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BULLETIN 505

ENGINEERING SOIL REPORT

DEWITT COUNTY, ILLINOIS

by
T. H. Thornburn
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ABSTRACT

THIS PUBLICATION IS THE LAST OF A SERIES WHICH REPORT ON AN INVESTIGATION OF THE ENGINEERING PROPERTIES OF THE SOILS OF NORTHEASTERN ILLINOIS. IT PRESENTS THE RESULTS OF A DETAILED PROGRAM OF SAMPLING AND TESTING OF THE SURFICIAL SOILS OF DEWITT COUNTY. SITE SELECTION FOR SAMPLING WAS BASED ON THE 1940 PUBLICATION, DEWITT COUNTY SOILS, PREPARED BY THE UNIVERSITY OF ILLINOIS AGRICULTURAL EXPERIMENT STATION. COMPLETE DATA ON THE ATTERBERG LIMITS, PARTICLE-SIZE CHARACTERISTICS, MOISTURE-DENSITY RELATIONS, AND ENGINEERING SOIL CLASSIFICATIONS ARE PRESENTED IN TABULAR FORM ACCORDING TO SOIL TYPE.

STATISTICAL DATA FOR EACH SOIL HORIZON ARE PRESENTED BY SOIL TYPE AND BY SOIL AREA. ON THE BASIS OF THESE DATA AND KNOWLEDGE OF THE FORMATIONAL CHARACTERISTICS OF THE SOIL PROFILES, PERTINENT ENGINEERING DESIGN AND CONSTRUCTION INFORMATION HAS BEEN ASSEMBLED. THIS INFORMATION IS APPLICABLE TO MOST COUNTIES IN EAST-CENTRAL ILLINOIS.

SIGNIFICANT CORRELATIONS ARE SHOWN TO EXIST BETWEEN THE PEDOLOGIC SOIL TYPES AND THEIR PHYSICAL PROPERTIES. THUS AGRICULTURAL SOIL REPORTS DELINEATE AREAS WITHIN WHICH THE SURFICIAL DEPOSITS ARE RELATIVELY UNIFORM IN THEIR PHYSICAL PROPERTIES. IT IS ALSO POSSIBLE TO GROUP SOILS FOR ENGINEERING PURPOSES ON THE BASIS OF THE PARENT GEOLOGIC MATERIALS FROM WHICH THEY WERE DERIVED. THE VALUE OF THE REPORT IN PRELIMINARY PLANNING AND AS A GUIDE TO DETAILED ENGINEERING SOIL SURVEYS IS ILLUSTRATED.

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CONTENTS

FIGURES

TABLES

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I. INTRODUCTION

A. PURPOSE OF REPORT

The principal objective of this report is to provide pertinent information concerning the relationships between pedologic soil types, parent materials, and engineering properties of surficial soils as they are mapped in DeWitt County, Illinois.

Where valid correlations exist between the engineering properties of soils and the properties upon which the pedologic soil classification is based, the agricultural soil report and map of DeWitt County constitute a valuable potential source of information for engineering purposes.

Soil survey reports have been published for 82 of the 102 counties in Illinois. Each of these reports contains a detailed map of the surface soils of the county and a description of the various soil types mapped. The pedologic soil types are differentiated and mapped on the basis of such properties as the number, color, texture, structure, chemical properties, and thickness of the different layers or horizons of the soil profile, and upon the geologic character of the parent material from which the soil developed. In the past these pedologic classifications have been used primarily for agricultural purposes, but since the classification system is based upon physical and chemical properties of the soil profile, these classifications can also be correlated with engineering behavior.

To establish these correlations five sites of each major soil type mapped in DeWitt County were selected and samples were taken of each major horizon in the soil profile at each site. Atterberg limits, grain-size distribution, and compaction characteristics were determined for each sample. Because of the inherent variability of natural soil deposits, the laboratory data for each soil type were analyzed statistically to determine the mean and the variability of the properties tested for each horizon of each soil type. Engineering Index Properties of Some Surficial Soils in Illinois by Liu and Thornburn(8)* contains an excellent introduction to the basic concepts of statistics which are necessary for an understanding of the statistical analysis used in this report.

Appendix 1 of this report contains the following data sheets for each soil type mapped in DeWitt County:

1. A description of the soil profile and an estimate of certain engineering index properties,

2. Design and construction information relating the properties and problems of each soil profile,

3. A summary of laboratory test data for each site sampled,

4. Statistical parameters defining the mean and the variability of the engineering properties tested.

Similar data sheets are given in Appendices 2 and 3 for the different parent materials and for four different Great Soil Groups. These data sheets constitute the essence of this report.

By reference to the pedological soil map of DeWitt County, the data sheets may be used to estimate engineering behavior, and to plan more detailed soil investigations for any area in which construction operations are anticipated. For this reason, the soil map

*Numbers in parentheses refer to References, Chapter VII.

from DeWitt County Soils should be considered to be an essential supplement for the proper use of this report.(12)

A brief account of the geology and pedology of DeWitt County are presented as necessary background for the understanding of the nature and distribution of the soils of the county. Surface Deposits of Illinois contains an excellent discussion of the general geology of Illinois, the nature of glacial deposits, and general concepts of pedology and soil profiles.(13) No attempt has been made to duplicate these discussions, hence that report is also an important reference.

B. SCOPE OF INVESTIGATION

This report is one of a series of investigations which has been conducted in order to evaluate the engineering properties of the surficial soils of Illinois through a detailed sampling and testing program and a statistical analysis of test data obtained from the soil samples.

Reports of similar studies of Livingston and Will County soils have already been published.(14,16) Originally, 10 counties throughout Illinois were selected for study to obtain nearly complete coverage of soil variations throughout the state. It was anticipated that an engineering soils report would be written for each county and that the data from the 10 reports would be utilized in developing a state engineering soils manual. Due to various circumstances, the complete investigation had to be terminated and this report is the last one in the series which has dealt with the soils of northeastern Illinois.

Related studies have, however, produced other publications of value to highway soils engineers.(7,8,9,15) All of these studies have been oriented toward defining a correlation between engineering properties of soils, pedologic soil types, and the parent material from which the soils were developed. Thus the wealth of detailed information about Illinois soils which has been accumulated by pedologists and agricultural soil scientists has been rendered more directly useful to the practicing soils engineer.

C. BRIEF DESCRIPTION OF DEWITT COUNTY

DeWitt County covers an area of about 396 square miles near the geographic center of Illinois, as shown in Figure 1. The principal towns and highways are shown in Figure 2. The county lies in Ranges 1 through 5 east of the Third Principal Meridian and in Townships 19, 20, and 21 north of the baseline for the Third Principal Meridian.

The climate of DeWitt County is humid and temperate. Annual rainfall averages about 37 in. with about 23 in. falling during the April to September growing season. Temperatures average around 31°F in winter and 73°F in summer. An extreme temperature range of nearly 150 degrees, from -34°F to 113°F, has been recorded at the nearest U.S. Weather Bureau Station at Lincoln, Illinois, 12 miles west of the county line. A frost-free season of 170 days is average.

Agriculture is the principal industry of the county and the major portion of the county is tillable. White settlers first began farming in the county in 1824 so that none of the natural soil profiles have been disturbed for more than about 140 years. Much of the land has been cultivated for less than 75 years, because it has been only relatively recently that drainage ditches and tile lines have been provided to drain the more poorly drained, swampy areas so they would be suitable for cultivation.

II. GEOLOGY OF DEWITT COUNTY

A. INTRODUCTION

Landforms and surface deposits of DeWitt County are the products of continental glaciation during the last one million years and their subsequent modification by the processes of weathering and erosion. Since an adequate discussion of the general geology of Illinois is available elsewhere, this report will present only a brief discussion of these features which relate specifically to the county.

B. GEOLOGIC HISTORY

The bedrock of DeWitt County is sedimentary rock of Pennsylvanian age, perhaps 250 million years old. There is no record of any deposition in the region throughout the 250 million years from the Pennsylvanian Period to the Pleistocene Epoch. It is generally assumed that this area was above sea level during that time.

Table 1 is a general geologic calendar of the Pleistocene Epoch in Illinois. Deep well records and surface exposures in the area disclose deposits which appear to correlate with all four major Pleistocene glacial stages. Furthermore, it is indicated that the entire county was covered by Kansan and Illinoian glaciers. In the Wisconsinan glacial stage (Woodfordian Substage), the Lake Michigan ice lobe covered all but the extreme southwest corner of the county at its furthest advance approximately 19,000 years ago. After the ice front receded, the whole region was covered by a moderately thick blanket of loess. Thus, most of the landforms and surface deposits of DeWitt County appear to be younger than 20,000 years. The exception is a very small area of Illinoian till plain in the southwest corner of the county, but it also has been modified by Wisconsinan outwash and loess.

C. PHYSIOGRAPHY

DeWitt County lies in the Till Plains Section of the Central Lowlands Physiographic Province.(5) The southwest corner of the county, beyond the limit of the Wisconsinan glaciation, lies in the Springfield Plain Subsection which is characterized by its relative flatness and the shallow entrenchment of the drainage lines. The remainder lies in the Bloomington Ridged Plain Subsection which is characterized by low, broad ridges (glacial moraines) separated by flat or gently rolling plains (outwash or till plains).

The ridge marking the outer boundary of the Bloomington Ridged Plain is the Shelbyville Moraine, the terminal moraine of the Wisconsinan glaciation in this area (Figure 3). This morainic ridge crosses the county in a northwest-southeast direction at a crest elevation of about 750 to 790 ft above mean sea level. Northeast of the Shelbyville Moraine, a relatively featureless flat to gently rolling Wisconsinan till plain slopes almost imperceptibly away from the ridge. To the west, the moraine drops abruptly to the Springfield Plain, which is very flat and slopes southwestwardly from an elevation of about 650 ft at the front of the moraine to about 620 ft in the extreme southwest corner of the county.

Salt Creek, a tributary of the Sangamon River, is the main drainage line of the county (Figure 2). It crosses the county diagonally from northeast to southwest and has eroded a conspicuous valley through the Shelbyville Till Plain and Moraine to get down to the level of the Springfield Plain. Kickapoo Creek, the other major drainage through the county, cuts transversely through the Shelbyville Moraine across the extreme northwest corner. It is essentially the same size and

character as Salt Creek, but drains only a small portion of the county.

Salt and Kickapoo Creeks have flood plains about 1/2 mile wide which are bounded by valley sides with slopes almost always greater than 5 percent and often greater than 15 percent, while slopes on the gently rolling Shelbyville Till Plain are almost invariably less than 4 percent, with about half of the plain having slopes of less than 0.5 percent. On the Springfield Plain, slopes are mostly less than 2 percent, with large areas of less than 0.5 percent. Natural drainage is good on the more rolling areas along the two creeks and along the front of the Shelbyville Moraine. Other parts of the county were generally very poorly drained with swampy conditions over considerable areas before tile lines and drainage ditches were constructed.

D. STRATIGRAPHY

1. Bedrock

Bedrock in DeWitt County is covered by about 200 ft of glacial drift and there are no natural bedrock exposures in the whole county. The bedrock is mostly sedimentary sandstone, siltstone, and shale of the McLeansboro Group of Pennsylvania age. Before glaciation the bedrock surface was part of a relatively featureless plain, the Pennsylvanian Lowland, which covered a large portion of Illinois.(2) The major preglacial drainage line of the area was the Mahomet-Teays Valley, a tributary of the ancestoral Mississippi River. This tributary flowed westwardly across central Illinois and crossed the southwestern half of DeWitt County in a southeast-northwest direction.

Figure 4 is a generalized contour map of the bedrock surface of DeWitt County. A comparison of this map with topographic maps of the present surface, with elevations ranging from 620 to 790 ft, shows that the thickness of the glacial drift may range from about 120 ft in the extreme southwest corner to as much as 500 ft over the buried Mahomet-Teays Valley. The geologic cross sections contained in Figure 5 present an idea of bedrock topography and depth of drift in the county. Because of its depth of burial, the bedrock does not warrant more detailed discussion in this report.

2. Glacial Deposits and Recent Alluvium

The cross sections in Figure 5a and b indicate the nature of the glacial deposits in DeWitt County, although only a small portion of section A-A' actually crosses the county. The Mahomet sand filling the Mahomet-Teays bedrock valley is of pre-Kansan age and is possibly overlain in places by Nebraskan drift, but its age is not well established. It is an important groundwater source for the area, but is nowhere exposed at the surface. The presence of Kansan drift with a deeply weathered zone at its top, probably of Yarmouthian age, is well established by deep well records throughout the county, although it is not exposed at the surface. Illinoian drift with a well-developed, weathered upper zone (Sangamon soil) is present near the surface under loess and outwash of Wisconsinan age in the extreme southwest corner of the county. The drift sheet and weathered zone appear to be continuous to the north and east under the Wisconsinan drift.

Except for the Recent alluvium along Salt Creek and Kickapoo Creek, all of the county is covered by deposits of Wisconsinan age; a relatively thick blanket of loess covers the whole county. This blanket is about 10 ft thick at the extreme southwest corner and thins northeastwardly to a thickness of about 5 ft at the northeast corner.(11)

Underlying the loess is the Wisconsinan glacial drift (Figure 6). The till of the Shelbyville Moraine and Till Plain has a loam texture and generally is 75 to 100 ft thick. Medium- and moderately fine-textured outwash from the Shelbyville Moraine covers the Illinoian drift in front of the moraine. In the extreme northeast corner of DeWitt County the Shelbyville Till is covered by outwash from the Champaign Moraine, which lies just outside the county.

Recent alluvium (mixed bottomland, terrace, and bluffwash materials) fills the valleys and flood plains of Salt and Kickapoo Creeks. This material is quite variable and locally may be of any texture.

III. PEDOLOGY OF DEWITT COUNTY

A. INTRODUCTION

The surface soils of DeWitt County result from the weathering and erosion of the glacial, aeolian, and alluvial deposits of Wisconsinan and Recent age. Since the general concepts of pedology are discussed in other sources, this report will only discuss those aspects of pedology which are necessary to place the pedology of DeWitt County into the general framework.(13,18)

B. FACTORS INFLUENCING SOIL DEVELOPMENT

Of the five factors influencing soil profile development, only topography, parent material, and vegetation are of real significance in producing variations in soils within DeWitt County. Although both climate and time have influenced the characteristics of DeWitt County soils, they have operated in an essentially constant manner on the exposed Wisconsinan deposits. No significant climatic variations exist within the county because of its small size and lack of major physiographic features. Because the whole county was covered with a relatively thick blanket of Peoria loess, the surface has been exposed to the action of weathering for essentially the same length of time. There are only two exceptions to this generalization: (1) recent alluvium along stream floodplains, where erosion and deposition are active, and (2) steep slopes where the rate of erosion is more rapid than the process of weathering.

Since much of the area of the county is nearly flat and the parent material is uniform, the variations of topography are so small that only a small number of different soil types have developed. On the steeper slopes, much of the original loess cover has been wholly or partially eroded so that topography exercises an indirect control on soil development by influencing the character of the parent material.

Although parent material is an important variable, a wide range of parent materials does not exist in DeWitt County. Figure 6, a parent material map, shows that besides the loess cover there are only three major types of deposits: glacial till and outwash, and Recent alluvium. The natural variations of these deposits, however, are partially or wholly masked by the relatively thick blanket of loess covering the county. Thus the majority of the soil profiles have developed mostly, if not entirely, within the loess blanket or within local wash from the loess.

Two different types of vegetation are native to the area and these have resulted in significant differences in the development of the soil profiles. Adjacent to the major drainage ways, the native vegetation was hardwood forest, mostly of mixed oak and hickory. In Figure 6, the areas designated by the letter B are those in which soils have developed under a forest vegetation. On the upland areas away from the streams the natural drainage was quite poor and swampy conditions were widespread. The natural vegetation was prairie and swamp grasses. The letter A in Figure 6 indicates areas where soils have developed under grass.

C. GENERAL PATTERNS OF SOILS IN DEWITT COUNTY

It is apparent from the preceding discussion that the soils of DeWitt County developed under a relatively narrow range of variables. The climate has been humid and temperate. The natural vegetation was oak-hickory forest or prairie and swamp grasses. Most soils have developed on a surface of generally low relief formed during Wisconsinan time. Furthermore the

parent materials are limited to relatively thick loess over loam till or medium-textured outwash, or to Recent alluvium on stream flood plains. Figures 7 and 8 indicate the relationships between various soil types which may develop under these conditions.

Principal soil series developed from the most common deposits in DeWitt County, loess over loam till, are illustrated in Figure 7. However, the loess thickness over much of DeWitt County (Figure 6) is about 2 ft more than is indicated in Figure 7.(11,18) All of the soils shown in Figure 7 are mapped in DeWitt County. The forest soils developed under these conditions are shown on the right side of the figure; the prairie soils are to the left. The correlation of soil types with topography is clearly illustrated.

Figure 8 similarly depicts the principal series developed on silt loam sediments (loess or silty local wash which is reworked loess) over sandy and gravelly sediments (outwash). Among the forest soils shown on the left of the figure, only Camden, No. 134, is mapped in DeWitt County. However, all of the prairie soils shown to the right, except Stockland, No. 155, and Brooklyn, No. 136, are mapped.

The conditions illustrated by Figures 7 and 8 are so common in DeWitt County that they account for 16 of the 23 soil types mapped in the county and 98 percent of the county's surface area. Table 2 shows the soil types classified according to Great Soil Group and parent material. A brief description of the Soil Orders and Great Soil Groups* mapped in DeWitt County are as follows:(13)

Zonal soils: well-developed profile determined by climate and vegetation

- Brunizem: prairie vegetation
- Gray-Brown Podzolic: forest vegetation

Intrazonal soils: more or less well-developed profile more strongly influenced by local relief or parent material than by climate or vegetation

- Humic-Gley: depressional soils under swampy vegetation
- Planosol: nearly level soils, prairie grass or forest vegetation

Azonal soils: no well-defined profiles

- Alluvial: continuous deposition from streams
- Regosol: continuous erosion

Intergrade soils: gradations between Great Soil Groups listed above

The members of four major Great Soil Groups, Brunizem, Gray-Brown Podzolic, Humic-Gley, and Alluvial, cover about 95 percent of the county.

Table 3 shows the association of soil types. There are five major associations of soil types and the twelve most common types comprise nearly 95 percent of the area of the county, thus:

3A	Brunizem soils developed from loess over loam till	43.82%
3A and 8A	Humic-Gley soils developed from local wash in loess over loam till or outwash	26.82%
3B	Gray-Brown Podzolic soils developed from loess over loam till	14.27%
8A	Brunizem soils developed from loess over outwash	2.09%
9A and B	Mixed types of floodplains, terraces, etc.	7.21%
		94.21%

Because of the similarities of profile characteristics and occurrence of the soils within these associations, it might be expected that the engineering

*Since the publication of the DeWitt County soil report a new soil classification system has been adopted which uses quite different terminology for Great Soil Groups. For purposes of comparison with most published agricultural and engineering soil reports, the older terminology has been retained here.

properties of these types also would be closely correlated. This hypothesis will be considered in a later section.

D. RECLASSIFICATION OF DEWITT COUNTY SOILS

Subsequent to the field mapping of DeWitt County soils and the publication of the county soil map, a number of soil types mapped in the county have been redefined and/or subdivided.(12) In addition, more information is now available concerning the soils and parent materials of the county. As a result, the soil map of DeWitt County is somewhat out of date according to present standards. In order to update the soil classifications, a soil scientist of the Soil Conservation Service, U.S. Department of Agriculture, personally checked the location of all sites used in this investigation and provided the correct modern identification of each soil profile sampled. Table 4 shows the relationships between the soil types shown on the map at the sample locations, the number of reclassifications, and the reason for the change. On the laboratory test data summary sheets, the reclassified sampling sites are indicated. For example, a comparison of Table 4 and the data summary sheet for 149 Brenton silt loam indicates that five of the six sampling sites mapped as 149 Brenton silt loam were reclassified. The reason is that the loess thickness at the five sites exceeds 40 in., the upper limit allowed for a soil to be classified as Brenton. Four of the five sites were reclassified as 198 Elburn silt loam, while the fifth site was redefined as 41 Muscatine silt loam.

The purpose of this report is to enable a soils engineer to anticipate soil problems and to plan more detailed soil investigations by referring to the soil map of the county. Thus it does not seem reasonable to analyze the test data in terms of the reclassified soil types, many of which do not even appear on the soil map. For this reason, the test data are analyzed in terms of the soil types as they are shown on the map, i.e., map units are analyzed, rather than actual soil types.

Because of the difference between present standards of soil classification and the soil types mapped in DeWitt County, it would be incorrect to directly extrapolate all data from DeWitt County into adjacent areas. For example, statistical test data for 149 Brenton silt loam from DeWitt County should not be assumed to be valid for areas of Brenton silt loam mapped in adjacent counties since five of the six sites sampled in DeWitt County would now be classified as other soil types. Wherever the soil profiles relating to a given map unit were reclassified, a note is shown on the test data summary sheet indicating the new classifications. Thus data from DeWitt County may be compared and analyzed with data from adjacent areas in terms of presently recognized soil types.

The soil type names used in this report are those which appear in the DeWitt County soil report.(12) In some cases, different descriptive adjectives are presently used in the names of these soil types. For example, soil type No. 25, Hennepin gravelly loam, is now termed Hennepin loam; however, the soil series can always be properly identified by the type number.

IV. PROCUREMENT AND ANALYSIS OF DATA

A. SOIL SAMPLING AND TESTING PROCEDURES

1. Site Selection

The location of sampling sites was done in the office by reference to the soil map of DeWitt County.(12) Sites were chosen at random on the basis of accessibility, although some control was exercised to avoid a concentration of sampling within a limited area. In the field the preselected site was checked only to see that it met the requirements of topography and drainage for the soil type being sampled, and no attempt was made to sample only "average" or "typical" profiles. Thus it is believed that the data obtained are representative of the range of soils included in a soil type map unit, rather than of "typical" soil profiles. Sites were generally chosen in fence rows in order to minimize profile disturbance which might have resulted from farming or road construction operations.

A previous study had indicated that for four common soil types in DeWitt County, a fairly reliable estimate of the liquid limit, plasticity index, and percent clay finer-than-2 microns cound be obtained by sampling five profiles of each type.(15) Therefore, in this investigation five profiles of the more common soil types were sampled, although fewer samples were taken of some of the less common types. Table 4 indicates the number of profiles of each soil type which were sampled. Because of problems involved in reclassification of some of the sites, more than five profiles of some soil types were sampled. This was done so that sufficient data would be available for the major reclassified soil types.

2. Field Sampling

Field sampling was usually done from test pits about 3 ft square opened to the depth at which the C horizon was encountered. The boundaries between horizons were noted on the walls of the pit. Samples of the A and B horizons were taken by shaving material from the wall of the pit with a spade and catching it in a shallow pan held near the bottom of the horizon. The top few inches of the A horizon were generally not sampled because of their high content of plant material and because they are normally removed in road construction operations. If the A and B horizons were thick enough, the transition zones between horizons (2 to 3 in.) were not included in the samples. With these exceptions, an attempt was made to sample the full thickness of the A and B horizons. Thus the test data obtained represent an average for the whole horizon. The C horizon was sampled from the bottom of the test pit with a 4-in. post hole auger.

Occasionally, sampling was done at the side of a road cut.. In such instances, several inches of material were shaved off the face of the cut before the samples were taken in order to avoid contamination. Samples were then taken from the road cuts in the same manner as from the sides of the test pits.

3. Laboratory Testing

Laboratory testing of the soil samples consisted of the determination of Atterberg limits, grain-size distribution, and compaction characteristics. Standard ASTM procedures for the determination of liquid limit (D423), plastic limit (D424), particle-size distribution (D422), and compaction characteristics (D698) were followed except that (1) samples for Atterberg limit tests were mixed with water and allowed to stand at least 12 hours before testing, and (2) the compaction tests were performed with a Rainhart automatic tamper using a rammer with a circle-sector face.

No attempt was made to exercise exceptional care in performing the laboratory testing. Instead, the work was conducted as a routine soil testing program, thus the data can be expected to include variations associated with normal laboratory procedures. Atterberg limits were not determined for the coarse-grained, nonplastic samples. Compaction characteristics are not reported for a number of samples because of the lack of satisfactory test data.

The laboratory test data and the sampling location, slope, and depth for each profile sampled are given on the Test Data Summary Sheets in Appendix I.

B. STATISTICAL ANALYSIS OF DATA

The data obtained by the methods outlined above were subjected to statistical analysis to determine the mean and the variability of pertinent index properties for each horizon of each major soil type. These index properties are liquid limit, plasticity index, maximum dry density, optimum moisture content, percent of material passing the No. 4, No. 10, No. 40, and No. 200 sieves, and the percent clay finer-than-2 microns. The Summary of Statistical Data Sheets in Appendix I show the number of sites for which data were available and the appropriate statistics. For those horizons containing coarse-grained, nonplastic materials, the statistical analysis of the Atterberg limits includes only the data for those samples which could be tested. In other words, values of zero for liquid limit and plasticity index were not considered to be valid values which could be averaged in with the values obtained from plastic samples.

The variability of each index property is indicated by its standard deviation given on the Summary sheets. Normally, it may be expected that test results from approximately 67 percent of the soil samples obtained in the field will fall within the range of the mean ±1 standard deviation. It also may be expected that approximately 95 percent of the data may fall within the range of the mean ±2 standard deviations, and 99 percent within the range of the mean ±3 standard deviations.

Statistical theory predicts that 85 percent of the time, any additional test results would lie within ±1.45 standard deviations of the mean. These are the ranges shown on the data sheets in Appendix I entitled Pedologic Profile Description and Engineering Characteristics. For example, the data sheet for No. 25, Hennepin gravelly loam, shows that there is an 85 percent probability that the liquid limit of the C horizon of any sample of this soil would be between 21 and 54. Alternatively, one could say that for any 100 samples of the C horizon of Hennepin gravelly loam, 85 samples would be expected to have a liquid limit between 21 and 54. For those soil types containing horizons which may be nonplastic, a special note is given. For example, the data sheet for soil type No. 134, Camden silt loam, indicates that the C horizon may be nonplastic or, if it is plastic, its plasticity index would be expected 85 percent of the time to be between 5 and 18.

The coefficient of variation is often a convenient indicator of the variability of an index property. A standard of comparison is given by the magnitude of the coefficient of variation commonly associated with the compressive strength of concrete cylinders. The strengths of a group of test cylinders taken from concrete used in ordinary construction work generally have a coefficient of variation on the order of 15 percent. Quality control would have to be exercised in order to produce concrete strengths with a coefficient of variation on the order of 10 percent or less. These values suggest that a soil index property whose coefficient of variation is 10 percent or less could be considered to be fairly uniform, but one whose coefficient of variation is over 20 percent is relatively variable. Thus, for example, the liquid limit of the C horizon of Hennepin gravelly loam is rather variable since its coefficient of variation is 29.8. But the percent of the C horizon passing the No. 4 sieve does not vary much from a mean value of 97.5 percent, since the coefficient of variation for this index property is only 2.4.

The Summary of Statistical Data Sheets also presents measures of the precision with which the sample mean approximates the population mean. From statistical theory, it is predicted that there is a 67 percent probability that the population mean lies within the range of the sample mean plus or minus the standard error. For example, the odds are 67 in 100 that the mean

liquid limit of the population consisting of all occurrences of the C horizon of Hennepin gravelly loam in DeWitt County lies in the range of 37.8 ± 5.0. A more confident estimate of the population mean is given by the sample mean plus or minus the limit of accuracy. This range contains the population mean 95 percent of the time. Thus the odds are 95 in 100 that the range of 37.8 ± 14.0 contains the population mean for the liquid limit of the C horizon of Hennepin gravelly loam. The last column on the Summary Sheets gives an estimate (based upon the variability of the sites sampled) of the number of samples required to determine the population mean to within ±5.0 units with 95 percent confidence. For example, 40 samples of the C horizon of Hennepin gravelly loam would need to be tested in order to determine the population mean liquid limit to within ±5.0. The "Number of Samples Required" provides a very convenient indication of the variability of each soil type and horizon and its index properties. The 40 samples required of the C horizon of Hennepin gravelly loam indicates that the plasticity characteristics of this horizon are quite variable. In contrast, the A horizon of Hennepin gravelly loam is much less variable since only 8 samples of the A horizon will define its liquid limit to within ±5.0.

V. INTERPRETATION OF DATA

A. INDIVIDUAL SOIL TYPES

The data sheets in Appendix I give detailed information on the individual soil types mapped in DeWitt County. The first data sheet for each soil type contains a description of the soil profile and its estimated engineering index properties and classifications according to both AASHO and Unified classification systems. Values of index properties can be expected to fall within the estimated ranges 85 percent of the time. The underlined classifications are the most probable ones, while the others listed are possible, based upon the estimated values of the index properties.

The second data sheet, entitled "Design and Construction Information," briefly summarizes properties and problems which can be expected from the soil type. These predictions are based upon data obtained from this and previously published studies.(14,16) The third sheet, entitled "Test Data Summary," summarizes the laboratory data for each sample tested and gives the location of each sampling site. For those sites which were reclassified after sampling, a footnote gives the newer classification. The fourth data sheet for each soil type gives the "Summary of Statistical Data," previously described. The engineering application of the data presented on these sheets will be discussed in Chapter VI.

B. PARENT MATERIALS

1. Introduction

The properties of the parent materials underlying the solum are of particular interest to the highway engineer since they are generally encountered in cuts at depths of 3 to 4 ft. These materials comprise the bulk of most fills, and they are the materials in which most shallow foundations are placed.

2. Occurrence

The areal extent of the various parent materials in DeWitt County is shown on Figure 6. As mentioned previously, most of the soils in the county have developed wholly or partly in loess. Loam till, medium-textured outwash, and Recent alluvium are the other near-surface materials which have been affected by soil development. Actually, the outwash is generally not a true parent material, since the solum has usually developed in loess overlying the outwash. Thus it would be more correct to describe the loess, loam till, outwash, and Recent alluvium as near-surface geologic materials associated with soil development, rather than to group them under the title of "parent materials" as will be done in this report.

Table 5 lists all but two soil types mapped in DeWitt County according to the parent material groups to which their C horizons belong. The two soil types not included are No. 73, Huntsville loam, for which no C horizons were sampled, and 195, Hersman clay loam, which was not sampled at all.

Soil types from all soil association groups listed in Table 3 are included in the loess parent material group in Table 5, because the loess thickness in the county is great enough to contain the entire profile of most soil types. As indicated in Figure 6, loess can be found in all parts of the county within and underlying the solum and extending to depths as great as 10 ft. In general, the loess thickness is greatest on the flat uplands away from the major streams, and in the southwest part of the county.

The presence of loam till in the

upper C horizon is limited mainly to soils developed on steeper slopes in the areas covered by the Wisconsinan glaciation. Here a substantial portion of the loess has been eroded away, or else the original deposit was never as thick as on the adjacent flatter areas. However, loam glacial till may be encountered at depths greater than 5 to 10 ft in nearly all areas covered by the Wisconsinan ice.

Outwash at a shallow enough depth for it to be sampled as the C horizon is limited mainly to terraces along Salt and Kickapoo Creeks, in soil type No. 134, Camden silt loam. Other terrace soils may also contain outwash, but at greater depth. The outwash plain in front of the Shelbyville Moraine can be expected to contain similar coarse-grained material, but it is covered by loess up to 10 ft thick.

Alluvial material is found on the bottomland and terraces along the major drainage lines.

3. Grain-Size Characteristics

The average grain-size distribution curves for the different parent materials are shown in Figure 9. These curves show the distinctive characteristics associated with each of the parent materials. The average grain-size curve for loess illustrates the typical concentration of silt-size particles resulting from the wind transportation and deposition. A predominance of silt-size particles combined with a clay content of 20 to 30 percent and a sand content of 0 to 10 percent is almost a certain identification of loess in DeWitt County.

The average curve for loam till exemplifies the "well-graded" size distribution characteristics of such glacial deposits. In DeWitt County the Shelbyville till typically has a combined sand and gravel content of 20 to 40 percent and a clay content (<2μ) of 20 to 30 percent.

The alluvium is found to have a grain-size distribution intermediate between that of loess and glacial till. This is reasonable in view of the fact that erosion of the latter two materials has provided the source of much of the recent alluvium. The marked similarity to the curve for loess is indicative that transportation of this material by water has provided much of the uppermost valley deposits.

The outwash which was deposited by rapidly moving glacial meltwaters would be expected to be coarser than the recent alluvium laid down by the present streams. The average grain-size distribution curve for outwash shows that this is actually the case. The outwash sampled in DeWitt County averages 30 percent gravel, 50 percent sand, and only 20 percent combined silt and clay size.

Figure 10 shows the average USDA textural classification of the parent materials. It appears that the terms loam and silt loam are appropriate textural descriptions for the till and loess respectively. The average alluvium texture is also that of a silt loam. The finer-than-gravel portion of the outwash is texturally a sandy loam, but because the gravel content averages 30 percent, the outwash would be correctly classified as gravelly sandy loam.

4. Plasticity Characteristics

Figure 11 illustrates the basis of the graphical presentation of statistical analysis of plasticity data. The mean values of the liquid limit and plasticity index for the C horizon of Hennepin gravelly loam are indicated by the square in the center of the rectangle. The rectangle encloses a range of 1.45 standard deviations on either side of the mean plasticity index and the mean liquid limit. As previously explained, this range theoretically encloses 85 percent of the population from which the test sample was taken. This 85 percentile range is shown by the diagonal of the rectangle, since a typical distribution of test data points lies roughly along this diagonal as shown in the figure. This 85 percentile diagonal is generally semiparallel to the A-line on the Casagrande Plasticity Chart. Hereafter, only the mean and the 85 percentile diagonal will be shown on plasticity diagrams in this report, and the test data points will not be indicated.

Such diagrams were used to estimate the probable engineering classification of each soil horizon and the soil groupings. For example, since the C horizon of Hennepin gravelly loam averages more than 35 percent finer-than-

the No. 200 sieve, the most probable classifications of a sample of this horizon would be A-6 or A-7-6, with a much smaller probability of it being classified as A-4. Even though the 85 percentile rectangle extends into the range of an A-7-5 or A-5 classification, the corner in these areas is so far from the 85 percentile diagonal that the probability is very small that a sample would have plasticity characteristics plotting in the A-7-5 or A-5 range. Thus an A-7-5 or A-5 classification is not listed as probable for the C horizon of Hennepin gravelly loam.

