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AIRPHOTO INTERPRETATION OF ENGINEERING SOILS OF INTERSTATE HIGHWAY
ROUTE 64 BETWEEN U.S. 41 AND SCALESVILLE
IN GIBSON, VANDERBURG AND WARRICK COUNTIES, INDIANA

FEBRUARY, 1964

NO. 4

by

P. T. YEH

Joint
Highway
Research
Project

PURDUE UNIVERSITY
LAFAYETTE INDIANA

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AIRPHOTO INTERPRETATION OF ENGINEERING SOILS OF INTERSTATE HIGHWAY

ROUTE 64 BETWEEN U S 41 AND SCALESVILLE, INDIANA

By
P. T. Yeh
Research Engineer

Joint Highway Research Project

Project: C-36-51C
File: 1-5-3

Prepared as Part of an Investigation

Conducted By

Joint Highway Research Project
Engineering Experiment Station
Purdue University

in cooperation with

Indiana State Highway Commission

and the

Bureau of Public Roads
U. S. Department of Commerce

and the

Soil Conservation Service
U. S. Department of Agriculture

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Not Reviewed By

Indiana State Highway Commission
or the
Bureau of Public Roads

Purdue University
Lafayette, Indiana
February 26, 1964

FINAL REPORT

AIRPHOTO INTERPRETATION OF ENGINEERING SOILS

INTERSTATE ROUTE 64 BETWEEN US 41 AND SCALESVILLE, INDIANA

TO: K. B. Woods, Director
Joint Highway Research Project

February 26, 1964

FROM: H. L. Michael, Associate Director
Joint Highway Research Project

File: 1-5-3
Project: C-36-51C

The attached report entitled "Airphoto Interpretation of Engineering Soils of I-64 between US 41 and Scalesville, Indiana," completes a portion of the project concerned with engineering soils mapping of the Interstate system from aerial photographs. This project was prepared as a part of an investigation conducted by Joint Highway Research Project in cooperation with the Indiana State Highway Commission, the Soil Conservation Service and the Bureau of Public Roads. The report was prepared by P. T. Yeh, Research Engineer, Joint Highway Research Project.

The soil mapping of I-64 between US 41 and Scalesville was done entirely by airphoto interpretation techniques. To increase the value, the soils strip map was prepared on a photographic base with annotations to show soil areas. The generalized soil profiles were prepared from the available literature.

Respectfully submitted,

H. L. Michael

H. L. Michael
Associate Director

HLM:bc

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AIRPHOTO INTERPRETATION OF ENGINEERING SOILS

INTERSTATE ROUTE I-64 BETWEEN U. S. 41 AND SCALESVILLE

INTRODUCTION

This report and series of photographic strip maps presents the airphoto interpretation of engineering soils for a section of Interstate 64 from US 41 east to Scalesville. The section includes parts of Vanderburg, Gibson and Warrick Counties, Indiana. The photographic strip map extends about one and one half mile on each side of the center line along the proposed route. The route discussed and indicated on the aerial photographs includes a portion of route alternate "A" and subalternate "C" as suggested by H. W. Lochner, Inc. Chicago, Illinois on September 27, 1963 and October 4, 1963.

Unrectified aerial photographs of a scale of 1/20,000 taken in August of 1940 by the United States Department of Agriculture were used in this study. The user should be aware of the fact that many cultural or surface features in the area have changed since the photography was taken. This is especially true in the strip mining areas south and east of Lynnville in Warrick County.

The photographic strip map is presented at an approximate scale of one inch representing 1500 feet scale (1/18,000). Since unrectified airphotos were used the photos may not be matched perfectly from one to the other. General soil profiles are prepared on a separate sheet in this report.

The engineering soil maps were prepared by airphoto interpretation methods. No field check and no soil exploration was made for this mapping study. However, available literature concerning the area was searched and used to complement the interpretation.

