MISSISSIPPI
State Geological Survey

E. N. LOWE
DIRECTOR

BULLETIN No. 16

Road-Making Materials of Mississippi

By E. N. LOWE

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STATE GEOLOGICAL COMMISSION.

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LETTER OF TRANSMITTAL.

Old Capitol, Jackson, Mississippi,
Office of State Geological Survey,
March 18, 1920.

To His Excellency, Governor Lee M. Russell, **Chairman**, and Members of the Geological Commission.

Gentlemen:—I have the honor to submit the manuscript of a report on the Road-Making Materials of Mississippi. I hope that the report will prove timely and useful to the citizens of the State.

The preparation of this Bulletin was originally undertaken during the summer and early fall of 1917, as part of the War Work of the National Research Council. In April, 1917, I received a communication from Dr. William Bullock Clark, of the Maryland Geological Survey, who had been appointed Chairman of a Sub-Committee on Materials for Rapid Highway Construction, in which he requested me to become a member of his subcommittee and prepare a report on Road Materials of Mississippi.

With some alterations and additions this Bulletin is in substance the report furnished to Dr. Clark in 1917, permission having been granted by the National Research Council to issue it as a bulletin of the State Geological Survey.

The bulletin is terse and statistical in its method of presentation, being intended as a purely practical reference volume.

Respectfully submitted,

E. N. LOWE, Director.

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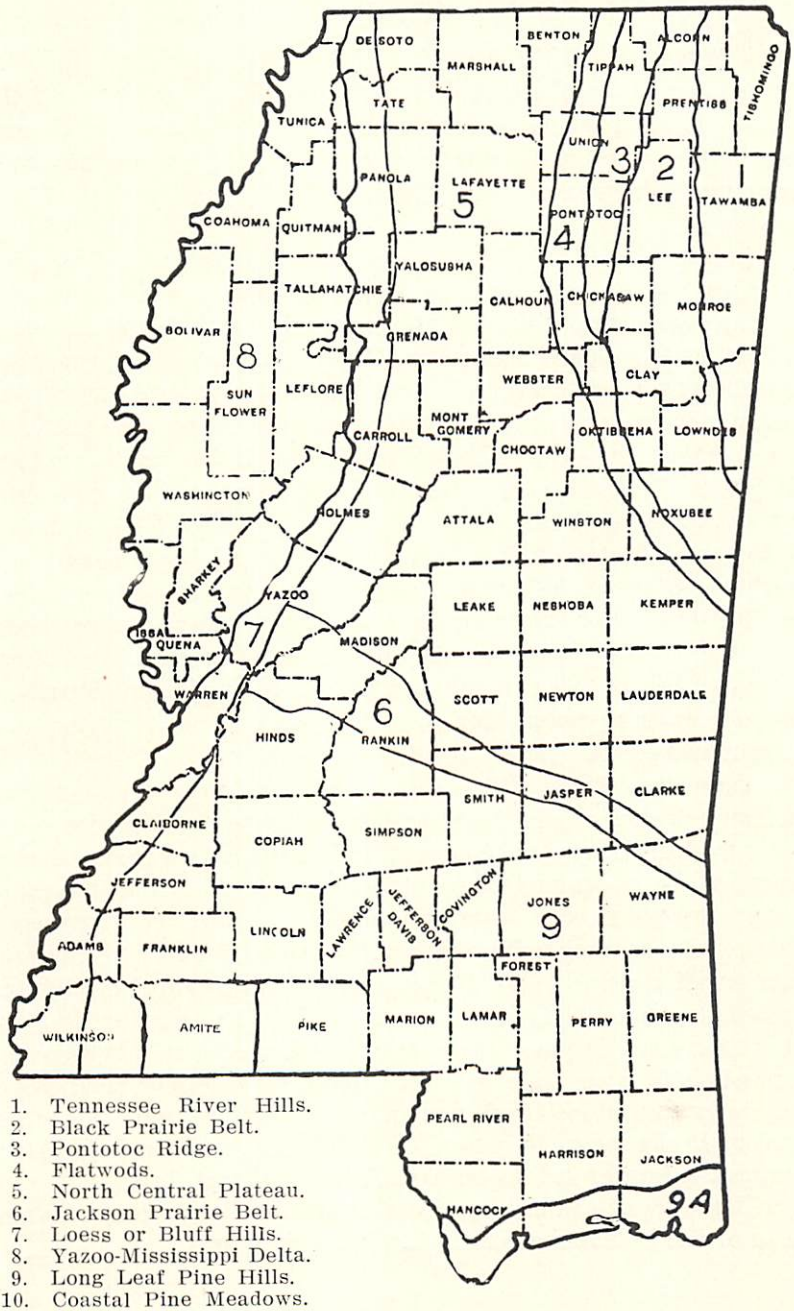

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PHYSIOGRAPHIC REGIONS OF MISSISSIPPI.

The surface of Mississippi is divisible into ten topographical regions, which conform closely to the geologic structure of the State. These regions differ not only in physiographic characters but in soil types, and in natural vegetation, and exert a pronounced influence upon the industrial development of the inhabitants.

In the extreme northeast corner of the State the Tennessee River forms the boundary for a short distance between Mississippi and Alabama, while the Mississippi River with its numerous and tortuous meanderings forms the western boundary from the line of Tennessee to that of Louisiana, a distance following the river's windings of more than 500 miles. These are the only streams that wash the soil of Mississippi which do not rise within the State. With the exception of a few small streams tributary to the Tennessee River, the whole drainage of the State is either southward into the Gulf or westward into the Mississippi. The southern extremity of the State has a coast line of 85 miles along the Gulf of Mexico, the mainland itself lying several miles inland of a chain of low sand islands, the intervening shelving bottom being covered by the shallow waters of the Mississippi Sound—a famous fishing ground for oysters, shrimp, red snapper, and other marine fish.

Tennessee River Hills—Occupying the two extreme northeastern counties of the State and adjacent parts of those counties bordering them on the west and south, is a region of considerable elevation and rough topography. The hills reach an altitude of 650 feet, and are rugged and steep; the streams of the east slopes, which flow through narrow deep ravines, pursue short swift courses to the Tennessee. It is a region of wild and picturesque beauty, farm houses and fields being sparsely scattered along the broader parts of the valleys. The hill tops and slopes bristle with forests of pine, oak and hickory; to these in the valley are added black walnut and sycamore, with an occasional umbrella magnolia where the soil is rich and shaded. Alder fringes the borders of the streams in the low wet flats.

The soils of the hills are thin, red, sandy and pebbly loams; those of the bottoms are rich, black, sandy loams.

Toward the south the region loses some of its ruggedness and numerous productive farms may be seen. The western slopes of these hills are less precipitous and the creeks flow more leisurely toward the Tombigbee.

The geological formations of this region are the indurated limestones, sandstones, and chert beds of the Palezoic Era, overlapped along the western and southern borders by the loose sands, clays, and gravels of the Tuscaloosa and Eutaw of the Cretaceous.

Black Prairie Belt—Lying immediately to the west of the region of hills just described is a broad low-lying belt of land of slight relief. In all its characters this region is the antipode of the other. Its surface is nearly level, consisting of open prairies almost devoid of tree growth, but having a rich herbaceous flora of prairie-loving species, like the prairie clovers, mellilotus, compass plant, and milk weed, besides abundance of good grasses.

The soils are black calcareous clay loams, that in the flatter areas, do not drain perfectly, but are very strong and productive. Throughout the region are areas of gentle elevation. Though the eye could scarcely detect the elevation these areas can be easily noted miles away because of the stunted growth of black jack and post oak that usually crown them. The soil is an infertile red or yellowish clay or gravelly loam, entirely different from the characteristic soil of the region.

The Black Prairies lie at a considerably lower level than the eastern hills, the altitude in the northern part being upwards of 400 feet. The surface slopes southward, and has an altitude at Macon of 179 feet. The region is a broad belt running from the northern border of the state southward and turning slightly eastward, touching the eastern line of the state in Noxubee and the northern half of Kemper counties. Less than ten miles wide in the northern part it broadens southward, reaching its greatest width west of Aberdeen where it is more than 25 miles wide.

This whole region marks the outcrop of the Selma Chalk, or Rotten Limestone of the Cretaceous, which forms the bedrock from which the black prairie soils are derived. The region is one of fine farms, prosperous towns, and rapidly growing wealth.

By referring to the accompanying sketch map of the State all these regions under discussion may be noted and their boundaries traced.

Pontotoc Ridge.—As the name would indicate, this is another region of high lands, bordering upon the west side the northern half of the Black Prairies. It is a small wedge-shaped region, broadest where it enters the state in Tippah and Alcorn counties, runs southward and comes to a point at Houston in Chickasaw county.

This ridge is a backbone averaging more than 500 feet high and parts the waters that flow into the Tombigbee on the east from those that feed the Pearl River and the westward flowing tributaries of the Mississippi. Bordering the main crest on either side are rugged broken hills that drop suddenly to the lowlands of the Prairies on the one hand and the Flatwoods on the other.

The region is not one of inviting aspect to the stranger. The surface looks too broken and the soil too red and sterile to suggest successful agriculture. And yet this is a region of prosperous homes and farms. The town of Pontotoc is a lively business point.

The soil is on the whole a red sandy loam derived from the weathering of the glauconitic sands and marls of the Ripley and Midway formations. It is peculiarly well adapted to the growth of the Elberta peach, and is very much more productive of general farm crops than its appearance would indicate.

Flatwoods.—A narrow band of low, flat land borders the Pontotoc Ridge on the west and sweeps in an open crescent around the western and southern margin of the Black Prairies. It is nowhere very wide, varying from two to eight miles. It is conspicuously lower than bordering areas, is so distinctly marked off and its surface is so nearly featureless, that it has been universally called the Flatwoods by the settlers, and was likened by Crider to a broad river bottom. In places, however, the surface becomes distinctly hilly.

The soil is uniformly a gray and sticky clay that is very retentive of water, and when dry cracks and becomes of stony hardness. It is difficult to cultivate, and on the whole is not very productive. Most of it needs drainage badly. The region is not

extensively farmed, but was originally densely covered with forests of post oak, spanish oak, and loblolly pine. In many places the forests are now being cut for lumber.

The geologic formation underlying the Flatwoods is the Flatwoods or Porters Creek Clay, a tenaceous gray joint clay, differing but little from the soil to which it gives rise.

North Central Plateau.—This region embraces all of that portion of North Central Mississippi lying between the Flatwoods on the east and the bluffs overlooking the Delta on the west, and extending from the border of Tennessee south to a line drawn approximately from Canton to Meridian. It includes the greater part of sixteen counties. As the name suggests, the surface was originally that of a plateau sloping gently southward and westward. The highest railroad point is on the Illinois Central Railroad near Holly Springs, the altitude being 625 feet, though neighboring points reach considerably higher.

In the more northern part of the region where it passes into Tennessee, the original level expanse of the old plateau is still quite evident, but over much of the area the drainage channels have been cut so deeply and intricately that the topography is decidedly rough.

The characteristic soil over the whole area is a yellowish-brown loam containing considerable proportions of silt and clay. This is spread like a blanket over many counties of the state, and varies in thickness from fifteen to two or three feet. Lying just beneath this loam, over almost the whole area, is a variable thickness of red sand, which was formely called Lafayette, but now believed to be weathered Eocene. The prevailing sloping surfaces of the land, the yielding mellowness of the soil, and the treacherous sand beneath, which outcrops on the hill slopes so as to be easily attacked by weather, render this region one peculiarly susceptible to erosion. Marked evidence of rapid erosion are to be seen in many places. When the soil is properly handled erosion may, in large measure, be prevented.

Productively this brown loam is perhaps the most generally useful soil in the state, being well adapted to almost any crop. The geologic formations underlying this region are the Lignitic or Wilcox, and the Claiborne. These are prevailingly sands and clays, but over most of the area they contribute little to the soil,

which is usually the brown loam alone or on slopes mixed with the red sands of the Eocene formations.

The region was originally forested with a mixed growth of pine, spanish oak, black jack, and white oak, chestnut, and hickory. The merchantable timber has now been largely cut away in the northern parts, though considerable timbered areas exist farther south.

Jackson Prairie Belt.—Immediately south of the North Central Plateau is a region of gently rolling lands with numerous small prairies interspersed through it. Much of the surface, however, is, or originally was, covered with forests of pine, oak and hickory.

The area of this Prairie Belt is not very extensive. It reaches across the state from the bluffs of the Mississippi to the line of Alabama in a narrow belt running a little south of east, the extreme width of about 40 miles being in Yazoo and Madison counties, but the average is not more than half that. The city of Jackson lies in the southern edge and gives name to the region.

The characteristic soil is a black calcareous prairie soil, very similer to that of the Cretaceous prairies, though the prevailing soil of the area in the western part is the brown loam already described. The soils are very rich and the region is one of the most prosperous in the state.

The geological formation underlying this region is the Jackson, consisting of calcareous clays, marls, and soft limestones.

Long Leaf Pine Hills.—The whole southern half of Mississippi south of the Jackson Prairies to within 10 to 15 miles of the Gulf is very easily and naturally described as a topographic unit. It resembles the North Central Plateau in surface features and in soils.

It slopes gently from an altitude of more than 400 feet at its northern border to about 150 feet at its southern border. That part lying west of Pearl River is more elevated than that farther east, some of the hills rising to 500 feet near the Mississippi Bluffs.

While the general surface of this region, like that of its prototype farther north, is maturely dissected, giving it an

uneven topography, there are large areas of gently rolling or nearly level land, cut through here and there by valleys of the larger streams. The one striking feature of the whole region is the forests of long leaf pine, which originally covered its surface in one unbroken expanse.

The soils of this region are red and yellow sandy loams derived from the Pliocene which is the prevailing surface formation east of the Pearl River. In the higher regions farther west the brown loam overlies the older formation to a great extent. As a result the pine forests are not so pure as eastward, but show a decided sprinkling of hardwood species.

Coastal Pine Meadows.—From the Gulf border inland for a distance of 5 to 25 miles extends a region of slight relief. It rises nowhere more than a few feet above sea level, is marked by sandy soils of recent or very late Pleistocene formations, the surface of which shows wide stretches of marshy, peaty flats with characteristic peat bog flora. The streams are sluggish and their waters during most parts of the year are amber-colored from the presence of peaty matter. Drainage is difficult on account of the sameness of level throughout this region.

The region has a covering of pine which constitutes a rather sparse and open forest, with an undergrowth of gallberry and sweet bay usually surrounding the low marshes. The soils of this region are more sandy than those of the region to the north of it.

Loess or Bluff Hills.—Skirting the eastern margin of the Yazoo Delta is a range of rugged precipitous hills known as the Loess or Bluff Hills. All streams flowing through them have cut deep narrow gorges, whose sides in many places stand in vertical walls. This region of hills varies in width from 5 to 15 miles, and follows the eastward curve of the Delta margin from Memphis to Vicksburg, thence southward hugs the east bank of the Mississippi River to the Louisiana line.

While the Bluff Hills might not properly be considered a distinct topographic unit, since they represent merely the intricately and deeply dissected margin of the plateau lands to the east, yet considered with reference to their soils, they constitute an easily recognized soil region. This is all the more noticeable

since it maintains its unity of character from the line of Tennessee to that of Louisiana, though it overlaps in this distance several very difficult geological formations .

The Bluffs stand 150 to 250 feet above the Delta; the hill slopes are so steep as to be difficult of cultivation, and many of the valleys are too narrow and inaccessible to afford very extensive farming. Still, on account of the extremely fertile soil, the region is one of the most productive in the state, and in spite of its rough topography is very generally farmed throughout its extent.

The soil of this region is the brown loam, which is here somewhat more silty than farther east, and is underlain by a yellowish calcareous silt, the Loess, which varies in depth, being sixty to seventy feet at the edge of the bluff, thinning eastward, to the east margin of the region where it features out. On the hill slopes the mixture of the loam and Loess silt makes a very fertile soil, with characteristics entirely distinct. The tree growth where it has not been cut over is magnificent in proportions and of the finest grade of white oak, yellow poplar, basswood, red gum, ash, and beech.

Yazoo Delta.—This region embraces all that great flood plain deposit of the Mississippi River and its tributaries lying on the east side of the great river between Memphis and Vicksburg. It is a low-lying featureless expanse, sloping gently southward. Its altitude at the Tennessee line is 217 feet, and at Vicksburg it is 94. The whole region originally heavily timbered with forests of red, white, and over-cup oak, elm, ash, cypress, red and tupelo gum, pecan, hickory, cottonwood, maple, magnolia, beech, basswood and hackberry. The two species of gum formed more than 50 per cent of the whole. Large forests still remain, but on account of the valuable hardwood, are being rapidly cut over and the lands prepared for cultivation.

While the average relief of this region is but slight, the higher lands lie adjacent to the streams, the inter-stream areas being low and more or less swampy. The whole region would profit greatly by drainage.

The soils are all alluvial and among the most fertile on the continent. Two general types are found, the distribution of which maintains rather a definite relation to the topography.

A dark, mellow, sandy loam generally occurs on the higher grounds near the streams, while a dark, tough, sticky clay occupies the lower areas back from the drainage courses. Both are very productive under proper conditions, but the black mud, or "buckshot" must be drained to make it produce well.

Until the completion of the levee, the annual overflow of the Mississippi retarded very much the development of the Delta. Since then development has been rapid, and with the completion of drainage schemes now being pushed in most parts of this region, about two-thirds of the lands now unused will be reclaimed.

SEC. I, PART 2.

CLIMATE OF MISSISSIPPI.

North Half of State.

Temperature: The mean annual temperature is 62.4 degrees. The winters are short, and while freezing temperatures are usually recorded in each of the winter months, a temperature below zero is exceptional, and of short duration. January, February and March are usually cloudy and damp months. The average date of the first killing frost in autumn is October 30 and of the last killing frost in the spring is March 28, though it occurs rarely as early as October 10, or as late as April 20.

The summers are long, and while the extreme of summer temperature is not excessive, the high atmospheric humidity makes the heat oppressive at times. The average number of days with maximum temperature above 90 degrees is about 55, and a temperature of 100 degrees occasionally is recorded in July and August. Temperature and general weather conditions are most agreeable in April, May, October and November.

Precipitation: The average annual precipitation is about 50 inches evenly distributed over this section of the state. March is the wettest month, having an average precipitation of six inches, and October the driest, with a precipitation of about two inches. The rains of summer are usually local, while the winter rains are general. Snow falls during the winter to an average depth of three inches.

South Half of State.

Temperature: The mean annual temperature of this section is 65.6 degrees. The winters are very short and mild, temperatures as low as 10 degrees being rare; though in the latitude of Vicksburg, Jackson, and Meridian, freezing weather is not unusual. On the Gulf Coast a temperature as low as 20 degrees is recorded once in about two years, though occasionally freezing weather is recorded on the coast as early as November and as late as March. As in the northern section, January and February are cloudy and damp months.