The plasticity characteristics of the four parent materials are shown in Figure 12. It can be seen from the location of the means and the lengths of the 85 percentile diagonals that the outwash, till, and loess have relatively distinct plasticity characteristics, but that the alluvium is much more variable. This is probably due partly to the inherent variability of alluvial deposits, and partly to the small number of test samples on which the statistical analysis was based. It should be noted that the outwash samples either had plasticity characteristics within the relatively small range indicated by the 85 percentile diagonal, or they were nonplastic. Of the 13 samples tested, 8 (62 percent) were nonplastic. A comparison of the lengths of the 85 percentile diagonals for loess and loam till shows that the loess has a shorter diagonal and therefore its plasticity characteristics are less variable than those of till. This might be anticipated in consideration of the rather specialized conditions under which loess is produced and the rather small variation in its other properties, such as grain-size distribution. Opposed to this uniformity of loess is the rather large variation of properties of glacial till, and its characteristic heterogeneity. It is also interesting to note that the loess is more plastic than the till in spite of nearly identical clay contents. This can be explained on the basis of previous research which indicates that the clay mineral in loess is primarily montmorillonite, whereas that in till is mostly illite.(18)

Table 5 shows that the parent material group "loess and silty sediments" includes soil types derived from (1) loess over loam till, and (2) loess and silty local wash over stratified outwash.

These designations indicate some variations in geologic origin so that the validity of grouping them together for analysis may be questioned. However, statistical analysis of these groups individually reveals only insignificant differences from an engineering viewpoint. It suggests that both groups consist of loess or reworked loess and that the reworking process has not significantly altered their engineering index properties.

5. Compaction Characteristics

The means and 85 percentile ranges of maximum dry density and optimum water content for the different parent materials are shown in Figure 13. The mean values lie along a line given by

$$\gamma_{max} = 145 - 2.1\ (w_{opt}).$$

In a manner similar to the distribution of test data points for plasticity characteristics, the test data points for compaction characteristics lie approximately along the 85 percentile diagonals which are semiparallel to the line defined by the equation above.

It is again evident that the loess exhibits greater uniformity of values than the till and that the alluvium is the most variable. The greater variability in moisture-density relations of the outwash as opposed to its small variation in plasticity characteristics probably results from variations in particle-size characteristics among the samples. Such variations are not as significant for plasticity properties since Atterberg limits are run on only the minus No. 40 sieve fraction of the plastic samples.

6. Summary

A comparison of Figures 9, 10, 12, and 13 shows that different parent material groups occur in the same relative order for textural, plasticity, and compaction characteristics. These trends are shown in Table 6. The relationship is that which might be predicted, with the finer-grained materials being more plastic and having lower maximum dry densities at higher optimum water contents.

The order of increasing variability for both plasticity and compaction characteristics is loess, till, and

alluvium with the position of outwash being somewhat indistinct. Since this order is also the order of decreasing number of samples (excluding outwash), it is probable that some of the change in variability is due to sample size.

Appendix II contains data sheets for parent materials which are similar to those in Appendix I for individual soil types. Included are data for estimated engineering characteristics, design and construction information, and a summary of statistical data.

C. GREAT SOIL GROUPS

1. Introduction

The majority of soil types mapped in DeWitt County have a solum which has developed in loess so that parent material is not a significant variable affecting their solum characteristics. Hence, the other two factors influencing the variability of soil profiles in DeWitt County--(1) topography, as it affects drainage, and (2) vegetation--must be considered in analyzing the solum characteristics of these soils. Because Great Soil Groups include individual soil types which have developed similar profile (mainly solum) characteristics due to similar conditions of drainage and vegetation, it seems reasonable to evaluate the solum characteristics of DeWitt County soils in terms of Great Soil Groups. Table 7 shows the groupings used, considering only those soil types which have developed from loess or loess-derived materials. The 15 soil types included in the table cover about 86 percent of the county. Not included in the table are (1) the Alluvial soils, since they have no true solum and are not directly derived from loess; (2) soil types No. 25, Hennepin gravelly loam, No. 60, LaRose silt loam, and No. 224, Strawn silt loam, since the solum of these soil types may include both loess and loam till; (3) soil type No. 234, Sunbury silt loam, a Brunizem-Gray Brown Podzolic intergrade; and (4) soil type No. 195, Hersman clay loam, since it was not sampled.

The influence of each of the two variables, vegetation and drainage, are not adequately separated in this analysis although general trends can be pointed out. Table 7 also indicates the conditions of slope and drainage which occur within each of the Great Soil Groups analyzed. The Humic-Gley soils are most poorly drained, occurring in nearly level to depressional topography on slopes of 0 to 0.5 percent. Next are the Planosols which occur on nearly level topography on slopes of 0 to 3 percent. The Brunizem and Gray-Brown Podzolic soils occur under more variable conditions of drainage and topography (nearly level to strongly sloping, 0 to 8 percent slopes), but generally they are better drained and occur on gently rolling ground at slopes of 1 to 4 percent.

Deciduous hardwood forest is the natural vegetation of the Gray-Brown Podzolic soils, prairie grasses are native to the Brunizem soils, and wet-prairie and marsh vegetation are native to the depressional, poorly drained Humic-Gley soils. Both prairie and deciduous hardwood vegetation are native to the Planosols analyzed in this report. Thus it would be expected that the average influence of vegetation on the Planosols is intermediate between that exerted on the Brunizem and on the Gray-Brown Podzolic soils. An analysis of the organic carbon content of typical soils of northeastern Illinois showed that the Gray-Brown Podzolic soils had the lowest values, Brunizem soils were intermediate, and Humic Gley soils the highest amounts in the upper horizons.(18) These data suggest that the values in Table 8 might approximate the average organic carbon contents of the samples of DeWitt County soils taken for this report.

With these average characteristics of drainage and organic carbon content in mind, some understanding of the average solum characteristics of DeWitt County soils can be obtained. The range of average percent finer-than-the No. 200 sieve for the C horizons for all four Great Soil Groups was from 93.2 to 96.2 percent. Figure 14 shows that the average percent clay (<2μ) for the C horizons ranged from 25.0 to 28.1. Figure 15 shows the plasticity characteristics of the C horizons. The uniformity and the magnitude of the mean plasticity and grain-size characteristics indicate clearly that the samples studied from the four Great Soil Groups developed on loess or loess-derived materials. Thus parent material is not responsible for variations in the solum characteristics.

A summary of statistical data for each of the Great Soil Groups analyzed

and estimated engineering properties based upon the 85 percentile ranges are given in Appendix III.

2. Grain-Size Characteristics

Figure 14 shows that the average percent clay in the A horizon of the Brunizem, Gray-Brown Podzolic, and Planosol soils ranges between 19.1 and 21.2, while that of the Humic-Gley soils averages 26.4. The uniformity of the clay content of the Brunizem, Gray-Brown Podzolic, and Planosol soils is suggested also in Table 7 where all of the soil types in these Great Soil Groups have the textural name silt loam. This relatively constant clay content indicates that the normal variability of topography and vegetation does not have as much effect upon the texture of the A horizon as does the uniformity of parent material. An exception to this generalization is found in the case of the Humic-Gley soils. Here, the influence of topography is great enough (because of the washing of finer materials into depressions) to have a significant influence on the soil profile resulting in a higher clay content in the A horizon.

The significance of eluviation and illuviation as soil forming processes is readily apparent in the Brunizem, Gray-Brown Podzolic, and Planosol soils where the A horizon has less clay than the parent material while the B horizon has more. In the case of the Humic-Gley soils, the influence of eluviation on the grain size of the A horizon is offset by local wash. The average clay contents of the B horizons of the Gray-Brown Podzolic, Humic-Gley, and Planosol soils are essentially the same, varying between 31.1 and 31.9 percent, while the clay content of the Brunizem soils is only 27.1 percent. This difference appears to be directly related to differences in vegetation and local drainage among the Great Soil Groups.

3. Plasticity Characteristics

Figure 16 shows the average plasticity values of the A horizons of the four Great Soil Groups. A comparison of these values with the estimated organic carbon contents (Table 8) shows a definite correlation between the two. This is in agreement with results previously reported that increases in the organic carbon content of a soil cause increases in its liquid limit and plasticity index.(10) Since the Gray-Brown Podzolic, Planosol, and Brunizem soils contain essentially the same percentage of clay in the A horizon, no significant variations in plasticity can be attributed to this factor. However, the higher plasticity of the Humic-Gley soils may be partially attributed to its higher clay content and partially to its higher organic content.

The plasticity characteristics of the B horizons of the four Great Soil Groups, shown in Figure 17, are significantly above those of the A horizons. This increase may, at least in part, be attributed to the higher clay content of the B horizon. Table 8 indicates that the B horizon samples of all Great Soils Groups might be expected to have about the same organic carbon contents, so that variations are not explained by this factor. The lower clay content of the Brunizem B horizon (Figure 14) might explain its plasticity being lower than that of the Humic-Gley or Planosol soils. However, such an explanation is not valid to explain the position of the Gray-Brown Podzolic B horizon mean value. It is apparent that the average plasticity values for all four Great Soil Groups are quite similar and, furthermore, that this similarity extends to the range of values for each group.

From the engineering standpoint, the most significant conclusions can be drawn from comparisons of Figures 15, 16, and 17. The C horizon (loessial parent material) has plasticity values which plot as borderline A-6 to A-7-6 irrespective of the Great Soil Group. In the A horizon the Gray-Brown Podzolic soils are borderline A-4 to A-6; the Brunizems and Planosols range from A-4 to A-7-6 with plasticity index values normally below 20 percent; and the Humic-Gleys predominantly classify as A-7-6 with plasticity index values ranging from 15 to 30 percent. In the B horizon all Great Soil Groups average an A-7-6 classification with plasticity index values normally ranging from 15 to 35 percent.

4. Compaction Characteristics

The average maximum dry density and optimum moisture content for the A, B, and C horizons of the different Great Soil Groups is shown in Figure 18, along with the mean values and 85 percentile ranges for the parent material, loess. It appears that the effect of

the soil-forming processes has been to lower the maximum dry density and increase the optimum water content of the original loess.

The mean maximum dry densities of the A horizons are seen to be inversely related to the expected content of organic carbon, given in Table 8. This suggests that the compaction characteristics of these soils, as well as plasticity characteristics, are significantly influenced by organic carbon content.

The mean maximum dry densities of the B horizons consistently plot below the data for the C horizon. Since the organic carbon content is relatively constant through the B and C horizons, the lower values of the B horizon data can most logically be explained in terms of the higher B horizon clay contents as illustrated in Figure 14.

D. SUMMARY

From the analysis of the laboratory data on DeWitt County soils, it has been found that certain generalizations can be drawn regarding properties of significance in highway engineering. The grouping of the soils with respect to the origin of their parent materials is particularly useful for predicting the properties of the C horizon material which may most often be used for road-building purposes. On the other hand, the differences in the solum characteristics of the soils are more closely related to the conditions of soil formation as indicated by the Great Soil Groups.

The average values of the liquid limit, plasticity index, and percent minus-2-micron clay are summarized in Table 9 for the principal soil series mapped in DeWitt County. Although more specific data on each series is given in Appendix I, a few significant comparisons can be drawn from the table.

In spite of the fact that most of the A horizons have developed from a loess cover, those developed under forest vegetation tend to be less plastic. This is true even though the clay content varies through a fairly narrow range from 17 to 28 percent and is not consistently related to the native vegetation. Thus the A horizons of Birkbeck, Camden, Hennepin, Strawn, Sunbury, and Ward classify on the average as A-4 or borderline A-4 to A-6. The A horizons of the moderately well to well-drained prairie types of Catlin, LaRose, and Proctor average borderline A-6 to A-7-6 classifications, whereas those of the imperfectly to poorly drained prairie types of Brenton, Drummer, Flanagan, Harpster, and Thorp all average A-7-6.

In the B horizon, the average clay contents range from 22 to 35 percent and in every case the percent of clay in the B exceeds that in the A by amounts ranging from 3 to 13. With three exceptions, the average B horizon classification is A-7-6. The Hennepin, LaRose, and Strawn which classify as A-6 are all developed in glacial till in well-drained to exceptionally well-drained positions. In fact, none of the sites sampled had an average slope less than 7 percent. Because of the large amount of runoff which occurs at such slopes, there is less opportunity for highly plastic clays to develop and be leached downward into the B horizon.

The characteristics of the C horizon materials in DeWitt County appear on the average to be remarkably consistent. Ten of the series average A-6 with liquid limits of 30 to 40 percent, plasticity indexes of 12 to 20 percent and clay contents of 14 to 28 percent. Proctor and Thorp both overlie outwash materials. The internal drainage of Proctor is good. The natural drainage of Thorp is poor and considerable amounts of clay were washed deep into the soil profile. This may account for their A-7-6 classification. On the other hand, both Flanagan and Ward have presumably developed on loam to silt loam till in imperfectly to poorly drained positions. In these cases, a majority of the C horizon samples appear to have been obtained from finer textured tills or in some cases may represent the lower part of a thick B horizon.

It should always be remembered that the physical properties of any specific soil profile may vary considerably from the average. Thus the data given in Appendix I should be used whenever estimates of soil conditions in a particular area are to be made.

VI. ENGINEERING EVALUATION OF DEWITT COUNTY SOILS

A. INTRODUCTION

The data presented in Appendices I, II, and III, when used in conjunction with the DeWitt County soil map(12) and knowledge of the geology and pedology of the county, will enable a soils engineer to make a reasonable prediction of the properties and problems presented by the surficial soils anywhere in the county. For example, one can locate those areas requiring major cuts and fills, and potential sources of good borrow material, granular material, and topsoil. Soil surveys can be planned to provide more data for the most variable and/or troublesome soils and less for those of more uniform characteristics.

The soil map(12) delineates the boundaries of pedologic units to be found in DeWitt County. The tables contained in Appendix I give pertinent classification data for each map unit, but the reliability of the data will vary with the degree of uniformity of each soil map unit. In some cases, there will be a very good correspondence between data obtained from tests on samples taken at any particular site and the average data presented in Appendix I. In other cases, the correspondence may be relatively poor due to the high degree of variability of the soil map unit. This does not seriously impair the usefulness of the soil map and the data presented herein, for it is not intended that this report should eliminate the performance of detailed engineering soil surveys. Rather, the data contained here show which soil areas are highly variable and thus warrant intensive sampling, in contrast to those which need a relatively small amount of sampling.

B. PRELIMINARY PLANNING FOR HIGHWAY LOCATIONS

For preliminary planning, it may often be advantageous to use more generalized maps than those showing pedologic soil types. For example, it is possible to determine the generalized characteristics of an area on the basis of a parent material map such as that presented in Figure 6. On this map, the surface soils have been grouped on the basis of parent material and surface color. The light-colored soils are typically Gray-Brown Podzolic soils developed under forest vegetation, while the dark-colored soils are Brunizem or Humic-Gley soils developed under prairie or swamp vegetation. Planosols may occur in either map unit. Thus some idea of the soil characteristics of an area can be obtained from the map combined with the data and discussion of solum characteristics contained herein.

Data sheets in Appendix II summarize the statistical characteristics of soil parent materials in DeWitt County. The information is presented in much the same way as for individual soil types. However, it is not possible to include typical profile characteristics, topography, drainage conditions, or Great Soil Group since these may vary widely for each parent material. Nevertheless, these data present a generalized engineering interpretation of the C horizon which is valuable for preliminary planning.

Although the final choice of proposed highway alignments will undoubtedly be influenced by other factors, data contained in this report allow the choice to be made with more consideration given to soil engineering problems, even before a field survey has been implemented.

C. ENGINEERING SOIL SURVEY

1. Preliminary Reconnaissance Survey

The common practice of first determining the alignment of a transportation facility and then making a soil survey is not economical from the soil engineering standpoint. Although pavements can be designed for poor soil conditions, frequently an alternate alignment can be selected so as to avoid some, if not all, of the areas where these occur.

The results of recent research suggest that a useful and economical soil survey for transportation facilities can best be achieved by the following approach:

(1) The preliminary corridor of the proposed transportation facility is first determined by considering all economic and desire factors, including the general soil conditions in the area.

(2) A preliminary soil survey of the corridor should then be made. The DeWitt County soil map should be used in planning this survey. Tests on samples from a few borings properly located enable the soils engineer to verify or modify estimates of the engineering properties of the various soil types given in this report. Areas which appear to have the worst subgrade conditions should be examined in more detail than those which appear to have good subgrade conditions.

A similar procedure may be followed in other counties where agricultural soil reports are available. If soil conditions are similar to those in DeWitt County, information contained in this report will be of value. In other areas, previously published reports should be utilized.(8,13,14,16) If no published soil map is available, then airphoto interpretation procedures used in combination with generalized soil information, such as soil association maps, will be of help in planning the survey.

(3) After the preliminary soil survey is completed, the final alignment can then be selected so as to avoid, as much as possible, those areas with undesirable soil conditions.

(4) The soil engineer can then plan the detailed exploratory program, giving special emphasis to areas of variable soil types, poor soil conditions, deep cuts, high fills, borrow materials, and other factors.

2. Detailed Final Survey for Design

It should be apparent from the preceding discussions that the soil survey map of DeWitt County provides an ideal basis for planning and carrying out a soil survey for engineering purposes. The soil types which appear on the map are particularly useful since they are natural units interrelated to the underlying substrata, the surface horizons, the topography, and the drainage conditions in the area. Because the soil map of DeWitt County is published on the scale of 1 in. = 1 mile, every minor change in soil types cannot be shown. For this reason, the map cannot be used to pinpoint the exact locations of borings. Furthermore, enlargements of the present map would not be more accurate. The map, however, can be utilized very effectively in conjunction with aerial photographs of an area. Photography is available to the scale of 1:20,000 (approximately 3.17 in. = 1 mile) and may be purchased from the U.S. Department of Agriculture. The outline of each pedologic map unit area may be transferred to the photographs. Generally, it is then apparent from shadings on the photographs where soil conditions change within any of the soil boundaries. Photographs taken to a scale of approximately 1 in. = 800 ft are particularly useful in planning and executing the engineering soil survey and will usually be available as a by-product of photogrammetric surveys prepared for highway purposes.

As soon as the final alignment is determined, it should be reproduced on the DeWitt County soil map and also on available aerial photographs. If the soil map has been used in the preliminary phases of alignment selection, the soil engineer should already be familiar with general soil conditions in the corridor.

Proposed locations of borings may be pin-pointed directly on the photographs and thus located readily by field survey crews. The actual procedure for locating the borings and the spacing to be employed will vary accoring to the nature of the facility. It is recommended, however, that the method selected should take advantage of the knowledge of soils in DeWitt County accumulated as part of this investigation. Thus test borings should be more heavily concentrated in those soil types

which this study has found to be quite variable in contrast to those which have been found to possess rather uniform properties. Previous publications contain suggestions regarding several methods by which the number of borings may be apportioned among soil types on the basis of their relative variabilities.(7,14,16) Such procedures tend to avoid problems resulting from a regular pattern of soil borings which include:

(a) The possibility of missing a detrimental soil type which may cause problems during construction all out of proportion to the amount of area which it occupies,

(b) The sampling of a uniform soil type many times more than is necessary to determine its average characteristics and variability, and,

(c) The possibility of placing a very small number of borings in an extremely erratic soil which actually may be responsible for the major engineering problems along the proposed line of right-of-way.

D. DESIGN FACTORS

For each soil type the data sheets in Appendix I contain certain information which may be utilized directly in design. In addition to that information which pertains directly to the engineering classification of soils, three other items of importance are listed under the headings: water table, frost action, and cut slopes. Water table information is given as estimated depth of the water table during the spring of the year in DeWitt County. This estimate is derived primarily from knowledge of the normal topographic position and general surface drainage characteristics as described by agricultural soil scientists.(17) Following this is a classification of the drainage in accordance with the policy followed by the Illinois Division of Highways in pavement design and construction.(4) Drainage conditions are described as good, fair, poor, or very poor, and sometimes range from one category to the next.

In most pavement design procedures, frost action is taken into consideration in two ways: on the basis of the average or maximum depth of frost penetration, and on the basis of the frost susceptibility of the materials. Little specific information is available on average depth of frost penetration in various parts of Illinois. For the DeWitt County area it is believed to be about 30 to 36 in. The maximum depth of frost penetration during a severe winter may be 40 in. or more. Depending upon the pavement design procedure which is utilized, either one of these figures may be incorporated into the design. As more precise data become available, they should be used. With regard to the classification of the materials on the basis of susceptibility to detrimental frost action, either the AASHO or Unified groupings may be used as general criteria. However, more specific criteria based on grain-size and plasticity characteristics have been adopted by the U.S. Army Corps of Engineers for use in airfield and highway pavement design.(6) The various soils of DeWitt County have been classified with regard to susceptibility to frost action as F_1, F_2, F_3, or F_4 with primary consideration being given to the character of the parent materials. The definition of each classification is given in the following paragraphs:

F_1 Gravelly soils containing 3 to 10 percent finer than 0.02 mm by weight.

F_2 (a) Gravelly soils containing 10 to 20 percent finer than 0.02 mm by weight.

(b) Sands containing 3 to 15 percent finer than 0.02 mm by weight.

F_3 (a) Gravelly soils containing more than 20 percent finer than 0.02 mm by weight.

(b) Sands, except very fine silty sands, containing more than 15 percent finer than 0.02 mm by weight.

(c) Clays with plasticity indexes of more than 12.

F_4 (a) All silts including sandy silts.

(b) Very fine silty sands containing more than 15 percent finer than 0.02 mm by weight.

(c) Clays with plasticity indexes of less than 12.

(d) Varved clays and other fine-grained, banded sediments.

Information on the stability of cut slopes is first given in terms of stability at a nominal slope of 1.5:1 (approximately 33 degrees). Appended to this may be other information relating to the particular characteristics of soil horizons, either developed or depositional, which influence the stability of deep cuts. These estimates are based primarily on the authors' general experiences and may well be modified by persons having more experience in a particular locality.

E. CONSTRUCTION PROBLEMS

In addition to design and construction information discussed in the preceding section, the data sheets in Appendix I contain for each soil type a brief notation regarding the kinds of construction problems which may be anticipated. These are enumerated specifically under the headings seepage, excavation, compaction, erosion, and special recommendations. In addition, three notations rate the soil type as a source of construction material for general borrow, granular material, and topsoil. While all of these notations must be considered qualitative in nature, they are based on the data regarding texture, plasticity, and moisture-density relationships of the soil horizons in combination with considerations of the topographic position, drainage characteristics, and the organic content of the A horizon of the soil type. Both engineers and contractors should find this information useful in planning construction and during construction.

Some of the most important soil engineering problems in DeWitt County will be related to one of the following features: natural stratification of the deposits near the surface, soils in depressional areas, soils on steep slopes, and strength or compressibility of soil materials.

1. Stratification of Deposits

Geologic studies of northeastern Illinois indicate that in a high percentage of the area several successive layers of glacial and postglacial deposits overlie bedrock.(3) This stratification of different types of materials may be exposed even in relatively shallow cuts.

Figure 6 shows that most of the area of DeWitt County is covered by loess which varies in thickness from about 5 to 10 ft. Where loess is more than 5 ft thick, the lower portion often retains some of the typical characteristics of wind-blown silt deposits and differs considerably in texture and plasticity from underlying glacial materials such as till or outwash. Where loess overlies glacial till, seepage often occurs at the base of the loess in cuts which expose this contact. Such seepage usually causes sloughing of the upper part of the slopes and it may be desirable to design the slope in such a manner as to reduce the likelihood of this occurrence. Where loess overlies relatively impermeable till, the water table is often perched above the till surface. This may provide excessive moisture to the loessial stratum and accentuate the problem of detrimental frost action due to the high frost susceptibility of wind-blown silt. A perched water table may also be of some concern when excavations are made close to the till surface, particularly in the spring or early summer. The lower part of the loessial stratum may become extremely soft under the action of heavy construction traffic and be completely impassable. If highway subgrades are established on such materials before adequate drainage is provided, irregular surfaces and relatively rapid deterioration of pavements may be expected. Where loess overlies granular outwash materials this problem should not be as serious, since internal drainage through outwash should be relatively good. Sometimes, however, if the upper layer of outwash material contains fine-grained silts or clays, then conditions will be similar to those described above. Many outwash areas occupy low topographic positions and water tables may be high in spite of relatively rapid permeability. Here again, the problems of construction during rainy seasons may be difficult to overcome, although drainage should be more readily accomplished in these areas.

Without detailed field exploration to depths greater than those usually attained in this sampling program, it is impossible to determine the thickness of outwash deposits. It is quite possible that in some of the areas designated as outwash in Figure 6 relatively shallow cuts will encounter underlying till. Generally, outwash strata will

be thickest near the front (south and west) of the moraines with which they are associated and also in or near the valleys which functioned as glacial drainageways during the retreat of the ice. It is also in these locations that one would anticipate finding the highest percentage of gravel in outwash deposits. At locations some distance in front of morainic ridges it may be expected that the outwash material will be composed predominantly of fine sands grading to silts. Since all outwash materials are stratified, only by detailed exploration can the average characteristics of each deposit be determined. Where road cuts expose the contact between outwash and underlying till seepage may be expected. As a rule, however, this does not present as serious a problem as does the loess-till contact because of the greater natural stability of granular outwash and underlying compact till.

At the present time no detailed information is available regarding the thickness of surface till sheets in DeWitt County. Moderately deep cuts in certain areas may penetrate underlying tills of significantly different character. It is possible that strata of water-deposited materials, especially silts and fine sands occasionally intermixed with organic materials, may occur at contacts between tills. Such strata often cause instability in cut slopes, since they generally are a source of seepage which may induce sloughing of the upper slopes. Even the best boring program sometimes fails to disclose the presence of these contacts and it may not be until the cuts are open that their significance is recognized.

2. Depressional Soils

Many of the most serious problems associated with engineering construction in surficial soils are encountered in the depressional areas where Humic-Gley soils occur. These soils generally have a very high water table in the spring of the year, organic surface horizons extending to depths of 18 to 20 in. or more, and occupy positions where surface water cannot be easily diverted. An analysis of the characteristics of these soils in central Illinois has been reported in a recent publication.(7) Because of their high-moisture and organic contents, these soils are relatively compressible and are easily worked into an impassable condition by the passage of heavy construction traffic. It has been found impossible to strip topsoil to moderate depths of 6 to 8 in. during rainy seasons of the year. It is generally recommended that no attempt be made to strip topsoil unless 18 in. or more can be removed and replaced with more suitable materials. It is usually more economical to build fills of four to five ft over such soils and allow consolidation to take place before the pavement is completed. Experience has indicated that even though rigid pavements are built, if they are at grade or on shallow fills of 1 to 2 ft, deterioration of the pavement takes place at a relatively rapid rate under modern highway loadings. Depressional areas can be readily delineated on the DeWitt County soil map, especially when used in conjunction with topographic maps. Detailed soil surveys indicate the thickness of the organic surface as well as the variability of underlying substrata. Smaller areas not shown on the soil map can usually be delineated on aerial photographs because of their very dark color. Both contractors and engineers should be aware of the problems associated with these depressional areas and be prepared to handle them in the most economical way possible.

3. Steep Slopes

Soils which occur on natural slopes of 10 percent or more in DeWitt County may vary in texture from loam to clay loam and in AASHO classification from A-4 to A-7-6. Cuts are nearly always required in such areas in order to provide proper vertical highway alignments. Both natural and artificial slopes are difficult to stabilize because of the character of the materials. Where the soils are loamy in texture, they often contain pockets of silt and fine sand which slough easily and cause rapid deterioration of cut slopes. Vegetation may be difficult to establish. Where fine-textured tills are exposed on such slopes, silt and sand inclusions are less common, but the material often exists at moisture contents well above optimum, making excavation difficult. Special problems of drying and compaction must be overcome if the material is to be placed satisfactorily in adjacent fills. Soil exploration should always be carried at least to the full depth of expected cuts in order to obtain information on the types of subgrade materials which

may be exposed when the cut is open. During construction, especially in the rainy seasons of the year, care should always be taken to proceed with the excavation in such a manner as to provide proper drainage away from the deepest part of the cut.

4. Strength and Compressibility of Drift

At the present time, only meager data are available regarding the characteristics of DeWitt County soil deposits as foundation materials. Indications are that the glacial tills commonly encountered within depths of 5 to 20 ft generally have unconfined compressive strengths in excess of 2 tons per sq ft. Such materials may be considered as relatively incompressible when subjected to the loads usually exerted by one- or two-story structures. On the other hand, unconfined compressive strengths of 1 ton per sq ft or less are not rare. They are much more common at depths less than 5 ft. The bearing capacity and compressibility of weathered loess, outwash, and alluvial materials are almost impossible to predict under any circumstances. It is apparent that a careful soil exploration should be conducted for all but the most modest structures. Adequate exploratory programs should invariably include the procurement of undisturbed samples which can be tested for determination of their shear strength and/or consolidation characteristics.

VII. REFERENCES

(1) Frye, J. C. and H. B. Willman, Classification of the Wisconsinan Stage in the Lake Michigan Glacial Lobe, Circular 285, Illinois State Geological Survey, Urbana (1960).

(2) Horberg, L., Bedrock Topography of Illinois, Bulletin 73, Illinois State Geological Survey, Urbana (1950).

(3) Horberg, L., Pleistocene Deposits Below the Wisconsin Drift in Northeastern Illinois, Report of Investigations No. 165, Illinois State Geological Survey, Urbana (1953).

(4) Illinois Division of Highways, Policy on Thickness Design of Subbase, Base, and Surface Courses for Highways, Illinois Division of Highways, revised (September, 1951).

(5) Leighton, M. M., G. E. Ekblaw, and L. Horberg, Physiographic Divisions of Illinois, Report of Investigations 129, Illinois State Geological Survey, Urbana (1948).

(6) Linnell, K. A. and C. W. Kaplar, "The Factor of Soil and Material Type in Frost Action," Highway Pavement Design in Frost Areas A Symposium: Part I, Basic Considerations, Highway Research Board Bulletin 225 (1959), pp. 81-128.

(7) Liu, T. K. and T. H. Thornburn, Statistically Controlled Engineering Soil Survey, University of Illinois, Civil Engineering Studies, Soil Mechanics Series No. 9, Urbana (1965).

(8) Liu, T. K and T. H. Thornburn, Engineering Index Properties of Some Surficial Soils in Illinois, University of Illinois Engineering Experiment Station Bulletin No. 477 (1965).

(9) Morse, R. K. and T. H. Thornburn, "Reliability of Soil Map Units," Proceedings, 5th International Conference on Soil Mechanics and Foundation Engineering, Dunod, Paris, France (1961), pp. 259-262.

(10) Odell, R. T., T. H. Thornburn, and L. J. McKenzie, Relationships of Atterberg Limits to Some Other Properties of Illinois Soils, Soil Science Society of America Proceedings, Vol. 24, No. 4 (July-August, 1960), pp. 297-300.

(11) Smith, Guy D., Illinois Loess, University of Illinois Agricultural Experiment Station Bulletin No. 490, Urbana (1942).

(12) Smith, Guy D. and L. H. Smith, DeWitt County Soils, Soil Report No. 67, University of Illinois Agricultural Experiment Station, Urbana (1940).

(13) Thornburn, T. H., Surface Deposits of Illinois, Circular No. 80, University of Illinois Engineering Experiment Station, Urbana (1963).

(14) Thornburn, T. H., D. J. Hagerty, and T. K. Liu, Engineering Soil Report, Will County, Illinois, University of Illinois Engineering Experiment Station Bulletin No. 501, Urbana (1970).

(15) Thornburn, T. H. and W. R. Larsen, "A Statistical Study of Soil Sampling," Proceedings, American Society of Civil Engineers, Journal, Soil Mechanics and Foundations Division, Vol. 85, SM5 (October, 1963), pp. 1-13.

(16) Thornburn, T. H., R. K. Morse, and T. K. Liu, Engineering Soil

Report, Livingston County, Illinois, University of Illinois Engineering Experiment Station Bulletin No. 482, Urbana (1966).

(17) Wascher, H. L., J. B. Fehrenbacher, R. T. Odell, and P. T. Veale, Illinois Soil Type Descriptions, Publication AG-1443, University of Illinois Agricultural Experiment Station, Urbana (1950).

(18) Wascher, H. L., J. D. Alexander, B. W. Ray, A. H. Beavers, and R. T. Odell, Characteristics of Soils Associated with Glacial Tills in Northeastern Illinois, University of Illinois Agricultural Experiment Station Bulletin No. 665, Urbana (1960).

TABLE 1

PLEISTOCENE GEOLOGIC CALENDAR*

New Classification					Tentative Time Scale (Yrs. B. P.)	Former Classification	
Stage	Substage		Principal Deposits			Stage	Substage
RECENT			Recent alluvium Dune Sand	Radiocarbon Time Scale	5,000	RECENT	
WISCONSINAN	Valderan		Alluvium Valders drift		8,000 11,000	WISCONSIN	Mankato
	Twocreekan				12,500		Cary
	Woodfordian	Peoria loess	Lake Border drift Richland loess Shelbyville drift Morton loess				Tazewell
	Farmdalian		Farmdale silt and peat		22,000		Iowan
	Altonian		Winnebago till Roxana silt		28,000		Farmdale
SANGAMONIAN			Sangamon soil		70,000	SANGAMON	
ILLINOIAN	Buffalo Hart Jacksonville Liman	Loveland loess	Buffalo Hart till Jacksonville till Mendon till	Relative Time Scale	225,000 274,000 310,000 330,000	ILLINOIAN	
YARMOUTHIAN			Yarmouth soil		600,000	YARMOUTH	
KANSAN			Kansan drift		700,000	KANSAN	
AFTONIAN			Afton soil		900,000	AFTONIAN	
NEBRASKAN			Nebraskan drift		1,000,000	NEBRASKAN	

*After Willman, Glass, and Frye, Mineralogy of Glacial Tills and Their Weathering Profiles in Illinois, Parts 1 and 2, Circular 347 (1963) and Circular 400 (1966), Illinois State Geological Survey, Urbana, and Frye and Willman.(1)

TABLE 2.