Reference was made to the agricultural soil surveys for Gibson County and for Vanderburg County (7,8);* the Formation, Distribution and Engineering Characteristics of Soils (9); and two airphoto interpretation thesis entitled "Airphoto Boundary Delineation of Loess or Loess-Like Soils in Southwestern Indiana" by K. Moulthrop (10), and "Airphoto Study and Boundary Delineation of Southwestern Indiana Shale-Sandstone Soil Materials," by J. H. McLerran for information on land forms, engineering soils, soil profile development, and parent material types.

The reference materials used in this study are listed in the bibliography. The procedures used are similar to those employed in county mapping projects previously completed by the staff of the Joint Highway Research Project (1).

DESCRIPTION OF AREA

General The area of interest along I-64 starts at route US 41 and extends in an easterly direction essentially along the border line of Vanderburg and Gibson Counties into Warrick County. The area of interest is about three miles

* Figures in parentheses refer to references appearing in the bibliography.

wide and approximately 20 miles long. The centerline of the proposed route extends east-west across the central portion of the area. The section ends about one mile east of Scalesville in Warrick County.

Physiography The entire section of this survey is situated in the aggraded valley section of the Interior Low Plateau Province of the United States (2). It is a low, maturely dissected plateau of sedimentary rock with extensive loess cover and wide, alluvial filled, valleys. Locally, the section is located in the Wabash Lowland (2). The Lowland is characterized by several wide alluvial plains underlain, in part, by lacustrine sediments as the result of glacial or post-glacial lakes (3).

Topography The topography of this section varies from the somewhat level surface of the filled valleys to a rolling hill type of upland. Local variation in relief is generally less than 100 feet except in the hilly area north of Lynnville (4) where local relief may exceed 130 ft. The filled valleys are situated at an elevation of about 400 to 420 feet above sea level.

The western half of the area is undulating, in general, and gradually changes to a rolling topography to the east. On the west, dissected sandstone-shale ridges are encountered in sections 23 and 24 of T.4 S., R.10 W. in Vanderburgh County and in sections 15 and 22 of T.4 S., R.9 W. about two miles east from Elberfield in

Warrick County. Dissected surfaces become more common on the portion east of Lynnville. In addition to a number of flat bottomed alluvial valleys, two large relatively flat lacustrine plains are also crossed by the proposed route between Elberfield and Lynnville.

Geology The study strip lies in the region of the coal measures of Pennsylvanian Age (2). The bedrock formations are irregular and complex. They occur as thick alternating beds of shales and sandstones with intermingling strata of limestone, coal and/or clay. A thin bed of limestone is often found a few feet over a layer of coal. This limestone is sometimes underlain by shale containing marine fossils (2). Although the formations appear to be lying horizontally, there is a well defined dip to the west. The amount of dip varies from 10 to 40 feet, with an average about 20 feet, to the mile (5).

The bedrock surface has been modified by erosion and, in general, has been modified by glacial, fluvial and eolian processes. Leverett (6) shows that the boundary and limit of the Illinoian drift cuts across the western end of the area. Vessel (7) indicates the Illinoian drift border farther to the west. The agricultural soil survey emphasizes the eolian deposits which may overlies Illinoian drift and/or sandstones and shales. In this report, the western portion is considered as a loess area. The entire section is considered to be covered with windblown loess deposits of varying thickness. The depth of the loess decreases towards the east with an increase in distance from the

lacustrine plains and wide flood plains to the west. In the flat bottomed alluvial (or lacustrine) plains deep silt and silty clay deposits up to 100 feet over bedrock are not uncommon (6).

Climate - The strip is situated in a continental climate belt, with hot summers and moderately cold winters. Rainfall is fairly well distributed throughout the year. The mean annual precipitation is about 42 inches.

LAND FORMS AND ENGINEERING SOIL AREAS

Engineering soils of this strip are significantly influenced by a mantle of windblown loess of varying depth that covers the entire area. In the western portion, where the depth of the blanket is 6 to 10 feet or more, surficial materials are considered as moderately deep loess soil (soil profile 1). As the depth of the loess mantle decreases toward the east, a thin, loess covered, shale-sandstone soil is encountered (soil profile 2). On the highly dissected upland; although still covered with about 18 to 30 inches of eolian material, the soil is considered as residual shale-sandstone soil (soil profile 3). The lacustrine soil areas are designated as soil profile 4 and are separated from the alluvial deposits (soil profile 5) on the flood plains. These two land form areas are very similar soil areas. There are a few areas with a very smooth surface gently sloping toward a drainage channel that are considered as colluvial deposits (soil profile 6). Along the main drainage channels a few low terraces can be recognized, and are designated as soil profile 7.