The summers are long, and owing to high relative humidity and light wind velocity, together with warm nights, sultry con-

ditions frequently prevail. Near the coast, however, the sea breezes temper the heat considerably, and these reach at times even as far north as Jackson and Vicksburg. The average number of days with maximum temperature about 90 degress is 67, and readings of 100 degrees are sometimes recorded in July and August. Temperature and general weather conditions are most agreeable in April, May, October and November.

The average date of the first killing frost in autumn, exclusive of the Gulf Coast counties, is November 5; the average date in the Gulf counties is November 25. The average date of the last killing frost in spring, exclusive of the Coast counties, is March 18; in the Coast counties is March 1. Killing frosts rarely occur in the latitude of Jackson earlier than October 15 or later than April 5; in the Coast counties earlier than November 1 or later than March 10. The most delightful season of the year in both sections of the state prevails in autumn when the temperature is agreeable and rainfall very light.

Precipitation: The average annual precipitation is 55 inches, usually heavier near the coast. In January, February, March, June, July and August normal rainfall is about five inches monthly. In the southern portion rainfall is heavier in July and August than farther north. October is the driest month, with precipitation of two and one-half inches. Monthly precipitation of less than one inch is common in autumn. The average annual snowfall in the latitude of Vicksburg is a little less than two inches, diminishing to a trace at the coast.

SEC. I, PART 3.

GEOLOGIC STRUCTURE OF MISSISSIPPI.

Paleozoic Formations.—Devonian. The oldest geologic formation known to outcrop in the state is the Devonian of the Paleozoic System. In the extreme northeast corner of Tishomingo county occurs a series of dark blue limestone overlain by black shales, which are exposed in the gorges of small streams tributary to the Tennessee. These have been determined to be the equivalent of the New Scotland beds of New York, and represent the base of the Devonian. They are exposed only toward the bases of the deepest ravines and form no important part of the land surface.

Mississippian, or Lower Carboniferous. This overlies the Devonian in the same region, but outcrops more extensively. It consist at the base of beds of siliceous chert, crushed and jointed by pressure. Resting upon this is a series of blue and gray limestones, more or less cherty and fossiliferous, the outcrop extending farther south. At the top of the Carboniferous is a massive gray sandstone outcroping along Bear Creek, Bull Mountain Creek, and the headwaters of the Tombigbee.

The Carboniferous, like the Devonian, is exposed chiefly along the stream channels of Tishomingo and Itawamba counties, the intervening divides being covered by later deposits.

Cretaceous Formations.—(1) Tuscaloosa: An unconformity occurs between the rocks of the Carboniferous and those of the Cretaceous which lie upon them. The record is not complete; a long period intervened between the deposition of the Carboniferous and the lowest Cretaceous beds here.

The Tuscaloosa beds lie upon the Carboniferous, hiding it from view except in very limited areas, as just stated. This formation is at the surface over a considerable part of the Tennessee River hills, which embrace all of Tishomingo and Itawamba counties, and parts of Alcorn, Prentiss, Monroe, and Lowndes.

The materials of the Tuscaloosa consist of clays and lignites in the lower part, and unconsolidated sands and gravels in the upper part.

(2) Eutaw: Overlying the Tuscaloosa are the Eutaw sands varigated in color, and micaceous, becoming in the upper

part greenish, and decidedly calcareous. They outcrop in the western part of the Tennessee River Hills, extending to the Tombigbee.

All these formations dip or incline westward and southward so that the outcrop or surface exposure of each newer formation must lie farther west and south than the next older one. Since they all dip in the same direction, a boring through the Eutaw would strike first the Tuscaloosa and then the Carboniferous, and finally the Devonian.

The outcrop of the four formations described has undergone extensive erosion, and constitutes a region of high, rough hills, of sandy and gravelly soils for the most part, which lies in the northeast part of the state, and is called the Tennessee River Hills.

(3) **Selma Chalk:** This was formerly known as the Rotten Limestone. It is a soft white to bluish-gray lime rock, which rests upon the Eutaw sands. The lower portion of the formation is somewhat sandy; the middle part is known as "blue rock," and contains a very considerable quantity of clay. The upper part is nearly white and has a high per cent of lime. This, like the other formations, dips gently toward the west and south. It is several hundred feet in thickness, and hence its outcrop is broad, constituting the Black Prairie Belt of northeast Mississippi. The black prairie soil is a residual soil from the limestone. Topographically the region has slight relief and lies considerably lower than the more sandy formations to the east and west.

(4) **Ripley:** This, the uppermost group of the Cretaceous, outcrops, as would be expected, along the western border of the Black Prairies from the Tennessee line to the town of Houston in Chickasaw county, where it disappears beneath younger formations.

The material of the Ripley consists of beds of sandstone and sandy limestone toward the base of the formation, above which lie blue, micaceous marls which are highly fossiliferous, and outcrop typically on Owl Creek near Ripley in Tippah county. In places micaceous, limey sandstone forms the top of the formation.

The outcrop of the Ripley constitutes a very distinct and prominent topographic feature of the northeast part of the state. It is a range of high, rugged hills, known as the Pontotoc Ridge, the soils of which are for the most part intensely red and sandy. This characteristic is particularly noticeable around the town of Pontotoc.

Tertiary Formations.—(1) Midway: The lowest member of the Midway formation consists of 10 to 15 feet of hard limestone studded with a species of spiral shell called Turritella Mortoni; whence the rock is known as the Turritella limestone. Lying above this is a variable thickness of micaceous yellowish sands. Both of these enter into the western edge of the Pontotoc Ridge.

The Porters Creek Clay is a tough, gray, joint clay, which overlies the formation just described, and constitutes the chief member of the Midway. Its outcrop is a low flat region skirting the Pontotoc Ridge on the west, thence passing south along the western border of the Selma Chalk, then eastward out of the state through Noxubee and Kemper counties.

This outcrops in a narrow belt, 3 to 6 miles wide, occasionally expanding to 12 miles, and is known as the Flatwoods region. The streams flowing through the Flatwoods are sluggish, and in wet seasons spread out widely over the flat section.

(2) **Wilcox:** Occupying all the broad areas of north central Mississippi is the Wilcox Formation. It is broadest at the Tennessee line, extending across three counties, and gradually narrows southward, bounded on the east by the Flatwoods, on the west by the Bluff Hills overlooking the lowlands of the Delta. About midway of its length it is crossed by the Southern Railroad, Maben and Winona being approximately on the east and west borders. Thence it curves slightly eastward and passes out of the state through Kemper and Lauderdale counties, having here narrowed to about half its width at the northern boundary.

The Wilcox is the thickest of the Tertiary formations of Mississippi, as is indicated by the width of its outcrop and from well data. Its thickness is 900 or 1000 feet. The materials of the formation are alternating beds of sand, clays, and lignite, the sands being variously colored and cross-bedded, the clays being either white pottery clays or dark lignitic clays. Lignite

occurs at numerous points in workable thickness and of good quality.

The region is one of mature erosion. The original surface was that of a gently rolling plateau of 500 or 600 feet elevation, but has been cut up into a region of ridges and often hilly, rough topography. This is called the North Central Plateau.

(3) **Claiborne:** This formation lies next to the Wilcox on the southwest, and, unlike that formation, passes only as far north as Grenada, so that the direction of strike is nearly northwest and southeast.

The lower portion of the Claiborne is decidedly sandy, passing upward into a hard quartzitic rock called buhrstone. Certain horizons in the lower Claiborne are highly ferruginous, giving rise, on weathering, to deeply colored soils.

The upper division of the Claiborne consists of calcareous sands and clays, and the outcrop is not so broad as that of the lower division. The topography of the lower division of the Claiborne is rough and hilly like that of the Wilcox, and may properly be included in the same topographic unit; the upper division passes imperceptibly into the next formation to be considered.

(4) **Jackson:** Immediately overlying the Claiborne is a series of calcareous clays and marls belonging to the Jackson formation. The outcrop in its widest part is more than forty miles wide and rapidly narrows eastward. It extends across the state in a direction almost east and west, and gives rise to the topographic unit known as the Jackson Prairie Belt.

(5) **Vicksburg:** A narrow band of alternating limestones and marls, highly fossiliferous, outcrops in ledges on the southern border of the Jackson, and is called, from its type locality, the Vicksburg formation. Topographically it forms the southern rougher and more elevated margin of the Jackson Prairies.

(6) **Grand Gulf:** South of the Jackson Prairies is an extensive region embracing practically the whole southern half of the state, which is a topographic unit. In general surface configuration it resembles the North Central Plateau. The soil is sandy or loamy and the region maturely eroded.

The whole region is underlain by the old Grand Gulf Complex, which now is subdivided into several formations. The

northernmost division is the Catahoula consisting of several hundred feet of gray standstone and gray and lignitic clays. This sandstone in places becomes of quartzitic hardness, but crumbles and chips off under the influence of the weather. South of this is a region of clay outcrop—the Hattiesburg clay—though for the most part it is concealed under a considerable thickness of clayey sands of a later formation. A limited outcrop along streams in southeast Mississippi of fossiliferous marine marls and clays constitute the Pascagoula formation, which does not occupy important areas at the surface.

(7) **Citronelle:** Covering very much of the southern half of Mississippi, overlapping several of the older formations, is the Citronelle, the equivalent of the southern extension of the Lafayette of Hilgard and of Smith. This formation is of Pilocene age, and widely distributed in South Mississippi and Alabama. The materials of the formation are tawny and red sands with an admixture of clay, which in a number of counties approximates the theoretical proportion suitable for making sand clay roads. Associated with these sands are extensive deposits of chert gravel which constitutes a valuable road material. The sands and gravel of the Citronelle dip beneath the later coastal deposits of the Coastal Pine Meadows.

Quarternary Formations.—Loess: Following the line of the Delta Bluffs, capping all the hills and spreading eastward to a distance of 5 to 15 miles in a layer that thins rapidly to a feather edge, is the Bluff Formation, or Loess. This is a yellowish-gray calcareous silt, 25 to 75 feet thick on the face of the Bluffs, very uniform in character from top to bottom, weathering in vertical walls, and usually studded with fossil snail shells. It shows little evidence of stratification. The elevation of this Loess region above the drainage of the adjacent Delta into which all the hill streams pour, and the tendency of the material to erode in vertical walls, have caused the development of a strikingly rough topography over the outcrop of the Loess, which is universally known as "the bluffs."

Except on the hillslopes the whole region is covered by a brownish silt loam, which is perhaps a weathered phase of the Loess. This loam forms the soil of the level uplands, but that of the slopes is an admixture of the loam and the loess. The soils

of the region are very fertile and easily worked, and even after long years of exhaustive cultivation are still among the most productive in the state.

Brown Loam: This is a very thin mantle of yellowish brown silt loam, of loessal origin, which forms the surface soil over perhaps a large part of the state. It is only a few feet in average thickness, and, as has already been said, covers the Loess region, but also spreads far beyond it, so that it blankets the uplands of many counties in the state. Wherever it occurs it either forms or enters largely into the formation of the soil. In the Bluff region it rests upon the Loess, but over the state generally it rests directly upon the older formations of the region. It overlies the eocene sands throughout the North Central Plateau, and the arrangement furnishes conditions most favorable to rapid erosion.

Recent Alluvium: The most recent of the geological formations is the alluvium or flood plain deposits of the streams of the state. These consist of unconsolidated horizontal beds of clay, silt, and sand and gravel more or less mixed, or in successive layers, and containing decaying vegetable matter.

These deposits follow the courses of the streams as flats of varying width, that of the Mississippi being the most extensive. It is known as the Yazoo-Mississippi Delta, and is remarkable for its fertile soil. While alluvial deposits generally possess considerable uniformity of character, owing to similarity of conditions of deposition, they may, and usually do consist of materials derived from widely diverse sources. This is especially true of the flood plains of large streams like the Mississippi.

SEC. I, PART 4.

THE STRUCTURAL MATERIALS OF MISSISSIPPI.

The structural materials of Mississippi consist of limestone for building purposes, for the manufacture of lime and cement, and for road metal; sandstones and ironstones for building purposes and for road metal; cherts, sand and gravel, for concrete and road metal.

Building Stones.

The rocks of the state containing stone suitable for structural purposes, are confined to a few formations and to limited areas. The oldest formations of the state, the Devonian and the Sub-Carboniferous, contain the most promising materials. Less promising sources are the Ripley, the Clayton, the Tallahatta Buhrstone, the Vicksburg and the Grand Gulf formations. Very limited quantities of fair stones have been obtained from the Selma and the Wilcox.

Limestones.

Limestones suitable for structural purposes may be obtained in sufficient quantity and of good quality, from the Devonian and from the Sub-Carboniferous formations which outcrop in Tishomingo county. More limited quantities of good stone have been found in the Selma, the Ripley, the Clayton and the Vicksburg formations.

Devonian Limestone.—The Devonian formation occupies a very limited areal extent in Tishomingo county. The formation consist of shales and limestones. Representative outcrops of these rocks are found along Yellow Creek, a tributary of the Tennessee River. The limestones attain a thickness of forty feet or more, and consist of layers of dark, compact, non-fossiliferous rock. The individual layers attain a thickness of eight feet or more, and are intersected by joint planes, which facilitate quarrying.

Sub-Carboniferous Limestone. — The Sub-Carboniferous formation which overlies the Devonian in Tishomingo and Itawamba counties contains beds of limestone suitable for structural purposes. The best outcrops occur along the course of Bear Creek. The limestone is gray in color and consists of

compact layers, some of which attain a thickness of ten feet or more. These layers are intersected by joint planes, and under the influence of weathering break up into large quadrangular blocks. These limestones have been used only to a very limited extent and for purely local purposes.

The Selma Limestone.—The Selma chalk or limestone contains, in local areas, hard layers of limestone which has served a local demand for building material. Some of the layers are crinoidal, being composed largely of the cemented fragments of crinoid stems. Such resistant layers of the Selma chalk have been found in Noxubee, in Oktibbeha, and in Lee county, and further details are given under those headings.

Ripley Limestone.—The Ripley formation consists chiefly of marls, but contains some layers of fossiliferous limestone, which have been used locally for building purposes. The total thickness of the formation is about 300 feet. It occupies a very narrow belt of outcrop, extending along the western border of the Selma chalk from Houston to beyond the Tennessee line. The harder layers are confined to the eastern border.

Midway (Clayton) Limestone.—The lowermost member of the Eocene group of rocks in Mississippi is the Midway, which consists of two formations, the Clayton and the Porter's Creek or Flatwoods. The Clayton is a marine formation, consisting of fossiliferous limestones and sandstones. The Porter's Creek consists of clay which is non-fossiliferous and probably non-marine. The Porter's Creek outcrop extends along the western border of the Cretaceous outcrop, but the Clayton is not co-extensive. It outcrops in the southern part of the area, and again in the northern, but no outcrops have been found between Houston and Shuqualak. Overlying the Ripley marl in the northern part of the area, there is a bed of limestone called the Turritella Limestone, from the abundance in it of the fossil, Turritella Mortoni. This limestone outcrops in many small areas in Tippah and in Union counties. It has served a local purpose for the construction of flues and the formations for frame buildings.

Vicksburg Limestone.—The outcrop of the Vicksburg limestone extends across the state from Vicksburg to Waynesboro. The continuity of the outcrop is broken by the overlapping of

younger formations and by the erosion of streams. As a rule the limestone is a soft, chalk-like rock of white or buff color. In some exposures, however, the formation consists of layers of a moderately hard blue limestone, separated by about equal thicknesses of shell marl. The limestone has been used in practically all parts of the area of outcrop for local building purposes. Larger quantities of the harder stone have been shipped to distant points to be used for riprapping and other purposes.

Sandstones.

Sandstones occurr in the Sub-Carboniferous, the Selma, the Clayton, the Tallahatta buhrstone, and the Grand Gulf. The best building stones are found in the sandstones of the Sub-Carboniferous and less suitable ones in the Tallahatta buhrstone and the Grand Gulf.

Sub-Carboniferous Sandstone.—The surface exposure of this sandstone is confined to Tishomingo, Prentiss and Ittawamba counties. The best exposures occur on Bear Creek, in Tishomingo county, where the beds attain a thickness of over 100 feet. The individual layers of the sandstone vary in thickness from a few inches to ten feet. The layers are intersected by joint planes which, in some outcrops, divide the stone into huge block, some of which are as much as 10 feet thick, 12 feet wide, and 40 feet long. The stone is gray in color and for the most part free from discoloring substances. It is said to be soft and easily cut when first taken from the quarry, but to harden under exposure. It has been used for building purposes in the construction of houses, foundations, pavements, well curbs and chimneys. Some of the chimneys were constructed more than a half a century ago and are still in good condition.

Selma Sandstone.—The upper portion of the Selma chalk, merging into the Ripley marls, contains in certain localities considerable sand. These sandy phases of the Selma are, in some places, cemented, forming thin beds of sandstone, which are sufficiently indurated to be of use for local structural purposes. The quantity, however, is exceedingly limited, and this cannot be looked upon as a fruitful source of building material. Outcrops occur in Kemper, Noxubee and Oktibbeha counties.

Clayton Sandstone.—The lower portion of the Clayton formation is composed of limestone, but the upper portion is a sand or sandy marl. The sand has, in some places, been changed into sandstone by cementation. The sandstone is seldom sufficiently indurated or the layers of sufficient thickness to be used for structural purposes.

The Tippah Sandstone of Tippah county is a gray, fine rock, occurring in beds two feet thick. The deposits are limited, but useful locally for foundations.

Tallahatta Sandstone.—The Silicious Claiborne or Tallahatta buhrstone contains beds of a quartzitic sandstone, which, in some localities, has been changed by cementation to a nearly pure quartzite, which reveals little of its arenaceous origin. The Tallahatta formation outcrops in a belt varying from 10 miles in width in its eastern border to 30 miles in its western border, and extending from Clarke county to Grenada county, where its outcrop becomes concealed by alluvium of the Yazoo basin. The best exposures of the sandstone are found in Holmes, Attala, and Lauderdale counties.

Grand Gulf Sandstone.—The Grand Gulf formation consists of sands, clays, gravels, sandstones and quartzites. The sandstones and quartzites are more abundant in the northwestern part of the area of outcrop, west of the Pearl River. Some of the stones are soft, fine-grained, aluminous rocks. Others are coarse-grained, incoherently cemented rocks. Some, however, are hard, vitreous rocks of quartzitic nature. The sandstone used in the old capitol building at Jackson was obtained from a quarry in the Grand Gulf near Raymond.

Sand.

Sand is being used in Mississippi in the manufacture of mortar, concrete and sand-lime brick, for sand-clay roads and for molding purposes. Good sands are available for nearly all of these purposes. The principal geological formations of the state which are sand bearing, are the Tuscaloosa, Eutaw and Ripley of the Cretaceous, the Wilcox and Tallahatta Buhrstone of the Eocene, the Grand Gulf and Citronelle of the later Tertiary, and terrace formations of the Pleistocene. There are other formations from which sand is derived by erosion, such as from sandy phases of the Selma, the Lisbon, the Jackson, and Loess.

