam	Rockingham, N. H.	Glacial till	0-3½	A	96	19	85	73	70	57	28	23	8	5	NP	NP	A-2-4 (0)	SM	
			6-17	B	115	12	85	69	66	52	22	22	9	7	NP	NP	A-2-4 (0)	SM	
			21+	C	115	9	85	73	67	37	4	3	2	2	NP	NP	A-1-b (0)	SP-SM	
	Rockingham, N. H.	Same	0-5	A	86	25	85	67	65	54	29	23	7	4	NP	NP	A-2-4 (0)	SM	
			9-20	B	120	10	85	61	56	44	21	17	6	3	NP	NP	A-2-4 (0)	SM	
			20+	C	126	8	85	65	60	46	20	15	5	3	NP	NP	A-2-4 (0)	SM	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	Horizon	MOISTURE - DENSITY: Maximum Dry Density	Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 1/: 3 in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	Unified 4/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Gloucester stony loamy sand	Rockingham, N.H.	Glacial till	0-2	A	88	23	75	69	68	54	24	20	6	5	NP	NP	A-2-4 (0)	SM	
			8-20	B	119	11	75	47	41	29	11	9	3	1	NP	NP	A-1-b (0)	SM	
			26+	C	121	9	75	52	48	36	13	10	3	2	NP	NP	A-1-b (0)	SM	
Gogebic sandy loam	Gogebic, Mich.	Glacial till	0-4	A	109	14	100	88	86	81	48	40	8	5	23	NP	A-4 ([illegible])	SM	
			4-8	B	106	16	100	92	90	83	47	41	14	11	24	NP	A-4 ([illegible])	SM	
			8-14	B	108	15	100	88	85	78	42	35	10	8	21	NP	A-4 ([illegible])	SM	
			14-22	B	118	10	100	91	88	80	33	26	6	4	NP	NP	A-2-4 (0)	SM	
			25-40	B_m	126	8	100	92	90	83	36	30	9	5	NP	NP	A-4 (0)	SM	
			40-50	C	127	8	100	94	92	84	34	29	8	6	NP	NP	A-2-4 (0)	SM	
	Bayfield, Wisc.	Same	0-5	A	109	14	100	98	97	88	53	48	13	9	24	2	A-4 ([illegible])	ML	
			5-9	B	111	15	100	96	95	86	52	48	17	12	22	1	A-4 ([illegible])	ML	
			9-14	B	115	12	100	97	95	84	46	40	14	10	20	2	A-4 ([illegible])	SM	
			17-24	B	127	8	100	98	96	86	39	33	9	6	NP	NP	A-4 ([illegible])	SM	
			24-40	B_b	128	8	100	95	93	79	34	28	9	6	NP	NP	A-2-4 (0)	SM	
			40-52	C	126	8	100	94	92	79	29	24	7	5	NP	NP	A-2-4 (0)	SM	
Goldsboro fine sandy loam	Duplin, N. C.	Coastal Plain sand & sandy clay	0-6	A	102	15			100	94	40	31	11	7	26	0	A-4 ([illegible])	SM	
			12-18	B	125	10			100	95	51	38	15	12	18	4	A-4 ([illegible])	ML-CL	
			18-46	B & B_g	120	13			100	92	46	39	21	19	26	10	A-4 ([illegible])	SC	
Greendale cherty silt loam	De Kalb, Ala.	Colluvium	0-12		114	13	100	64	53	38	22	21	11	6	29	7	A-2-4 (0)	SM-SC	
			12-26		124	11	100	74	64	44	29	26	12	9	20	4	A-2-4 (0)	SM-SC	
	Maury, Tenn.	Alluvium	0-14		103	18	100	77	76	70	63	58	18	12	29	7	A-4 (6)	ML-CL	
			14+		107	17	90	50	46	33	27	26	10	7	30	7	A-2-4 (0)	GM	
Greendale silt loam	Coffee, Tenn.	Colluvium and alluvium	0-11		101	19		100	99	98	93	91	33	22	34	10	A-4 (8)	ML-CL	
			11-22		110	16		100	99	98	94	90	36	25	33	12	A-6 (9)	CL	
	Coffee, Tenn.	Same	0-14		108	16	97	92	91	89	86	82	26	16	29	7	A-4 (8)	ML-CL	
			14-28		112	16	100	95	93	90	86	84	35	24	32	11	A-6 (8)	CL	
Grenada silt loam	De Soto, Miss.	Loess over Coastal Plain	0-6	A	106	16			100	99	99	92	20	16	27	6	A-4 (8)	ML-CL	
			6-16	B	108	18					100	97	33	25	37	15	A-6 (10)	CL	
			30-38	C	106	18					100	96	30	24	41	19	A-7-6 (12)	CL	
Granville stony loam	Franklin, N. Y.	Glacial till	0-4	A	100	19	84	72	70	65	39	32	11	6	34	7	A-4 (2)	SM	
			4-12	B	114	13	85	77	75	68	39	31	11	7	24	4	A-4 (2)	SM-SC	
			23-32	C	120	9	87	73	71	64	31	23	6	3	NP	NP	A-4 (0)	SM	
	Franklin, N. Y.	Same	0-7	A	105	17	84	69	66	58	38	34	14	8	37	9	A-4 (2)	SM	
			7-13	B	115	13	85	79	76	66	41	34	12	7	26	5	A-4 (3)	SM-SC	
			18-33	C	130	8	87	71	68	60	36	29	8	4	15	2	A-4 (1)	SM	
	Franklin, N. Y.	Same	0-8	A	94	23	84	74	73	67	51	42	17	10	40	9	A-4 (5)	ML	
			8-17	B	109	16	85	81	80	75	57	44	18	11	28	7	A-4 (7)	ML-OL	
			23-37	C	129	8	87	56	51	37	19	13	3	2	NP	NP	A-1-b (0)	SM	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture - density: Maximum Dry Density	Moisture - density: Optimum Moisture	Mechanical analysis 1/ — Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 3/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Grundy silty clay loam	Jefferson, Iowa	Loess	0-7	A	96	22			100	99	97	96	40	34	44	17	A-7-6 (12)	ML-CL	
			16-22	B	99	22			100	99	99	97	47	41	60	32	A-7-6 (20)	CH	
			41-48	C	107	17				100	99	98	37	31	43	20	A-7-6 (13)	CL	
	Jefferson, Iowa	Same	0-8	A	95	19			100	98	95	93	35	29	44	15	A-7-6 (11)	ML	
			13-21	B	95	19			100	99	99	97	48	42	58	32	A-7-6 (20)	CH	
			48-56	C	109	17					100	98	38	29	40	20	A-6 (12)	CL	
	Jefferson, Iowa	Same	0-4	A	102	19			100	98	96	95	38	30	36	13	A-6 (9)	ML-CL	
			13-21	B	94	24			100	99	98	97	52	45	68	40	A-7-6 (20)	CH	
			39-59	C	108	17				100	99	98	35	28	40	18	A-6 (11)	CL	
Guelph loam	Sanilac, Mich.	Glacial till	0-10½	A	110	15	100	98	97	92	70	64	28	18	25	6	A-4 (7)	ML-CL	
			10½-17	B_t	111	17		100	99	96	76	73	42	35	37	19	A-6 (12)	CL	
			17+	C	122	13	100	97	96	92	78	75	38	29	30	14	A-6 (10)	CL	
	Sanilac, Mich.	Same	0-7	A	109	16	100	98	97	92	63	58	25	16	29	8	A-4 (6)	ML-CL	
			7-14	B_t	122	12	100	97	96	90	59	55	26	19	25	10	A-4 (5)	CL	
			14+	C	121	13	100	95	93	88	64	60	32	23	27	12	A-6 (7)	CL	
Guelph loam & silt loam	Sanilac, Mich.	Same	0-8	A	104	17	100	95	94	89	64	59	26	16	31	7	A-4 (6)	ML-CL	
			8-19	B_t	109	17	100	99	99	98	89	87	54	42	39	18	A-6 (11)	CL	
			23+	C	120	14	100	98	97	94	82	81	44	30	29	12	A-6 (9)	CL	
	Sanilac, Mich.	Same	0-5	A	114	14	100	97	95	86	57	51	23	15	25	6	A-4 (4)	ML-CL	
			5-9	A	120	12	100	97	96	90	66	60	29	20	20	5	A-4 (6)	ML-CL	
			9-18	B_t	111	17			100	96	79	75	46	38	36	18	A-6 (11)	CL	
			26-30	C	120	13	100	99	98	93	75	72	34	24	28	13	A-6 (9)	CL	
Guthrie silt loam	Coffee, Tenn.	Loess over cherty limestone	5-28	B_g	115	15		100	99	98	87	81	30	22	28	10	A-4 (8)	CL	
			28-60+	C	116	14	100	97	97	96	84	78	27	21	29	11	A-6 (8)	CL	
	Coffee, Tenn.	Same	6-32	B	113	14			100	99	89	86	31	22	27	8	A-4 (8)	CL	
			32-52	B_m	102	20				100	94	90	52	40	50	25	A-7-6 (16)	CL	
Hagerstown silt loam	Maury, Tenn.	Limestone	0-8	A	112	14			100	98	82	78	20	15	24	5	A-4 (8)	ML-CL	
			8-30	B	113	16			100	97	86	84	35	27	35	15	A-6 (10)	CL	
			30+	C	106	20			100	98	86	84	50	42	45	22	A-7-6 (14)	CL	
	Frederick, Md.	Same	0-7	A	106	17	100	92	89	82	73	70	31	20	33	10	A-4 (8)	ML-CL	
			7-38	B	96	25			100	98	95	93	72	66	63	34	A-7-6 (20)	CH	
			38-60+	C	92	26	100	85	82	79	75	74	62	57	71	37	A-7-5 (20)	MH-CH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLAS-TICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 2/	Unified 3/	
			Inches		Lb./cu.ft.	Percent													
Haig silty clay loam	Jefferson, Iowa	Loess	0-7	A	99	21			100	99	97	96	36	28	38	12	A-6 (9)	ML-OL	
			18-27	B	95	21			100	99	98	97	52	44	63	35	A-7-6 (20)	OH	
			48-65	C	109	17					100	99	39	32	42	22	A-7-6 (13)	CL	
	Jefferson, Iowa	Same	0-7	A	94	22			100	99	98	97	36	28	44	16	A-7-6 (11)	ML-OL	
			23-29	B	94	25			100	99	98	97	52	46	66	38	A-7-6 (20)	OH	
			49-64	C	106	18					100	98	40	33	47	26	A-7-6 (16)	CL	
	Jefferson, Iowa	Same	0-9	A	99	21					100	98	37	29	39	14	A-6 (10)	ML-OL	
			14-23	B	95	25					100	98	54	47	66	40	A-7-6 (20)	OH	
			52-64	C	107	19					100	98	40	32	45	24	A-7-6 (15)	CL	
Hamblen silt loam	Blount, Tenn.	Alluvium	0-14		105	20		100	98	93	87	83	31	26	38	14	A-6 (10)	ML-OL	
			14-36		105	19		100	99	93	87	86	34	26	36	14	A-6 (10)	CL	
Hanover silt loam	Fairfield, Ohio	Illinoian glacial till	0-9½	A	105	16			100	99	97	94	24	15	28	6	A-4 (8)	ML-CL	
			17-24	B	110	18					100	96	36	30	41	18	A-7-6 (11)	CL	
			37-65	X	110	16				100	98	93	28	23	36	14	A-6 (10)	CL	
			65+	C	117	13			100	98	89	85	27	19	25	8	A-4 (8)	CL	
Hartland very fine sandy loam	Lewis, N. Y.	Lacustrine	0-8	A	100	19			100	96	57	44	11	7	34	5	A-4 (4)	ML	
			8-15	B	116	12			100	94	55	43	9	6	NP	NP	A-4 (4)	ML	
			15-25	B	108	14			100	99	95	81	9	6	NP	NP	A-4 (8)	ML	
			25-40	C	108	14				100	89	56	6	2	NP	NP	A-4 (8)	ML	
Hartsells fine sandy loam	De Kalb, Ala.	Sandstone & conglomerate	0-9		119	10	100	99	99	98	40	39	12	7	NP	NP	A-4 (1)	SM	
			9-28		123	11			100	99	53	51	20	14	20	7	A-4 (4)	ML-CL	
			28-48		121	11			100	99	48	45	22	16	21	6	A-4 (3)	SM-SC	
Hastings silt loam	York, Nebr.	Loess	10-15	A	102	20				100	99	94	36	32	38	18	A-6 (11)	OL	
			20-37	B	99	23					100	97	44	39	52	28	A-7-6 (18)	OH	
			48-60	C	105	20					100	96	38	27	37	14	A-6 (10)	ML-CL	
	Clay, Nebr.	Same	0-10	A	107	17				100	99	93	32	26	29	7	A-4 (8)	ML-CL	
			15-31	B	98	23					100	97	47	41	50	26	A-7-6 (16)	CL	
			47-60	Cca	104	20				100	99	96	35	26	36	13	A-6 (9)	ML-CL	
Hatchie silt loam	Henderson, Tenn.	Mixed loessal & Coastal Plain	0-5		115	12			100	98	77	64	17	13	20	2	A-4 (8)	ML	
			5-16		112	15			100	99	85	76	26	20	30	10	A-4 (8)	OL	
			16-34		112	15			100	99	85	74	26	21	32	12	A-6 (9)	CL	
			34+		117	14			100	99	78	66	23	19	28	10	A-4 (8)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS [1]								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve [2]					Percentage Smaller Than [2]							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. [3]	Unified [4]	
			Inches		Lb./cu. ft.	Percent													
Hayden fine sandy loam	Isanti, Minn.	Mankato glacial till	4-10	A	117	12	100	98	96	86	51	42	11	8	20	3	A-4 (3)	ML	
			17-38	B	114	15	100	98	96	87	61	54	25	20	37	19	A-6 (9)	CL	
			38-55+	C	121	12	100	99	98	93	74	63	17	12	24	7	A-4 (8)	ML-CL	
	Isanti, Minn.	Same	3-8	A	110	13			100	97	87	72	12	9	NP	NP	A-4 (8)	ML	
			8-28	B	111	16			100	98	92	78	30	17	28	9	A-4 (8)	CL	
			42-50+	C	112	15			100	99	94	85	16	10	27	6	A-4 (8)	ML-CL	
Hayden loam	Scott, Minn.	Same	2-8.5	A	115	13		100	98	89	62	55	23	15	23	5	A-4 (5)	ML-CL	
			11-17.5	B	101	22	100	98	93	86	62	60	39	33	49	26	A-7-6 (13)	CL	
			45+	C	123	11	100	97	93	76	39	32	14	10	20	4	A-4 (1)	SM-SC	
	Scott, Minn.	Same	3-8	A	114	12		100	99	93	71	64	18	12	22	3	A-4 (7)	ML	
			10.5-19.5	B	113	14	100	98	95	86	63	56	28	24	34	17	A-6 (8)	CL	
			32+	C	119	12	100	97	93	83	54	49	20	14	25	9	A-4 (4)	CL	
	Scott, Minn.	Same	3-10	A	119	10		100	98	84	49	42	14	10	19	2	A-4 (3)	SM	
			13-22	B	114	14	100	99	97	84	55	48	27	22	32	16	A-6 (6)	CL	
			41+	C	115	15	100	96	95	87	68	65	27	20	31	13	A-6 (8)	CL	
Haynie silt loam	Monona, Iowa	Alluvium	14-20		107	17				100	89	85	19	14	30	8	A-4 (8)	ML-CL	
Helena coarse sandy loam	Alamance, N. C.	Granite	0-3	A	117	11		100	99	51	27	25	10	7	25	2	A-2-4 (0)	SM	
			17-20	B	107	18		100	97	74	64	63	48	44	65	36	A-7-6 (17)	CH	
			32+	C	108	17		100	96	73	56	54	36	33	51	25	A-7-6 (11)	CH	
Helena fine sandy loam	Nottoway, Va.	Hornblende gneiss & granite gneiss	3-10	A	127	9			100	79	40	36	18	11	17	3	A-4 (1)	SM	
			15-27	B_t	100	22			100	91	75	73	60	55	75	43	A-7-5 (20)	CH	
			36-48	C	118	13			100	74	34	29	14	11	31	7	A-2-4 (0)	SM	
Henry silt loam	De Soto, Miss.	Loess	0-8	A	99	17			100	97	96	91	21	15	30	6	A-4 (8)	ML-CL	
			8-26	B	109	15			100	96	94	92	22	16	26	6	A-4 (8)	ML-CL	
			26-42	C	110	17					100	92	28	22	34	15	A-6 (10)	CL	
Hicks loam	Maury, Tenn.	Interbedded limestone and sandy shales	0-8	A	109	15	100	95	94	93	73	64	19	13	25	5	A-4 (8)	ML-CL	
			8-24	B	107	19	100	-	-	-	73	66	32	27	36	13	A-6 (9)	ML-CL	
			24+	C	106	20	100	-	-	-	43	38	17	14	38	15	A-6 (3)	GC	
Holdrege silt loam	Phelps, Nebr.	Loess	0-11	A	104	19				100	98	90	32	27	34	13	A-6 (9)	CL	
			14-27	B	104	19				100	99	92	34	29	38	16	A-6 (10)	CL	
			42-60	C_{ca}	108	18				100	99	91	24	18	30	7	A-4 (8)	ML-CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 2/	Unified 3/	
			Inches		Lb./cu.ft.	Percent													
Holston loam	Coffee, Tenn.	Alluvium (terrace)	3-8	A	112	13		100	99	98	71	65	22	15	22	3	A-4 (7)	ML	
			11-36	B	118	14		100	99	97	74	69	32	20	26	8	A-4 (8)	CL	
			36+	C	116	14	100	96	95	92	66	62	28	22	31	13	A-6 (7)	CL	
	Coffee, Tenn.	Same	0-8	A	112	12	100	98	97	95	70	63	16	9	NP	NP	A-4 (7)	ML	
			14-28	B	117	13	100	99	97	95	76	72	27	19	27	10	A-4 (8)	CL	
			34+	C	104	20		100	99	98	72	69	43	40	48	22	A-7-6 (14)	ML-CL	
Houdek loam	Edmunds, S. D.	Glacial till (Mankato)	0-7	A & B	101	19	100	98	96	89	69	61	29	23	38	14	A-6 (8)	ML-CL	
			7-14	B	108	16		100	99	93	66	59	33	28	36	16	A-6 (9)	CL	
			14-33	Bca & Cca	112	15	100	96	94	88	66	60	36	28	38	18	A-6 (9)	CL	
			33-45	C	111	15	100	97	94	88	70	63	37	29	42	21	A-7-6 (12)	CL	
Houston black clay	McLennan, Tex.	Marine clay	0-44	A	96	24			100	99	93	91	63	55	76	45	A-7-5 (20)	CH	
			84-120	C	101	21			100	99	98	98	80	57	69	47	A-7-6 (20)	CH	
	McLennan, Tex.	Marine clay or marl	0-50	A	86	31			100	99	98	97	81	72	104	63	A-7-5 (20)	MH-CH	
			66-108	C	107	20	100	55	42	42	42	41	32	22	69	46	A-7-6 (7)	GC	
	McLennan, Tex.	Taylor marl	0-34	A	97	23			100	98	88	83	53	46	65	34	A-7-5 (20)	MH-CH	
			66-84	C	100	23				100	99	99	80	64	83	53	A-7-5 (20)	CH	
Howard gravelly loam	Cortland, N. Y.	Glacial outwash	0-8	A	95	23	85	48	45	41	34	32	15	10	48	13	A-7-5 (2)	GM	
			8-20	A	113	15	85	37	32	28	23	21	7	5	29	6	A-2-4 (0)	GM	
			32-48	B	125	11	73	26	21	17	13	11	4	3	25	6	A-1-b (0)	GM-GC	
			48-66	C	130	9	75	26	23	17	14	12	5	3	21	3	A-1-b (0)	GM	
	Cortland, N. Y.	Same	0-6	A	114	14	100	76	61	40	34	31	14	10	40	9	A-2-4 (0)	SM	
			6-18	A	121	13	100	48	40	31	26	24	11	7	29	6	A-2-4 (0)	GM-GC	
			32-46	B	127	11	100	67	62	40	28	27	13	9	22	5	A-2-4 (0)	SM-SC	
			46-66	C	132	10	100	90	80	35	20	18	12	9	NP	NP	A-1-b (0)	SM	
Howard-Valois loam	Cortland, N. Y.	Glacial till and outwash	0-6	A	95	23	100	71	65	59	53	51	18	12	44	9	A-5 (4)	ML	
			6-20	A	104	18	90	67	64	59	53	50	18	10	30	5	A-4 (5)	ML	
			28-43	B	119	13	85	45	41	36	31	29	12	8	26	6	A-4 (0)	GM-GC	
			43-60	C	125	10	78	26	23	21	18	16	6	4	21	4	A-1-b (0)	GM-GC	
Hubbard fine sand	Scott, Minn.	Outwash terrace	4-12	A	108	13			100	99	11	8	5	5	NP	NP	A-2-4 (0)	SP-SM	
			12-38	B	107	14				100	9	7	5	5	NP	NP	A-3 (0)	SP-SM	
			38+	C	105	14			100	99	7	5	3	3	NP	NP	A-3 (0)	SP-SM	
Hubbard loamy fine sand	Scott, Minn.	Same	2-20	A	111	12				100	15	12	7	6	NP	NP	A-2-4 (0)	SM	
			20-38	B	109	13				100	13	10	6	6	NP	NP	A-2-4 (0)	SM	
			38-48	C	109	14				100	14	11	7	6	NP	NP	A-2-4 (0)	SM	
	Scott, Minn.	Same	0-9	A	111	15			100	96	19	18	12	8	NP	NP	A-2-4 (0)	SM	
			14-23	B	107	14			100	97	9	6	5	4	NP	NP	A-3 (0)	SP-SM	
			39+	C	102	15			100	96	5	4	3	3	NP	NP	A-3 (0)	SP	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu. ft.	Percent													
Huntington silt loam	Maury, Tenn.	Alluvium	0-30		111	16			100	98	77	70	22	17	30	11	A-6 (8)	CL	
			30+		109	18	100	94	85	32	18	18	10	9	32	9	A-2-4 (0)	SC	
	Moniteau, Mo.	Local alluvium	0-20		108	16				100	98	91	22	17	29	7	A-4 (8)	ML-CL	
	De Kalb, Ala.	Alluvium	0-12		105	18				100	99	96	35	24	35	12	A-6 (9)	ML-CL	
			12-30		115	13	100	94	92	88	82	75	23	15	25	7	A-4 (8)	ML-CL	
	Coffee, Tenn.	Same	0-12		104	19				100	98	93	34	24	35	11	A-6 (8)	ML-CL	
			12-30		106	19			100	99	95	93	40	29	39	16	A-6 (10)	CL	
	Coffee, Tenn.	Same	0-14		107	17			100	98	81	75	35	26	32	10	A-4 (8)	ML-CL	
			14-30		110	16			100	95	66	62	32	24	30	11	A-6 (7)	CL	
Huron silt loam	Sanilac, Mich.	Silty clay loam glacial till	0-14	A	94	23			100	97	78	72	27	17	44	11	A-7-6 (9)	ML	
			14-30	B_t	112	17	100	99	98	95	84	81	48	36	36	16	A-6 (10)	CL	
			30+	C	112	17	100	99	98	95	89	88	59	41	39	17	A-6 (11)	CL	
Ryman silt loam	Henderson, Tenn.	Mixed loessal & Coastal Plain	0-20		106	18				100	92	88	39	28	33	10	A-4 (8)	ML-CL	
			20+		107	17				100	85	80	33	25	33	11	A-6 (8)	ML-CL	
Ida silt loam	Monona, Iowa	Loess	12-20		107	18				100	99	93	22	18	34	10	A-4 (8)	ML-CL	
	Monona, Iowa	Same	14-20		107	18				100	99	96	27	22	37	12	A-6 (9)	ML-CL	
Inman silt loam	Maury, Tenn.	Interbedded limestone & sandy shale	0-10	A	116	14	100	99	98	95	70	66	24	19	24	7	A-4 (7)	ML-CL	
			10+	C	91	29	100		50	50	46	43	30	27	54	20	A-7-5 (6)	GM	
Iredell loam	Alamance, N. C.	Olivine gabbro	5-11	A	115	15	100	99	97	74	58	53	20	13	27	4	A-4 (5)	ML-CL	
			15-22	B_t	102	21	100	99	98	90	78	74	48	44	62	38	A-7-6 (20)	CH	
			25-27	C	110	18		100	99	87	73	68	41	37	52	30	A-7-6 (18)	CH	
Iredell silt loam	Fairfax, Va.	Diabase	0-7	A	111	16	100	98	98	86	76	72	28	17	27	5	A-4 (8)	ML-CL	
			11-26	B	93	26			100	94	84	81	63	57	80	50	A-7-5 (20)	CH	
			29-32	C	120	15		100	97	69	43	35	17	14	36	15	A-6 (3)	SC	
Jeddo silty clay loam	Sanilac, Mich.	Silty clay loam drift	0-6½	A	94	23			100	97	75	72	42	29	45	16	A-7-6 (11)	ML	
			6½-11	GA	107	18			100	97	76	71	39	28	36	15	A-6 (10)	CL	
			11-26	GB	113	15			100	97	74	70	40	29	34	15	A-6 (10)	CL	
			26-54	GG	113	15			100	96	74	71	41	30	36	17	A-6 (11)	CL	
			60+	C	114	16	100	99	98	94	80	76	45	30	33	13	A-6 (9)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density: Maximum dry density	Moisture-density: Optimum moisture	Mechanical analysis 1/ — Percentage passing sieve 2/: 3 in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Jefferson loam	Blount, Tenn.	Alluvium	0-9	A	110	15			100	95	70	68	28	20	28	8	A-4 (7)	CL	
			15-39	B	115	15			100	96	72	72	34	25	32	13	A-6 (9)	CL	
			39-60	B & C	114	16	100	99	99	95	65	63	33	29	33	13	A-6 (7)	CL	
	Blount, Tenn.	Same	0-10		108	16			100	95	72	71	22	14	26	5	A-4 (7)	ML-CL	
			10-30		117	14			100	97	76	74	25	17	24	8	A-4 (8)	CL	
			30-48		113	16	100	98	97	92	63	62	30	21	30	10	A-4 (6)	CL	
Johnsburg loam	De Kalb, Ala.	Sandstone and conglomerate	1-9		112	13			100	99	69	64	19	12	21	4	A-4 (7)	ML-CL	
			9-24		117	13			100	99	74	70	28	22	27	9	A-4 (8)	CL	
			24-36		108	19			100	98	75	73	40	33	43	19	A-7-6 (12)	CL	
Johnston loam	Duplin, N. C.	Stream alluvium	0-6	A	89	25				100	62	52	26	17	42	6	A-5 (5)	OL	
			6-18	A	91	23			100	98	45	32	12	8	NP	NP	A-4 (2)	SM	
			26-30	A	116	14			100	99	46	37	20	17	22	4	A-4 (2)	SM-SC	
Kalmia fine sandy loam	Escambia, Fla.	Coastal Plain sediments	0-6	A	113	12			100	93	57	44	10	7	NP	NP	A-4 (4)	ML	
			6-12	A	118	13			100	97	64	51	21	19	26	7	A-4 (6)	ML-CL	
			44-48	C	119	10			100	92	49	36	12	9	NP	NP	A-4 (3)	SM	
			48+	D	114	12	100	81	69	37	6	5	3	3	NP	NP	A-1-b (0)	SP-SM	
Katy fine sandy loam	Fort Bend, Tex.	Coastal Plain sediments	0-24	A	116	10				100	49	36	9	6	15	0	A-4 (3)	SM	
			26-36	B	107	19				100	72	64	40	37	48	29	A-7-6 (16)	CL	
	Fort Bend, Tex.	Same	0-25	A	119	10				100	51	39	10	7	15	1	A-4 (3)	ML	
			26-38	B	108	17				100	72	64	40	36	50	32	A-7-6 (17)	CL	
	Fort Bend, Tex.	Same	0-26	A	121	9			100	99	43	34	10	7	NP	NP	A-4 (2)	SM	
			26-38	B	109	17			100	99	65	57	36	33	39	22	A-6 (11)	CL	
Keith silt loam	Hitchcock, Nebr.	Loess	0-9	A	104	18				100	97	86	26	21	31	8	A-4 (8)	ML-CL	
			9-23	B	105	18				100	98	89	33	28	37	16	A-6 (10)	CL	
			33-60	C_{ca} & C	107	18				100	98	83	23	17	29	7	A-4 (8)	ML-CL	
	Hitchcock, Nebr.	Same	0-14	A	107	17				100	97	84	30	26	30	10	A-4 (8)	CL	
			14-27	B	102	21				100	96	85	40	35	42	22	A-7-6 (13)	CL	
			33-60	C_{ca}	109	17				100	97	82	23	16	28	6	A-4 (8)	ML-CL	
Kelly silt loam	Fairfax, Va.	Baked shales and shaly sandstone	0-7	A	107	17		100	99	95	89	87	31	18	27	4	A-4 (8)	ML-CL	
			7-16	B	109	18		100	98	94	90	89	44	30	38	14	A-6 (10)	ML-CL	
			16-25	B	101	22		100	99	97	94	92	56	48	60	33	A-7-6 (20)	CH	
			25-39	B_m	87	30			100	99	98	97	75	69	98	64	A-7-5 (20)	CH	
Kendaia silt loam	Grand Isle, Vt.	Glacial till	0-6	A	101	19	97	91	90	86	61	53	23	17	37	11	A-6 (6)	ML-CL	
			8-14	B_g	123	11	95	91	88	82	52	45	21	16	22	7	A-4 (4)	ML-CL	
			27+	C_{mg}	126	9	95	88	85	76	50	44	13	9	16	2	A-4 (4)	ML	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu. ft.	Percent													
Kendaia very stony silt loam	Grand Isle, Vt.	Glacial till	0-6	A	96	23	95	93	92	88	73	69	32	22	44	15	A-7-5 (11)	ML	
			9-16	Bg	124	10	95	92	89	83	61	54	16	10	18	3	A-4 (6)	ML	
			23+	Cmg	125	10	95	91	87	80	59	52	15	10	16	1	A-4 (5)	ML	
	Grand Isle, Vt.	Same	0-7	A	83	31	82	81	80	73	54	52	33	22	60	17	A-7-5 (12)	MH or OH	
			7-14	Bg	111	16	82	75	70	62	43	42	29	21	36	15	A-6 (5)	OL	
			20-28	Cg	123	11	92	87	84	76	54	50	23	16	22	7	A-4 (5)	ML-OL	
Kenyon silt loam	Fillmore, Minn.	Glacial till	0-12	A	97	21			100	93	73	69	35	28	42	15	A-7-6 (10)	ML-OL	
			22-30	B	110	16		100	99	90	63	59	35	30	37	18	A-6 (9)	OL	
			38+	C	116	15	100	99	98	90	64	60	36	31	35	18	A-6 (9)	OL	
	Fillmore, Minn.	Same	0-13	A	105	17			100	93	73	70	30	22	34	12	A-6 (8)	ML-OL	
			13-23	B	113	15	100	98	97	87	64	61	31	26	33	15	A-6 (8)	OL	
			36+	C	120	12	100	99	97	84	48	45	27	22	28	13	A-6 (4)	SC	
Keri fine sand	Sarasota, Fla.	Stratified beds of marine sand and marl	7-15		105	14			100	93	4	4	2	2	NP	NP	A-3 (0)	SP	
			15-22		111	11			100	91	5	4	2	2	NP	NP	A-3 (0)	SP-SM	
			22-31		104	19			100	93	32	32	23	19	28	8	A-2-4 (0)	SC	
Keyport very fine sandy loam	Norfolk, Va.	Coastal Plain sediments	2-10	A	112	13			100	89	75	68	20	12	25	5	A-4 (8)	ML-OL	
			13-21	B	111	16			100	95	86	80	39	31	36	16	A-6 (10)	OL	
			36-46	C	123	10	100	92	83	62	37	32	19	17	34	16	A-6 (2)	SC	
Kirkland silt loam	Pawnee, Okla.	Interbedded sandstones & clays	0-12	A	115	13			100	99	74	63	14	11	20	3	A-4 (8)	ML	
			14-26	B	102	21				100	88	83	46	40	54	33	A-7-6 (19)	CH	
			44-85	C	115	15				100	56	51	31	28	31	16	A-6 (7)	CL	
	Pawnee, Okla.	Same	0-14	A	110	15				100	95	83	24	20	29	9	A-4 (8)	CL	
			14-30	B	103	20				100	99	92	48	42	54	31	A-7-6 (19)	CH	
			44-92+	C	106	20			100	99	93	84	41	37	50	30	A-7-6 (18)	CL	
	Pawnee, Okla.	Same	0-12	A	102	19				100	91	78	26	22	38	14	A-6 (10)	ML-CL	
			15-34	B	103	19				100	93	84	37	33	45	24	A-7-6 (15)	CL	
			46-96+	C	108	18			100	99	91	85	42	38	51	31	A-7-6 (18)	CH	
Lackawanna channery silt loam	Potter, Pa.	Glacial till	6-16	B	107	19	100	68	64	60	45	39	16	12	32	9	A-4 (3)	GC	20-30% discarded in sampling.
			20-30	C	123	12	100	43	38	32	22	19	8	5	23	5	A-2-4 (0)	GM-GC	40-50% discarded in sampling.
			40-50	C	122	13	100	64	56	51	43	42	24	14	29	11	A-6 (4)	OL	50-60% discarded in sampling.
							(Lackawanna samples not corrected for material discarded larger than 3 in.)												
Lackawanna flaggy silt loam	Delaware, N. Y.	Same	0-5	A	81	33	88	64	63	62	52	50	26	18	62	16	A-7-5 (12)	MH	
			22-42	Bb	123	12	75	44	40	36	25	23	9	6	22	4	A-2-4 (0)	GM-GC	
			42-54+	Bb	127	11	70	44	42	37	27	25	11	7	21	5	A-4 (1)	GM-GC	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 5/	
			Inches		Lb./cu. ft.	Percent													
Lake Charles clay	Fort Bend, Tex.	Coastal Plain	0-8	A	88	26				100	94	89	64	58	79	48	A-7-6 (20)	CH	
			8-46	AC	93	26				100	97	93	70	65	88	55	A-7-6 (20)	CH	
			0-34	A	92	25				100	93	87	59	50	67	41	A-7-6 (2)	CH	
Lakeland fine sand	Duplin, N. C.	Coastal Plain sand	0-4	A	105	13			100	83	6	6	4	2	NP	NP	A-3 (0)	SP-SM	
			8-34	B	110	12			100	85	7	7	5	2	NP	NP	A-3 (0)	SP-SM	
			34-44	B	110	12			100	83	8	7	6	4	NP	NP	A-3 (0)	SP-SM	
	Alachua, Fla.	Same	12-30		114	10			100	86	9	8	5	3	NP	NP	A-3 (0)	SP-SM	
Lakewood fine sand	Sarasota, Fla.	Sand	1-12		101	15			100	97	2	2	2	2	NP	NP	A-3 (0)	SP	
			18-25		105	14			100	96	3	3	2	2	NP	NP	A-3 (0)	SP	
			50-65		105	14			100	96	2	2	1	1	NP	NP	A-3 (0)	SP	
Landisburg silt loam	Loudon, Tenn.	Alluvium	1-6	A	106	16	100	89	80	73	65	63	25	14	31	7	A-4 (6)	ML-CL	
			9-18	B	117	14	100	90	83	77	70	66	28	18	28	9	A-4 (7)	CL	
			25-42	C	116	14	100	93	84	77	70	68	29	18	31	11	A-6 (7)	CL	
	Loudon, Tenn.	Same	0-6	A	108	15	100	95	93	86	71	69	25	15	27	5	A-4 (7)	ML-CL	
			22-36	B	114	15	100	97	95	89	79	77	36	25	32	12	A-6 (9)	CL	
			36-59	B	111	17			100	95	86	83	36	26	36	13	A-6 (9)	ML-CL	
	Loudon, Tenn.	Same	1-7	A	109	16	100	95	88	86	70	68	30	17	28	5	A-4 (7)	ML-CL	
			18-27	B	114	15	100	98	91	82	74	73	40	26	31	11	A-6 (8)	CL	
			38-48	C_m	110	18			100	98	95	93	58	35	38	17	A-6 (11)	CL	
Lansdale loam	Lancaster, Pa.	Triassic sandstone	5-13	A	112	14	100	98	96	84	64	58	25	15	27	4	A-4 (6)	ML-CL	
			17-26	B	118	13	100	96	94	79	59	53	26	19	31	11	A-6 (5)	CL	
			32-37	C	123	11	100	87	85	71	40	35	16	12	23	5	A-4 (1)	SM-SC	
	Lancaster, Pa.	Triassic sandstone conglomerate, & arkose	7-11	A	116	13	100	89	86	70	46	41	19	13	27	6	A-4 (2)	SM-SC	
			15-19	B	121	12	100	82	78	60	41	37	19	14	29	10	A-4 (1)	SC	
			24-32	B	121	11	100	81	75	72	66	63	32	21	28	9	A-4 (6)	CL	
Lawrence silt loam	Coffee, Tenn.	Loess over cherty limestone	4-7	A	113	13	100	98	96	94	83	77	20	12	22	4	A-4 (8)	ML-CL	
			12-23	B	117	14	100	92	86	83	75	71	26	16	29	10	A-4 (8)	CL	
			23-42	B_m	120	12	100	90	84	79	70	66	20	12	24	6	A-4 (7)	ML-CL	
			42+	B_c	120	12	97	44	41	39	35	33	10	6	23	6	A-4 (0)	GM-GC	
	Coffee, Tenn.	Same	4-10	A	110	15				100	94	92	29	18	27	6	A-4 (8)	ML-CL	
			14-26	B	110	16				100	96	92	37	25	33	13	A-6 (9)	CL	
			26-49	B_m	111	17				100	96	94	38	25	33	12	A-6 (9)	CL	
			49+	C_m	105	20				100	94	90	50	37	43	19	A-7-6 (12)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE - DENSITY: Maximum Dry Density	MOISTURE - DENSITY: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	CLASSIFICATION: Unified 4/	REMARKS
			Inches		Lb./cu.ft.														
Leadvale silt loam	Blount, Tenn.	Alluvium	0-8	A	109	18			100	94	89	88	34	23	32	10	A-4 (8)	ML-CL	
			17-31	B	98	24			100	98	96	95	69	58	63	34	A-7-6 (20)	CH	
			31-48	C	98	26			100	89	81	80	58	48	56	22	A-7-5 (16)	MH	
	Blount, Tenn.	Same	0-8		112	15			100	97	80	74	23	14	24	6	A-4 (8)	ML-CL	
			8-18		116	15			100	98	86	83	38	23	27	10	A-4 (8)	CL	
			18-36		102	22			100	99	87	84	50	39	53	28	A-7-6 (18)	CH	
Leetonia stony loamy sand	Potter, Pa.	Sandstones and conglomerate	5-10	A	121	10	100	79	76	65	26	22	7	5	NP	NP	A-2-4 (0)	SM	80% discarded in sampling.
			15-25	B	117	12	100	66	62	50	25	22	7	5	NP	NP	A-2-4 (0)	SM	70% discarded in sampling.
							(Leetonia samples not corrected for material discarded larger than 3 in.)												
Lenoir fine sandy loam	Duplin, N. C.	Coastal Plain clay	0-8	A	115	13			100	96	59	50	16	11	20	5	A-4 (5)	ML-CL	
			12-30	B	102	20			100	98	81	77	49	42	49	26	A-7-6 (16)	CL	
			30-42	C	102	21			100	98	81	78	51	45	57	32	A-7-6 (19)	CH	
Lenoir silt loam	Fairfax, Va.	Coastal Plain sediments	1-6	A	101	20			100	99	94	92	40	25	36	8	A-4 (8)	ML	
			6-15	B	108	18				100	97	95	47	30	33	10	A-4 (8)	ML-CL	
			15-40	B	99	23				100	96	94	66	53	59	30	A-7-6 (20)	MH-CH	
			47-67	C	116	14			100	99	65	50	22	18	26	8	A-4 (6)	CL	
Leon fine sand	Sarasota, Fla.	Unconsolidated sand	9-20		104	14			100	96	5	5	3	1	NP	NP	A-3 (0)	SP-SM	
			20-22		101	16			100	96	12	9	6	5	NP	NP	A-2-4 (0)	SP-SM	
			22-26		106	13			100	97	9	8	4	3	NP	NP	A-3 (0)	SP-SM	
			26-52		109	10			100	97	6	5	3	2	NP	NP	A-3 (0)	SP-SM	
Lester silt loam	Scott, Minn.	Mankato glacial till	0-9.5	A	93	23			100	98	83	78	36	26	44	15	A-7-6 (11)	ML	
			14-23	B	104	19		100	99	97	86	80	35	28	38	15	A-6 (10)	ML-CL	
			49+	C	109	16	100	96	94	86	64	57	30	22	35	15	A-6 (8)	CL	
	Scott, Minn.	Same	0-9	A	94	22		100	98	92	67	61	29	22	43	14	A-7-6 (8)	ML	
			21-35	B	102	18		100	99	94	66	59	35	29	38	18	A-6 (9)	CL	
			47-66	C	100	21		100	98	92	68	62	36	29	47	23	A-7-6 (13)	CL	
			66+	C	104	19	100	99	97	91	69	65	35	26	43	22	A-7-6 (12)	CL	
	Scott, Minn.	Same	0-5	A	106	17			100	97	69	62	28	22	31	11	A-6 (7)	CL	
			14-32.5	B	83	32				100	96	93	80	71	87	49	A-7-5 (20)	MH-CH	
			41+	C	113	15	100	95	91	80	55	50	24	16	30	12	A-6 (5)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu. ft.	Percent													
LeSueur silty clay loam	Scott, Minn.	Mankato glacial till	0-11	A	93	23		100	99	94	69	65	37	30	43	15	A-7-6 (9)	ML-CL	Mapped as Webster-LeSueur.
			16-22.5	B	103	18		100	98	90	62	58	34	30	40	19	A-6 (9)	CL	
			33+	C	110	17	100	98	95	86	62	58	32	25	34	17	A-6 (8)	CL	
	Scott, Minn.	Same	0-10	A	84	29			100	96	78	73	32	24	54	17	A-7-5 (14)	MH or OH	Mapped as Webster-LeSueur.
			16-25.5	B	102	19		100	99	97	71	65	31	25	40	18	A-6 (10)	CL	
			31.5+	C	108	17			100	93	73	65	28	20	32	11	A-6 (8)	CL	
	Scott, Minn.	Same	0-9	A	83	31			100	98	88	85	42	30	55	19	A-7-5 (15)	MH or OH	Mapped as Webster-LeSueur.
			22-40	B	87	28		100	98	93	81	77	51	41	66	36	A-7-5 (20)	OH	
			50+	C	96	24	100	99	96	90	78	73	43	33	54	29	A-7-6 (18)	CH	
Lexington silt loam	De Soto, Miss.	Loess over Coastal Plain	0-4	A	101	18				100	99	87	16	14	30	6	A-4 (8)	ML or CL	
			10-20	B	111	15			100	97	87	83	27	23	33	13	A-6 (9)	CL	
			24-46	B & C	121	12			100	91	61	58	18	15	27	11	A-6 (6)	ML-CL	
			46+	D	117	12			100	78	18	18	6	4	NP	NP	A-2-4 (0)	SM	
	Henderson, Tenn.	Same	0-6		110	14			100	98	94	88	19	14	25	5	A-4 (8)	ML-CL	
			6-34		107	18				100	98	94	37	30	44	22	A-7-6 (14)	CL	
			34+		114	15			100	95	79	75	26	21	32	12	A-6 (9)	CL	
Lindside silt loam	Maury, Tenn.	Alluvium	0-24		108	17		100	98	83	75	74	29	23	39	14	A-6 (10)	ML-CL	
			24+		106	19		100	99	93	85	82	38	30	42	19	A-7-6 (12)	CL	
Linker fine sandy loam	De Kalb, Ala.	Sandstone and conglomerate	0-9		122	11	100	97	95	86	51	49	21	16	20	6	A-4 (3)	ML-CL	
			11-25		114	15	100	98	96	87	58	58	33	28	32	13	A-6 (6)	CL	
			25-50		106	19	100	99	97	89	63	62	44	41	41	13	A-7-6 (7)	ML	
Lintonia silt loam	De Soto, Miss.	Alluvium (terrace)	0-6	A	104	17			100	99	97	87	17	13	26	4	A-4 (8)	ML-CL	
			12-20	B	105	20					100	95	33	28	42	19	A-7-6 (12)	CL	
			40+	C	107	18					100	94	27	22	37	14	A-6 (10)	ML-CL	
Lits shaly silt loam	Blount, Tenn.	Shale	0-6	A	100	22		100	96	92	90	89	60	38	36	11	A-6 (8)	ML-CL	
			6-18	C	100	21		100	98	93	90	89	47	29	32	8	A-4 (8)	ML-CL	
	Blount, Tenn.	Same	1-7	A	106	18	100	93	87	79	70	69	25	16	30	7	A-4 (7)	ML-CL	
			7-27	C	93	26			100	96	92	91	62	49	63	31	A-7-5 (20)	MH-CH	
	De Kalb, Ala.	Clay shale, limestone & sandstone	1-8		107	17	100	93	88	82	77	70	34	24	32	8	A-4 (8)	ML-CL	
			8-30		106	19	100	57	48	45	44	43	29	22	43	17	A-7-6 (4)	GC	
Lloyd loam	Alamance, N. C.	Greenstone schist	0-3	A	91	24	100	98	97	92	79	73	26	20	47	12	A-7-6 (10)	ML	
			14-31	B	90	29			100	99	95	93	71	61	80	36	A-7-5 (20)	MH	
			31+	B	94	25				100	98	96	55	42	63	25	A-7-5 (18)	MH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-In.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu.ft.	Percent													
Lobelville silt loam	Coffee, Tenn.	Alluvium	0-12		107	16	100	97	94	92	79	73	31	21	30	8	A-4 (8)	ML-CL	
			16-30		114	14	100	90	86	82	66	61	25	19	27	8	A-4 (6)	CL	
	Coffee, Tenn.	Same	0-14		113	14	100	99	98	97	89	81	28	21	24	6	A-4 (8)	ML-CL	
			14-26		117	14	100	97	92	88	82	78	34	22	29	11	A-6 (8)	CL	
Lobitos loam	San Mateo, Calif	Silty sandstone or shale	0-9	A	94	24				100	93	78	31	25	42	13	A-7-6 (10)	ML	
			18-29	B	96	23				100	96	86	35	29	48	20	A-7-6 (14)	ML-CL	
	San Mateo, Calif	Same	0-8	A	91	25		100	99	97	78	75	44	35	47	16	A-7-6 (12)	ML	
			15-28	B	81	32	100	98	98	94	86	84	53	43	76	38	A-7-5 (20)	MH	
Lordstown channery silt loam	Cortland, N. Y.	Glacial till	0-8	A	93	25	98	81	75	69	64	61	24	15	50	9	A-5 (8)	ML	
			8-20	B	100	22	95	75	70	63	58	55	21	14	38	7	A-4 (5)	ML	
	Cortland, N. Y.	Same	0-8	A	94	25	95	68	63	57	52	52	23	14	50	11	A-7-5 (5)	ML	
			8-14	B	100	23	95	81	72	68	65	65	28	19	40	8	A-4 (7)	ML	
			25-32	B or A_b	122	12	85	65	58	52	46	44	15	8	23	3	A-4 (4)	ML	
			43-48	D_t	124	12	75	50	44	38	34	32	14	10	26	6	A-4 (2)	GM-GC	
	Cortland, N. Y.	Same	0-8	A	83	30	100	77	72	68	64	62	25	17	54	12	A-7-5 (9)	MH	
			8-18	B	110	17	100	87	83	79	76	72	29	19	31	5	A-4 (8)	ML	
			24-30	B or C	122	12	100	93	82	72	66	62	20	12	25	3	A-4 (6)	ML	
			30-34	D	121	12	100	62	48	40	36	34	12	9	27	4	A-4 (0)	GM-GC	
Loring silt loam	De Soto, Miss.	Loess	2-6	A	105	17					100	94	20	14	29	5	A-4 (8)	ML-CL	
			12-24	B	107	18					100	93	34	28	41	17	A-7-6 (11)	ML-CL	
			32-42	B	106	19					100	94	30	24	43	22	A-7-6 (13)	CL	
Louisburg sandy loam	Nottoway, Va.	Granite gneiss	3-16	A	122	9		100	97	65	30	25	12	7	18	1	A-2-4 (0)	SM	
			16-26	C	119	11		100	99	67	30	24	10	8	23	0	A-2-4 (0)	SM	
Lufkin fine sandy loam	Brazos, Tex.	Clay and sandy clay	0-6	A	113	14				100	45	33	12	10	20	2	A-4 (2)	SM	
			6-34	B	102	20				100	75	66	45	41	64	39	A-7-6 (20)	CH	
			46-60	C	90	29	100	70	59	59	57	56	37	31	86	54	A-7-5 (15)	OH	
	Brazos, Tex.	Same	0-5	A	110	13				100	44	31	11	9	20	3	A-4 (2)	SM	
			5-34	B	101	20				100	76	67	44	41	53	31	A-7-6 (19)	CH	
			42-72	C	96	24	100	78	69	69	44	38	25	21	56	32	A-7-6 (8)	SO	
	Brazos, Tex.	Same	0-7	A	115	13			100	99	60	45	12	9	21	4	A-4 (5)	OL-ML	
			7-34	B	104	19			100	99	82	71	44	39	54	33	A-7-6 (19)	CH	
			42-72	C	98	23			100	97	70	63	43	38	61	35	A-7-6 (18)	OH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu.ft.	Percent													
Lunt fine sandy loam	Fairfax, Va.	Coastal Plain sediments	1-9	A	113	14			100	85	33	31	21	17	27	9	A-2-4 (0)	SC	
			9-18	B	101	19			100	86	44	42	35	31	54	28	A-7-6 (8)	SC	
			21-46	C	106	17			100	90	30	29	25	22	42	16	A-2-7 (1)	SM-SC	
	Fairfax, Va.	Same	0-9	A	120	12			100	64	41	39	20	13	29	6	A-4 (1)	SM-SC	
			12-26	B	106	18			100	85	75	75	46	35	55	28	A-7-6 (18)	CH	
			45-60	C	116	13	100	69	62	43	27	25	19	15	49	24	A-2-7 (2)	SC	
Laton clay	Monona, Iowa	Alluvium	2-10		90	29				100	99	98	61	50	66	37	A-7-6 (20)	CH or OH	
			18-24		92	28			100	99	99	99	79	66	84	54	A-7-5 (20)	CH	
Lynchburg fine sandy loam	Escambia, Fla.	Coastal Plain sediments	0-7	A	112	15			100	99	40	37	18	13	24	6	A-4 (1)	SM-SC	
			10-16	B	123	11			100	97	35	32	17	14	19	5	A-2-4 (0)	SM-SC	
			27+	C	122	12	100	96	91	83	35	33	18	15	23	7	A-2-4 (0)	SM-SC	
	Duplin, N. C.	Coastal Plain sand and sandy clay	0-6	A	114	12			100	95	42	34	13	8	21	3	A-4 (1)	SM	
			14-30	B_g	128	10			100	95	46	41	20	15	18	5	A-4 (2)	SM-SC	
			30-54	B_g	124	11			100	96	49	44	23	16	23	10	A-4 (3)	SC	
McBride fine sandy loam	Sanilac, Mich.	Sandy loam glacial till	4-10	A & B	113	13	100	94	90	83	45	37	12	6	NP	NP	A-4 (2)	SM	
			16-46	B_h	125	11	100	94	91	82	41	36	15	11	17	3	A-4 (1)	SM	
			46-78	C	118	11	100	97	96	92	49	38	10	7	NP	NP	A-4 (3)	SM	
McGary & Fitchville silt loams	Fairfield, Ohio	Wisconsin stratified silts and clays	4-10	A	101	19			100	98	91	88	36	22	36	12	A-6 (9)	ML-CL	
			20-28	B	103	21				100	99	99	82	65	62	34	A-7-6 (20)	CH	
			31+	C	104	20			100	99	98	98	77	52	49	23	A-7-6 (15)	ML-CL	
McGirk silt loam	Moniteau, Mo.	Shale	0-10	A	105	17			100	97	95	89	23	16	27	5	A-4 (8)	ML-CL	
			18-36	B	96	24			100	99	96	93	53	48	60	34	A-7-6 (20)	CH	
Madison sandy loam	Nottoway, Va.	Quartz mica gneiss	1-6	A	122	11	100	99	98	61	33	29	14	9	24	4	A-2-4 (0)	SM-SC	
			6-20	B	100	23			100	82	61	61	50	46	64	31	A-7-5 (16)	MH-CH	
			28-40	C	102	20			100	75	41	39	26	22	58	9	A-5 (2)	SM	
Manatee fine sandy clay	Sarasota, Fla.	Clay sediments over marly clay material	0-9		103	19			100	91	28	27	19	16	30	7	A-2-4 (0)	SM-SC	
			20-35		118	13			100	91	24	22	19	17	28	13	A-2-6 (0)	SC	
			35-49		124	11			100	92	37	34	28	22	26	14	A-6 (1)	SC	
Manatee fine sandy loam	Sarasota, Fla.	Sand over clay material underlain by marl	0-12		100	19			100	88	22	16	9	7	NP	NP	A-2-4 (0)	SM	
			12-25		117	13			100	88	18	17	12	9	NP	NP	A-2-4 (0)	SM	
			25-40		117	13			100	88	18	17	13	11	NP	NP	A-2-4 (0)	SM	
			40-54		119	12			100	89	17	15	12	11	20	5	A-2-4 (0)	SM-SC	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-In.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu.ft.	Percent													
Manor channery gravelly loam	Frederick, Md.	Mica schist	18-36+	C	112	17	99	53	45	36	29	27	16	10	36	9	A-2-4 (0)	GM	
Manor loam	Newcastle, Del.	Schists and gneisses	1-8	A	109	17	100	74	66	57	37	34	22	14	35	9	A-4 (0)	SM	
			8-16	B	115	15	100	91	80	70	46	42	24	19	36	12	A-6 (3)	SC	
			30-42	C	118	14	100	63	50	40	21	19	10	8	34	7	A-2-4 (0)	SM	
Manor silt loam	Fairfax, Va.	Schist	0-8	A	107	17	100	98	96	95	72	60	21	15	34	4	A-4 (7)	ML	
			8-36	C	102	19			100	99	73	61	14	6	35	1	A-4 (8)	ML	
Mansker sandy clay loam	Lynn, Tex.	Wind blown sediments	0-16	A	117	13			100	98	59	50	27	22	25	10	A-4 (5)	CL	
			16-62	Cca	114	15	100	99	98	90	66	61	36	24	29	14	A-6 (8)	CL	
			62-120+	C	116	14			100	98	66	59	39	30	36	19	A-6 (10)	CL	
	Lynn, Tex.	Same	0-16	A	116	13	100	96	94	92	56	43	18	15	23	7	A-4 (4)	ML-CL	
			16-30	Cca	114	15	100	86	83	76	56	49	28	21	25	9	A-4 (4)	CL	
			30-84+	C	123	12	100	92	88	81	53	46	24	18	21	9	A-4 (4)	CL	
	Lynn, Tex.	Same	0-14	A	117	14	100	99	98	94	64	56	33	25	28	12	A-6 (7)	CL	
			14-38	Cca	115	15	100	98	96	92	77	73	53	31	29	13	A-6 (9)	CL	
			38-84	C	112	15	100	94	93	89	71	67	46	28	40	22	A-6 (12)	CL	
Mardin channery silt loam	Cortland, N. Y.	Glacial till	0-8	A	90	27	100	64	59	54	45	42	15	9	50	10	A-5 (3)	GM	
			19-28	Bbgm	123	12	98	68	62	56	50	47	20	13	23	6	A-4 (3)	ML-CL	
			49-59	C	124	11	95	67	61	56	49	45	20	12	23	5	A-4 (3)	ML-CL	
	Cortland, N. Y.	Same	0-5	A	85	29	100	71	67	63	57	54	21	14	56	13	A-7-5 (7)	MH	
			16-29	Bbgm	125	11	95	69	63	56	49	45	17	11	23	5	A-4 (3)	ML-CL	
			50-64	C or D	127	11	92	64	54	46	40	39	19	14	25	7	A-4 (2)	GM-GC	
	Cortland, N. Y.	Same	0-8	A	86	30	100	87	84	82	77	75	34	24	55	14	A-7-5 (13)	MH	
			18-29	Bbgm	122	13	93	78	71	63	58	55	28	19	27	8	A-4 (5)	CL	
			36-44	C	123	13	80	67	60	54	47	46	22	16	27	9	A-4 (5)	CL	
Marengo silty clay loam	Fairfield, Ohio	Wisconsin glacial till	0-7		101	19			100	97	86	81	38	28	44	17	A-7-6 (12)	ML-CL or CL	
			15-25		109	17			100	98	90	87	48	38	46	25	A-7-6 (15)	CL	
			52-75		116	14	100	97	95	89	74	69	38	28	32	14	A-6 (9)	CL	
Marlboro fine sandy loam	Duplin, N. C.	Coastal Plain sandy clay	0-5	A	117	10			100	93	54	37	8	5	16	2	A-4 (4)	ML	
			18-32	B	112	16			100	95	72	60	36	32	39	19	A-6 (11)	CL	
			48-56+	C	116	14			100	96	67	53	26	24	34	15	A-6 (8)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density: Maximum dry density	Moisture-density: Optimum moisture	Mechanical analysis [1] Percentage passing sieve [2]: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than [2]: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. [3]	Unified [4]	Remarks
			Inches		Lb./cu.ft.	Percent													
Marlette loam	Sanilac, Mich.	Loam glacial till	3-6	A	115	13	100	98	96	89	49	41	14	9	21	3	A-4 (3)	SM	
			15-30	B_t	115	16	100	99	98	94	70	67	40	30	31	13	A-6 (8)	CL	
			30+	C	121	13	100	99	97	92	63	59	33	24	28	12	A-6 (6)	CL	
	Sanilac, Mich.	Same	8-24	A & B	124	10	100	94	92	84	46	42	18	14	16	3	A-4 (2)	SM	
			24-40	B_t	118	13	100	99	98	93	68	66	37	29	29	13	A-6 (8)	CL	
			40+	C	126	10	100	93	92	86	61	55	21	15	20	6	A-4 (5)	ML-CL	
Matapeake silt loam	Fairfax, Va.	Coastal Plain sediments	2-8	A	111	15			100	99	79	73	29	20	23	4	A-4 (8)	ML-CL	
			22-38	B	111	17				100	77	69	41	33	37	15	A-6 (10)	CL	
			44-52	C	114	15				100	68	58	29	24	29	9	A-4 (7)	CL	
Matapeake very fine sandy loam	Norfolk, Va.	Same	2-9	A	114	14			100	99	73	69	23	16	21	5	A-4 (8)	ML-CL	
			12-20	B	106	20			100	99	84	81	47	39	39	14	A-6 (10)	ML-CL	
			47-54	C	117	12			100	99	33	28	15	12	NP	NP	A-2-4 (0)	SM	
Maumee fine sandy loam	Will, Ill.	Water laid sand	0-18	A	114	13			100	98	22	20	10	8	NP	NP	A-2-4 (0)	SM	
			18+	B & C	109	13			100	99	9	7	6	5	NP	NP	A-3 (0)	SP-SM	
Maury silt loam	Maury, Tenn.	Limestone	0-12	A	104	20			100	97	89	86	34	27	36	12	A-6 (9)	ML-CL	
			12-36	B	104	22	100		95	88	74	73	39	33	42	16	A-7-6 (11)	ML-CL	
			36+	C	106	22	100	74	73	66	44	43	26	22	39	15	A-6 (3)	SC	
Mecklenburg silt loam	Fairfax, Va.	Diabase	0-8	A	107	19	100	98	98	90	75	71	34	22	35	11	A-6 (8)	ML-CL	
			8-32	B	93	27			100	92	79	75	48	40	61	28	A-7-5 (19)	MH	
			32-48	C	119	15	100	99	86	59	35	30	18	13	34	12	A-2-6 (0)	SC	
Melvin silt loam	De Kalb, Ala.	Alluvium	1-10		116	14	100	94	89	81	68	63	29	23	31	14	A-6 (8)	CL	
			10-32		116	12	100	93	89	77	60	55	18	12	24	6	A-4 (5)	ML-CL	
Melvin silty clay loam	Blount, Tenn.	Same	0-9		102	22				100	99	99	61	44	45	21	A-7-6 (13)	CL	
			9-40		110	18	100	99	97	94	85	84	40	29	35	16	A-6 (10)	CL	
Memphis silt loam	De Soto, Miss.	Loess	2-8	A	103	16					100	91	16	10	23	2	A-4 (8)	ML	
			20-32	B	106	18					100	92	31	26	41	17	A-7-6 (11)	ML-CL	
			36-50	B	108	18					100	91	26	21	37	15	A-6 (10)	CL	
			100-112	C	107	17					100	91	19	14	33	11	A-6 (8)	ML-CL	