The discussion that follows is a brief summary of the soil profile areas delineated on the photographic strip maps that accompany this report.

1. Moderately deep loess deposit. This deposit occurs on the western half of the section and is designated soil area 1. The engineering soils are primarily silts. The silt deposit is of eolian origin. The topography of this deposit varies from undulating to very gently rolling. Local relief is low. The depth of the loess is generally about 6 to 10 feet although on the slopes near the drainage channels thinner cover can be expected. Weathered shale-sandstone bedrock is found beneath the loess. However, a thin layer of clayey Illinoian drift may be found on top of the shale-sandstone in the most western portion of the strip at high, flat terrain positions.

The surface soil as shown in soil profile 1 varies from friable silty loam to a silty clay loam. The inferred classification of the surface soil is an A-4 or A-6. The subsurface soil from about 10 to 48 inches varies between a silty clay loam to a more plastic silty clay. It depends on the location of the deposit. The more plastic or clayey soils are found toward the east where the deposit is further away from the source and influence of eolian processes. A layer of silty loam or silty clay loam material is found at greater depth lying on top of the residual and interbedded shale-sandstone. In the western part a clay loam Illinoian till may be encountered above the sandstone-shale rock. Glacially derived erratics may therefore be encountered. The engineering problem in this soil area is primarily the control of moisture

during construction and compaction of the silty material. The subgrades will become weak under adverse moisture or due to frost action unless adequately protected. Bedrock will be encountered in deep cuts.

2. Thin loess on shale-sandstone residual soil.

This soil area occurs mainly in the middle portion of the section between Elberfield and Lynnville. The soil area is designated as 2 and the soil profile is shown as profile 2. The topography becomes more rolling and the drainage of the area is more fully developed from the moderately deep loess area. The depth of the loess mantle is generally less than 3 to 6 feet and may be absent in places where severe erosion has occurred. The only real difference from profile No. 1 is the thinner loess mantle. The development of this soil may, therefore, be influenced by the bedrock material. A clay loam layer with broken and weathered rock fragments is frequently found at depths of three to six feet on top of the interbedded sandstone and shale.

The problem in this area is the variation of loess to rock in shallow cut areas and the placement of fill on loess material. The underlying sandstone and shale may be encountered at shallow depths and the problems will be similar to those for the sandstone and shale area next described. South of Lynnville the coal strip mining operation creates a special engineering problem as the disturbed overburden is not a uniform material. This material is a mixture of fine textured soils with

broken rock of various types including coal lumps.

3. Residual shale - sandstone soil.

The residual shale-sandstone soil is indicated on the maps as area 3. Although it is called residual shale-sandstone soil in this study, the area is covered with a very thin loess mantle. The mantle varies from a depth of less than 18 inches to as much as 30 inches. On the steeper slopes where soil is subjected to severe erosion the loess mantle may have been completely removed. The shale-sandstone soil region is concentrated east of Lynnville. However, isolated hills and ridges are found along the entire strip. Dotted lines are used to delineate these ridges from the plains. The most prominent ridge is located north of Lynnville. The Kingham Hill reaches 617 feet at the northwestern corner of section 33 and the Dyson Knob is about 650 feet above sea level at the northeastern section of 34.

The soil derived from the shale-sandstone bedrock in this section is predominately silty clay throughout the profile as shown in soil profile No. 3. It is inferred that these soils would be classified as A-6 or A-7 subgrade materials. A loam soil which tends to be more sandy with depth and contains many rock fragments, is found in the subsoil overlying the interbedded shale-sandstone formation. The thickness of this loam varies according to topographic position.