Building Sand.—The widespread distribution in the state of sandy coastal plain formations, and their extensive erosion and redeposition as sands along stream channels, have made sands for various structural purposes easily accessible in most parts of the state. Perhaps every county of the state has available sand deposits that could be used for application to clay roads to make sand clay mixture, or to make cement for macadamizing. The more definite location of these sands will be taken up under the discussion of each county.

Chert Gravel.—The most important road making material is Chert Gravel, which consists of subangular or water-worn fragments of chert, or impure flint, embedded in a matrix of clay or clayey sand. These fragments vary considerably in size, but average about one to one and one-half inch in diameter. The chert pebbles are opaque, very hard and tough, and range in color from creamy white to dark brown.

Two main zones of these gravels occur in the state, one following the bluffs of the Mississippi River, and spreading eastward across the state in the southern counties, the other much less extensive, lying adjacent to Tennessee River and upon the Tennessee-Tombigbee divide. The gravel of the western zone is reddish brown in color and of uniform size, that of the northeastern zone is yellowish white and often contains large masses of Chert.

Large deposits of reworked gravel in the courses of streams flowing away from those across present clean washed gravel suitable for concrete.

Chert (Bedded).—In the lower Carboniferous beds of Tishomingo county occur extensive deposits of chert interbedded with limestone. These chert deposits outlie in high hills near the Tennessee River, and are of great thickness—50 to 75 feet—and present a very valuable source of excellent road metal. This bedded chert differs but little from the Novaculite of Southern Illinois, and for road construction will be as good, when once made available.

SEC II.

ROAD CONSTRUCTION.

as Related to

The Geology and Topography of the State.

A study of the geologic structure of the state brings out forcibly the fact that even though not a mountainous state, the successful location of highways must bear a close relation to the geologic and topographic features of the state. No elevation in the state is known to reach 1,000 feet above sea level, so that road building in Mississippi meets with no problems of mountain climbing, which necessitates searching out available gaps and low points for crossing.

Though not mountainous, by far the greater part of the surface of the state consists of uplands 400 to 600 feet above sea level, and presenting a more or less irregular surface. This irregularity is due to several causes; mainly, however, because this region has reached a stage of mature physiographic development, and consisting as it does of somewhat diverse materials, presents features of topographic diversity.

The divides between streams are ridges rising usually 150 to 250 feet above drainage in the northern parts of the state, seldom more than 100 to 125 feet in the more southern parts. Owing to our moist climate, all the larger streams have a system of tributaries, each of which in turn has its numerous small tributaries, and so on down to the smallest evanescent rills and gullies that carry water only immediately after rains. All these streams, large and small, cut into the dividing ridges, and in the soft formations of the Coastal Plain, and rapidly work back, until the upland ridges have become very largely dismembered into a maze of hills with numerous intervening valleys, only the larger of which have permanent streams.

Where the above stage of erosion has been reached roads penetrating the region are forced to wind in and out among the hills finding a passage as favorable as possible between adjoining valleys. Where the upland surface still persists intact as a winding ridge between valleys, the roads are usually located upon the ridge and follow its windings. These roads are locally

called "ridge roads." In both cases a road is also nearly always constructed along one of the larger valleys where the grade is easy. During wet seasons the alluvial soil of the valley is very liable to work up into deep mud making the valley road well nigh impassable. In addition to this, often the stream overflows the whole alluvial bottom, so that unless the road can be located upon a second bottom or a terrace above reach of overflows, the "river road" as it is usually called, has to be abandoned for the time. Thus, in these regions the ridge road is the wet weather road, because the river road becomes impassable from mud and overflows, while the river road is the dry weather road because it presents no heavy grades and the alluvium packs under travel to a hard concrete-like road bed. It follows then that since spring and winter are the wet season the upland roads would be used then, and **vice versa.**

Where divides between streams still persist as broad gently undulating plains the roads take the shortest route between points. In Mississippi, when possible to do so, roads should be constructed upon the uplands or upon the river terrace above the inconveniences of overflows, otherwise during part of the year communication would be cut off or rendered very difficult.

Where two lines of communication between two points appear equally favorable in other respects, the one along or near which abundance of good road building material is readily available, would naturally become the preferable one along which to construct the road. The axiomatic rules of road-building are these:

1. Where practicable, select the shortest route between two points.

2. As far as possible, choose that route which offers the easiest grade.

3. As far as compatible with well-constructed plans, avoid all such obstacles as swamps, and where they are unavoidable, cross them at right angles.

And to the above may be added:

4. Other things being equal, or approximately so, choose the route along which good road-building material is available.

It will take good engineering judgment and calculation to accurately balance these complex factors determining the best

route for a road, even with all the desired facts in hand; without these facts, the best engineer may go far wrong. It is the purpose of this report to furnish these essential facts so far as they have been worked out in Mississippi.

Tennessee River Hills.—This region of rugged uplands is the highest land in the state, with the possible exception of parts of Pontotoc Ridge. The Tennessee River, which touches the border of the state for a distance of about 12 miles, runs at an altitude above sea level of about 400 feet. The uplands of Tishomingo county rise abruptly above the river to an elevation of 650 to 675 feet. All the region lying north of the Southern Railroad in this physiographic region of the state consists of high, broken uplands, the surface being cut by short tributaries of the Tennessee into narrow ridges. The intervening valleys are narrow and cut down into the bed rocks of the Paleozoics. Within a mile or two, south of the Tennessee, the red clayey sands and gravels of the Cretaceous begin, and cover all the regions to the south with a blanket of sand gravel 30 to 75 feet thick.

In the vicinity of Iuka, on the Southern Railroad these immense gravel deposits have been opened in three or four great pits which are equipped with spur tracks, steam shovels, and loading facilities. Extensive pits could be opened both north and south of the Southern Railroad for a distance of six or eight miles.

A very fair county road, which with little effort or expense could be made an excellent highway, connects Iuka on the Southern Railroad with the boat landing on the Tennessee River at Old Eastport. Gravel outcrops in, or within a few hundred yards of this road along its whole length of eight miles. The gravel has strong cementing qualities. Certain points in the road present rather steep grades, but these could be reduced by a careful survey.

The chief problem in road building from the Tennessee River to the Southern Railroad is one of avoiding steep grades in rising out of the Tennessee Valley. From Iuka southward to the Birmingham branch of the Illinois Central Railroad the topography is much less rugged, and good grades will not be difficult

to find. The Cretaceous formations are much more sandy than farther north, but some good gravel deposits occur at intervals.

Another route available in passing from the Tennessee River to the Southern Railroad is up Yellow Creek valley. There is a boat landing at the mouth of Yellow Creek, and from there the road runs to Red Sulphur Spring and thence to Burnsville, following part of the way the creek valley. This route becomes impracticable during wet seasons owing to overflow and to bogginess of the alluvial flats. Towards the Tennessee the grades are steep. A better road is from Red Sulphur Spring to Short, east of Yellow Creek, and thence over the uplands to Iuka. This is a very fair road except for heavy grades between the Tennessee River and Short.

Farther west an excellent graveled automobile road runs from the Tennessee River at Shiloh National Park to Corinth at the intersection of the Southern and Mobile & Ohio Railroads. This road, however, lies west of the boundaries of the topographic region now under consideration.

The old Natchez Trace crosses the Tennessee River at Colbert's Ferry and passes southeast into Mississippi through this region. It is a very good road and traverses immense gravel deposits.

All the larger streams of the eastern half of this region cut down into the hard Paleozoic rocks and present high rock walls on one side or both, so that roads can cross only at favorable points.

In the western part of the region the topography is developed entirely from the sand formations of the Cretaceous. The rugged uplands become less pronounced, and the elevation and relief diminishes westward to the region of the prairies of northeast Mississippi.

The high ridges in the immediate vicinity of the Tennessee River are capped by thick beds of lower Carboniferous chert, which is finely jointed, and where exposed at the surface is broken up into small angular fragments as if just from the crusher. This material is at least 50 feet thick and inexhaustible in quantity. These deposits lie within one and one-half mile of Tennessee River; other deposits equally extensive lie west

of Bear Creek between Eastport and Iuka, within one or two miles of the Riverton branch of the Southern Railroad.

Tests of this material prove it to be tough and to have good cementing qualities. It is practically identical with the Illinois Novaculite.

Black Prairie Belt.—The northeastern Prairies, or Black Prairie Belt, as it is usually called, is a topographic region lying immediately to the west of the Tennessee River Hills. Its outlines may be noted by reference to the geologic map which accompanies this report. Compared with the topographic units bordering this region on the east and on the west, it is a region of slight relief lying conspicuously lower than the bordering regions. The surface is gently rolling to almost level, and in contrast to the Tennessee River Hills, which is a wooded region, this consists for the most part of open prairies. Here and there tongues of reddish soils covered by growth of undersized post oak, black jack, and a few other species, separate the open prairie tracts. The river bottoms are usually timbered with various hardwoods.

The surface of this region slopes southward from an altitude of about 400 to 450 feet in the northern parts to 179 feet at Macon in the southern part. This whole region marks the outcrop of the Selma Chalk of the Cretaceous, a semi-indurated limestone of 60 to 80 per cent of lime carbonate. On hillslopes and valley sides along streams the limestone is often exposed, though covered elsewhere with soil several feet deep.

Streams traversing this region are nearly all tributary to the Tombigbee, and flow across it in a southeasterly direction. Their channels lie in valleys broad and meandering, but seldom as much as 40 feet below the general level, so that, except for their very heavy, sticky alluvial soils, almost impassable as roads for much of the year, the region presents no greater obstacles to highway construction.

The upland soil of this prairie belt is a dark gray calcareous clay soil residual from the Selma limestone, very tough and sticky during wet weather, and on the level areas drains so poorly as to be boggy much of the time.

It will readily be seen that the highways across these prairies must be confined to the uplands, and that on the uplands, so far

as possible, on account of poor drainage and bogginess of the surface the roads should follow the higher ridges. Only in crossing an occasional stream does the question of a proper grade figure in building a road in the prairie belt.

During the dry parts of the year (summer and autumn) the ordinary dirt roads in this region, where properly made and kept up, become as smooth and firm as macadam roads. During the winter and spring when rains are frequent and often continuous for days, these roads become worked up by travel into deep, sticky, and all but impassable tracts of mud. In many counties the roads are now being surfaced with gravel or other surfacing material, and where this is done the roads remain good throughout the year.

The gravel deposits of Tishomingo county and the adjacent parts of Alabama are easily accessible to this region. The gravel has highly cementing qualities and makes a first-class road surfacing material. Locally, as a temporary expedient, difficult or impassable places could receive a thick dressing of the crushed Selma limestone. It has been found that where the Selma rock itself, and not the sticky clay soil residual from it, forms the roadbed it makes a very satisfactory road at all seasons of the year. Where streams follow the desired direction it would not be difficult to lay out roads along the top of the slope bordering the valley, for almost always the residual soil is removed by erosion and the firm Selma chalk is exposed, which would require only to be shaped into a road bed.

Pontotoc Ridge.—This region of high ridges divides the drainage basins of the Tombigbee on the east, from the Tallahatchie and Yalobusha on the west. In the northern part the drainage is north into the Tennessee River. This is a great backbone ridge, lying immediately west of the Prairie Belt from the Tennessee line south to Houston, in Chickasaw county, and is bordered on the west by the low-lying Flatwoods. The elevation of this ridge reaches a maximum at Blue Mountain, in Tippah county, where the high points reach an altitude of between 650 and 700 feet.

This region has very rough topography, especially in the northern parts, streams flowing through valleys 250 feet below the uplands, and difficult to cross because of the precipitous

slopes. The geological formations exposed are red sands cemented in places into soft brown sandstone with occasional outcrops on the slopes of marine calcareous marls, and hard, crystalline limestones, all belonging to the Cretaceous. The country is wooded with various species of hardwood, especially oaks, and the soil is rich and productive of good crops.

The topography marks this region as one difficult to build roads across. The ridges generally are broken into hills with steep slopes, so that a road bed would have to be heavily graded, or wind among the hills to find outlet. The sands of the Cretaceous and Tertiary marls weather to an intense red color and contain a percentage of clay in most places that almost gives it the proper proportion for sandy-clay road metal. The best east-west road crossing the ridge is in the latitude of New Albany, and follows pretty closely the roadbed of the Frisco Railroad, the only railroad that crosses Pontotoc Ridge in Mississippi. The New Orleans, Mobile & Chicago Railroad follows closely the western border of the ridge from its point in Chickasaw county to the line of Tennessee, but avoids the broken country of the ridge itself.

No gravel deposits or other road-making materials are found in this region, other than limestone mentioned above, and limited deposits of Tertiary limestone which outcrop nearly Ripley, Tippah county.

Flatwoods.—This is the name popularly given to the narrow crescentic zone of low wooded lands that skirt Pontotoc Ridge and the Cretaceous Prairies on the west side. This belt is never more than six to eight miles wide, but extends in an open crescent from the line of Tennessee to Alabama (See Geological Map accompanying this report).

This physiographic region coincides with the outcrop of the Porters Creek Clay of the Midway Eocene. As is the rule with clay or shale formations, the outcrop of the dense gray clays of the Porters Creek has been reduced by erosion to low flat surfaces showing only occasional hills of notable size. While the region lies at a much lower level than Pontotoc Ridge on the east and the uplands of the North Central Plateau on the west, it is found to be but little lower than the Cretaceous Prairies which it borders from Chickasaw county to the Alabama line. It differs from the latter, however, in being well-timbered.

The soil of the region is a very heavy, sticky, waxy clay soil derived by weathering from the underlying clay formation. This has remarkably uniform characteristics throughout the region. During the dry months this clay bakes to the hardness of concrete, but a rain or two is sufficient to cause it to become putty-like, and to roll up on the wheels of vehicles in such masses as to practically prohibit travel. During the winter and early spring months the roads get worked into deep, clinging mud until travel is almost impossible.

Any highways passing through Mississippi from northeast to southwest must necessarily pass across this **regi diaboli**, but fortunately the distance is not great, seldom as much as eight miles. The only remedy for the conditions mentioned lies in sloping the roads so as to drain quickly and thoroughly and surfacing them with gravel or other surfacing material. This has been done in at least two roads crossing the Flatwoods from Pontotoc to Lafayette Springs, and from Porterville to Scooba, and the result has been eminently satisfactory.

The streams crossing the Flatwoods, as the Tallahatchie and the Yalobusha, pursue sluggish courses across the region in channels but little below the bordering lands, and after any heavy shower are liable to spread beyond their channels. For this reason approaches to bridges crossing even small streams have to be elevated and extended from side to side of the lowlands.

This region possesses no road-making material of any description, unless it should be found locally economic to make burnt-clay roads, as was advocated for such clay regions a few years ago, but which now seems to have dropped into disuse. If such methods could be made economic anywhere, it should be in this region, for both the clay and the fuel are at hand. With the most excellent road-making gravel accessible by railroad, at no great distance, it may be questioned whether the burnt clay road would be an economical enterprise.

Manifestly in the Flatwoods region the construction of roads along stream courses would be impracticable and inadvisable.

North Central Plateau.—The boundaries of this region may be ascertained by referring to the chapter on Physiographic Regions of Mississippi. It embraces one of the largest physio-

graphic divisions of the state. Its surface lies from 600 feet above sea level in its northern parts to 400 or 450 feet in the southern parts, and consists of a plateau whose original surface slopes gently toward the Gulf. It is maturely dissected, the uplands surface consisting for the most part of ridges separating intervening valleys. In places where wide spaces separate the larger water courses, the surface presents broad, gently rolling areas, but usually the dividing ridges are narrow and tortuous, often cut into hills, presenting a broken and difficult topography for the road builder.

Throughout the whole area except the southern third the drainage is into the Mississippi River, the larger streams all flowing in a southwest direction. The southern third is drained southward by the Pearl River and by the tributaries and headwaters of the Chickasawhay.

This region coincides with the outcrop of the lower Eocene formations, consisting of the Wilcox (Northern Lignitic of Hilgard) and the lower divisions of the Claiborne.

The Wilcox outcrop consists in its lower part of several hundred feet of gray and lignitic clays and lignite, with occasional intercalated beds of spathic iron ore, mostly concretionary. These clays outcrop in the eastern part of the region in a zone from two or three to 20 miles wide. The clays are less putty-like in wet weather than those of the adjacent region of the Flatwoods, but present difficulties in the way of good roads during wet weather, except where the roads are well drained and surfaced with gravel or other good surfacing material. Locally the beds and concretionary masses of spathic iron ore might be used as a surfacing material, but the deposits are scattered, and after bringing together and crushing this material, it would not prove in any respect preferable to the gravel of Tishomingo county, which would be available, except at points distant from railroad transportation.

The topography in this clay phase of the Wilcox is more rolling than the corresponding parts of the Flatwoods, but less so than the sandy regions to the west.

The greater part of the Wilcox in the North Central Plateau of Mississippi consists of unconsolidated sands of variegated colors. The sands stand in precipitous and broken hills and

ridges 200 feet or more above drainage, and at a considerably higher level than the adjacent clay regions of the lower Wilcox.

Owing to the broken character of the topography and especially to the yielding nature of the sands in this part of the region, road building is difficult. On the level lowlands along the streams are to be encountered difficulties due to overflow in wet season and to wet, boggy soil in most parts, though deforestation of the uplands with consequent erosion is leading to a general tendency to sandiness in all stream bottoms. The smaller streams nearly all have sandy flats bordering them that pack and make firm roads during rainy weather, but become yielding and heavy in dry weather.

On the uplands the slopes are steep and usually deep in sand, so that roads encounter both difficulties—the high grades and the yielding and shifting sands. On the tops of the broader ridges consisting of the original plateau surface, a layer of brown silt loam overlies the sand to a thickness of four to six feet, and this when properly shaped up makes a firm, good road, although working up into deep mud in rainy seasons, unless regularly dragged. Fortunately, however, over a large portion of this region much of the difficulty of road building can be obviated by a proper mixture of the surface loam and the Wilcox sands, making a sand-clay road. The formation is more purely sandy and the topography rougher from Grenada northward than in the parts toward the south.

From Grenada southward and westward the lower Claiborne formations outcrop and enter largely into the formation of the surface soil. The topography is hilly and broken, as is the case farther north, and the surface formations are intensely red, clayey sands derived from weathered greens and "greensand" and marls of the Claiborne. This material properly drained and graded makes a fairly good sand-clay road, so that here, particularly from Winona southward, the chief problem in road making is that of establishing proper grades. On the lowlands are encountered the same difficulties as in the state generally —overflows due to the heavy rainfall in our climate, particularly in winter and spring, and to the slight gradients of the streams. Terrace roads have a minimum of difficulties, as already suggested elsewhere.