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			Inches		Lb./cu.ft.	Percent													
Merrimac loamy sand	Rockingham, N.H.	Glacial outwash & terrace	0-2½	A	97	20	100	84	80	58	17	14	5	4	NP	NP	A-2-4 (0)	SM	
			6-24	B	114	13	100	78	69	42	11	10	5	4	NP	NP	A-1-b (0)	SW-SM	
			24+	C	111	14	100	79	70	41	3	2	2	1	NP	NP	A-1-b (0)	SP	
Merrimac sandy loam	Rockingham, N.H.	Same	0-5	A	93	21	100	86	81	49	24	19	7	5	NP	NP	A-1-b (0)	SM	
			9-14	B	121	11	100	67	54	22	5	4	3	2	NP	NP	A-1-b (0)	SW-SM	
			27+	C	105	12	100	96	93	41	5	4	3	3	NP	NP	A-1-b (0)	SP-SM	
	Rockingham, N.H.	Same	0-3	A	91	21	100	98	97	85	39	31	10	7	NP	NP	A-4 (1)	SM	
			8-15	B	118	10	100	93	90	76	26	21	8	6	NP	NP	A-2-4 (0)	SM	
			23+	D	115	12	100	59	43	9	2	2	1	0	NP	NP	A-1-a (0)	SP	
Mexico silt loam	Callaway, Mo.	Loess over glacial till	0-9	A	104	18			100	97	95	93	28	20	33	9	A-4 (8)	ML-CL	
			14-23	B	89	27					100	98	64	56	66	32	A-7-5 (20)	MH-CH	
			30-58	C	100	22					100	97	50	41	55	31	A-7-6 (19)	CH	
	Callaway, Mo.	Same	0-7	A	102	19			100	97	95	93	30	23	35	11	A-6 (8)	ML-CL	
			16-25	B	93	26				100	98	97	60	52	72	40	A-7-5 (20)	MH-CH	
			34-50	C	105	19				100	98	97	45	38	48	26	A-7-6 (16)	CL	
	Callaway, Mo.	Same	0-7	A	108	16			100	97	84	80	23	19	30	8	A-4 (8)	ML-CL	
			21-32	B	106	19			100	97	88	84	39	35	45	23	A-7-6 (14)	CL	
			32-56	D & C	110	18			100	98	87	83	38	33	40	21	A-6 (12)	CL	
Miami silt loam	Will, Ill.	Glacial till	0-6	A	104	19			100	98	92	89	32	25	35	12	A-6 (9)	ML-CL	
			16-32	B	106	19	100	99	99	98	94	90	78	55	50	27	A-7-6 (17)	CL	
	Fairfield, Ohio	Wisconsin glacial till	0-5	A	113	15	100	88	86	79	67	64	30	21	32	10	A-4 (6)	ML-CL	
			12½-17	B	106	17	100	96	93	86	75	74	52	44	54	32	A-7-6 (19)	CH	
			22+	C	121	12	100	87	83	72	59	56	29	21	30	13	A-6 (6)	CL	
Milaca fine sandy loam	Isanti, Minn.	Cary glacial till	3-11	A	125	9	100	94	91	78	36	32	8	5	15	2	A-4 (0)	SM	
			20-47	B	125	11			100	99	92	88	18	10	27	5	A-4 (8)	ML-CL	
			47-75+	C	128	10			100	99	94	91	34	27	35	15	A-6 (10)	CL	
Milaca silt loam	Isanti, Minn.	Same	2-9	A	112	13			100	95	79	66	11	7	20	3	A-4 (8)	ML	
			15-42	B	130	9	100	92	89	78	34	27	10	8	16	3	A-2-4 (0)	SM	
			42-60+	C	134	8	100	81	76	62	25	20	8	5	14	3	A-2-4 (0)	SM	
Miller clay	Brazos, Tex.	Alluvium	0-36	A	95	25					100	99	85	69	72	40	A-7-5 (20)	CH	
	Brazos, Tex.	Same	0-36	A	97	24					100	99	82	67	69	39	A-7-5 (20)	CH	
	Fort Bend, Tex.	Same	0-36		95	23				100	99	98	75	64	68	38	A-7-5 (20)	CH	