The engineering problems in this soil area are generally associated with alignment and rock cuts. Pumping and subgrade failure may be a problem in cuts where seepage occurs because of interbedded sandstones and shales. Since tremendous coal strip mining operations occur near Lynnville, the

vast torn-up land of mixed debris should be given special attention. These strip mines were developed primarily since the photography was obtained; therefore, only small mines actually show on the maps. Extensive strip mines are developed in sections 2, 3, 8, 9, 10 and 11 in T.3 S., R.8 W. near Lynnville.

4. Lacustrine soil.

The proposed route crosses two lacustrine plains in this section. They are designated as soil area 4. The one across Pigeon Creek is three quarters of a mile or more in width. The other on Big Creek is about the same size. The surface materials on these lacustrine plains may be of alluvial origin and associated with the streams that meander across the lacustrine plains.

The topography of the lacustrine plain is nearly level. Slight depressions, however, are found and some of these may be abandoned meander scars of the streams. These depressions may have an accumulation of organic material and, also, may exhibit a high water table.

Soils of the lacustrine plains are fine textured deposits of silt or silty clays and, in this local, may be of considerable depth. Stratification resembling varved deposits may be found, in places, at depths below four feet. The texture may vary considerably in different locations of a particular lakebed. A general soil profile is shown as soil profile No. 4. The surface is a silty clay loam and the subsurface

soils vary from a silty clay loam to a silty clay. The texture becomes more clayey with depth. Stratified layers including silts and or sands may be found at depth. Organic material may be found in the swampy depressions where poor drainage conditions prevail.

The engineering problems in this area consist of providing drainage and adequate subgrade support. Settlement of high fills placed on the lacustrine materials should be considered. Flooding is a problem also.

5. Alluvial soil.

The proposed route crosses a number of narrow alluvial valleys. Some of them are about 500 feet or more in width and many are actually gullies of fairly narrow widths. These forms are designated as soil area 5 on the soil strip map. The alluvial valleys designated are flat bottomed and slope very gently in the downstream direction. These aggraded valleys are being filled with silty deposits from the surrounding uplands. The distinction between lacustrine plain and flood plain is difficult because they frequently merge.

Extremely silty soils are found in the alluvial deposits as illustrated in soil profile No. 5. Both the topsoil and the subsoil are friable silt loam except that the topsoil is darker in color due to higher organic content. A heavier silty loam or silty clay loam may be encountered at depth. Lenses of sand and distinct stratification of silt and clay may be found.

Since these soils are subject to frequent flooding, subgrade support is poor during wet seasons. Problems of settlement as in the lacustrine plains,

may occur.

6. Colluvial soil.

There are a few soil areas in this study that can be considered as colluvial deposits. They are designated as soil area 6. The colluvial deposit exhibit an apron like land form. The surface is generally smooth and sloped toward a drainage channel.

The soil of the colluvial deposit is very similar to the soil of the surrounding area except that it has been washed in from the upland.

The generalized soil profile is shown in soil profile No. 6. The upper horizons vary both in depth and texture depending on topographic position and the material of the adjacent upland.

7. Terrace soil.

A number of small, isolated, terraces are found north and south of the proposed route between U.S. 41 and Elberfield. Several larger ones are located southwest of Lynnville. They are designated as soil area 7. None of them lie on the planned route.

All the terraces have a smooth and nearly level surface. They are only slightly higher than the alluvial floodplains or the lacustrine plains. No infiltrations basins or surface drainage are found on the small terraces that would tend to indicate coarse-textured deposits. However, some surface channels are developed on the one south of Lynnville.

The terraces are composed of silt and silty clay. Some of them

might be the remnants of an old lakebed. The soil profile (soil profile No. 7) is similar to the lacustrine deposit. The top soil is a friable silty clay loam underlain by a silt-clay subsoil. A tough, plastic clay soil may be found at depth. A more friable silt-clay soil may be encountered above the stratified silt, clay and fine sand.

Engineering problems associated with these land forms are very similar to those discussed under lacustrine plains and/or floodplains.