CLASSIFICATION OF SOIL TYPES AS MAPPED IN DEWITT COUNTY*

Great Soil Group, natural vegetation, natural drainage		Regosol-Gray-Brown Podzolic Intergrade (Forest)	Gray-Brown Podzolic (Forest)		Gray-Brown Podzolic-Brunizem Intergrade (Forest-Prairie)	Gray-Brown Podzolic-Planosol Intergrade (Forest)	Planosol-Brunizem Intergrade (Prairie)	Brunizem (Prairie)			Humic-Gley (Prairie)	Alluvial
Parent Material		Well drained	Well drained	Moderately well drained	Imperfectly drained	Poorly drained	Poorly drained	Well drained	Moderately well drained	Imperfectly drained	Poorly drained	
Silt loam (loess) over loam till, Parent Material 3	< 24" loess	25 Hennepin	224 Strawn					60 LaRose			152 Drummer 67 Harpster	
	> 24" loess			233 Birkbeck	234 Sunbury	207 Ward		171 Catlin		154 Flanagan		
Silt loam (loess) over stratified silty, sandy outwash, Parent Material 8				158 Vance			58 Osceola 206 Thorp	159 Pilot	148 Proctor	149 Brenton	152 Drummer 67 Harpster	
Mixed bottomland and terrace, Parent Material 9.			134 Camden			51 Kern		80 Alexis		81 Littleton	195 Hersman	73 Huntsville 107 Sawmill

*Soils in some portions of the county would be reclassified according to present soil classification standards, usually because depth of loess in DeWitt County exceeds present limits set for the soil types mapped.

TABLE 3.

ASSOCIATIONS OF SOIL TYPES AS MAPPED IN DEWITT COUNTY*

Soil Association (Soil Association Map of Illinois,) (Refs. 13, 17)	Parent Material and Vegetation	Topography	Great Soil Group	Soil Types, with % Area	
				Common	Less common types and associated types of different Great Soil Groups
H - dark colored, moderately permeable soils developed from moderately thick loess over calcareous loam till	3A - loess over loam till, prairie vegetation	inter-stream areas: more rolling areas, slopes generally > 1/2%	Brunizem	154 Flanagan 34.90 171 Catlin 8.92	234 Sunbury 2.17 60 LaRose .26
		flat to depressional areas slopes < 1/2%	Humic-Gley	152 Drummer 24.14** 67 Harpster 2.58**	
I - light-colored, moderately permeable soils developed from moderately thick to thin loess on loam till	3B - loess over loam till, forest vegetation	near streams, mostly more rolling areas	Gray-Brown Podzolic	233 Birkbeck 9.84 224 Strawn 4.43	25 Hennepin 1.44 207 Ward .47
R - predominantly dark-colored moderately permeable soils developed from medium- to fine-textured water deposits	8A - loess over medium and moderately fine textured outwash, prairie vegetation	inter-stream areas: more rolling areas, slopes generally > 1/2%	Brunizem	148 Proctor .99 149 Brenton 1.10	159 Pilot .03
		flat to depressional areas slopes < 1/2%	Humic-Gley	152 Drummer 24.14** 67 Harpster 2.58**	206 Thorp .85 58 Osceola .21
Mapped with I in DeWitt County	9 A+B - Mixed bottomland, and terrace materials, prairie and forest vegetation	near streams: floodplains and terraces	Mixed	73 Huntsville 4.77 107 Sawmill .69 134 Camden 1.23 80 Alexis .52	158 Vance .15 51 Kern .02 195 Hersman .10 81 Littleton .09

*Soils in some portions of the county would be reclassified according to present soil classification standards, usually because depth of loess in DeWitt County exceeds present limits set for the soil types mapped.

**Percentages given are combined for parent material 3A and 8A.

TABLE 4

RECLASSIFICATION OF PROFILES SAMPLED IN DEWITT COUNTY

Soil Type Mapped		Profiles sampled were classified as:		*Reason for change*
Soil Type	Number of Sampling Sites	Soil Type	Number of Sites	
25 Hennepin	5	25 Hennepin	5	---
51 Kern	1	208 Sexton	1	51 Kern abandoned as a soil type, replaced by 208 Sexton
58 Osceola	2	206 Thorp	2	58 Osceola redefined to consist only of till under loess or silty outwash, 206 Thorp has outwash underlying the silty cover
60 LaRose	6	60 LaRose	5	---
		145 Saybrook	1	flatter slope and thicker solum than LaRose
67 Harpster	5	67 Harpster	5	---
73 Huntsville	3	451 Lawson	3	73 Huntsville and 107 Sawmill combined as 451 Lawson
80 Alexis	3	199 Plano	3	loess more than 40 in. thick
81 Littleton	5	81 Littleton	5	---
107 Sawmill	2	451 Lawson	2	107 Sawmill and 73 Huntsville combined as 451 Lawson
134 Camden	6	134 Camden	4	---
		243 St. Charles	2	loess more than 40 in. thick
148 Proctor	3	199 Plano	3	loess more than 40 in. thick

TABLE 4 (cont.)

Soil Type Mapped		Profiles sampled were classified as:		*Reason for change*
Soil Type	Number of Sampling Sites	Soil Type	Number of Sites	
149 Brenton	6	149 Brenton	1	---
		198 Elburn	4	loess between 40 and 60 in. thick
		41 Muscatine	1	loess more than 60 in. thick
152 Drummer	5	152 Drummer	5	---
154 Flanagan	6	154 Flanagan	6	---
158 Vance	2	134 Camden	1	158 Vance mapped as 134 Camden
		243 St. Charles	1	loess more than 40 in. thick
159 Pilot	2	199 Plano	1	loess more than 40 in. thick
		285 Carmi	1	more gravel in C than in Pilot as currently defined
171 Catlin	5	171 Catlin	5	---
195 Hersman	0	---		now correlated with 152 Drummer
206 Thorp	5	206 Thorp	5	---
207 Ward	5	207 Ward	5	---
224 Strawn	7	224 Strawn	6	---
		322 Russell	1	loess cover more than 24 in. thick
233 Birkbeck	5	233 Birkbeck	5	---
234 Sunbury	6	234 Sunbury	5	---
		385 Atlanta	1	more oxidation of the profile than is associated with Sunbury

TABLE 5

GROUPING OF SOIL TYPES TO EVALUATE PARENT MATERIAL PROPERTIES

Loess and Silty Sediments - 46 samples

51 Kern silt loam, terrace

58 Osceola silt loam

67 Harpster clay loam

80 Alexis silt loam, terrace

148 Proctor silt loam

149 Brenton silt loam (except sample 71 C which appears to be outwash)

152 Drummer clay loam

154 Flanagan silt loam (except sample 51 C which appears to be till)

158 Vance silt loam

171 Catlin silt loam (except samples 32 C and 65 C which appear to be till)

206 Thorp silt loam

207 Ward silt loam

233 Birkbeck silt loam (except samples 4 C_3 and 64 D which appear to be till)

234 Sunbury silt loam (except samples 30 C and 63 C which appear to be till)

Loam Till - 26 samples

25 Hennepin gravelly loam

60 LaRose silt loam

224 Strawn silt loam

(plus the exceptions listed above for loess)

Outwash - 13 samples

134 Camden silt loam, terrace (except samples 23 C_1 and 48 C_1 which appear to be loess)

159 Pilot silt loam (except sample 10 C_1 which appears to be loess)

Alluvium - 4 samples

81 Littleton silt loam, terrace

107 Sawmill clay loam, bottom

TABLE 6

TRENDS IN TEXTURE, PLASTICITY, AND MOISTURE-DENSITY RELATIONS OF PARENT MATERIAL GROUPS

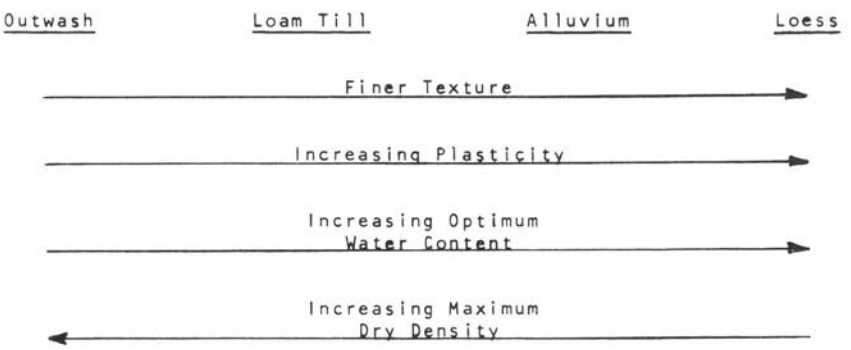


TABLE 7

CLASSIFICATION ACCORDING TO GREAT SOIL GROUP, DRAINAGE AND SLOPE OF SOIL TYPES WITH SOLA DEVELOPED IN LOESS*

Great Soil Group	Drainage	Soil Type	Slope	Number of Sites Analyzed
Brunizem	imperfectly drained	149 Brenton SiL	0-2%	6
		154 Flanagan SiL	1-4%	5
	moderately well drained	148 Proctor SiL	1-4%	3
	well drained	171 Catlin SiL	3-7%	4
		80 Alexis SiL	3-8%	3
		159 Pilot SiL	0-4%	1
Gray-Brown Podzolic	moderately well drained	233 Birkbeck SiL	2-8%	5
		158 Vance SiL	1-4%	2
	well drained	134 Camden SiL	0-4%	6
Humic-Gley	poorly drained	67 Harpster CL	0-0.5%	4
		152 Drummer CL	0-0.5%	5
Planosol and Planosol-intergrades	poorly drained	206 Thorp SiL	0-0.5%	5
		207 Ward SiL	0-1%	5
		51 Kern SiL	0-1%	1
		58 Osceola SiL	0-3%	2

*Since the publication of the DeWitt County soil report (12) a new soil classification system has been adopted which uses quite different terminology for Great Soil Groups. For the purpose of comparison with most published soil reports, as well as the Livingston County engineering soil report, the older terminology has been retained.

TABLE 8

ESTIMATED AVERAGE ORGANIC CARBON CONTENT
OF THREE GREAT SOIL GROUPS

Great Soil Group	Percent Organic Carbon		
	A Horizon	B Horizon	C Horizon
Gray-Brown Podzolic	0.75	0.50	0.33
Planosols	*	*	*
Brunizem	1.5-2.0	0.50	0.33-0.50
Humic-Gley	2.0-3.0	0.50-0.75	0.50

*No data but probably similar to Gray-Brown Podzolic data from Reference 18.

TABLE 9

SUMMARY OF AVERAGE INDEX PROPERTIES OF
THE MAJOR SOIL SERIES OF DEWITT COUNTY

Soil Series	No.	A Horizon				B Horizon				C Horizon			
		LL	PI	<2μ	AASHO Class	LL	PI	<2μ	AASHO Class	LL	PI	<2μ	AASHO Class
Birkbeck	233	31	8	21	A-4	42	19	31	A-7-6	39	17	26	A-6
Brenton	149	41	14	18	A-7-6	48	24	27	A-7-6	38	16	23	A-6
Camden	134	32	10	20	A-4	45	23	33	A-7-6	29	12	14	A-6
Catlin	171	41	15	20	A-7-6	48	23	26	A-7-6	37	16	24	A-6
Drummer	152	51	23	24	A-7-6	50	28	32	A-7-6	37	16	24	A-6
Flanagan	154	46	18	23	A-7-6	53	27	32	A-7-6	45	22	28	A-7-6
Harpster	67	52	22	28	A-7-6	50	26	31	A-7-6	40	17	26	A-6
Hennepin	25	32	10	17	A-4	36	16	25	A-6	38	20	27	A-6
Huntsville	73	47	19	24	A-7-6	-	-	-	-	-	-	-	-
LaRose	60	39	16	20	A-6	40	18	23	A-6	32	12	21	A-6
Proctor	148	40	13	17	A-6	43	18	22	A-7-6	42	18	25	A-7-6
Strawn	224	33	11	21	A-6	35	15	27	A-6	30	12	20	A-6
Sunbury	234	37	11	22	A-6	48	24	32	A-7-6	37	17	28	A-6
Thorp	206	41	15	24	A-7-6	49	26	32	A-7-6	42	21	28	A-7-6
Ward	207	35	10	19	A-4	53	29	35	A-7-6	43	20	20	A-7-6

FIGURE 1. INDEX MAP OF ILLINOIS

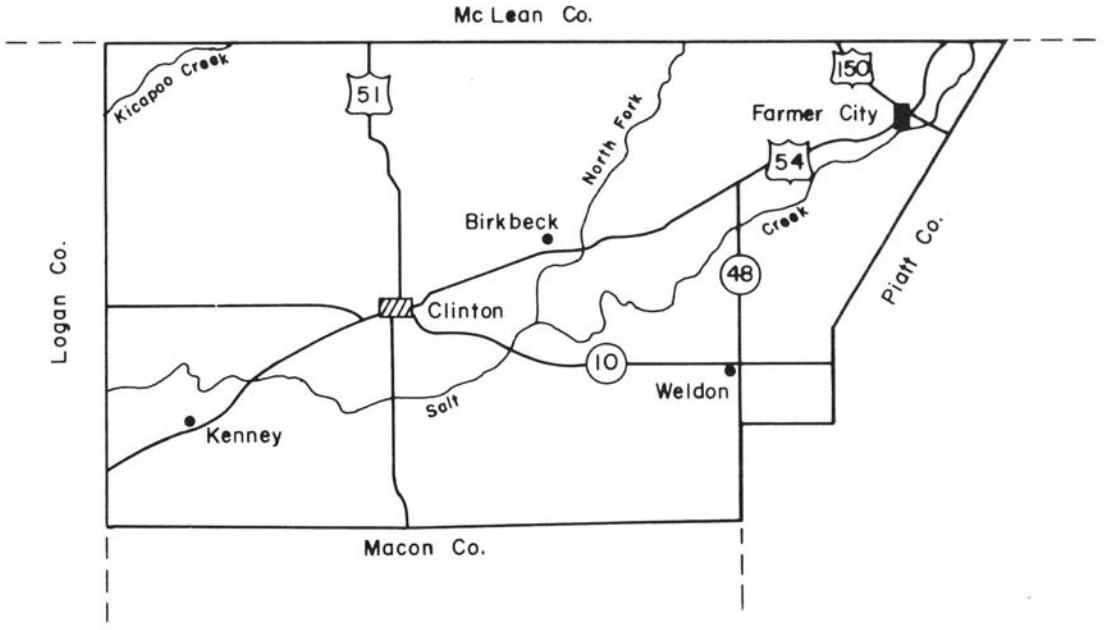


FIGURE 2. DEWITT COUNTY OUTLINE MAP

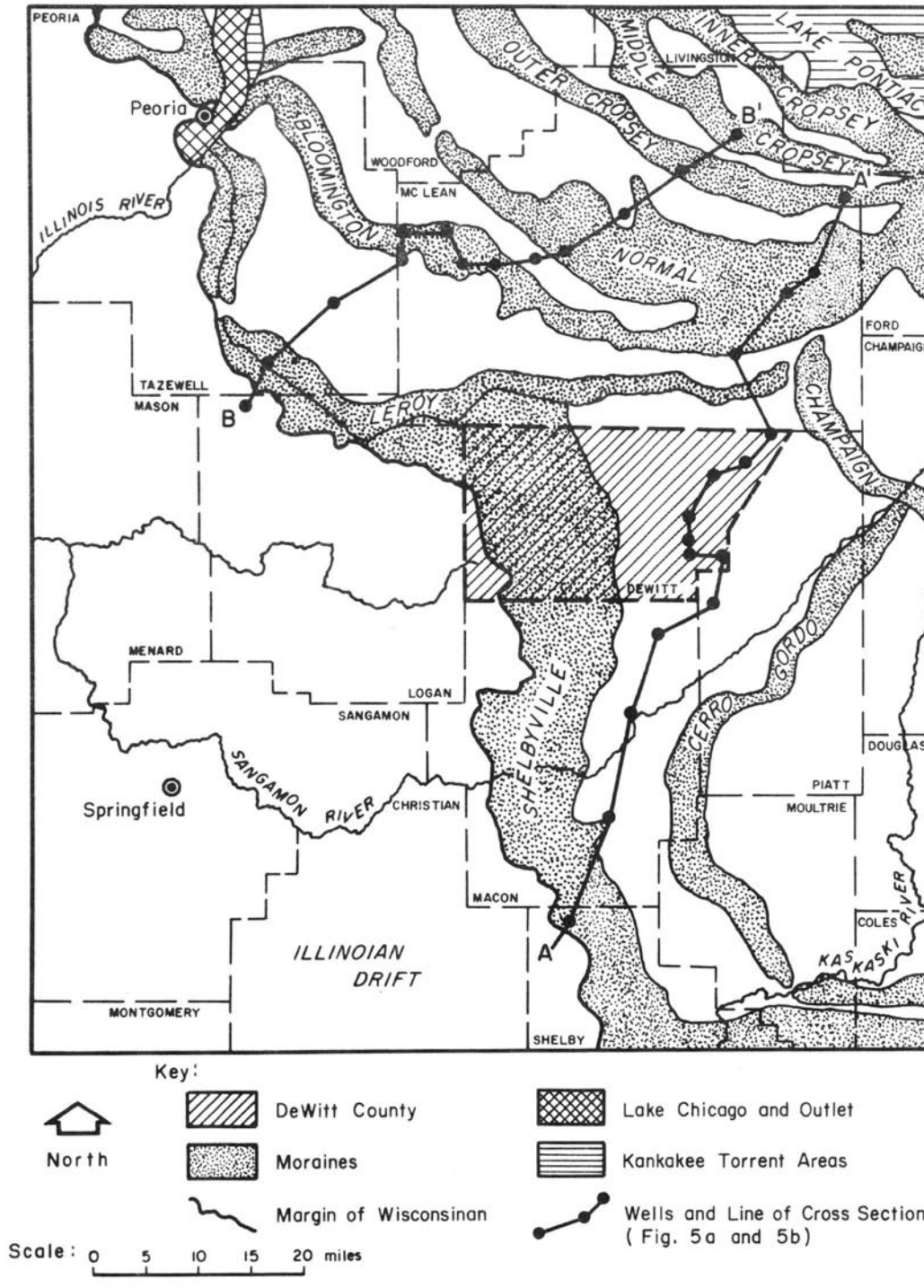


FIGURE 3. GLACIAL MAP OF PORTION OF NORTHEASTERN ILLINOIS (AFTER G. E. EKBLAW, ILLINOIS STATE GEOLOGICAL SURVEY, 1960)

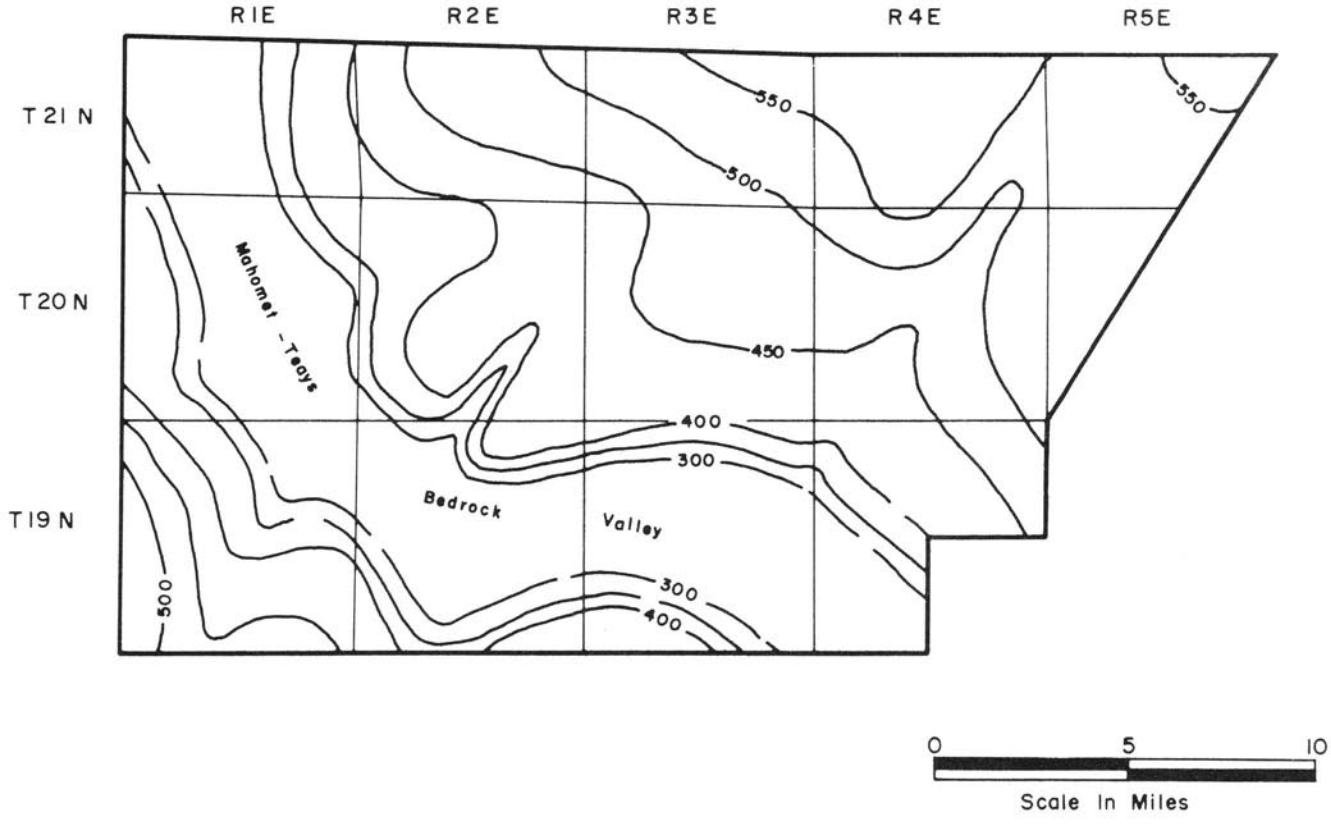
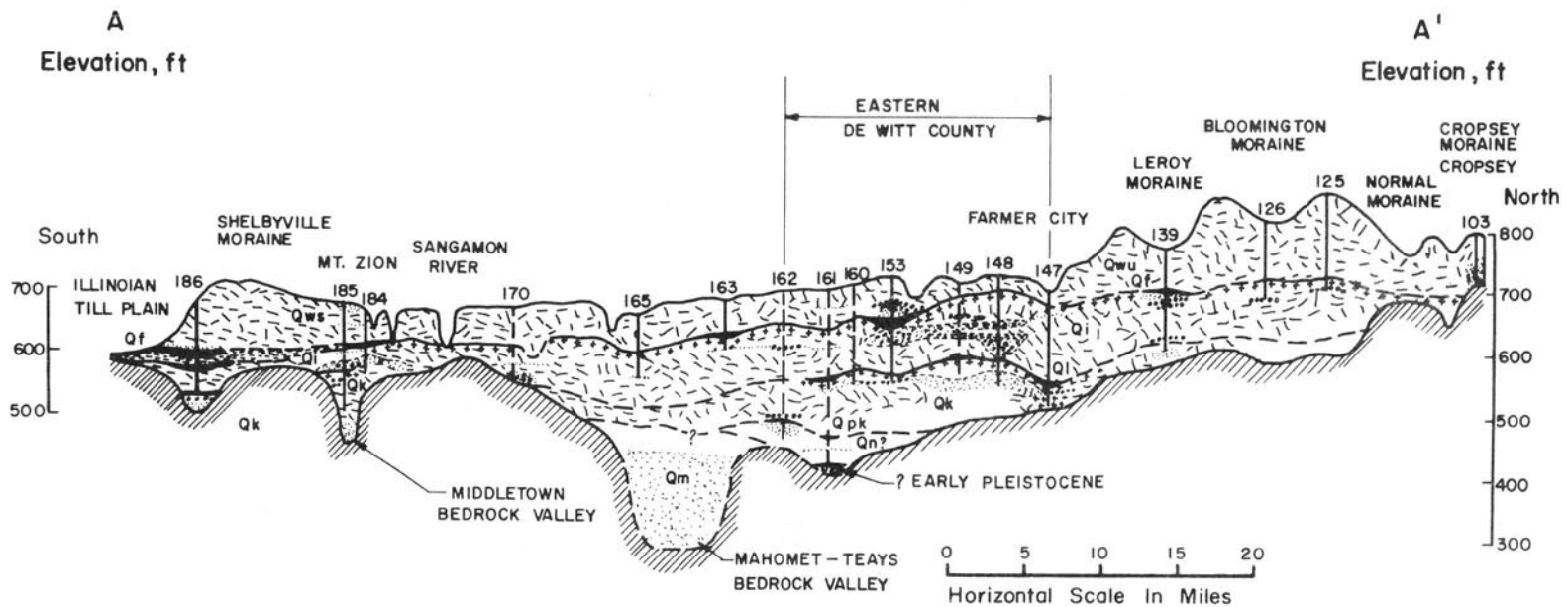


FIGURE 4. BEDROCK CONTOURS OF DEWITT COUNTY (AFTER HORBERG, REFERENCE 2)

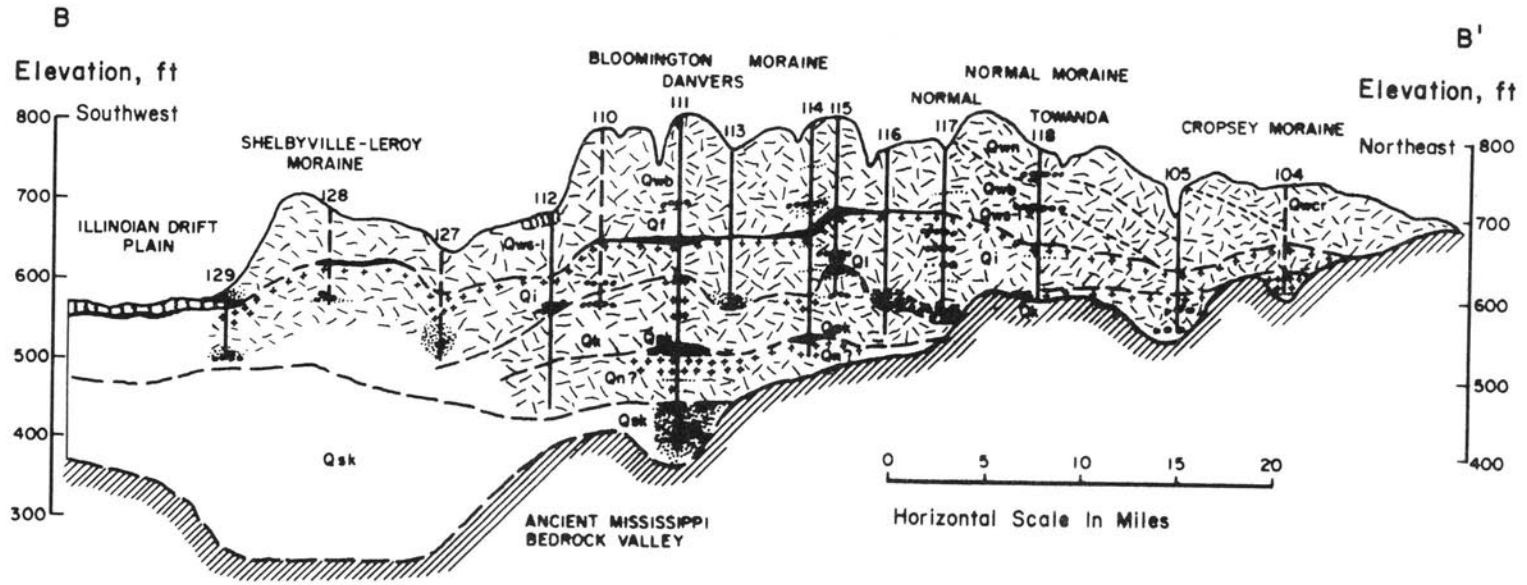


Section A–A' (See Fig. 3)

Qws – Shelbyville
Qwu – Wisconsin drift, undifferentiated
Qwcr – Cropsey
Qwn – Normal
Qwb – Bloomington
Qwl – Leroy
Qf – Farmdale deposits, (Farmdale & Iowan loess)
Qi – Illinoian drift
Ql – Loveland deposits, includes Loveland loess
Qk – Kansan drift
Qpk – Pro-Kansan (?) deposits (Aftonian ?)
Qn – Nebraskan drift
Qm – Mahomet sand
Qsk – Sankoty sand

Sand
Gravel
Bedrock Surface
Buried non-glacial deposits – includes peat, loess and interglacial silts
Weathered zone – includes leached or oxydized deposits
Silt and clay

FIGURE 5a. PLEISTOCENE STRATIGRAPHY IN CENTRAL ILLINOIS (AFTER HORBERG, REFERENCE 3)

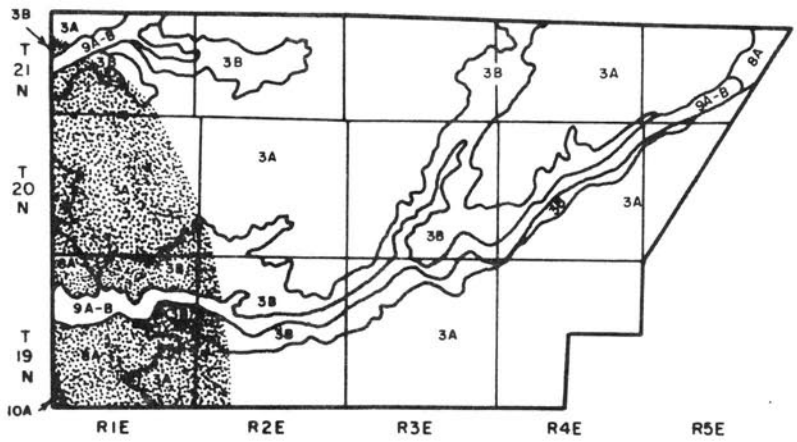


Section B–B' (See Fig. 3)

Qws - Shelbyville
Qwu - Wisconsin drift, undifferentiated
Qwcr - Cropsey
Qwn - Normal
Qwb - Bloomington
Qwl - Leroy
Qf – Farmdale deposits, (Farmdale & Iowan loess)
Qi – Illinoian drift
Ql – Loveland deposits, includes Loveland loess
Qk – Kansan drift
Qpk - Pro-Kansan (?) deposits (Aftonian ?)
Qn – Nebraskan drift
Qm – Mahomet sand
Qsk - Sankoty sand

Sand
Gravel
Bedrock Surface
Buried non-glacial deposits – includes peat, loess and interglacial silts
Weathered zone – includes leached or oxydized deposits
Silt and clay

FIGURE 5b. PLEISTOCENE STRATIGRAPHY IN CENTRAL ILLINOIS (AFTER HORBERG, REFERENCE 3)



Legend

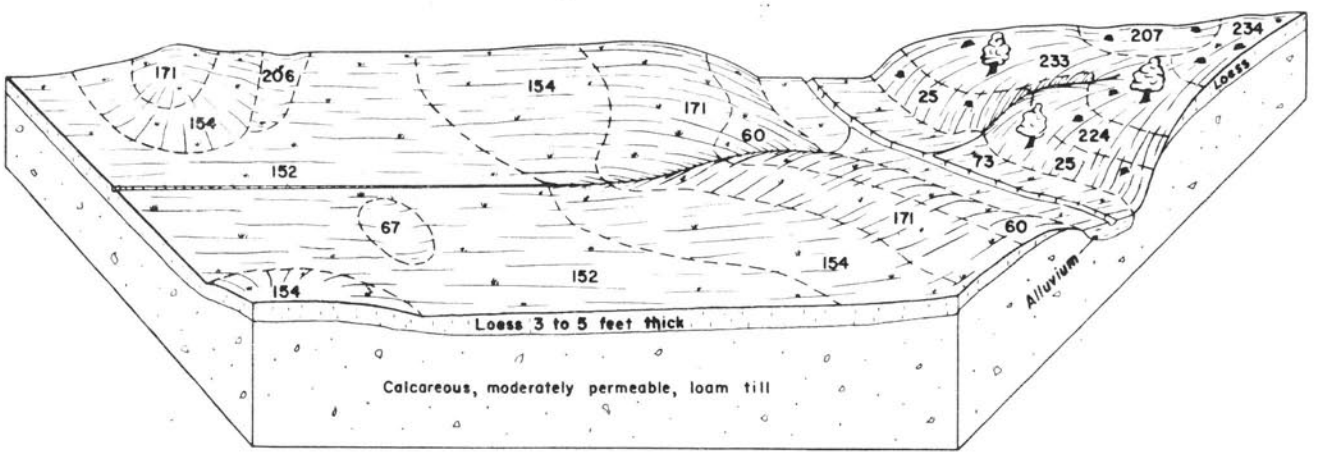
Loess, 7 to 10 feet Thick

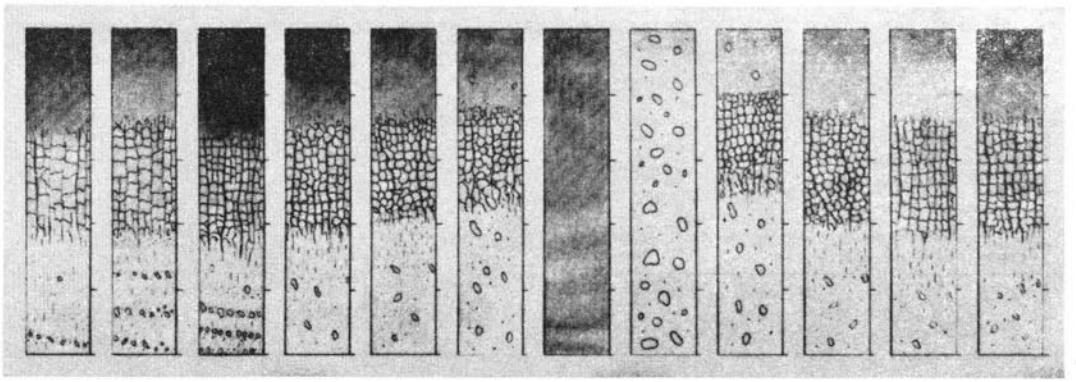
Loess, 5 to 7 feet Thick

3 – Loam Till
8 – Medium Textured Glacial Outwash
9 – Recent Alluvium, Terrace and Bluffwash Materials
10 – Illinoian Drift

A – Dark Colored Soils Developed Under Prairie Vegetation
B – Light Colored Soils Developed Under Forest Vegetation