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Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture - density: Maximum dry density	Moisture - density: Optimum moisture	Mechanical analysis 1/ Percentage passing sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Unified 4/	Remarks
			Inches		Lb./cu.ft.	Percent													
Mimosa silt loam	Maury, Tenn.	Clayey limestone	0-8	A	105	19			100	96	91	87	34	24	35	12	A-6 (9)	ML-CL	
			8-30	B	94	27	100	95	95	90	87	86	60	53	58	24	A-7-5 (17)	MH	
			30+	C	82	31			100	95	91	90	76	70	72	29	A-7-5 (20)	MH	
Minvale cherty silt loam	De Kalb, Ala.	Colluvium	3-11	A	111	14	98	79	72	61	48	46	19	13	27	7	A-4 (3)	SM-SC	
			15-30	B	117	13	97	62	48	38	31	31	17	12	29	11	A-2-6 (0)	GC	
			30-48	C	118	13	99	82	74	63	49	48	23	16	25	8	A-4 (3)	SC	
Mohave loam	Maricopa, Ariz.	Alluvium (alluvial fan)	0-12	A	120	13	100	98	95	80	56	48	27	21	26	10	A-4 (4)	CL	
			16-28	B	106	19			100	88	71	66	39	34	40	20	A-6 (11)	CL	
			33-56	B_{ca}	110	18	100	99	97	92	70	62	28	19	33	13	A-6 (8)	CL	
Monona silt loam	Monona, Iowa	Loess	2-8		97	23				100	99	97	35	28	48	20	A-7-6 (14)	ML-CL	
			12-18		102	21				100	99	98	35	29	46	20	A-7-6 (13)	ML-CL	
			30-36		107	19				100	99	96	30	23	38	14	A-6 (10)	ML-CL	
Montalto silt loam	Fairfax, Va.	Diabase	0-7	A	103	22	100	93	93	82	66	61	32	22	40	12	A-6 (7)	ML	
			7-18	B	96	27	100	98	98	92	76	72	49	42	52	22	A-7-5 (25)	MH-CH	
			18-27	B	97	26			100	89	68	63	41	36	52	22	A-7-5 (13)	MH-CH	
			27-37	C	104	21	100	96	94	73	52	48	27	24	45	16	A-7-6 (6)	ML	
Montalto very stony silt loam	Lancaster, Pa.	Same	2-11	A	106	18		100	99	96	91	89	39	27	35	10	A-4 (8)	ML-CL	Soil normally contains some particles larger than 3 inches.
			19-26	B	94	27			100	98	93	91	63	54	71	34	A-7-5 (20)	MH	
			35-51	B	85	31			100	99	95	92	67	59	75	31	A-7-5 (20)	MH	
	Lancaster, Pa.	Same	4-8	A	99	21	100	76	76	58	32	27	16	11	42	12	A-2-7 (0)	SM	Soil normally contains some particles larger than 3 inches.
			18-32	B	94	26	100	97	97	96	92	90	59	46	68	31	A-7-5 (20)	MH	
			48-60+	C	89	29	100	98	98	97	89	85	52	41	63	22	A-7-5 (17)	MH	
Moody silty clay loam	Cuming, Nebr.	Loess	0-7	A	97	21				100	99	96	45	38	42	16	A-7-6 (11)	ML-CL	
			24-33	B	102	20					100	98	46	38	50	25	A-7-6 (16)	CL	
			47-54	C	105	20					100	97	41	34	42	19	A-7-6 (12)	CL	
	Dixon, Nebr.	Same	0-7	A	99	20				100	99	95	40	34	45	19	A-7-6 (13)	ML-CL	
			21-30	B	104	19				100	99	96	39	32	43	20	A-7-6 (13)	CL	
			55-60	C_{ca}	106	19				100	99	96	37	30	37	15	A-6 (10)	CL	
	Dixon, Nebr.	Same	0-6	A	104	19			100	99	98	95	38	32	38	14	A-6 (10)	ML-CL	
			14-23	B_{ca}	107	18		100	99	99	98	95	34	29	39	17	A-6 (11)	CL	
			40-60	C	106	19					100	96	36	30	37	14	A-6 (10)	ML-CL	
	Wayne, Nebr.	Same	0-6	A	95	25				100	99	96	44	39	44	17	A-7-6 (12)	ML-CL	
			20-30	B	101	20					100	97	46	40	54	29	A-7-6 (18)	CH	
			48-60	C_{ca}	105	20				100	99	96	39	34	42	20	A-7-6 (12)	CL	
	Wayne, Nebr.	Same	0-6	A	99	22				100	99	97	42	35	44	18	A-7-6 (12)	ML-CL	
			11-18	B_{ca}	107	19		100	99	96	96	93	40	33	43	18	A-7-6 (12)	ML-CL	
			45-60	C	106	19				100	99	97	35	31	38	15	A-6 (10)	ML-CL	

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			Inches		Lb./cu.ft.	Percent													
Mountview silt loam	Coffee, Tenn.	Loess over cherty limestone	1-8	A	107	16			100	97	93	91	28	17	26	4	A-4 (8)	ML-CL	
			10-29	B	110	17			100	98	95	93	39	28	41	18	A-7-6 (11)	CL	
			34+	D	100	23			100	99	97	93	55	47	57	25	A-7-5 (17)	MH	
	Coffee, Tenn.	Same	2-9	A	114	13		100	99	98	86	81	22	14	20	2	A-4 (8)	ML	
			15-30	B	115	15	100	99	98	97	88	82	30	23	33	13	A-6 (9)	CL	
			30-42	B	110	17		100	99	98	88	83	37	32	40	19	A-6 (12)	CL	
			42-54	B_0	108	18	100	98	96	94	80	74	38	32	45	21	A-7-6 (13)	CL	
Muskingum sandy loam	Fairfield, Ohio	Sandstone	3-8	A	110	16	100	99	98	94	52	47	22	15	29	8	A-4 (3)	ML-CL	
			8-28	C	123	11	100	96	95	90	53	51	26	18	20	7	A-4 (4)	ML-CL	
Muskingum silt loam	Fairfield, Ohio	Sandstone & shale	0-7	A	105	17	100	85	84	83	80	76	22	15	29	6	A-4 (8)	ML-CL	
			12-20	C	114	14	100	40	38	38	36	32	10	7	24	4	A-4 (0)	GM-GC	
Muskingum stony fine sandy loam	De Kalb, Ala.	Sandstone	0-7		110	14	100	95	95	91	40	39	19	14	24	5	A-4 (1)	SM-SC	
			7-17		119	12	100	99	99	95	47	46	25	20	22	6	A-4 (2)	SM-SC	
Myersville loam	Frederick, Md.	Schistose meta-basalt	0-8	A	108	19	100	94	92	85	76	73	27	18	41	11	A-7-5 (9)	ML	
			8-34	B	107	19	100	98	96	91	86	84	36	35	44	16	A-7-6 (11)	ML-CL	
			46+	C	108	18			100	97	85	79	28	20	45	14	A-7-5 (11)	ML	Mapped as Myersville & Fauquier.
	Frederick, Md.	Same	0-10	A	102	20	100	98	96	89	82	80	30	21	39	11	A-6 (8)	ML	
			10-29	B	105	20	100	94	92	86	81	78	30	19	37	11	A-6 (8)	ML-CL	
			46+	C	108	19			100	95	79	75	17	10	37	9	A-4 (8)	ML	Mapped as Myersville & Fauquier.
Napa clay	Monona, Iowa	Alluvium	10-16		97	24			100	99	88	86	53	46	81	58	A-7-6 (20)	OH	
Napier silt loam	Monona, Iowa	Alluvium	12-18		98	23				100	99	96	29	24	44	17	A-7-6 (12)	ML-CL	
Neshaminy silt loam	Newcastle, Del.	Quartz gabbro	0-8	A	103	18			100	99	96	89	28	18	33	9	A-4 (8)	ML-CL	
			21-33	B	110	17			100	96	91	85	35	28	39	17	A-6 (11)	CL	
			44-51	B	102	21	100	97	97	87	76	73	46	41	50	24	A-7-6 (16)	ML-CL	
Norfolk fine sandy loam	Escambia, Fla.	Coastal Plain sediments	0-6	A	116	12	100	99	99	95	34	29	10	8	NP	NP	A-2-4 (0)	SM	
			20-48	B	121	12	100	99	98	95	48	44	25	22	26	10	A-4 (3)	SC	
			48-66	C	91	24			100	97	65	63	48	45	54	19	A-7-5 (12)	MH	
	Duplin, N. C.	Coastal Plain sand & sandy clay	2.5-15	A	118	9			100	98	33	28	9	6	NP	NP	A-2-4 (0)	SM	
			18-30	B	112	16			100	99	51	45	30	28	35	13	A-6 (4)	ML-CL	
			42-48+	C	118	14			100	98	29	28	17	16	25	6	A-2-4 (0)	SM-SC	
Norton gravelly silt loam	Frederick, Md.	Colluvium	8-15	A	114	14	100	73	71	57	44	43	21	14	31	9	A-4 (2)	GC	
			15-31	B	119	14	100	84	82	67	53	45	30	21	32	13	A-6 (5)	CL	
			31-48	B	110	18	100	92	90	76	64	62	42	35	50	27	A-7-6 (14)	CL	