. In the western parts of the region (note Geological Map) are encountered outcrops of quartzite beds of the lower Claiborne. They are usually coincident with very rough topography. These outcrops strike southeast across the state into northern Newton, Lauderdale, and Clarke counties, where they pass into high broken hills of hard claystone capped with quartzite. The quartzite is variable in hardness within short distances making an indifferent, but where urgently necessary, an available road material. In the counties just named roads avoid, where possible, passing over the precipitous hard rock hills and ridges, but occasional breaks in the hard rock capping of the ridges afford available passes for roads. From Meridian a well graded road passes south to Enterprise over the "mountain" through one of these gaps.

Jackson Prairie Belt—This physiographic region strikes nearly east and west across the state a little south of the center in a zone from 10 to 30 miles wide, gradually widening from east to west.

Considered as a whole, the region is one of gently rolling topography, although in the extreme northern and southern parts which mark transitions to other regions, the surface becomes decidedly rolling and in places hilly. Usually these hilly regions are coincident with the outcrop of sandy formations, the Claiborne on the north, and the Madison sands of the Vicksburg group on the south.

The region presents little or no serious difficulty to road construction as regards grades, favorable grades being almost everywhere readily located; but as regards suitable roadbeds the region presents differences in the eastern, western and middle parts. In the broader area from Jackson and Pearl River westward, the surface soil is prevailingly of the brown loam type derived from the loess. As in the last-described region, it is a reddish brown silt loam, which from the viewpoint of road building might be regarded as a clay. When properly drained and dragged after rains, it makes a good firm roadbed, although it works up into deep dust during protracted dry weather, and in wet weather, unless regularly dragged and well drained it works up into equally deep mud. When surfaced with good surfacing material, as gravel, it makes a firm roadbed. Very

little gravel or other surfacing material occurs within this region, but abundance of good gravel is easily accessible in the regions immediately to the west and south. Some limited gravel deposits occur in the vicinity of Jackson that have been used locally.

In limited localities of this western part of the Jackson Prairies occur spots of a few acres to a few hundred acres in extent of a sticky, dark gray clay soil derived from the Jackson formation. These outcrops mark the prairies proper, or so-called "bald prairies," the surrounding areas marked by loam soils, not being open prairies, but presenting a growth of undersized hardwoods, mostly post oak, black jack, spanish oak and hickory.

These "bald prairies" with their sticky, heavy gray clay soils which do not occur extensively in the western parts of the region, become much more marked in the central parts, embracing southeast Madison, the northern parts of Rankin, Scott, Smith and Jasper counties. Here they constitute the prevailing soil, and coincidentally, in these parts unless roads are carefully drained and surfaced, travel during rainy seasons becomes almost impossible. These clay soils are practically identical with those of the northeastern prairies of Mississippi, and present very similar difficulties to road construction. Scott county and adjacent parts of Smith and Jasper where these clay soils outcrop, have notoriously bad roads, although with proper construction and surfacing, roads in this region could be made as good as in most parts of the state.

In the southeastern part of this region sands of later formations overlie much of the clays of the Jackson formation, and eliminate the serious problem of the clay belt. These sands might readily be mixed with the clays where they are found conveniently near to each other and both the sandy and the clay stretches converted into sand-clay roads. Considerable gravel deposits occur in this part of the region, and in adjacent regions to the south, and furnish abundance of surfacing material readily available. Railroad facilities are such that in most parts of this region surfacing gravel can be had with little difficulty.

Long Leaf Pine Uplands—This region, though a large one and presenting some diversity of conditions, offers few real

difficulties in road construction. The boundaries can be made out on the Geological Map accompanying this report. It will be seen to be one of the largest physiographic regions of the state, and presents an eastern and a western part, separated by the Pearl River, the two sections differing in some important respects.

While the region is one of irregular topography, the irregularities are not so pronounced as to offer any serious obstacle to road-building. Good grades may easily be found in most places. Roads running towards the coast would usually have few large stream crossings to encounter, since the larger streams all flow south, and only tributaries would be crossed by north-south thoroughfares.

Over much of the region east of Pearl River the soil is a tawny to reddish-brown, often mottled, sand with sufficient admixture of clay to make a natural sand-clay roadbed. Roads in these regions if properly constructed and drained, and dragged after rains to prevent the formation of ruts and "chuck holes," are firm and good throughout the year. In parts where the sand and clay are not in right proportions, contiguous areas will often furnish material to correct the deficiency.

In most parts of this region, however, are to be found abundant deposits of chert gravel, most of which is available and suitable for road surfacing. In another part of this report these gravel deposits are taken up in detail.

In the areas west of Pearl River the general altitude is greater than farther east and the relief more pronounced, so that real obstacles are sometimes encountered in locating suitable grades. These are not insuperable, however, and with detailed examination of the ground, usually good routes may be located which require a minimum of grading.

In this western part of the region the uplands have, as in the North Central Plateau, a blanket of brown loam soil 4 to 12 feet thick covering the underlying sandy formations. This loam has here the same characters as in the above mentioned region, and presents the same road problems as noted there. (See North Central Plateau).

The larger streams of this region show distinct terraces above the present flood plains. These terraces afford very

favorable conditions for roads. On the first bottoms, besides overflows during wet seasons, there may be swampy wet areas that offer a serious impediment to travel.

Coastal Pine Meadows—At a varying distance from the Gulf Coast the region of uplands just considered gives place to a low, level stretch of open pine meadows. Whereas in the Pine Hills region low, swampy stretches are occasional, in this region flat, water-sogged swamp areas become the prevailing characteristic. The soil is sandy, with an intermixture of peaty matter, and the swamp waters are sour and amber-colored. Peat bog vegetation is common in the wet meadows.

The lack of drainage is due to the general flatness of the surface of the region preventing surface run-off, and to the surface of the region which present surface run-off, and to the which hinder the vertical sinking of the water.

In this region roads are necessarily confined to the somewhat higher ridges that separate the low meadows. East-west roads roughly parallel to the coast would find a system of ridges having that general direction, marking the location of old beach lines of a previous epoch. Where the low swamps have to be crossed it will be necessary to fill in sufficiently to insure a firm roadbed. Sands from the beach could be used for this purpose, or gravels brought in from the hills just to the north. When obtainable shells make excellent road surfacing material.

Bluff Hills Region—This is a long narrow zone following the edge of the uplands bordering the Mississippi flood plain. It is a region of broken precipitous topography. All streams cut through this zone in deep and usually steep-sided valleys. The roughness of the topography is due to the intricate and deep erosion of the edge of the uplands where they suddenly break off into the lowlands especially where the blanket of loess is very thick. This material erodes into vertical faces 25 to 75 feet high, so that streams cutting through it present precipitous slopes of their valley walls. All the largest stream channels are cut deep into the underlying formations, giving a total relief in this region of 150 to 250 feet. Where the formations under the loess are of hard rock, or contain hard rock ledges, the valley sides are especially precipitous.

Permanent and wet weather streams have cut the region into an intricate maze of deep valleys and precipitous ravines, the larger having a general east-west direction. These deepen and increase in number toward the western border of the division.

Roads built in this region are usually located upon the ridges, and wind about with them. North-south roads are difficult on account of the numerous steep-sided valleys to be crossed, except toward the eastern border of the region. East-west roads keep upon the uplands a few miles, then pass down into some valley. The grades are usually high, but the roads of Warren county have been constructed on good grades and surfaced with Illinois Novaculite, making, perhaps, the finest system of roads in the state.

The loess makes a very good roadbed, better than most soft formations in the state, but for heavy traffic would be much better surfaced with gravel or some other good surfacing material.

Mississippi River Floodplain—This region, usually called the Delta, is a very large one, lying in the western part of the north half of the state, and embracing all or parts of at least fifteen counties. The soils are all alluvial and the surface practically a featureless plain. The lands lying next to the larger streams are slightly higher than those in the interstream areas. The soils in these higher lands are sandy loams, and when roads are properly constructed with sloping crown and side ditches for adequate drainage they stand travel very well during all seasons of the year. In the lower interstream areas which are by far the most extensive, the soil is a dense, sticky clay, which under travel becomes very hard and compact during dry weather, but during wet seasons, as in winter and spring, work up into almost bottomless tracts of mud.

In the Delta roads should when possible follow the higher lands, both because of better road conditions, and because in the occasional overflows these lands escape inundation longer than other parts, if not entirely.

As a rule, roads traversing the Delta, unless following the ridges along the stream courses, should always be surfaced with firm, impervious surfacing material, to avoid the winter muds.

Realizing this most of the Delta counties are surfacing their roads with gravel, which is found abundantly in the regions just east of the bluffs, and to a less extent in the bluff regions. Abundance of clean gravels suitable for making concrete occur in the Mississippi River channel in great banks at numerous points.

A serious obstacle to road construction in the Delta is the presence over most of the region of a maze of bayous, sloughs, lakes, and other sluggish stream channels, which are practically dry throughout most of the year, but full of water during winter and spring. These have to be bridged, and usually require bridges with long approaches to raise the road above the muddy swamps at low water stage, or above back waters in time of flood, all of which adds to the cost of construction and maintenance of roads in the Delta.

Sec. III

PITS, QUARRIES, AND UNDEVELOPED DEPOSITS of ROAD MATERIALS IN MISSISSIPPI

SEC. III.

ADAMS COUNTY.

Gravel Pit.

Owner: Lee Parker, Natchez.
Location of Pit: In St. Catherine Creek, two miles east of Natchez, near Washington gravel road.
Nearest Railroads: Yazoo & Mississippi Valley and Mississippi Central.
Capacity with present equipment: No equipment at present; pit not in operation.
Overburden: No overburden.
Extent: Pit one mile along the creek; depth exposed, about 10 feet. Cleaned washed gravel, suitable for concrete.

Gravel Pit (1).

Owner: Foster Creek Concrete Gravel Co., Chas. Mendelson, Secretary, 339 Carondelet Street, New Orleans, La.
Location of pit: Foster, Adams Couny, 5 miles northeast of Natchez.
Nearest railroad: Yazoo and Mississippi Valley Railroad.
Operator: Foster Creek Gravel Co.
Clean washed gravel, better adapted to cement manufacture than to road covering.
(U. S. Office of Public Roads Test No. 5591.) See page 96.

Gravel Pit.

Owner: Kemp Bend Company, Natchez, Miss.
Location of pit: Kemp Bend, Miss., about 35 miles above Natchez in the Mississippi River.
Nearest railroad: At Vidalia, La., or Natchez, Miss. Transportation by barge.
Operator: Kemp Bend Company, Fred L. Hartigan, Vice-President, Natchez, Miss.
Capacity with present equipment: 5,000 cubic yards per day—will begin delivery about January 1, 1920.
Overburden: None.
Length of pit, area: 1,000 acres
Depth of pit: 80 feet.

Gravel Pit (2).

Location of pit: At Gravel Point on Mississippi River, 1 mile north of Yazoo & Mississippi Valley Railroad at Natchez.
Nearest railroad or main county road: Yazoo & Mississippi Valley Railroad.
Capacity: Not operated; no equipment.
Overburden: Consist of 65 to 90 feet of sand and loess, except where exposed by slump.
Dimension of deposit: Cannot be determined.
No pit test been opened on this deposit. See page 83.

Gravel Pit (3).

Owner: James Surget, et als., Natchez, Miss.
Location of pit: On St. Catherine's Creek, three miles south of Natchez, Miss.
Nearest railroad: Yazoo & Mississippi Valley.
Present operators: T. J. Tildsley and Wm. Jenkins.
Capacity: This is a small pit for local use; not operated regularly; no especial equipment; gravel moved by pick and shovel.
Overburden: None.
Length of pit: Several hundred yards along creek bed.
Depth: Three to ten feet.
(U. S. Office of Public Road Test No. 6466.)

ALCORN COUNTY.

(4) Road materials used in this county are nearly all shipped in from the adjoining county of Tishomingo.

Local material is not of a high order and very local. A few small gravel deposits are reported to be opened for use on the roads in the east and west thirds of the county. No examination of this material has been made and no tests are known to have been made.

Sands and highly ferruginated sand rock occur in the east and west edges of the county and have had local use in road-building. The material is not of a very high order as road-making material.

AMITE COUNTY.

Gravel Pit (5).

Owner: Mississippi Gravel Co., 1050 Bank of Commerce Bldg., Memphis, Tenn.
Location of pit: Barney's Spur, Amite County, Miss., eight miles north of Gloster.
Nearest railroad: Yazoo & Mississippi Valley Railroad.
Operators: Mississippi Gravel Co.; began operation in January, 1917.
Output: 25 car loads.
Overburden: Sand and clay, 8 feet.
Length of pit: Not given.
Depth of pit: Not given. See page 95.

ADDITIONAL DATA:

Test of materials in New Orleans show.....

Chert pebbles	70%
Clay	15%
Sand	15%

Gravel Pit.

Owner: Interstate Gravel Co., Coles, Miss.
Location of pit: 1½ miles east Yazoo & Mississippi Valley Railroad; 1½ miles northeast of Stephenson, Miss.
Nearest railroad: Yazoo & Mississippi Valley.
Operator: H. A. Knight.
Capacity with present equipment: 30 cars per day.
Overburden: 3 feet (about).
Length of pit: Three to four hundred feet.
Depth of pit: About 20 feet.
(U. S. Bureau of Public Roads Lab. Test No. 14212.) See page 98.

Gravel Pit (5-A).

Owner: G. M. Causey, Liberty, Miss.
Location of pit: Three miles north of Gloster, Miss.
Nearest railroad: Yazoo & Mississippi Valley Railroad.
This gravel deposit is not yet operated for shipment.
Capacity and output with present equipment: No equipment.
Overburden: Consist of a few feet of red loam soil; deposit covers 160 acres.
Depth of pit: Not determined.

ATTALA COUNTY.

Rock Deposits.

(6) A gray siliceous sandstone of the Tallahatta-Claiborne formation outcrops in Attala county in the vicinity of Kosciusko. The rock is very variable in toughness, being in places of quartzitic hardness and toughness, and passing within a short distance into rock that crumbles easily under the wheels of vehicles. The rock occurs in practically horizontal beds of a few feet in thickness, the individual beds being separated by unconsolidated sand layers.

This rock is an indifferent road material, but has been locally used with fair success.

Exposures of this rock occur one mile south of Kosciusko and four or five miles north. In the latter locality it has been quarried and used in road construction in Attala county, but the quarry has been closed since then. The face of the pit exposes about 25 feet of rock, 10 feet of soft sandstone overlying a quartzitic layer 15 to 18 feet thick.

An exposure of the same rock deposit occurs at intervals between the above pit and the Illinois Central Railroad at West, Holmes County. On the east side of Big Black River opposite West is an exposure of the gray quartzitic rock showing a maximum thickness of 18 feet. A quarry opened here a few years ago shipped 100 carloads of the rock to a point in Louisiana to be used in road construction. The quarry is not now operating. The rock is not easily broken by explosives, making the quarrying expensive.

A test made by the Office of Public Roads of the Department of Agriculture at Washington was made of this material, with the result shown on page 82.

CARROLL COUNTY.

Gravel Pit (7).

Owner: Dr. T. H. Somerville, Oxford, Miss.
Location of pit: Malmaison, Carroll County, Miss., three miles northwest of station at Malmaison.
Nearest railroad: Four miles from Southern Railroad.
This gravel deposit is not operated; not equipped; no output; overlying loess removed by erosion.
Length of pit: Extends half a mile along bluffs.
Depth of pit: 25 to 30 feet.
(U. S. Office of Public Roads Test No. 7308.) See page 99.

Gravel Pit (8).

Owner: Mrs. J. L. Leflore, Malmaison, Carroll County.
Location of pit: Malmaison (Valley Hill P. O.), Carroll County, Miss., seven miles west of Carrollton.
Nearest railroad: On short spur of Southern Railroad.
Capacity and output with present equipment: 30 carloads daily.
Overburden: A few feet of loess soil.
Length of pit: Several hundred feet.
Depth of pit: Few feet to 40 or 60 feet.
(U. S. Office of Public Roads Test No. 7128.) See page 99.

ADDITIONAL DATA:

(9) In southern Carroll county rock deposits of the gray quartzitic sandstone of the Tallahatta-Claiborne formation, such as have been described from Attala and Holmes Counties, occur to a limited extent. It is exposed in ledges 6 to 8 feet thick about seven miles west of Vaiden and five miles southeast of Vaiden. The rock in this vicinity has not been quarried, but could be made available locally. Between Vaiden and West and east and south of West it lies in the immediate vicinity of the Illinois Central Railroad.

Associated with this quartzitic rock around Vaiden is an abundance of red glauconitic sandy marl, having similar cementing qualities to that of Madison county (see page 64). This, perhaps, offers better promise for road construction than the harder quartzitic rock.

CHICKASAW COUNTY.

Rock Deposits.

(10) The Selma chalk and the Ripley marls occupy the sub-surface of Chickasaw county east of Houston. The Clayton and the Porter's Creek formations occupy the sub-surface of the western part of the county.

The structural materials of the county consist of sands, clays, sandstones, and limestones.

Clayton Limestone—The Clayton limestone outcrops at several points between Pontotoc and Houston. It is exposed for a hundred yards in a small creek bed, about one mile and a half north of Houston, on the west side of the railroad. The surface of the limestone is rough and shows the signs of much weathering. The color varies from gray to yellow. The total thickness of the bed is about 10 feet. The individual layers vary from 6 to 18 inches in thickness. This limestone occurs also capping a

low ridge on the east side of the railroad, one mile north of Houston. A sample of this limestone has an absorption of 10.2 per cent.

Other exposures of the limestone are found along the New Orleans, Mobile & Chicago Railroad, between Houston and Pontotoc. There are outcrops of a crumbly white limestone in railroad cuts near Algoma. Near Gershorn the exposures are 10 feet in thickness. It is exposed in a stream bed south of New Houlka, and south of Belmont there are exposures in the railroad cuts and stream channels. Some of the layers are 18 inches in thickness and fairly resistant.

(11) At numerous points in the eastern half of the county the Selma chalk is exposed in railroad cuts, creek valleys and ravines cut into the uplands.

This material is a rather soft "semi-cemented" limestone, which has been called "rotten limestone" because of its soft crumbly nature. It is usually high in calcium carbonate, but the proportion varies greatly at different localities. It is decidedly sandy towards the top of the formation (in the western part of its outcrop) but contains a considerable proportion of clay toward the middle. On exposure to the weather blocks of the rock soon shell off and completely disintegrate. The color of the Selma rock varies from blue to white.

Between Houston and Okolona all cuts in the Houston branch of the Mobile and Ohio Railroad expose the Selma in deep white and bluish cuts. All the slopes around Okolona show the typical Selma rock. The state has established a lime-crushing plant on the Mobile & Ohio Railroad 3½ miles west of Okolona, at a cut 300 feet long and 25 feet deep. The overburden is a few feet of residual clay soil. Capacity of plant is eight tons per hour.

CLARKE COUNTY.

Rock Deposits.