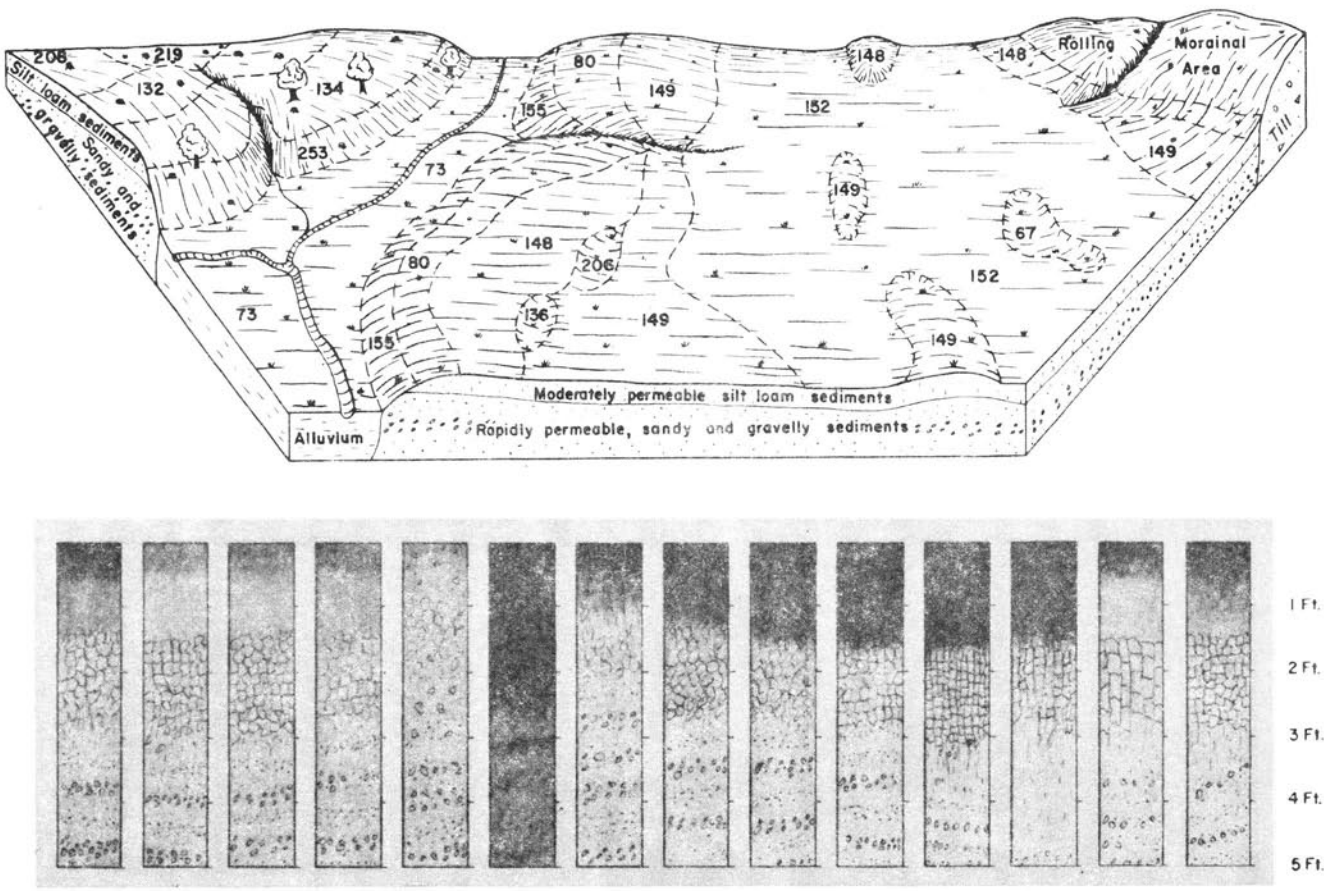
FIGURE 6. PARENT MATERIAL AND SURFACE COLOR OF DEWITT COUNTY SOILS (AFTER WASCHER ET AL., REFERENCE 18)





Type No.	67	206	152	154	171	60	73	25	224	233	207	234
Name	Harpster	Thorp	Drummer	Flanagan	Catlin	La Rose	Huntsville	Hennepin	Strawn	Birkbeck	Ward	Sunbury
Slope-%	0-.5	0-.5	0-.5	1-4	3-10	5-15	0-.5	15+	5-15	2-8	0-1	1-4

FIGURE 7. RELATIONSHIPS OF SOILS ASSOCIATED WITH THE FLANAGAN AND BIRKBECK SERIES (AFTER WASCHER ET AL., REFERENCE 17)



Type No.	219	208	132	134	253	73	155	80	148	149	152	67	136	206
Name	Millbrook	Sexton	Starks	Camden	Stonington	Huntsville	Stockland	Alexis	Proctor	Brenton	Drummer	Harpster	Brooklyn	Thorp
Slope-%	.5-1.5	0-.5	0-2	0-4	4-15+	0-.5	4-12	3-8	1-4	0-2	0-.5	0-.5	0-.5	0-.5

FIGURE 8. RELATIONSHIPS OF SOILS ASSOCIATED WITH THE BRENTON AND STARKS SERIES (AFTER WASCHER ET AL., REFERENCE 17)

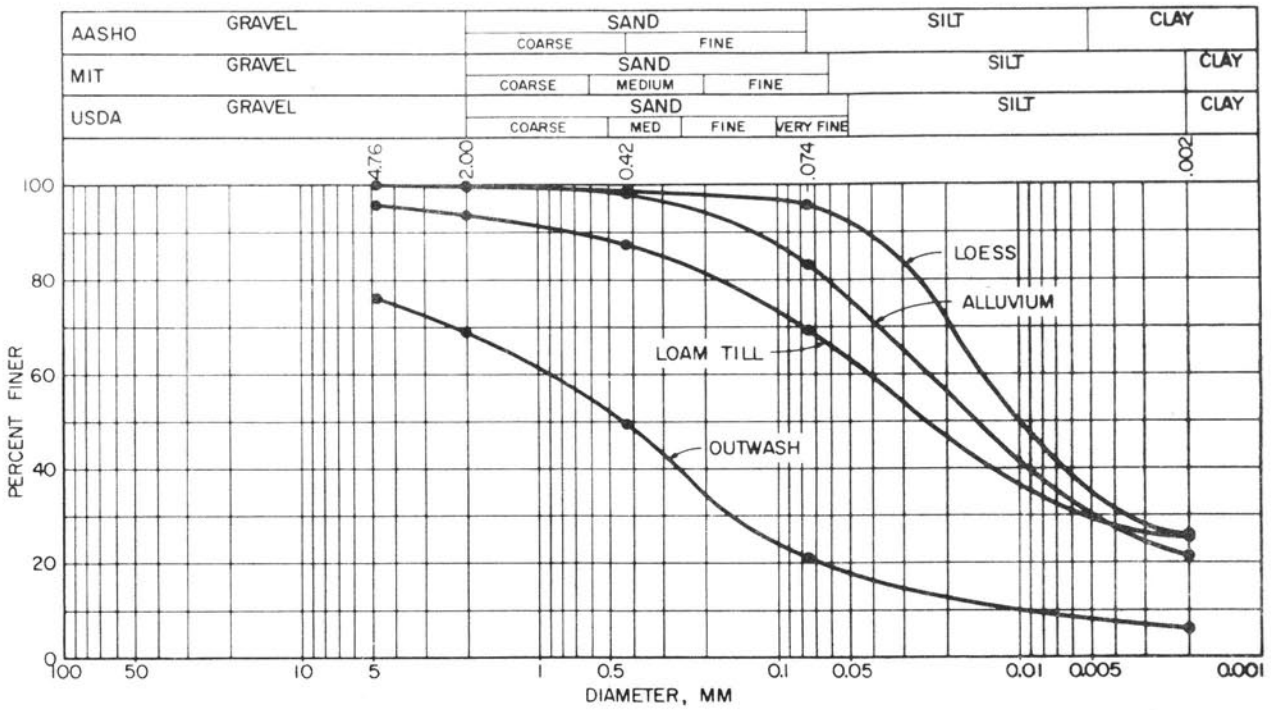


FIGURE 9. AVERAGE GRAIN-SIZE CHARACTERISTICS, PARENT MATERIAL GROUPS, C HORIZON

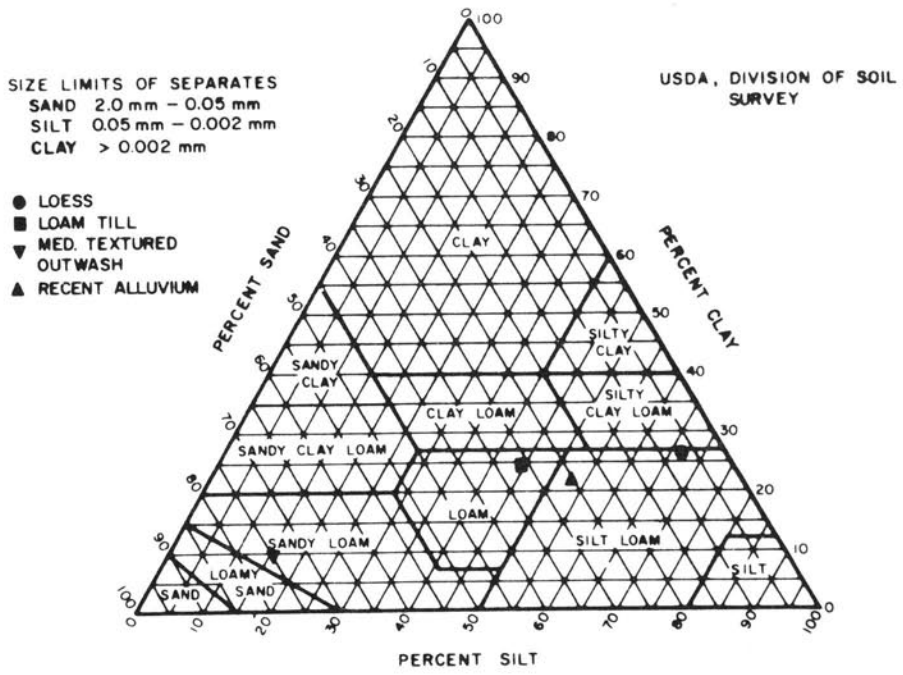


FIGURE 10. AVERAGE USDA TEXTURAL CLASSIFICATION, PARENT MATERIAL GROUPS, C HORIZON

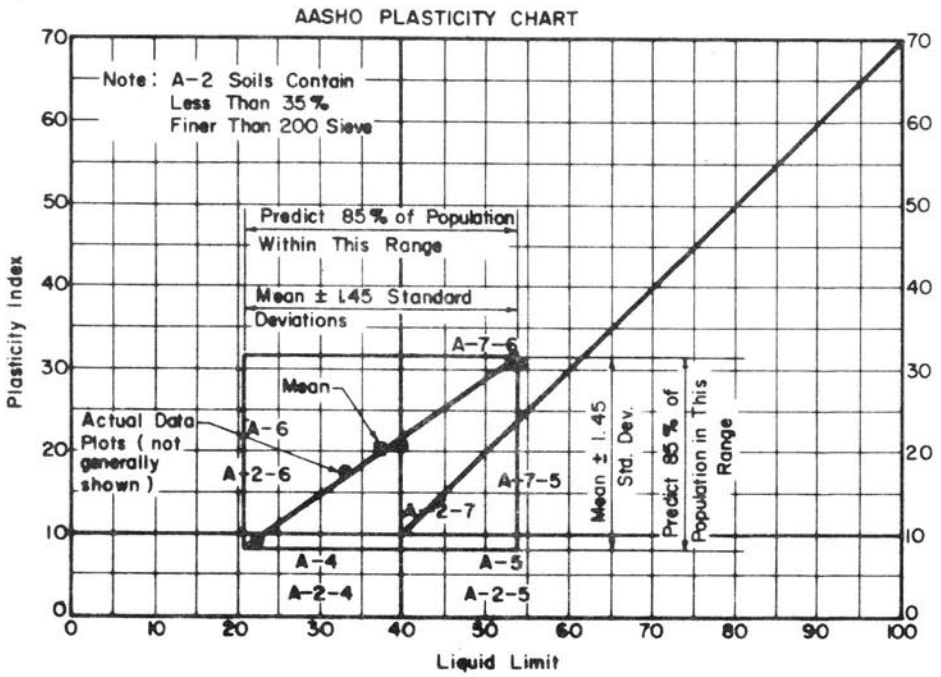


FIGURE 11. METHOD OF GRAPHICAL PRESENTATION OF MEAN AND 85 PERCENTILE RANGE FOR PLASTICITY DATA (HENNEPIN GRAVELLY LOAM, C HORIZON)

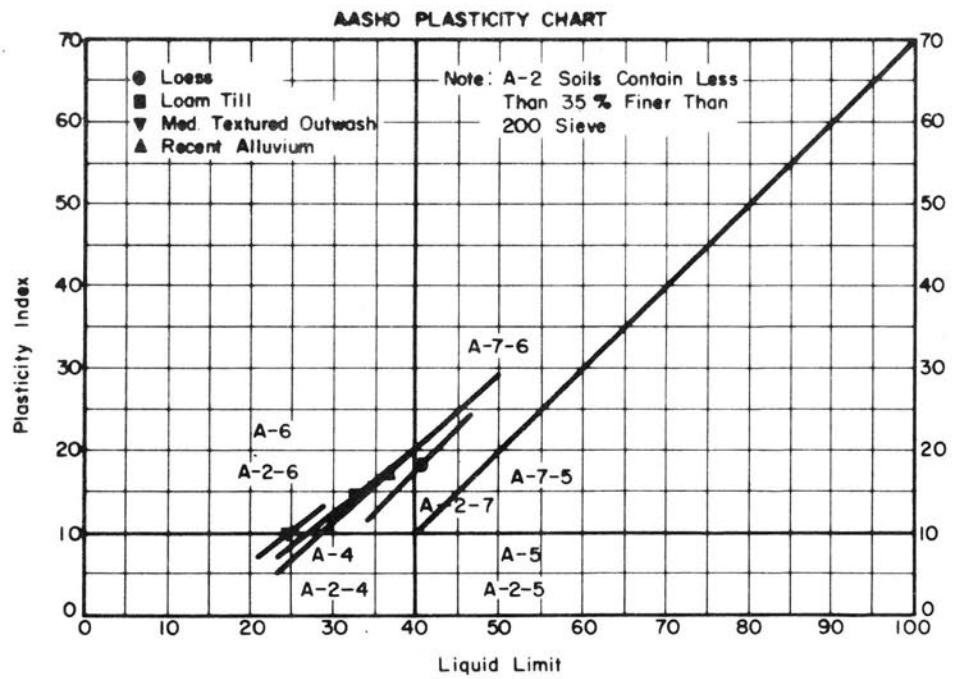


FIGURE 12. PLASTICITY VALUES FOR PARENT MATERIAL GROUPS, C HORIZON, AVERAGE AND 85 PERCENTILE RANGE

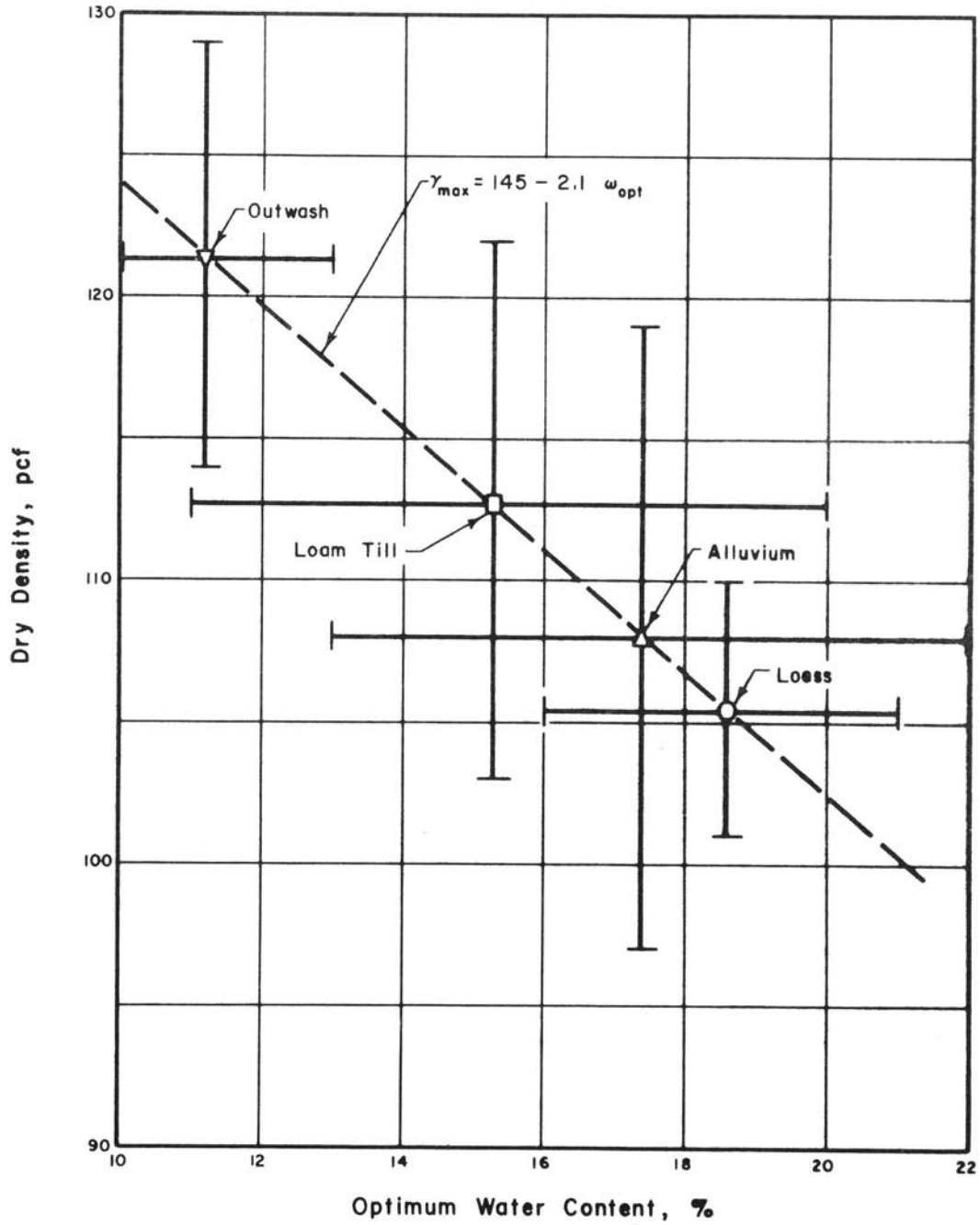


FIGURE 13. MOISTURE-DENSITY RELATIONS FOR PARENT MATERIAL GROUPS, C HORIZON, AVERAGE AND 85 PERCENTILE RANGES

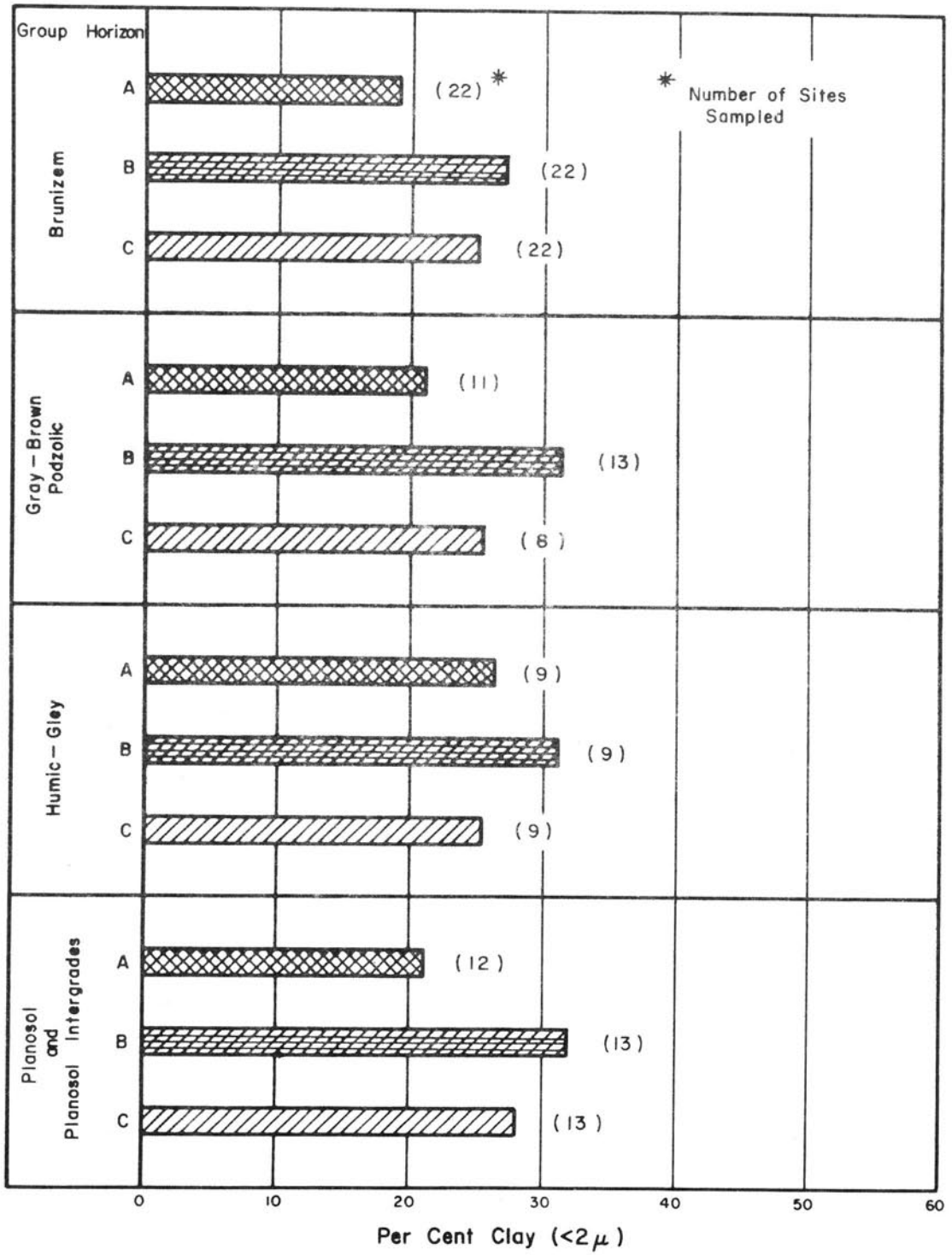


FIGURE 14. AVERAGE CLAY CONTENTS FOR GREAT SOIL GROUPS

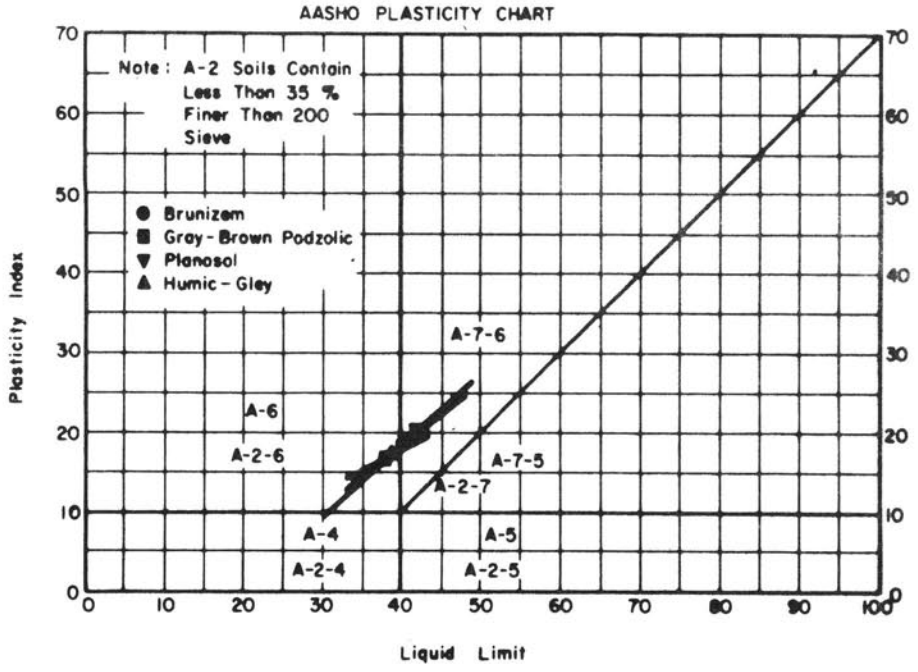


FIGURE 15. PLASTICITY VALUES FOR C HORIZON OF GREAT SOIL GROUPS, AVERAGE AND 85 PERCENTILE RANGE

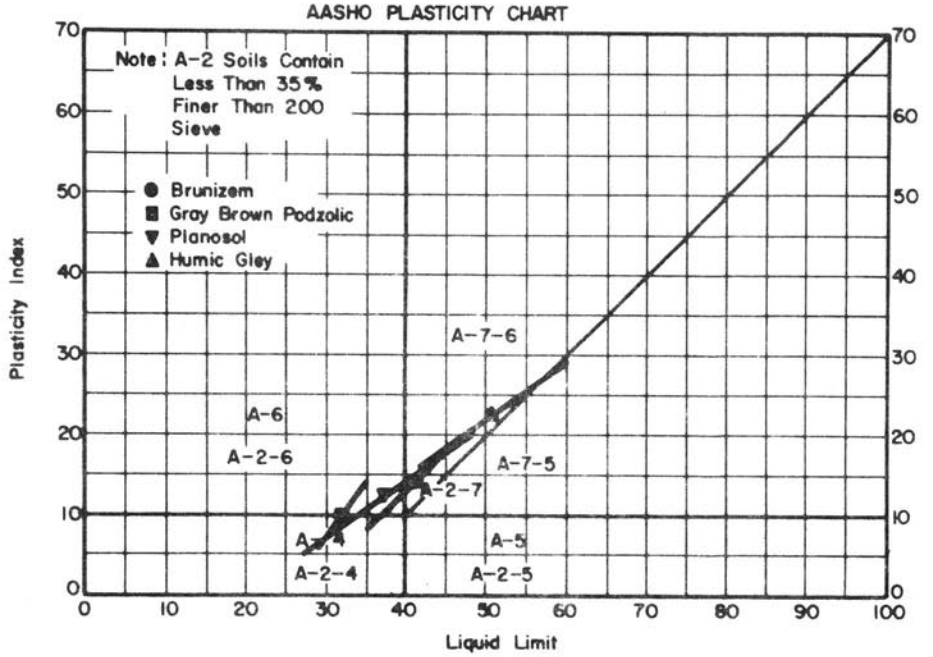


FIGURE 16. PLASTICITY VALUES FOR A HORIZON OF GREAT SOIL GROUPS, AVERAGE AND 85 PERCENTILE RANGE

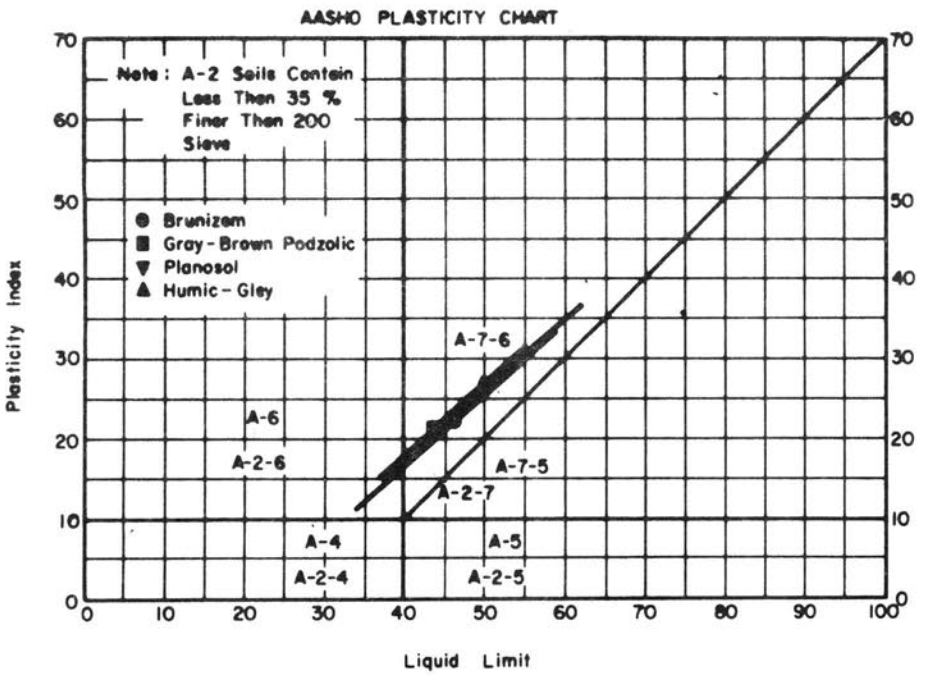


FIGURE 17. PLASTICITY VALUES FOR B HORIZON OF GREAT SOIL GROUPS, AVERAGE AND 85 PERCENTILE RANGE

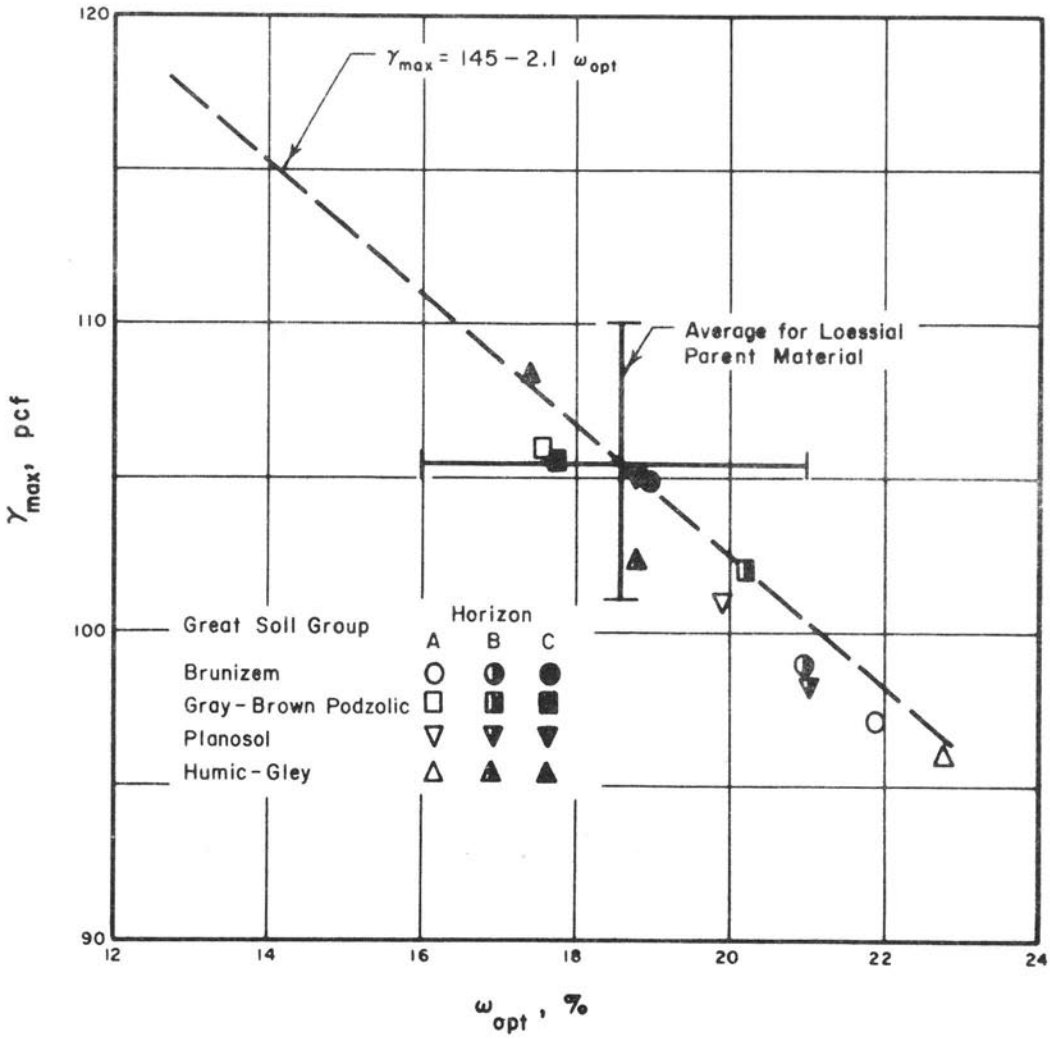


FIGURE 18. AVERAGE MOISTURE-DENSITY RELATIONS FOR A, B, AND C HORIZONS OF GREAT SOIL GROUPS

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VIII. APPENDICES

APPENDIX I: SOIL TYPES OF DEWITT COUNTY DATA SHEETS

These sheets are arranged in numerical order by soil type number. They contain information on each of the principal soil types shown on the DeWitt County agricultural soil map.(12) The typical profile characteristics and the pedologic and geologic classifications are given first. The physical data for each horizon represent the probable 85 percentile ranges as determined from the statistical analysis of the basic data. The design and construction information represents qualitative interpretation based on the typical physical properties and profile descriptions. The test data summary lists the location, depth, physical properties, and engineering classification of each sample tested. Finally, the statistical data on each soil horizon are summarized for the benefit of those who may wish to perform additional analyses.