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Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density: Maximum Dry Density	Moisture-density: Optimum Moisture	Mechanical analysis 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 2/	Unified 1/	Remarks
			Inches		Lb./cu. ft.	Percent													
Olivier silt loam	De Soto, Miss	Alluvium (terrace)	2-8	A	107	16					100	90	21	17	27	5	A-4 (8)	ML-CL	
			12-22	B	106	18					100	93	28	23	37	13	A-6 (9)	ML-CL	
			26-37	M	106	19					100	95	28	23	36	12	A-6 (9)	ML-CL	
			56-62	C	107	19					100	93	26	22	41	19	A-7-6 (12)	CL	
Ona fine sand	Sarasota, Fla.	Marine-deposited sand	0-9		107	13			100	89	14	11	6	4	NP	NP	A-2-4 (0)	SM	
			9-15		103	16			100	93	11	9	6	4	NP	NP	A-2-4 (0)	SP-SM	
			15-22		108	11			100	93	9	7	5	4	NP	NP	A-3 (0)	SP-SM	
			22-34		112	10			100	93	7	6	4	3	NP	NP	A-3 (0)	SP-SM	
			34-56		113	10			100	93	7	6	5	4	NP	NP	A-3 (0)	SP-SM	
Ona fine sand (variation)	Sarasota, Fla.	Same	0-9		102	15			100	94	9	7	2	2	NP	NP	A-3 (0)	SP-SM	
Ontario fine sandy loam	Wayne, N. Y.	Drumlin (glacial till)	0-7	A	109	14	100	96	95	91	60	44	15	10	25	3	A-4 (5)	ML	
			28-38	B	118	14	100	98	97	94	78	71	38	29	27	10	A-4 (8)	CL	
			51-69	C	123	12	100	92	90	85	69	61	26	19	21	7	A-4 (7)	ML-CL	
Ontario gravelly loam	Wayne, N. Y.	Same	0-9	A	117	13	100	84	82	77	55	46	21	15	24	6	A-4 (4)	ML-CL	
			11-26	B	126	10	100	94	92	86	62	52	25	18	21	7	A-4 (5)	ML-CL	
			53-71	C	131	9	100	86	84	76	55	43	17	11	16	4	A-4 (4)	ML-CL	
Ontario fine sandy loam	Wayne, N. Y.	Same	0-8	A	113	13	100	90	87	81	50	37	11	6	21	2	A-4 (3)	SM	
			22-32	B	125	10	100	95	93	87	56	43	16	12	18	3	A-4 (4)	ML	
			41-60	C	129	8	100	95	92	83	53	40	11	6	14	1	A-4 (4)	ML	
Orange silt loam	Fairfax, Va.	Greenstone	0-9	A	113	14		100	96	88	81	77	30	17	23	3	A-4 (8)	ML	
			9-23	B	116	15	100	99	92	84	77	72	30	19	29	9	A-4 (8)	CL	
			23-41	B$_{m}$	91	28		100	97	93	90	87	65	60	86	53	A-7-5 (20)	CH	
	Alamance, N. C.	Slate	2-4	A	112	14		100	98	92	83	80	20	12	24	4	A-4 (8)	ML-CL	
			17-29	B	111	17		100	99	97	90	87	43	34	46	28	A-7-6 (16)	CL	
			47-77	B	87	30					100	99	78	65	92	54	A-7-5 (20)	MH-CH	
Othello very fine sandy loam	Norfolk, Va.	Coastal Plain sediments	2-10	A	120	11			100	99	62	57	19	12	18	4	A-4 (5)	ML-CL	
			12-30	B$_{g}$	113	15			100	99	71	68	38	31	35	21	A-6 (12)	CL	
			35-40	C	112	13				100	38	28	10	9	NP	NP	A-4 (1)	SM	
Ottawa loamy fine sand	Monroe, N. Y.	Glacial outwash	0-11	A	114	12			100	93	26	17	8	6	NP	NP	A-2-4 (0)	SM	
			18-35	B	112	12	100	99	97	89	17	11	6	4	NP	NP	A-2-4 (0)	SM	
			35-48	B	106	15			100	97	14	8	3	1	NP	NP	A-2-4 (0)	SM	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	Horizon	MOISTURE - DENSITY: Maximum Dry Density	Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	Unified 4/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Palouse silt loam	Walla Walla, Wash.	Loess	0-9	A	103	18				100	98	88	28	21	32	8	A-4 (8)	ML-CL	
			23-47	B	109	17				100	98	86	28	20	33	11	A-6 (8)	ML-CL	
			56-72	C	105	18				100	98	85	24	15	30	6	A-4 (8)	ML-CL	
	Walla Walla, Wash.	Same	0-9	A	108	16				100	98	86	28	23	31	11	A-6 (8)	CL	
			19-44	B	109	17				100	99	86	28	21	35	13	A-6 (9)	ML-CL	
			58-72	C	111	17				100	99	86	28	21	33	11	A-6 (8)	ML-CL	
Panton silty clay loam	Franklin, N. Y.	Marine clay	0-8	A	100	22	100	99	99	95	71	66	50	42	44	17	A-7-6 (11)	ML	
			8-11	B_g	100	21			100	98	77	73	61	52	45	20	A-7-6 (13)	OL	
			11-26	B_g	97	26			100	99	85	83	69	61	55	27	A-7-6 (18)	CH	
			26-38	B_g	94	27	100	98	97	95	92	92	80	67	58	30	A-7-6 (20)	CH	
	Franklin, N. Y.	Same	0-7	A	95	23			100	98	86	77	36	27	46	14	A-7-5 (11)	ML	
			7-11	B_g	111	16			100	99	94	86	48	37	37	15	A-6 (10)	CL	
			11-22	B_g	104	20			100	99	94	87	53	44	40	19	A-6 (12)	CL	
			22-33	B_g	102	22				100	98	93	56	46	44	22	A-7-6 (14)	CL	
Parkhill loam	Sanilac, Mich.	Loam drift	0-7	A	98	20				100	58	53	30	20	38	12	A-6 (5)	ML-CL	
			7-16	CA	123	11			100	99	50	48	29	21	24	10	A-4 (3)	OL	
			16-23	CB	122	12				100	54	52	30	24	26	12	A-6 (5)	OL	
			23-30	CB	123	12			100	99	52	48	29	23	25	13	A-6 (4)	CL	
			30-36	CB	122	12				100	57	54	29	22	23	10	A-4 (4)	CL	
			36+	C	122	12				100	67	64	31	21	23	9	A-4 (6)	OL	
	Sanilac, Mich.	Same	0-7½	A	91	23			100	97	69	60	27	20	44	10	A-5 (8)	ML	
			7½-17	CA	114	15			100	97	69	62	29	22	29	10	A-4 (7)	OL	
			17-29	CB	114	14			100	97	69	62	31	24	30	11	A-6 (7)	OL	
			29-46	CB	117	14			100	96	69	61	28	21	26	9	A-4 (7)	CL	
			56+	C	124	11	100	93	88	87	59	52	24	15	22	6	A-4 (5)	ML-CL	
Parsons silt loam	Mayes, Okla.	Shales	0-12	A	107	15			100	99	88	78	20	14	25	6	A-4 (8)	ML-CL	
			20-42	B	99	22			100	99	94	91	56	50	56	32	A-7-6 (19)	CH	
			50-100+	C	107	19			100	99	88	82	46	41	55	37	A-7-6 (19)	CH	
	Mayes, Okla.	Shales	20-42	B	91	28			100	99	94	92	59	55	62	34	A-7-6 (20)	CH	
Paulding clay	Paulding, Ohio	Lacustrine clay	0-4	A	80	33			100	99	94	94	75	62	76	36	A-7-5 (20)	MH or CH	
			16-19	B_g	96	23				100	97	97	81	69	75	44	A-7-5 (20)	CH	
			45+	C	100	24			100	99	96	95	77	64	69	42	A-7-6 (20)	CH	
	Paulding, Ohio	Same	0-6	A	88	25				100	97	96	81	66	68	33	A-7-5 (20)	MH or CH	
			19-22	B_g	94	25				100	97	97	84	71	77	45	A-7-5 (20)	CH	
			30-33	B_g	96	25				100	99	98	84	71	78	48	A-7-5 (20)	CH	
			51-54	C	101	23			100	99	97	97	83	66	63	35	A-7-6 (20)	CH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu.ft.	Percent													
Paxton fine sandy loam	Rockingham, N.H.	Glacial till	0-3	A	98	19	95	82	80	65	34	29	12	8	NP	NP	A-4 (0)	SM	
			3-8	B	109	16	95	59	55	44	23	19	7	5	NP	NP	A-1-b (0)	GM-SM	
			27+	C	121	9	95	82	81	74	37	27	8	5	NP	NP	A-4 (1)	SM	
	Rockingham, N.H.	Same	0-7	A	95	21	95	78	75	64	41	34	14	10	41	8	A-5 (2)	SM	
			14-22	B	113	15	95	78	75	66	43	38	19	13	27	6	A-4 (2)	SM-SC	
			22+	C	122	12	95	81	77	66	44	36	17	13	22	5	A-4 (2)	SM-SC	
Paxton loam	Rockingham, N.H.	Same	0-9	A	110	15	90	66	63	53	30	25	11	8	NP	NP	A-2-4 (0)	SM	
			9-15	B	118	12	90	78	75	63	36	30	13	10	22	3	A-4 (1)	SM	
			21+	C	125	10	90	76	74	61	32	25	11	8	NP	NP	A-2-4 (0)	SM	
Penn shaly loam	Frederick, Md.	Shale & sandstone	3-14	B & C	112	15	100	89	72	55	51	51	23	13	31	7	A-4 (3)	ML-CL	
			14-36	C	115	15	100	48	40	32	28	27	14	8	29	7	A-2-4 (0)	GM-GC	
Penn silt loam	Frederick, Md.	Same	6-19	B	111	16		100	99	94	82	78	31	19	28	5	A-4 (8)	ML-CL	
			19-31	C	112	17	100	97	96	92	80	76	31	21	32	10	A-4 (8)	ML-CL	
			31+	Dr	117	15	96	29	29	27	22	22	8	5	28	7	A-2-4 (0)	GM-GC	
	Fairfax, Va.	Siltstone & shaly sandstone	0-8	A	113	14		100	99	93	84	78	26	16	27	4	A-4 (8)	ML-CL	
			8-19	C	115	14			100	98	87	77	22	15	26	3	A-4 (8)	ML	
Perth silt loam	Sanilac, Mich.	Silty clay loam, glacial till	0-5	A	100	22	100	98	97	94	76	75	38	25	41	13	A-7-6 (9)	ML	
			7-14	Btg	110	17			100	99	88	87	55	41	40	18	A-6 (11)	CL	
			15+	C	112	18			100	99	95	94	55	38	37	16	A-6 (10)	CL	
Plummer fine sand	Sarasota, Fla.	Marine-deposited sand	4-38		106	12			100	95	5	4	2	1	NP	NP	A-3 (0)	SP-SM	
			38-52		114	10			100	96	11	10	6	5	NP	NP	A-2-4 (0)	SP-SM	
Pompano fine sand	Sarasota, Fla.	Fine sand over clayey materials	4-16		110	12			100	96	8	7	4	4	NP	NP	A-3 (0)	SP-SM	
			16-32		110	11			100	96	8	7	6	4	NP	NP	A-3 (0)	SP-SM	
			32-48		119	13			100	97	22	21	19	19	24	8	A-2-4 (0)	SC	
			48-62		117	12			100	88	14	13	9	7	NP	NP	A-2-4 (0)	SM	
Port silt loam	Pawnee, Okla.	Alluvium	0-36	A & C	114	15				100	72	62	23	20	25	7	A-4 (7)	ML-CL	
	Pawnee, Okla.	Same	0-36	A & C	110	17				100	96	88	38	32	37	18	A-6 (11)	CL	
	Pawnee, Okla.	Same	0-36	A & C	115	14				100	95	84	28	23	29	11	A-6 (8)	CL	
Port Byron silt loam	LaCrosse, Wisc.	Peorian loess	0-12	A	96	22				100	97	92	27	20	40	12	A-6 (9)	ML	
			27-36	B	108	17				100	98	92	30	25	37	13	A-6 (9)	ML-CL	
			44-60	C	114	15			100	99	85	78	23	19	31	11	A-6 (8)	CL	
	LaCrosse, Wisc.	Same	0-10	A	86	28				100	99	96	34	24	48	14	A-7-5 (11)	ML	
			28-37	B	107	18				100	99	97	32	27	40	17	A-6 (11)	CL	
			46-60	C	106	18				100	99	95	32	27	43	20	A-7-6 (13)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Horizon	Moisture-Density: Maximum Dry Density	Optimum Moisture	Mechanical analysis 1/ Percentage Passing Sieve 2/: 3 in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	Liquid Limit	Plasticity Index	Classification: A.A.S.H.O. 3/	Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Portneuf silt loam	Jerome, Ida.	Loess	0-2	A	100	18				100	95	88	18	13	29	4	A-4 (8)	ML	
			3-9	B	108	17				100	98	90	26	20	29	9	A-4 (8)	CL	
			22-34	B_{ca}	107	17				100	96	90	15	10	24	3	A-4 (8)	ML	
			45-70	B & C	108	15				100	99	90	11	8	23	3	A-4 (8)	ML	
	Jerome, Ida.	Same	0-2	A	106	16				100	97	90	20	15	25	4	A-4 (8)	ML-CL	
			3½-8	B	110	16				100	98	90	22	17	28	9	A-4 (8)	CL	
			13-21	B_{ca}	107	16			100	99	97	90	22	16	26	4	A-4 (8)	ML-CL	
			56-80	C or B	108	15				100	99	93	12	9	24	3	A-4 (8)	ML	
	Twin Falls, Ida.	Same	7-17	B	108	16				100	98	90	28	22	31	10	A-4 (8)	ML-CL	
			17-34	B_{ca}	106	18			100	99	97	91	20	14	25	3	A-4 (8)	ML	
			47-75	B_{ca}	106	16				100	98	90	11	8	26	4	A-4 (8)	ML-CL	
Portsmouth loam	Norfolk, Va.	Coastal Plain sediments	0-12	A	94	20			100	97	35	33	12	9	NP	NP	A-2-4 (0)	SM	
			15-23	B_g	126	10			100	97	35	34	16	12	16	4	A-2-4 (0)	SM-SC	
			27-45	D	104	13			100	99	7	6	2	2	NP	NP	A-3 (0)	SP-SM	
Proctor silt loam	Will, Ill.	Glacial outwash	0-16	A	104	18			100	93	66	62	26	20	39	16	A-6 (9)	CL	
			28-45	B	115	13			100	85	43	41	26	22	33	16	A-6 (2)	SC	5-15% discarded in sampling.
			45+	C	123	11	100	75	69	48	26	23	12	10	28	11	A-2-6 (0)	GW-GC	40-80% discarded in sampling.
							(Proctor samples not corrected for discarded material larger than 2 mm.)												
Providence silt loam	Henderson, Tenn.	Loess over Coastal Plain	0-6		108	14			100	97	87	82	19	11	24	4	A-4 (8)	ML-CL	
			6-28		108	18			100	98	92	89	33	26	39	17	A-6 (11)	CL	
			28-40		114	15			100	96	79	75	23	18	30	11	A-6 (8)	CL	
			40+		119	12			100	94	71	68	23	18	27	10	A-4 (7)	CL	
Pullman loam	Quay, N. Mex.	Fine textured sediments	4-8	A	116	13				100	76	64	26	21	23	7	A-4 (8)	ML-CL	
			15-25	B	105	18				100	82	72	41	37	35	18	A-6 (11)	CL	
			33-40	B_{ca}	110	16			100	99	79	68	37	33	31	15	A-6 (10)	CL	
			56-84	C_{ca}	116	14			100	99	81	73	52	38	25	11	A-6 (8)	CL	
	Quay, N. Mex.	Same	4-9	A & B	116	13			100	98	67	58	29	23	24	10	A-4 (6)	CL	
			9-19	B	101	22			100	99	77	71	46	42	44	23	A-7-6 (14)	CL	
			33-56	C_{ca}	108	17			100	93	68	63	50	38	28	10	A-4 (7)	CL	
	Quay, N. Mex.	Same	2.5-8	A & B	118	12			100	99	65	51	24	19	21	7	A-4 (6)	ML-CL	
			8-21	B	110	15			100	99	68	59	34	31	31	15	A-6 (9)	CL	
			33-55	B_{ca} & C_{ca}	118	13	100	99	98	95	55	45	28	24	26	11	A-6 (4)	CL	
Bains fine sandy loam	Duplin, N. C.	Coastal Plain sand & sandy clay	0-4	A	91	21			100	99	52	45	18	10	32	5	A-4 (3)	ML-CL	
			8-28	B_g	126	10			100	99	49	45	22	14	17	5	A-4 (3)	SM-SC	
			28-38	B_g	116	14			100	99	58	53	29	23	24	10	A-4 (5)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture - density: Maximum Dry Density	Moisture - density: Optimum Moisture	Mechanical analysis 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Randall clay	Lynn, Tex.	Playa lake sediments	0-36	A	100	22				100	83	75	48	43	51	33	A-7-6 (18)	CH	
			2-36	A	102	20				100	89	83	55	47	49	29	A-7-6 (17)	CL	
			4-40	A	101	22				100	79	72	47	42	45	26	A-7-6 (15)	CL	
Readington silt loam	Frederick, Md.	Shale & sandstone	0-7	A	100	21		100	99	93	84	82	42	30	43	16	A-7-6 (11)	ML-CL	
			12-28	B	110	18		100	99	96	92	89	47	38	45	24	A-7-6 (15)	CL	
			34-48+	C	113	16	100	97	95	91	86	84	43	32	38	19	A-6 (12)	CL	
Red Bay fine sandy loam	Escambia, Fla.	Coastal Plain sediments	0-10	A	120	10			100	96	51	45	17	12	19	4	A-4 (3)	ML-CL	
			10-60	B	113	16			100	97	61	58	38	36	40	15	A-6 (7)	ML-CL	
			60+	C	115	15			100	97	54	50	32	31	36	14	A-6 (5)	CL	
	Escambia, Fla.	Coastal Plain sediments	0-6	A	118	11			100	97	34	31	14	11	16	2	A-2-4 (0)	SM	
			15-144	B	119	13			100	98	47	45	34	31	28	12	A-6 (3)	SC	
			144-152	B	117	14			100	98	42	39	31	29	27	10	A-4 (1)	SC	
Renova silt loam	Fillmore, Minn.	Glacial till (Iowan)	2-8	A	116	12	100	99	98	91	69	66	20	14	21	4	A-4 (7)	ML-CL	
			18-30	B	118	12	100	95	93	80	51	46	30	24	28	12	A-6 (4)	CL	
			39+	C	119	12	100	95	93	80	50	46	26	20	30	14	A-6 (4)	SC	
	Fillmore, Minn.	Glacial till (Iowan)	4-12	A	110	15			100	97	87	84	25	17	24	4	A-4 (8)	ML-CL	
			17-27	B	117	13	100	99	97	89	65	61	26	21	29	13	A-6 (7)	CL	
			38-54	C	111	15	100	98	97	94	66	61	33	28	34	17	A-6 (9)	CL	
Richland silt loam	De Soto, Miss.	Alluvium	2-8	A	98	20					100	92	19	13	33	8	A-4 (8)	ML-CL	
			18-24	A & B	107	18					100	93	30	25	38	14	A-6 (10)	ML-CL	
			34-42	B	107	18					100	93	23	19	32	9	A-4 (8)	ML-CL	
			60-72	C	109	18					100	95	25	19	34	12	A-6 (9)	ML-CL	
	De Soto, Miss.	Same	2-10	A	102	18				100	99	94	19	13	30	6	A-4 (8)	ML-CL	
			14-24	B	107	18					100	96	27	25	35	13	A-6 (9)	ML-CL	
			32-42	C	106	19			100	99	99	95	30	25	40	18	A-6 (11)	CL	
Ritzville silt loam	Walla Walla, Wash.	Loess over stratified lake-laid material	0-7	A	110	15			100	98	88	73	20	12	25	4	A-4 (8)	ML-CL	
			7-31	B	110	15			100	97	87	73	16	9	26	4	A-4 (8)	ML-CL	
				C	112	16			100	95	81	69	17	9	26	4	A-4 (8)	ML-CL	
				D	113	16			100	94	85	74	21	11	26	6	A-4 (8)	ML-CL	
	Walla Walla, Wash.	Loess	0-8	A	106	16				100	94	75	15	10	25	2	A-4 (8)	ML	
			8-32	B	107	16				100	94	74	13	8	25	1	A-4 (8)	ML	
			48-60	C	110	16				100	97	76	12	8	24	2	A-4 (8)	ML	
	Walla Walla, Wash.	Same	0-9	A	103	16			100	99	89	67	13	9	24	0	A-4 (8)	ML	
			9-37	B	103	18				100	91	70	11	7	26	1	A-4 (8)	ML	
			50-65	C	106	16			100	99	90	72	11	6	NP	NP	A-4 (8)	ML	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (County and State)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-Density: Maximum Dry Density	Moisture-Density: Optimum Moisture	Mechanical analysis 1/ — Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Euston fine sandy loam	Escambia, Fla.	Coastal Plain sediments	0-6	A	115	12			100	95	45	38	16	11	20	4	A-4 (2)	SM-SC	
			18-42	B	117	13			100	96	56	51	30	27	31	12	A-6 (5)	CL	
			42+	C	112	16			100	97	54	50	34	31	36	13	A-6 (5)	ML-CL	
	Duplin, N. C.	Coastal Plain sand & sandy clay	0-6	A	115	11			100	93	33	20	7	3	NP	NP	A-2-4 (0)	SM	
			20-42	B	116	15			100	97	57	45	32	28	37	19	A-6 (8)	CL	
			42-48	B	111	17			100	99	65	52	35	31	41	21	A-7-6 (11)	CL	
	Henderson, Tenn.	Coastal Plain sediments	0-3		107	15			100	86	51	47	12	7	26	2	A-4 (3)	ML	
			3-18		125	18			100	84	40	36	12	7	14	0	A-4 (1)	SM	
			18+		124	11			100	85	41	38	15	13	20	5	A-4 (1)	SM-SC	
Euston loamy sand	Peach, Ga.	Stratified clays and sands	0-12	A	121	10			100	86	30	24	10	8	NP	NP	A-2-4 (0)	SM	
			15-35	B	114	15			100	90	51	47	39	38	37	19	A-6 (6)	CL	
			38-60+	C	108	18			100	88	50	47	42	41	42	21	A-7-6 (7)	SC	
Rutlege fine sand	Sarasota, Fla.	Unconsolidated fine sand	6-32		107	13			100	93	11	11	5	4	NP	NP	A-2-4 (0)	SP-SM	
			32-45		106	13			100	92	3	3	2	1	NP	NP	A-3 (0)	SP	
Buxton silt loam	Fairfax, Va.	Diabase	0-6	A	108	20	100	78	71	58	44	41	21	16	38	11	A-6 (2)	SM	
			6-24	C	100	23	100	95	83	70	42	37	19	14	40	7	A-4 (1)	SM	
Sagemoor very fine sandy loam	Walla Walla, Wash.	Shallow loess over lake-laid material	0-12	A	109	15				100	89	67	15	8	21	1	A-4 (8)	ML	
			12-24	B	109	15				100	92	77	20	10	23	1	A-4 (8)	ML	
			32-60	C	108	17				100	98	88	29	15	29	5	A-4 (8)	ML-CL	
Salix silt loam	Monona, Iowa	Alluvium	0-10		100	21				100	97	92	30	25	40	14	A-6 (10)	ML-CL	
			40-45		106	20				100	99	96	30	24	36	12	A-6 (9)	ML-CL	
Salmon fine sandy loam	Franklin, N. Y.	Glaciolacustrine silts & fine sands	0-9	A	104	16			100	99	70	55	10	7	24	2	A-4 (7)	ML	
			9-23	B	113	12			100	99	65	50	8	6	NP	NP	A-4 (6)	ML	
			23-46	C	114	12			100	99	70	51	8	5	NP	NP	A-4 (7)	ML	
	Franklin, N. Y.	Same	0-7	A	92	23	100	97	97	92	72	61	15	8	38	6	A-4 (7)	ML	
			7-12	B	116	12			100	98	82	73	21	11	20	4	A-4 (8)	ML-CL	
			21-36	C	115	13			100	99	83	68	14	7	17	1	A-4 (8)	ML	
Sango silt loam	Coffee, Tenn.	Loess over cherty limestone	3-10	A	111	14		100	99	97	88	85	28	16	25	6	A-4 (8)	ML-CL	
			15-32	B	113	14	100	99	98	94	86	81	28	20	30	9	A-4 (8)	ML-CL	
			32-48	Bm	112	14	100	99	98	96	89	85	29	19	30	10	A-4 (8)	CL	
			48+	Bm	108	16		100	99	97	90	86	39	28	42	18	A-7-6 (12)	ML-CL	
	Coffee, Tenn.	Same	3-9	A	116	13	100	98	96	94	82	77	22	14	23	5	A-4 (8)	ML-CL	
			15-24	B	115	13	100	97	95	93	83	79	26	18	27	8	A-4 (8)	CL	
			24-38	Bm	120	12	100	92	87	84	75	70	21	13	23	5	A-4 (8)	ML-CL	
			38-52	Bm	122	11	100	90	83	78	70	66	21	12	21	5	A-4 (7)	ML-CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE - DENSITY: Maximum Dry Density	MOISTURE - DENSITY: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 1/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	Unified 4/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Sarpy loamy sand	Monona, Iowa	Alluvium	14-28		113	12				100	35	30	8	6	NP	NP	A-2-4 (0)	SM	
Sassafras fine sandy loam	Norfolk, Va.	Coastal Plain sediments	4-10	A	122	10			100	97	41	38	15	9	15	2	A-4 (1)	SM	
			14-26	B	117	14			100	97	46	45	27	24	27	10	A-4 (2)	SC	
			38-50	C	111	12			100	97	13	13	11	10	NP	NP	A-2-4 (0)	SM	
Saybrook silt loam	Will, Ill.	Loess over glacial till	0-12	A	93	24			100	99	92	89	37	27	50	20	A-7-5 (14)	ML-CL	
			21-32	B	101	22			100	99	94	92	58	44	50	25	A-7-6 (16)	CL	
			32+		117	15	100		84	80	74	71	37	27	33	15	A-6 (10)	CL	
Sequatchie loam	Blount, Tenn.	Alluvium	0-10		113	15			100	99	67	63	18	14	25	6	A-4 (6)	ML-CL	
			10-32		115	14				100	79	75	24	20	27	9	A-4 (8)	CL	
			32-48		114	15				100	76	73	21	16	26	7	A-4 (8)	ML-CH	
Sequatchie sandy loam	Frederick, Md.	Sandy alluvium over limestone	7-13	A	124	10	100	99	98	72	30	28	13	8	16	2	A-2-4 (0)	SM	
			13-34	B	108	15	100	97	97	70	14	14	10	9	NP	NP	A-2-4 (0)	SM	
			34-48+	C	104	18			100	76	12	12	6	6	NP	NP	A-2-4 (0)	SP-SM	
Sequoia silt loam	Blount, Tenn.	Shale	0-8	A	104	19	100	98	96	93	91	89	29	23	33	11	A-6 (8)	ML-CL	
			8-23	B	99	24		100	99	97	96	96	59	49	59	33	A-7-6 (20)	CH	
			23-48	C	98	24	100	99	97	95	91	90	52	47	58	29	A-7-6 (19)	MH-CH	
	Blount, Tenn.	Same	0-8	A	109	16		100	99	94	91	88	25	18	29	7	A-4 (8)	ML-CL	
			12-31	B	90	30			100	99	98	98	73	65	74	40	A-7-5 (20)	MH-CH	
			31-50	C	89	30			100	99	98	98	76	66	75	39	A-7-5 (20)	MH-CH	
	Blount, Tenn.	Same	0-7	A	110	14			100	98	91	86	25	15	23	5	A-4 (8)	ML-CL	
			14-34	B	109	18			100	99	96	88	44	35	43	21	A-7-6 (13)	CL	
			34-56	B & C	98	24			100	99	96	95	59	52	61	32	A-7-6 (20)	MH-CH	
Seymour silt loam	Moniteau, Mo.	Loess	0-10	A	99	20			100	99	99	94	29	22	36	11	A-6 (8)	ML-CL	
			16-35	B	92	27			100	99	99	98	60	54	73	42	A-7-5 (20)	CH	
			40-50	C	102	21			100	99	99	97	45	37	56	33	A-7-6 (19)	CH	
Sharpsburg silt loam	Adair, Iowa	Loess	2-10	A	94	22				100	99	96	39	32	48	19	A-7-6 (13)	ML-CL	
			20-32	B	98	21					100	97	42	35	51	22	A-7-6 (15)	MH-CH	
			38-48	C	104	20					100	98	37	31	47	23	A-7-6 (15)	CL	
	Madison, Iowa	Same	0-8	A	96	22				100	99	97	44	37	44	17	A-7-6 (12)	ML-CL	
			16-30	B	97	22					100	97	47	39	56	28	A-7-6 (18)	MH-CH	
			38-44	C	104	20					100	98	42	35	49	25	A-7-6 (16)	CL	
Sharpsburg silty clay loam	Madison, Iowa	Same	0-8	A	98	20				100	99	98	46	39	40	14	A-6 (10)	ML-CL	
			16-30	B	98	22					100	98	48	41	55	29	A-7-6 (19)	CH	
			38-44	C	104	21					100	99	43	35	46	21	A-7-6 (14)	ML-CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu.ft.														
Silerton silt loam	Henderson, Tenn.	Loess over Coastal Plain	0-7		104	16			100	99	97	89	23	17	26	4	A-4 (8)	ML-CL	
			7-24		104	20				100	99	98	41	36	45	20	A-7-6 (13)	ML-CL	
			24+		110	16	100	95	89	84	80	71	36	30	43	22	A-7-6 (13)	CL	
Sinai silty clay loam	Brookings, S. D.	Lacustrine silty clay on Cary drift plain	0-8	A	92	23			100	98	89	81	42	34	48	19	A-7-6 (13)	ML-CL	
			8-17	B	98	21				100	93	87	46	38	54	27	A-7-6 (18)	CH	
			17-29	B_{ca}	105	19				100	98	93	53	40	49	26	A-7-6 (16)	CL	
			29-60	C_{ca} & C_g	101	22				100	97	94	55	42	54	31	A-7-6 (19)	CH	
Skyberg silt loam	Fillmore, Minn.	Glacial till	7-12	A	108	17			100	96	84	82	34	26	30	10	A-4 (8)	OL	
			18-27	B	119	12		100	99	95	52	50	31	26	25	10	A-4 (3)	OL	
			27+	C	122	11			100	97	52	50	33	26	25	12	A-6 (4)	CL	
	Fillmore, Minn.	Glacial till	5-12	A	111	15	100	99	99	91	70	38	32	23	27	8	A-4 (7)	OL	
			21-30	B	121	11	100	97	94	79	38	34	19	15	22	7	A-4 (1)	SM-SC	
			30+	C	121	12	100	99	98	84	47	43	22	17	25	10	A-4 (2)	SC	
Sodus gravelly fine sandy loam	Wayne, N. Y.	Glacial till	0-8	A	105	13	100	79	77	74	49	35	8	5	NP	NP	A-4 (3)	SM	
			11-16	B	112	13	100	82	79	74	45	35	12	7	NP	NP	A-4 (2)	SM	
			16-28	A_b	120	9	100	85	83	77	49	34	11	6	NP	NP	A-4 (3)	SM	
			28-58	B_b	122	9	100	85	82	76	48	33	11	7	16	1	A-4 (3)	SM	
			58-70	C	124	9	100	90	87	81	51	38	12	9	16	1	A-4 (3)	ML	
	Wayne, N. Y.	Same	0-7	A	110	13	100	66	63	58	36	28	8	5	26	4	A-4 (0)	SM-SC	
			8-21	B	120	10	100	83	79	72	41	32	9	7	17	1	A-4 (1)	SM	
			21-29	A_b	122	9	100	84	81	73	44	33	11	7	16	1	A-4 (2)	SM	
			29-45	B_b	124	9	100	79	76	68	46	34	12	8	17	2	A-4 (2)	SM	
			45-57	C	124	9	100	91	89	84	56	41	15	8	16	2	A-4 (4)	ML	
	Wayne, N. Y.	Same	0-5	A	106	15	100	90	87	82	55	41	14	9	27	1	A-4 (4)	ML	
			8-18	B	112	13	100	83	80	75	48	36	12	8	NP	NP	A-4 (3)	SM	
			18-26	A_b	122	10	100	87	85	81	50	36	13	8	NP	NP	A-4 (3)	SM	
			26-85	B_b	123	10	100	90	88	84	56	42	11	7	16	2	A-4 (4)	ML	
			85-121	C	120	9	100	90	87	81	47	35	10	6	15	0	A-4 (2)	SM	
Staser fine sandy loam	Blount, Tenn.	Alluvium	0-14		107	18			100	94	57	55	27	21	35	10	A-4 (4)	ML-CL	
			14-36		116	14			100	89	42	42	17	14	26	6	A-4 (1)	SM-SC	
Steinauer loam	Monona, Iowa	Glaciall till	24-30		113	16	100	99	98	92	72	69	39	32	41	24	A-7-6 (13)	CL	
Suffield silt loam	Chittenden, Vt.	Lake deposit	0-6	A	93	23			100	99	94	83	26	14	40	7	A-4 (8)	ML	
			10-28	C	114	16				100	97	89	39	28	32	13	A-6 (9)	CL	
			28+	D	97	25				100	99	97	85	73	64	38	A-7-6 (20)	OH	
	Washington, Vt.	Glacial lake deposit	0-3	A	102	20			100	97	91	88	40	26	37	11	A-6 (8)	ML-CL	
			7-21	B	104	20				100	99	96	33	19	32	7	A-4 (8)	ML-CL	
			29+	C	99	22					100	98	30	13	NP	NP	A-4 (8)	ML	
	Strafford, N. H.	Same	0-9	A	83	30			100	96	86	81	40	26	50	10	A-5 (8)	ML	
			12-17	B	99	22			100	99	98	94	39	25	32	6	A-4 (8)	ML	
			22-30	C_g	107	20			100	99	98	93	51	38	40	18	A-6 (11)	CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density: Maximum dry density	Moisture-density: Optimum moisture	Mechanical analysis 1/ Percentage passing sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Sunnyland fine sand	Sarasota, Fla.	Marine-deposited sand over clayey materials containing marl	21-37		118	13			100	93	26	22	18	16	29	14	A-2-6 (0)	SC	
			37-46		124	12	100	83	79	69	24	21	15	13	28	14	A-2-6 (0)	SC	
Swanton fine sandy loam	Grand Isle, Vt.	Marine sediments	0-9	A	101	18			100	99	49	35	13	9	30	4	A-4 (3)	SM-SC	
			11-21	B_g	115	12				100	49	35	15	12	20	1	A-4 (3)	SM	
			42+	D_g	99	22				100	95	92	68	56	54	30	A-7-6 (19)	CH	
	Grand Isle, Vt.	Same	0-12	A	106	17		100	99	98	53	46	25	19	30	7	A-4 (4)	ML-CL	
			15-20	B_g	122	12				100	53	44	25	20	22	7	A-4 (4)	ML-CL	
			20-36	D_g	118	14	100	99	98	96	68	58	31	25	28	12	A-6 (7)	CL	
	Grand Isle, Vt.	Same	0-9	A	96	21				100	38	29	16	11	35	6	A-4 (1)	SM	
			13-19	B_g	109	13				100	21	15	12	8	NP	NP	A-2-4 (0)	SM	
			22+	D_g	108	17			100	99	93	88	42	32	40	19	A-6 (12)	CL	
Sweeney clay loam	San Mateo, Calif.	Basaltic material (diabase)	0-7	A	105	19			100	97	62	55	32	25	40	15	A-6 (7)	ML-CL	
			7-16	B	104	20			100	97	63	56	36	30	42	18	A-7-6 (9)	ML-CL	
			33-45	C	108	18			100	88	44	37	15	10	35	9	A-4 (2)	SM	
Sweeney loam	San Mateo, Calif.	Same	0-6	A	100	21			100	96	75	69	34	25	41	14	A-7-6 (10)	ML-CL	
			6-17	B	101	21			100	96	74	68	36	27	42	16	A-7-6 (11)	ML-CL	
			30-48	C	105	20			100	90	56	49	19	14	39	12	A-6 (5)	ML-CL	
Talbott silt loam	Blount, Tenn.	Clayey limestone	1-7	A	101	22				100	99	99	66	42	43	18	A-7-6 (12)	ML-CL	
			7-18	B	92	27			100	99	98	97	77	64	62	29	A-7-5 (20)	MH-CH	
			18-24	C	93	28				100	99	99	73	58	58	26	A-7-5 (18)	MH-CH	
	Maury, Tenn.	Limestone	0-6	A	108	16			100	96	91	85	28	19	30	9	A-4 (8)	ML-CL	
			6-24	B	94	27	100		95	92	88	86	60	50	65	31	A-7-5 (20)	MH-CH	
			24+	C	87	31				100	99	98	83	77	82	43	A-7-5 (20)	MH	
Talbott silty clay loam	De Kalb, Ala.	Clayey limestone and shale	0-7		116	13	100	98	97	91	72	67	29	20	26	10	A-4 (7)	CL	
			7-27		116	15	100	99	98	91	68	65	33	27	32	13	A-6 (8)	CL	
			27-48		108	18	100	99	98	93	67	65	40	33	39	14	A-6 (8)	ML-CL	
	Loudon, Tenn.	Argillaceous limestone	0-7	A	104	20			100	98	93	90	45	31	37	13	A-6 (9)	ML-CL	
			14-30	B	92	29					100	98	74	64	74	41	A-7-5 (20)	MH-CH	
			30-48	B or C	91	30					100	98	70	61	70	37	A-7-5 (20)	MH-CH	
	Loudon, Tenn.	Same	0-6	A	104	20			100	99	95	91	46	35	37	13	A-6 (9)	ML-CL	
			12-21	B	91	30				100	99	98	76	67	78	45	A-7-5 (20)	CH	
			30-45	C	90	30				100	99	99	76	65	80	43	A-7-5 (20)	MH-CH	
	Loudon, Tenn.	Same	0-7	A	107	18			100	97	89	84	40	27	33	11	A-6 (8)	ML-CL	
			12-29	B	88	31				100	98	96	76	67	86	51	A-7-5 (20)	OH	
			29-44	B or C	90	31					100	98	73	62	72	36	A-7-5 (20)	MH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	Horizon	MOISTURE - DENSITY: Maximum Dry Density	Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	Unified 4/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Tellico loam	Blount, Tenn.	Sandstone and sandy shale	0-7	A	119	13			100	99	55	49	25	19	23	8	A-4 (4)	OL	
			7-47	B	100	24				100	75	75	61	57	56	27	A-7-6 (18)	MH-CH	
			48-72	C	97	27				100	75	74	64	57	63	31	A-7-5 (20)	MH-CH	
	Blount, Tenn.	Same	0-7	A	113	13	100	94	91	91	33	32	13	11	NP	NP	A-2-4 (0)	SM	
			7-29	B	107	20				100	53	52	43	40	44	22	A-7-6 (9)	OL	
			29-60	C	98	26	100	99	96	95	71	70	54	45	60	27	A-7-5 (18)	MH	
	Blount, Tenn.	Same	0-8	A	113	15			100	99	54	52	30	24	27	11	A-6 (4)	OL	
			8-32	B	106	20			100	99	60	60	46	42	46	19	A-7-6 (9)	ML-OL	
			32-72	C	107	20			100	99	66	65	42	41	41	20	A-7-6 (10)	CL	
	Loudon, Tenn.	Sandy limestone & sandy shales	0-8	A	117	14				100	57	53	30	20	24	7	A-4 (4)	ML-CL	
			17-39	B	114	17				100	72	69	46	37	36	16	A-6 (10)	CL	
			60-76	B or C	105	21				100	73	71	55	49	51	24	A-7-6 (15)	MH-CH	
	Loudon, Tenn.	Same	3-10	A	114	16			100	97	59	55	29	23	27	8	A-4 (5)	OL	
			21-36	B	110	18			100	98	70	65	42	36	38	18	A-6 (10)	CL	
			58-65	C	104	22				100	76	70	52	45	50	23	A-7-6 (15)	ML-OL	
	Loudon, Tenn.	Same	0-7	A	93	26			100	97	64	62	36	26	42	12	A-7-5 (7)	ML	
			14-32	B	103	24			100	99	71	70	54	48	53	25	A-7-6 (16)	MH-CH	
			44-70	C	105	23			100	99	70	68	55	47	52	23	A-7-6 (14)	MH-CH	
Tifton fine sandy loam	Escambia, Fla.	Coastal Plain sediments	0-6	A	117	11	100	95	95	92	37	29	8	7	NP	NP	A-4 (0)	SM	
			25-34	B	120	12	100	93	92	89	45	40	23	20	23	7	A-4 (2)	SM-SC	
			58-64+	C	109	18	100	99	98	95	51	48	33	31	39	16	A-6 (5)	OL	
Tirzah silt loam	Alamance, N. C.	Slate	0-3	A	91	26	100	81	80	76	70	68	36	25	49	13	A-7-5 (10)	ML	
			13-28	B	90	30			100	99	96	94	74	64	81	40	A-7-5 (20)	MH	
			44+	C	99	23				100	90	86	45	28	49	14	A-7-5 (11)	ML	
Trinity clay	McLennan, Tex.	Recent alluvium	0-36		98	21				100	96	92	57	48	67	39	A-7-6 (20)	CH	
	McLennan, Tex.	Same	0-36		100	21				100	95	88	56	49	63	37	A-7-6 (20)	CH	
	McLennan, Tex.	Same	0-36		98	24				100	96	94	65	55	83	52	A-7-5 (20)	CH	
Trout River gravelly loamy coarse sand	Franklin, N. Y.	Beach deposits	0-9	A	120	11	99	75	65	24	14	13	4	3	38	8	A-2-4 (0)	SM	
			9-24	B	126	13	99	69	55	22	14	11	4	3	25	4	A-1-b (0)	SM-SC	
			24-40	C	123	13	99	63	37	13	8	5	1	0	NP	NP	A-1-a (0)	SP-SM	
	Franklin, N. Y.	Same	0-9	A	120	11	99	78	73	17	10	9	3	2	36	6	A-1-b (0)	SP-SM	
			9-19	B	124	11	99	84	78	21	12	11	3	3	28	3	A-1-b (0)	SM	
			29-37	C	111	16	98	64	61	6	1	1	1	1	NP	NP	A-1-b (0)	SP	
	Franklin, N. Y.	Same	0-8	A	111	14	100	69	62	32	22	20	7	4	47	9	A-2-5 (0)	SM	
			8-16	B	120	12	100	69	59	23	13	13	6	4	33	6	A-1-b (0)	SM	
			20-36	C	121	13	100	66	52	10	4	3	2	1	NP	NP	A-1-b (0)	SP	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture - density: Maximum Dry Density	Moisture - density: Optimum Moisture	Mechanical analysis 1/ — Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 2/	Classification: Unified 1/	Remarks
			Inches		Lb./cu. ft.	Percent													
Troy gravelly silt loam	Orange, N. Y.	Drumlin (glacial till)	0-6	A	104	20	98	80	73	64	53	50	24	15	35	6	A-4 (4)	ML	
			22-32	B2	119	15	98	87	80	68	56	53	32	24	32	12	A-6 (5)	CL	
			74-82	C	122	14	95	77	70	60	50	49	29	22	29	12	A-6 (4)	CL	
Union silt loam	Moniteau, Mo.	Limestone & loess	0-8	A	104	17				100	98	94	27	20	31	8	A-4 (8)	ML-CL	
			12-30	B	102	20			100	99	97	95	48	39	51	26	A-7-6 (16)	CH	
			30-42	C	108	18	100	97	96	93	89	85	35	27	37	16	A-6 (10)	CL	
	Moniteau, Mo.	Same	0-8	A	107	16			100	97	95	89	22	16	27	6	A-4 (8)	ML-CL	
			12-26	B	101	22				100	98	96	47	39	47	22	A-7-6 (14)	CL	
			26-40	C	107	19	100	99	98	95	89	86	36	29	37	16	A-6 (10)	CL	
Vance sandy loam	Nottoway, Va.	Granite gneiss and hornblende gneiss	0-8	A	123	9	100	99	99	76	29	24	8	4	16	1	A-2-4 (0)	SM	
			13-24	B	103	21			100	90	67	67	50	43	57	29	A-7-6 (17)	MH-CH	
			40-52	C	96	24			100	95	63	63	42	36	65	28	A-7-5 (16)	MH	
	Alamance, N. C.	Granite	0-6	A	120	9	100	92	91	75	33	27	10	7	NP	NP	A-2-4 (0)	SM	
			8-23	B2	89	29			100	92	80	78	68	63	80	44	A-7-5 (20)	MH-CH	
			42+	C	100	22			100	84	65	62	36	31	58	21	A-7-5 (13)	MH	
Vergennes silt loam	Jefferson, N. Y.	Glacial lacustrine	0-7	A	96	24			100	99	95	93	53	37	41	12	A-7-6 (9)	ML	
			11-20	B	99	25				100	99	98	74	58	52	26	A-7-6 (17)	CH	
			51-78+	C	104	22	100	99	99	98	97	97	75	54	46	24	A-7-6 (15)	CL	
Vergennes silty clay loam	Essex, N. Y.	Same	0-5	A	92	28			100	96	89	87	65	54	51	19	A-7-5 (14)	MH	
			8-19	B	93	28				100	99	97	90	83	72	41	A-7-5 (20)	CH	
			36-60+	C	94	30			100	99	99	99	92	85	71	41	A-7-5 (20)	CH	
Volusia channery silt loam	Potter, Pa.	Glacial till	3-10	A	89	28	100	76	75	73	65	64	41	32	57	20	A-7-5 (15)	MH	10-20% discarded in sampling.
			20-30	Cg	111	17	100	96	95	93	84	81	47	38	42	20	A-7-6 (12)	CL	20-30% discarded in sampling.
							(Volusia samples not corrected for material discarded larger than 3 in.)												
	Cortland, N. Y.	Same	0-8	A	90	26	97	70	66	63	58	56	21	15	52	15	A-7-5 (8)	MH	
			13-30	Bgm	120	12	95	65	59	55	49	46	13	9	23	4	A-4 (3)	ML-CL	
			44-65	C	122	12	88	42	40	36	31	28	10	6	24	5	A-2-4 (0)	GM-GC	
	Cortland, N. Y.	Same	0-9	A	90	27	92	82	80	76	65	62	30	21	54	16	A-7-5 (12)	MH	
			15-32	Bgm	124	12	92	78	70	62	50	46	21	14	23	5	A-4 (4)	ML-CL	
			50-60	C	124	12	90	74	68	61	49	46	21	14	24	7	A-4 (4)	ML-CL	
	Cortland, N. Y.	Reworked glacial till	0-5	A	85	31	92	61	59	57	54	51	24	18	59	16	A-7-5 (9)	MH	
			13-26	Bgm	116	15	92	82	76	70	67	64	21	16	27	6	A-4 (8)	ML-CL	
			38-52	C	124	11	89	71	64	58	53	50	17	12	23	4	A-4 (5)	ML-CL	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density: Maximum dry density	Moisture-density: Optimum moisture	Mechanical analysis 1/ Percentage passing sieve 2/: 3 in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu.ft.	Percent													
Walla Walla silt loam	Walla Walla, Wash.	Loess	0-8	A	109	16				100	98	84	22	15	26	4	A-4 (8)	ML-CL	
			23-42	B	110	15				100	97	78	18	12	27	5	A-4 (8)	ML-CL	
			52-72	C_{ca}	107	16				100	98	80	13	7	25	2	A-4 (8)	ML	
	Walla Walla, Wash.	Same	0-8	A	109	16			100	99	93	79	25	18	29	7	A-4 (8)	ML-CL	
			17-39	B	111	16			100	98	92	77	20	13	28	5	A-4 (8)	ML-CL	
			57-72	C_{ca}	111	16			100	96	86	72	15	7	25	3	A-4 (8)	ML	
	Walla Walla, Wash.	Loess over stratified lake-laid material	0-8	A	108	17				100	94	77	21	14	26	2	A-4 (8)	ML	
			15-34	B	104	17				100	93	74	14	7	26	1	A-4 (8)	ML	
			43-60	C_{ca}	107	16				100	94	76	15	7	27	5	A-4 (8)	ML-CL	
			60+	D	108	16				100	89	70	11	6	25	3	A-4 (8)	ML	
Warsaw silt loam	Will, Ill.	Sand and gravel (terrace)	0-14	A	98	21			100	99	95	90	35	25	41	15	A-7-6 (10)	ML-OL	
			24-30	B	97	23			100	97	91	88	51	43	54	26	A-7-6 (17)	MH-OH	5-15% discarded in sampling.
			33+	D	129	12	100	51	44	24	7	7	3	2	NP	NP	A-1-a (0)	GP	40-80% discarded in sampling.
							(Warsaw samples not corrected for discarded material larger than 2 mm.)												
Watsonville loam	San Mateo, Calif.	Marine sediments	0-9	A	98	18	100	98	96	90	70	61	23	16	34	8	A-4 (7)	ML	
			14-24	B	98	23		100	99	95	78	73	48	44	58	36	A-7-6 (20)	CH	
			44-54	C	109	19	100	91	86	72	42	40	28	23	38	20	A-6 (4)	SC	
	San Mateo, Calif.	Same	0-9	A	105	16		100	98	94	70	63	24	20	29	7	A-4 (7)	ML-OL	
			12-21	B	95	25			100	98	83	75	48	44	58	34	A-7-6 (20)	OH	
			54-64	C	112	15	100	99	98	90	62	54	28	23	34	16	A-6 (8)	CL	
Waynesboro loam	Blount, Tenn.	Alluvium	0-8	A	113	13			100	95	67	60	19	12	24	6	A-4 (6)	ML-OL	
			8-42		102	20			100	96	73	73	49	47	46	16	A-7-5 (11)	ML	
			42-72		103	21	100	96	93	86	54	52	37	35	45	21	A-7-6 (9)	CL	
	Loudon, Tenn.	Same	1-7	A	120	12	100	98	96	87	55	48	19	13	19	3	A-4 (4)	ML	
			27-37	B	94	28	100	91	90	86	71	68	57	53	68	29	A-7-5 (18)	MH	
			45-60	C	99	24	100	94	92	86	71	68	51	46	66	31	A-7-5 (19)	MH	
	Loudon, Tenn.	Same	0-7	A	122	12	100	87	83	71	46	42	20	13	23	7	A-4 (2)	SM-SC	
			26-38	B	108	19	100	97	93	78	55	53	42	39	58	28	A-7-5 (13)	MH-CH	
			46-60	C	115	15	100	98	94	75	47	42	29	27	48	23	A-7-6 (7)	SC	
	Loudon, Tenn.	Same	1-7	A	119	12	100	93	90	81	55	50	20	13	20	5	A-4 (4)	ML-OL	
			29-39	B	106	21	100	93	89	82	63	60	44	40	52	23	A-7-6 (12)	MH-CH	
			54-72	C	101	23	100	94	91	84	65	62	46	41	56	23	A-7-5 (14)	MH	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE - DENSITY: Maximum Dry Density	MOISTURE - DENSITY: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 2/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 2/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	CLASSIFICATION: Unified 4/	REMARKS
			Inches		Lb./cu. ft.	Percent													
Webster silty clay loam	Scott, Minn.	Mankato glacial till	0-7	A	86	27		100	99	94	69	65	31	24	51	16	A-7-5 (11)	OH or MH	Mapped as Webster-LeSueur.
			12.5-19	B	104	18		100	99	93	68	62	33	25	36	16	A-6 (9)	OL	
			19-37	B	102	21	100	99	98	91	64	57	35	29	47	27	A-7-6 (14)	OL	
			37+	C	109	18	100	98	96	88	63	57	30	20	35	16	A-6 (8)	CL	
	Scott, Minn.	Same	0-11	A	87	27		100	99	96	81	73	42	32	52	20	A-7-5 (14)	OH or MH	Mapped as Webster-LeSueur.
			14-25	B	98	22	100	99	97	89	67	62	41	33	51	25	A-7-6 (14)	CH	
			30.5+	C	100	21		100	99	96	86	83	42	25	43	18	A-7-6 (12)	ML-CL	
	Scott, Minn.	Same	0-10	A	96	22			100	97	84	80	37	28	43	19	A-7-6 (12)	OL or CL	Mapped as Webster-LeSueur.
			15-27	C	99	22	100	99	98	91	71	66	45	38	58	38	A-7-6 (18)	CH	
			48+	C	107	18	100	98	96	90	67	60	35	27	40	22	A-6 (11)	OL	
Wehadkee silt loam	Nottoway, Va.	Alluvium	0-22		97	23			100	98	80	79	55	38	46	17	A-7-6 (12)	ML	
Weller silt loam	Jefferson, Iowa	Loess	0-3	A	90	26			100	99	97	95	27	19	38	8	A-4 (8)	ML	
			15-28	B	97	26					100	98	52	44	60	33	A-7-6 (20)	CH	
			56-66	C	107	18				100	99	98	38	30	40	19	A-6 (12)	OL	
	Jefferson, Iowa	Same	0-5	A	92	22			100	99	97	96	30	21	42	11	A-7-5 (9)	ML	
			24-35	B	98	22					100	98	50	44	59	34	A-7-6 (20)	CH	
			59-66	C	107	18				100	98	97	40	33	40	20	A-6 (12)	CL	
	Jefferson, Iowa	Same	0-3	A	102	19				100	99	97	34	26	37	11	A-6 (8)	ML-CL	
			16-24	B	100	22					100	98	48	41	56	31	A-7-6 (19)	CH	
			49-60	C	108	18				100	98	97	40	30	36	16	A-6 (10)	CL.	
Westland silty clay loam	Fairfield, Ohio	Wisconsin glacial outwash	4-10		95	23			100	97	88	85	50	39	55	21	A-7-5 (15)	MH or CH	
			25-31		106	19			100	98	91	89	52	45	63	38	A-7-6 (20)	CH	
			43-53		124	11	100	76	72	63	49	44	17	13	26	8	A-4 (3)	SC	
Westmoreland silt loam	Marshall, W. Va.	Interbedded shale, siltstone, sandstone and limestone	0-8	A	106	17			100	97	89	86	34	22	30	6	A-4 (8)	ML-CL	
			13-26	B	111	17			100	96	89	86	43	32	38	16	A-6 (10)	CL	
			26-35	C	115	15	79	32	28	27	25	25	12	8	34	11	A-2-6 (0)	GC	
	Marshall, W. Va.	Same	2-8	A	106	19	100	93	91	87	76	72	27	18	32	7	A-4 (8)	ML-CL	
			8-16	B	114	15	100	90	86	84	72	67	31	21	26	5	A-4 (7)	ML-CL	
			16-30	C	115	14	79	41	38	37	35	33	15	10	32	10	A-4 (2)	GC	
Wheeling fine sandy loam	Wood, W. Va.	Terrace	0-8	A	116	13			100	97	36	34	14	10	NP	NP	A-4 (0)	SM	
			12-25	B	124	10			100	98	46	34	17	12	NP	NP	A-4 (2)	SM	
			36-45+	D	127	9	97	52	34	21	10	10	6	5	25	10	A-2-4 (0)	GP-GC	
Wheeling silt loam	Wood, W. Va.	Same	0-10	A	106	16	100	99	99	98	92	86	26	18	28	5	A-4 (8)	ML-CL	
			14-34	B	111	16				100	94	84	27	23	32	11	A-6 (8)	CL	
			34-58	B	113	13				100	70	57	13	13	21	1	A-4 ([illegible])	ML	
			64-74+	D	127	9	97	41	30	16	5	5	3	3	NP	NP	A-1-a (0)	GW-GM	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture - density: Maximum dry density	Moisture - density: Optimum moisture	Mechanical analysis 1/ Percentage passing sieve 2/: 3 in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 2/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Williams loam	Ward, N. D.	Glacial till	0-5	A	98	20	100	99	97	91	68	60	32	25	39	15	A-6 (9)	ML-CL	
			5-13	B	106	17		100	99	94	70	64	37	30	38	18	A-6 (10)	CL	
			13-25	C_{ca}	108	18			100	96	77	72	40	30	38	18	A-6 (12)	CL	
			25-60	C	113	15	100	98	87	82	64	57	29	21	37	20	A-6 (12)	CL	
Williamson silt loam	Wayne, N. Y.	Glacial lacustrine	0-10	A	99	19			100	99	91	76	17	10	30	3	A-4 (8)	ML	
			20-32	B_m	117	14				100	92	80	18	14	24	4	A-4 (8)	ML-CL	
			72-84+	C	115	14				100	95	82	14	10	25	5	A-4 (8)	ML-CL	
Wilson clay loam	McLennan, Tex.	Clay of old stream terrace	0-8	A	105	18			100	99	87	79	38	32	43	23	A-7-6 (14)	CL	
			8-42	B	104	18			100	99	90	84	43	36	47	26	A-7-6 (16)	CL	
			58-80	C	114	16			100	99	87	74	38	32	45	27	A-7-6 (16)	OL	
	McLennan, Tex.	Marine clay	0-10	A	99	21				100	96	90	41	32	48	25	A-7-6 (16)	CL	
			10-46	B	106	18			100	98	83	75	40	34	52	33	A-7-6 (18)	CH	
			84-120	C	113	15			100	97	78	66	30	26	44	26	A-7-6 (15)	OL	
	McLennan, Tex.	Same	0-7	A	112	16			100	98	76	65	33	26	37	21	A-6 (12)	CL	
			7-34	B	108	17			100	98	79	73	43	37	50	31	A-7-6 (18)	CL	
			58-84	C	114	15			100	96	77	70	39	33	47	29	A-7-6 (17)	CL	
Winfield silt loam	Moniteau, Mo.	Loess	0-10	A	106	16				100	99	89	21	14	25	4	A-4 (8)	ML-CL	
			15-30	B	102	21					100	98	48	41	60	37	A-7-6 (20)	CH	
			30-46	C	104	20					100	96	36	28	41	21	A-7-6 (13)	CL	
Winterset light silty clay loam	Madison, Iowa	Loess	0-10	A	98	22			100	99	99	96	42	35	44	18	A-7-6 (12)	ML-CL	
			20-32	B	94	25			100	99	98	97	52	46	70	40	A-7-5 (20)	CH	
			43-54	C	102	21					100	98	47	41	59	32	A-7-6 (20)	CH	
Winterset silty clay loam	Adair, Iowa	Same	2-12	A	95	23			100	99	99	98	42	33	46	20	A-7-6 (13)	ML-CL	
			22-34	B_g & B	98	23			100	99	99	98	50	44	64	38	A-7-6 (20)	CH	
			44-52	C	102	21			100	99	98	97	46	39	57	31	A-7-6 (19)	CH	
	Madison, Iowa	Same	2-12	A	96	22			100	99	98	97	41	32	42	16	A-7-6 (11)	ML-CL	
			22-36	B	95	23			100	99	98	97	52	45	61	32	A-7-6 (20)	MH-CH	
			44-50	C	101	21					100	98	47	40	57	33	A-7-6 (19)	CH	
Woodstown fine sandy loam	Norfolk, Va.	Coastal Plain sediments	6-11	A	117	12			100	90	36	35	15	12	20	5	A-4 (0)	SM-SC	
			22-36	B	125	10			100	89	38	38	19	14	20	6	A-4 (1)	SM-SC	
			36-60	C	121	10			100	86	20	19	11	9	NP	NP	A-3-4 (0)	SM	
Woostern gravelly loam	Potter, Pa.	Kames and glacial drift	10-20	B	105	19	100	49	46	39	27	25	9	5	31	3	A-2-4 (0)	GM	10-20% discarded in sampling.
			40-50	C	124	10	100	38	32	25	12	11	3	2	NP	NP	A-1-a (0)	GM	30-40% discarded in sampling.
			90-100	C	106	16			100	99	11	9	4	3	NP	NP	A-2-4 (0)	SP-SM	

(Woostern samples at 10-20" and 40-50" not corrected for material discarded larger than 3 in.)