(12) Clarke county has extensive rock deposits in the northeastern part where the Tallahatta Claiborne formation outcrops in a region of high, precipitous hills. This is the same formation that furnishes the gray quartzitic rock of Attala and Holmes counties.

The Mobile & Ohio Railroad cuts through this deposit at the Lauderdale-Clarke county line, the deep cuts exposing the rock extending from one mile north of Basic to Enterprise, a distance of five miles.

The greater part of the rock exposed in these cuts, which are 50 to 75 feet deep, consists of thin-bedded siliceous claystone, yellowish-white in color, of very low specific gravity, and for the most part soft, about the hardness of shale. Some of the strata are indurated into resistant beds that stand out in noticeable ledges.

At the top of the cuts are exposed beds of white quarzite two to four feet thick, separated by thin partings of softer materials, to a maximum of 20 feet.

None of this material has been used for road construction, but the quartzite, and to a less extent, the claystone, could be applied to that purpose. The rock could be easily quarried, and its outcrop along both the Mobile & Ohio Railroad and the New Orleans & Northeastern Railroad make it particularly available.

(13) In the extreme southwest corner of Clarke county, at Nancy and adjacent regions, outcroppings of the Vicksburg limestones occur within 2 to 3 miles of the New Orleans & Northeastern Railroad. The Vicksburg formations here consist of a capping of hard, buff-colored to blue limestone in individual beds of two to four feet thick separated by a few inches of soft marl. These beds have an aggregate thickness of 12 to 18 feet.

Below this capping of hard lime rock lies a considerable thickness (12 to 20 feet) of soft bluish limestone weathered, where exposed, to buff-color with ferruginous specks. This material is homogeneous, and of uniform hardness throughout.

Neither of these materials has been used in road construction, but the hard limestone crushed ought to be a very good road material. The soft limestone could be made an effective dressing, probably, on the clayey roads of the region. When crushed fresh from the quarry, spread, rolled, and exposed to the drying effects of the atmosphere during the dry seasons, the material would set and become very hard.

No other material suitable for road construction is known to occur in Clarke county .

COPIAH COUNTY.

Gravel Deposits.

(14) **Crystal Springs Gravel**—Numerous outcrops of gravel and sand are found around Crystal Springs and much gravelly soil occurs on the slopes of the ridges. Well records indicate that from 50 to 70 feet of sand and gravel exist in some of these deposits. The gravels are chiefly water-worn pebbles, consisting for the most part of yellow or white chert. The pebbles vary from the size of a pea to 3 inches in diameter.

These beds can be profitably washed for concrete material, especially where they are situated near a permanent water supply, and not too deeply covered with overburden. (See page 83.)

(15) **Wesson.**—Gravel occurs on the slopes and the crowns of the hills around Wesson and is pierced by the wells of that locality. The quality is very similar to that described above. (See page 84.)

Much of the gravel mentioned at both places is easily accessible to the Illinois Central Railroad.

Gravel Pit (15-A).

Owner: Walter S. Catchings, Georgetown, Miss.
Location of pit: One mile south of Georgetown on Copiah Creek.
Nearest railroad: New Orleans & Great Northern Railroad.
Operator: Walter S. Catchings, Georgetown, Miss.
Present output: No equipment; limited use locally.
Overburden: None.
Length of deposit: One-half mile.
Depth of deposit: 15-25 feet.
Clean, washed gravel, small uniform size; an excellent concrete gravel.

COVINGTON COUNTY.

Owner: Mrs. Ada C. Pettus, Ellisville, Miss.
Location of pit: Half mile west of Collins.
Nearest railroad: Gulf & Ship Island Railroad.
Pit is not operated at present.
Present output: Not equipped; worked from time to time with pick and shovel for local use.
Overburden: A few feet of soil.
Length of pit: Not given.
Depth of pit: Four to six feet.
No tests.
A good road gravel with high cementing qualities.
All this part of Covington has abundance of good road gravel lying within a few hundred yards of the Gulf & Ship Island Railroad.

Gravel Pit (17).

Owner: Dr. W. H. Pickering, Collins, Miss.
Location of pit: Station of Pickering, one mile west of Collins.
Nearest railroad: Gulf & Ship Island Railroad.

Operator: Used locally by the general public without charge.
Present output: No equipment; worked simply with pick and shovel for local use.
Overburden: A few feet of sandy soil.
Length of deposit: Large but little development.
Depth: Six to eight feet.

Gravel Pit (18).

Owner: Dr. W. H. Pickering, Collins, Miss.
Location of deposit: Pickering, Covington County, Miss., one-fourth mile southeast of railroad station.
Nearest railroad: One-fourth mile east of Gulf & Ship Island Railroad.
Not operated.
Present output: Deposit has been tested, but never developed; no equipment.
Overburden: Two or three feet of soil.
Deposit covers 240 acreas, but no pit.
Depth of pit: Gravel has been found to be 25 to 50 feet deep.
No test.
This gravel consists of brown chert pebbles of rather small uniform size, with a cementing material of red clayey sand. Cementing qualities good.

DeSOTO COUNTY.

Gravel Pit (19).

Owner: Flynn & Norrell, Olive Branch, Miss.
Location of pit: One mile southwest of Olive Branch on a spur from the Frisco Railroad.
Nearest railroad: St. Louis & San Francisco Railroad.
Pit is not operated at present.
Capacity when operated: Twenty-five carloads per day.
Overburden: Six to ten feet of soil.
Length of pit: 600 feet.
Depth of pit: 20 to 75 feet.

OTHER GRAVEL PITS.

(20) At Hernando, in DeSoto County, the streets are paved with chert gravel obtained from beds that outcrop all around the town. These deposits are continuous under all the hills westward all along to the Bluffs, and eastward for a distance of eight miles. Practically the whole western third of the county is underlain by good road-making gravel. Small local pits have been opened at a number of points, but have no equipment, the gravel being removed from the pit with pick and shovel. This gravel has a considerable proportion of sand-clay matrix, causing it to coment firmly in a road bed.

Depth of gravel 10 to 15 feet; with overburden generally of about 6 to 10 feet of loam soil.

FORREST COUNTY.

Gravel Pit (21).

Owner: I. V. Austin, Hattiesburg, Miss.
Location of pit: Near Rawls Springs, Forrest County, on a spur, one-fourth mile from Gulf & Ship Island Railroad bridge over Bowie River.
Nearest railroad: Gulf & Ship Island Railroad.
Operator: Dixie Gravel Co., Hattiesburg, Mississippi.
Present capacity: Eight cars of gravel and five cars of sand; 10,000 tons of gravel shipped in 1916.
Overburden: 10 to 18 feet of sand.
Deposit covers about 40 acres.
Depth of pit: 25 feet.

McCallum Gravel Pit (22).

Owner: J. P. Carter, Hattiesburg, Miss.
Location of pit: One mile south from McCallum Station.
Nearest railroad: Mobile & Great Northern Railroad.
Operator: Used by county for road construction.
Present output: No special equipment; worked in a limited way with shovel and scraper.
Overburden: One or two feet of soil.
Deposit covers 80 acres.
Depth of deposit: 25 feet.

Carter Gravel Pit (23).

Owner: J. P. Carter, Hattiesburg, Miss.
Location of pit: In Section 3, Township 3 north, Range 13 west; four miles south of Hattiesburg.
Nearest railroad: Mobile & Great Northern Railroad.
Operator: County operates pit on small scale.
Present output: No equipment; worked with shovel and scrapers.
Overburden: A few feet of soil.
Deposit covers 100 acres.
Depth: 20 to 25 feet.

Louisiana Gravel Pit (24).

Owner: Louisiana Gravel & Sand Co., Hattiesburg, Miss.
Location of pit: Hattiesburg, Miss., 2½ miles northwest, on Leaf River.
Nearest railroad: New Orleans & Northeastern Railroad.
Operator: Louisiana Gravel & Sand Co., Hattiesburg, Miss.
Capacity: 15 carloads.
Overburden: 3 or 4 feet of sandy soil.
Length of pit: 400 feet.
Depth of pit: 18 feet above water level; 30 feet below water level.
Clean washed concrete gravel.
(U. S. Office of Public Roads Test No. 9745.) See page 102.

Brooklyn Gravel Pit (25).

Owner: J. P. Carter, Hattiesburg, Miss.
Location of pit: Five miles south of Hattiesburg, on Hattiesburg and Brooklyn County Road.
Nearest railroad: Gulf & Ship Island Railroad.
Operator: County operates pit in a limited way for material for road repairing.
Present capacity: No regular equipment; worked with shovel and scrapers.
Overburden: A few feet of sandy soil.
Length of pit: Not stated.
Depth of pit: 25 feet.

Hattiesburg Gravel Pit (26).

Owner: Herbert Gilles, et al., Hattiesburg, Miss.
Location of pit: Three miles southeast of Hattiesburg.
Nearest railroads:... On Mississippi Central and Mobile & Great Northern Railroads.
Operator: Herbert Gilles, Hattiesburg, Miss.
Capacity with present equipment: 10 carloads.
Overburden: One to three feet of soil.
Deposit covers 10 acres.
Depth of deposit: 10 to 40 feet.

Inland Gravel Pit (27).

Owner: Inland Gravel Co., Hattiesburg, Miss.
Location of pit: One mile east of Hattiesburg.
Nearest railroads: On Mississippi Central and Gulf & Ship Island Railroads.
Operator: No longer operated.
Capacity with present equipment: Dismantled.
Overburden: A few feet of soil.
Length of pit: Not given.
Depth of pit: 20 to 30 feet.
Clean, washed gravel.

Maxie Gravel Pit (28).

Owner: Gulf & Ship Island Railroad, Gulfport, Miss.
Location of pit: Maxie, Forrest County, Miss.
Direction and distance from town or station: One-half mile west of station on spur track, also on public road.
Nearest railroad: On Gulf & Ship Island Railroad.
Operator: Gulf & Ship Island Railroad.
Overburden: A few feet of red sand.

FRANKLIN COUNTY.

Hamburg Gravel Pit (29).

Owner: Yazoo & Mississippi Valley R. R., New Orleans, La.
Location of pit: One mile northeast of Hamburg.
Nearest railroad: Yazoo & Mississippi Valley Railroad.
Operator: Yazoo & Misssisippi Valley Railroad.
Depth of pit: 18 to 25 feet.
Overburden: 4 to 6 feet of red loam.

HINDS COUNTY.

Well's Gravel Pit (30).

Owner: W. C. Wells, Jackson, Miss.
Location of pit: Two and three-fourths miles northeast from Raymond, at Thompson's Spur.
Nearest railroad: Natchez branch of Yazoo & Mississippi Valley R. R.
Operator: W. C. Wells, Jackson, Miss.
Capacity with present equipment: No equipment; operated with pick and shovel for local use.
Overburden: 3 to 5 feet of soil.
Length of pit: 75 feet.
Depth of pit: 12 to 18 feet.

OTHER PITS NEAR RAYMOND.

Gravel With Sand and Sandy Clay Matrix (30-A)

One mile east of Raymond two prominent hills are capped with gravel and sand deposits twenty-five feet thick, the lower ten feet being rusty red sands, with 15 feet of overlying gravel. While not extensive enough to put upon the market, these gravel deposits are of local value. Two or three small pits have been opened and are worked at intervals to meet local needs.

Cooper's Well, in this same vicinity, is surrounded by hills which contain extensive gravel deposits. These have not yet been developed, but possess potential value.

Coopers Well Gravel Pit (31).

Owner: A. D. Spengler, Raymond, Miss.
Location of pit: Cooper's Well.
Direction and distance from town or station: 3 miles north of Raymond
Nearest railroad: Yazoo & Mississippi Vailley R. R.—3 miles.
Operator: Not at present operated.
Capacity with present equipment: No equipment.
Overburden: 2 or 3 feet of soil.
Length of pit: 150 feet.
Depth of pit: 10 feet.

All the hills upon which the hotel and buildings are located, 20-25 acres in extent, show deposits of gravel 10 to 25 feet deep. The gravel is uniform in size, averaging about 1 inch in diameter, and having a sandy-clay matrix, which binds well.

Sand Gravel Pit (32).

Owner: Tom I. Brown, Jackson, Miss.
Location of pit: On Pearl River, just east of city of Jackson corporation line.
Nearest railroad: About 400 yards from Alabama & Vicksburg R. R.
Operator: Tom I. Brown, Jackson, Miss.
Capacity with present equipment: No equipment; sand is loaded on wagons with shovels.
No overburden.
Coarse, clean sand, suitable for mixture for concrete, or to put on clay road in vicinity of Jackson, making sand-clay roads.

Taylor Gravel Pit (33).

Owner: S. J. Taylor, Jackson, Miss.
Location of pit: On top of high ridge west of Jackson, Miss.
Direction and distance from town or station: Six miles west of Jackson, on high ridge, one mile north of Forest Hill School.
Nearest railroad: Natchez branch of Illinois Central R. R.
Operator: Not operated regularly. City of Jackson used this gravel for concrete pavements. Leased to Hinds County for five years.
Capacity with present equipment: About 10 carloads per day.
Overburden: 3 to 5 feet of red loam.
Length of pit: Extent of deposit is 5 or 6 acres; opened whole length.
Depth of pit: 5 or 6 feet.

Edwards Gravel Pit (34).

Owners: Lowrey & Rabb, M. Davis, et al., Edwards, Mississippi.
Location of pit: One mile northeast of Edwards, on Travelers Highway.
Nearest railroad: Alabama & Vicksburg Railroad.
Overburden: 6-12 ft. of soil.
Depth of pit: About 12-15 feet thick.

This gravel was used in building the highway, and is a good grade of road gravel.

Bolton Gravel Pit (34-A).

Owner: C. C. Clark, Duckport, La.
Location of pit: 6 miles northwest of Bolton, Miss., on Travelers Highway.
Nearest Railroad: A. & V. Railroad—3 miles.
Operator: Not operated; built gravel county road from this pit.
Overburden: 8 to 12 feet of soil.
Length of pit: In big hill.
Depth of pit: About 20 feet of gravel.

Dulaney Gravel Pit (34-B).

Owner: A. D. Dulaney, Terry, Miss.
Location of pit: Section 10, Township 3, Range 2 W, six miles west of Terry, on gravel road.
Direction and distance from town or station: Six miles west of Terry.
Nearest railroad or main county road: Dulaney road (I. C. R. R.).
Operator: A. D. Dulaney; only for local use.
Capacity and output: No equipment.
Overburden: A few feet of soil.
Length of pit: 250 yards.
Depth of deposit: Unknown.

HOLMES COUNTY.

(35) A large gravel deposit occurs in the edge of the bluffs on Providence plantation formerly owned by S. D. Gwin, estate, now owned and occupied by Champ Taylor. This deposit is covered by 18-20 feet of loess except where exposed in the slope of the hill by erosion. No pits have been opened on the deposit. U. S. Office of Public Roads give test No. 10484 of this gravel. The deposit is 8 miles northeast of Tchula and 6 miles east of Cruger.

A gravel deposit on Henry McGee plantation 3 miles east of Tchula and 3 miles north of Howard Station has been opened in a small way and locally used on roads.

A large gravel deposit is reported on the DeLoach plantation half a mile from Jones' Crossing. This has not been used.

Five miles north of Lexington on D. H. Hobbs' plantation occurs extensive gravel deposits that have been used in large quantities on local roads in District No. 1.

A gravel pit owned by Pahlen Bros. of Lexington has been opened two miles south of Lexington, and considerable gravel taken out for use on local roads. None of these pits have permanent equipment, being worked by shovels and scrapers.

Rock Deposits.

(36) **West Quartzitic Sandstone.**—The quarzitic layer of the Claiborne buhrstone is exposed at West in Holmes county. Outcrops occur on both sides of the Big Black River. The out-

crop on the west side of the river extends in a northwesterly direction for at least three miles, but it is not contiguous for this distance. The maximum thickness is about eighteen feet, but the average is not over six feet. In places the sandstone has a heavy overburden of clay or loam. The outcrops rarely form continuous ledges, but are more frequently isolated masses or boulders. The sandstones are friable, but the quartzitic masses are hard and difficult to break up even with explosives. This material has been used for road metal. A few years ago about one hundred carloads were shipped to Louisiana to be used for that purpose. This quartzite shows no absorption.

ITAWAMBA COUNTY.

Gravel Doposits.

(36-A) Itawamba county lies off the railroad lines in the state, so that there has been only very local working of the gravel deposits of the county. The extent of these deposits is not definitely known yet, although it is known that in the eastern parts of the county occur extensive outcrops of the Cretaceous gravels that are shipped extensively for road building from Tishomingo county and the adjacent counties of Alabama.

According to tests made in the U. S. Department of Agriculture, the gravels of Tishomingo county are of the very finest quality for graveling roads, having cementing qualities of a high order. The Itawamba gravels are in all probability equally good.

These deposits lie several miles south of the Illinois Central Railroad.

JASPER COUNTY.

Marathon Gravel Pit (37).

Owner: Marathon Lumber Co., Laurel, Miss.
Location of pit: Five miles northeast of Montrose, in Section 19, Township 4, Range 11; one and three-fourths miles from N. O., M. & C. R. R.
Nearest railroad: New Orleans, Mobile & Chicago Railroad.
Operator: Marathon Lumber Co., Laurel, Miss.
Overburden: 6 to 8 feet of sandy soil.
Capacity with present equipment: 10 car loads.
Deposit covers 20 acres.
Depth of pit: 30 feet.

Eureka Gravel Pit (38).

Owner: Eureka Gravel Company, Montrose, Miss.
Location of pit: Five miles northeast of Montrose, in Section 16, Township 4, Range 11 east, three miles from railroad.
Nearest railroad: New Orleans, Mobile & Chicago Railroad.
Operator: Not operated; has been tested, but never opened for use.

Capacity and output: No equipment; no output.
Overburden: 10 to 15 feet of sand.
Length of pit: Only test pits present. The gravel deposit makes a ridge a mile long.
Depth: From overburden to bottom of gravel, where tested or exposed, is 20 to 35 feet.
(U. S. Office of Public Roads Tests Nos. 7411 and 7412.) See page 108.

Rock Deposits.

(39) **Bay Springs Stone.**—About four miles west of Bay Springs in Jasper county there are outcrops of stratified white and yellow sandstone. Below the layers of sandstone are beds of clay. Above are Lafayette gravels, sands and ironstone, having a thickness of 20 or 30 feet. The sandstone has an absorption of 13.2%. The sandstone is too porous and soft to be of much value as a structural material. On the east bank of Tallahala Creek, at the crossing of the public road, there is an exposure of Vicksburg limestone. The upper ledge consists of a hard, bluish-grey limestone, which is of value as a structural material. The lower portion consists of a soft, unindurated material (limestone) which is easily cut, but is of little resistance. The limestone from this vicinity is used locally for building purposes and the burning of lime.

The Vicksburg limestone also outcrops three miles north of Bay Springs at a point about three-fourths of a mile west of the New Orleans, Mobile and Chicago Railroad. It has here, however, an overburden of at least 25 feet of red sands.