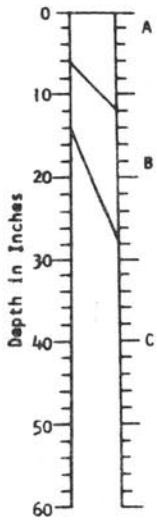
Alphabetical Index to Soil Types

25 HENNEPIN GRAVELLY LOAM

Soil Association Area: I (3b)
Soil Group: Regosol, intergrade to Gray-Brown Podzolic
Parent Material: Loam to silt loam till

Topography: Steep, usually more than 15% slope
Surface Drainage: Rapid
Internal Drainage: Medium

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Yellowish gray to brownish gray loam to gravelly loam (often absent due to erosion)	25-39	5-15	100-113	14-21	95-100	92-100	85-98	51-92	7-27	A-4 A-6	CL OL CL-ML
B	Yellowish gray to brownish yellow clay loam to gravelly clay loam (sometimes absent due to erosion)	28-44	9-23	101-117	13-19	97-100	95-100	87-99	58-95	12-38	A-6 A-4	CL
C	Yellowish gray to brownish yellow loam to silt loam with gravel	21-54	8-32	94-124	11-24	94-100	88-100	72-100	44-94	16-39	A-6 A-7-6 A-4	CL CH SC

Design and Construction Information

Alignment:	moderate to deep cuts and fills
Thickness of topsoil:	0 to 1.0 ft
Water table:	below 6 ft, good drainage
Frost action:	medium to high susceptibility, F_3; occasionally very high, F_4
Seepage:	serious if silt or sand strata are exposed
Excavation:	usually not difficult; when wet surface is slippery and often soft
Cut slopes:	usually stable at 1.5 to 1; silt pockets slough rapidly where seepage occurs
Compaction:	not difficult at water contents near optimum; heavy tamping rollers recommended
Erosion:	often serious on both cut and fill slopes unless protected; special surface drainage installations may be required
Source of borrow:	generally good unless very silty
Source of granular material:	no
Source of topsoil:	generally poor
Special recommendations:	at high water contents very unstable under heavy construction traffic; soil material absorbs rain readily and should be scarified, partially dried, and recompacted prior to placing subbase or more fill; drainage should be provided to prevent water standing on surface of cuts or fills

25 HENNEPIN GRAVELLY LOAM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γd pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T19N, R2E, Sec 8	24-A	0-7	30	10	109	16		100	99	98	92		62		18	12	A-4(5)	L	CL
SW 1/4, SW 1/4, S10	24-B	10-24	40	20	107	14		100	98	97	92		69		21	10	A-6(11)	SiL	CL
15%	24-C	34-38	40	21	106	16		100	99	98	92		68		37	30	A-6(11)	CL	CL
T21N, R1E, Sec 29	31-A	1-5	40	13	100	21				100	97		92		20	12	A-6(9)	SiL	OL
NW 1/4, SW 1/4, NW Cor	31-B	7-20	38	17	103	19				100	99		98		31	26	A-6(11)	SiL	CL
15%	31-C	25-32	38	20	106	19				100	98		88		34	28	A-6(12)	CL	CL
T20N, R4E, Sec 30	42-A	1-8	28	8	-	-			100	99	96		82		28	22	A-4(8)	SIL	CL
SE 1/4, NE 1/4, NE 1/4	42-B	9-18	38	16	107	16		100	99	98	95		79		36	29	A-6(10)	CL	CL
35%	42-C	21-29	54	31	97	23	100	99	98	96	91		74		43	34	A-7-6(19)	CL	CH
T20N, R3E, Sec 22	82-A	2-10	34	14	107	17	99	98	94	92	86		61		32	26	A-6(7)	CL	CL
SW 1/4, NW 1/4, NW Cor	82-B	12-24	37	20	109	17	100	98	97	96	90		72		41	34	A-6(11)	CL	CL
20%	82-C	34-42	33	17	113	16	100	99	98	96	91		72		36	30	A-6(10)	CL	CL
T21N, R3E, Sec 35	83-A	2-10	28	6	110	16	100	99	98	97	88		62		19	12	A-4(5)	L	CL-ML
SE 1/4, SE 1/4, SW Cor	83-B	19-33	26	8	118	14	100	99	98	96	88		66		33	25	A-4(6)	CL	CL
17%	83-C	36-51	23	9	124	11	100	99	94	87	68		42		18	14	A-4(1)	SaCL	SC

Summary of Statistical Data

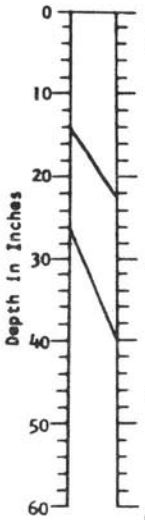
Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	5	31.9	5.0	15.7	2.2	6.2	8
	PI	5	10.1	3.3	32.6	1.5	4.1	4
	γmax	4	106.4	4.5	4.3	2.3	7.2	9
	OMC	4	17.3	2.6	14.8	1.3	4.1	3
	% < No. 4	5	98.2	2.2	2.2	1.0	2.7	2
	% < No. 10	5	97.1	3.2	3.3	1.4	3.9	4
	% < No. 40	5	91.7	4.7	5.1	2.1	5.8	7
	% < No. 200	5	71.7	14.3	19.9	6.4	17.7	63
	% < 2μ	5	16.7	6.9	40.9	3.1	8.5	15
B	LL	5	35.6	5.5	15.5	2.5	6.9	10
	PI	5	16.4	4.8	29.3	2.2	6.0	8
	γmax	5	108.8	5.6	5.1	2.5	6.9	10
	OMC	5	16.1	2.2	13.6	1.0	2.7	2
	% < No. 4	5	98.6	1.1	1.1	0.5	1.3	1
	% < No. 10	5	97.4	1.8	1.9	0.8	2.3	1
	% < No. 40	5	92.9	4.4	4.7	2.0	5.4	6
	% < No. 200	5	76.7	12.6	16.5	5.7	15.7	50
	% < 2μ	5	24.8	9.0	36.2	4.0	11.2	25
C	LL	5	37.8	11.3	29.8	5.0	14.0	40
	PI	5	19.7	8.1	41.1	3.6	10.1	21
	γmax	5	109.2	10.3	9.5	4.6	12.8	33
	OMC	5	17.0	4.5	26.2	2.0	5.6	7
	% < No. 4	5	97.5	2.4	2.4	1.1	2.9	2
	% < No. 10	5	95.1	5.0	5.3	2.2	6.2	8
	% < No. 40	5	88.1	11.5	13.0	5.1	14.2	41
	% < No. 200	5	69.0	17.0	24.6	7.6	21.0	89
	% < 2μ	5	27.4	7.8	28.4	3.5	9.7	19

51 KERN SILT LOAM, TERRACE

Soil Association Area: R (8b)
Topography: Nearly level, 0 to 1% slope
Soil Group: Gray-Brown Podzolic-Planosol Intergrade
Surface Drainage: Very slow
Parent Material: Thin silty sediments over stratified outwash
Internal Drainage: Poor

Pedological Profile Description and Engineering Characteristics

Horizon	Description	LL	PI	γ_{max}	OMC	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
		%	%	pcf	%							



A Light brownish gray silt loam
grading to
Light gray ashy silt loam below 4 to 6 in.

B Grayish yellow clay loam to clay

C Stratified silty material, sands and gravels (outwash)

Insufficient data available to estimate the average properties of this soil.

Remarks: The one site sampled was reclassified as 208, Sexton silt loam.

Design and Construction Information

Alignment:

Thickness of topsoil:

Water table:

Insufficient data available to justify a detailed description of this soil type, refer to 206, Thorp silt loam

Frost action:

Seepage:

Excavation:

Cut slopes:

Compaction:

Erosion:

Source of borrow:

Source of granular material:

Source of topsoil:

Special recommendations:

51 KERN SILT LOAM, TERRACE

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γd pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
* T19N, R2E, Sec 14	26-A	5-11	33	11	105	17				100	99		96		27	18	A-6(8)	SiL	CL
NE 1/4, SW 1/4, SW Cor	26-B	14-24	52	26	102	20					100		99		40	31	A-7-6(17)	SICL	CH
0-0.5%	26-C	34-52	44	20	105	18					100		99		36	30	A-7-6(13)	SICL	CL

* Reclassified as 208 Sexton Silt Loam

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required

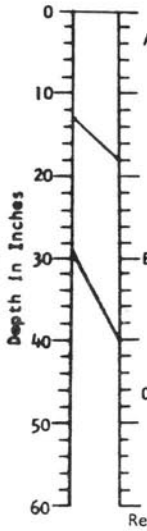
Insufficient Data Available for Statistical Analysis of this Soil Type

58 OSCEOLA SILT LOAM

Soil Association Area: R (8a)
Soil Group: Planosol-Brunizem Intergrade
Parent Material: Thin silty sediments over stratified outwash

Topography: Nearly level to gently sloping, 0 to 3% slope
Surface Drainage: Slow
Internal Drainage: Very poor

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Very dark gray to brownish gray silt loam grading to Gray to light gray silt loam below 7 to 8 in.											
B	Brownish gray to grayish brown silty clay loam to clay											
C	Silty materials (loess or silty outwash) over coarse textured stratified outwash											

Insufficient data available to estimate the average properties of this soil

Remarks: This soil type was mapped on outwash plains in DeWitt County. It is, however, presently defined as thin outwash over strongly weathered till. Thus, the 2 sites samples were reclassified.

Design and Construction Information

Alignment:

Thickness of topsoil:

Water table:

Frost action:

Seepage:

Excavation:

Cut slopes:

Compaction:

Erosion:

Source of borrow:

Source of granular material:

Source of topsoil:

Special recommendations:

Insufficient data available to justify a detailed description of this soil type, refer to 206 Thorp silt loam

58 OSCEOLA SILT LOAM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γd pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
* T21N, R5E, Sec 23	14-A	9-17	39	13	100	20				100	98		92		30	20	A-6(9)	SiL	OL
NE 1/4, NE 1/4, E10	14-B	19-30	47	22	100	18					100		97		32	22	A-7-6(14)	SiL	CL
0 to -0.5%	14-C	39-60	39	15	106	18					100		98		28	20	A-6(10)	SiL	CL
* T19N, R1E, Sec 7	60-A	5-14	36	13	100	19				100	98		95		27	18	A-6(9)	SiL	CL
NE 1/4, NE 1/4, SE Cor	60-B	16-34	46	23	100	22				100	99		97		38	28	A-7-6(14)	SiCL	CL
1%	60-C	44-54	42	21	102	20				100	98		97		33	26	A-7-6(13)	SiL	CL

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required

Insufficient Data Available for Statistical Analysis of this Soil Type

60 LAROSE SILT LOAM

Soil Association Area: H (3a)

Soil Group: Brunizem

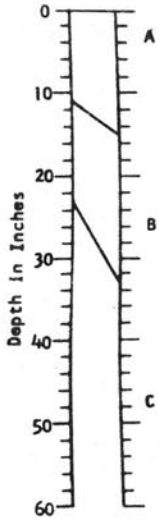
Parent Material: Thin loess, 0 to 2 ft, on loam to silt loam till

Topography: Moderately to strongly sloping, 7-15% slope

Surface Drainage: Rapid

Internal Drainage: Good

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Brown to light brown silt loam, sometimes pebbly, grading to Yellowish brown silt loam to loam below 5 to 7 in.	31-47	10-21	93-109	16-24	97-100	95-100	89-100	65-100	10-29	A-6 A-7-6	CL
B	Yellowish brown silty clay loam to clay loam	30-50	12-24	95-114	15-23	98-100	96-100	90-100	69-100	15-31	A-7-6 A-6	CL
C	Yellowish brown silt loam to loam with some gravel	23-40	6-19	102-121	12-20	88-100	85-100	75-100	51-100	12-30	A-6 A-4	CL

Design and Construction Information

Alignment:	moderate to deep cuts and fills
Thickness of topsoil:	approximately 1.0 ft
Water table:	below 6 ft, good drainage
Frost action:	medium to high susceptibility, F_3; occasionally very high, F_4
Seepage:	may be serious where silt or sand pockets are exposed
Excavation:	usually not difficult; when wet the surface is slippery and often soft
Cut slopes:	stable at 1.5 to 1; silt pockets slough rapidly where seepage occurs
Compaction:	not difficult at moisture contents near optimum; heavy tamping rollers recommended
Erosion:	often serious on both cut and fill slopes until protected; special surface drainage installations may be required
Source of borrow:	generally good unless very silty
Source of granular material:	no
Source of topsoil:	fair
Special recommendations:	normal topsoil stripping of 6 to 8 in. recommended beneath low fills; at high water contents very unstable under heavy construction traffic; soil material absorbs water readily and after rains should be scarified, partially dried, and recompacted prior to placing subbase or more fill; drainage should be provided to prevent water standing on surface of cuts or fills

60 LAROSE SILT LOAM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T21N, R5E, Sec 14	15-A	7-15	47	21	96	22				100	97		89		25	16	A-7-6(14)	SiL	CL
NW 1/4, NE 1/4, NE 1/4	15-B	18-26	42	19	99	20					100		97		28	20	A-7-6(12)	SiL	CL
10%	15-C	39-57	31	9	-	-					100		97		22	14	A-4(8)	SiL	CL
T20N, R1E, Sec 8	29-A	4-9	41	16	99	21				100	94		85		16	9	A-7-6(11)	SiL	CL
SW 1/4, SW 1/4, NW Cor	29-B	14-29	44	21	101	21				100	98		89		26	17	A-7-6(13)	SiL	CL
8-9%	29-C	34-43	36	18	109	16	96	93	86	82	73		51		21	17	A-6(6)	GL	CL
T20N, R2E, Sec 26	55-A	6-14	39	15	98	22					100		97		32	23	A-6(10)	SiL	CL
NW 1/4, SW 1/4, NW Cor	55-B	18-30	47	23	100	20				100	99		96		34	25	A-7-6(15)	SiL	CL
10%	55-C	44-48	26	11	117	13	100	98	97	95	91		77		25	17	A-6(8)	SiL	CL
* T20N, R1E, Sec 29	76-A	2-15	41	19	99	22				100	99		98		38	29	A-7-6(12)	SiCL	CL
SE 1/4, SW 1/4, SE Cor	76-B	22-30	43	17	100	22					100		99		41	32	A-7-6(11)	SiCL	CL
7%	76-C	31-40	40	19	104	20	100	99	97	97	95		92		38	31	A-6(12)	SiCL	CL
T19N, R1E, Sec 25	77-A	0-13	33	10	104	18			100	99	94		79		25	18	A-6(8)	SiL	CL
NE 1/4, 0.15 mi E of SE Cor	77-B	13-23	33	13	109	18		100	99	99	95		80		27	22	A-6(9)	SiL	CL
7%	77-C	23-33	32	11	109	17		100	99	98	94		79		29	23	A-6(8)	SiL	CL
T20N, R2E Sec 21	95-A	0-14	33	13	111	16	100	98	96	94	88		62		29	22	A-6(7)	L	CL
SW 1/4, SE 1/4, SW Cor	95-B	15-25	30	14	116	14		100	98	94	88		65		32	23	A-6(8)	L	CL
10%	95-C	30-40	25	8	120	13	99	97	94	92	83		62		31	23	A-4(6)	L	CL

* Reclassified as 145 Saybrook Silt Loam

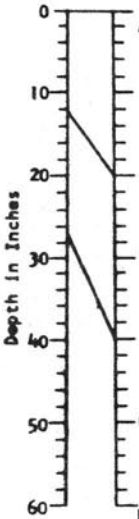
Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	6	39.0	5.5	14.2	2.2	5.8	8
	PI	6	15.6	3.9	24.8	1.6	4.1	4
	γmax	6	101.0	5.5	5.4	2.2	5.8	8
	OMC	6	20.1	2.7	13.3	1.1	2.8	2
	% < No. 4	6	99.2	1.7	1.7	0.7	1.8	1
	% < No. 10	6	98.8	2.6	2.6	1.0	2.7	2
	% < No. 40	6	95.5	4.2	4.4	1.7	4.4	5
	% < No. 200	6	84.9	13.6	16.0	5.6	14.3	49
	% < 2μ	6	19.6	6.8	34.7	2.8	7.1	13
B	LL	6	40.0	6.9	17.3	2.8	7.3	13
	PI	6	17.8	4.0	22.4	1.6	4.1	5
	γmax	6	104.2	6.5	6.3	2.7	6.9	12
	OMC	6	19.0	2.7	14.3	1.1	2.8	2
	% < No. 4	6	99.5	1.0	1.0	0.4	1.0	1
	% < No. 10	6	99.0	2.2	2.3	0.9	2.4	2
	% < No. 40	6	96.6	4.4	4.5	1.8	4.6	6
	% < No. 200	6	87.8	13.1	15.0	5.4	13.8	46
	% < 2μ	6	23.3	5.6	23.8	2.3	5.8	9
C	LL	6	31.8	5.8	18.3	2.4	6.1	9
	PI	6	12.8	4.4	34.7	1.8	4.6	6
	γmax	5	111.7	6.5	5.8	2.9	8.0	13
	OMC	5	15.8	3.0	18.6	1.3	3.7	3
	% < No. 4	6	95.6	5.0	5.3	2.0	5.3	7
	% < No. 10	6	94.1	6.3	6.7	2.6	6.6	11
	% < No. 40	6	89.3	9.8	10.9	4.0	10.3	26
	% < No. 200	6	76.3	17.4	22.8	7.1	18.2	80
	% < 2μ	6	20.9	6.0	28.8	2.5	6.3	10

67 HARPSTER SILTY CLAY LOAM

Soil Association Area: H, R (3a, 8a)
Soil Group: Humic-Gley
Parent Material: Silty local wash and loess, 2 to 5 ft, on loamy glacial drift
Topography: Nearly level to depressional, 0 to 0.5% slope
Surface Drainage: Very slow
Internal Drainage: Poor

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Black to very dark gray clay loam or silty clay loam grading to Dark gray to grayish brown clay loam to silty clay loam below 6 to 12 in.	47-57	16-29	88-103	19-28	100	99-100	98-100	95-100	14-43	A-7-6 A-7-5	OL OH CH CL
B	Dark gray, mottled with yellowish brown clay loam to silty clay loam	46-54	21-32	100-105	17-22	99-100	99-100	97-100	94-100	19-42	A-7-6	CH CL
C	Gray loam to silty clay loam	34-47	11-24	104-111	15-21	95-100	91-100	89-100	87-100	17-36	A-7-6 A-6	CL

Remarks: Substrata may sometimes be sandy or gravelly. This soil differs from Drummer, No. 152, principally by the presence of small snail shells which give the soil an alkaline reaction.

Design and Construction Information

Alignment: shallow fills

Thickness of topsoil: 1.0 to 1.5 ft

Water table: 0 to 3 ft, poor drainage

Frost action: medium to high susceptibility, F_3; occasionally very high, F_4

Seepage: a serious problem if pockets or strata of silt or sand are exposed

Excavation: can be made easily above water table during dry season; when wet the surface is slippery and very soft

Cut slopes: usually stable at 1.5 to 1; silt pockets slough rapidly where seepage occurs

Compaction: not difficult at water contents near optimum; heavy tamping rollers recommended

Erosion: often serious on fill slopes; special surface drainage installations may be required

Source of borrow: generally good below 3 ft; drying usually required to reduce moisture content to optimum

Source of granular material: generally no; but where associated with Brenton (149), sands or sandy gravels of varying quality may be found below 6 ft

Source of topsoil: excellent

Special recommendations: topsoil stripping of 6 to 8 in. will not usually remove all organic compressible soil, 12 in. or more should be stripped under low fills; at high water contents very unstable under heavy construction traffic; preferable to elevate grade line 4 to 5 ft and not attempt to strip topsoil

67 HARPSTER SILTY CLAY LOAM

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	5	51.9	3.7	7.1	1.6	4.6	5
	PI	5	22.2	4.6	20.9	2.1	5.8	7
	γmax	4	95.7	5.3	5.5	2.7	8.4	12
	OMC	4	23.8	3.1	13.0	1.5	4.9	4
	% < No. 4	5	99.9	0.2	0.2	0.1	0.2	1
	% < No. 10	5	99.8	0.3	0.3	0.1	0.4	1
	% < No. 40	5	99.2	0.8	0.8	0.4	1.0	1
	% < No. 200	5	97.5	1.9	2.0	0.9	2.4	2
	% < 2μ	5	28.3	10.2	36.1	4.6	12.7	33
B	LL	5	50.2	2.6	5.1	1.1	3.2	2
	PI	5	26.2	3.8	14.4	1.7	4.7	5
	γmax	5	102.2	1.7	1.7	0.8	2.1	1
	OMC	5	19.2	1.6	8.2	0.7	2.0	1
	% < No. 4	5	99.7	0.5	0.5	0.2	0.6	1
	% < No. 10	5	99.6	0.6	0.6	0.3	0.7	1
	% < No. 40	5	98.8	1.1	1.1	0.5	1.3	1
	% < No. 200	5	97.3	2.2	2.3	1.0	2.8	2
	% < 2μ	5	30.7	7.9	25.8	3.5	9.8	20
C	LL	5	40.1	4.5	11.3	2.0	5.6	7
	PI	5	17.1	4.5	26.4	2.0	5.6	7
	γmax	5	107.4	2.6	2.4	1.2	3.3	3
	OMC	5	18.1	1.8	10.2	0.8	2.3	1
	% < No. 4	5	98.1	2.5	2.5	1.1	3.1	2
	% < No. 10	5	97.2	4.0	4.1	1.8	4.9	5
	% < No. 40	5	95.8	4.7	4.9	2.1	5.9	7
	% < No. 200	5	94.4	5.0	5.3	2.2	6.2	8
	% < 2μ	5	26.4	6.6	25.0	2.9	8.2	14

Test Data Summary

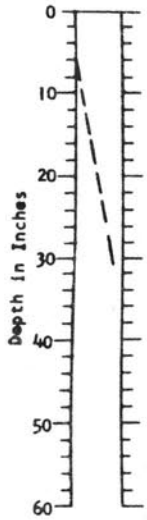
Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T19N, R3E, Sec 24	2-A	6-18	47	24	103	20			100	99	97		94		30	21	A-7-6(15)	SiL	CL
SE 1/4, SE 1/4	2-B	22-30	46	23	104	19		100	99	98	96		93		32	22	A-7-6(14)	SiL	CL
0-0.5%	2-C	31-48	36	13	112	16		100	95	91	89		87		26	18	A-6(9)	SiL	CL
T19N, R4E, Sec 4	40-A	9-16	50	15	95	24				100	99		98		32	21	A-7-5(12)	SiL	OL
NW 1/4, NW 1/4, NW Cor	40-B	20-30	52	25	101	22					100		99		38	26	A-7-6(17)	SiL	CH
0-0.5%	40-C	30-43	36	12	109	17		100	96	95	93		92		28	23	A-6(9)	SiL	CL
T20N, R2E, Sec 2	47-A	6-16	52	23	-	-					100		97		31	21	A-7-6(16)	SiL	OH
NW 1/4, NE 1/4, NE Cor	47-B	22-35	49	24	104	18				100	99		99		36	28	A-7-6(15)	SiL	CL
0%	47-C	38-49	43	20	106	18					100		99		37	27	A-7-6(13)	SiCL	CL
T19N, R1E, Sec 30	73-A	0-16	56	28	93	26					100		99		55	43	A-7-6(18)	SiC	CH
SE 1/4, SW 1/4, SW Cor	73-B	24-33	52	33	100	18				100	99		97		49	39	A-7-6(18)	SiCL	CH
0%	73-C	33-59	40	17	106	20				100	99		97		43	31	A-7-6(11)	SiCL	CL
T20N, R1E, Sec 16	78-A	3-15	54	21	91	26					100		99		46	35	A-7-5(15)	SiCL	OH
NE 1/4, NE 1/4, NE Cor	78-B	26-32	51	26	101	20		100	99	99	99		99		49	40	A-7-6(17)	SiCL	CH
0.5%	78-C	36-54	46	23	105	20				100	98		98		43	34	A-7-6(14)	SiCL	CL

73 HUNTSVILLE LOAM, BOTTOM

Soil Association Area: Y (9a)
Soil Group: Alluvial
Parent Material: Medium-textured water-deposited sediments

Topography: Nearly level, 0 to 0.5% slope
Surface Drainage: Slow
Internal Drainage: Medium

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Brown to yellowish brown loam to sandy loam grading to Yellowish brown to grayish brown loam below 6 to 12 in.	30-64	12-26			100	100	97-100	79-100	14-34	A-7-5 A-6	CL OL OH
C	Yellowish brown to gray varying from silty clay loam to gravelly loam	No data available for this horizon										

Remarks: This type has been combined with 107, Sawmill clay loam, bottom, as 451, Lawson silt loam.

Design and Construction Information

Alignment: moderate to deep fills and/or structures

Thickness of topsoil: 0.5 to 3 ft

Water table: 0 to 3 ft, fair to poor drainage

Frost action: low to high susceptibility, F_3; occasionally F_2

Seepage: to be expected in cuts below water table

Excavation: seldom made; not difficult above water table, dragline required below

Cut slopes: sheeting usually required due to high water table

Compaction: usually not difficult at moisture contents near optimum; tamping, grid or pneumatic rollers acceptable.

Erosion: often serious on fill slopes, surface drainage installations may be required

Source of borrow: generally fair to good below 3 ft; excavation below water table usually required

Source of granular material: generally poor; but silty sand or possibly even sandy gravel may be found at depth

Source of topsoil: good to excellent; stripping may be difficult

Special recommendations: topsoil stripping of 6 to 8 in. will not normally remove all organic compressible soil, 18 in. or more should be stripped under low fills; soil normally unstable under heavy construction traffic and stripping must usually be done with dragline; if moderately high fills are to be built, the strength and compressibility of the substrata should be determined in order to avoid base failures or excessive settlement; area usually subjected to flooding, embankment slopes may require special protection.

73 HUNTSVILLE LOAM, BOTTOM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
* T19N, R2E, Sec 18 NE 1/4, NE 1/4, NE Cor 0-0.5%	22-A	3-25	58	24	-	-					100		99		48	32	A-7-5(17)	SiCL	OH
* T20N, R3E, Sec 35 NE 1/4, NE 1/4, E10 0-0.5%	25-A	5-21	35	14	106	17					100		85		27	20	A-6(10)	SiL	CL
* T20N, R4E, Sec 29 SW 1/4, SW 1/4, W 1/2 0-0.5%	41-A	2-27	48	18	95	23				100	98		86		30	20	A-7-5(13)	SiL	OL

* Reclassified as 451 Lawson Silt Loam

Summary of Statistical Data

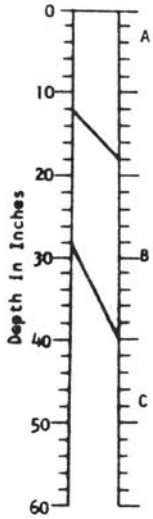
Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	3	47.1	11.8	25.1	6.8	29.4	104
	PI	3	18.8	5.0	26.5	2.9	12.4	19
	γmax	2	-	-	-	-	-	-
	OMC	2	-	-	-	-	-	-
	% < No. 4	3	100.0	0.0	-	-	-	-
	% < No. 10	3	100.0	0.0	-	-	-	-
	% < No. 40	3	99.0	1.2	1.2	0.7	2.9	1
	% < No. 200	3	89.9	7.6	8.4	4.4	18.9	43
	% < 2μ	3	24.0	7.0	28.9	4.0	17.3	36

80 ALEXIS SILT LOAM, TERRACE

Soil Association Area: R (8a)
Soil Group: Brunizem
Parent Material: Silty sediments, 0 to 3 ft, on stratified glacial outwash

Topography: Moderately sloping, 3 to 8% slope
Surface Drainage: Rapid
Internal Drainage: Good

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Brown to light brown silt loam grading to Brown to yellowish brown silt loam to light silty clay loam below 7 to 10 in.	33-48	6-22	90-99	21-25	100	100	96-100	88-99	9-17	A-7-6 / A-4	OL / CL
B	Yellowish brown clay loam to silty clay loam	37-49	14-24	96-103	16-24	100	100	99-100	97-99	22-28	A-7-6 / A-6	CL / ML
C	Yellowish brown sandy loam to silty clay loam over stratified silts, sands and gravels sometimes capped by a reddish brown gravelly clay loam	36-49	15-27	100-104	19-21	100	100	100	96-99	22-31	A-7-6 / A-6	CL

Remarks: Soils in DeWitt County mapped as 80, Alexis silt loam, generally developed from loess which is thicker than the limits presently defined for this soil type. Accordingly, all 3 sites sampled were reclassified as 199, Plano silt loam.

Design and Construction Information

Alignment:	moderate cuts and fills
Thickness of topsoil:	1.0 to 1.5 ft
Water table:	below 6 ft, good drainage
Frost action:	medium to high susceptibility, F_3; sometimes F_4, in A horizon
Seepage:	may be a serious problem if strata or pockets of silt or fine sand are exposed
Excavation:	usually not difficult; when wet the surface may be slippery and soft
Cut slopes:	usually stable at 1.5 to 1; silt strata or pockets slough rapidly where seepage occurs
Compaction:	in overlying silty sediments, water content must be carefully controlled near optimum, large shrinkage factor is to be expected; in underlying outwash not difficult at water contents near optimum; grid, tamping, or pneumatic rollers usually satisfactory
Erosion:	may be serious on both cut and fill slopes
Source of borrow:	generally poor in overlying silty sediments; generally good below 3 ft
Source of granular material:	poor to excellent; varies with depth, thickness, and texture of underlying outwash
Source of topsoil:	fair to good, depending on slope and erosion
Special recommendations:	normal topsoil stripping of 6 to 8 in. recommended beneath low fills; material encountered in shallow cuts may be extremely unstable under heavy construction traffic when wet; drainage should be provided to prevent water standing on surface of cuts or fills

80 ALEXIS SILT LOAM, TERRACE

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
* T21N, R5E, Sec 33	16-A	9-15	36	8	96	22					100		96		23	11	A-4(8)	SiL	OL
NW 1/4, SE 1/4, E10	16-B	20-30	39	17	102	17				100	99		97		34	24	A-6(11)	SiL	CL
3%	16-C	37-51	46	23	100	20					100		99		36	25	A-7-6(14)	SiL	CL
* T19N, R1E, Sec 17	45-A	4-18	40	12	97	22				100	96		89		22	12	A-7-6(9)	SiL	OL
NW 1/4, NW 1/4, SW Cor	45-B	22-36	44	17	98	22					100		99		36	27	A-7-6(12)	SiCL	ML
4%	45-C	39-61	38	16	103	19					100		97		32	24	A-6(10)	SiL	CL
* T20N, R3E, Sec 36	57-A	6-16	46	20	91	24				100	98		95		29	16	A-7-6(13)	SiL	CL
SE 1/4, SE 1/4, SE Cor	57-B	22-34	47	23	97	22				100	99		98		35	24	A-7-6(15)	SiL	CL
4%	57-C	40-60	44	24	102	19				100	99		97		36	30	A-7-6(14)	SiCL	CL

* Reclassified as 199 Plano Silt Loam

Summary of Statistical Data

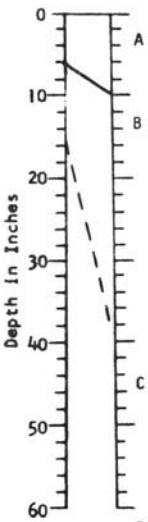
Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	3	40.8	5.1	12.5	3.0	12.7	20
	PI	3	13.3	6.0	45.2	3.5	14.9	27
	γmax	3	94.6	3.0	3.2	1.7	7.4	7
	OMC	3	22.8	1.3	5.8	0.8	3.3	2
	% < No. 4	3	100.0	0.0	----	----	----	--
	% < No. 10	3	100.0	0.0	----	----	----	--
	% < No. 40	3	98.2	1.8	1.8	1.0	4.5	3
	% < No. 200	3	93.4	3.8	4.1	2.2	9.5	11
	% < 2μ	3	13.1	2.8	21.1	1.6	6.8	6
B	LL	3	43.1	4.0	9.4	2.3	10.0	13
	PI	3	18.7	3.4	17.9	1.9	8.3	9
	γmax	3	99.3	2.5	2.6	1.5	6.3	5
	OMC	3	20.2	2.8	13.8	1.6	6.9	6
	% < No. 4	3	100.0	0.0	----	----	----	--
	% < No. 10	3	100.0	0.0	----	----	----	--
	% < No. 40	3	99.4	0.4	0.4	0.2	1.0	1
	% < No. 200	3	98.1	1.0	1.0	0.6	2.4	1
	% < 2μ	3	25.0	2.1	8.4	1.2	5.2	4
C	LL	3	42.4	4.4	10.4	2.6	11.0	15
	PI	3	21.2	4.3	20.3	2.5	10.7	14
	γmax	3	102.0	1.6	1.5	0.9	3.9	2
	OMC	3	19.7	0.7	3.6	0.4	1.7	1
	% < No. 4	3	100.0	0.0	----	----	----	--
	% < No. 10	3	100.0	0.0	----	----	----	--
	% < No. 40	3	99.5	0.4	0.4	0.2	0.9	1
	% < No. 200	3	97.7	1.0	1.0	0.6	2.4	1
	% < 2μ	3	26.3	3.2	12.0	1.8	7.8	8

81 LITTLETON SILT LOAM, TERRACE

Soil Association Area: R (8a)
Soil Group: Brunizem
Parent Material: Medium textured water-deposited sediments

Topography: Very gently sloping, 0.5 to 2% slope
Surface Drainage: Medium to slow
Internal Drainage: Medium

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Brown to dark brown silt loam grading to	27-48	7-19	90-106	17-26	100	100	98-100	83-100	16-26	A-6 A-4 A-7-5	CL OL
B	Dark yellowish brown to dark grayish brown silt loam below 7 to 10 in.	35-44	13-18	97-105	18-23	100	100	99-100	74-100	15-30	A-6 A-7-6	CL OL
C	Yellowish brown to brownish gray silty to sandy clay loam	20-48	3-25	94-122	12-23	100	100	99-100	54-100	12-31	A-4 A-6 A-7-6	CL CL-ML

Remarks: The B horizon is weakly developed and is difficult to distinguish from the A and upper C horizons.