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY BUREAU OF PUBLIC ROADS

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE - DENSITY		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 2/					Percentage Smaller Than 2/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3 in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 3/	Unified 4/	
			Inches		Lb./cu. ft.	Percent													
Worsham silt loam	Nottoway, Va.	Colluvium	0-7	A	110	16			100	93	72	65	33	26	31	9	A-4 (7)	ML-CL	
			10-46	B	104	20			100	97	86	82	58	48	60	34	A-7-6 (20)	CH	
			46-62	C	113	14			100	92	68	62	41	35	48	26	A-7-6 (14)	OL	
Worth stony fine sandy loam	Franklin, N. Y.	Glacial till	0-6	A	91	23	92	86	85	79	51	40	13	7	49	16	A-7-5 (8)	ML	
			6-16	B	94	23	92	81	80	76	54	44	13	6	34	4	A-4 (5)	ML	
			21-33	Bm	123	9	92	75	72	61	20	15	5	3	NP	NP	A-2-4 (0)	SM	
			33-62	C	122	8	92	76	74	60	18	12	4	2	NP	NP	A-2-4 (0)	SM	
	Franklin, N. Y.	Same	0-7	A	99	19	92	81	79	72	51	42	12	6	35	6	A-4 (4)	ML	
			7-12	B	124	10	92	73	68	57	26	22	10	5	NP	NP	A-2-4 (0)	SM	
			14-32	Bm	124	8	92	50	46	34	13	10	4	2	NP	NP	A-1-b (0)	GM	
			32-80	C	135	8	92	85	83	67	30	25	13	8	14	3	A-2-4 (0)	SM	
	Franklin, N. Y.	Same	0-5	A	109	15	92	71	68	57	24	19	6	4	NP	NP	A-2-4 (0)	SM	
			5-14	B	121	11	92	69	65	48	16	13	4	3	NP	NP	A-2-4 (0)	SM	
			14-23	Bm	124	8	92	71	67	49	16	12	4	3	NP	NP	A-2-4 (0)	SM	
			23-54	C	126	8	92	74	68	47	14	12	4	2	NP	NP	A-2-4 (0)	SM	
Zimmerman loamy fine sand	Isanti, Minn.	Glacial outwash	0-5	A	110	12			100	91	11	10	5	4	NP	NP	A-2-4 (0)	SP-SM	
			5-60	B	110	13			100	93	12	12	5	4	NP	NP	A-2-4 (0)	SP-SM	
			60-80	C	110	13			100	91	11	10	4	4	NP	NP	A-2-4 (0)	SP-SM	
	Isanti, Minn.	Same	0-8	A	104	15				100	19	13	4	3	NP	NP	A-2-4 (0)	SM	
			8-48	B	104	15				100	18	12	4	3	NP	NP	A-2-4 (0)	SM	
			60+	C	105	14			100	99	20	15	5	3	NP	NP	A-2-4 (0)	SM	

Footnotes

1/ Mechanical analyses according to the American Association of State Highway Officials Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the A.A.S.H.O. procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2mm. in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 mm. in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming texture classes for soils.

2/ Coarse particles were discarded during field sampling of some soils. Laboratory test data were corrected to include the percent discarded in field sampling, as noted in "Remarks" column.

3/ Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, A.A.S.H.O. Designation M 145-49.

4/ Based on the Unified Soil Classification System, Technical Memorandum No. 3-357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953.

SECTION II

PART II: ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Horizon	Moisture-density 2/: Maximum dry density	Optimum moisture	Mechanical analysis 1/ — Percentage passing sieve 3/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 3/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 1/	Unified 1/	Remarks
			Inches		Lb./cu. ft.	Percent													
Abilene clay loam	Haskell, Tex. a/	Unconsolidated clays and sandy clays	11-19	B					100	99	82	79	36	28	46	24	A-7-6(15)	CL	
			19-33	B					100	98	81	78	38	28	47	26	A-7-6(16)	CL	
			52-72+	C_{ca}				100	99	97	75	74	50	30	40	24	A-6(14)	CL	
	Haskell, Tex. a/	Same	9-14	B					100	98	82	63	23	15	42	22	A-7-6(13)	CL	
			14-35	B					100	98	87	86	43	30	51	30	A-7-6(18)	CH	
			60-72+	C_{ca}				100	99	90	74	72	49	28	44	28	A-7-6(16)	CL	
	Haskell, Tex. a/	Same	6-14	B						100	92	86	46	39	50	28	A-7-6(17)	CL	
			14-24	B						100	92	88	60	48	50	29	A-7-6(18)	CL	
			40-54+	C_{ca}			100	95	91	85	79	76	55	41	38	22	A-6(13)	CL	
Alamance silt loam	Saluda, S. C.	Carolina slate	0-10	A	108	15 c/	100	96	92	84	75	70	11	8	NP	NP	A-4(8)	ML	
			10-38	B	109	19 c/	100	96	96	93	88	84	36	32	44	20	A-7-6(13)	CL	
			38-56	C	104	20 c/	100	96	96	92	88	85	44	36	55	31	A-7-6(19)	CH	
			56-74	D_r	110	17 c/	100	66	57	51	46	43	16	10	42	16	A-7-6(4)	GM-GC	
Albertville loam	Cullman, Ala.	Interbedded shales and sandstone	0-5	A			100	96	89	86	78	68	21	17	23	3	A-4(8)	ML	
			5-16	B			100	96	96	93	89	84	56	50	60	26	A-7-5(18)	MH	
			28-80	C					100	95	88	79	38	27	41	13	A-7-6(9)	ML	
	Cullman, Ala.	Same	0-7	A			100	97	93	90	75	70	19	13	24	4	A-4(8)	ML-CL	
			11-17	B			100	99	96	93	84	81	31	24	33	11	A-6(8)	ML-CL	
			17-29	B					100	99	95	93	48	39	52	20	A-7-5(14)	MH	
			29-41	B					100	99	96	93	52	40	53	22	A-7-5(15)	MH	
	Cullman, Ala.	Same	0-7	A			100	97	93	92	46	39	7	5	NP	NP	A-4(2)	SM	
			7-17	A			100	95	91	90	57	53	16	11	18	4	A-4(4)	ML-CL	
			17-28	B			100	98	92	90	57	53	27	20	30	10	A-4(4)	CL	
			35-66	C			100	97	95	93	62	59	35	28	40	12	A-6(6)	ML	
Allenwood gravelly silt loam	Carbon, Pa. b/	Glacial till	18-25	B	115	16	100	74	68	56	48	47	30	24	36	14	A-6(4)	GC-SC	
			36-43	C	113	17	100	60	55	45	31	30	20	18	36	14	A-2-6(1)	GC	
	Carbon, Pa. b/	Same	17-32	B	106	19	100	61	58	51	46	46	30	25	44	13	A-7-5(3)	GM	5% discarded in sampling.
			38-55	C	106	18	100	62	58	49	42	40	29	24	48	18	A-7-5(4)	GM	
	Carbon, Pa. b/	Same	29-39	B	118	13	100	48	35	23	15	14	9	7	25	7	A-2-4(0)	GM-GC	
			52-64	C	119	14	100	75	58	39	21	20	13	11	21	2	A-1-b(0)	SM	
	Carbon, Pa. b/	Glacial till (Jerseyan)	15-22	B	115	14	100	78	70	64	55	52	24	19	30	8	A-4(4)	ML-CL	
			31-39	B	114	15	100	85	81	73	64	60	30	23	31	8	A-4(6)	ML-CL	
	Carbon, Pa. b/	Glacial till (Illinoian)	29-49	B	102	22	100	98	97	94	85	82	65	55	42	12	A-7-5(9)	ML	
			63-84	B	99	23	100	87	86	82	73	73	52	43	44	13	A-7-5(10)	ML	
	Carbon, Pa. b/	Glacial till	16-25	B	122	11	100	76	70	58	40	38	21	16	24	6	A-4(1)	SM-SC	
			25-42	C	124	12	100	66	61	50	30	28	16	12	21	2	A-2-4(0)	GM	

(Allenwood sample not corrected for material discarded larger than 3 inches).

a/ Tests performed by Texas Highway Department.
b/ Tests performed by Pennsylvania Department of Highways.
c/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE-DENSITY 1/		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 4/					Percentage Smaller Than 4/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 5/	Unified 6/	
			Inches		Lb./cu.ft.	Percent													
Altvan loam	Kimball, Nebr.	Loess over Pleistocene gravel	0-6	A	107	17	100	97	92	77	59	51	20	17	30	10	A-4(5)	CL	
			11-17	B	105	18	100	99	91	81	67	61	29	24	39	18	A-6(10)	CL	
			27-32	C	117	13	100	96	90	73	47	36	15	12	26	8	A-4(2)	SC	
	Kimball, Nebr.	Same	0-6	A	112	12	100	96	90	72	58	50	18	14	29	8	A-4(5)	ML-CL	
			12-18	B	99	21			100	93	85	77	37	33	43	20	A-7-6(13)	CL	
			26-32	C	111	16	100	89	80	62	46	41	20	15	31	10	A-4(2)	SC	
	Kimball, Nebr.	Same	0-6	A	112	14	100	97	94	83	60	50	21	15	27	8	A-4(5)	CL	
			6-11	B	107	17	100	99	95	84	64	54	27	23	36	18	A-6(9)	CL	
			22-38	C	110	15	100	99	97	88	65	52	20	16	28	8	A-4(6)	CL	
	Kimball, Nebr.	Same	0-6	A	109	15	100	97	93	82	69	58	22	16	30	8	A-4(7)	ML-CL	
			11-15	B	97	23			100	96	89	82	41	37	49	25	A-7-6(16)	CL	
			29-36	C	120	11	100	93	86	70	40	30	14	11	25	8	A-4(1)	SC	
	Kimball, Nebr.	Loess over outwash gravel	0-6	A	118	13	100	96	87	66	48	40	15	11	26	5	A-4(3)	SM-SC	
			15-24	B	104	19	100	99	97	89	78	72	33	29	47	23	A-7-6(15)	CL	
			30-48+	D	124	10	100	95	81	30	11	10	6	6	NP	NP	A-1-b(0)	SW-SM	
	Kimball, Nebr.	Same	0-8	A	121	10	100	93	83	60	39	32	14	11	25	7	A-4(1)	SM-SC	
			11-16	B	108	17	100	99	97	84	67	59	32	26	38	17	A-6(9)	CL	
			24-40+	D	127	9	100	89	78	45	18	16	9	8	19	4	A-1-b(0)	SM-SC	
	Kimball, Nebr.	Same	0-5	A	124	10	100	96	86	63	29	23	11	9	21	4	A-2-4(0)	SM-SC	
			13-18	A_c	114	14	100	99	96	79	45	38	22	19	30	13	A-6(3)	SC	
			27-33+	D	124	9	100	94	79	30	10	9	7	6	NP	NP	A-1-b(0)	SW-SM	
Amarillo fine sandy loam	Lamb, Tex. a/	Alluvial and aeolian sediments (Quaternary and Tertiary)	0-11	A					100	99	52	42	18	15	24	7	A-4(3)	ML-CL	
			11-27	B						100	60	54	33	28	35	19	A-6(9)	CL	
			38-56	C_{ca}			100	76	72	68	46	43	29	22	30	14	A-6(3)	SC	
	Lamb, Tex. a/	Same	0-8	A					100	95	42	34	13	11	19	5	A-4(1)	SM-SC	
			8-17	B					100	97	45	38	21	20	29	14	A-6(3)	SC	
			28-54	B			100	99	98	97	61	54	29	26	32	17	A-6(8)	CL	
	Lamb, Tex. a/	Same	0-9	A						100	50	36	16	14	22	5	A-4(3)	SM-SC	
			12-26	B					100	99	62	53	33	28	37	20	A-6(9)	CL	
			42-72+	C_{ca}			100	97	95	90	66	64	52	37	26	12	A-6(7)	CL	
Amarillo sandy clay loam	Lamb, Tex. a/	Same	0-10	A						100	51	44	22	20	25	10	A-4(3)	CL	
			10-32	B						100	67	60	34	32	35	18	A-6(10)	CL	
			56-80	C_{ca}			100	98	97	95	74	68	48	35	30	15	A-6(10)	CL	
	Lamb, Tex. a/	Same	0-12	A					100	99	67	57	26	23	31	14	A-6(8)	CL	
			12-25	B					100	99	72	65	39	35	41	22	A-7-6(12)	CL	
			37-66+	C_{ca}			100	98	96	93	66	57	34	28	30	16	A-6(9)	CL	
	Lamb, Tex.	Same	0-11	A					100	99	62	53	30	22	29	13	A-6(7)	CL	
			11-21	B					100	99	71	64	39	34	40	20	A-6(11)	CL	
			26-70+	C_{ca}			100	99	98	94	64	62	34	28	32	18	A-6(9)	CL	

a/ Tests performed by Texas Highway Department.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (County and State)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum Dry Density	Moisture-density 2/: Optimum Moisture	Mechanical analysis 3/: Percentage passing sieve 4/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 4/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 5/	Classification: Unified 6/	Remarks
			Inches		Lb./cu. ft.	Percent													
Amarillo fine sandy loam	Terry, Tex. a/	Alluvial and aeolian sediments (Quaternary and Tertiary)	0-10	A					100	99	27	24	10	9	20	4	A-2-4(0)	SM-SC	
			10-54	B					100	99	44	43	25	24	28	14	A-6(3)	SC	
	Terry, Tex. a/	Same	0-9	A						100	35	29	13	10	19	2	A-2-4(0)	SM	
			13-20	B						100	47	44	33	30	33	17	A-6(5)	SC	
	Terry, Tex. a/	Same	0-24	A						100	29	27	15	14	19	3	A-2-4(0)	SM	
			24-42	B					100	99	33	31	18	16	20	3	A-2-4(0)	SM	
Amarillo loamy fine sand	Terry, Tex. a/	Same	0-16	A						100	19	18	11	10	19	2	A-2-4(0)	SM	
			16-60	B						100	30	28	19	18	24	7	A-2-4(0)	SM-SC	
	Terry, Tex. a/	Same	0-8	A					100	98	18	17	12	11	19	3	A-2-4(0)	SM	
			18-60	B					100	99	39	38	28	28	32	16	A-6(2)	SC	
	Terry, Tex. a/	Same	0-22	A					100	99	20	19	11	10	18	2	A-2-4(0)	SM	
			22-48	B						100	38	36	23	21	25	11	A-6(1)	SC	
Anselmo loamy fine sand	Dundy, Nebr.	Aeolian sands	0-6	A	114	12			100	93	23	12	6	6	NP	NP	A-2-4(0)	SM	
			27-36	B	116	12			100	95	33	19	13	11	22	3	A-2-4(0)	SM	
			44-60	C	113	13			100	95	31	14	10	8	NP	NP	A-2-4(0)	SM	
	Dundy, Nebr.	Same	0-7	A	115	12			100	90	19	11	7	6	NP	NP	A-2-4(0)	SM	
			20-28	B	120	12			100	96	33	21	13	12	20	3	A-2-4(0)	SM	
			41-60	C	114	13			100	99	27	16	9	7	NP	NP	A-2-4(0)	SM	
Appling sandy loam	Douglas, Ga.	Granite	0-8	A	120	9 b/	100	91	90	72	25	21	8	5	NP	NP	A-2-4(0)	SM	
			14-33	B	104	20			100	89	62	59	44	41	49	23	A-7-6(12)	ML-CL	
			43-72	C	107	18			100	84	52	47	23	19	38	10	A-4(3)	ML	
	Douglas, Ga.	Granite with quartz	8-18	A	127	10			100	76	43	40	23	19	22	9	A-4(2)	SC	
			21-39	B	98	24			100	88	75	73	56	52	60	24	A-7-5(18)	MH	
			45-75	C	105	19			100	82	52	47	31	26	44	14	A-7-5(5)	ML	
	Douglas, Ga.	Granite with quartz mica schist	0-5	A	125	10 b/	100	95	94	70	25	21	8	7	NP	NP	A-2-4(0)	SM	
			16-31	B	98	24			100	84	67	66	51	48	62	28	A-7-5(17)	MH	
			31-61	C	109	17 b/	100	96	95	76	48	43	25	20	41	13	A-7-6(4)	SM	
Appling fine sandy loam	Yadkin, N. C.	Granite	3-8	A			100	97	96	80	31	26	12	7	NP	NP	A-2-4(0)	SM	
			16-23	B					100	89	60	57	45	42	53	23	A-7-5(12)	MH-CH	
			41-62+	C					100	94	65	61	42	36	61	17	A-7-5(12)	MH	

a/ Tests performed by Texas Highway Department.
b/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE-DENSITY 1/: Maximum Dry Density	MOISTURE-DENSITY 1/: Optimum Moisture	MECHANICAL ANALYSIS 1/ — Percentage Passing Sieve 1/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 1/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: AASHO 1/	CLASSIFICATION: Unified 1/	REMARKS
			Inches		Lb./cu. ft.	Percent													
Appling sandy loam	Cherokee, S. C.	Gneiss	0-6	A			100	95	92	82	30	24	11	9	NP	NP	A-2-4(0)	SM	
			15-48	B	93	28			100	94	73	71	62	57	64	26	A-7-5(18)	MH	
			48+	C	99	24			100	96	73	67	38	28	49	17	A-7-5(12)	ML	
	Cherokee, S. C	Gneiss and granite	0-5	A	118	11 b/	100	97	94	84	29	22	8	6	NP	NP	A-2-4(0)	SM	
			5-25	B	105	21			100	95	65	61	47	43	43	19	A-7-6(12)	CL	
			38+	C	96	25			100	92	68	63	32	25	50	14	A-7-5(10)	ML	
	Cherokee, S. C.	Granite	0-6	A	127	10			100	68	30	26	12	9	18	3	A-2-4(0)	SM	
			16-40	B	92	26			100	88	75	73	60	58	61	26	A-7-5(18)	MH	
			40+	C	111	16			100	78	52	48	29	25	38	16	A-6(6)	CL	
	Oconee, S. C.	Same	2-10	A	123	10			100	67	25	22	9	7	NP	NP	A-2-4(0)	SM	
			14-24	B	108	18			100	81	59	57	48	45	47	26	A-7-6(12)	CL	
			40-60	C	105	19			100	78	58	54	35	33	52	21	A-7-5(10)	MH	
Atkins silt loam	Cullman, Ala.	Alluvium	0-9	A						100	98	96	36	20	36	7	A-4(8)	ML	
			19-30	C_g					100	99	84	76	25	14	20	4	A-4(8)	ML-CL	
			30-45	C_g					100	98	82	75	32	23	27	2	A-4(8)	ML	
			45-68	C_g						100	74	67	33	27	31	14	A-6(9)	CL	
	Cullman, Ala.	Same	0-14	A						100	90	86	25	16	27	5	A-4(8)	ML-CL	
			15½-21	A_{gb}						100	76	72	23	11	20	3	A-4(8)	ML	
			21-29	C_g						100	61	52	17	11	18	2	A-4(5)	ML	
			29-75	C_g						100	65	57	24	19	25	6	A-4(6)	ML-CL	
	Cullman, Ala.	Same	0-6	A_g						100	88	85	35	21	31	7	A-4(8)	ML-CL	
			6-13	A_g						100	84	79	32	22	25	7	A-4(8)	ML-CL	
			13-30	B_g						100	94	91	53	42	50	25	A-7-6(16)	CL	
			30-76	C_g						100	55	43	10	7	NP	NP	A-4(4)	ML	
Bayboro clay loam	McIntosh, Ga.	Pamlico marine terrace	1-14	A	92	25			100	86	65	63	47	41	51	21	A-7-5(12)	OH	
			19-32	B_g	97	23			100	90	72	71	55	50	66	39	A-7-6(19)	CH	
			38-52	C_g	100	22			100	92	78	76	62	56	72	45	A-7-6(20)	CH	
	McIntosh, Ga.	Same	0-10	A	75	37			100	94	77	73	42	32	60	17	A-7-5(15)	OH	
			17-25	B_g	91	26			100	94	79	76	51	45	52	23	A-7-6(16)	MH-CH	
			36-64+	C_g	90	27			100	95	81	78	56	49	54	24	A-7-5(16)	MH-CH	
Beltsville very fine sandy loam	Northumberland, Va. a/	Coastal Plain sediments	0-7	A	118	11			100	98	62	55	13	6	17	NP	A-4([illegible])	ML	
			7-23	B	120	13			100	98	71	67	24	16	24	6	A-4([illegible])	ML-CL	
			23-34	BM	124	10			100	98	54	46	19	12	16	NP	A-4([illegible])	ML	
			34-60	C	111	17		100	99	96	55	49	34	30	36	10	A-4([illegible])	ML-CL	

a/ Tests performed by Virginia Department of Highways.
b/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum dry density	Moisture-density 2/: Optimum moisture	Mechanical analysis 3/ – Percentage passing sieve 4/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 4/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 5/	Classification: Unified 6/	Remarks
			Inches		Lb./cu.ft.	Percent													
Bertie silt loam	Northumberland, Va. a/	Coastal Plain sediments	0-7	A	106	15			100	98	83	76	17	10	25	NP	A-4(8)	ML	
			7-32	B	117	15			100	98	85	79	30	21	26	5	A-4(8)	ML-CL	
			43-72	C	100	17			100	88	6	4	3	2	NP	NP	A-3(0)	SP-SM	
Bladen fine sandy loam	McIntosh, Ga.	Pamlico marine terrace	0-3	A	93	22			100	98	64	57	22	18	36	9	A-4(6)	ML or OL	Mapped as Bladen-Coxville
			15-26	BG	105	19			100	99	71	66	45	41	45	22	A-7-6(13)	CL	
			42-50	C_g	96	24				100	81	76	56	54	69	34	A-7-6(20)	CH	
	McIntosh, Ga.	Same	0-5	A	109	13			100	96	53	28	9	6	NP	NP	A-4(4)	ML or OL	Mapped as Bladen-Coxville
			14-30	BG	95	22			100	99	75	71	57	55	64	35	A-7-6(20)	CH	
			41-57	C_g	103	20			100	99	64	59	47	45	48	25	A-7-6(13)	CL	
Bow silt loam	San Juan, Wash.	Glacial till	0-11	B	108	16	100	96	91	76	60	57	23	15	26	5	A-4(5)	ML-CL	
			16-32	B_t	104	20	100	99	98	96	89	87	62	45	46	24	A-7-6(15)	CL	
			40-50	C	104	21	100	98	98	97	91	87	56	43	45	23	A-7-6(14)	CL	
	San Juan, Wash.	Same	0-9	B	103	19	100	96	94	87	79	76	34	17	30	6	A-4(8)	ML-CL	
			20-33	B_t	113	15	100	96	93	87	61	57	31	22	29	13	A-6(6)	CL	
			33-41	C	117	14	100	95	93	86	60	53	29	19	24	9	A-4(5)	CL	
Brandywine loam	Rappahannock, Va. a/	Granite and granodiorite	3-10	A	109	14	100	77	74	61	41	33	12	6	29	NP	A-4(1)	SM	
			20-38	C	116	12			100	57	27	22	8	6	26	NP	A-2-4(0)	SM	
Bridgeport silt loam	Dundy, Nebr.	Alluvium	0-5	A	108	16				100	90	67	18	14	28	5	A-4(8)	ML-CL	
			11-23	C	110	16				100	88	64	15	13	26	2	A-4(8)	ML	
			35-47	A_b	110	15				100	88	62	17	15	26	3	A-4(8)	ML	
	Dundy, Nebr.	Same	0-5	A	109	16				100	93	77	22	18	27	4	A-4(8)	ML-CL	
			13-21	A_b	112	16				100	88	68	21	17	28	6	A-4(8)	ML-CL	
			34-42	A_b	110	16				100	90	68	14	10	28	5	A-4(8)	ML-OL	
	Dundy, Nebr.	Alluvium (Terrace)	0-8	A	115	14			100	96	62	47	20	18	26	8	A-4(5)	CL	
			8-16	B	115	15			100	96	64	53	27	22	29	12	A-6(7)	CL	
			28-39	C	116	16			100	98	78	66	33	28	31	13	A-6(9)	CL	
	Dundy, Nebr.	Same	0-9	A	114	14			100	97	67	51	21	19	27	9	A-4(6)	CL	
			9-15	B	113	16			100	98	74	59	28	25	31	13	A-6(9)	CL	
			28-37	C	110	18				100	93	82	40	32	37	16	A-6(10)	CL	
	Dundy, Nebr.	Alluvium	0-6	A	109	17				100	92	77	24	20	31	9	A-4(8)	ML-CL	
			26-42	C	112	16				100	93	72	25	20	28	7	A-4(8)	ML-CL	
			42-60	A_b	112	16				100	92	69	23	19	27	6	A-4(8)	ML-CL	
	Dundy, Nebr.	Same	0-7	A	116	13			100	98	71	54	18	15	23	4	A-4(7)	ML-CL	
			19-34	C	112	16				100	92	80	27	21	30	9	A-4(8)	ML-CL	
			48-60	C	112	16				100	92	78	26	21	28	7	A-4(8)	ML-CL	

a/ Tests performed by Virginia Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum Dry Density	Moisture-density 2/: Optimum Moisture	Mechanical analysis 1/ — Percentage passing sieve 3/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 4/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: AASHO 5/	Classification: Unified 6/	Remarks
			Inches		Lb./cu.ft.	Percent													
Brownfield fine sand	Lamb, Tex. a/	Aeolian sediments	0-28	A					100	98	10	8	6	6	22	2	A-2-4(0)	SP-SM	
			28-55	B					100	99	44	39	26	24	33	18	A-6(4)	SC	
	Lamb, Tex. a/	Same	0-18	A					100	99	9	5	3	3	24	4	A-2-4(0)	SP-SC	
			18-38	B					100	99	37	35	24	23	30	15	A-6(2)	SC	
	Lamb, Tex. a/	Same	0-16	A					100	99	9	8	4	3	23	4	A-2-4(0)	SP-SC	
			16-28	B						100	31	29	20	18	27	12	A-2-6(0)	SC	
			37-77	Bb						100	43	37	25	23	30	15	A-6(3)	SC	
	Terry, Tex. a/	Same	0-27	A						100	11	9	7	7	20	2	A-2-4(0)	SM-SP	
			27-57	B						100	26	24	19	18	25	8	A-2-4(0)	SC	
	Terry, Tex. a/	Same	0-29	A						100	17	15	11	11	20	3	A-2-4(0)	SM	
			29-56	B						100	32	28	20	20	27	8	A-2-4(0)	SC	
	Terry, Tex. a/	Same	0-36	A						100	9	8	5	5	22	3	A-3(0)	SM-SP	
			36-47	B						100	28	26	19	19	26	10	A-2-4(0)	SC	
			47-60	C						100	19	17	12	11	20	2	A-2-4(0)	SM	
	Jackson, Okla. b/	Sandy earths	0-14	A					100	91	14	8	4	3	NP	NP	A-2-4(0)	SM	
			20-26	B					100	95	33	15	12	12	22	5	A-2-4(0)	SM-SC	
			32-48	C					100	96	16	10	9	9	21	2	A-2-4(0)	SM	
Canyon loam	Kimball, Nebr.	Tertiary sediments with limestone fragments	0-6	A	113	14	100	92	88	73	44	35	18	14	27	9	A-4(2)	SC	
			11-18	C	109	16	100	87	82	66	45	39	25	20	34	14	A-6(3)	SC	
	Kimball, Nebr.	Same	0-4	A	111	14	100	98	95	84	49	40	18	14	26	6	A-4(3)	SM-SC	
			9-16	C	103	19	100	87	85	73	49	43	24	17	36	14	A-6(4)	SC	
	Kimball, Nebr.	Same	0-5	A	113	13	100	97	93	84	46	33	14	11	23	4	A-4(2)	SM-SC	
			17-21	C	115	13	100	93	82	66	36	30	16	13	28	10	A-4(0)	SC	
Canyon sandy loam	Kimball, Nebr.	Limestone (Ogallala formation)	0-7	A	114	12	100	93	89	78	33	25	12	9	NP	NP	A-2-4(0)	SM	

a/ Tests performed by Texas Highway Department.
b/ Tests performed by Oklahoma Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	Horizon	MOISTURE-DENSITY 2/: Maximum Dry Density	Optimum Moisture	MECHANICAL ANALYSIS 3/: Percentage Passing Sieve 4/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 3/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 5/	Unified 6/	REMARKS
			Inches		Lb./cu. ft.	Percent													
Carnegie loamy fine sand	Gadsden, Fla.	Coastal Plain sediments	5-9	A	122	10	100	85	84	76	27	20	13	9	NP	NP	A-2-4(0)	SM	
			18-35	B	115	15	100	88	87	80	41	38	31	30	36	17	A-6(3)	SC	
			56-65+	C	101	22	100	98	97	93	64	58	49	48	55	25	A-7-5(14)	MH-CH	
	Gadsden, Fla.	Same	0-7	A	112	12	100	95	94	91	30	18	7	5	NP	NP	A-2-4(0)	SM	
			13-36	B	110	17	100	96	95	93	50	44	36	34	36	16	A-6(5)	SC	
			51-65+	C	103	20				100	62	53	45	44	49	24	A-7-6(12)	CL	
	Gadsden, Fla.	Same	0-3	A	118	12	100	91	89	86	32	25	18	16	19	5	A-2-4(0)	SM-SC	
			9-22	B	99	23	100	98	98	97	70	66	61	60	48	25	A-7-6(14)	CL	
			36-46+	C	92	27			100	99	78	75	69	69	64	30	A-7-5(20)	MH	
Caroline sandy loam	Darlington, S. C.	Coastal Plain sediments	2.5-13	A	121	8			100	83	28	21	6	4	NP	NP	A-2-4(0)	SM	
			13-30	B	118	14			100	87	47	42	29	27	32	15	A-6(4)	SC	
			38+	C	109	18			100	93	49	43	34	33	50	27	A-7-6(9)	SC	
Cecil fine sandy loam	Yadkin, N. C.	Granite gneiss containing biotite mica	5-10	A			100	89	88	76	39	34	18	13	NP	NP	A-4(1)	SM	
			13-27	B			100	97	96	88	64	60	46	41	51	21	A-7-5(12)	MH-CH	
			34-72	C					100	95	62	58	41	36	50	16	A-7-5(9)	ML	
Cheshire stony fine sandy loam	Hartford, Conn.	Glacial till	0-2	A	97	20	88	84	83	77	45	41	14	10	33	6	A-4(3)	ML	14% discarded in sampling
			3-24	B	118	11	85	74	71	65	35	30	11	8	NP	NP	A-4(1)	SM	20% " " "
			24-40	C	122	11	95	78	72	62	40	35	12	7	20	3	A-4(1)	SM	15% " " "
	Hartford, Conn.	Same	0.75-6.5	A	114	13	98	91	88	75	48	42	14	10	22	4	A-4(3)	SM-SC	5% " " "
			6.5-24	B	123	10	95	74	71	60	38	33	12	9	18	2	A-4(1)	SM	20% " " "
			24-60	C	127	7	90	64	59	47	21	17	5	4	NP	NP	A-2-4(0)	SM	30% " " "
	Hartford, Conn.	Same	0.5-4	A	98	19	100	95	95	87	63	55	16	13	NP	NP	A-4(6)	ML	5% " " "
			4-24	B	111	15	100	85	83	76	58	51	14	11	24	3	A-4(5)	ML	10% " " "
			24-40	C	122	9	100	72	69	59	30	26	8	4	NP	NP	A-2-4(0)	SM	20% " " "
							(Cheshire samples corrected for material discarded larger than 1 inch.)												
Chester loam	Rappahannock, Va. a/	Granite	0-8	A	106	17	100	95	95	75	55	39	11	6	34	6	A-4(4)	ML	
			11-22	B	105	19			100	83	71	65	39	29	45	14	A-7-5(10)	ML	
			44-120	C	109	16			100	74	55	49	11	6	34	NP	A-4(4)	ML	
Chiniak silt loam	Kodiak Island, Alaska	Volcanic ash over beach sand and gravel	0-5	Ash	71	35				100	80	77	13	8	NP	NP	A-4(8)	ML	
			13-28+	C_b	124	12	100	33	12	2	1	1	1	1	NP	NP	A-1-a(0)	GW	Volcanic ash
	Kodiak Island, Alaska	Same	1-5	Ash	74	31				100	68	63	13	7	NP	NP	A-4(7)	ML	
			11-24+	C_b	115	14	100	98	83	6	3	3	2	2	NP	NP	A-1-b(0)	SP	Volcanic ash
	Kodiak Island, Alaska	Same	2-9	Ash	72	34				100	69	64	13	7	NP	NP	A-4(7)	ML	
			18-32+	C_b	110	17	100	98	97	51	6	5	4	4	NP	NP	A-3(0)	SP-SM	Volcanic ash

a/ Tests performed by Virginia Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE-DENSITY 1/		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 1/					Percentage Smaller Than 1/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 1/	Unified 1/	
			Inches		Lb./cu.ft.	Percent													
Clarksville cherty silt loam	Calhoun, Ala.	Cherty dolomitic limestone	0-5	A	114	13	100	89	80	71	58	54	22	13	24	5	A-4(5)	ML-CL	
			13-25	B	116	13	100	80	70	60	52	50	37	17	28	9	A-4(3)	CL	
			30-40+	C	114	13	99	54	40	30	24	23	17	13	34	11	A-2-6(0)	GM-GC	1% discarded in sampling
	Calhoun, Ala.	Same	3-5	A	93	22	99	58	51	45	36	35	16	8	41	5	A-5(0)	GM	1% " " "
			15-26	B	118	12	99	67	55	47	41	40	24	15	25	6	A-4(1)	GM-GC	1% " " "
			26-72	C	115	14	95	72	63	51	44	43	28	19	28	7	A-4(2)	SM-SC	2% " " "
Clarksville stony loam	Calhoun, Ala.	Same	1-5	A	109	14	100	78	62	46	35	34	14	8	25	3	A-2-4(0)	SM	
			8-24	B	120	11	100	71	54	38	29	28	14	8	21	3	A-2-4(0)	SM	
			24-40	C	120	12	99	75	61	41	27	25	15	10	21	3	A-2-4(0)	SM	1% " " "
			50-60	C	118	13	99	65	51	34	22	21	11	6	20	1	A-1-b(0)	SM	1% " " "
							(Clarksville samples corrected for material discarded larger than 3 inches.)												
Congaree fine sandy loam	Yadkin, N. C.	Alluvium	0-9						100	99	32	23	7	5	NP	NP	A-2-4(0)	SM	
			22-36							100	68	60	28	22	31	9	A-4(7)	ML-CL	
			36-52+							100	53	45	21	16	27	5	A-4(4)	ML-CL	
Congaree silt loam	Cherokee, S. C.	Same	0-8	A	113	15			100	99	89	81	25	19	29	8	A-4(8)	ML-CL	
			8-32	B	115	15			100	99	91	85	35	27	31	12	A-6(9)	CL	
Congaree fine sandy loam	Cherokee, S. C.	Same	0-10	A	114	14			100	99	52	42	20	15	25	5	A-4(3)	ML-CL	
			10-25	B	116	14				100	58	48	24	20	24	5	A-4(5)	ML-CL	
Coxville fine sandy loam	Darlington, S. C.	Coastal Plain sediments	0-6	A	122	11			100	81	50	45	18	13	22	7	A-4(3)	SM-SC	
			6-27	Bg	115	15			100	86	63	60	38	33	39	20	A-6(10)	CL	
			36+	C	114	15			100	87	67	64	37	32	38	20	A-6(10)	CL	
Craven silt loam	Northumberland, Va. a/	Coastal Plain sediments	0-9	A	108	15			100	97	84	78	21	11	25	NP	A-4(8)	ML	
			9-23	B	110	16			100	96	80	77	42	33	34	13	A-6(9)	CL	
			23-42	B	101	21			100	94	72	69	50	44	53	26	A-7-6(16)	MH-CH	
			42-93	C	98	22			100	99	91	88	60	51	59	32	A-7-6(20)	CH	
Dekalb very stony loam	Carbon, Pa. b/	Pocono sandstone	16-25	B	127	10	100	77	69	53	30	29	17	13	23	5	A-2-4(0)	SM-SC	15% discarded in sampling
			25-38	C	124	10	100	62	56	43	28	27	16	12	26	9	A-2-4(0)	GC	15% " " "
	Carbon, Pa. b/	Siltstone, sandstone, and shale	15-22	B	116	14	100	33	27	24	20	20	11	9	30	7	A-2-4(0)	GM-GC	40% " " "
			22-36	C	121	12	100	19	16	12	10	9	4	3	28	6	A-1-a(0)	GP-GC	40% " " "
	Carbon, Pa. b/	Glacial till	7-16	B	126	10	100	75	71	53	30	29	16	13	21	4	A-2-4(0)	SM-SC	10% " " "
			16-34	C	128	9	100	68	64	48	26	25	14	11	19	3	A-2-4(0)	SM	10% " " "
							(Dekalb samples not corrected for material discarded larger than 3 inches.)												