JEFFERSON COUNTY.

McNair Gravel Pit (40).

Owner: Yazoo & Mississippi Valley R. R., New Orleans, La.
Location of pit: One-half mile south of McNair.
Nearest railroad: Yazoo & Mississippi Valley Railroad.
Operator: Not now in operation.
Capacity with present equipment: Dismantled; gravel reported exhausted.

JEFFERSON DAVIS COUNTY.

Prentiss Gravel Pit (41).

Owner: Mississippi Central Railroad, Hattiesburg, Miss.
Location of pit: Prentiss, Jefferson Davis County, Miss., 250 yards west of station at Prentiss.
Nearest railroad: On Mississippi Central Railroad.
Operator: Mississippi Central Railroad.
Capacity with present equipment: Worked with shovels and scrapers; output not very large.
No overburden; gravel at surface.
Length of pit: 250 feet.
Depth: 10 feet.

Other Gravel Deposits.

(42) **Mount Olive Road.**—The structural materials of this county are confined to the sands and gravels of the Citronelle formation. Some of the gravel deposits are very promising. A sample of gravel was collected from an outcrop four miles west of Mount Olive by Mr. E. S. Porter, who gives the following description of the occurrence:

"On a cut on the Mount Olive Road, four miles west of Mount Olive, from four to six feet of gravel is exposed; the lower limitation of the gravel is not exposed, good gravel being found at the lowest part of the cut. Some sand is also present, the gravel itself ranging in size from a pigeon's or bantam's egg to a hickory nut. No other excavation has been made in the deposits than the road cut, but from the fact that on either side of the road, gravel is found near the surface, it is probable that the low hill at this point is largely composed of gravel and sand similar to that exposed in the road cut." See page 84.

JONES COUNTY.

Moselle Gravel.

(43) A bed of gravel occurs on the Leaf River bottom about three miles south of Moselle on the Estabutchie Road, half a mile west of the New Orleans & Northeastern Railroad. The thickness of the bed is not revealed, as only the upper surface is exposed. A little of the gravel has been removed for road purposes. The gravel contained about 30% of sand. See page 84.

LAMAR COUNTY.

Local Gravel Pit (44).

Location of pit: Small local gravel beds, average every three miles along Jackson Highway, between Lumberton and Hattiesburg.
Nearest railroad or main county road: New Orleans & Northeastern Railroad, and Jackson Highway.
Operated locally.
Capacity and output with present equipment: No permanent equipment.
Overburden: Not over two feet.

LAUDERDALE COUNTY.

Rock Deposits.

(45) Gravel deposits do not occur in Lauderdale county. The chief road-making material is the Tallahatta Claiborne quartzite and clay stone already described as occurring in the adjoining county of Clarke. These materials are abundant in

southern Lauderdale, capping the high hills around Meridian, and is tunnelled through by the Alabama & Vicksburg Railroad at Lost Gap, six miles southeast of Meridian. These materials occur also in the hills of northeastern Lauderdale on the Meridian & Memphis Railroad between Durfee and Little Rock.

The claystone is much more abundant than quartzite, and is a less satisfactory road material. This material occurs all along the Alabama & Vicksburg Railroad as far west as Chunkey, in Newton county.

Sand for putting upon clay roads is found abundantly in all parts of the county.

LINCOLN COUNTY.

Brookhaven Gravel Pit.

Owner: Brookhaven Gravel Co., Brookhaven, Miss.
Location of pit: Brookhaven, Miss.
Direction and distance from town or station: Seven miles east of Brookhaven.
Nearest railroad or main county road: I. C. R. R.; gravel road to Brookhaven.
Operator. Brookhaven Gravel Co., Brookhaven, Miss.
Capacity with present equipment: 200 cars per day.
Overburden: 3 to 4 feet over face of 6,200 feet sandy loam and clay.
Length of pit: 6,200 feet.
Depth of pit: 35 feet.
(U. S. Department of Public Roads Test No. 7581.) See page 111.

Illinois Central Gravel Pit (46).

Owner: Illinois Central Railroad, Chicago, Illinois.
Location of pit: Brookhaven gravel pits, six miles east of Brookhaven, Miss.
Nearest railroad: Located on spur of Illinois Central R. R.
Operator: Illinois Central Railroad.
Capacity with present equipment: 25 to 50 carloads.
Overburden: 2 to 3 feet of soil.
Length of pit: One and one-fourth mile.
Depth of pit: 40 to 50 feet.

McGrath Gravel Pit (47).

Owner: McGrath Brothers, Brookhaven, Miss.
Location of pit: Two miles south of Brookhaven, Miss.
Nearest railroad: On spur of Illinois Central Railroad.
Operator: McGrath Brothers, Brookhaven, Miss.
Capacity with present equipment: 25 carloads per day.
Overburden: A few feet of soil.
Cubic contents of deposit three million cubic yards.
Depth: 50 to 75 feet. See page 85

Allen Gravel Pit (48).

Owner: E. S. Allen, Brookhaven, Miss.
Location of pit: Two miles east of Brookhaven; gravel road connecting with railroad.
Nearest railroad: Illinois Central Railroad.

Operator: E. S. Allen, Brookhaven, Miss.
Capacity with present equipment: Approximately 500 yards per day.
Overburden: A few feet of clay soil.
Length of pit: 5 acres.
Depth of pit: 5 to 30 feet.

LOWNDES COUNTY.

Tombigbee Gravel Pit (50).

Owners: C. F. Sherrod, W. N. Tuckett, Dave Bowlin, Columbus, Miss.
Location of pit: Adjoining corporation line of city of Columbus, on west bank of Luxapalila River.
Nearest railroad: On Mobile & Ohio Railroad.
Operator: Sherrod Gravel Company, Tuckett Gravel Company, Bowlin Gravel Company.
Output with present equipment: Four carloads per day for each company; output easily increased.
Overburden. A few feet of soil.
Length of pit: 400 yards.
Depth of pit: 10 to 20 feet. See page 86.

MADISON COUNTY.

Marl Deposits.

(51) Madison county is without gravel deposits of economic importance, and has no rock that could be classified as road material. A zone several miles wide of weathered glauconitic sandy marl passes across the county from southeast to northwest. It is best seen on the Canton and Camden county road both north and south of Sharon. This material is intensely red, somewhat fossiliferous, and contains sand and clay in proper proportions to make a sand clay road. That part of the county road which traverses this marl outcrop after being properly constructed, needs no gravel or other surfacing. The marl, which is slightly calcareous, cements to a perfectly firm road bed, remaining firm in both dry and wet weather. It deserves further tests.

MARION COUNTY.

Southern Gravel Pit (52).

Owner: Jahncke Navigation Co., New Orleans, La.
Location of pit: Columbia, Miss.
Nearest railroad: Gulf & Ship Island R. R.
Operator: Southern Gravel & Sand Company, Columbia, Miss.
Capacity with present equipment: 15 to 25 carloads per day.
Overburden: 4 to 6 feet of soil.
Length of pit: Not given.
Depth of pit: Not given.

A well log at the school house well, Columbia, shows depth of gravel 16 feet.

Foxworth Gravel Pit (53).

Owner: Southern Gravel & Sand Co., 814 Howard Ave., New Orleans.
Location of pit: Condron, Mississippi, about 3 miles north of Foxworth Station on New Orleans & Great Northern R. R.
Nearest railroad: One-fourth mile from main line of N. O. & G. N. R. R.
Operator: Southern Gravel & Sand Company, 814 Howard Ave., New Orleans, La.
Capacity with present equipment: From 5 to 10 cars per day.
Overburden: From 3 to 4 feet.
Length of pit: About 1,000 feet.
Depth of pit: About 20 feet.

MONROE COUNTY.

Monroe county contains building sands derived from the Eutaw and the Lafayette, and gravels from the latter. The thickest gravel beds are along the valley of the Tombigbee River.

(54) **Amory Gravel.**—The town of Amory is built on a terrace of the Tombigbee River. The terrace is composed of a bed of clay and loam, overlying a bed of gravel and sand. The former has a thickness of 8 to 10 feet, while the latter varies from 12 to 20 feet. The gravel layer is exposed in the clay pit of the Tubbs Brick Plant in Amory, where the overburden of clay has been stripped off. The gravel is also exposed on the borders of the terrace between the town and the river. An exposure occurs on the Cotton Gin Port Road, about three-quarters of a mile southwest of Amory. A sample of this gravel was given a mechanical separation with the results recorded in No. 54 of the Table of Tests. See page 86.

(55) **Stockton Gravel.**—Gravel outcrops on the Stockton farm, four miles north of Amory, on the Smithville road; the total thickness of the bed is not exposed in the outcrop, but well records show a thickness for that part of the valley of from 10 to 20 feet. Test was made of a sample of this gravel. See page 86.

(56) **Bigbee Bridge Gravel and Sand.**—In the Tombigbee River bed at Amory, there is a deposit of sand and gravel. The deposit occupies a bar on the east side of the stream bed from the wagon bridge down to the Frisco Railroad bridge. The sand and gravel are derived from the second bottom deposits which have been cut into by the river at points higher up. The sand and gravel in this deposit are washed clean by the water of the stream and are used for concrete and plaster. See page 86.

MONTGOMERY COUNTY.

Marl Deposits.

(57) Montgomery county lies mostly in the division of the Tallahatta-Claiborne formation, which is characterized by glauconitic sands and sandy marls of a deep Indian red. Most of these deposits have an admixture of clay, with usually a little lime, that causes the material when properly spread out upon a roadbed to cement very firmly and make an excellent road in both wet and dry weather. If properly cared for such a road becomes very firm, being neither very dusty in dry weather nor very muddy in wet weather. When the road passes through a region where these marls outcrop, it is only necessary to shape the road up, raising the center and providing for drainage at the sides. When the marl is applied as a dressing to a road, after proper preparation of the roadbed, providing for adequate drainage, the marl should be applied at least 8 inches to 12 inches deep, and thoroughly rolled until a firm and compact roadbed is made.

NESHOBA COUNTY.

Rock and Marl Deposits.

(58) Neshoba county presents in most of its area only sands as a material suitable for use in road construction. This, however, occurs in abundant outcrops along the course of the New Orleans, Mobile & Chicago Railroad. These sand deposits in most localities contain enough clay to make them suitable, with a slight addition of clay, for a sandy-clay mixture, and could be used where the roadbed would furnish the additional clay. Other sands could be used on clay roads.

In southwest Neshoba, however, the Tallahatta Claystone outcrops a few miles southeast of Philadelphia and west and southwest of Philadelphia. This rock is identical with that described from Clarke and Lauderdale Counties (see page 53).

(59) Associated with these rock outcrops red glauconitic marls occur along the New Orleans, Mobile & Chicago Railroad from McDonald south to the county line. This material has road-making qualities like those described from Carroll and Montgomery counties.

Neither of these materials has been quarried or used, so far as is known.

NEWTON COUNTY.

Marl and Rock Deposits.

(60) The Tallahatta Claystone described from Neshoba county passes into northeastern Newton, occurring in deep conspicuous cuts along the Meridian & Memphis Railroad from Little Rock southeastward into Lauderdale county.

(61) Exposures of the deep red glauconitic sandy marls that have been mentioned as occurring in southern Neshoba, extend southward into Newton, the town of Union being built upon an eminence of this material. This material is identical with that described from Carroll and Montgomery counties (see pages 51, 66), has identical properties, and occurs in cuts along the New Orleans, Mobile and Chicago Railroad in great quantity.

NOXUBEE COUNTY.

Bigbee Gravel Pit (62).

Owner: Mrs. Monk.
Location of pit: One in northeastern part of county, and one in eastern part; both in Tombigbee bottom. Neither operated.
Direction and distance from town or station: One about 18 miles from Brooksville, Miss., and the other about 18 miles from Macon, Miss.
Nearest railroad or main county road: Both on good roads.
Operator: Not operated at present.
Capacity with present equipment: Handled by pick and shovel.
Overburden: Do not know.
Length of pit: Small pit for local use.
(U. S. Office of Public Roads Test No. 5884.) See page 122.

Rock Deposits.

(64) The Selma Chalk, similar to that described from Chickasaw county, outcrops at Macon, Noxubee county, at the junction of Macon Creek with Noxubee River. The rock is here of average and uniform hardness, averages about 76 per cent of Calcium Carbonate, and is blue to buff color. The bluffs here expose 25 to 30 feet of the typical Selma rock. This is three-fourths mile from the Mobile & Ohio Railroad.

Around Brooksville, the Selma Chalk everywhere underlies a few feet of residual soil.

In a great cut on the Mobile & Ohio Railroad, three miles north of Shuqualak, this rock is exposed in a section 400 feet long and 20 feet deep.

While not an ideal road material, applications of this material crushed to sizes of a walnut could be used to advantage in making possible difficult stretches of road. See page 87.

(63) **Prairie Point Limestone.**—On the D. Cresswell farm, about one-half mile east of Prairie Point, and 12 miles east of Macon, there is a somewhat resistant layer in the Selma chalk. Rock from this layer has been used in constructing about a half a mile of public road. The rock is too soft to last long in such works. It has an absorption of 16.8%, which is entirely too high for a durable road metal. A chemical analysis of a sample of this limestone is found in the tables under the heading "Tests."

The large amount of carbonate of lime found in this limestone, combined with the extremely low percentage of impurities, is an excellent indication of its adaptability to the manufacture of quick lime. A similar limestone is found in the vicinity of Cliftonville, where it forms a capping for a low range of hills.

OKTIBBEHA COUNTY.

Rock Deposits.

(65) Oktibbeha county, like most of the prairie counties, is not supplied with the best quality of road making material. It is supplied, however, with abundant outcrops of the Selma chalk, which presents its typical characteristics as seen in Chickasaw and Noxubee counties (pages 51, 67) in the eastern part of Oktibbeha, the rock in the western part being rather sandy. This, together with sands of later geological age, and some brown concretionary iron sandstone that caps the hills of the western edge of the county, furnishes available sands to apply to the prevailingly clay roads which are found in most parts of the county. These are accessible to the Mobile & Ohio and the Illinois Central railroads.

PANOLA COUNTY.

Robertson Gravel Pit (66).

Owner: Miss A. Robertson, Sardis, Miss.
Location of pit: One and one-half miles east of Sardis.
Nearest railroad: Illinois Central Railroad.
Operator: Not regularly operated.
Capacity and output: No equipment; only used locally.
Overburden: 6 feet of clay soil.
Length of pit: Small pit 30 to 40 feet.
Depth of pit: 6 to 10 feet.

Sardis Gravel Pit (67).

Owner: Illinois Central Railroad, Chicago, Ill.
Location of pit: Four miles south of Sardis.
Nearest railroad: Illinois Central Railroad.
Operator: Not operated.
Capacity with present equipment: Pit dismantled; no output.
Overburden: 4 to 6 feet of red loam soil.

OTHER GRAVEL DEPOSITS.

Other Gravel Deposits: The gravel deposits in the vicinity of Sardis lie in all directions for the town, and the supply is extensive and so far but little developed. Several small pits have been opened from time to time, two or three miles east of Sardis, from which considerable gravel has been taken for local use and for street paving in neighboring towns. The depth of the gravel has not been penetrated in these pits which expose only 5 or 6 feet of gravel. The overburden is 3 to 5 feet of brown loam of loessal origin.

On the whole these gravel deposits furnish gravel of uniform size, the pebbles having an average size of a quail's egg, seldom as large as a hen's egg, mostly chert of rich olive to brown color, with considerable proportions of sand and in places, clay. Where clay is not present the sand can be screened out, and the material is suitable for concrete mixtures.

Batesville Gravel Pit (67-A).

Owner: Batesville Gravel & Material Co., Batesville, Miss.
Location of pit: Near Batesville, Mississippi.
Direction and distance from Station: One-half mile south of station; lies between Illinois Central and Batesville Southwestern.
Nearest railroad: Spur from Illinois Central to pit.
Operator: Batesville Gravel & Material Co., Batesville.
Capacity with present equipment: Just opening with new steam shovel. Estimated 40 carloads a day.
Overburden: Not stated.
Length of pit: Large deposit.
(U. S. Office of Public Roads Test No. 7450.) See page 122.

Askew Gravel Pit (67-B).

Owner: N. A. Dawson, Tunica, Miss.
Location of pit: Between Sarah and Crenshaw.
Direction and distance from town or station: 1½ miles northeast of Askew, on spur 2,000 feet long.
Nearest railroad: Illinois Central Railroad.
Operator: A. M. Bradford, Tunica.
Capacity with present equipment: Equipped with steam shovel; 25 carloads a day.
Overburden: 1-6 feet of soil.
Length of pit: 600 feet.
Depth of pit: 30 feet.
Gravel uniform in size; good cementing quality.

PEARL RIVER COUNTY.

Seale Gravel Pit (68).

Owner: N. B. Seale, Poplarville, Miss.
Location of pit: One mile northeast of Poplarville.
Nearest railroad: New Orleans and Northeastern Railroad.
Operator: N. B. Seale, Poplarville.
Capacity with present equipment: No particular equipment; operated in a small way for local use.
Overburden: A few feet of red sand.
Another small pit seven miles north of Poplarville, also used locally. See page 87.

PERRY COUNTY.

Gravel Pit (69).

Owner: New Orleans, Mobile & Chicago Railroad, Mobile, Alabama.
Location of pit: Richton, Perry County, Miss., one and one-half mile south of New Augusta, Miss.
Nearest railroad: New Orleans, Mobile & Chicago Railroad.
Operator: New Orleans, Mobile & Chicago R. R. Company.
Overburden: 3 to 6 feet of soil. See page 123.

PIKE COUNTY.

Gravel Pit (70).

Owner: Illinois Central Railroad, Chicago, Illinois.
Location of pit: Half mile south of Chatawa.
Nearest railroad: Illinois Central Railroad.
Operator: Not now in operation.
Capacity with present equipment: Pit dismantled, but old spur could be easily and quickly replaced.
Overburden: Four to six feet of sand.
Length of pit: 350 feet.
Depth of pit: 25 to 35 feet.
This gravel pit, while dismantled, is by no means exhausted. Great quantities of gravel being still available by running further into the hills.

Gravel Pit (71).

Owner: Illinois Central Railroad, Chicago, Illinois.
Location of pit: One-fourth mile south of station at Osyka.
Nearest railroad: Illinois Central Railroad.
Operator: Not in operation.
Capacity with present equipment: No output.
Overburden: 4 feet of sandy loam.
Depth of pit: 14 feet. See page 87.

RANKIN COUNTY.

Rock Deposits (72).

Owner: Jackson State National Bank, Jackson, Miss.
Location of quarry: Two miles southeast of Rankin, on spur of Alabama & Vicksburg Railroad.
Nearest railroad: Alabama & Vicksburg.
Operator: Not operated at present.
Capacity and output: No output; quarry dismantled.
Overburden: 4 to 6 feet of clay soil.
Length of quarry: 250 feet.
Depth of quarry: 18 feet.
The material consists of hard Vicksburg limestone in beds two to three feet thick, inter-stratified with thin beds of soft sand. Difficult to quarry on account of the alternating hard and soft beds. See page 88.