Design and Construction Information

Alignment:	shallow to moderate cuts and fills
Thickness of topsoil:	0.5 to 3.0 ft
Water table:	3 to 6 ft, fair drainage
Frost action:	medium to very high susceptibility, F_3 to F_4
Seepage:	to be expected if cuts are made below the water table
Excavation:	usually not difficult unless cuts extend below water table; when wet, surface is slippery and often soft
Cut slopes:	usually stable at 1.5 to 1; silt strata slough rapidly where seepage occurs
Compaction:	not difficult at moisture contents near optimum; tamping, grid or pneumatic rollers acceptable
Erosion:	may be serious on both cut and fill slopes
Source of borrow:	generally good below 3 ft unless very silty; excavation below water table may be required
Source of granular material:	uncertain; if present, usually found at depths below 5 to 6 ft
Source of topsoil:	generally excellent
Special recommendations:	topsoil stripping of 6 to 8 in. will not normally remove all organic compressible soil, 18 in. or more should be stripped under low fills; at high water contents very unstable under heavy construction traffic; if moderately high fills are built, the strength and compressibility of the substrata should be determined in order to avoid base failures or excessive settlement; area may be subject to flooding

81 LITTLETON SILT LOAM

Test Data Summary Sheet

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γd pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T21N, R5E, Sec 32,	17-A	5-10	50	20	90	27					100		98		34	20	A-7-5(14)	SiL	OL
NW 1/4, SE 1/4, SE Cor	17-B	12-24	41	16	100	21					100		98		30	16	A-7-6(11)	SiL	CL
1%	17-C	26-45	38	16	103	20					100		99		36	24	A-6(10)	SiL	CL
T19N, R3E, Sec 3	56-A	3-10	34	10	102	19							100		26	17	A-4(8)	SiL	OL
NE 1/4, NE 1/4, NW Cor	56-B	15-38	40	16	99	20					100		99		42	26	A-6(11)	SiL	CL
1%	56-C	43-58	42	21	102	20				100	99		98		37	26	A-7-6(13)	SiL	CL
T19N, R1E, Sec 15,	67-A	2-10	34	11	100	21				100	99		96		37	26	A-6(8)	SiL	CL
NW 1/4, NW 1/4, SE Cor	67-B	11-31	40	14	99	23				100	99		96		39	28	A-6(10)	SiCL	OL
0-1%																			
T19N, R2E, Sec 18,	84-A	2-14	34	11	102	19				100	98		94		32	22	A-6(8)	SiL	CL
NE 1/4, 0.05 mi E of	84-B	16-27	44	16	103	19				100	99		93		36	25	A-7-6(12)	SiL	OL
NW Cor																			
1.5%																			
T20N, R3E, Sec 22	85-A	0-10	35	14	96	22				100	98		81		31	22	A-6(10)	SiL	CL
SE 1/4, SW 1/4, SW Cor	85-B	14-30	35	13	105	19				100	99		70		26	18	A-6(8)	L	CL
0%	85-C	36-55	23	6	119	13				100	99		60		17	14	A-4(5)	L	CL-ML

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	5	37.5	7.0	18.6	3.1	8.7	15
	PI	5	12.9	4.0	31.4	1.8	5.0	5
	γmax	5	97.9	5.3	5.4	2.4	6.6	9
	OMC	5	21.6	3.3	15.5	1.5	4.1	4
	% < No. 4	5	100.0	0.0	-	-	-	-
	% < No. 10	5	99.9	0.2	0.2	0.1	0.2	1
	% < No. 40	5	99.0	0.9	0.9	0.4	1.1	1
	% < No. 200	5	93.6	7.3	7.8	3.3	9.1	17
	% < 2μ	5	21.2	3.5	16.4	1.6	4.3	4
B	LL	5	39.9	3.1	7.7	1.4	3.8	3
	PI	5	15.2	1.6	10.7	0.7	2.0	1
	γmax	5	101.3	2.8	2.8	1.3	3.5	3
	OMC	5	20.1	1.8	8.9	0.8	2.2	1
	% < No. 4	5	100.0	0.0	-	-	-	-
	% < No. 10	5	100.0	0.0	-	-	-	-
	% < No. 40	5	99.3	0.4	0.4	0.2	0.5	1
	% < No. 200	5	91.1	11.9	13.1	5.3	14.8	44
	% < 2μ	5	22.6	5.2	23.2	2.3	6.5	9
C	LL	3	34.3	9.8	28.7	5.7	24.4	72
	PI	3	14.1	7.7	54.6	4.4	19.1	44
	γmax	3	108.0	9.6	8.9	5.5	23.9	69
	OMC	3	17.4	3.8	21.8	2.2	9.4	11
	% < No. 4	3	100.0	0.1	0.1	0.0	0.1	1
	% < No. 10	3	100.0	0.1	0.1	0.0	0.1	1
	% < No. 40	3	99.2	0.4	0.4	0.2	0.9	1
	% < No. 200	3	85.6	22.0	25.7	12.7	54.6	358
	% < 2μ	3	21.4	6.5	30.6	3.8	16.2	32

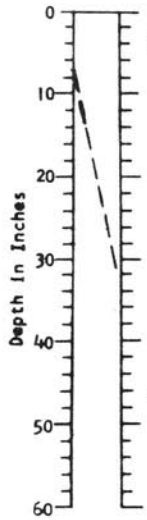
107 SAWMILL CLAY LOAM, BOTTOM

Soil Association Area: Y (9a)
Soil Group: Alluvial
Parent Material: Fine textured water-laid sediments

Topography: Nearly level, < 0.5% slope
Surface Drainage: Slow
Internal Drainage: Medium to poor

Pedological Profile Description and Engineering Characteristics

Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Unified
A	Black to dark grayish black silty clay loam to clay loam generally becoming more grayish below 7 to 12 in.											
C	Variable silty water-laid sediments											



Insufficient data available to estimate the average properties of this soil

Remarks: This type has been combined with 73, Huntsville loam, bottom, as 451, Lawson silt loam.

Design and Construction Information

Alignment:

Thickness of topsoil:

Water table:

Frost action:

Seepage:

Excavation:

Cut slopes:

Compaction:

Erosion:

Source of borrow:

Source of granular material:

Source of topsoil:

Special recommendations:

Insufficient data available to justify a separate analysis of this soil type. See recommendations for 73, Huntsville loam, bottom

107 SAWMILL CLAY LOAM, BOTTOM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth In.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
* T21N, R5E, Sec 32	18-A_1	4-7	56	24	-	-				100	93		65		15	9	A-7-5(14)	L	OH
SE 1/4, NW 1/4, SW Cor	18-A_3	10-24	48	28	104	18			100	99	95		81		33	22	A-7-6(17)	SiL	CL
0-0.5%	18-C	24-41	44	25	108	18			100	99	95		79		30	22	A-7-6(15)	L	CL
* T20N, R4E, Sec 14	52-A_1	4-17	44	20	-	-				100	97		82		26	16	A-7-6(13)	SiL	CL
NW 1/4, SW 1/4, NE Cor	52-A_3	17-28	44	19	101	20				100	98		82		27	19	A-7-6(12)	SiL	CL
0%																			

* Reclassified as 451 Lawson Silt Loam

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required

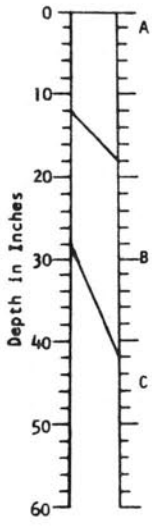
Insufficient Data Available for Statistical Analysis of this Soil Type

134 CAMDEN SILT LOAM, TERRACE

Soil Association Area: R (8b)
Soil Group: Gray-Brown Podzolic
Parent Material: Silty sediments, 0 to 3 ft, on stratified glacial outwash

Topography: Gently sloping, 1-4% slope
Surface Drainage: Rapid
Internal Drainage: Good

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Yellowish gray to brownish gray silt loam grading to Grayish yellow to yellowish brown silt loam below 4 to 6 in.	28-36	6-14	101-111	16-19	99-100	98-100	95-100	85-100	13-26	A-4 A-6	CL OL
B	Yellow to yellowish brown clay loam to silty clay loam	37-53	17-28	99-105	18-22	100	100	99-100	97-100	29-36	A-7-6 A-6	CL CH
C	Yellow to yellowish brown silty to sandy loam over stratified silts, sands, and gravels which are sometimes capped by a reddish brown gravelly clay loam	17-41 or NP	5-18 or NP	105-129	8-17	81-100	73-100	40-100	4-92	0-30	A-6 A-2-4 A-4 A-2-6	SC CL SM
		Mostly clean coarse-grained, non-plastic outwash materials.									A-1 A-2-6 A-2-4	GW GP SP

Remarks: Soils in DeWitt County mapped as 134, Camden silt loam, frequently developed from loess which is thicker than the limits presently defined for this soil type. Two sites sampled were reclassified.

Design and Construction Information

Alignment: moderate cuts and fills

Thickness of topsoil: 1.0 to 1.5 ft

Water table: below 6 ft, good drainage

Frost action: medium to high susceptibility, F_3; occasionally very high, F_4

Seepage: not serious unless cuts are made below water table

Excavation: not difficult unless cuts are made below water table, then dragline operation will probably be required

Cut slopes: usually stable at 1.5 to 1 or steeper; silt pockets or strata may slough where seepage occurs

Compaction: not difficult at water contents near optimum; tamping, grid or pneumatic rollers acceptable

Erosion: may be serious in cuts

Source of borrow: generally good

Source of granular material: generally good to excellent; below 5 to 6 ft sands and gravels of variable quality are generally found

Source of topsoil: generally poor

Special recommendations: normal topsoil stripping of 6 to 8 in. recommended below low fills; material encountered in shallow cuts may be very unstable under heavy construction traffic when wet; drainage should be provided to prevent water standing on surface of cuts or fills; thorough exploration is required to determine extent and variability of the outwash when used as a source of granular material

134 CAMDEN SILT LOAM, TERRACE

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth In.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
* T19N, R2E, Sec 17	6-A_2	7-14	30	11	111	16				100	99		94		31	22	A-6(8)	SiL	CL
NE 1/4, SE 1/4, SW 1/4	6-B	17-48	48	27	104	20					100		98		38	30	A-7-6(16)	SiCL	CL
SE Cor of gravel pit	6-C_1	50-80	NP	NP	122	11				100	97		33				A-2-4(0)	SaL	SM
2%	6-C_2	82-100	NP	NP	-	-	95	84	70	55	30		11				A-1-b	SaG	GW
	6-C_3	100-120	NP	NP	-	-	99	87	56	46	22		4				A-1-a	SaG	GW
T20N, R3E, Sec 35	23-A_2	6-11	37	15	109	16				100	99		98		36	26	A-6(10)	SiL	CL
NE 1/4, SE 1/4, E10	23-B	12-22	52	26	99	22					100		99		40	32	A-7-6(17)	SiCL	CH
2%	23-C_1	33-43	39	16	106	18				100	99		93		31	24	A-6(10)	SiL	CL
	23-C_2	61-65	28	12	-	-	87	76	60	49	14		2		0	0	A-2-6(0)	GSa	GW
	23-C_3	89-113	NP	NP	109	-	80	61	32	12	1		0		0	0	A-1-a	G	GP
T21N, R1E, Sec 24	48-A_2	5-15	30	6	104	18				100	99		97		27	16	A-4(8)	SiL	OL
SE 1/4, NW 1/4, NW Cor	48-B	22-35	47	25	102	21					100		99		41	32	A-7-6(15)	SiCL	CL
3%	48-C_1	37-47	36	18	108	16		100	98	97	92		78		36	28	A-6(11)	CL	CL
	48-C_2	56-72	26	12	-	-		100	98	96	88		66		32	23	A-6(7)	L	CL
T19N, R1E, Sec 11	68-A	2-10	32	9	106	18		100	98	98	94		82		28	18	A-4(8)	SiL	CL
NE 1/4, SW 1/4, NE Cor	68-1B	12-25	41	20	101	19				100	99		97		43	36	A-7-6(12)	SiCL	CL
4%	68-11B	32-43	34	14	109	16	100	99	96	93	85		76		28	23	A-6(10)	SiCL	CL
	68-C	45-58	22	9	119	12	98	93	86	82	54		21		11	10	A-2-4(0)	SaCL	SC
* T21N, R5E, Sec 33	86-A	2-11	33	10	104	18				100	98		95		32	22	A-4(8)	SiL	CL
NE 1/4, NE 1/4, SW Cor	86-B_1	14-29	37	17	104	20				100	99		98		40	31	A-6(11)	SiCL	CL
7%	86-B_2	31-51	41	20	104	20					100		98		40	32	A-7-6(12)	SiCL	CL
	86-C	55-75	23	9	120	11		100	99	98	80		44		19	16	A-4(2)	SaL	SC
T20N, R3E, Sec 36	87-A_2	16-27	30	8	101	18				100	98		96		26	14	A-4(8)	SiL	CL
NE 1/4, SE 1/4, SE Cor	87-1B	36-59	44	22	103	18					100		99		44	35	A-7-6(14)	SiCL	CL
10%	87-11B	80-95	33	17	119	12		100	90	80	43		26		16	14	A-2-6(1)	SaC	SP
	87-C_1	108-123	23	7	127	10	95	90	79	69	37		20		8	6	A-2-4(0)	SaC	SC
	87-C_2	150-170	NP	NP	127	10	93	85	74	68	42		12		6	5	A-1-b(0)	SaC	SP

* Reclassified as 243 St. Charles Silt Loam

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	6	32.0	2.6	8.1	1.1	2.7	2
	PI	6	9.8	3.0	30.2	1.2	3.1	3
	γmax	6	106.1	3.6	3.4	1.5	3.8	4
	OMC	6	17.4	1.3	7.4	0.5	1.4	1
	% < No. 4	6	99.7	0.6	0.7	0.3	0.7	1
	% < No. 10	6	99.6	0.9	0.9	0.4	0.9	1
	% < No. 40	6	98.0	2.0	2.0	0.8	2.1	1
	% < No. 200	6	93.5	5.8	6.2	2.4	6.1	9
	% < 2μ	6	19.8	4.4	22.2	1.8	4.6	6
B	LL	6	44.9	5.4	12.0	2.2	5.6	8
	PI	6	22.6	4.0	17.6	1.6	4.2	5
	γmax	6	102.2	1.9	1.9	0.8	2.0	1
	OMC	6	20.0	1.1	5.6	0.5	1.2	1
	% < No. 4	6	100.0	0.0	----	----	----	--
	% < No. 10	6	100.0	0.0	----	----	----	--
	% < No. 40	6	99.6	0.2	0.2	0.1	0.2	1
	% < No. 200	6	98.6	0.8	0.8	0.3	0.9	1
	% < 2μ	6	32.6	2.4	7.3	1.0	2.5	2
C	LL	5	28.7	8.3	29.0	3.7	10.3	22
	PI	5	11.9	4.6	38.4	2.0	5.7	7
	γmax	6	117.2	8.4	7.1	3.4	8.8	19
	OMC	6	13.0	3.1	23.9	1.3	3.2	3
	% < No. 4	6	93.7	9.0	9.6	3.7	9.5	22
	% < No. 10	6	91.1	12.6	13.9	5.2	13.3	43
	% < No. 40	6	76.6	25.4	33.2	10.4	26.7	171
	% < No. 200	6	48.2	30.5	63.4	12.5	32.1	247
	% < 2μ	6	14.1	10.9	77.2	4.4	11.4	32

148 PROCTOR SILT LOAM

Soil Association Area: R (8a)

Soil Group: Brunizem

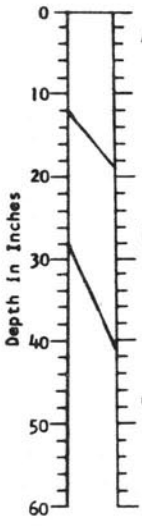
Parent Material: Silty sediments, 0 to 3 ft, on stratified glacial outwash

Topography: Gently rolling, 1 to 4% slope

Surface Drainage: Medium

Internal Drainage: Good

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Brown to dark brown silt loam grading to Dark brown to yellowish brown silt loam below 7 to 11 in.	37-43	6-20	93-102	20-24	100	100	99-100	90-100	13-21	A-4 A-7 A-7-6	OL CL
B	Dark yellowish brown, mottled with yellowish brown, clay loam to silty clay loam	37-49	11-25	99	18-23	100	100	98-100	95-100	21-23	A-7-6 A-6	CL ML
C	Grayish brown to yellowish brown silty to sandy loam over stratified silts, sands, and gravels which are sometimes capped by a reddish brown gravelly clay loam	36-49	12-24	96-110	15-24	100	100	99-100	91-100	19-31	A-6 A-7-6	CL ML

Remarks: Soils in DeWitt County mapped as 148, Proctor silt loam generally developed from loess which is thicker than the limits presently defined for this soil type. Accordingly, all three sites samples were reclassified as 199, Plano silt loam.

Design and Construction Information

Alignment:	shallow to moderate cuts and fills
Thickness of topsoil:	1.0 to 1.5 ft
Water table:	below 6 ft, good drainage
Frost action:	medium to high susceptibility, F_3; occasionally very high, F_4
Seepage:	not a problem unless cuts are made below water table
Excavation:	usually not difficult; when wet the surface may be slippery and soft; below water table dragline operation will be required
Cut slopes:	usually stable at 1.5 to 1 or steeper; silt pockets or strata may slough where seepage occurs
Compaction:	not difficult at water contents near optimum; grid, tamping, or pneumatic rollers usually satisfactory
Erosion:	may be serious on both cut and fill slopes
Source of borrow:	generally good
Source of granular material:	generally fair to excellent; below 5 to 6 ft sands and gravels of variable quality are usually found
Source of topsoil:	fair to good
Special recommendations:	topsoil stripping of at least 8 in. recommended beneath low fills; material encountered in shallow cuts may, when wet, be very unstable under heavy construction traffic; drainage should be provided to prevent water standing on cut or fill surfaces.

148 PROCTOR SILT LOAM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth In.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
* T19N, R1E, Sec 15																			
SW 1/4, NE 1/4, SW Cor	9-A	9-15	39	17	101	20				100	99		95		28	19	A-6(11)	SiL	CL
E side of paved road	9-B	18-28	47	24	99	19					100		98		31	22	A-7-6(15)	SiL	CL
2-3%	9-C	38-56	40	17	107	17				100	99		92		32	26	A-6(11)	SiL	CL
* T21N, R5E, Sec 14	13-A	12-18	42	14	96	22					100		97		26	14	A-7-6(10)	SiL	OL
SE 1/4, SE 1/4, S10	13-B	21-30	44	16	99	22					100		98		33	21	A-7-6(11)	SiL	ML
3%	13-C	42-48	39	14	103	20				100	99		97		27	20	A-6(10)	SiL	ML
* T19N, R1E, Sec 17	46-A	5-14	39	8	96	23				100	99		98		30	18	A-4(8)	SiL	OL
SW1/4, SW 1/4, NW Cor	46-B	20-33	39	14	99	21				100	99		98		33	23	A-6(10)	SiL	CL
3%	46-C	42-47	48	23	98	23					100		98		36	28	A-7-6(15)	SiL to SiCL	CL

* Reclassified as 199 Plano Silt Loam

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	3	40.1	1.9	4.8	1.1	4.7	3
	PI	3	13.0	4.5	34.8	2.6	11.2	15
	γmax	3	97.6	2.9	3.0	1.7	7.3	7
	OMC	3	21.6	1.4	6.7	0.8	3.6	2
	% < No. 4	3	100.0	0.0	----	----	----	--
	% < No. 10	3	100.0	0.0	----	----	----	--
	% < No. 40	3	99.3	0.2	0.2	0.1	0.6	1
	% < No. 200	3	95.2	3.5	3.7	2.0	8.6	9
	% < 2μ	3	17.0	3.0	17.9	1.8	7.6	7
B	LL	3	43.2	4.1	9.4	2.4	10.1	13
	PI	3	17.9	4.9	27.6	2.8	12.3	18
	γmax	3	99.1	0.2	0.2	0.1	0.6	1
	OMC	3	20.6	1.5	7.2	0.9	3.7	2
	% < No. 4	3	100.0	0.0	----	----	----	--
	% < No. 10	3	100.0	0.0	----	----	----	--
	% < No. 40	3	99.3	0.7	0.7	0.4	1.6	1
	% < No. 200	3	97.4	1.5	1.6	0.9	3.8	2
	% < 2μ	3	22.0	1.0	4.6	0.6	2.5	1
C	LL	3	42.3	4.6	10.9	2.7	11.4	16
	PI	3	17.8	4.3	24.4	2.5	10.8	14
	γmax	3	102.7	4.8	4.7	2.8	12.0	18
	OMC	3	19.9	3.2	15.8	1.8	7.8	8
	% < No. 4	3	100.0	0.0	----	----	----	--
	% < No. 10	3	100.0	0.0	----	----	----	--
	% < No. 40	3	99.3	0.2	0.2	0.2	0.6	1
	% < No. 200	3	95.8	3.0	3.2	1.8	7.6	7
	% < 2μ	3	24.6	4.2	16.8	2.4	10.3	13

149 BRENTON SILT LOAM

Soil Association Area: R (8a)

Soil Group: Brunizem

Parent Material: Silty sediments, 0 to 3 ft, on stratified glacial outwash

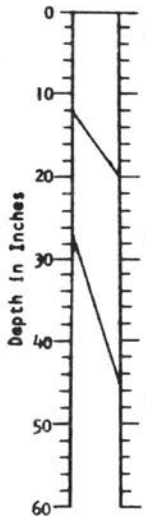
Topography: Nearly level to very gently rolling, 0 to 2% slope

Surface Drainage: Medium to slow

Internal Drainage: Medium

Pedological Profile Description and Engineering Characteristics

Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Very dark brown silt loam to silty clay loam grading to Very dark grayish brown silty clay loam below 8 to 12 in.	33-48	6-22	94-99	20-25	100	100	93-100	72-100	8-28	A-7-6 A-4 A-6	OL CL OH
B	Dark grayish brown, mottled with yellowish brown, silty clay loam to clay loam	29-67	6-42	92-105	19-25	100	99-100	91-100	83-100	20-35	A-7-6 A-6 A-4	CL CH
C	Grayish brown to yellowish brown silty to sandy loam or clay loam over stratified silts, sands and gravels	31-44	10-22	102-110	16-24	100	100	97-100	90-100	18-29	A-6 A-7-6 A-4	CL



Remarks: Soils in DeWitt County mapped as 149, Brenton silt loam, generally developed from loess which is thicker than the limits presently defined for this soil type. All but one site sampled was reclassified.

Design and Construction Information

Alignment:	shallow fills
Thickness of topsoil:	1.0 to 1.5 ft
Water table:	3 to 6 ft, fair to poor drainage
Frost action:	medium to high susceptibility, F_3; occasionally very high, F_4
Seepage:	serious in cuts below water table
Excavation:	not difficult unless cuts are made below water table; then dragline operation will probably be required; surface is slippery when wet
Cut slopes:	usually stable at 1.5 to 1 or steeper; silt pockets or strata may slough where seepage occurs
Compaction:	not difficult at water contents near optimum; tamping, or pneumatic rollers generally satisfactory
Erosion:	may be serious on both cut and fill slopes
Source of borrow:	generally good below 3 ft; drying may be required to reduce moisture content to optimum
Source of granular material:	generally fair to excellent; below 6 ft sands and gravels of variable quality are usually found
Source of topsoil:	good to excellent
Special recommendations:	12 in. or more of topsoil should be stripped under low fills to remove all compressible organic soil; at high water contents may be very unstable under heavy construction traffic; after rains soil should be scarified, partially dried, and recompacted prior to placing subbase or more fill; drainage should be provided to prevent water standing on surface of cuts or fills

149 BRENTON SILT LOAM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
* T19N, R1E, Sec 28	7-A	6-18	46	19	96	23				100	98		95		23	15	A-7-6(13)	SiL	OH
NE 1/4, NE 1/4	7-B	24-34	61	38	95	22				100	99		97		38	30	A-7-6(20)	SiCL	CH
0-1%	7-C	41-62	35	14							100		99		24	18	A-6(10)	SiL	CL
* T20N, R1E, Sec 19	27-A	9-15	46	19	96	20				100	91		66		12	8	A-7-6(11)	L	CL
NW 1/4, NW 1/4, NW Cor	27-B	21-29	65	39	94	24				100	90		81		30	23	A-7-6(20)	L	CH
1%	27-C	40-59	38	18	108	17					100		98		26	21	A-6(11)	SiL	CL
* T19N, R1E, Sec 6	44-A	4-13	38	7	94	23				100	99		96		26	15	A-4(8)	SiL	OL
NE 1/4, NE 1/4, E10	44-B	18-31	39	15	99	21				100	98		94		33	24	A-6(10)	SiL	CL
0-2%	44-C	36-56	44	20	103	20				100	99		98		34	27	A-7-6(13)	SiL to SiCL	CL
* T19N, R1E, Sec 24	71-A	4-14	37	13	99	22				100	99		98		36	26	A-6(9)	SiL	CL
NW 1/4, 0.2mi N of SE Cor	71-B	16-37	47	24	97	23				100	99		97		43	33	A-7-6(15)	SiCL	CL
2-3%	71-C	41-48	35	16	110	17		100	99	97	90		73		37	29	A-6(10)	CL	CL
** T19N, R1E, Sec 31	72-A	0-15	43	16	96	24				100	99		98		37	25	A-7-6(11)	SiL	OL
SW 1/4	72-B	17-33	45	20	98	24					100		99		42	33	A-7-6(13)	SiCL	CL
0.2 mi E. of SW Cor	72-C	35-59	40	17	104	20							100		35	27	A-6(11)	SiL	CL
1%	72-D	67-79	28	9	117	14				100	96		80		27	20	A-4(8)	SiL	CL
T21N, R5E, Sec 13	88-A	2-16	34	8	98	21				100	96		92		28	19	A-4(8)	SiL	OL
NW 1/4, NE 1/4, NE Cor	88-B	20-36	31	8	106	18			100	99	95		89		31	21	A-4(8)	SiL	CL
1%	88-C	55-74	32	10	109	18				100	96		89		30	23	A-4(8)	SiL	CL

* Reclassified as 198 Elburn Silt Loam

** Reclassified as 41 Muscatine Silt Loam

Summary of Statistical Data

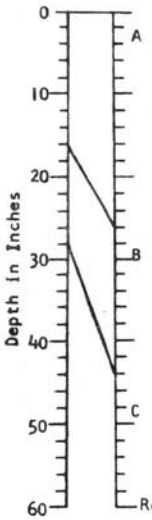
Horizon	Index Property	No. of Samples Tested	Means	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	6	40.8	5.1	12.6	2.1	5.4	7
	PI	6	13.9	5.4	39.0	2.2	5.7	8
	γmax	6	96.6	1.8	1.8	0.7	1.9	1
	OMC	6	22.1	1.8	8.0	0.7	1.8	1
	% < No. 4	6	100.0	----	----	----	----	--
	% < No. 10	6	99.9	0.2	0.2	0.1	0.2	1
	% < No. 40	6	97.3	3.1	3.2	1.3	3.2	3
	% < No. 200	6	90.0	12.2	13.5	5.0	12.8	40
	% < 2μ	6	18.0	6.8	38.1	2.8	7.2	13
B	LL	6	48.0	13.0	27.2	5.3	13.7	45
	PI	6	24.2	12.3	51.0	5.0	12.9	41
	γmax	6	98.4	4.4	4.4	1.8	4.6	5
	OMC	6	21.9	2.2	10.1	0.9	2.3	2
	% < No. 4	6	100.0	0.1	0.1	0.0	0.1	1
	% < No. 10	6	99.8	0.4	0.4	0.2	0.4	1
	% < No. 40	6	96.8	3.8	3.9	1.5	3.9	4
	% < No. 200	6	92.1	6.5	7.1	2.7	6.9	12
	% < 2μ	6	27.3	5.3	19.5	2.2	5.6	8
C	LL	5	37.8	4.5	12.0	2.0	5.6	7
	PI	5	15.9	4.0	25.0	1.8	4.9	5
	γmax	4	106.2	2.8	2.7	1.4	4.5	4
	OMC	4	18.7	1.6	8.6	0.8	2.6	1
	% 2 No. 4	5	100.0	0.0	----	----	----	--
	% < No. 10	5	100.0	0.1	0.1	0.0	0.1	1
	% < No. 40	5	98.9	1.4	1.4	0.6	1.7	1
	% < No. 200	5	95.9	4.0	4.2	1.8	5.0	5
	% < 2μ	5	23.2	3.9	16.8	1.7	4.8	5

152 DRUMMER SILTY CLAY LOAM

Soil Association Area: H, R (3a, 8a)
Soil Group: Humic-Gley
Parent Material: Silty local wash and loess, 2 to 5 ft, on loamy glacial drift

Topography: Nearly level to depressional, 0 to 0.5% slope
Surface Drainage: Slow
Internal Drainage: Medium to poor

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Black silty clay loam to clay loam grading to Very dark gray clay loam to silty clay loam below 10 to 16 in.	39-62	17-29	89-103	18-26	100	100	96-100	85-98	15-32	A-7-6 A-7-5 A-6	CH OL CL OH
B	Brownish gray, mottled with yellowish brown, clay loam to silty clay loam	43-57	23-32	96-109	18-19	100	100	96-100	91-100	27-36	A-7-6	CH CL
C	Gray loam to silty clay loam	26-48	7-26	104-115	14-19	99-100	98-100	96-99	86-100	18-30	A-6 A-7-6 A-4	CL

Remarks: This soil type differs from 67, Harpster silty clay loam, mainly because it lacks the snail shells and alkaline reaction of 67, Harpster silty clay loam.

Design and Construction Information

Alignment: shallow fills

Thickness of topsoil: 1.5 to 2.0 ft

Water table: 0 to 3 ft, poor drainage

Frost action: medium to high susceptibility, F_3; sometimes very high, F_4

Seepage: a serious problem if pockets or strata of silt or sand are exposed in cuts

Excavation: can be made easily above water table during dry season; when wet the surface is slippery and very soft

Cut slopes: usually stable at 1.5 to 1; silt strata slough rapidly where seepage occurs

Compaction: not difficult at moisture contents near optimum; heavy tamping rollers recommended

Erosion: often serious on fill slopes; special surface drainage installations may be required

Source of borrow: generally good below 3 ft; drying usually required to reduce moisture content to optimum

Source of granular material: generally no; but where associated with Brenton (149) and Proctor (148) in outwash areas, sand or sandy gravel may be found below 6 ft

Source of topsoil: excellent

Special recommendations: 18 in. or more of topsoil should be stripped under low fills to remove all compressible organic soil; at high water contents very unstable under heavy construction traffic; preferable to elevate grade line 4 to 5 ft and not to attempt to strip topsoil

152 DRUMMER SILTY CLAY LOAM

Test Data Summary Sheet

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γd pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T19N, R3E, Sec 14, SW 1/4, SE 1/4 0-0.5%	3-A	6-20	54	26	96	22				100	98		94		32	23	A-7-6(17)	SiL	CH
	3-B	23-36	53	32	105	18				100	98		97		40	28	A-7-6(19)	SiCL	CH
	3-C	41-54	42	21	108	18			100	99	98		94		34	26	A-7-6(13)	SiL	CL
T20N, R1E, Sec 18 SW 1/4, SW 1/4, SW Cor 0-0.5%	28-A	12-23	47	20	95	23				100	96		86		24	14	A-7-6(13)	SiL	OL
	28-B	30-40	51	27	--	--				100	95		93		42	32	A-7-6(17)	SiCL	CH
	28-C	48-54	48	25	105	18				100	96		91		37	29	A-7-6(16)	SiCL	CL
T21N, R3E, Sec 16 SW 1/4, SE 1/4, SW Cor 0.5%	35-A	5-15	59	23	90	26				100	99		94		37	28	A-7-5(17)	SiCL	OH
	35-B	24-34	54	28	97	18				100	99		99		46	37	A-7-6(18)	SiCL	CH
	35-C	42-59	29	8	112	15		100	99	98	97		97		24	18	A-4(8)	SiL	CL
T21N, R3E, Sec 22, SW 1/4, SW 1/4, SW Cor 0%	54-A	6-16	54	28	97	19				100	99		96		34	24	A-7-6(18)	SiL	CH
	54-B	20-36	51	27	101	18					100		98		40	31	A-7-6(17)	SiCL	CH
	54-C	43-64	36	15	---	--				100	99		98		32	24	A-6(10)	SiL	CL
T19N, R1E, Sec 30, SE 1/4, 1/4 mi W of SE Cor, 0-0.5%	74-A	0-20	39	18	103	20				100	98		87		36	28	A-6(11)	SiCL	CL
	74-B	23-40	42	24	107	18				100	99		92		37	31	A-7-6(14)	SiCL	CL
	74-C	44-65	31	13	113	15				100	98		85		31	23	A-6(9)	SiL	CL

Summary of Statistical Data

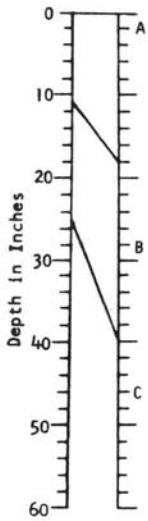
Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	5	50.5	7.7	15.2	3.4	9.5	19
	PI	5	22.7	4.1	18.3	1.9	5.1	6
	γmax	5	95.9	4.7	4.9	2.1	5.8	7
	OMC	5	22.0	2.7	12.1	1.2	3.3	3
	% < No. 4	5	100.0	0.0	----	----	----	--
	% < No. 10	5	99.9	0.2	0.2	0.1	0.3	1
	% < No. 40	5	98.2	1.3	1.4	0.6	1.7	1
	% < No. 200	5	91.6	4.7	5.2	2.1	5.9	7
	% < 2μ	5	23.5	5.8	24.8	2.6	7.2	11
B	LL	5	50.0	4.7	9.3	2.1	5.8	7
	PI	5	27.5	3.0	11.0	1.3	3.7	3
	γmax	4	102.4	4.3	4.2	2.1	6.8	8
	OMC	4	18.2	0.3	1.4	0.1	0.4	1
	% < No. 4	5	100.0	0.0	----	----	----	--
	% < No. 10	5	99.9	0.1	0.1	0.0	0.1	1
	% < No. 40	5	98.2	1.8	1.8	0.8	2.2	1
	% < No. 200	5	95.6	3.1	3.2	1.4	3.8	3
	% < 2μ	5	31.7	3.3	10.4	1.5	4.1	4
C	LL	5	37.3	7.5	20.2	3.4	9.4	18
	PI	5	16.4	6.8	41.3	3.0	8.4	15
	γmax	4	109.6	3.6	3.3	1.8	5.7	6
	OMC	4	16.6	1.7	10.3	0.8	2.7	2
	% < No. 4	5	99.7	0.5	0.5	0.2	0.6	1
	% < No. 10	5	99.5	0.7	0.7	0.3	0.8	1
	% < No. 40	5	97.5	1.2	1.2	0.5	1.5	1
	% < No. 200	5	92.7	5.0	5.4	2.2	6.2	8
	% < 2μ	5	23.9	3.9	16.5	1.8	4.9	5

154 FLANAGAN SILT LOAM

Soil Association Area: H (3a)
Soil Group: Brunizem
Parent Material: Loess, $3\frac{1}{2}$ to 5 ft, on loam till