a/ Tests performed by Virginia Department of Highways.
b/ Tests performed by Pennsylvania Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE-DENSITY 2/		MECHANICAL ANALYSIS 3/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	Percentage Passing Sieve 4/					Percentage Smaller Than 4/					A.A.S.H.O. 5/	Unified 6/	
							3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm					
			In.		Lb./cu.ft.	Percent													
Dodgeville silt loam	Dane, Wisc.	Loess over limestone	0-10	A	91	25				100	98	95	37	26	51	19	A-7-5(14)	MH	
			15-25	B	99	23 c/	100	98	98	98	98	95	45	36	45	19	A-7-6(13)	ML-CL	
			29-38	C	93	24 c/	100	95	94	93	91	90	61	53	61	30	A-7-5(20)	MH-CH	
	Iowa, Wisc.	Same	0-8	A	98	22				100	99	96	38	30	44	18	A-7-6(12)	ML-CL	
			19-25	B	95	26 c/	100	94	93	91	90	88	52	46	60	29	A-7-5(20)	MH-CH	
			25-31	C	83	30 c/	100	92	91	89	86	85	70	66	80	37	A-7-5(20)	MH	
	Iowa, Wisc.	Same	0-10	A	96	23				100	98	95	34	25	43	15	A-7-6(11)	ML-CL	
			24-33	B	101	20 c/	100	96	95	95	95	93	40	34	48	22	A-7-6(14)	ML-CL	
			38-46	C	96	25 c/	100	94	93	92	91	87	52	48	52	24	A-7-6(16)	MH-CH	
Dragston silt loam	Lancaster, Va. a/	Coastal Plain sediments	0-9	A	116	12			100	97	44	40	16	9	16	NP	A-4(2)	SM	
			9-27	B	121	11			100	97	45	40	23	16	21	3	A-4(2)	SM	
			35-60	C	104	15			100	98	15	10	10	8	21	NP	A-2-4(0)	SM	
Drifton very stony loam	Carbon, Pa. b/	Glacial till	19-27	B_g	122	11	100	48	46	41	25	23	11	9	22	3	A-1-b(0)	GM	
			33-40	C^g	124	10	100	54	51	46	27	26	11	8	19	5	A-2-4(0)	GM-GC	
	Carbon, Pa. b/	Same	14-25	B	110	17	100	86	83	78	69	67	38	27	32	9	A-4(7)	ML-CL	
			34-50+	C	111	15	100	84	81	76	67	65	39	28	33	10	A-4(6)	ML-CL	
	Carbon, Pa. b/	Same	18-23	B_C	120	11	100	77	75	60	41	39	21	15	24	5	A-4(1)	SM-SC	
			23-29	C^C	126	9	100	81	79	61	37	35	17	11	18	1	A-4(0)	SM	
Dubuque silt loam	Crawford, Wisc.	Loess over limestone	0-5	A	106	17				100	98	94	27	18	31	7	A-4(8)	ML-CL	
			8-16	B	106	20			100	99	97	95	37	29	36	13	A-6(9)	ML-CL	
			16-23	B	84	37	100	60	43	42	40	39	31	29	76	39	A-7-5(6)	GM	
	Crawford, Wisc.	Loess over shale and sandstone	0-7	A	89	26			100	99	94	91	22	11	41	7	A-5(8)	ML	
			19-29	B	106	21			100	99	94	91	34	30	40	18	A-6(11)	CL	
			29-44	B	91	29	100	89	72	69	58	56	45	44	64	33	A-7-5(15)	MH-CH	
	Crawford, Wisc.	Same	0-8	A	108	18				100	96	93	30	26	35	12	A-6(9)	ML-CL	
			12-18	B	107	19				100	98	95	34	28	40	17	A-6(11)	CL	
			18-36	B	94	27	100	87	64	60	47	46	38	36	58	31	A-7-6(10)	SC	
Dunbar fine sandy loam	McIntosh, Ga.	Pamlico marine terrace	0-5	A	113	11			100	95	34	26	8	6	NP	NP	A-2-4(0)	SM	
			17-24	B_g	123	11			100	96	55	35	19	15	21	5	A-4(4)	ML-CL	
			33-48	D_g	107	18			100	97	54	50	40	38	44	22	A-7-6(9)	CL	
	McIntosh, Ga.	Same	0-3	A	106	15			100	98	85	40	12	8	NP	NP	A-4(8)	ML or OL	
			9-16	B_g	118	13			100	99	60	54	28	23	26	11	A-6(5)	CL	
			21-31	D_g	102	20				100	75	72	50	48	54	26	A-7-6(17)	MH-CH	

a/ Tests performed by Virginia Department of Highways.
b/ Tests performed by Pennsylvania Department of Highways.
c/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D.C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE-DENSITY 2/: Maximum Dry Density	MOISTURE-DENSITY 2/: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 1/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 1/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	CLASSIFICATION: Unified 4/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Dyke loam	Rappahannock, Va. a/	Old colluvium	0-8	A	103	18			100	89	72	66	33	22	42	16	A-7-6(10)	ML-CL	
			18-29	D	101	22			100	93	79	78	65	59	55	26	A-7-6(17)	MH-CH	
			93-144+	C	90	30			100	98	88	79	60	50	74	34	A-7-5(20)	MH	
Efland silt loam	Saluda, S. C.	Carolina slate	0-8	A	117	13 c/	100	90	77	59	50	45	9	7	23	3	A-4(3)	SM	
			10-38	B	94	26			100	96	90	87	64	58	80	50	A-7-5(20)	CH	
			30-44	C	124	13 c/	100	94	68	57	35	31	13	10	30	12	A-2-6(1)	SC	
			44-62	Dr	127	13 c/	100	37	35	33	21	18	6	4	27	8	A-2-4(0)	GC	
Enterprise very fine sandy loam	Jackson, Okla. b/	Wind blown material	0-11	A					100	98	59	35	12	9	23	6	A-4(5)	ML-CL	
			12-30	AC					100	98	35	23	13	11	22	6	A-2-4(0)	SM-SC	
			34-53	C					100	97	28	18	12	10	22	5	A-2-4(0)	SM-SC	
Eubanks loam	Rappahannock, Va. a/	Granite and granodiorite	0-5	A	110	16			100	92	73	68	32	20	31	7	A-4(8)	ML-CL	
			17-26	B	102	22			100	95	80	79	58	50	52	18	A-7-5(14)	MH	
			79-96	C	104	19			100	86	63	59	26	20	37	NP	A-4(6)	ML	
Eulonia fine sandy loam	McIntosh, Ga.	Pamlico marine terrace	0-3.5	A	88	22			100	96	45	40	14	8	NP	NP	A-4(2)	SM	Mapped as Eulonia-Fairhope
			11-18	B	112	17			100	98	60	55	33	29	33	15	A-6(7)	CL	
			24-34	C	96	22			100	98	69	67	58	56	63	30	A-7-5(18)	MH-CH	
	McIntosh, Ga.	Same	0-4.5	A	107	12			100	97	29	24	9	5	NP	NP	A-2-4(0)	SM	Mapped as Eulonia-Fairhope
			14-22	B	119	13			100	97	41	36	25	23	28	10	A-4(1)	SC	
			33-43	D	114	15			100	98	35	31	26	25	32	12	A-2-6(0)	SC	
Eustis loamy sand	Gadsden, Fla.	Coastal Plain sediments	0-11	A	114	10			100	93	16	13	6	4	NP	NP	A-2-4(0)	SM	
			46-63	C	117	10			100	94	21	15	7	6	NP	NP	A-2-4(0)	SM	
			71-77+	D	123	11			100	96	36	31	23	22	24	10	A-4(0)	SC	
	Gadsden, Fla.	Same	0-6	A	116	10			100	95	18	14	6	4	NP	NP	A-2-4(0)	SM	
			24-39	B	119	9			100	96	20	16	9	9	NP	NP	A-2-4(0)	SM	
			44-55+	D	116	14			100	96	39	35	29	26	29	12	A-6(1)	SC	
Eustis coarse sand	Gadsden, Fla.	Same	3-12	A	114	10			100	48	10	8	5	4	NP	NP	A-1-b(0)	SP-SM	
			12-60	C	113	13			100	49	9	8	4	3	NP	NP	A-1-b(0)	SP-SM	
			90-104+	C	108	15			100	45	4	4	2	2	NP	NP	A-1-b(0)	SP	
Faceville loamy fine sand	Gadsden, Fla.	Coastal Plain sediments	7-14	A	117	13	100	99	98	92	31	26	19	17	20	5	A-2-4(0)	SM-SC	
			17-35	B	109	19			100	95	50	47	42	40	35	17	A-6(6)	SC	
			61-79	C	113	17			100	91	38	36	32	31	39	20	A-6(3)	SC	
	Gadsden, Fla.	Same	0-6	A	120	11	100	95	95	92	34	28	16	13	19	4	A-2-4(0)	SM-SC	
			9-43	B	112	16	100	96	95	92	54	49	38	36	35	17	A-6(6)	CL	
			54-65+	C	94	27			100	99	77	74	69	68	53	21	A-7-5(15)	MH	
	Gadsden, Fla.	Same	3-6	A	121	11	100	95	94	90	29	23	13	11	18	3	A-2-4(0)	SM	
			11-29	B	108	18	100	97	96	93	55	52	46	46	37	19	A-6(8)	CL	
			47-58+	C	98	25			100	98	71	69	62	62	50	22	A-7-6(14)	ML-CL	

a/ Tests performed by Virginia Department of Highways.

b/ Tests performed by Oklahoma Department of Highways.

c/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE-DENSITY 2/: Maximum Dry Density	MOISTURE-DENSITY 2/: Optimum Moisture	MECHANICAL ANALYSIS 1/ Percentage Passing Sieve 3/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	MECHANICAL ANALYSIS 1/ Percentage Smaller Than 3/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 3/	CLASSIFICATION: Unified 1/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Fairhope fine sandy loam	McIntosh, Ga.	Pamlico marine terrace	0-5	A	97	19			100	97	50	42	15	10	30	5	A-4(3)	SM	
			16-24	B	98	23			100	99	76	72	56	54	64	32	A-7-5(20)	MH-CH	
			32-47	C	97	22				100	77	73	58	56	61	30	A-7-5(20)	MH-CH	
	McIntosh, Ga.	Same	0-6	A	105	15			100	98	33	27	11	6	NP	NP	A-2-4(0)	SM	
			12-19	B	98	23			100	99	70	68	57	54	64	33	A-7-5(18)	MH-CH	
			28-41	C or D	105	18				100	62	58	45	42	55	30	A-7-6(15)	CH	
Falsington fine sandy loam	Lancaster, Va. a/	Coastal Plain sediments	3-7	A	117	12			100	96	40	36	14	8	19	NP	A-4(1)	SM	
			7-27	B	125	10			100	95	32	29	18	11	16	NP	A-2-4(0)	SM	
			34-65	C	103	14			100	98	10	10	8	6	21	NP	A-3(0)	SP-SM	
Flint fine sandy loam	Darlington, S. C.	Alluvium (terrace)	0-6	A	118	12			100	98	60	46	17	13	20	3	A-4(5)	ML	
			12-42	B	94	27				100	79	72	55	53	65	29	A-7-5(20)	MH	
			42-61+	C	103	21				100	58	52	39	36	49	22	A-7-6(10)	ML-CL	
Floyd silty clay loam	Dodge, Minn.	Glacial till (Iowan)	0-15	A	89	26			100	98	93	90	39	32	54	22	A-7-5(16)	MH or OH	
			33-52	C	125	11	100	93	92	83	52	46	24	19	27	13	A-6(4)	CL	
			52+	C	126	10	100	86	87	75	48	40	19	16	25	11	A-6(3)	SC	
	Dodge, Minn.	Same	0-12	A	92	23	100	98	98	92	78	76	35	28	57	24	A-7-5(17)	MH or OH	
			25-34	B	130	8	100	90	88	72	25	23	12	10	19	4	A-2-4(0)	SM-SC	
			40+	C	123	11	100	81	80	74	53	50	26	21	32	17	A-6(6)	CL	
	Dodge, Minn.	Same	0-15	A	89	28			100	99	94	91	40	34	56	23	A-7-5(16)	MH or OH	
			28-45	B	122	12	100	93	92	85	58	53	31	25	32	17	A-6(7)	CL	
			45+	C	122	12	100	91	89	81	58	52	28	23	31	17	A-6(7)	CL	
Galestown fine sand	McIntosh, Ga.	Old beach ridge	0-7	A	104	14			100	99	10	9	8	6	NP	NP	A-3(0)	SP-SM	
			12-29	B	104	14				100	9	9	8	7	NP	NP	A-3(0)	SP-SM	
			29-44	C_g	104	16				100	8	7	6	5	NP	NP	A-3(0)	SP-SM	
	McIntosh, Ga.	Same	2-10	B	104	14				100	10	9	7	6	NP	NP	A-3(0)	SP-SM	
			10-27	B	102	16				100	9	8	6	5	NP	NP	A-3(0)	SP-SM	
			27-43	C_g	102	17				100	20	10	7	6	NP	NP	A-2-4(0)	SM	
Georgeville silt loam	Saluda, S. C.	Carolina slate	0-9	A	105	18 b/	100	96	95	93	84	80	22	14	26	4	A-4(8)	ML-CL	
			9-38	B	100	23			100	99	96	94	52	38	60	29	A-7-5(20)	MH-CH	
			38-78	C	100	23			100	98	92	90	45	30	53	20	A-7-5(15)	MH	
Gilead sandy loam	Darlington, S. C.	Coastal Plain sediments	0-13	A	119	9			100	72	18	15	9	7	NP	NP	A-2-4(0)	SM	
			13-27	B and B_m	118	14			100	72	37	36	28	25	37	16	A-6(2)	SC	
			27-54+	C	101	22			100	94	86	83	65	52	53	23	A-7-5(16)	MH-CH	

a/ Tests performed by Virginia Department of Highways.
b/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum Dry Density	Moisture-density 2/: Optimum Moisture	Mechanical analysis 1/ — Percentage passing sieve 3/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 3/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	Classification: A.A.S.H.O. 4/	Classification: Unified 4/	REMARKS
			Inches		Lb./cu. ft.	Percent													
Halewood fine sandy loam	Oconee, S. C.	Aplitic granites and gneisses	2-10	A	101	21			100	89	59	55	35	29	39	13	A-6(6)	ML-CL	
			14-25	B	106	19			100	86	53	49	30	25	42	13	A-7-6(5)	ML	
			34-50	C	105	18			100	88	39	32	12	8	NP	NP	A-4(1)	SM	
			96-100	D_r	103	18			100	86	39	31	8	6	NP	NP	A-4(1)	SM	
	Oconee, S. C	Granite and gneiss	4-15	A	116	11			100	88	36	29	13	10	NP	NP	A-4(0)	SM	
			17-29	B	108	18	100	98	97	88	54	50	40	36	39	18	A-6(7)	CL	
			29-46	C	110	16			100	92	50	45	32	29	36	16	A-6(5)	SC	
	Oconee, S. C.	Same	2-8	A	111	14	100	91	88	72	30	25	12	9	NP	NP	A-2-4(0)	SM	
			10-22	B	112	16			100	88	49	43	27	24	28	7	A-4(3)	SM-SC	
			30-40	C	113	14			100	83	35	30	15	11	NP	NP	A-2-4(0)	SM	
Hartleton channery silt loam	Carbon, Pa. a/	Glacial till (Jerseyan)	20-28	B	124	10	100	35	28	24	12	11	5	4	20	0	A-1-a(0)	GP-GM	
			32-40	C	121	12	100	44	36	28	17	14	6	5	20	1	A-1-b(0)	GP-GM	
	Carbon, Pa. a/	Same	19-27	B	119	13	100	58	48	42	36	33	15	12	27	6	A-4(0)	GM-GC	
			31-38	C	117	14	100	52	44	38	34	30	15	12	29	8	A-2-4(0)	GM-GC	
	Carbon, Pa. a/	Same	22-29	B	121	11	100	26	20	14	12	11	5	4	27	6	A-1-a(0)	GP-GC	
			33-41	C	120	12	100	22	17	14	12	10	4	3	25	4	A-1-a(0)	GP-GM	
Hayesville fine sandy loam	Yadkin, N. C.	Granite gneiss	3-9	A			100	91	88	72	36	32	16	11	NP	NP	A-4(0)	SM	
			25-31	B					100	86	61	57	44	42	46	18	A-7-6(9)	ML-CL	
			35-40+	C			100	92	88	69	43	40	32	30	45	12	A-7-5(2)	SM	
	Oconee, S. C.	Granite and gneiss	2-10	A	105	16	100	99	99	90	52	48	30	24	31	11	A-6(4)	CL	Mapped as Cecil and Hayesville
			14-28	B	104	21	100	97	96	88	60	57	41	36	45	19	A-7-6(9)	ML-CL	
			36-58	C	103	21			100	92	58	53	34	26	41	14	A-7-6(6)	ML-CL	
			60-84	D_r	103	18			100	81	38	33	13	10	NP	NP	A-4(1)	SM	
	Oconee, S. C.	Same	1.5-6	A	118	11			100	96	48	38	16	11	NP	NP	A-4(3)	SM	Mapped as Cecil and Hayesville
			16-40	B	108	18			100	95	61	54	36	32	40	17	A-6(8)	CL	
			40-70	C	105	20			100	96	63	55	37	33	45	18	A-7-6(10)	ML-CL	
	Oconee, S. C	Same	2-11	A	111	15			100	87	36	31	18	14	24	4	A-4(0)	SM-SC	Mapped as Cecil and Hayesville
			11-27	B	109	17			100	91	55	51	37	32	36	13	A-6(5)	ML-CL	
			60-70	C	114	14	100	97	97	83	38	32	19	16	30	7	A-4(1)	SM-SC	
Hazleton very stony loam	Carbon, Pa. a/	Glacial till (Jerseyan)	20-30	B	119	14	100	73	68	58	42	41	20	15	30	7	A-4(1)	SM-SC	
			38-44	C	122	12	100	78	74	56	36	35	22	17	30	9	A-4(0)	SM-SC	
	Carbon, Pa. a/	Glacial till (Illinoian)	24-36	B	114	16	100	68	67	64	45	42	29	25	32	11	A-6(2)	GC	
			42-54	C	110	17	100	98	97	94	66	63	47	43	35	12	A-6(7)	ML-CL	
	Carbon, Pa. a/	Same	10-22	B	125	10	100	66	61	45	27	26	15	11	22	4	A-2-4(0)	SM-SC	
			29-37	C	126	9	100	64	63	48	28	27	15	12	18	3	A-2-4(0)	GM-SM	

a/ Tests performed by Pennsylvania Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum dry density	Moisture-density 2/: Optimum moisture	Mechanical analyses 3/: Percentage passing sieve 3/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 3/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 4/	Classification: Unified 5/	Remarks
			Inches		Lb./cu.ft.	Percent													
Helena sandy loam	Douglas, Ga.	Granite	0-6	A	122	10			100	79	28	23	10	8	NP	NP	A-2-4(0)	SM	
			6-15	B	103	20			100	90	64	60	47	41	50	24	A-7-6(13)	ML-CL	
			23-80	C	100	21			100	88	51	46	27	25	51	19	A-7-5(7)	MH	
	Douglas, Ga.	Granite and some diabase	0-8	A	122	9 a/	100	96	96	78	24	20	6	3	NP	NP	A-2-4(0)	SM	
			11-29	B	122	12			100	85	51	48	30	25	31	15	A-6(5)	CL	
			36-80	C	114	15 a/	100	99	99	86	54	51	35	30	37	18	A-6(7)	CL	
	Douglas, Ga.	Granite	0-6	A	121	11			100	78	29	25	13	9	20	3	A-2-4(0)	SM	
			6-23	B	99	22			100	90	69	67	51	47	62	32	A-7-5(18)	MH-CH	
			29-80	C	103	20			100	87	53	48	30	25	47	17	A-7-5(7)	ML	
Herndon silt loam	Saluda, S. C.	Carolina slate	0-9	A	105	15 a/	100	98	97	94	85	78	13	9	NP	NP	A-4(8)	ML	
			9-37	B	109	19			100	97	92	89	41	34	44	20	A-7-6(13)	CL	
			37-73	C	98	24			100	99	95	92	56	47	66	36	A-7-5(20)	CH	
Hivassee loam	Rappahannock, Va. a/	Alluvial terrace	0-5	A	101	20			100	85	66	45	12	7	37	4	A-4(6)	ML	
			15-67	B	91	29			100	97	90	88	76	72	57	13	A-7-5(13)	MH	
Hollister clay loam	Haskell, Tex. b/	Permian clays and shales	8-14	B					100	99	92	89	35	23	49	25	A-7-6(16)	CL	
			14-32	B				100	99	99	93	87	36	28	54	30	A-7-6(19)	CH	
			52-72+	C_{ca}					100	99	94	94	65	55	47	27	A-7-6(16)	CL	
	Haskell, Tex. b/	Same	9-13	B					100	99	88	80	30	18	45	21	A-7-6(13)	CL	
			13-38	B				100	99	98	90	84	35	27	54	30	A-7-6(19)	CH	
			58-72+	C_{ca}				100	99	95	88	88	60	32	43	25	A-7-6(15)	CL	
	Haskell, Tex. b/	Same	6-15	B						100	88	78	33	27	38	20	A-6(12)	CL	
			15-30	B					100	99	87	79	47	42	51	30	A-7-6(18)	CH	
			52-72+	C_{ca}				100	95	88	76	68	38	32	41	24	A-7-6(14)	CL	
	Jackson, Okla. c/	Red beds	0-8	A					100	98	82	68	31	25	34	12	A-6(9)	ML-CL	
			8-20	B					100	99	88	76	42	36	46	23	A-7-5(14)	CL	
			30-50	C					100	97	90	76	45	40	49	26	A-7-6(16)	ML-CL	
Iredell fine sandy loam	Yadkin, N. C.	Mafic rock	6-11	A			100	97	88	79	54	47	10	5	NP	NP	A-4(4)	ML	
			11-22	B					100	99	89	85	67	60	84	49	A-7-5(20)	CH	
			22-30+	C					100	99	81	77	53	46	64	37	A-7-6(20)	CH	

a/ Tests performed by Virginia Department of Highways.
b/ Tests performed by Texas Highway Department.
c/ Tests performed by Oklahoma Department of Highways.
d/ Based on AASHO Designation T 99-57, Method C

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum dry density	Moisture-density 2/: Optimum moisture	Mechanical analysis 1/, Percentage passing sieve 1/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 1/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu. ft.	Percent													
Keith loam	Kimball, Nebr.	Loess	0-5	A	112	15			100	91	70	58	22	19	28	8	A-4(7)	CL	
			10-18	B	101	21			100	98	89	79	36	31	40	17	A-6(11)	CL	
			40-57	C	111	15			100	96	79	60	18	14	26	5	A-4(8)	ML-CL	
	Kimball, Nebr.	Same	0-6	A	108	16			100	96	80	68	26	21	30	10	A-4(8)	CL	
			11-17	B	100	21				100	93	82	36	30	41	17	A-7-6(11)	ML-CL	
			41-55	C	106	17				100	89	73	21	16	26	4	A-4(8)	ML-CL	
	Kimball, Nebr.	Same	0-6	A	108	17	100	99	97	91	78	66	24	20	30	9	A-4(8)	ML-CL	
			8-14	B	97	21			100	98	89	80	40	36	47	24	A-7-6(15)	CL	
			20-29	C_{ca}	103	20			100	99	92	79	27	20	32	8	A-4(8)	ML-CL	
	Kimball, Nebr.	Same	0-5	A	120	11			100	83	40	31	14	11	22	5	A-4(1)	SM-SC	
			9-14	B	114	14			100	90	48	38	19	17	28	10	A-4(3)	SC	
			34-59	C	119	13			100	91	46	31	12	10	23	5	A-4(2)	SM-SC	
	Kimball, Nebr.	Loess over Tertiary sediments, with granitic gravel and limestone fragments	0-6	A	109	15	100	98	95	86	72	62	22	18	30	8	A-4(7)	ML-CL	
			11-20	B	102	20			100	95	84	77	38	33	46	23	A-7-6(14)	CL	
			23-28	C	105	18			100	95	78	68	28	21	35	13	A-6(9)	ML-CL	
	Kimball, Nebr.	Loess over Tertiary gravel and sand-stone fragments	0-6	A	112	14	100	99	96	84	63	54	23	16	28	9	A-4(6)	CL	
			9-15	B	104	19			100	92	79	70	35	31	44	22	A-7-6(14)	CL	
			15-25	C_{ca}	108	17			100	94	75	63	26	19	30	10	A-4(8)	CL	
	Kimball, Nebr.	Loess over Tertiary sediments	0-6	A	112	14		100	99	95	61	47	21	17	25	6	A-4(5)	ML-CL	
			10-15	B	112	15			100	96	67	51	25	20	28	9	A-4(6)	CL	
			26-32	C	106	18			100	98	80	65	27	20	30	9	A-4(8)	ML-CL	
	Kimball, Nebr.	Loess over Tertiary sediments with granitic gravel and limestone fragments	0-6	A	111	14			100	86	63	53	22	17	28	9	A-4(6)	CL	
			10-20	B	107	16			100	89	67	59	29	24	37	18	A-6(10)	CL	
			23-30	C	110	15			100	93	70	58	27	21	31	11	A-6(7)	CL	
Keith fine sandy loam	Dundy, Nebr.	Loess-like Tertiary material	0-6	A	116	11			100	85	18	11	5	3	NP	NP	A-2-4(0)	SM	
			10-19	B	114	16			100	97	55	43	22	19	32	13	A-6(5)	CL	
			34-47	D	112	16			100	99	80	54	20	15	29	8	A-4(8)	ML-CL	
	Dundy, Nebr.	Same	0-5	A	118	13			100	96	42	27	13	11	21	3	A-4(1)	SM	
			10-18	B	115	14			100	99	57	37	17	16	27	6	A-4(4)	ML-CL	
			42-60	C_b	111	16				100	79	50	16	12	27	5	A-4(8)	ML-CL	
Kenyon silt loam	Dodge, Minn.	Wind-deposited material over glacial till (Iowan)	0-9	A	89	25	100	99	99	96	87	85	37	29	52	19	A-7-5(14)	MH	
			42-54	C	121	12	100	91	90	82	50	47	27	23	32	17	A-6(6)	SC	
			54+	C	122	12	100	87	85	76	54	49	27	22	31	17	A-6(6)	CL	
	Dodge, Minn.	Same	0-12	A	98	21	100	98	98	95	84	82	34	27	42	16	A-7-6(11)	ML-CL	
			32-48	B	118	13	100	94	93	86	60	55	31	25	35	18	A-6(8)	CL	
			48+	C	121	12	100	86	84	76	54	50	27	22	29	14	A-6(5)	CL	
	Dodge, Minn.	Same	0-12	A	96	22	100	99	99	95	83	81	38	31	42	16	A-7-6(11)	ML-CL	
			31-48	B	115	13	100	92	90	84	63	60	31	26	39	22	A-6(10)	CL	
			48-60	C	122	12	100	93	91	82	57	53	29	24	30	15	A-6(6)	CL	