SCOTT COUNTY.

Owners: Mrs. J. M. Mathews, J. W. Nelms, Jeff Kent, Norris, Miss.
Location of pit: Four miles east of Forest, Miss.
Nearest railroad: Alabama & Vicksburg Railroad.
Operator: Harvey Jones, Norris, Miss.
Capacity and output: Gravel deposits almost unlimited; equipment crude.
Overburden: 6 to 10 feet of red sand.

Gravel Pit (74)

Owner: Hall & Ligon Lumber Co., Morton, Miss.
Location of pit: 1½ miles north of Morton.
Nearest railroad: Alabama & Vicksburg Railroad.
Operator: Hall & Ligon Lumber Co.
Capacity and output: New pit; has been prospected, but no equipment installed.
Overburden: A few feet of red sand.
Extent: Gravel deposit one-fourth mile long and 40 feet deep.
Depth of pit: Opened only a few feet—ten to twelve.
Red gravel with clayey sand binder. A good road gravel.

SIMPSON COUNTY.

Gravel Pit (75).

Owner: D. J. Morrison, Jackson, Miss.
Location of pit: One mile south of Weathersby on Gulf & Ship Island R. R.
Nearest railroad: Gulf & Ship Island Railroad.
Operator: A. W. Dent, Mendenhall, Miss.

Gravel Pit (75-A).

Owner: Simpson County Gravel Co., Saratoga, Miss.
Location of pit: Saratoga.
Direction and distance from town or station: North of Station on spur 300 yards long on west side of G. & S. I. R. R. track.
Nearest railroad: G. & S. I. R. R.
Operator: Simpson County Gravel Co., G. B. Harris, Manager, Saratoga.
Capacity with present equipment: Steam shovel; 25 cars per day.
Overburden:... 2 or 3 feet soil.
Length of pit: 175 yards.
Depth of pit: 20 to 38 feet.
(U. S. Bureau of Public Roads Test No. 14688.) See page 127.

Gravel Pit (76).

Owner: Mississippi Gravel Co., J. D. George, Manager, Weathersby, Miss.
Location of pit: Two miles south of Weathersby, on Gulf & Ship Island Railroad.
Nearest railroad: Gulf & Ship Island Railroad.
Operator: J. D. George, Weathersby, Miss.
Capacity and output with present equipment: 70 carloads per day; one large steam shovel.
Overburden: 2 to 4 feet of soil.
Length of pit: 800 feet.
Depth of pit: 25 to 40 feet.
Gravel furnished to Camp Shelby when tests were made.

Gravel Pit (77).

Owner: J. T. Jones Estate; Gulfport, Miss.
Location of pit: One and three-fourths miles south of railroad station at Weathersby.
Nearest railroad: Gulf & Ship Island Railroad.
Operator: Gulf & Ship Island Railroad, for ballast. Not at present operating.
Capacity and output with present equipment: 40 carloads per day; no regular equipment at present.
Overburden: 10 to 12 feet of red sand.
Length of pit: 1,000 feet.
Depth of pit: 40 feet. See page 89.

Gravel Pit (78).

Owner: Yellow Pine Lumber Co., D'Lo, Miss.
Location of pit: Two miles from D'Lo.
Nearest railroad: Gulf & Ship Island Railroad.
Operator: Not developed.
Capacity and output: No equipment installed.
Overburden: 5 to 8 feet of soil.
Extent of deposit: Deposit estimated at half a million cubic yards.

SMITH COUNTY.

(79) The Vicksburg limestone outcrops in a zone running nearly east and west through Smith county. The formation presents here characters very much as in Clarke county (see page 52), the lower parts being a soft buff-colored limestone, the upper parts consisting of alternating beds of soft marl and hard limestone. In the hills four or five miles west of Bay Springs, bluffs 25 to 40 feet high border Tallahala Creek, all of which expose the Vicksburg limestone, the upper 10 to 15 feet being the hard rock phase. This rock was quarried some years ago on land belonging to ex-Governor A. H. Longino, of Jackson. The quarry is not now in operation. A spur from the New Orleans, Mobile & Chicago Railroad was contemplated, but has never been constructed.

STONE COUNTY.

Gravel Pit (79-A).

Owner: Harrison County, Gulfport.
Location of pit: One mile northwest of McHenry on spur of G. & S. I. one-third mile long.
Direction and distance from town or station: One mile northwest of McHenry, at old Perry Station.
Nearest railroad: G. & S. I. R. R.
Operator: Harrison County.
Capacity and output with present equipment: 425 carloads per day. Present equipment scrapers and mule teams.
Overburden: None.
Length of pit: 34 acres, all gravel.
Depth of pit: 31 feet.
(U. S. Department Public Roads Test No. 9936.) See page 106.

TALLAHATCHIE COUNTY.

Gravel Pit (79-B).

Owner: P. H. Sherman, Charleston, R. F. D.
Location of pit: Eight miles north of Charleston.
Nearest railroad or main county road: On Charleston and Tocawa road 4 miles from Batesville, Southern Railroad.
Operator: No pits opened, except test pits by Illinois Central Railroad, which is reported to have found the deposit very extensive.
Capacity and output, in carloads per day, with present equipment: No equipment.

Gravel Pit (79-C).

Owner: W. K. Black, Oakland, Miss.
Location of pit: Charleston.
Direction and distance from town or station: Two miles south of Charleston, in Bluff Hills.
Nearest railroad or main county road: Yazoo & Mississippi Valley R. R., at Charleston.
Capacity with present equipment: No equipment.
Overburden: 6 to 25 feet of loess silt and sand.
Length of pit: 100 feet.
Depth of pit: 10 to 15 feet.

TATE COUNTY.

Buxton Gravel Pit (80).

Owner: Yazoo & Mississippi Valley R. R., New Orleans, La.
Location of pit: Buxton, Tate County, Miss., on Y. & M. V. R. R., one mile south of Sarah.
Nearest railroad: Yazoo & Mississippi Valley R. R.
Operator: Yazoo & Mississippi Valley R. R.
Capacity and output with present equipment: 1,000 cubic yards per day.

(81) Gravel deposits underlie the whole region of this county from the bluffs bordering the Mississippi lowlands eastward for 12 to 15 miles. The gravel is of the type prevalent in the western part of the state, consisting of brown chert gravel of rather uniform size, with a cementing material of red sand and clay, the percentage of sand often being too high to make a perfectly satisfactory gravel road.

No pits have been opened in these gravels except small ones for local use on individual farms. The gravel deposits are undoubtedly very extensive and vary in depth from a few feet to 20 to 25 feet, the overburden being 5 to 6 feet of loam soil toward the eastern part of the gravel region, and thickening westward to the bluffs, where the gravel lies beneath 25 or 30 feet of loess.

Around Senatobia are several small pits; one three miles east of town, one four miles east, and one four miles west. All these deposits lie along the line of the Illinois Central Railroad.
See page 128.

TIPPAH COUNTY.

Rock Deposits.

(82) Limited deposits of limestone and sandstone occur in this county. The uplands of the county are largely sandy clay ridges that have sand and clay very well proportioned for sand-clay roads.

In the edges of the hills two or three miles west of Ripley, a ledge of hard crystalline limestone outcrops. This is 10 to 20 feet thick, and is covered by glauconitic sands 15 to 25 feet thick. The rock would make a very good road metal. This limestone outcrops at intervals north and south through the county within accessible distance of the New Orleans, Mobile & Chicago Rail-

road. A speckled gray sandstone of moderate toughness caps the high hills in north Tippah around Walnut and Tipplersville, on both sides of the railroad. The supply is limited, and would be important only locally.

TISHOMINGO COUNTY.

Gravel Pit (83).

Owner: Geo. T. Wofford, Johnson City, Tennessee.
Location of pit: Two miles north of Golden, on east side of Bear Creek.
Nearest railroad: Illinois Central Railroad.
Operator: Not opened for operation.
Overburden: 3 to 6 feet of sandy clay soil.
Capacity and output: Not equipped at present, and no output.
Extent: Deposit 700 by 1,800 feet.
Depth of pit: Average 40 feet.

Gravel Pit (84).

Owner: C. D. Smith & Co., 1630 Exchange Building, Memphis, Tenn.
Location of pit: Four miles east of Iuka, Miss.
Nearest railroad: Southern Railroad.
Operator: C. D. Smith & Co., Memphis, Tenn.
Capacity with present equipment: 50 carloads per day.
Overburden: 3 to 6 feet of soil.
Length of pit: 600 yards.
Depth of pit: 50 to 75 feet.

Gravel Pit (85).

Owner: Tishomingo Gravel Co., Jackson, Miss.
Location of pit: Morrison Siding, five miles east of Iuka, Miss.
Nearest railroad: Southern Railroad.
Operator: Tishomingo Gravel Co., D. J. Morrison, Manager, Jackson, Miss.
Capacity with present equipment: 100 carloads per day.
Overburden: 3 to 6 feet of soil.
Length of pit: One half mile.
Depth of pit: 50 to 75 feet.

Gravel Pit (86).

Owner: Allen Gravel Company, Iuka, Miss.
Location of pit: Three miles east of Iuka, Miss.
Nearest railroad: Southern Railroad.
Operator: Allen Gravel Company, Iuka, Miss.
Capacity with present equipment: At least 50 carloads per day.
Overburden: 5 to 6 feet of soil.
Length of pit: 600 yards.
Depth of pit: 40 to 60 feet.
(U. S. Office of Public Roads Test No. 7559.) See page 129.

Rock Deposits.

Limestone, Sandstone, and Chert occur in this county in sufficient quantity to be important for road-making. These rocks represent the Paleozoic formations of the state, which outcrop only in this and the adjoining county of Itawamba.

(87) **Tishomingo City Gravel.**—A few hundred yards south of the station at Tishomingo City, there is a deposit of water-worn chert gravel of considerable thickness. This gravel has been used for local structural purposes and also shipped to Corinth and other places. The bed of gravel probably belongs to the Tuscaloosa formation. The outcrop on the east side of the track is owned by the Tishomingo City Gravel Company. A little farther south, on the J. E. Norman place, the outcrop covers eight to nine acres, and the deposit has a thickness of from 20 to 30 feet. The mechanical condition of these two gravels is recorded in the Tables of Tests. See page 89.

(88) Limestone of Devonian age outcrops in the bluffs of the Tennessee River from the northwest corner of the county to the vicinity of old Eastport at the mouth of Bear Creek. These beds consist of a hard gray rock of fine, uniform texture, very compact and heavy. The material would undoubtedly form a fine road metal, unsurpassed by any limestone used for the purpose. This rock is overlain by a bluish shaly limestone, which forms a natural cement.

The exposures in the vicinity of Bugg Hollow and southeastward to Eastport are continuous and unlimited in quantity, and would be easily accessible to Tennessee River.

On the west side of Bear Creek near the wagon bridge, almost due east of Iuka, the steep slopes expose thick ledges of fine, hard limestone, very tough and intractable under the hammer. These ledges are largely covered by slope wash and slump, but appear to be 25 to 30 feet thick, with overburden of bedded chert, which is even better road material. The outcrop extends along the hills a distance of several miles.

This rock lies within one mile of the Riverton branch of the Southern Railroad.

No quarries are operating in either of the above limestone outcrops. See page 89.

(89) **Chert.**—In the same region with these limestones, and outcropping above them in the Tennessee River and Bear Creek bluffs to a thickness of 50 feet or over, extensive deposits of bedded chert occur. This material is a buff color, is finely jointed, and at most exposures immense quantities are so broken up as to appear to have been crushed into sizes suitable for road metal.

Lying several miles from the Southern Railroad, these deposits have thus far received no development. No quarries have been opened at any point along the outcrop. The most favorable site for quarries are: On land of R. W. Busby near the mouth of Indian Creek, nine miles north of Iuka and one and one-half miles from Tennessee River; at the point of the hill between Bear Creek and a northward flowing tributary one mile southeast of Eastport on Tennessee River; half a mile west of the wagon bridge over Bear Creek seven miles east of Iuka. At the first two mentioned localities, a quarry would be accessible to Tennessee River; at the third, to the Riverton branch of the Southern Railroad, one mile distant. See page 89.

(90) **Sandstone.**—On the west bank of Bear Creek three and one-half miles northeast of Tishomingo City is an extensive exposure of light gray sandstone of medium fine texture. This sandstone occurs in heavy beds one to eight or ten feet thick, and broken by joints into immense rectangular blocks. The material has been tested for building purposes, with results as shown elsewhere (page 90). It has never been used for road making and probably would not prove very satisfactory, although possessing considerable toughness.

The stone belongs to the North Mississippi Traction Company, Iuka, Miss.; a quarry has been opened and a spur built from the Illinois Central Railroad at Tishomingo City. The quarry is not now operating. No equipment. See page 90.

WARREN COUNTY.

Gravel Pit. (91).

Owner: Miller Engineering Co., Vicksburg, Miss.
Location of pit: On Yazoo River, one mile north of Yazoo & Mississippi Valley Railroad station at Vicksburg.
Nearest railroad: Yazoo & Mississippi Valley Railroad.
Operator: Miller Engineering Co., Vicksburg, Miss.
Capacity with present equipment: 750 cubic yards per day.
No overburden; river gravel.
Length of pit: 150 yards.
Depth of pit: 15 to 20 feet.
Clean washed gravel suitable for concrete.

Gravel Pit (92).

Owner: J. H. Adams, Vicksburg, Miss.
Location of pit: Three miles north of Vicksburg, Miss.
Nearest railroad: Yazoo & Mississippi Valley Railroad.
Operator: J. H. Adams, Vicksburg, Miss.
Capacity with present equipment: No equipment; worked with shovel and scraper for local use.

Gravel Pit (92-A.)

Owner: John Bianchi, Vicksburg, Miss.
Location of pit: At Spout Springs, four miles north of Vicksburg.
Nearest railroad: Yazoo & Mississippi Valley Railroad.
Operator: John Bianchi, Vicksburg, Miss.
Capacity and output: No permanent equipment; worked at irregular intervals with pick and shovel.
Overburden: 10 to 40 feet of loess.
Length of pit: 75 yards.
Depth of pit: 12 to 20 feet.
This gravel contains a high percentage of sand with little clay, and is better suited for the making of concrete than for road surfacing. The pits are rather limited, the gravel having been used locally only. The supply of gravel is apparently considerable, probably much greater than is revealed.

Gravel Pit (93).

Owner: Memphis Stone & Gravel Co., 1630 Exchange Building, Memphis, Tenn.
Location of pit: Whittaker, Warren County, Miss., a few miles south of Vicksburg.
Nearest railroad: Yazoo & Mississippi Valley Railroad.
Operator: Memphis Stone & Gravel Co., 1630 Exchange Building, Memphis, Tennessee.
Capacity with present equipment: 2,000 tons daily.
No overburden; clean river gravel.
Length of pit: 300 yards.
Depth of pit: 12 to 25 feet.
Good concrete gravel.

Rock Deposits.

(94) **Vicksburg.**—The Vicksburg formation received its name from the city of Vicksburg, located on the bluffs of the Mississippi, at the confluence of the Yazoo. The Vicksburg limestone underlies the city, and outcrops along the bluffs of the river. The limestone occurs in layers interbedded with marls and clays. The thickness of the layers varies from one and one-half to five feet. The amount of overburden and interbedding, in many places, will prevent the economical utilization of the limestone unless some use can be found for the former. The following section is exposed near the Refuge Oil Mill at Vicksburg:

Section of Vicksburg Limestone at the Refuge Oil Mill, two and one-fourth miles south of Vicksburg:

9.	Loess in the bluff back from the river	100 feet
8.	Marl	2 feet
7.	Ledge of hard limestone	3 feet
6.	Bed of soft marl	3 feet
5.	Ledge of limestone	5 feet
4.	Marl stratum	5 feet
3.	Ledge of hard limestone	5 feet
2.	Hard limestone	3 feet
1.	Bed of compact marl	5 feet

A table of analysis of the different beds of the above section is given on page 90, Sec. IV.

WASHINGTON COUNTY.

Gravel Pit (95).

Owner: Greenville Stone & Gravel Company, 1628 Exchange Bldg., Memphis, Tenn.
Location of pit: Bed of Mississippi River, one-half mile west of Greenville.
Nearest railroad: At junction of Yazoo & Mississippi Valley and Southern Railroads.
Operator: Greenville Stone & Gravel Co.
Capacity with present equipment: 50 carloads per day.
Overburden: A few feet of loess sand.

(U. S. Office of Public Roads Tests Nos. 10470 and 10471.)
Gravel deposits on this river front are almost unlimited in quantity. The gravel is clean washed gravel suitable for concrete; not well adapted to gravel road building, because of absence of cementing qualities.

WAYNE COUNTY.

Rock Deposits.

Wayne county contains outcrops of Vicksburg limestone which can be used for the manufacture of lime and for building and road construction. Workable beds of sand and gravel occur in recent deposits.

(96) **Waynesboro.**—Along the base of the second bottom terraces of the Chickasawhay River, there are outcrops of sand and gravel. The sand is usually iron-stained, rounded quartz grains, but often weathers out into white or gray beds. The mechanical condition of a sample taken from the Chickasawhay Valley near Waynesboro is given in Table No.———

(97) **Waynesboro.**—A ledge of Vicksburg limestone outcrops in the bed of the Chickasawhay River above the wagon bridge at Waynesboro and along the banks of the river up to the mouth of Yellow Creek, a western tributary of the Chickasawhay River. There are also exposures of limestone along the banks of Yellow Creek for a distance of three or four miles up the creek, the channel of the stream having been carved in the limestone. On the Plummer place, up Yellow Creek, about three miles from Waynesboro, a quarry has been opened in the limestone. The limestone is soft and easily cut with a saw. In quarrying the rock is sawed out in blocks. After losing some quarry water, they become slightly indurated. The stone has been used only locally in the building of chimneys and for foundations for houses. A sample of the limestone disintegrated badly when placed in water for the purpose of testing its absorptive power.

At the mouth of Limestone Creek occurs an outcrop of Vicksburg limestone 60 feet in vertical height. The lower half of the exposure is the soft "chimney rock" used locally for building chimneys, the upper half being alternating beds of hard limestone and soft marl.

The state has established a crushing plant at this locality, crushing the hard rock for agricultural purposes. This plant is located immediately upon the main line of the Mobile & Ohio Railroad, three miles north of Waynesboro. The capacity of the plant is about 50 tons per day.

A chemical analysis of the rock is given on another page.

WILKINSON COUNTY.

Gravel Pit (98).

Owner: Yazoo & Mississippi Valley R. R., New Orleans, La.
Location of pit: Two miles south of Rosetta.
Nearest railroad: Yazoo & Mississippi Valley R. R.
Operator: No longer operated.
Capacity with present equipment: Equipment dismantled; no production.
Overburden: Sandy soil 5-15 feet.
Length of pit: 400 feet.
Depth of pit: 35 feet.