Topography: Gently sloping, 1 to 4% slope
Surface Drainage: Medium
Internal Drainage: Medium

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Brown to very dark grayish brown silt loam grading to Dark yellowish brown silt loam below 5 to 8 in.	30-62	8-29	95-99	21-23	100	100	80-100	69-100	18-28	A-7-6 A-7-5 A-4	OL CL OH
B	Yellowish brown, mottled with brownish gray, silty clay loam	47-59	22-32	94-99	18-24	100	100	90-100	87-100	25-40	A-7-6	CH CL
C	Yellowish brown silt loam	35-54	14-30	101-107	18-22	98-100	98-100	96-100	91-100	23-32	A-7-6 A-6	CL CH

Design and Construction Information

Alignment: shallow cuts and fills

Thickness of topsoil: 1.0 to 1.5 ft

Water table: 3 to 6 ft, fair drainage

Frost action: medium to high susceptibility, F_3; occasionally very high, F_4

Seepage: probable at loess-till contact; from silt or sand pockets in till below the water table

Excavation: usually not difficult; when wet the surface is slippery and soft

Cut slopes: stable at 1.5 to 1; silt pockets or loess slough rapidly where seepage occurs

Compaction: not difficult if water content is kept near optimum; tamping, grid, or pneumatic rollers acceptable

Erosion: often serious on both cut and fill slopes until protected; special surface drainage installations may be required

Source of borrow: fair to good depending upon silt content; drying may be required to reduce moisture content to optimum

Source of granular material: no

Source of topsoil: good to excellent

Special recommendations: to remove all compressible organic soil, 12 in. or more of topsoil should be stripped under low fills; at high moisture contents very unstable under heavy construction traffic; after rains soil should be scarified, partially dried, and recompacted prior to placing subbase or more fill; drainage should be provided to prevent water standing on surface of cuts or fills

154 FLANAGAN SILT LOAM

Test Data Summary Sheet

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γd pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T19N, R4E, Sec. 20,	1-A	6-18	45	20	99	22				100	97		93		33	21	A-7-6(13)	SiL	CL
NE 1/4, NE 1/4,	1-B	21-32	59	31	95	23				100	99		98		46	32	A-7-6(20)	SiCL	CH
2%	1-C	36-48	48	26	102	20				100	99		98		35	25	A-7-6(16)	SiL	CL
T21N, R1E, Sec.32	33-A	5-15	67	31	---	--				100	74		60		24	18	A-7-5(16)	L	OH
SE 1/4, NE 1/4, NE Cor	33-B	18-30	58	32	---	--				100	87		83		34	28	A-7-6(20)	CL	CH
1-2%	33-C	33-49	54	30	---	--				100	98		97		38	31	A-7-6(19)	SiCL	CH
T21N, R5E, Sec 29,	36-A	4-14	46	17	96	22				100	99		97		32	24	A-7-6(12)	SiL	OL
NE 1/4, NW 1/4, NW Cor	36-B	20-28	52	25	98	18					100		98		38	32	A-7-6(17)	SiCL	CH
3%	36-C	35-40	48	23	102	20				100	98		96		32	26	A-7-6(15)	SiL	CL
T21N, R3E, Sec 18	51-A	6-15	42	16	96	21					100		99		34	25	A-7-6(11)	SiL	OL
SE 1/4, SW 1/4, SE Cor	51-B	19-30	50	24	98	22				100	99		98		35	28	A-7-6(16)	SiCL	CL
3%	51-C	36-50	36	16	107	18		100	98	97	95		89		32	24	A-6(10)	SiL	CL
T19N, R2E, Sec 19,	66-A	2-18	41	16	98	23				100	99		97		40	28	A-7-6(11)	SiCL	CL
NW 1/4, SW 1/4, SE Cor	66-B	19-37	49	25	98	21				100	99		97		44	34	A-7-6(16)	SiCL	CL
1%	66-C	39-59	39	18	106	19					100		98		36	27	A-6(11)	SiL	CL
T20N, R2E, Sec 28,	89-A	2-12	35	10	98	22				100	98		96		36	23	A-4(8)	SiL	OL
NW 1/4, NE 1/4, NE Cor	89-B	22-37	51	25	94	24					100		98		52	41	A-7-6(16)	SiC	CH
2%	89-C	41-56	42	20	103	21				100	99		98		38	23	A-7-6(12)	SiCL	CL

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	6	46.0	10.8	23.5	4.4	11.4	31
	PI	6	18.2	7.2	39.6	3.0	7.6	14
	γmax	5	97.1	1.6	1.6	0.7	1.9	1
	OMC	5	22.0	0.6	2.9	0.3	0.8	1
	% < No. 4	6	100.0	0.0	----	----	----	--
	% < No. 10	6	100.0	0.0	----	----	----	--
	% < No. 40	6	94.4	10.3	10.9	4.2	10.8	28
	% < No. 200	6	90.3	15.0	16.6	6.1	15.7	60
	% < 2μ	6	23.1	3.4	14.8	1.4	3.6	4
B	LL	6	53.2	4.1	7.8	1.7	4.3	5
	PI	6	27.1	3.3	12.3	1.4	3.5	3
	γmax	5	96.6	1.9	2.0	0.9	2.4	2
	OMC	5	21.6	2.3	10.5	1.0	2.8	2
	% < No. 4	6	100.0	0.0	----	----	----	--
	% < No. 10	6	100.0	0.0	----	----	----	--
	% < No. 40	6	97.3	4.9	5.0	2.0	5.1	7
	% < No. 200	6	95.6	6.1	6.4	2.5	6.4	10
	% < 2μ	6	32.4	4.9	15.3	2.0	5.2	7
	LL	6	44.5	6.5	14.7	2.7	6.9	12
	PI	6	22.0	5.2	23.9	2.1	5.5	8
	γmax	5	104.0	2.2	2.2	1.0	2.8	2
	OMC	5	19.6	1.3	6.8	0.6	1.7	1
	% < No. 4	6	99.7	0.8	0.8	0.3	0.9	1
	% < No. 10	6	99.5	1.1	1.2	0.5	1.2	1
	% < No. 40	6	98.4	1.6	1.6	0.6	1.7	1
	% < No. 200	6	96.0	3.6	3.7	1.5	3.7	4
	% < 2μ	6	27.5	3.3	12.0	1.3	3.4	3

158 VANCE SILT LOAM

Soil Association Area: R (8b)

Soil Group: Gray-brown Podzolic

Parent Material: Silty sediments, 0 to 3 ft, on stratified glacial outwash

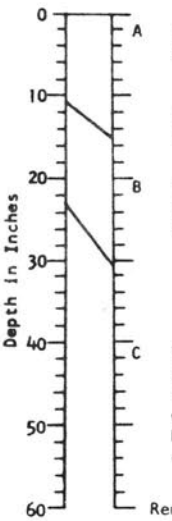
Topography: Nearly level to gently rolling, 1 to 4% slope

Surface Drainage: Medium to rapid

Internal Drainage: Medium to good

Pedological Profile Description and Engineering Characteristics

Horizon	Description	LL	PI	γ_{max}	OMC	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
		%	%	pcf	%							
A	Yellowish gray to brownish gray silt loam grading to Light yellowish brown silt loam below 5 to 8 in.											
B	Yellowish brown to brownish yellow silty clay loam to clay loam											
C	Yellowish brown to gray silty to sandy loam over stratified silts and sands which are sometimes capped by a reddish brown gravelly clay loam											



Insufficient data available to estimate the average properties of this soil

Remarks: This soil type is no longer in use. Sites sampled in DeWitt County were reclassified as 134, Camden silt loam or 243, St. Charles silt loam.

Design and Construction Information

Alignment:

Thickness of topsoil:

Water table:

Frost action:

Seepage:

Excavation:

Cut slopes:

Compaction:

Erosion:

Source of borrow:

Source of granular material:

Source of topsoil:

Special recommendations:

Insufficient data available to justify a detailed description of this soil type, refer to 134 Camden silt loam, terrace

158 VANCE SILT LOAM

Test Data Summary Sheet

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γd pcf	Opt. w %	Mechanical Analsysi Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
*T19N, R1E, Sec 6,	62-A	8-15	33	13	104	19					100		98		34	24	A-6(19)	SiL	CL
SW 1/4, SW 1/4, SW Cor	62-B	18-38	43	21	101	22					100		99		39	30	A-7-6(13)	SiCL	CL
3%	62-C	47-67	37	18	105	19					100		99		32	25	A-6(11)	SiL	CL
**T19N, R1E, Sec 7,	59-A	5-12	32	11	103	16				100	99		98		31	20	A-6(8)	SiL	CL
SE 1/4, NE 1/4, NE Cor	59-B	14-34	43	22	101	20							100		37	29	A-7-6(13)	SiCL	CL
3%	59-C	43-61	32	15	106	17				100	99		96		30	25	A-6(10)	SiL	CL

* Reclassified as 243 St. Charles Silt Loam

**Reclassified as 134 Camden Silt Loam

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required

Insufficient Data Available for Statistical Analysis of this Soil Type

159 PILOT SILT LOAM

Soil Association Area: R (8a)

Soil Group: Brunizem

Parent Material: Silty sediments, 0 to 3 ft, on stratified glacial outwash

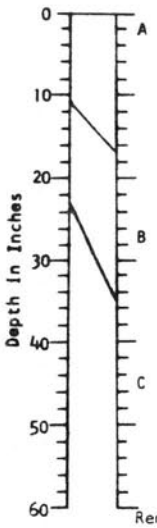
Topography: Nearly level to gently sloping, 0 to 4% slope

Surface Drainage: Medium

Internal Drainage: Rapid

Pedological Profile Description and Engineering Characteristics

Horizon	Description	LL	PI	γ_{max}	OMC	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
		%	%	pcf	%							
A	Brown to dark grayish brown silt loam to loam grading to Dark yellowish brown silt loam to loam below 6 to 9 in.											
B	Dark yellowish brown silty clay loam to sandy clay loam											
C	Yellowish to grayish brown sandy loam to sandy clay loam on stratified sands and gravels											



Insufficient data available to estimate the average properties of this soil

Remarks: Soils in DeWitt County mapped as 159, Pilot silt loam generally developed from silty sediments (usually loess) which is thicker than the limits presently defined for this soil type. The two sites sampled were reclassified.

Design and Construction Information

Insufficient data available to justify a detailed description of this soil type, refer to 148 Proctor silt loam

Alignment:

Thickness of topsoil:

Water table:

Frost action:

Seepage:

Excavation:

Cut slopes:

Compaction:

Erosion:

Source of borrow:

Source of granular material:

Source of topsoil:

Special recommendations:

159 PILOT SILT LOAM

Test Data Summary Sheet

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γd pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
*T19N, R1E, Sec 15, SW 1/4, NE 1/4, NW 1/4	10-A	6-12	40	15	100	20				100	99		98		34	24	A-7-6(10)	SiL	CL
	10-B	12-26	45	19	102	21					100		98		38	26	A-7-6(13)	SiL	CL
	$10\text{-}C_1$	25-40	45	19	102	21					100		99		33	24	A-7-6(13)	SiL	CL
	$10\text{-}C_3$	85-100	NP	NP	---	--	85	73	60	52	35		13				A-1-b	GSa	SM
**T19N, R1E, Sec 17, NE 1/4, SE 1/4, SW Cor 4%	58-A	0-11	37	17	---	--				100	94		64		20	14	A-6(9)	L	CL
	58-B	13-23	27	12	110	15				100	94		55		23	18	A-6(5)	L	CL
	$58\text{-}C_1$	34-40	NP	NP	118	13				100	94		31		15	13	A-2-4(0)	SaL	SM
	$58\text{-}C_2$	42-47	NP	NP	114	11	90	84	76	74	56		17		10	9	A-2-4(0)	LSa	SM

*Reclassified as 199 Plano Silt Loam

**Reclassified as 285 Carmi Loam

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required

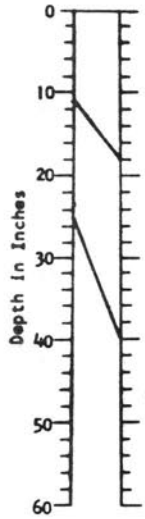
Insufficient Data Available for Statistical Analysis of this Soil Type

171 CATLIN SILT LOAM

Soil Association Area: H (3a)
Soil Group: Brunizem
Parent Material: Loess, 3½ to 5 ft, on loam till

Topography: Moderately to strongly sloping, 3 to 7% slope
Surface Drainage: Medium to rapid
Internal Drainage: Medium to good

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Very dark yellowish brown to brown silt grading to Dark yellowish brown silt loam below 6 to 10 in.	34-49	10-19	92-104	19-24	100	100	97-100	87-100	13-27	A-7-6 A-6	OL CL
B	Yellowish brown silty clay loam	38-58	18-28	95-103	19-22	96-100	95-100	88-100	75-100	18-34	A-7-6 A-6	CL CH
C	Yellowish brown silt loam (loess) over loam till	27-46	12-21	99-119	13-21	94-100	92-100	84-100	61-100	20-28	A-6 A-7-6	CL

Design and Construction Information

Alignment:	moderate cuts and fills
Thickness of topsoil:	1.0 to 1.5 ft
Water table:	below 6 ft, good drainage
Frost action:	medium to high susceptibility, F_3; occasionally very high, F_4
Seepage:	probable at loess-till contact; from silt or sand pockets in till below the water table
Excavation:	usually not difficult; when wet the surface is slippery and soft
Cut slopes:	stable at 1.5 to 1; silt pockets or loess slough rapidly where seepage occurs
Compaction:	not difficult if water content is kept near optimum; tamping, grid or pneumatic rollers acceptable
Erosion:	often serious on both cut and fill slopes until protected; special surface drainage installations may be required
Source of borrow:	fair to good depending upon silt content
Source of granular material:	no
Source of topsoil:	good
Special recommendations:	to remove all compressible organic soil, 12 in. of topsoil should be stripped under low fills; at high moisture contents very unstable under heavy construction traffic; after rains soil should be scarified, partially dried, and recompacted prior to placing subbase or more fill; drainage should be provided to prevent water standing on surface of cuts and fill

171 Catlin Silt Loam

Test Data Summary Sheet

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γd pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T20N, R3E, Sec 31,	12-A	5-13	47	17	---	--				100	99		97	35	23		A-7-6(12)	SiL	OL
SW 1/4, SE 1/4, NW 1/4,	12-B	14-27	57	29	---	--				100	99		98	40	27		A-7-6(19)	SiCL	CH
4%	12-C	31-45	42	20	105	18					100		99	32	26		A-7-6(12)	SiL	CL
T21N, R1E, Sec 32,	32-A	6-16	40	16	98	21				100	97		87	21	13		A-6(10)	SiL	CL
NE 1/4, SE 1/4, SE Cor	32-B	20-30	40	20	103	19	99	97	95	94	88		76	27	21		A-6(12)	L	CL
5-6%	32-C	33-40	32	16	113	15	97	96	95	93	87		67	30	23		A-6(9)	L	CL
T21N, R4E, Sec 36,	39-A	4-15	40	13	96	22				100	99		97	29	18		A-7-6(9)	SiL	OL
NE 1/4, SE 1/4, SW Cor	39-B	19-30	51	24	98	21				100	92		82	27	20		A-7-6(16)	SiL	CH
3%	39-C	37-53	40	17	105	18				100	98		91	30	22		A-6(11)	SiL	CL
T21N, R3E, Sec 18,	50-A	6-15	45	18	95	23					100		98	32	22		A-7-6(12)	SiL	OL
SW 1/4, SW 1/4, SW Cor	50-B	20-30	49	22	96	21					100		99	38	29		A-7-6(15)	SiCL	CL
7%	50-C	38-58	42	18	103	20							100	34	27		A-7-6(12)	SiL	CL
T19N, R1E, Sec 24,	65-A	2-14	34	11	104	20				100	98		92	31	24		A-6(8)	SiL	CL
NE 1/4, NE 1/4, SE Cor	65-B	14-33	44	21	100	21				100	96		94	42	33		A-7-6(13)	SiCL	CL
5%	65-C	38-52	28	11	119	13		100	96	93	86		67	30	20		A-6(7)	L	CL

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	5	41.3	5.2	12.6	2.3	6.4	9
	PI	5	15.0	3.1	20.4	1.4	3.8	3
	γmax	4	98.1	4.0	4.0	2.0	6.3	7
	OMC	4	21.4	1.6	7.7	0.8	2.6	2
	% < No. 4	5	100.0	0.0	-	-	-	-
	% < No. 10	5	100.0	0.0	-	-	-	-
	% < No. 40	5	98.5	1.1	1.1	0.5	1.3	1
	% < No. 200	5	93.7	4.5	4.8	2.0	5.6	7
	% < 2μ	5	20.1	4.6	22.8	2.1	5.7	7
B	LL	5	48.0	6.6	13.8	3.0	8.2	14
	PI	5	23.1	3.7	15.8	1.6	4.5	5
	γmax	4	99.2	2.9	3.0	1.5	4.7	4
	OMC	4	20.6	1.3	6.1	0.6	2.0	1
	% < No. 4	5	99.0	2.3	2.3	1.0	2.9	2
	% < No. 10	5	98.8	2.6	2.7	1.2	3.3	3
	% < No. 40	5	95.6	5.0	5.3	2.3	6.3	8
	% < No. 200	5	89.3	9.8	11.0	4.4	12.1	30
	% < 2μ	5	25.9	5.4	21.0	2.4	6.8	10
C	LL	5	36.7	6.5	17.7	2.9	8.1	13
	PI	5	16.4	3.2	19.3	1.4	3.9	4
	γmax	5	109.0	6.8	6.2	3.0	8.5	15
	OMC	5	16.8	2.7	15.9	1.2	3.3	3
	% < No. 4	5	98.2	2.6	2.6	1.1	3.2	3
	% < No. 10	5	97.1	3.8	4.0	1.7	4.8	5
	% < No. 40	5	94.0	7.1	7.5	3.2	8.8	16
	% < No. 200	5	84.3	16.0	19.0	7.2	19.9	79
	% < 2μ	5	23.6	2.7	11.5	1.2	3.4	3

195 HERSMAN CLAY LOAM, TERRACE

Soil Association Area:
Soil Group:
Parent Material:

Topography:
Surface Drainage:
Internal Drainage:

Pedological Profile Description and Engineering Characteristics

Horizon	Description	LL	PI	γ_{max}	OMC	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
		%	%	pcf	%							

This soil type is identical to 152, Drummer silty clay loam. It was mapped separately only because its position on terraces along Salt Creek subjects it to overflow in times of exceptionally high flood.

Because of its similarity to 152, Drummer silty clay loam, samples were not obtained for this soil type.

Design and Construction Information

Alignment:
Thickness of topsoil:
Water table:
Frost action:
Seepage:
Excavation:
Cut slopes:
Compaction:
Erosion:
Source of borrow:
Source of granular material:
Source of topsoil:
Special recommendations:

No data available for this soil type, refer to 152 Drummer clay loam. Hersman clay loam differs from Drummer clay loam by being located on stream terraces which are subject to overflow in times of very high floods; hence, embankment slopes may require special protection.

195 HERSMAN CLAY LOAM, TERRACE

Test Data Summary Sheet

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γd pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified

No profile was sampled

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required

No Data Available for Statistical Analysis of this Soil Type

206 THORP SILT LOAM

Soil Association Area: R (8a)

Soil Group: Planosol-Brunizem Intergrade

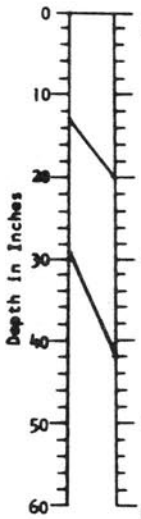
Parent Material: Silty sediments, 0 to 3 ft, on stratified glacial outwash

Topography: Nearly level to depressional, 0 to 0.5% slope

Surface Drainage: Slow

Internal Drainage: Poor

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Grayish brown to very dark gray silt loam grading to Gray silt loam below 6 to 8 in.	28-54	7-23	91-103	19-24	100	100	96-99	89-97	14-35	A-6 A-4 A-7-5	CL OL OH
B	Brownish gray, mottled with brownish yellow, clay loam to silty clay loam	41-57	17-34	95-101	20-24	99-100	98-100	93-100	87-100	20-43	A-7-6	CL CH
C	Brownish gray to brownish yellow silty to sandy loam	33-50	13-28	104-110	17-19	100	98-100	93-100	88-100	23-34	A-7-6 A-6	CL

Remarks: Substrata are stratified silts, sands and gravels.

Design and Construction Information

Alignment:	shallow fills
Thickness of topsoil:	1.0 to 1.5 ft
Water table:	0 to 3 ft, poor drainage
Frost action:	medium to high susceptibility, F_3; occasionally very high, F_4
Seepage:	to be expected in cuts below water table
Excavation:	can be made easily above water table during dry season; when wet the surface is slippery and soft; deep cuts below water table will probably require dragline operations
Cut slopes:	usually stable at 1.5 to 1; silt pockets or strata slough rapidly where seepage occurs
Compaction:	not difficult if water content is near optimum; tamping, grid, or pneumatic rollers acceptable
Erosion:	may be serious on both cut and fill slopes
Source of borrow:	generally good below 3 ft; drying usually required to reduce moisture content to optimum
Source of granular material:	generally fair to excellent; below 5 ft sands and gravels of variable quality are usually found
Source of topsoil:	fair
Special recommendations:	12 in. or more of topsoil should be stripped under low fills to remove all compressible soil; at high water contents very unstable under heavy construction traffic; elevation of grade line preferable to stripping topsoil

206 THORP SILT LOAM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth In.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T19N, R1E, Sec 21	8-A_2	8-16	39	16	100	20				100	99		96		26	15	A-6(10)	SIL	CL
SE 1/4, NE 1/4, SE 1/4	8-B	19-26	57	33	99	21				100	98		96		35	24	A-7-6(19)	SIL	CH
0-0.5%	8-C_1	40-57	46	26	-	-				100	98		96		34	26	A-7-6(16)	SIL	CL
	8-C_2	57-70	41	19	-	-				100	98		96		29	22	A-7-6(12)	SIL	CL
T21N, R5E, Sec 23	34-A	5-15	57	24	91	24				100	96		93		38	28	A-7-5(17)	SIL	OH
NW 1/4, NW 1/4, NE Cor	34-B	24-32	48	24	98	22		100	99	97	92		87		37	30	A-7-6(15)	SICL	CL
0-0.5%	34-C	44-62	44	20	108	17			100	98	92		89		36	30	A-7-6(13)	SICL	CL
T19N, R1E, Sec 6	61-A	6-15	38	14	97	21				100	98		96		30	21	A-6(10)	SIL	CL
NE 1/4, SE 1/4, NE Cor	61-B	18-38	47	23	98	21				100	99		98		36	27	A-7-6(15)	SICL	CL
0%	61-C	45-68	36	17	-	-				100	99		98		30	25	A-6(11)	SIL	CL
T20N, R1E, Sec 31	90-A	2-22	34	9	101	20				100	97		89		33	24	A-4(8)	SIL	OL
NW 1/4, NE 1/4, NW Cor	90-B	24-42	51	29	94	25				100	99		96		51	43	A-7-6(18)	SIC	CH
0%	90-C	42-61	46	26	104	18				100	99		97		42	34	A-7-6(16)	SICL	CL
T21N, R5E, Sec 13	91-A	2-14	40	14	98	23				100	98		96		45	34	A-6(10)	SICL	OL
NW 1/4, NW 1/4	91-B	19-36	43	19	99	22				100	99		98		43	35	A-7-6(12)	SICL	CL
0.2 mi E of NW Cor	91-C	41-66	40	14	108	18				100	99		96		32	26	A-6(10)	SIL	CL
0.5%																			

Summary of Statistical Data

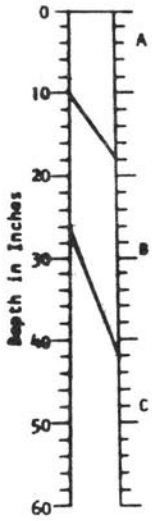
Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	5	41.4	9.0	21.7	4.0	11.2	25
	PI	5	15.2	5.5	36.2	2.5	6.8	10
	γmax	5	97.3	4.1	4.2	1.8	5.1	6
	OMC	5	21.5	1.8	8.1	0.8	2.2	1
	% < No. 4	5	100.0	0.0	-	-	-	-
	% < No. 10	5	99.9	0.1	0.1	0.1	0.2	1
	% < No. 40	5	97.5	0.9	0.9	0.4	1.1	1
	% < No. 200	5	93.2	2.8	3.0	1.3	3.5	3
	% < 2μ	5	24.4	7.2	29.4	3.2	8.9	16
B	LL	5	49.3	5.4	11.0	2.4	6.7	9
	PI	5	25.6	5.6	21.8	2.5	6.9	10
	γmax	5	97.7	2.0	2.0	0.9	2.5	2
	OMC	5	22.1	1.5	6.7	0.7	1.8	1
	% < No. 4	5	99.8	0.4	0.4	0.2	0.5	1
	% < No. 10	5	99.5	1.2	1.2	0.5	1.4	1
	% < No. 40	5	97.7	3.3	3.4	1.5	4.1	4
	% < No. 200	5	94.3	4.9	5.2	2.2	6.1	8
	% < 2μ	5	31.5	7.9	25.0	3.5	9.8	20
C	LL	5	41.6	5.6	13.4	2.5	6.9	10
	PI	5	20.5	5.4	26.5	2.4	6.8	10
	γmax	3	106.7	2.1	2.0	1.2	5.2	4
	OMC	3	17.8	0.7	4.1	0.4	1.8	1
	% < No. 4	5	99.9	0.2	0.2	0.1	0.2	1
	% < No. 10	5	99.5	1.1	1.1	0.5	1.4	1
	% < No. 40	5	97.5	3.2	3.3	1.4	4.0	4
	% < No. 200	5	94.0	3.9	4.1	1.7	4.8	5
	% < 2μ	5	28.1	3.8	13.7	1.7	4.8	5

207 WARD SILT LOAM

Soil Association Area: I (3b)
Soil Group: Gray-Brown Podzolic-Brunizem Intergrade
Parent Material: Loess, 3½ to 5 ft, on loam till

Topography: Nearly level, 0 to 1% slope
Surface Drainage: Slow
Internal Drainage: Poor

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Brownish gray silt loam grading to Yellowish gray to light gray silt loam below 5 to 8 in.	26-43	2-18	98-107	16-22	100	99-100	95-99	89-97	15-23	A-4 A-6 A-7-6	OL CL
B	Dark gray, mottled with yellowish brown, silty clay loam to silty clay	36-71	16-42	90-105	18-24	100	100	98-100	93-100	29-42	A-7-6 A-6	CH CL
C	Yellowish brown silt loam (loess) over loam till	34-51	14-26	100-108	16-23	100	100	99-100	94-100	21-38	A-7-6 A-6	CL CH

Design and Construction Information

Alignment: shallow fills

Thickness of topsoil: 1.0 to 1.5 ft

Water table: 0 to 3 ft, poor drainage

Frost action: medium to high susceptibility, F_3; occasionally very high, F_4

Seepage: probable at loess-till contact; from silt or sand pockets in till below the water table

Excavation: usually not difficult; when wet the surface is slippery and soft

Cut slopes: stable at 1.5 to 1; silt pockets or strata slough rapidly where seepage occurs

Compaction: not difficult if moisture content is kept near optimum; tamping, grid or pneumatic rollers acceptable

Erosion: may be serious on both cut and fill slopes, A horizon especially susceptible

Source of borrow: fair to good depending on silt content; drying may be required to reduce moisture content to optimum

Source of granular material: no

Source of topsoil: fair

Special recommendations: topsoil stripping of 8 to 10 in. recommended beneath low fills; at high water contents unstable under heavy construction traffic; drainage should be provided to prevent water standing on surface of cuts or fills; material absorbs water readily and after rains should be scarified, partially dried, and recompacted prior to placing subbase or more fill

207 WARD SILT LOAM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth In.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T19N, R2E, Sec 9	11-A	8-16	34	12	-	-				100	96		94		32	20	A-6(9)	SiL	CL
NE 1/4, NE 1/4, NW 1/4	11-B	20-35	60	34	97	19				100	99		98		45	34	A-7-6(20)	SiCL	CH
0.5%	11-C	41-56	51	24	-	-				100	99		98		40	32	A-7-6(16)	SiCL	CH
T20N, R4E, Sec 30	43-A	3-12	32	5	103	16				100	97		93		26	16	A-4(8)	SiL	OL
SW 1/4, NW 1/4, NE Cor	43-B	16-26	58	33	93	24				100	99		98		46	36	A-7-6(20)	SiCL	CH
0-0.5%	43-C	37-54	42	18	103	20				100	99		98		34	26	A-7-6(12)	SiL to SiCL	CL
T21N, R2E, Sec 19	49-A	8-12	44	18	99	21				100	99		95		34	23	A-7-6(12)	SiL	CL
NE 1/4, NW 1/4, NW Cor	49-B	15-30	65	36	93	22				100	99		97		49	37	A-7-6(20)	SiCL	CH
0-1%	49-C	43-64	35	14	107	16					100		99		28	23	A-6(10)	SiL	CL
T19N, R1E, Sec 2	70-A	2-12	28	5	106	18				100	98		96		28	20	A-4(8)	SiL	OL
SW 1/4, NW 1/4, NE Cor	70-B	17-34	50	29	97	21					100		99		49	41	A-7-6(18)	SiC	CH
0.5%	70-C	36-60	40	20	105	20				100	99		98		37	29	A-7-6(12)	SiCL	CL
T21N, R3E, Sec 36	75-A	2-10	35	8	103	19		100	99	95		92			26	16	A-4(8)	SiL	OL
NW 1/4, NW 1/4, NW Cor	75-B	12-26	34	13	106	19				100	98		95		38	29	A-6(9)	SiCL	CL
1%	75-C	28-41	45	24	100	22					100		99		44	38	A-7-6(15)	SiCL	CL

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	5	34.5	5.9	17.0	2.6	7.3	11
	PI	5	9.8	5.7	57.9	2.5	7.1	10
	γmax	4	102.6	3.1	3.0	1.5	4.9	4
	OMC	4	18.6	2.0	10.6	1.0	3.1	2
	% < No. 4	5	99.9	0.2	0.2	0.1	0.2	1
	% < No. 10	5	99.8	0.3	0.3	0.1	0.4	1
	% < No. 40	5	96.9	1.5	1.6	0.7	1.9	1
	% < No. 200	5	92.9	2.6	2.8	1.2	3.3	3
	% < 2μ	5	19.2	2.9	15.3	1.3	3.6	3
B	LL	5	53.3	12.0	22.4	5.4	14.9	45
	PI	5	28.9	9.3	32.1	4.2	11.5	27
	γmax	5	97.4	6.3	5.4	2.4	6.6	9
	OMC	5	20.9	1.9	9.3	0.9	2.4	2
	% < No. 4	5	100.0	0.0	----	----	----	--
	% < No. 10	5	100.0	0.0	----	----	----	--
	% < No. 40	5	99.1	0.8	0.8	0.3	0.9	1
	% < No. 200	5	96.6	2.3	2.3	1.0	2.8	2
	% < 2μ	5	35.4	4.4	12.5	2.0	5.5	6
C	LL	5	42.6	6.0	14.1	2.7	7.5	12
	PI	5	20.0	4.3	21.4	1.9	5.3	6
	γmax	4	103.9	2.9	2.8	1.5	4.7	4
	OMC	4	19.5	2.5	13.0	1.3	4.0	3
	% < No. 4	5	100.0	0.0	----	----	----	--
	% < No. 4	5	100.0	0.0	----	----	----	--
	% < No. 40	5	99.3	0.4	0.4	0.2	0.5	1
	% < No. 200	5	97.4	2.3	2.3	1.0	2.8	2
	% < 2μ	5	29.6	5.8	19.5	2.6	7.1	11

224 STRAWN SILT LOAM

Soil Association Area: I (3b)
Soil Group: Gray-Brown Podzolic
Parent Material: Loam till, sometimes with thin loess cover

Topography: Strongly sloping, 5 to 15% slope
Surface Drainage: Rapid
Internal Drainage: Good

Pedological Profile Description and Engineering Characteristics

Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Yellowish gray to brownish gray silt loam to loam, occasionally with gravel grading to Grayish yellow loam to silt loam below 5 to 7 in.	19-46	2-19	95-117	13-24	98-100	97-100	97-100	64-100	12-31	A-4 A-6 A-7-6	CL OL
B	Yellowish brown clay loam to silty clay, loam	26-44	8-22	103-117	12-20	92-100	88-100	78-100	50-100	22-32	A-6 A-4 A-7-6	CL SC
C	Yellowish brown silt loam to loam with some gravel	23-36	6-17	107-122	11-18	77-100	71-100	56-100	31-96	12-29	A-4 A-6 A-2-6	CL SC

Remarks: One sampled profile was developed from loess which is thicker than the limits presently defined for this soil type. It was reclassified as 322, Russell silt loam. At two sampling sites erosion may have exposed the upper B horizon which was erroneously identified as the A horizon.