FHA-Wash., D.C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum dry density	Moisture-density 2/: Optimum moisture	Mechanical analysis 3/ Percentage passing sieve 4/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 4/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 5/	Classification: Unified 6/	Remarks
			Inches		Lb./cu. ft.	Percent													
Klinesville channery silt loam	Carbon, Pa. a/	Glacial till (Jerseyan)	5-13	B	122	12	100	31	20	12	10	10	6	4	33	9	A-2-4(0)	GP-GC	5% discarded in sampling
			13-20	C	116	16	100	16	11	7	5	5	3	2	31	6	A-1-a(0)	GW-GM	30% " " "
	Carbon, Pa. a/	Same	9-18	B	134	9	100	34	19	6	4	4	3	3	29	7	A-2-4(0)	GW	
			18-28	C	132	8	100	53	29	9	4	4	3	3	20	1	A-1-a(0)	SW	
	Carbon, Pa. a/	Same	9-18	B	112	14	100	24	21	16	11	11	6	5	30	4	A-1-a(0)	GP-GM	
			18-31	C			100	4	4	3	2	2	1	1	28	5	A-1-a(0)	GP	
							(Samples not corrected for material discarded larger than 3 inches.)												
Kodiak silt loam	Kodiak Island, Alaska	Volcanic ash over glacial till	2-6	Ash	70	33				100	70	66	13	6	NP	NP	A-4(7)	ML	Volcanic ash
			8-11	Ash	63	39			100	98	18	17	10	6	NP	NP	A-2-4(0)	SM	
			15-23	A_b	51	67			100	98	72	66	17	8	NP	NP	A-4(7)	ML or OL	
	Kodiak Island, Alaska	Same	2-4	Ash	72	33				100	71	67	12	6	NP	NP	A-4(7)	ML	Volcanic ash
			5-7	Ash	65	35			100	99	15	14	7	5	NP	NP	A-2-4(0)	SM	
			10-15	A_b	66	45	100	81	78	72	49	44	17	11	NP	NP	A-4(3)	SM	
			19-27	C	113	15	100	83	72	51	33	30	14	9	NP	NP	A-2-4(0)	SM	
	Kodiak Island, Alaska	Same	1-3	Ash	76	28				100	57	53	13	7	NP	NP	A-4(4)	ML	Volcanic ash
			5-9	Ash	69	35			100	99	27	25	10	6	NP	NP	A-2-4(0)	SM	
			12-19	A_b	55	62			100	98	76	70	19	11	NP	NP	A-4(8)	ML or OL	
			23-36+	CD	103	20	100	83	75	64	52	50	20	11	35	4	A-4(3)	ML	
La Casa clay loam	Jackson, Okla. b/	Red beds	0-10	A					100	99	94	78	32	24	36	12	A-6(9)	ML-CL	
			11-27	B					100	99	97	89	50	41	46	20	A-7-6(13)	ML-CL	
			38-68	C					100	98	88	83	55	47	51	26	A-7-6(17)	CH	
Lakeland coarse sand	Gadsden, Fla.	Coastal Plain sediments	2-5	A	114	10			100	64	9	8	5	4	NP	NP	A-3(0)	SP-SM	
			11-31	C	113	12			100	64	9	8	5	4	NP	NP	A-3(0)	SP-SM	
			55-74	C	114	12			100	68	9	7	5	4	NP	NP	A-3(0)	SP-SM	
			74-82+	D	124	10			100	68	24	22	16	15	23	8	A-2-4(0)	SC	
	Gadsden, Fla.	Same	2-8	A	105	13			100	78	7	6	4	3	NP	NP	A-3(0)	SP-SM	
			60-86	C	106	14			100	76	7	6	3	2	NP	NP	A-3(0)	SP-SM	
			86-110	C	102	16			100	74	4	3	2	2	NP	NP	A-3(0)	SP	
Lakeland loamy sand	Gadsden, Fla.	Same	0-4	A	120	11			100	80	32	28	13	11	NP	NP	A-2-4(0)	SM	
			14-39	C	125	9			100	68	18	16	12	10	NP	NP	A-2-4(0)	SM	
			39-68+	D	125	10	100	94	88	54	20	18	12	11	23	5	A-2-4(0)	SM-SC	
Leadvale loam	Cullman, Ala.	Colluvial fan accumulations	0-8	A			100	88	81	73	34	29	7	5	NP	NP	A-2-4(0)	SM	
			10½-17½	B			100	96	91	86	61	57	27	20	30	9	A-4(5)	ML-CL	
			17½-26	B_m			100	92	86	78	57	43	28	21	33	10	A-4(4)	ML-CL	
			26-33	B_m			100	98	96	93	72	68	34	25	35	11	A-6(8)	ML-CL	
			33-55+	C			100	70	60	50	33	30	16	12	32	9	A-2-4(0)	SM-SC	
	Cullman, Ala.	Same	0-8	A			100	96	89	83	68	59	16	11	26	4	A-4(7)	ML-CL	
			12-33	B			100	94	90	84	74	68	27	17	29	7	A-4(8)	ML-CL	
			33-72+	B_m			100	80	74	68	59	56	26	18	33	9	A-4(5)	ML-CL	
	Cullman, Ala.	Same	0-8	A			100	99	98	94	79	70	19	13	24	2	A-4(8)	ML	
			8-26	B			100	97	96	93	80	74	26	17	26	5	A-4(8)	ML-CL	
			26-44	B_m			100	97	96	93	79	72	26	17	25	5	A-4(8)	ML-CL	
			44-68+	B_m			100	95	94	90	77	72	29	21	29	7	A-4(8)	ML-CL	

a/ Tests performed by Pennsylvania Department of Highways.
b/ Tests performed by Oklahoma Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE-DENSITY 1/		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 1/					Percentage Smaller Than 1/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 1/	Unified 1/	
			Inches		Lb./cu. ft.	Percent													
Lehew shaly loam	Calhoun, Ala.	Shale and sandstone	4-12	A	111	14	100	96	86	71	64	58	21	12	23	3	A-4(6)	ML	
			12-20	BC	112	15	100	98	88	74	64	59	23	14	25	4	A-4(6)	ML-CL	
			20-30	C	110	16	100	99	91	79	67	63	26	16	28	5	A-4(6)	ML-CL	
	Calhoun, Ala.	Same	0-5	A	111	16			100	92	76	64	29	20	24	4	A-4(8)	ML-CL	
			7-30	C	107	20			100	89	73	64	40	33	33	10	A-4(8)	ML-CL	
Lehew shaly very fine sandy loam	Calhoun, Ala.	Same	4-13	A	111	16	100	98	96	89	74	61	21	13	24	2	A-4(8)	ML	
			13-17	C	110	18	100	83	74	64	55	48	18	13	28	4	A-4(4)	ML-CL	
Lenoir silt loam	Northumberland, Va. a/	Coastal Plain sediments	0-7	A	106	16			100	99	90	82	19	8	25	1	A-4(8)	ML	
			7-16	B	116	14		100	99	94	83	80	35	25	29	7	A-4(8)	ML-CL	
			16-36	B	113	16		100	98	88	64	59	41	35	40	17	A-6(9)	CL	
			36-72	C	98	23			100	98	92	89	62	52	60	30	A-7-5(20)	MH-CH	
Lloyd clay loam	Douglas, Ga.	Diabase with very little mica	0-5	A	130	10 b/	100	96	93	83	36	33	19	15	17	3	A-4(0)	SM	
			9-32	B	110	17 b/	100	99	97	89	63	61	48	44	43	21	A-7-6(10)	CL	
			64-80	C	100	24			100	90	69	67	49	42	50	16	A-7-5(11)	ML	
	Douglas, Ga.	Diabase and mica schist	0-6	A	116	14 b/	100	96	90	83	38	34	23	20	27	8	A-4(1)	SC	
			6-21	B	102	23 b/	100	98	96	90	65	62	47	42	55	25	A-7-5(14)	MH-CH	
			33-60	C	102	21			100	98	56	52	27	22	45	11	A-7-5(5)	ML	
	Douglas, Ga.	Same	0-5	A	108	16 b/	100	98	93	82	46	42	24	20	31	9	A-4(2)	SM-SC	
			5-22	B	100	23			100	92	69	66	51	48	54	26	A-7-6(16)	MH-CH	
			31-80	C	104	21			100	83	43	40	25	23	42	14	A-7-6(3)	SM	
Lloyd loam	Yadkin, N. C.	Red and black mafic rock containing some mica	0-6	A					100	96	72	68	39	26	42	12	A-7-5(9)	ML	
			19-38	B					100	98	86	83	63	54	78	35	A-7-5(20)	MH	
			53-90	C					100	98	83	78	41	33	68	18	A-7-5(15)	MH	
Lloyd sandy loam	Oconee, S. C.	Hornblende gneiss	2-7	A	118	12	100	94	93	87	35	30	19	16	20	4	A-2-4(0)	SM-SC	
			10-24	B	95	26			100	97	71	69	63	58	52	24	A-7-6(15)	MH-CH	
			40-60	C	115	15			100	95	38	34	23	18	29	7	A-4(1)	SM-SC	
Louisa fine sandy loam	Douglas, Ga.	Mica schist	2-8	A	114	15 b/	100	92	77	66	45	40	16	12	34	17	A-6(4)	SC	
			8-27	C	116	15 b/	100	98	89	76	51	46	25	20	32	8	A-4(3)	ML-CL	
	Douglas, Ga.	Mica schist with some diabase	0-6	A	106	17 b/	100	92	80	66	42	38	13	8	40	6	A-4(1)	SM	
			6-26	C	118	14 b/	100	97	85	65	41	37	15	11	30	3	A-4(1)	SM	
	Douglas, Ga.	Mica schist	0-7	A	110	15 b/	100	99	96	87	58	50	19	14	28	4	A-4(5)	ML-CL	
			7-18	B	102	21			100	94	74	69	43	36	51	22	A-7-6(15)	MH-CH	
			24-34	C	110	16 b/	100	98	96	89	60	56	24	17	36	9	A-4(5)	ML	

a/ Tests performed by Virginia Department of Highways.
b/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum dry density	Moisture-density 2/: Optimum moisture	Mechanical analysis 2/ — Percentage passing sieve 3/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Mechanical analysis — Percentage smaller than 3/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 4/	Remarks
			Inches		Lb./cu.ft.	Percent													
Louisburg loamy sand	Douglas, Ga.	Granite	0-7	A	125	10			100	72	37	33	12	9	18	3	A-4(0)	SM	Mapped as Louisburg complex
			13-30	B	102	20			100	81	62	59	42	39	58	27	A-7-5(15)	MH-CH	
			30-34	C	110	16			100	73	45	41	30	27	43	16	A-7-6(4)	SM-SC	
	Douglas, Ga.	Same	0-7	A	124	10 a/	100	98	91	58	30	26	10	6	20	2	A-2-4(0)	SM	Mapped as Louisburg complex
			15-28	B	104	19			100	78	58	56	43	39	59	29	A-7-5(14)	MH-CH	
			28-46	C	110	16 a/	100	98	90	64	38	34	23	19	45	17	A-7-6(2)	SM	
	Douglas, Ga.	Same	0-6	A	115	12			100	80	28	23	10	7	NP	NP	A-2-4(0)	SM	Mapped as Louisburg complex
			13-23	C	116	13			100	82	27	23	10	7	NP	NP	A-2-4(0)	SM	
Luton silty clay	Washington, Nebr.	Alluvial clays (Flood plain)	6-12	A_b	89	29					100	98	75	64	87	53	A-7-5(20)	CH	* Flocculation due to calcium sulfate
			24-33	A_b	90	30			100	99	96	*	*	*	90	58	A-7-5(20)	CH	
			50-60	C_{cab}	91	29				100	98	*	*	*	100	63	A-7-5(20)	CH	
	Washington, Nebr.	Same	0-5	A	89	28					100	99	77	65	78	44	A-7-5(20)	MH-CH	
			16-26	A_b	88	29					100	98	84	71	92	55	A-7-5(20)	CH	
			46-60	C_{gca}	90	29			100	99	98	97	80	66	93	53	A-7-5(20)	MH-CH	
Madison gravelly fine sandy loam	Douglas, Ga.	Mica schist	0-6	A	118	12 a/	100	97	95	89	32	27	11	9	NP	NP	A-2-4(0)	SM	
			8-32	B	103	21			100	98	63	60	50	45	47	21	A-7-6(11)	ML-CL	
			61-80+	C	109	18 a/	100	99	98	87	38	32	22	19	NP	NP	A-4(0)	SM	
	Douglas, Ga.	Same	0-5	A	126	10 a/	100	97	89	76	26	21	10	8	NP	NP	A-2-4(0)	SM	
			8-17	B	112	18 a/	100	99	94	86	61	59	50	44	40	19	A-6(9)	CL	
			21-38	C	117	15 a/	100	95	87	76	43	39	30	27	38	14	A-6(3)	SM-SC	
	Douglas, Ga.	Same	0-9	A	109	16 a/	100	97	97	93	46	43	25	16	28	6	A-4(2)	SM-SC	
			22-44	B	102	23			100	98	66	64	49	42	53	22	A-7-5(13)	MH	
			44-72+	C	104	20			100	98	55	52	33	27	43	13	A-7-5(6)	ML	
Madison sandy loam	Cherokee, S. C.	Mica schist	0-6	A			100	91	86	71	37	33	26	11	19	4	A-4(0)	SM-SC	Mapped as Madison and Cecil
			20-45	B	91	30 a/	100	99	98	94	81	78	66	63	62	24	A-7-5(18)	MH	
	Cherokee, S. C.	Quartz mica schist	0-5	A			100	72	64	58	24	20	11	8	NP	NP	A-2-4(0)	SM	Mapped as Madison and Cecil
			5-22	B	92	28			100	96	78	74	59	51	66	25	A-7-5(18)	MH	
			37+	C	105	20			100	84	42	37	19	14	46	10	A-5(2)	SM	
	Cherokee, S. C.	Schist	0-4	A			100	80	70	62	31	24	9	6	NP	NP	A-2-4(0)	SM	Mapped as Madison and Cecil
			4-38	B	100	24 a/	100	96	92	88	72	70	60	55	50	22	A-7-6(14)	ML-CL	

a/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface		Moisture-density 2/		Mechanical analysis 3/								Liquid limit	Plasticity index	Classification		Remarks
							Percentage passing sieve 4/					Percentage smaller than 4/							
			Depth	Horizon	Maximum dry density	Optimum moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 5/	Unified 6/	
			Inches		Lb./cu. ft.	Percent													
Magnolia loamy fine sand	Gadsden, Fla.	Coastal Plain sediments	0-6	A	120	10			100	96	26	20	11	10	NP	NP	A-2-4(0)	SM	
			12-48	B	114	15			100	97	51	46	38	35	37	20	A-6(7)	CL	
			128-168+	C	111	17			100	97	46	45	41	39	44	23	A-7-6(6)	SC	
	Gadsden, Fla.	Same	0-4	A	121	11			100	97	33	25	15	12	NP	NP	A-2-4(0)	SM	
			12-49	B	114	15			100	98	55	44	36	34	35	15	A-6(6)	CL	
			63-72+	C	113	16			100	98	37	31	25	22	34	13	A-6(1)	SC	
	Gadsden, Fla.	Same	0-7	A	117	13			100	97	34	29	21	18	22	7	A-2-4(0)	SM-SC	
			9-38	B	106	19			100	98	54	51	46	43	40	19	A-6(7)	CL	
			48-65+	C	114	15			100	98	32	28	25	23	34	13	A-2-6(1)	SC	
Marshall silt loam	Shelby, Iowa	Loess	0-7	A	97	21				100	99	95	37	32	43	18	A-7-6(12)	ML-CL	
			11-18	B	97	22					100	97	43	35	52	24	A-7-6(16)	MH-CH	
			29-40	C	104	19					100	97	37	31	45	21	A-7-6(13)	CL	
	Shelby, Iowa	Same	0-6	A	99	21				100	99	96	41	34	44	17	A-7-6(12)	ML-CL	
			12-17	B	102	19					100	97	38	32	46	20	A-7-6(13)	ML-CL	
			23+	C	104	19					100	97	35	30	41	17	A-7-6(11)	ML-CL	
	Washington, Nebr.	Peorian loess	5-12	A	97	22					100	97	42	36	48	19	A-7-6(13)	ML-CL	
			24-36	B	99	22					100	97	45	39	57	31	A-7-6(19)	CH	
			48-60	C	104	20					100	97	40	35	49	26	A-7-6(16)	CL	
	Washington, Nebr.	Same	6-12	A	98	23					100	97	40	35	45	20	A-7-6(13)	ML-CL	
			25-36	B	99	22					100	98	43	39	55	27	A-7-6(18)	MH-CH	
			45-60	C	105	21					100	97	37	32	47	24	A-7-6(15)	CL	
Marshall silty clay loam	Washington, Nebr.	Same	0-6	A	99	21					100	97	40	34	44	18	A-7-6(12)	ML-CL	
			17-27	B	101	22					100	97	39	34	52	25	A-7-6(16)	MH-CH	
			54-65	C	107	19					100	95	35	28	43	19	A-7-6(12)	CL	
	Washington, Nebr.	Same	0-7	A	101	20					100	97	38	33	44	17	A-7-6(12)	ML-CL	
			15-25	B	104	21					100	97	36	32	49	23	A-7-6(15)	ML-CL	
			47-60	C	107	19					100	97	35	30	42	18	A-7-6(12)	ML-CL	
Matapeake silt loam	Northumberland, Va. a/	Coastal Plain sediments	0-9	A	115	13			100	90	68	62	15	8	23	3	A-4(7)	ML	
			9-32	B	118	14			100	92	69	63	27	20	26	8	A-4(7)	CL	
			40-66	C	123	11	100	98	90	58	14	12	5	5	15	NP	A-2-4(0)	SM	
Mayodan fine sandy loam	Yadkin, N. C.	Triassic sandstone and shale	3-8	A			100	85	82	78	71	70	52	45	73	35	A-7-5(20)	MH	
			11-24	B			100	97	95	84	61	54	16	11	NP	NP	A-4(5)	ML	
			32-40	C					100	94	84	81	55	44	73	33	A-7-5(20)	MH	

a/ Tests performed by Virginia Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum dry density	Moisture-density 2/: Optimum moisture	Mechanical analysis 3/ — Percentage passing sieve 4/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 5/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 6/	Classification: Unified 7/	Remarks
			Inches		Lb./cu.ft.	Percent													
Miles fine sandy loam	Haskell, Tex. a/	Old unconsolidated alluvium	0-8	A					100	98	34	27	10	8	17	3	A-4(0)	SM	
			8-15	B					100	97	40	37	22	17	27	14	A-6(2)	SC	
			15-39	B					100	98	48	47	29	25	31	17	A-6(5)	SC	
			39-72+	B						100	47	46	24	19	30	16	A-6(4)	SC	
	Haskell, Tex. a/	Same	0-8	A					100	98	40	36	20	18	18	3	A-4(1)	SM	
			8-16	B					100	97	50	48	33	30	31	15	A-6(5)	SC	
			16-46	B					100	98	56	54	36	34	33	18	A-6(7)	CL	
			46-72+	B					100	98	46	37	21	20	30	16	A-6(4)	SC	
	Haskell, Tex. a/	Same	0-8	A				100	98	94	27	23	12	11	16	3	A-2-4(0)	SM	
			8-15	B				100	99	93	30	28	21	20	21	5	A-2-4(0)	SM-SC	
			15-26	B				100	99	95	37	37	29	25	27	13	A-6(1)	SC	
			26-45	B					100	94	31	30	22	21	21	7	A-2-4(0)	SM-SC	
	Jackson, Okla. b/	Sandy earths	0-8	A					100	91	26	19	9	7	18	2	A-2-4(0)	SM	
			10-28	B					100	93	42	31	17	15	29	12	A-6(2)	SC	
			38-61	C					100	94	39	28	19	17	30	13	A-6(2)	SC	
	Jackson, Okla. b/	Same	0-12	A					100	93	38	30	11	10	19	5	A-4(1)	SM-SC	
			16-27	B					100	92	46	37	23	21	32	13	A-6(3)	SM	
			36-49	C					100	94	58	49	30	28	36	18	A-6(8)	CL	
	Jackson, Okla. b/	Same	0-13	A					100	95	49	37	14	12	20	5	A-4(3)	SM-SC	
			17-26	B					100	95	42	32	16	15	25	8	A-4(1)	SC	
			32-48	C					100	96	37	26	14	13	24	6	A-4(0)	SM-SC	
Monona silt loam	Shelby, Iowa	Loess	0-5	A	95	23				100	99	95	35	29	44	15	A-7-6(11)	ML	
			9-17	B or C	98	22					100	96	36	31	44	16	A-7-6(11)	ML-CL	
			28+	C	105	19					100	95	33	25	39	15	A-6(10)	ML-CL	
	Washington, Nebr.	Peorian loess	0-6	A	100	21					100	97	36	30	41	16	A-7-6(11)	ML-CL	
			15-27	B	104	20					100	97	37	30	49	24	A-7-6(15)	CL	
			47-62	C	105	20					100	97	33	27	45	21	A-7-6(13)	CL	
	Washington, Nebr.	Same	0-6	A	104	19					100	97	32	27	36	11	A-6(8)	ML-CL	
			22-34	B	105	20					100	97	32	28	44	19	A-7-6(12)	ML-CL	
			48-60	C	106	19					100	97	32	26	40	17	A-6(11)	CL	
Montevallo shaly silt loam	Calhoun, Ala.	Shale and sandstone	2-6	A	110	16	100	97	87	72	61	58	28	17	32	7	A-4(5)	ML-CL	
			6-15	C	109	17	100	95	84	70	60	58	32	22	37	11	A-6(5)	ML-CL	
	Calhoun, Ala.	Same	0-5	A	109	16	100	70	62	53	46	43	17	12	36	9	A-4(2)	GM	
			5-12	BC	112	16	100	94	89	82	75	67	32	23	34	11	A-6(8)	ML-CL	

a/ Tests performed by Texas Highway Department.
b/ Tests performed by Oklahoma Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES [1]

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE-DENSITY [2]		MECHANICAL ANALYSIS [3]								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve [4]					Percentage Smaller Than [4]							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. [5]	Unified [6]	
			Inches		Lb./cu.ft.	Percent													
Montevallo channery silt loam	Carbon, Pa. a/	Glacial till (Jerseyan)	5-12	B			100	24	21	14	12	12	7	4	40	6	A-1-a(0)	GP-GM	
			12-23	C			100	6	3	2	1	1	1	1	41	12	A-2-7(0)	GP	
	Carbon, Pa. a/	Same	11-27	B	116	15	100	66	34	15	11	11	6	4	47	17	A-2-7(0)	SP-SM	
			27-40	C	118	14	100	63	30	14	10	10	6	4	41	9	A-2-5(0)	SP-SM	
	Carbon, Pa. a/	Glacial till	2-7	B1r	85	30	100	15	10	8	6	5	2	2	88	1	A-1-a(0)	GW-GM	15% discarded in sampling
			7-26	C	127	11	100	39	14	5	4	4	3	2	36	5	A-1-a(0)	GP	15% " " "
							(Montevallo samples not corrected for material discarded larger than 3 inches.)												
Musella clay loam	Douglas, Ga.	Diabase and hornblende	0-6	A	124	13 c/	100	92	88	79	48	41	21	16	23	5	A-4(3)	SM-SC	
			6-20	B	113	18 c/	100	76	74	70	49	45	25	22	34	14	A-6(4)	SC	
	Douglas, Ga.	Diabase and granite	0-4	A	113	16 c/	100	97	93	84	54	50	35	30	33	15	A-6(6)	CL	
			4-17	B	100	21 c/	100	97	91	80	59	55	38	34	53	24	A-7-6(12)	MH-CH	
			17-40	C	98	24			100	87	60	54	30	26	42	13	A-7-6(6)	ML	
	Douglas, Ga.	Diabase	0-7	A	104	22 c/	100	93	92	84	64	60	35	29	42	17	A-7-6(9)	ML-CL	
			9-20	B	92	29			100	98	83	79	49	43	64	28	A-7-5(19)	MH	
			20-57	C	92	29			100	92	62	56	22	17	47	8	A-5(5)	ML	
Myersville stony silt loam	Rappahannock, Va. b/	Greenstone	0-5	A	81	34	82	45	43	35	30	23	9	6	51	6	A-5(1)	GM	18% discarded in sampling
			11-26	B	93	27	82		82	75	67	54	27	16	46	11	A-7-5(10)	ML	18% " " "
			26-46	C	91	27	82		82	79	75	64	30	16	47	6	A-5(9)	ML	18% " " "
Narragansett silt loam	Hartford, Conn.	Glacial till	0-6	A	93	23	99	95	95	93	82	71	16	11	36	6	A-4(8)	ML	5% discarded in sampling
			6-20	B	106	16	98	90	90	87	74	68	14	11	27	3	A-4(8)	ML	10% " " "
			26-40	D	110	13	95	81	78	69	27	17	3	2	NP	NP	A-2-4(0)	SM	15% " " "
Narragansett stony silt loam	Hartford, Conn.	Same	0-5.25	A	96	20	83	74	73	65	50	45	12	9	NP	NP	A-4(5)	ML	25% discarded in sampling
			5.25-16	B	115	13	77	66	62	54	39	35	8	8	NP	NP	A-4(3)	ML	30% " " "
			22-40	D	124	9	85	70	66	55	32	27	8	5	NP	NP	A-4(1)	SM	25% " " "
	Hartford, Conn.	Same	0.5-6	A	99	19	100	96	96	89	71	63	17	12	33	4	A-4(7)	ML	4% discarded in sampling
			6-24	B	114	13	100	91	89	82	60	51	16	13	23	2	A-4(5)	ML	5% " " "
			27-40	D	125	8	100	84	79	63	29	23	10	6	NP	NP	A-2-4(0)	SM	10% " " "
							(Narragansett samples corrected for material discarded larger than 1 inch.)												
Mason very fine sandy loam	Cherokee, S. C.	Schist	1-6	A			100	96	96	95	90	78	20	14	25	5	A-4(8)	ML-CL	
			10-32	B	101	22				100	99	94	46	39	54	24	A-7-5(16)	MH-CH	
			45+	C	106	18				100	98	90	25	17	38	10	A-4(8)	ML	
Mason gravelly very fine sandy loam	Cherokee, S. C.	Same	0-6	A			100	94	92	76	41	34	12	8	NP	NP	A-4(1)	SM	
			18-35	B	96	25			100	92	82	78	54	47	63	30	A-7-5(20)	ML-CL	
			35+	C					100	86	70	66	28	21	39	13	A-6(8)	ML-CL	
Mason very fine sandy loam	Cherokee, S. C.	Same	0-6	A			100	93	88	78	50	45	24	16	26	5	A-4(3)	SM-SC	
			15-40	B	96	26			100	92	78	75	55	47	61	24	A-7-5(18)	MH	
			40+	C	103	21			100	91	66	61	33	28	44	14	A-7-5(8)	ML	

a/ Tests performed by Pennsylvania Department of Highways.
b/ Tests performed by Virginia Department of Highways.
c/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum dry density	Moisture-density 2/: Optimum moisture	Mechanical analysis 1/ — Percentage passing sieve 3/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 3/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 3/	Classification: Unified 3/	Remarks
			Inches		Lb./cu.ft.	Percent													
Hobscot fine sand	Jackson, Okla. a/	Sandy earths of plains outwash	0-30	A					100	86	15	8	3	3	NP	NP	A-2-4(0)	SM	
			30-39	B					100	82	15	12	10	10	21	5	A-2-4(0)	SM-SC	
			45-84	C					100	87	23	17	12	12	23	7	A-2-4(0)	SM-SC	
Norfolk loamy fine sand	Gadsden, Fla.	Coastal Plain sediments	2-8	A	114	11			100	95	57	19	9	6	NP	NP	A-4(4)	ML	
			16-47	B	114	15			100	97	49	44	35	33	33	14	A-6(4)	SC	
			64-85+	C	112	16			100	98	52	46	38	37	36	16	A-6(6)	CL	
	Gadsden, Fla.	Same	0-3	A	117	11			100	97	33	24	12	10	Np	Np	A-2-4(0)	SM	
			9-29	B	111	17			100	97	53	47	40	38	34	15	A-6(6)	CL	
			55-67+	C	103	21	100	98	96	93	56	50	42	41	42	17	A-7-6(7)	ML-CL	
	Gadsden, Fla.	Same	2-10	A	119	9			100	96	26	19	9	7	NP	NP	A-2-4(0)	SM	
			27-43	B	115	14			100	97	44	37	28	26	32	15	A-6(3)	SC	
			65-76+	C	109	18			100	98	51	46	37	36	40	17	A-6(6)	CL	
Orange silt loam	Saluda, S. C.	Mixed basic rocks and Carolina slate	0-9	A	108	18 c/	100	99	93	84	76	72	24	17	36	10	A-4(8)	ML-CL	
			9-29	B	101	22			100	96	92	91	53	45	63	33	A-7-5(20)	MH-CH	
			29-52	C	105	19			100	99	96	94	47	29	63	33	A-7-5(20)	MH-CH	
			55-78	D_r	107	17			100	98	93	90	37	19	52	22	A-7-5(15)	MH-CH	
Orangeburg loamy fine sand	Gadsden, Fla.	Coastal Plain sediments	0-6	A	118	11			100	93	26	21	10	8	NP	NP	A-2-4(0)	SM	
			16-38	B	116	15			100	96	27	20	12	10	34	16	A-2-6(1)	SC	
	Gadsden, Fla.	Same	3-7	A	119	11	100	97	96	92	46	40	33	32	NP	NP	A-4(0)	SM	
			10-36	B	106	20	100	98	98	95	58	54	50	49	44	19	A-7-6(9)	ML-CL	
			52-62+	C	101	22			100	97	60	57	50	50	46	18	A-7-6(9)	ML-CL	
	Gadsden, Fla.	Same	0-7	A	119	9			100	86	17	14	8	6	NP	NP	A-2-4(0)	SM	
			21-57	B	117	14			100	88	42	38	34	33	35	19	A-6(4)	SC	
			57-86+	C	110	18			100	91	50	47	42	42	43	17	A-7-6(6)	SM-SC	
Othello silt loam	Northumberland, Va. b/	Coastal Plain sediments	2-6	A	106	17			100	98	86	77	23	14	30	3	A-4(8)	ML	
			6-27	B	112	16			100	99	93	87	35	25	32	9	A-4(8)	ML-CL	
			35-55	C	111	10			100	98	13	11	7	3	14	NP	A-2-4(0)	SM	
Philo fine sandy loam	Calhoun, Ala.	Alluvium	8-17	A	119	11			100	98	64	54	19	13	19	3	A-4(6)	ML	
			24-66	Cbg	123	11	100	94	84	71	47	41	18	14	22	7	A-4(2)	SM-SC	
	Calhoun, Ala.	Same	5-17	A	112	13			100	99	85	75	20	14	23	4	A-4(8)	ML-CL	
			23-38	C	120	12	100	99	99	94	58	50	23	19	22	6	A-4(5)	ML-CL	
			38-74	C	125	10	80	48	44	35	21	18	9	7	21	5	A-2-4(0)	GM-GC	20% discarded in sampling
Philo silt loam	Calhoun, Ala.	Same	0-10	A	108	17				100	90	87	40	27	32	10	A-4(8)	ML-CL	
			18-62	C	109	17				100	95	92	43	28	32	11	A-6(8)	CL	

a/ Tests performed by Oklahoma Department of Highways.
b/ Tests performed by Virginia Department of Highways.
c/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE-DENSITY 2/		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 1/					Percentage Smaller Than 1/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 1/	Unified 1/	
			Inches		Lb./cu.ft.	Percent													
Portales fine sandy loam	Lamb, Tex. a/	Plains sediments (Pleistocene)	0-12	A					100	99	46	39	18	15	24	6	A-4(2)	SM-SC	
			36-72+	C_{ca}			100	95	87	80	47	42	28	23	28	14	A-6(4)	SC	
	Lamb, Tex. a/	Same	0-11	A					100	99	53	42	21	16	26	11	A-6(4)	CL	
			30-70	C_{ca}						100	89	78	58	55	50	28	A-7-6(17)	CL	
	Lamb, Tex. a/	Same	0-11	A			100	99	99	98	55	42	17	13	25	8	A-4(4)	CL	
			30-66	C_{ca}			100	95	91	88	66	59	47	33	30	15	A-6(8)	CL	
	Terry, Tex. a/	Same	0-7	A						100	30	27	12	10	19	3	A-2-4(0)	SM	
			36-60+	C_{ca}			100	98	91	88	40	39	23	22	33	17	A-6(3)	SC	
	Terry, Tex. a/	Same	0-12	A					100	99	53	47	19	15	25	9	A-4(4)	CL	
			35-70+	C_{ca}			100	95	93	91	57	54	41	32	30	17	A-6(7)	CL	
	Terry, Tex. a/	Same	0-10	A				100	99	98	18	17	9	8	18	3	A-2-4(0)	SM	
			10-40	AC					100	99	35	33	20	18	23	5	A-2-4(0)	SM-SC	
			40-60+	C_{ca}			100	90	82	71	40	39	28	20	27	10	A-4(1)	SC	
Pottsville shaly silt loam	Cullman, Ala.	Black fissile shale	0-5	A			100	88	84	74	70	68	33	18	35	7	A-4(7)	ML	
			5-9	AC			100	61	59	53	50	48	27	14	35	7	A-4(3)	GM	
	Cullman, Ala.	Interbedded shale and sandstone	3-10	A			100	78	75	66	50	45	17	10	25	4	A-4(3)	SM-SC	
			10-26	C			100	80	78	69	54	49	23	14	27	5	A-4(4)	ML-CL	
	Cullman, Ala.	Same	0-5	A			100	83	80	75	54	49	20	14	24	4	A-4(4)	ML-CL	
			5-12	B			100	97	97	95	89	87	61	50	58	24	A-7-5(17)	MH	
Purdy silt loam	Cullman, Ala.	Alluvium (terrace)	0-8	A						100	84	80	20	14	25	4	A-4(8)	ML-CL	
			15-36	B_g					100	99	85	80	35	28	32	11	A-6(8)	CL	
			36-72	B_{mg}					100	99	83	79	37	30	34	13	A-6(9)	CL	
	Cullman, Ala.	Same	0-9	A						100	97	90	22	16	29	6	A-4(8)	ML-CL	
			11-24	B_g					100	99	92	88	39	22	28	8	A-4(8)	CL	
			37-60	B_{mg}					100	99	96	93	54	37	38	14	A-6(10)	ML-CL	
			60-85	C_g					100	98	92	89	56	40	41	18	A-7-6(11)	CL	
	Cullman, Ala.	Same	7-21	B_g						100	84	80	27	17	20	3	A-4(8)	ML	
			21-30	B_g						100	89	86	42	31	30	11	A-6(8)	CL	
			40-72	B_g						100	88	84	42	33	36	15	A-6(10)	CL	
Randall clay	Lamb, Tex. a/	High Plains lake bed sediments	10-23	A					100	99	90	86	57	47	56	32	A-7-6(19)	CH	
	Lamb, Tex. a/	Same	11-29	A						100	77	71	45	40	41	24	A-7-6(14)	CL	
			50-68	AC						100	80	72	43	33	42	23	A-7-6(14)	CL	
	Lamb, Tex. a/	Same	0-18	A						100	47	38	20	18	24	5	A-4(2)	SM-SC	
			18-35	A					100	99	61	53	35	33	37	20	A-6(9)	CL	

a/ Tests performed by Texas Highway Department.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE-DENSITY 2/: Maximum Dry Density	MOISTURE-DENSITY 2/: Optimum Moisture	MECHANICAL ANALYSIS 3/ Percentage Passing Sieve 4/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 4/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 5/	CLASSIFICATION: Unified 6/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Rarden silt loam	Calhoun, Ala.	Shale	2-7	A	114	13	100	98	86	69	55	52	18	11	25	3	A-4(4)	ML	
			9-23	B	90	27	100	95	88	82	79	78	64	57	81	43	A-7-5(20)	MH-CH	
			23-30	C	102	21	100	88	76	66	59	58	47	40	63	31	A-7-5(15)	MH-CH	
	Calhoun, Ala.	Same	2-6	A	107	18	100	97	91	78	72	69	29	18	34	8	A-4(7)	ML	
			6-14	B	108	18			100	93	89	87	49	32	40	12	A-6(9)	ML	
			18-28	C	108	16			100	89	84	82	47	33	44	16	A-7-6(11)	ML-CL	
			28-63	D_r	118	13	100	90	74	65	59	56	25	15	32	10	A-4(5)	ML-CL	
	Calhoun, Ala.	Shale and sandstone	2-12	B	88	28	100	99	98	95	90	89	74	66	86	42	A-7-5(20)	MH	
			14-44	C	96	23			100	92	84	81	56	44	62	26	A-7-5(18)	MH	
Red Bay loamy fine sand	Gadsden, Fla.	Coastal Plain sediments	0-5	A	121	9			100	93	26	21	11	10	NP	NP	A-2-4(0)	SM	
			10-24	B	119	13			100	96	45	40	32	30	30	15	A-6(4)	SC	
	Gadsden, Fla.	Same	0-9	A	120	8			100	81	17	14	8	8	NP	NP	A-2-4(0)	SM	
			19-68	B	118	13			100	86	39	37	31	31	30	16	A-6(2)	SC	
			110-150+	C	123	11			100	84	25	23	20	18	24	8	A-2-4(0)	SC	
	Gadsden, Fla.	Same	0-8	A	122	10			100	85	21	18	11	9	NP	NP	A-2-4(0)	SM	
			24-72	B	116	14			100	86	40	38	34	32	33	17	A-6(3)	SC	
			72-122+	C	120	13			100	79	33	26	23	22	30	13	A-2-6(0)	SC	
Roche loam	San Juan, Wash.	Vashon glacial drift	0-9	B_{ir}	106	16	100	96	93	86	58	51	21	13	25	3	A-4(5)	ML	
			17-24	A,B or C	121	12	100	98	96	90	58	49	22	13	18	3	A-4(5)	ML	
			34-48	C	125	10	100	96	93	86	51	45	21	13	18	4	A-4(3)	ML-CL	
	San Juan, Wash.	Same	0-9	B_{ir}	109	14	100	97	77	64	40	35	15	8	23	2	A-4(1)	SM	
			21-35	C	123	10	100	95	92	86	49	40	14	8	15	1	A-4(3)	SM	
			48-54	C	124	9	100	95	92	87	39	30	9	6	NP	NP	A-4(1)	SM	
Roscoe clay	Haskell, Tex. a/	Old unconsolidated alluvium	0-19	A					100	99	88	82	32	23	47	24	A-7-6(15)	CL	
			19-32	A					100	99	87	84	44	34	48	27	A-7-6(16)	CL	
			60-72+	C_{ca}					100	94	77	76	50	30	48	30	A-7-6(18)	CL	
	Haskell, Tex. a/	Same	5-20	A					100	98	91	84	45	31	55	31	A-7-6(19)	CH	
			20-40	A					100	98	91	90	46	35	58	37	A-7-6(20)	CH	
			54-72+	C_{ca}						100	94	92	57	40	48	30	A-7-6(18)	CL	
	Haskell, Tex. a/	Same	0-14	A						100	88	85	67	23	49	27	A-7-6(17)	CL	
			14-27	A					100	92	76	75	48	42	46	27	A-7-6(16)	CL	
			45-58+	C_{ca}					100	99	87	81	44	38	48	28	A-7-6(17)	CL	