SUMMARY

The proposed route starts at U.S. 41 near the border line between Gibson and Vanderburg Counties. It proceeds eastward on a gently undulating and moderately deep loess region for about 2.5 miles before encountering a dissected shale and sandstone region. The proposed route is located along the edge of the shale-sandstone remnant for about one mile and returns to the moderately deep loess plain. After passing by Elberfield on the south (about six miles from U.S. 41) the route cuts through a low mound of sandstone-shale with thin loess cover before crossing the lacustrine plain associated with Pigeon Creek. This plain is about 60 feet below the loess plain. The proposed route re-enters the loess upland across a narrow dissected shale-sandstone plain at about 7.7 miles from U.S. 41.

At a point about 10 1/4 miles from the western end, the route cuts across the large lacustrine plain associated with Big Creek. A thin loess on shale-sandstone region is then crossed east of Big Creek. The route then traverses

a colluvial deposit about one mile wide. After crossing a narrow alluvial plain south of Lynnville, the proposed route is located on the rolling shale-sandstone region with thin (less than 6 feet) loess cover. The route enters the shale-sandstone plain at a point about 14.5 miles from its western end. Between 16.5 and 17 miles from U.S. 41 the route traverses a rolling (thin loess cover) shale-sandstone region. Finally, the route enters a dissected shale-sandstone plain which extends to the end of this section.

Tremendous coal mining operations occur south and east of Lynnville. The ownership of the coal rights should be considered before the final route is adopted.

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ACKNOWLEDGMENTS

All airphoto used in connection with the preparation of this report automatically carry the following credit lines: "Photographed for United States Department of Agriculture."

SOIL CLASSIFICATION AND PROFILE SYMBOLS

Description	Grain Size Distribution				Plastic Index	Symbol
	Gravel % Retained on #10	Sand #10-#200	Silt 0.05-0.005mm	Clay Less than 0.005mm		
Gravel	85-100	0-15	0-10	0-10	NP	
Sandy Gravel	50-85	15-50	0-10	0-10	6 Max.	
Sand	0-15	85-100	0-10	0-10	NP	
Gravelly Sand	20-49	45-85	0-10	0-10	6 Max.	
Sandy Loam	0-19	50-80	0-50	0-20	6 Max.	
Sandy Clay Loam	0-19	50-80	0-30	20-30	10 Max.	
Sandy Clay	0-19	55-70	0-15	30-45	11 Min.	
Loam	0-19	30-50	30-50	0-20	10 Max.	
Silt Loam	0-19	0-50	50-100	0-20	10 Max.	
Silty Clay Loam	0-19	0-30	70-100	20-30	11 Min.	
Silty Clay	0-19	0-15	55-70	30-45	11 Min.	
Clay Loam	0-19	20-50	50-80	20-30	11 Min.	
Clay	0-19	0-55	0-55	30-100	11 Min.	
Peat or Muck						
Limestone						
Sandstone						
Shale						
Stony Fragments						
Organic Matter						
Topsoil						

Classification of Gravelly Soils

85%-100% gravel plus finer material - Gravel
 50%-84% gravel plus finer material - Clayey, silty or sandy gravel
 20%-49% gravel plus finer material - Use fine classification and called
 gravelly sand, gravelly silt or gravelly clay
 0%-19% gravel plus finer material - Use fine classification only

GENERAL SOIL PROFILES

PROFILE NO.1

(MODERATELY DEEP
LOESS SOIL)

PROFILE NO.2

(THIN LOESS ON
SHALE-SANDSTONE)

PROFILE NO.3

(RESIDUAL
SHALE-SANDSTONE)

PROFILE NO.4

(LACUSTRINE)

PROFILE NO.5

(ALLUVIAL)

PROFILE NO.6

(COLLUVIAL)

PROFILE NO.7

(TERRACE)

QV-3A-91

GIBSON CO.

WARRICK CO.

LYNNVILLE

S. R. 68

New York Central R. R.

QV-3A-89

Plum Branch

Little Creek

QV-3A-47

Stanley

GS-1A-4

Dyson Knob

AA-1120400 183

34

35

③

36

31

S. P. 61

AV-24-97

S. R. 68

②

⑤

AA-35

3

2

1

6

AV-24

S. P. 61

②

10

③

②

11

12

7

Pond

AV-24-95

Strip line

Pond

②

③

③