Design and Construction Information

Alignment: moderate to deep cuts

Thickness of topsoil: 0.5 to 1.0 ft

Water table: below 6 ft, good drainage

Frost action: medium to very high susceptibility, F_3 to F_4

Seepage: may be serious at loess contact with till if it is distinct and exposed, or in silt or sand pockets in till

Excavation: usually not difficult; when wet the surface is slippery and often soft

Cut slopes: stable at 1.5 to 1; silt pockets slough rapidly where seepage occurs

Compaction: not difficult at moisture contents near optimum; tamping or pneumatic rollers acceptable

Erosion: often serious on cut slopes until protected; special surface drainage installations may be required

Source of borrow: generally good unless very silty

Source of granular material: no

Source of topsoil: generally poor

Special recommendations: normal topsoil stripping of 6 to 8 in. recommended beneath low fills; at high water contents very unstable under heavy construction traffic; absorbs water readily and after rain should be scarified, partially dried, and recompacted prior to placing subbase or more fill; drainage should be provided to prevent water standing on surface of cuts or fills

224 STRAWN SILT LOAM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth In.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
* T19N, R2E, Sec 16	S-A_2	5-12	26	12	117	14			100	98	96	90		63		28	22	A-6(6)	L	CL
NW 1/4, SE 1/4, NW 1/4	S-B	14-25	40	23	109	16			100	98	96	90		68		37	30	A-6(12)	CL	CL
10%	S-C	27-50	30	15	118	12			100	96	94	86		55		26	20	A-6(6)	L	CL
T20N, R3E, Sec 36	**21-A	8-13	46	19	100	22						100		98		35	28	A-7-6(13)	SICL	CL
SW 1/4, SW 1/4, W10	21-B	18-25	43	18	-	-						100		98		34	25	A-7-6(12)	SIL	CL
10%	21-C	35-41	35	12	108	18					100	99		95		29	21	A-6(9)	SIL	CL
T21N, R4E, Sec 36	38-A	4-10	21	1	-	-			100	99	98	95		76		20	14	A-4(8)	SIL	CL
SE 1/4, NE 1/4, SE Cor	38-B	14-24	29	10	112	15			100	98	97	89		64		30	25	A-4(6)	L	CL
8%	38-C	32-44	34	15	111	16			100	99	98	91		65		40	31	A-6(8)	CL	CL
T19N, R1E, Sec 3	69-A	2-12	26	7	112	15			100	99	98	93		75		28	20	A-4(8)	SIL	CL
SW 1/4, NE 1/4, SW Cor	69-B	12-27	28	11	116	15			100	97	95	88		70		34	26	A-6(7)	CL	CL
8%	69-C	27-42	23	7	119	13			100	98	96	88		67		27	20	A-4(6)	L	CL
T20N, R2E, Sec 28	79-A	1-12	39	10	98	22					100	99		96		27	18	A-6(8)	SIL	OL
SW 1/4, NE 1/4, NE Cor	79-B	13-25	41	18	102	21					100	99		97		42	34	A-7-6(12)	SICL	CL
10%	79-C	40-65	28	8	111	17	100		99	99	99	95		88		37	23	A-4(8)	SIL	CL
T21N, R1E, Sec 28	92-A	2-12	29	7	109	17	99		99	99	99	96		82		22	15	A-4(8)	SIL	OL
NE 1/4, SW 1/4, SW Cor	92-B	12-23	33	14	110	15	100		95	90	84	74		50		27	23	A-6(4)	CL	SC
9%	92-C	28-46	32	15	114	15	86		83	77	72	59		35		20	17	A-2-6(1)	SaCL	SC
T21N, R3E, Sec 25	**93-A	2-14	42	16	101	22					100	99		97		40	32	A-7-6(11)	SICL	CL
SW 1/4, 0.1mi N of SE Cor	93-B	18-30	31	11	111	17			100	99	99	96		86		30	25	A-6(8)	SIL	CL
10%	93-C	39-50	25	8	122	12	92		86	77	69	54		40		16	11	A-4(1)	L	SC

* Reclassified as 322 Russell Silt Loam

**Samples 21-A and 93-A appear to contain upper B horizon material.

Summary of Statistical Data

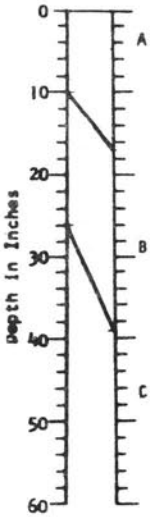
Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	7	32.7	9.5	29.0	3.6	8.8	22
	PI	7	10.5	6.1	58.2	2.3	5.6	9
	γmax	6	106.2	7.6	7.2	3.1	8.0	16
	OMC	6	18.5	3.8	20.8	1.6	4.0	4
	% < No. 4	7	99.3	0.7	0.7	0.3	0.6	1
	% < No. 10	7	98.8	1.5	1.5	0.6	1.4	1
	% < No. 40	7	96.0	3.7	3.8	1.4	3.4	4
	% < No. 200	7	84.0	13.5	16.1	5.1	12.5	44
	% < 2μ	7	21.1	6.6	31.0	2.5	6.1	11
B	LL	7	35.0	6.2	17.9	2.4	5.8	10
	PI	7	14.9	4.9	32.7	1.8	4.5	6
	γmax	6	109.8	4.8	4.4	2.0	5.0	6
	OMC	6	16.5	2.4	14.5	1.0	2.5	2
	% < No. 4	7	97.5	3.7	3.8	1.4	3.4	4
	% < No. 10	7	95.9	5.4	5.6	2.0	5.0	7
	% < No. 40	7	90.8	9.0	9.9	3.4	8.3	20
	% < No. 200	7	76.1	18.0	23.7	6.8	16.7	78
	% < 2μ	7	27.0	3.8	14.0	1.4	3.5	4
C	LL	7	29.7	4.5	15.1	1.7	4.1	5
	PI	7	11.5	3.8	33.2	1.4	3.5	4
	γmax	7	114.7	5.1	4.5	1.9	4.7	7
	OMC	7	14.5	2.4	16.4	0.9	2.2	2
	% < No. 4	7	92.3	10.5	11.4	4.0	9.7	27
	% < No. 10	7	89.7	13.1	14.6	5.0	12.1	42
	% < No. 40	7	82.1	17.8	21.7	6.8	16.5	77
	% < No. 200	7	63.7	22.6	35.4	8.5	20.9	122
	% < 2μ	7	20.4	6.0	29.6	2.3	5.6	9

233 BIRKBECK SILT LOAM

Soil Association Area: I (3b)
Soil Group: Gray-Brown Podzolic
Parent Material: Loess, 3½ to 5 ft, on loam till

Topography: Moderately to strongly sloping, 2 to 8% slope
Surface Drainage: Medium to rapid
Internal Drainage: Medium to good

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Brownish gray to yellowish gray silt loam grading to Grayish yellow silt loam below 6 to 8 in.	28-34	5-12	104-109	16-19	100	100	99-100	96-99	12-29	A-4 A-6	OL CL CL-ML
B	Yellowish brown silty clay loam	35-49	12-26	100-105	18-22	100	100	99-100	97-100	24-38	A-7-6 A-6	CL
C	Yellowish brown silt loam (loess) over loam till	35-44	15-20	102-110	16-20	100	100	97-100	90-100	22-30	A-6 A-7-6	CL ML

Design and Construction Information

Alignment: moderate cuts and fills

Thickness of topsoil: 1.0 to 1.5 ft

Water table: below 6 ft, good drainage

Frost action: moderate to very high susceptibility, F_3 to F_4

Seepage: may occur at loess-till contact, or from sand or silt pockets in till

Excavation: usually not difficult; when wet the surface is slippery and soft

Cut slopes: stable at 1.5 to 1; loess or silt pockets slough rapidly where seepage occurs

Compaction: not difficult if water content is kept near optimum; tamping, grid or pneumatic rollers acceptable

Erosion: may be serious on both cut and fill slopes; special surface drainage installations may be required

Source of borrow: fair to good depending upon silt content

Source of granular material: no

Source of topsoil: generally poor

Special recommendations: normal topsoil stripping of 6 to 8 in. recommended beneath low fills; at high water contents very unstable under heavy construction traffic; absorbs water readily and after rain should be scarified, partially dried, and recompacted prior to placing subbase or more fill; drainage should be provided to prevent water standing on surface of cuts or fills

233 BIRKBECK SILT LOAM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth In.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T19N, R2E, Sec 3	4-A_2	6-12	33	13	108	18					100		97		32	25	A-6(9)	SIL	CL
NW 1/4, NE 1/4, NE 1/4	4-B	16-34	47	24	101	21					100		98		34	26	A-7-6(15)	SIL	CL
4 1/2%	4-C_1	38-48	38	18	108	17			100	99	98		93		28	22	A-6(11)	SIL	CL
	4-C_3	61-72	26	10	121	12		100	99	95	90		64		22	16	A-6(6)	L	CL
T19N, R3E, Sec 2	20-A	8-15	32	8	-	-					100		98		28	16	A-4(8)	SIL	OL
NE 1/4, SE 1/4, NE Cor	20-B	18-25	42	18	102	20					100		98		38	30	A-7-6(12)	SICL	CL
7%	20-C	39-44	44	17	102	20				100	99		96		32	26	A-7-6(12)	SIL	ML
T21N, R4E, Sec 36	37-A	10-18	32	7	-	-				100	99		97		28	16	A-4(8)	SIL	OL
SE 1/4, SE 1/4, NW Cor	37-B	20-30	40	16	102	20				100	99		98		37	30	A-7-6(11)	SICL	CL
2%	37-C	34-53	41	19	105	17					100		98		32	28	A-7-6(12)	SICL	CL
T19N, R2E, Sec 19	64-A	2-14	28	7	107	17				100	99		96		25	17	A-4(8)	SIL	CL-ML
NW 1/4, NW 1/4, NE Cor	64-B	16-35	35	12	106	18				100	99		97		39	30	A-6(9)	SICL	CL
2%	64-C	35-42	37	17	-	-				100	97		91		35	29	A-6(11)	SICL	CL
	64-D	42-63	27	12	118	13		100	98	92	82		44		21	18	A-6(2)	SaCL	SC
T21N, R3E, Sec 25	80-A	2-12	32	8	104	19					100		99		37	28	A-4(8)	SIL	OL
SW 1/4, SE 1/4	80-B	15-28	45	25	101	21							100		45	39	A-7-6(15)	SICL	CL
1.5 mi N of SE Cor	80-C	36-49	37	14	108	16							100		33	26	A-6(10)	SIL	CL
5%																			

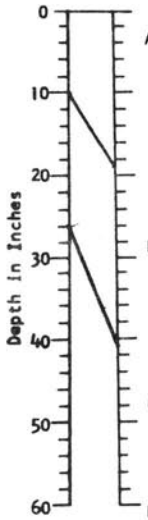
Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	5	31.3	2.0	6.4	0.9	2.5	2
	PI	5	8.5	2.6	30.5	1.2	3.2	3
	γmax	3	106.4	1.7	1.6	1.0	4.2	3
	OMC	3	17.9	1.0	5.8	0.6	2.6	1
	% < No. 4	5	100.0	0.0	----	----	----	--
	% < No. 10	5	100.0	0.0	----	----	----	--
	% < No. 40	5	99.3	0.4	0.4	0.2	0.6	1
	% < No. 200	5	97.4	1.0	1.1	0.5	1.3	1
	% < 2μ	5	20.5	5.6	27.3	2.5	6.9	10
B	LL	5	41.8	4.8	11.4	2.1	5.9	7
	PI	5	19.0	5.1	26.6	2.3	6.3	8
	γmax	5	102.4	2.0	2.0	0.9	2.5	2
	OMC	5	20.0	1.1	5.7	0.5	1.4	1
	% < No. 4	5	100.0	0.0	----	----	----	--
	% < No. 10	5	100.0	0.0	----	----	----	--
	% < No. 40	5	99.5	0.3	0.3	0.1	0.4	1
	% < No. 200	5	98.3	0.9	1.0	0.4	1.2	1
	% < 2μ	5	31.0	4.8	15.5	2.2	6.0	8
C	LL	5	39.4	3.0	7.6	1.3	3.7	3
	PI	5	17.2	1.8	10.4	0.8	2.2	1
	γmax	4	105.6	2.7	2.6	1.4	4.4	3
	OMC	4	17.6	1.4	7.8	0.7	2.2	1
	% < No. 4	5	99.9	0.1	0.1	0.1	0.2	1
	% < No. 10	5	99.8	0.3	0.3	0.1	0.3	1
	% < No. 40	5	98.9	1.0	1.0	0.4	1.2	1
	% < No. 200	5	95.5	3.7	3.9	1.7	4.6	5
	% < 2μ	5	26.2	2.7	10.1	1.2	3.3	3

234 SUNBURY SILT LOAM

Soil Association Area: H, I (3a, b)
Soil Group: Gray-Brown Podzolic-Brunizem Intergrade
Parent Material: Loess, 3½ to 5 ft, on loam till
Topography: Gently sloping, 1 to 4% slope
Surface Drainage: Medium
Internal Drainage: Medium

Pedological Profile Description and Engineering Characteristics



Horizon	Description	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	Grayish brown to dark grayish brown silt loam grading to Brownish gray silt loam below 6 to 9 in.	28-46	7-15	92-111	15-27	100	100	97-100	93-97	18-25	A-4 A-6 A-7-5 A-7-6	OL CL
B	Yellowish brown, mottled with brown, silty clay loam	38-58	16-31	94-104	19-23	100	100	97-100	86-100	26-38	A-7-6	CL CH
C	Yellowish brown silt loam (loess) over loam till	33-40	15-18	103-113	14-21	98-100	97-100	92-100	69-100	22-33	A-6 A-7-6	CL

Remarks: The profile at one site was reclassified as 385, Atlanta silt loam since it was moderately well-drained and more highly oxidized than typical Sunbury.

Design and Construction Information

Alignment: shallow to moderate cuts and fills

Thickness of topsoil: 1.0 to 1.5 ft

Water table: 3 to 6 ft, fair drainage

Frost action: medium to high susceptibility, F_3; occasionally very high, F_4

Seepage: probable at loess-till contact; from silt or sand pockets in till

Excavation: usually not difficult; when wet the surface is slippery and soft

Cut slopes: stable at 1.5 to 1; silt pockets or loess strata slough rapidly where seepage occurs

Compaction: not difficult if water content is kept near optimum; tamping, grid or pneumatic rollers acceptable

Erosion: may be serious on both cut and fill slopes until protected; special surface drainage installations may be required

Source of borrow: fair to good depending upon silt content; drying may be required to reduce moisture content to optimum

Source of granular material: no

Source of topsoil: fair

Special recommendations: normal topsoil stripping of 6 to 8 in. recommended beneath low fills; at high water contents very unstable under heavy construction traffic; absorbs water readily and after rain should be scarified, partially dried, and recompacted prior to placing subbase or more fill; drainage should be provided to prevent water standing on surface of cuts or fills

234 SUNBURY SILT LOAM

Test Data Summary

Sampling Location and Slope	Sample and Horizon	Samp. Depth in.	LL %	PI %	γ_d pcf	Opt. w %	Mechanical Analysis Percent Finer 1"	1/2"	No. 4	No. 10	No. 40	No. 60	No. 200	50μ	5μ	2μ	Classification AASHO	USDA	Unified
T19N, R3E, Sec 1	19-A	13-18	41	15	-	-					100		96		32	22	A-7-6(10)	SiL	OL
SW 1/4, NW 1/4	19-B	20-30	54	26	96	22				100	99		96		40	28	A-7-6(17)	SiCL	CH
4%	19-C	45-61	38	17	109	15				100	98		95		33	25	A-6(11)	SiL	CL
* T21N, R1E, Sec 29	30-A	5-15	34	13	105	18				100	98		95		27	18	A-6(9)	SiL	CL
NW 1/4, SE 1/4, SE Cor	30-B	20-30	43	19	103	19				100	96		86		32	26	A-7-6(12)	SiL	CL
2%	30-C	34-40	34	18	112	15		100	98	97	93		70		33	26	A-6(10)	L	CL
T21N, R3E, Sec 26	53-A	9-17	30	9	105	19				100	97		95		32	23	A-4(8)	SiL	CL
SE 1/4, SE 1/4, NE Cor	53-B	17-31	58	33	96	22				100	99		97		45	34	A-7-6(20)	SiCL	CH
3%	53-C	41-61	37	16	107	17					100		99		29	22	A-6(10)	SiL	CL
T19N, R1E, Sec 13	63-A	2-14	38	11	-	-				100	98		96		31	22	A-6(8)	SiL	OL
SW 1/4, NE 1/4, SE Cor	63-B	16-31	41	21	102	20				100	98		88		42	32	A-7-6(13)	SiCL	CL
2%	63-C	32-43	35	17	109	15		100	98	97	92		73		40	32	A-6(10)	CL	CL
T21N, R2E, Sec 26	81-A	2-10	46	13	92	25				100	98		93		31	21	A-7-5(10)	SiL	OL
NW 1/4, NE 1/4, NE Cor	81-B	17-27	45	21	99	22				100	99		95		43	32	A-7-6(13)	SiCL	CL
1.5-2%	81-C	29-42	40	17	102	21					100		99		39	31	A-7-6(11)	SiCL	CL
T21N, R1E, Sec 27	94-A	2-10	31	8	105	19				100	99		98		33	24	A-4(8)	SiL	OL
NE 1/4, SE 1/4, SW Cor	94-B	12-23	46	22	99	23					100		99		46	38	A-7-6(14)	SiCL	CL
1%	94-C	26-42	37	15	108	19				100	99		99		35	29	A-6(10)	SiCL	CL

* Reclassified as 385 Atlanta silt loam

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	6	36.7	6.1	16.7	2.5	6.4	10
	PI	6	11.4	2.8	24.9	1.2	3.0	3
	γmax	4	101.9	6.5	6.4	3.3	10.4	18
	OMC	4	20.3	3.4	17.0	1.7	5.5	5
	% < No. 4	6	100.0	0.0	----	----	----	--
	% < No. 10	6	100.0	0.0	----	----	----	--
	% < No. 40	6	98.3	0.9	0.9	0.4	1.0	1
	% < No. 200	6	95.3	1.6	1.7	0.7	1.7	1
	% < 2μ	6	21.6	2.3	10.5	0.9	2.4	2
B	LL	6	47.9	6.8	14.1	2.8	7.1	12
	PI	6	23.7	5.3	22.6	2.2	5.6	8
	γmax	6	99.0	3.2	3.2	1.3	3.3	3
	OMC	6	21.1	1.3	6.1	0.5	1.4	1
	% < No. 4	6	100.0	0.0	----	----	----	--
	% < No. 10	6	100.0	0.0	----	----	----	--
	% < No. 40	6	98.5	1.2	1.3	0.5	1.3	1
	% < No. 200	6	93.5	5.3	5.7	2.2	5.6	8
	% < 2μ	6	31.7	4.2	13.1	1.7	4.4	5
C	LL	6	36.9	2.4	6.5	1.0	2.5	2
	PI	6	16.7	1.2	6.9	0.5	1.2	1
	γmax	6	107.8	3.4	3.2	1.4	3.6	4
	OMC	6	17.1	2.5	14.5	1.0	2.6	2
	% < No. 4	6	99.4	0.9	0.9	0.4	0.9	1
	% < No. 10	6	99.0	1.5	1.5	0.6	1.6	1
	% < No. 40	6	97.1	3.5	3.6	1.4	3.7	4
	% < No. 200	6	89.1	13.8	15.4	5.6	14.4	50
	% < 2μ	6	27.6	3.8	13.6	1.5	3.9	4

APPENDIX II: PARENT MATERIAL GROUPS OF DEWITT COUNTY DATA SHEETS

The following sheets, in numerical order, contain information on each of the geologic parent materials found in DeWitt County. The data were obtained by analyzing the basic results on the C horizon samples from all soil types developed from a particular parent deposit.

The statistical summary shows the number of samples tested for each property. The engineering characteristics are given in terms of 85 percent probability ranges as determined from a statistical analysis of the basic data. The design and construction information has been interpreted from the physical data tempered with some knowledge of special field problems in each soil area.

LOESS AND SILTY SEDIMENTS

Engineering Characteristics

LL %	PI %	γ_{max} pcf	OMC %	%< No. 4	%< No. 10	%< No. 40	%< No. 200	% Clay (<2μ)	Classification AASHO	Classification Unified
34-47	12-24	101-110	16-21	98-100	97-100	95-100	91-100	20-32	A-6, A-7-6	CL ML

Summary of Statistical Data

Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
LL	46	40.4	4.6	11.5	0.7	1.4	4
PI	46	18.2	4.1	22.5	0.6	1.2	3
γ_{max}	46	105.4	3.2	3.0	0.5	1.0	2
OMC	46	18.6	1.9	10.0	0.3	0.6	1
% < No. 4	46	99.7	1.0	1.0	0.1	0.3	1
% < No. 10	46	99.5	1.5	1.5	0.2	0.4	1
% < No. 40	46	98.5	2.2	2.2	0.3	0.6	1
% < No. 200	46	96.0	3.5	3.6	0.5	1.0	2
% < 2μ	46	26.1	4.1	15.7	0.6	1.2	3

Design and Construction Information

Alignment:	variable, depending upon local relief
Water table:	variable, depending upon local relief
Frost action:	medium to high susceptibility, F_3; may approach very high susceptibility; F_4
Seepage:	to be expected at contact between loess and underlying till
Excavation:	easily made unless cuts extend below water table; when wet the surface is slippery and usually very soft
Cut slopes:	nearly vertical in unweathered loess, 1.5 to 1 usually stable in drift; deep cuts in loess may be benched; maintain ditches at base of slopes to prevent sloughing
Compaction:	may be difficult unless moisture content is closely controlled; large shrinkage factor is to be expected; tamping, grid, or pneumatic rollers acceptable
Erosion:	usually serious on both cut and fill slopes until protected; special surface drainage installations may be required
Source of borrow:	poor to fair, underlying drift may vary
Source of granular material:	no
Special recommendations:	very unstable under heavy construction traffic at high water contents; absorbs water readily and after rains should be scarified, partially dried, and recompacted prior to placing of subbase or more fill, surface drainage should be provided in both cut and fill sections

LOAM TILL

Parent Material 3

Engineering Characteristics

LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (<2μ)	Classification AASHO	Classification Unified
23-42	7-22	103-122	11-20	87-100	82-100	71-100	44-94	14-32	A-6, A-4, A-7-6	CL, CL-ML, SC

Summary of Statistical Data

Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
LL	26	32.3	6.7	20.8	1.3	2.7	8
PI	26	14.4	5.4	37.6	1.1	2.2	5
γ_{max}	25	112.6	6.6	5.8	1.3	2.7	8
OMC	25	15.3	2.9	18.8	0.6	1.2	2
% < No. 4	26	95.7	6.2	6.5	1.2	2.5	7
% < No. 10	26	93.5	7.8	8.3	1.5	3.1	11
% < No. 40	26	87.2	11.5	13.2	2.2	4.6	23
% < No. 200	26	69.1	17.1	24.7	3.4	6.9	50
% < 2μ	26	22.8	6.4	28.1	1.3	2.6	7

Design and Construction Information

Alignment:	generally moderate, some deep, cuts and fills needed to maintain grade
Water table:	variable depending on local relief
Frost action:	medium to high susceptibility, F_3; very high if silt pockets are exposed, F_4
Seepage:	to be expected at contact with overlying loess; a serious problem where sand or silt pockets are exposed
Excavation:	usually not difficult except in depressional areas, when wet the surface is slippery and often very soft
Cut slopes:	stable at 1.5 to 1, silt pockets slough rapidly where seepage occurs
Compaction:	not difficult at moisture contents near optimum, heavy tamping rollers recommended
Erosion:	often serious on both cut and fill slopes unless protected, special surface drainage installations may be required
Source of borrow:	generally good unless very silty; some drying may be required to reduce moisture content to optimum
Source of granular material:	no
Special recommendations:	exercise care in breaking up embankment material before it dries to hard lumps; surfaces of uncompleted fills absorb rain readily and should be scarified, partially dried, and recompacted before additional fill is placed; in cuts good surface drainage should be provided since excess water in the C horizon material causes instability under heavy construction traffic

MEDIUM TEXTURED GLACIAL OUTWASH

Parent Material 8

Engineering Characteristics

LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
21-28 or NP	7-13 or NP	114-129	10-13	46-100	30-100	4-95	0-48	0-17	A-1 A-2-4 A-2-6	GW, GP SP

Summary of Statistical Data

Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
LL	5	24.5	2.6	10.6	1.2	3.2	3
PI	5	9.9	1.9	19.4	0.9	2.4	2
γ_{max}	7	121.3	5.2	4.3	2.0	4.8	7
OMC	7	11.2	0.9	8.0	0.3	0.8	1
% < No. 4	13	76.2	20.7	27.2	5.8	12.5	82
% < No. 10	13	68.8	26.6	38.6	7.4	16.1	135
% < No. 40	13	50.0	31.5	63.0	8.7	19.0	189
% < No. 200	13	21.1	18.5	87.6	5.1	11.2	65
% < 2μ	13	6.0	7.8	128.9	2.2	4.7	12

Design and Construction Information

Alignment:	shallow to moderate cuts and fills needed to maintain grade
Water table:	variable depending on local relief
Frost action:	generally low susceptibility, F_1 or F_2; fine silty sands may have very high susceptibility, F_4
Seepage:	to be expected in cuts below water table
Excavation:	usually not difficult unless cuts are made below water table, then dragline operations will probably be required
Cut slopes:	usually stable at 1.5 to 1 or steeper; silt pockets or strata may slough where seepage occurs
Compaction:	not difficult at moisture contents near optimum; grid, vibrating, or pneumatic rollers usually acceptable
Erosion:	may be serious on both cut and fill slopes
Source of borrow:	generally good
Source of granular material:	generally good to excellent, ranges from silty sands to clean, well graded gravel at depths below about 6 ft.
Special recommendations:	thorough exploration required to determine extent and variability of the deposit

RECENT ALLUVIUM

Parent Material 9

Engineering Characteristics

LL %	PI %	γ_{max} pcf	OMC %	%< No. 4	%< No. 10	%< No. 40	%< No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
23-50	5-29	97-119	13-22	100	99-100	95-100	57-100	14-29	A-4 A-6 A-7-6	CL CL-ML CH

Summary of Statistical Data

Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
LL	4	36.7	9.4	25.5	4.7	14.9	36
PI	4	16.8	8.2	49.1	4.1	13.1	28
γ_{max}	4	108.0	7.8	7.3	3.9	12.5	25
OMC	4	17.4	3.1	17.7	1.6	4.9	4
% < No. 4	4	100.0	0.0	0.0	0.0	0.0	1
% < No. 10	4	99.8	0.3	0.3	0.1	0.5	1
% < No. 40	4	98.1	2.2	2.3	1.1	3.6	2
% < No. 200	4	83.8	18.3	21.8	9.1	29.1	136
% < 2μ	4	21.7	5.4	24.8	2.7	8.5	12

Design and Construction Information

Alignment:	moderate to deep fills generally needed over bottom lands to raise roadway or provide bridge approaches
Water table:	generally shallow, very poor drainage
Frost action:	medium to high susceptibility, F_3
Seepage:	to be expected in cuts below the water table
Excavation:	seldom made; not difficult above water table, dragline required below
Cut slopes:	sheeting usually required due to high water table
Compaction:	not difficult at moisture contents near optimum, heavy tamping rollers recommended
Erosion:	often serious on both cut and fill slopes, surface drainage installations may be required
Source of borrow:	generally good unless very silty; excavation below water table generally required
Source of granular material:	generally poor; but may contain sands or even gravels at depths below about 6 ft.
Special recommendations:	cuts normally unstable under heavy construction traffic, dragline operation usually required; if moderately high fills are to be built the strength and compressibility of the substrata should be investigated in order to avoid base failure and/or excessive settlement; area is subject to flooding, embankment slopes may require special protection

APPENDIX III: GREAT SOIL GROUPS OF DEWITT COUNTY DATA SHEETS

The sheets contain a summary of the statistical data on the A and B horizons of the four Great Soil Groups mapped in DeWitt County. The soil types were grouped as shown in Table 7 of the text. No data are given for the C horizon since in some cases these would represent more than one parent material. As in the case of Appendix I, the engineering characteristics represent the probable 85 percentile ranges and the most probable comparable soil classification.

BRUNIZEM

Engineering Characteristics

Horizon	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	35-47	8-20	93-101	20-24	100	100	96-100	83-100	11-27	A-7-6, A-6, A-4	OL, CL
B	34-59	11-33	93-104	17-24	100	100	94-100	79-100	19-36	A-7-6, A-6	CL, CH

Summary of Statistical Data

Horizon	Index Property	No. of Samples	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	22	40.7	4.0	9.9	0.9	1.8	3
	PI	22	14.2	4.2	29.4	0.9	1.8	3
	γ_{max}	22	97.0	2.6	2.7	0.6	1.2	2
	OMC	22	21.9	1.4	6.2	0.3	0.6	1
	% < No. 4	22	100.0	0.0	0.0	0.0	0.0	1
	% < No. 10	22	100.0	0.1	0.1	0.0	0.0	1
	% < No. 40	22	98.3	1.9	1.9	0.4	0.8	1
	% < No. 200	22	93.6	7.0	7.5	1.5	3.1	9
	% < 2μ	22	19.1	5.6	29.1	1.2	2.5	5
B	LL	22	46.6	8.8	19.0	1.9	3.9	14
	PI	22	22.0	7.5	34.0	1.6	3.3	10
	γ_{max}	22	98.8	3.8	3.8	0.8	1.7	3
	OMC	22	21.0	2.3	10.9	0.5	1.0	1
	% < No. 4	22	100.0	0.1	0.1	0.0	0.0	1
	% < No. 10	22	100.0	0.2	0.2	0.0	0.1	1
	% < No. 40	22	98.0	2.7	2.8	0.6	1.2	2
	% < No. 200	22	93.5	9.9	10.6	2.1	4.4	17
	% < 2μ	22	27.1	5.8	21.4	1.2	2.6	6

GRAY-BROWN PODZOLIC

Engineering Characteristics

Horizon	LL %	PI %	γ_{max} pcf	OMC %	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification AASHO	Classification Unified
A	29-35	6-14	102-110	16-19	99-100	99-100	96-100	89-100	15-28	A-4, A-6	CL, OL, CL-ML
B	37-50	15-27	99-105	19-22	100	100	99-100	97-100	27-36	A-7-6, A-6	CL, CH

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	11	31.8	2.3	7.2	0.7	1.5	1
	PI	11	10.0	2.8	27.5	0.8	1.9	2
	γ_{max}	11	105.8	2.9	2.7	0.9	1.9	2
	OMC	11	17.6	1.2	6.8	0.4	0.8	1
	% < No. 4	11	99.8	0.5	0.5	0.2	0.3	1
	% < No. 10	11	99.8	0.7	0.7	0.2	0.4	1
	% < No. 40	11	98.6	1.6	1.6	0.5	1.0	1
	% < No. 200	11	95.4	4.7	4.9	1.4	3.1	5
	% < 2μ	11	21.2	4.4	21.0	1.3	3.0	4
B	LL	13	43.4	4.7	10.8	1.3	2.8	5
	PI	13	21.1	4.3	20.2	1.2	2.6	4
	γ_{max}	13	102.0	1.8	1.8	0.5	1.1	1
	OMC	13	20.2	1.1	5.6	0.3	0.7	1
	% < No. 4	13	100.0	0.0	0.0	0.0	0.0	1
	% < No. 10	13	100.0	0.0	0.0	0.0	0.0	1
	% < No. 40	13	99.6	0.3	0.3	0.1	0.2	1
	% < No. 200	13	98.6	0.8	0.9	0.2	0.5	1
	% < 2μ	13	31.4	3.4	10.8	1.0	2.1	3

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Engineering Characteristics

Horizon	LL	PI	γ_{max}	OMC	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification	
	%	%	pcf	%						AASHO	Unified
A	27-48	5-20	94-106	17-23	100	99-100	96-99	91-97	13-29	A-6, A-4, A-7-6	OL, CL
B	39-62	17-36	93-103	18-24	100	99-100	96-100	91-100	22-41	A-7-6	CL, CH

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	12	37.8	7.3	19.4	2.1	4.7	11
	PI	12	12.5	5.4	43.5	1.6	3.5	6
	γ_{max}	12	100.1	4.1	4.1	1.2	2.6	4
	OMC	12	19.9	2.2	11.0	0.6	1.4	1
	% < No. 4	12	100.0	0.1	0.1	0.0	0.1	1
	% < No. 10	12	99.8	0.2	0.2	0.1	0.2	1
	% < No. 40	12	97.6	1.2	1.2	0.3	0.8	1
	% < No. 200	12	93.7	2.2	2.3	0.6	1.4	1
	% < 2μ	12	21.0	5.6	26.4	1.6	3.5	6
B	LL	13	50.6	8.0	15.9	2.2	4.9	13
	PI	13	26.4	6.7	25.2	1.8	4.0	9
	γ_{max}	13	98.2	3.6	3.6	1.0	2.2	3
	OMC	13	21.1	1.9	9.1	0.5	1.2	1
	% < No. 4	13	99.9	0.2	0.2	0.1	0.2	1
	% < No. 10	13	99.8	0.7	0.7	0.2	0.4	1
	% < No. 40	13	98.6	2.1	2.2	0.6	1.3	1
	% < No. 200	13	96.0	3.5	3.7	1.0	2.1	3
	% < 2μ	13	31.9	6.5	20.4	1.8	3.9	8

HUMIC GLEY

Engineering Characteristics

Horizon	LL	PI	γ_{max}	OMC	% < No. 4	% < No. 10	% < No. 40	% < No. 200	% Clay (< 2μ)	Classification	
	%	%	pcf	%						AASHO	Unified
A	42-60	16-29	89-103	19-27	100	99-100	97-100	87-100	14-39	A-7-6, A-7-5	OL, OH,
B	45-55	22-32	98-106	17-21	99-100	99-100	98-100	93-100	22-40	A-7-6	CL, CH

Summary of Statistical Data

Horizon	Index Property	No. of Samples Tested	Mean	Standard Deviation	Coefficient of Variation	Standard Error	Limit of Accuracy	No. of Samples Required
A	LL	9	51.0	6.0	11.8	2.0	4.6	8
	PI	9	22.4	4.4	19.6	1.5	3.4	4
	γ_{max}	9	95.8	4.6	4.9	1.6	3.6	5
	OMC	9	22.8	2.8	12.4	0.9	2.2	2
	% < No. 4	9	100.0	0.1	0.1	0.0	0.1	1
	% < No. 10	9	99.8	0.2	0.2	0.1	0.2	1
	% < No. 40	9	98.6	1.2	1.2	0.4	0.9	1
	% < No. 200	9	94.2	4.8	5.0	1.6	3.6	5
	% < 2μ	9	26.4	8.5	32.3	2.8	6.6	16
B	LL	9	50.0	3.7	7.5	1.2	2.9	3
	PI	9	26.8	3.5	13.0	1.2	2.7	3
	γ_{max}	9	102.3	2.9	2.8	1.0	2.2	2
	OMC	9	18.8	1.2	6.6	0.4	1.0	1
	% < No. 4	9	99.8	0.4	0.4	0.1	0.3	1
	% < No. 10	9	99.7	0.5	0.5	0.2	0.4	1
	% < No. 40	9	98.9	0.8	0.8	0.3	0.6	1
	% < No. 200	9	96.8	2.5	2.6	0.8	1.9	2
	% < 2μ	9	31.1	6.1	19.5	2.0	4.7	8

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