a/ Tests performed by Texas Highway Department.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE-DENSITY 2/		MECHANICAL ANALYSIS 3/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 4/					Percentage Smaller Than 4/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 5/	Unified 6/	
			Inches		Lb./cu. ft.	Percent													
Rosebud loam	Kimball, Nebr.	Tertiary calcareous	0-7	A	106	16	100	99	97	89	62	51	23	18	32	10	A-4(5)	ML-CL	
		sandstone	7-15	B_{ca}	104	18		100	99	90	66	56	32	26	38	16	A-6(9)	CL	
			15-26	C	106	18			100	92	65	56	27	21	31	12	A-6(7)	CL	
	Kimball, Nebr.	Same	0-6	A	109	16			100	90	59	49	21	16	29	10	A-4(5)	CL	
			10-16	B_{ca}	96	23			100	95	80	74	39	34	47	21	A-7-6(14)	ML-CL	
			16-28	C	99	22	100	97	96	88	72	65	36	29	42	17	A-7-6(11)	ML-CL	
	Kimball, Nebr.	Tertiary sandy	0-6	A	108	17			100	91	70	58	25	20	31	11	A-6(7)	CL	
		limestone with some	13-17	B	104	19			100	95	77	67	33	28	40	19	A-6(12)	CL	
		loess influence	17-23	C	100	21			100	97	85	70	29	22	36	13	A-6(9)	ML-CL	
	Kimball, Nebr.	Tertiary sandy	0-5	A	111	15	100	99	97	84	54	44	17	14	27	6	A-4(4)	ML-CL	
		limestone (Ogallala	10-17	B	105	19	100	99	98	87	61	50	22	18	33	12	A-6(6)	CL	
		formation)	17-23	C	104	19			100	89	61	51	26	20	32	12	A-6(6)	CL	
	Kimball, Nebr.	Loess over Tertiary	0-4	A	107	17			100	94	71	63	28	22	32	13	A-6(8)	CL	
		sediments with grav-	4-12	B	96	23			100	98	84	76	42	38	52	28	A-7-6(18)	CH	
		el and limestone fragments	15-22	C	101	21			100	99	82	74	38	33	41	18	A-7-6(11)	CL	
	Kimball, Nebr.	Loess over Tertiary	0-5	A	107	17			100	96	83	73	29	23	33	11	A-6(8)	ML-CL	
		limestone (Ogallala	7-13	B	97	22			100	98	93	86	42	36	49	24	A-7-6(15)	CL	
		formation)	13-17	C_{ca}	95	25			100	98	89	82	37	30	44	17	A-7-6(12)	ML-CL	
	Kimball, Nebr.	Loess over Tertiary	0-6	A	104	18			100	93	63	52	26	21	30	12	A-6(6)	CL	
		sandstone	9-18	B	97	22			100	96	63	54	30	24	34	14	A-6(7)	CL	
			18-25	C	95	25			100	92	40	33	14	11	21	5	A-4(1)	SM-SC	
	Kimball, Nebr.	Loess over Tertiary	0-4	A	108	15			100	90	65	57	24	20	30	11	A-6(6)	CL	
		sandstone with	4-11	B	102	19			100	94	72	64	34	29	41	19	A-7-6(11)	CL	
		gravel	19-23	C	116	14	100	95	93	76	44	37	21	17	26	8	A-4(2)	SC	
Ruston loamy fine sand	Gadsden, Fla.	Coastal Plain	0-9	A	118	11			100	95	29	24	12	11	NP	NP	A-2-4(0)	SM	
		sediments	15-32	B	111	17			100	97	53	48	38	37	33	17	A-6(6)	CL	
			68-90+	C	100	24	100	99	99	97	66	61	54	53	50	22	A-7-6(13)	ML-CL	
	Gadsden, Fla.	Same	4-9	A	120	10			100	95	29	20	11	10	NP	NP	A-2-4(0)	SM	
			22-31	B	108	19			100	97	53	49	41	40	40	17	A-6(6)	CL	
			47-55+	C	102	22			100	99	66	61	55	54	51	24	A-7-6(14)	MH-CH	
	Gadsden, Fla.	Same	0-5	A	120	9	100	98	97	80	36	14	8	7	NP	NP	A-4(0)	SM	
			31-38	B	116	15			100	90	36	34	31	30	32	14	A-6(1)	SC	
			47-60+	C	112	16			100	94	33	32	29	28	31	14	A-2-6(1)	SC	

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE-DENSITY 2/		MECHANICAL ANALYSIS 3/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 3/					Percentage Smaller Than 4/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 5/	Unified 6/	
			Inches		Lb./cu.ft.	Percent													
Salonie silt loam	Kodiak Island, Alaska	Volcanic ash on silty alluvium over glacial outwash	7-10	C	62	40			100	99	21	20	8	6	NP	NP	A-2-4(0)	SM	
			10½-19	CGb	95	24		100	99	97	88	85	38	24	45	12	A-7-6(10)	ML	
			91-31+	D	128	10	100	42	27	11	4	4	2	2	NP	NP	A-1-a(0)	GW	
	Kodiak Island, Alaska	Same	9-12	C	70	32				100	32	30	10	6	NP	NP	A-2-4(0)	SM	
			12½-20	Cb	88	26			100	93	62	56	21	14	NP	NP	A-4(5)	ML	
			27-40+	D	116	13	100	37	25	15	8	8	4	3	NP	NP	A-1-a(0)	GW-GM	
	Kodiak Island, Alaska	Same	5-8	C	61	41			100	98	15	15	8	4	NP	NP	A-2-4(0)	SM	
			9-14	CGb	80	33			100	99	83	76	32	19	54	10	A-5(11)	MH or OH	
			14-24+	D	126	11	100	29	19	7	4	4	2	2	NP	NP	A-1-a(0)	GW	
Sassafras fine sandy loam	Northumberland, Va. a/	Coastal Plain sediments	0-10	A	123	10			100	89	42	39	10	6	16	NP	A-4(1)	SM	
			14-33	B	124	12			100	91	50	48	25	18	25	7	A-4(3)	SM-SC	
			42-66	C	106	12			100	89	6	5	4	3	11	NP	A-3(0)	SP-SM	
Scantic silt loam	Hartford, Conn.	Lacustrine terrace	0-6	A	73	39			100	99	95	93	52	30	74	20	A-7-5(16)	MH or OH	
			9-26	Bg	108	19				100	97	95	54	29	39	16	A-6(10)	CL	
			26-60	Cg	107	20			100	99	95	94	63	38	37	15	A-6(10)	CL	
	Hartford, Conn.	Same	0-7	A	81	31				100	95	92	34	23	55	9	A-5(11)	MH or OH	
			11-34	Bg	112	16			100	99	91	88	34	25	31	10	A-4(8)	ML-CL	
			40-54	Dg	128	9	98	60	50	38	23	21	9	6	21	4	A-2-4(0)	GM-GC	10% discarded in sampling
	Hartford, Conn.	Same	0-7	A	88	26	98	98	98	97	91	87	29	18	49	14	A-7-5(11)	ML	2% " " "
			10-36	Bg	111	16	100	96	95	93	88	84	32	23	33	12	A-6(9)	CL	3% " " "
			36-52	Dg	126	10	85	38	30	20	16	14	5	3	23	5	A-1-a(0)	GM-GC	50% " " "
							(Scantic samples corrected for material discarded larger than 1 inch.)												
Sharpsburg silty clay loam	Washington, Nebr.	Peorian loess	0-6	A	102	20				100	99	95	38	33	38	13	A-6(9)	ML-CL	
			20-30	B	103	20				100	99	95	37	32	50	26	A-7-6(16)	CL	
			42-60	C	104	20					100	95	38	33	46	23	A-7-6(14)	CL	
	Washington, Nebr.	Same	0-7	A	103	20					100	97	35	30	37	12	A-6(9)	ML-CL	
			17-30	B	102	22					100	97	41	36	50	23	A-7-6(15)	ML-CL	
			48-60	C	106	19					100	97	36	30	44	20	A-7-6(13)	CL	
	Washington, Nebr.	Same	0-6	A	98	23					100	97	43	37	44	17	A-7-6(12)	ML-CL	
			10-22	B	100	22					100	97	41	35	53	26	A-7-6(17)	MH-CH	
			42-60	C	106	20					100	97	38	33	44	21	A-7-6(13)	CL	
	Washington, Nebr.	Same	0-5	A	98	23				100	99	95	42	38	44	18	A-7-6(12)	ML-CL	
			13-23	B	101	21					100	97	42	36	51	24	A-7-6(16)	MH-CH	
			45-60	C	107	20					100	96	35	29	42	20	A-7-6(12)	CL	
Skyberg silt loam	Dodge, Minn.	Wind-deposited material over glacial till (Iowan)	26-38	Bg	117	13	100	92	91	84	59	56	29	25	32	16	A-6(7)	CL	
			38-50	Bg	116	14	100	98	98	94	76	74	30	26	34	19	A-6(12)	CL	
			50+	C	107	18			100	99	93	91	43	37	43	24	A-7-6(14)	CL	
	Dodge, Minn.	Same	27-38	Bg	120	12	100	90	89	81	50	45	23	20	28	15	A-6(5)	SC	
			40-51	Bg	120	11	100	90	83	42	9	8	7	6	NP	NP	A-1-b(0)	SW-SM	
			53+	C	121	12		100	98	89	62	57	29	22	29	15	A-6(7)	CL	
	Dodge, Minn.	Same	26-34	Bg	109	17			100	97	78	75	35	32	38	21	A-6(12)	CL	
			34-46	Bg	112	16			100	98	86	83	35	30	35	18	A-6(11)	CL	
			46+	Cg	110	16			100	95	75	72	35	31	36	19	A-6(12)	CL	

a/ Tests performed by Virginia Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE-DENSITY 1/		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 1/					Percentage Smaller Than 1/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 1/	Unified 1/	
			Inches		Lb./cu. ft.	Percent													
Tama silt loam	Iowa, Wisc.	Loess over limestone	0-10	A	91	25			100	99	96	93	27	18	45	14	A-7-5(11)	ML	
			28-35	B	103	20					100	96	37	31	45	20	A-7-6(13)	ML-CL	
			40-46	C	107	18					100	97	35	30	42	20	A-7-6(12)	CL	
	Iowa, Wisc.	Same	0-11	A	92	25					100	97	37	27	45	15	A-7-5(11)	ML	
			22-30	B	103	22					100	97	38	33	44	20	A-7-6(13)	CL	
			45-50	C	107	19					100	98	35	30	42	19	A-7-6(12)	CL	
	Iowa, Wisc.	Same	0-9	A	85	28				100	98	96	29	19	50	17	A-7-5(13)	ML	
			18-27	B	104	19					100	97	39	32	45	22	A-7-6(14)	CL	
			46-60	C	109	18					100	97	30	25	37	17	A-6(11)	CL	
Tatum silty clay loam	Cherokee, S. C.	Schist	0-8	A			100	94	92	89	56	44	13	9	NP	NP	A-4(4)	ML	
			26-52	B	96	25			100	99	85	79	53	45	59	24	A-7-5(17)	MH	
			52+	C	104	19			100	99	74	66	27	17	43	13	A-7-5(10)	ML	
	Cherokee, S. C	Same	0-6	A			100	89	87	81	54	47	14	18	22	3	A-4(4)	ML	
			19-52	B	96	25			100	99	88	84	50	42	59	25	A-7-5(18)	MH	
			52+	C	98	23				100	97	93	43	33	52	18	A-7-5(14)	MH	
Tatum very fine sandy loam	Cherokee, S. C.	Same	0-6	A			100	98	95	84	48	41	15	11	NP	NP	A-4(0)	SM	
			6-36	B	104	20 c/	100	99	98	94	80	76	49	38	47	23	A-7-6(15)	CL	
			58+	C	95	26			100	98	84	79	38	26	52	16	A-7-5(13)	MH	
Tifton loamy fine sand	Gadsden, Fla.	Coastal Plain sediments	3-6	A	121	10	100	98	98	90	28	22	11	9	NP	NP	A-2-4(0)	SM	
			13-40	B	112	17	100	84	82	77	40	36	28	28	36	14	A-6(2)	SC	
			60-72+	C	119	8	100	88	86	79	43	39	32	29	39	15	A-6(3)	SM-SC	
	Gadsden, Fla.	Same	0-6	A	121	11	100	92	91	77	26	23	14	10	20	6	A-2-4(0)	SM-SC	
			12-32	B	118	13	100	85	84	74	34	29	24	21	26	11	A-2-6(0)	SC	
			47-74	C	113	16	100	95	94	80	54	38	30	27	36	16	A-6(6)	CL	
	Gadsden, Fla.	Same	0-5	A	109	14	100	94	94	86	31	22	7	5	NP	NP	A-2-4(0)	SM	
			16-30	B	109	18	100	91	89	84	50	44	33	32	37	14	A-6(4)	SM-SC	
			42-49+	C	99	24	100	99	98	93	70	65	55	53	54	24	A-7-5(15)	MH-CH	
Tillman clay loam	Haskell, Tex. a/	Permian clays and shales	6-22	B				100	99	97	92	83	33	21	48	27	A-7-6(16)	CL	
			22-42	B					100	99	94	92	52	40	48	28	A-7-6(17)	CL	
			42-62+	C_{ca}				100	99	99	94	94	53	38	42	23	A-7-6(14)	CL	
	Haskell, Tex. a/	Same	6-25	B				100	99	94	75	68	30	18	43	24	A-7-6(14)	CL	
			25-47	B			100	96	93	87	70	63	33	22	40	24	A-6(13)	CL	
			47-72+	C_{ca}						100	84	80	51	33	42	26	A-7-6(15)	CL	
	Haskell, Tex. a/	Same	5-26	B				100	99	96	89	83	41	30	43	24	A-7-6(14)	CL	
			26-38	B					100	97	89	89	49	41	39	22	A-6(13)	CL	
			38-66+	C_{ca}				100	99	97	89	78	38	25	32	19	A-6(12)	CL	
	Jackson, Okla. b/	Clayey red beds	0-8	A					100	99	82	64	26	20	27	9	A-4(8)	CL	
			10-26	B					100	99	85	70	44	40	42	20	A-7-6(12)	CL	
			28-42	C					100	97	78	68	44	38	40	20	A-6(12)	CL	

a/ Tests performed by Texas Highway Department.
b/ Tests performed by Oklahoma Department of Highways.
c/ Based on AASHO Designation T99-57, Method C.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum Dry Density	Moisture-density 2/: Optimum Moisture	Mechanical analysis 3/ — Percentage Passing Sieve 4/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 5/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 6/	Classification: Unified 6/	Remarks
			Inches		Lb./cu.ft.	Percent													
Tilsit fine sandy loam	Cullman, Ala.	Sandstone and shale	0-6	A			100	97	96	95	48	45	12	7	NP	NP	A-4(3)	SM	
			10-22	B			100	97	96	95	62	59	24	17	26	10	A-4(5)	CL	
			23-34	B_m			100	95	92	91	52	49	20	14	22	6	A-4(3)	ML-CL	
			34-61	C			100	82	80	79	50	47	28	22	36	13	A-6(4)	SM-SC	
	Cullman, Ala.	Same	0-5	A						100	56	52	12	8	NP	NP	A-4(4)	ML	
			9-27	B			100	99	98	97	62	58	24	16	23	6	A-4(5)	ML-CL	
			27-41	B_m			100	99	98	97	52	48	18	13	19	3	A-4(3)	ML	
			41-80	D			100	99	98	97	50	47	29	26	34	11	A-6(3)	SM-SC	
	Cullman, Ala.	Same	0-6	A			100	98	97	96	76	72	16	11	21	3	A-4(8)	ML	
			6-17	B			100	97	96	95	78	75	22	15	24	6	A-4(8)	ML-CL	
			17-27	B_m			100	99	98	97	76	73	26	19	28	9	A-4(8)	CL	
			27-38	B_m			100	99	98	97	76	72	28	22	30	9	A-4(8)	ML-CL	
			38-65	C			100	99	98	97	76	70	28	22	32	11	A-6(8)	CL	
Tipton loam	Jackson, Okla. a/	Old alluvial or aeolian materials	0-18	A					100	99	83	58	23	19	27	7	A-4(8)	ML-CL	
			18-30	B						100	85	65	26	21	34	8	A-4(8)	ML	
			48-61	C						100	87	70	31	25	36	15	A-6(10)	CL	
	Jackson, Okla. a/	Same	0-21	A						100	82	58	16	12	25	6	A-4(8)	ML-CL	
			21-32	B						100	79	55	19	17	28	10	A-4(8)	ML-CL	
			33-50	C						100	78	50	19	15	27	8	A-4(8)	CL	
	Jackson, Okla. a/	Same	0-18	A					100	97	51	40	16	12	20	5	A-4(3)	ML	
			22-36	B					100	96	60	47	24	22	33	14	A-6(7)	CL	
			40-73	C					100	96	67	57	29	26	38	19	A-6(10)	CL	
Tirzah silt loam	Saluda, S. C.	Metamorphic rocks with some quartz dikes	0-8	A	102	19			100	97	90	87	33	24	37	10	A-4(8)	ML	
			8-43	B	110	17			100	99	95	91	48	41	43	10	A-5(9)	ML	
			43-76+	C	100	24			100	99	97	95	62	51	65	32	A-7-5(20)	MH-CH	
Tivoli fine sand	Jackson, Okla. a/	Sand dune	0-72	A and C						100	8	5	3	1	NP	NP	A-3(0)	SP-SM	
Vaucluse sandy loam	Darlington, S. C.	Coastal Plain sediments	0-5	A	92	24			100	72	46	43	26	21	47	11	A-7-5(3)	SM	
			5-12	A	118	12			100	64	34	32	24	22	30	10	A-2-4(0)	SC	
			12-25	B_m and B	121	12			100	65	36	35	29	28	33	14	A-6(1)	SC	
			25-60+	C	116	15	100	95	93	78	46	41	27	22	36	12	A-6(3)	SC	

a/ Tests performed by Oklahoma Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE: Depth	POSITION FROM GROUND SURFACE: Horizon	MOISTURE-DENSITY 2/: Maximum Dry Density	MOISTURE-DENSITY 2/: Optimum Moisture	MECHANICAL ANALYSIS 3/ Percentage Passing Sieve 4/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage Smaller Than 5/: .05mm	.005mm	.002mm	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION: A.A.S.H.O. 5/	CLASSIFICATION: Unified 6/	REMARKS
			Inches		Lb./cu.ft.	Percent													
Vebar sandy loam	Kimball, Nebr.	Tertiary sandstone	0-7	A	120	11			100	79	40	30	14	10	22	4	A-4(1)	SM-SC	
			7-14	B	120	12		100	99	76	41	30	19	16	25	8	A-4(1)	SC	
			25-36	C	124	10	100	99	95	66	27	22	16	12	20	4	A-2-4(0)	SM-SC	
	Kimball, Nebr.	Same	0-6	A	120	11			100	80	43	36	14	11	22	4	A-4(2)	SM-SC	
			9-16	B	114	14			100	87	54	45	23	20	30	12	A-6(5)	CL	
			29-48	C	121	11			100	82	42	32	13	11	21	4	A-4(1)	SM-SC	
	Kimball, Nebr.	Same	0-6	A	117	11	100	99	98	87	35	26	14	12	20	3	A-2-4(0)	SM	
			6-14	B	114	14	100	99	97	86	39	30	16	14	24	6	A-4(1)	SM-SC	
			21-40	C	114	14	100	98	96	84	50	41	27	19	23	7	A-4(3)	SM-SC	
Vernon clay	Haskell, Tex. a/	Permian shales and clays	0-10	A				100	99	97	92	88	60	48	47	24	A-7-6(15)	CL	
			10-30	C			100	99	97	90	77	73	46	39	48	25	A-7-6(16)	CL	
	Haskell, Tex. a/	Same	0-8	A			100	96	95	91	82	79	56	47	49	26	A-7-6(16)	CL	
			8-30	C			100	99	98	95	58	50	34	28	39	25	A-6(11)	CL	
	Haskell, Tex. a/	Same	0-6	A			100	97	96	94	90	80	40	28	38	20	A-6(12)	CL	
			6-26	C					100	98	95	86	50	38	42	23	A-7-6(14)	CL	
	Jackson, Okla. b/	Red beds	0-8	A					100	98	79	65	34	28	28	10	A-4(8)	CL	
			11-22	C					100	81	53	48	28	23	36	14	A-6(6)	CL	
			36-43	C					100	73	54	32	14	11	34	11	A-6(4)	ML-CL	
Walpole sandy loam	Hartford, Conn.	Terrace	0-10	A	108	17		100	99	76	42	39	15	11	31	6	A-4(1)	SM	
			10-22	B	117	13		100	99	71	34	30	12	9	24	4	A-2-4(0)	SM-SC	
			25-60	C or D	102	17			100	91	6	5	2	2	NP	NP	A-3(0)	SP-SM	
	Hartford, Conn.	Same	0-8	A	91	24	98	88	86	71	48	44	14	11	48	12	A-7-5(4)	SM	5% discarded in sampling
			11-24	B_g	118	13	98	83	80	64	38	33	11	8	26	4	A-4(1)	SM-SC	8% " " "
			24-48	C_g or D	122	10	98	80	77	60	24	19	6	4	NP	NP	A-2-4(0)	SM	10% " " "
	Hartford, Conn.	Same	0-7	A	92	23			100	97	36	28	10	6	NP	NP	A-4(0)	SM	
			10-18	B_g	108	14			100	95	30	21	7	6	NP	NP	A-2-4(0)	SM	
			18-60	C_g	103	14			100	93	18	12	4	3	NP	NP	A-2-4(0)	SM	
							(Walpole samples corrected for material discarded larger than 1 inch.)												
Watson silt loam	Carbon, Pa. c/	Glacial till	22-30	B_g	116	13	100	90	85	79	64	57	30	23	29	8	A-4(6)	ML-CL	
			41-53	C^g	115	14	100	82	78	74	59	53	27	22	29	8	A-4(5)	ML-CL	
	Carbon, Pa. c/	Same	21-31	B_g	115	14	100	79	77	70	53	49	33	26	33	10	A-4(4)	ML-CL	5% discarded in sampling
			35-42	C^g	116	14	100	92	88	82	62	57	37	30	35	12	A-6(6)	ML-CL	5% " " "
	Carbon, Pa. c/	Same	20-28	B_g	118	14	100	60	56	47	34	33	19	16	31	9	A-2-4(0)	GM-GC	10% " " "
			32-42	C^g	115	16	100	61	58	47	32	31	24	22	39	14	A-2-6(1)	GM-GC	15% " " "
							(Watson samples not corrected for material discarded larger than 3 inches.)												

a/ Tests performed by Texas Highway Department.
b/ Tests performed by Oklahoma Department of Highways.
c/ Tests performed by Pennsylvania Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

Soil name	Location (county and state)	Parent material	Position from ground surface: Depth	Position from ground surface: Horizon	Moisture-density 2/: Maximum dry density	Moisture-density 2/: Optimum moisture	Mechanical analysis 3/ – Percentage passing sieve 4/: 3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	Percentage smaller than 4/: .05mm	.005mm	.002mm	Liquid limit	Plasticity index	Classification: A.A.S.H.O. 5/	Classification: Unified 6/	Remarks
			In.		Lb./cu. ft.	Pct.													
Weston fine sandy loam	McIntosh, Ga.	Pamlico marine terrace	0-5	A	118	11			100	75	17	15	7	3	NP	NP	A-2-4(0)	SM	
			31-44	B	112	16			100	80	41	40	31	27	35	17	A-6(3)	SC	
			44-66	C	114	14			100	71	35	33	28	26	37	18	A-2-6(2)	SC	
	McIntosh, Ga.	Same	0-6	A	113	13			100	86	20	18	8	4	NP	NP	A-2-4(0)	SM	
			23-34	B	110	16			100	88	42	40	31	27	42	25	A-7-6(6)	SC	
			34-57	C	116	14			100	88	36	34	28	25	36	21	A-6(2)	SC	
Wethersfield stony loam	Hartford, Conn.	Glacial till	0-5	A	105	18	100	82	76	70	59	53	21	13	33	7	A-4(5)	ML	5% discarded in sampling
			5-22	B	118	13	100	83	77	67	52	46	17	12	24	5	A-4(3)	ML-CL	5% " " "
			22-60	C_m and B_m	122	12	100	86	83	76	64	58	26	19	23	8	A-4(6)	CL	5% " " "
Wethersfield loam	Hartford, Conn.	Drumlin	0-7	A	95	23	98	88	82	73	62	58	23	13	43	8	A-5(6)	ML	5% " " "
			7-22	B	112	15	98	82	75	66	55	51	20	13	26	5	A-4(4)	ML-CL	7% " " "
			26-48	C_m or B_m	120	13	100	86	81	70	57	53	25	17	27	10	A-4(4)	CL	5% " " "
	Hartford, Conn.	Glacial till	0.5-6	A	101	19	100	93	91	81	55	51	18	13	35	5	A-4(4)	ML	5% " " "
			6-22	B	122	10	100	93	89	74	45	40	15	10	20	3	A-4(2)	SM	5% " " "
			22-40	C_m or B_m	126	11	100	92	89	74	44	39	20	15	24	8	A-4(2)	SC	5% " " "
							(Wethersfield samples corrected for material discarded larger than 1 inch.)												
Weymouth loam	Jackson, Okla. a/	Calcareous red beds	0-7	A					100	97	86	65	28	20	31	12	A-6(9)	CL	
			8-16	AC					100	95	82	76	41	35	39	17	A-6(11)	ML-CL	
			32-44	C_{ca}					100	92	82	74	46	35	33	15	A-6(10)	CL	
Wickham loam	Rappahannock, Va. b/	Alluvium (terrace)	0-10	A	109	16			100	91	72	71	33	19	34	12	A-6(9)	ML-CL	
			10-38	B	102	20			100	91	76	75	53	45	48	18	A-7-5(13)	ML	
			52-70	C	105	19			100	86	65	61	47	35	44	12	A-7-5(7)	ML	
Wickham fine sandy loam	Yadkin, N. C.	Same	0-11	A			100	98	96	86	51	44	25	19	24	7	A-4(3)	ML-CL	
			19-29	B					100	95	77	74	57	51	60	23	A-7-5(17)	MH	
			29-53	B					100	92	64	60	46	42	53	20	A-7-5(12)	MH	
Wickham sandy loam	Oconee, S. C.	Same	2-8	A	125	9	100	95	93	76	26	20	10	7	NP	NP	A-2-4(0)	SM	
			14-26	B	106	20	100	97	93	77	53	51	45	42	50	23	A-7-6(10)	ML-CL	
			50-65	C	110	18			100	90	62	57	39	35	42	18	A-7-6(9)	ML-CL	
Wilkes sandy loam	Cherokee, S. C.	Acid and basic rocks	0-3	A			100	95	92	84	54	45	13	9	NP	NP	A-4(4)	ML	
			3-14	B	101	23			100	98	83	76	51	46	44	20	A-7-6(13)	CL	
			14+	C	111	17			100	97	61	53	28	25	34	13	A-6(6)	CL	
	Cherokee, S. C.	Same	0-7	A			100	95	91	84	39	17	7	6	NP	NP	A-4(1)	SM	
			7-13	B	104	20			100	97	69	63	46	40	45	22	A-7-6(12)	CL	
			13+	C	109	17			100	96	58	51	31	27	40	18	A-6(8)	CL	
	Cherokee, S. C.	Same	0-7	A			100	98	94	89	58	49	14	10	NP	NP	A-4(5)	ML	
			7+	C	115	14			100	90	45	37	17	14	NP	NP	A-4(2)	SM	

a/ Tests performed by Oklahoma Department of Highways.
b/ Tests performed by Virginia Department of Highways.

FHA-Wash., D. C.

ENGINEERING TEST DATA FOR SOILS SAMPLED BY SOIL CONSERVATION SERVICE AND TESTED BY HIGHWAY LABORATORIES 1/

SOIL NAME	LOCATION (COUNTY AND STATE)	PARENT MATERIAL	POSITION FROM GROUND SURFACE		MOISTURE-DENSITY 1/		MECHANICAL ANALYSIS 1/								LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION		REMARKS
							Percentage Passing Sieve 1/					Percentage Smaller Than 1/							
			Depth	Horizon	Maximum Dry Density	Optimum Moisture	3-in.	No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (.42mm)	No. 200 (.074mm)	.05mm	.005mm	.002mm			A.A.S.H.O. 1/	Unified 1/	
			Inches		Lb./cu.ft.	Percent													
Windsor loamy fine sand	Hartford, Conn.	Terrace	0-8	A	108	14			100	95	24	19	7	5	NP	NP	A-2-4(0)	SM	
			10-22	B	107	13			100	98	30	21	5	4	NP	NP	A-2-4(0)	SM	
			26-60	C	103	17			100	95	13	9	4	4	NP	NP	A-2-4(0)	SM	
Windsor fine or medium sand	Hartford, Conn.	Dune on terrace	0.5-6	A	108	15			100	89	13	9	6	5	NP	NP	A-2-4(0)	SM	
			6-22	B	106	15			100	90	10	8	5	4	NP	NP	A-3(0)	SP-SM	
			22-60	C	104	16			100	92	5	5	4	3	NP	NP	A-3(0)	SP-SM	
Windsor loamy coarse sand	Hartford, Conn.	Terrace	0-9	A	120	11	100	99	97	63	21	19	9	6	NP	NP	A-2-4(0)	SM	
			9-20	B	122	11		100	98	66	24	20	9	6	NP	NP	A-2-4(0)	SM	
			24-60	C	112	17	100	98	91	38	4	4	2	2	NP	NP	A-1-b(0)	SP	
Woodstown fine sandy loam	Northumberland, Va. a/	Coastal Plain sediments	0-10	A	114	12			100	97	49	46	14	9	15	NP	A-4(3)	SM	
			16-29	B	125	10			100	97	52	50	18	12	16	NP	A-4(3)	ML	
			34-78	C	111	12			100	94	13	11	4	3	14	NP	A-2-4(0)	SM	

a/ Tests performed by Virginia Department of Highways.

FHA-Wash., D. C.

FOOTNOTES

1/ Samples were tested in accordance with standard procedures of the American Association of State Highway Officials (AASHO) in a cooperative program involving State highway departments, universities or colleges, and the Bureau of Public Roads. Letter footnotes a, b, c, etc., referring to specific soils as noted in the "Location" column, identify the testing agency. Where no letter footnote occurs, tests on samples from that location were performed by the Division of Physical Research, Bureau of Public Roads.

2/ Moisture-density tests were performed in accordance with AASHO Test Designation T99-57, which has 4 methods of test, as follows:

Method A. -
Soil material retained on No. 4 sieve is discarded. Material passing No. 4 sieve is compacted in 4-inch diameter mold in 3 equal layers, using 25 blows per layer of a 5.5-pound rammer dropping 12 inches.

Method B. -
Sample preparation same as in Method A. Material passing No. 4 sieve is compacted in 6-inch diameter mold in 3 equal layers, using 56 blows per layer of a 5.5-pound rammer dropping 12 inches.

Method C. -
Same as Method A except sample is split on 3/4-inch sieve and material retained on 3/4-inch sieve is discarded. Material passing 3/4-inch sieve is tested.

Method D. -
Sample preparation same as in Method C. Soil Material is compacted in 6-inch diameter mold in 3 equal layers, using 56 blows per layer of a 5.5-pound rammer dropping 12 inches.

When not indicated by a letter footnote on the page of test data, sample was tested by Method A. When sample was tested by one of the other 3 methods, or by a variation from one of the 4 test methods, the method is indicated by a letter footnote on page of test data.

3/ Mechanical analyses according to the American Association of State Highway Officials Designation T88, except as indicated by letter footnote on page of test data. Results by the T88 procedure frequently may differ somewhat from results that would have been obtained by the Soil Survey procedure of the Soil Conservation Service (SCS). In the A.A.S.H.O. procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 mm. in diameter. In the SCS Soil Survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 mm. in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming Soil Survey texture classes for soils.

4/ Coarse particles were discarded during field sampling of some soils. Note immediately following the test data of the soil indicates whether the laboratory test data were corrected for the discarded material. Percentage discarded in field sampling is noted in the "Remarks" column.

5/ Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, A. A.S.H.O. Designation M145-49.

6/ Based on the Unified Soil Classification System, Technical Memorandum No. 3-357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953.

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