Though this pit is dismantled the old railroad spur could be rebuilt with little expense or delay. The breast of the pit shows abundance of good gravel, and surrounding hills show the supply to be practically inexhaustible. The gravel consists of subangular brown chert pebbles with a matrix of red clayey sand. In certain limited zones the cementing material is brown iron oxide that consolidates the sand and gravel into a firm conglomerate which requires crushing.

SEC. IV—PART 1

TABLES OF TESTS AND ANALYSES OF ROAD MATERIALS IN MISSISSIPPI

Made, except where otherwise credited, at Department of Engineering of Mississippi Agricultural and Mechanical College

Physical Tests of Road-Building Rock from Mississippi.

REPORT ON SAMPLE OF ROAD MATERIAL FROM KOSCIUSKO, ATTALA COUNTY, MISSISSIPPI. (6)

(See Page 50)

Material: Sandstone

DETERMINATIONS:

Specific gravity	162.00
Absorption per cubic foot	0.90
Per cent of wear	6.30
French coefficient of wear	6.30
Hardness	19.20
Toughness	5.00

REPORT ON SAMPLE FROM HOUSTON, CHICKASAW COUNTY, MISS.

Material: Argillaceous Limestone

DETERMINATIONS:

Weight per cubic foot	150.00
Absorption per cubic foot	6.28
Per cent of wear	12.20
French coefficient of wear	3.30
Hardness	6.70
Toughness	5.00
Cementing value	49.00

REPORT ON SAMPLE FROM WOODLAND, CHICKASAW COUNTY, MISSISSIPPI

Material: Ferruginous Sandstone.

DETERMINATIONS:

Weight per cubic foot	162.00
Absorption per cubic foot	4.91
Per cent of wear	23.70
French coefficient of wear	1.70
Hardness	*
Toughness	*
Cementing value	12.00

REPORT ON SAMPLE OF ROAD MATERIAL FROM STONINGTON, JEFFERSON COUNTY, MISS.

Material: Ferruginous Sandstone.

DETERMINATIONS:

Weight per cubic foot	131.00
Absorption per cubic foot	11.60
Per cent of wear	31.80
French coefficient of wear	1.30
Hardness	*
Toughness	*
Cementing value	*

REPORT ON SAMPLES FROM COLUMBUS, LOWNDES COUNTY, MISS.

Material: Limestone.

DETERMINATIONS:

Weight per cubic foot	159.00
Absorption per cubic foot	3.46
Per cent of wear	4.20
French coefficient of wear	9.50
Hardness	7.40
Toughness	6.00
Cementing value	41.00

*Not tested.

REPORT ON SAMPLE FROM HOLLY SPRINGS, MARSHALL COUNTY, MISSISSIPPI

Material: Ferruginous Sandstone.

DETERMINATIONS:

Weight per cubic foot	181.00
Absorption per cubic foot	1.72
Per cent of wear	28.10
French coefficient of wear	1.40
Hardness	15.40
Toughness	3.00
Cementing value	27.00

REPORT ON SAMPLE OF ROAD MATERIAL FROM NESHOBA COUNTY, MISSISSIPPI

(Made at the request of J. H. Hester, Philadelphia, Miss.)

Material: Argillaceous Sandstone.

DETERMINATIONS:

Specific gravity	1.90
Weight per cubic foot	119.00
Water absorbed per cubic foot	14.00
Per cent of wear	10.10
French coefficient of wear	4.00
Hardness	11.00
Toughness	5.00
Cementing value	Excellent

Remarks: This material is soft, shows low resistance to wear, toughness and excellent cementing value. Not recommended for use in macadam road construction.

GRANULARMETRIC ANALYSIS OF GRAVEL FROM GRAVEL POINT, NATCHEZ, MISSISSIPPI. (2)

(See Page 48)

1. Amount retained on 1½-inch mesh sieve.....20%, passed 80%
2. Amount retained on 1-inch mesh sieve.....50%, passed 30%
3. Amount retained on ½-inch mesh sieve.....28%, passed 2%

ANALYSIS OF VICKSBURG LIMESTONE, WAYNE COUNTY. (13)

W. F. HAND, State Chemist, Analyst.

Constituent	%
Moisture (H_2O)	1.79
Volatile Matter (CO_2, etc.)	35.40
Silicon Dioxide (SiO_2)	6.77
Iron Oxide (Fe_2O_3)	2.00
Aluminum Oxide (Al_2O_3)	4.68
Calcium Oxide (CaO)	45.51
Magnesium Oxide (MgO)	.64
Sulphur Trioxide (SO_3)	3.00
Total	99.79

GRANULARMETRIC ANALYSIS OF CRYSTAL SPRINGS GRAVEL. (14)

(See Page 54)

1. Amount retained on 1½-inch mesh sieve..... 5%, passed 95%
2. Amount retained on 1-inch mesh sieve.....51%, passed 44%
3. Amount retained on ½-inch mesh sieve.....34%, passed 10%

GRANULARMETRIC ANALYSIS OF WESSON GRAVEL... (15).
(See Page 54)

1. Amount retained on 1½-inch mesh sieve..... 1%, passed 99%
2. Amount retained on 1-inch mesh sieve.....32%, passed 67%
3. Amount retained on ½-inch mesh sieve.....51%, passed 16%

The percentage of voids contained in this sample is 39; the weight per cubic foot is 101.6 pounds.

GRANULARMETRIC ANALYSIS OF MOUNT OLIVE SAND. (42).

1. Amount retained on 16-mesh sieve.....00%, passed 100%
2. Amount retained on 20-mesh sieve.....10%, passed 90%
3. Amount retained on 40-mesh sieve.....47%, passed 43%
4. Amount retained on 60-mesh sieve.....27%, passed 16%
5. Amount retained on 80-mesh sieve.....12%, passed 4%
6. Amount retained on 100-mesh sieve..... 3%, passed 1%

The percentage of voids is about 30; weight per cubic foot is 110 pounds of all passing 16 mesh sieve.

A sample of gravel possesses the characteristics given below:

GRANULARMETRIC ANALYSIS OF MOUNT OLIVE GRAVEL.
(See Page 62)

1. Amount retained on 1½-inch mesh sieve.....00%, passed 100%
2. Amount retained on 1-inch mesh sieve.....20%, passed 80%
3. Amount retained on ½-inch mesh sieve.....30%, passed 50%

The percentage of voids is about 48; the weight per cubic foot is 117 pounds of all that was retained on a 16 mesh sieve.

GRANULARMETRIC ANALYSIS OF MOSELLE GRAVEL. (43).
(See Page 62)

1. Amount retained on 1-inch mesh sieve.....35%, passed 65%
2. Amount retained on ½-inch mesh sieve.....36%, passed 29%

The percentage of voids is 39; the weight per cubic foot is 106 pounds.

The sand obtained from the gravel showed on examination the following degree of fineness:

GRANULARMETRIC ANALYSIS OF MOSELLE SAND, SAMPLE No. 1

1. Amount retained on 20-mesh sieve.....13%, passed 87%
2. Amount retained on 40-mesh sieve.....57%, passed 30%
3. Amount retained on 60-mesh sieve.....19%, passed 11%
4. Amount retained on 80-mesh sieve..... 4%, passed 7%
5. Amount retained on 100-mesh sieve..... 1%, passed 6%

GRANULARMETRIC ANALYSIS OF MOSELLE SAND, SAMPLE No. 2.

1. Amount retained on 20-mesh sieve.....23%, passed 77%
2. Amount retained on 40-mesh sieve.....55%, passed 22%
3. Amount retained on 60-mesh sieve.....19%, passed 4%
4. Amount retained on 80-mesh sieve..... 3%, passed %

The percentage of voids is 40; the weight per cubic foot is 116.5 pounds.

GRANULARMETRIC ANALYSIS OF GRAVEL FROM BOTTOM OF McGRATH PIT, BROOKHAVEN. (47)

(See Page 63)

1. Amount retained on 1½-inch mesh sieve.....10%, passed 90%
2. Amount retained on 1-inch mesh sieve.....30%, passed 60%
3. Amount retained on ½-inch mesh sieve.....34%, passed 26%

The percentage of voids is 44; the weight per cubic foot is 112 pounds.

The sand taken from the above gravel, all of which passed the 16 mesh sieve, has the following degree of fineness:

GRANULARMETRIC ANALYSIS OF SAND FROM BOTTOM OF McGRATH PIT, BROOKHAVEN.

1. Amount retained on 20-mesh sieve..... 9%, passed 91%
2. Amount retained on 40-mesh sieve.....66%, passed 25%
3. Amount retained on 60-mesh sieve.....20%, passed 5%
4. Amount retained on 80-mesh sieve..... 3%, passed 2%
5. Amount retained on 100-mesh sieve..... 0%, passed 2%

GRANULARMETRIC ANALYSIS OF GRAVEL FROM MIDDLE OF McGRATH PIT, BROOKHAVEN.

	Sample No. 1	Sample No. 2
1. Amount retained on 1½-inch mesh sieve.....	00%, passed 100%	00%, passed 100%
2. Amount retained on 1-inch mesh sieve.....	15%, passed 85%	15%, passed 85%
3. Amount retained on ½-inch mesh sieve.....	50%, passed 35%	55%, passed 30%

The percentage of voids is 44; the weight per cubic foot is 112 pounds. The sand which passed the 16-mesh sieve exhibited the following degree of fineness:

	Sample No. 1	Sample No. 2
1. Amount retained on 20-mesh sieve....	21%, passed 79%	8%, passed 92%
2. Amount retained on 40-mesh sieve....	43%, passed 36%	51%, passed 41%
3. Amount retained on 60-mesh sieve....	24%, passed 12%	31%, passed 10%
4. Amount retained on 80-mesh sieve....	9%, passed 3%	31%, passed 1%
5. Amount retained on 100-mesh sieve....	00%, passed 3%	00%, passed 1%

From a red layer of iron-coated sand and gravel near the bottom of the pit the following sample was taken:

GRANULARMETRIC ANALYSIS OF IRON COATED GRAVEL.

1. Amount retained on 1½-inch mesh sieve.....00%, passed 100%
2. Amount retained on 1-inch mesh sieve.....40%, passed 60%
3. Amount retained on ½-inch mesh sieve.....30%, passed 30%

The percentage of voids in this gravel is 48; the weight per cubic foot is 114 pounds.

GRANULARMETRIC ANALYSIS OF COLUMBUS GRAVEL AND SAND. (50).

(See Page 64)

1. Amount retained on	16-mesh sieve	33.5%, passed	66.5%
2. Amount retained on	20-mesh sieve	2.1%, passed	64.4%
3. Amount retained on	40-mesh sieve	28.4%, passed	36.0%
4. Amount retained on	60-mesh sieve	26.5%, passed	9.5%
5. Amount retained on	80-mesh sieve	7.2%, passed	2.3%
6. Amount retained on	100-mesh sieve	.2%, passed	2.1%

GRANULARMETRIC ANALYSIS OF AMORY GRAVEL. (54).

(See Page 65)

1. Amount retained on	1½-inch mesh sieve	00.0%, passed	100.0%
2. Amount retained on	1-inch mesh sieve	22.0%, passed	77.9%
3. Amount retained on	½-inch mesh sieve	23.4%, passed	54.5%
4. Amount retained on	1/16-inch mesh sieve	14.0%, passed	40.5%

GRANULARMETRIC ANALYSIS OF STOCKTON GRAVEL. (55).

(See Page 65)

1. Amount retained on	1½-inch mesh sieve	00.0%, passed	100.0%
2. Amount retained on	1-inch mesh sieve	11.1%, passed	88.9%
3. Amount retained on	½-inch mesh sieve	40.6%, passed	48.3%
4. Amount retained on	1/16-inch mesh sieve	32.0%, passed	16.3%

GRANULARMETRIC ANALYSIS OF BIGBEE BRIDGE SAND. (56).

(See Page 65)

1. Amount retained on	16-mesh sieve	01.5%, passed	98.5%
2. Amount retained on	20-mesh sieve	.3%, passed	98.2%
3. Amount retained on	40-mesh sieve	8.5%, passed	89.7%
4. Amount retained on	60-mesh sieve	71.4%, passed	18.3%
5. Amount retained on	80-mesh sieve	16.0%, passed	2.3%
6. Amount retained on	100-mesh sieve	0.1%, passed	2.2%

The Percentage of voids is 42; the weight per cubic foot is 95 pounds; the specific gravity is 1.50. Tensile strength 227.5 pounds.

A sample of the gravel as taken from the pit was separated with the following results:

GRANULARMETRIC ANALYSIS OF BIGBEE BRIDGE GRAVEL

1. Amount retained on	1½-inch mesh sieve	16.2%, passed	83.8%
2. Amount retained on	1-inch mesh sieve	7.1%, passed	76.7%
3. Amount retained on	½-inch mesh sieve	20.3%, passed	56.4%
4. Amount retained on	1/16-inch mesh sieve	42.4%, passed	14.0%

ANALYSIS OF SELMA LIMESTONE—CRESSWELL FARM. (63).

(See Page 67)

(W. S. McNeil, U. S. Geological Survey, Analyst.)

Silica (SiO_2)	1.13
Alumina (Al_2O_3)	.68
Iron Oxide (Fe_2O_3)	.68
Lime Carbonate ($CaCO_3$)	98.36
Magnesium Carbonate ($MgCO_3$)	trace
Water (H_2O)	.40
Total	100.57

ANALYSIS OF SELMA LIMESTONE—FROM MACON. (64).

(See Page 67)

	No. 1	No. 2
Silica (SiO_2)	9.09	13.03
Alumina (Al_2O_3)	7.47	7.43
Iron Oxide (Fe_2O_3)	7.47	7.43
Lime Carbonate ($CaCO_3$)	80.99	76.71
Magnesium Carbonate ($MgCO_3$)	.00	.36
Water	1.08	.95
Sulphur Trioxide (SO_3)	.00	.64

No. 1 by W. S. McNeil, Chemist of U. S. Geological Survey.
No. 2 by W. F. Hand, State Chemist, A. & M. College.

ANALYSIS OF SELMA LIMESTONE FROM OKTIBBEHA COUNTY. ..(65).

(W. F. Hand, State Chemist, Analyst.)

Silica (SiO_2)	2.89	2.33	3.03	2.55
Alumina (Al_2O_3)	1.53	1.72	1.92	1.96
Iron Oxide (Fe_2O_3)	1.53	1.72	1.92	1.96
Lime Carbonate ($CaCO_3$)	94.10	94.35	93.60	94.07
Magnesium Carbonate ($MgCO_3$)	1.84	1.82	1.64	2.12.
Water	.36	.44	.42	.52

GRANULARMETRIC ANALYSIS OF OKTIBBEHA SAND.

	Sample No. 1	Sample No. 2
1. Amount retained on 16-mesh sieve	1.6%, passed 98.4%	1.8%, passed 98.2%
2. Amount retained on 20-mesh sieve	1.1%, passed 97.3%	1.2%, passed 97.0%
3. Amount retained on 40-mesh sieve	43.5%, passed 53.8%	46.0%, passed 51.0%
4. Amount retained on 60-mesh sieve	42.8%, passed 11.0%	40.5%, passed 10.5%
5. Amount retained on 80-mesh sieve	9.25%, passed 1.75%	9.1%, passed 1.4%
6. Amount retained on 100-mesh sieve	.55%, passed 1.20%	0.0%, passed 1.4%

The percentage of voids is 40; the weight per cubic foot is 95 pounds; the specific gravity is 1.52.

The cement mixture, 1 to 3, tested for tensile strength, as follows:

	3 Days	90 Days
1. Briquette	71	160
2. Briquette	70	180
3. Briquette	69	170
Average tensile strength	70	170

GRANULARMETRIC ANALYSIS OF POPLARVILLE GRAVEL. (68).

(See Page 69)

1. Amount retained on 1½-inch mesh sieve.....00.0%, passed 100.0%
2. Amount retained on 1-inch mesh sieve.....23.0%, passed 77.0%
3. Amount retained on ½-inch mesh sieve.....51.0%, passed 26.0%

The percentage of voids is 39; the weight per cubic foot is 97.2 pounds.

GRANULARMETRIC ANALYSIS OF POPLARVILLE SAND.

1. Amount retained on 16-mesh sieve..... (include in gravel)
2. Amount retained on 20-mesh sieve..... 2.0%, passed 98.0%
3. Amount retained on 40-mesh sieve.....40.0%, passed 58.0%
4. Amount retained on 60-mesh sieve.....45.0%, passed 13.0%
5. Amount retained on 80-mesh sieve..... 9.0%, passed 4.0%
6. Amount retained on 100-mesh sieve..... 1.0%, passed 3.0%

GRANULARMETRIC ANALYSIS OF OSYKA GRAVEL. (71).

(See Page 70)

	Sample No. 1	Sample No. 2
1. Amount retained on 1½-inch mesh sieve	00.0%, passed 100.0%	00%, passed 100%
2. Amount retained on 1-inch mesh sieve	20.0%, passed 80.0%	50%, passed 50%
3. Amount retained on ½-inch mesh sieve	50.0%, passed 30.0%	40%, passed 10%

The percentage of voids is 45; the weight per cubic foot is 106 pounds.

The sand from the above which passed the 16-inch mesh sieve has the following degrees of fineness:

	Sample No. 1	Sample No. 2
1. Amount retained on 20-mesh sieve	13%, passed 87%	17%, passed 83%
2. Amount retained on 40-mesh sieve	48%, passed 39%	49%, passed 34%
3. Amount retained on 60-mesh sieve	18%, passed 21%	17%, passed 17%
4. Amount retained on 80-mesh sieve	8%, passed 13%	8%, passed 9%
5. Amount retained on 100-mesh sieve	13%, passed 10%	2%, passed 7%

ANALYSIS OF VICKSBURG LIMESTONE FROM ROBINSON QUARRY. (72).

(Four Miles Southeast of Brandon)

(See Page 70)

(By W. F. Hand State Chemist, Agricultural and Mechanical College)

	1	2	3	4
Silica (SiO_2)	4.22	4.55	5.56	1.58
Alumina (Al_2O_3)	.75	.00	1.09	4.40
Iron Oxide (Fe_2O_3)	4.37	4.25	4.01	3.31
Lime Oxide (CaO)	49.62	49.92	48.44	48.40
Magnesium Oxide (MgO)	.09	.09	.78	1.27
Volatile Matter (CO_2)	40.05	39.61	38.12	39.70
Sulphur Trioxide (SO_3)	.36	.72	.24	.45
Moisture	.88	.95	1.61	.66

WEATHERSBY GRAVEL

(See Page 71)

GRANULARMETRIC ANALYSIS OF SAMPLE OF AVERAGE GRAVEL (77).

1. Amount retained on 1½-inch mesh.....00%, passed 100%
2. Amount retained on 1-inch mesh.....11%, passed 89%
3. Amount retained on ½-inch mesh.....30%, passed 59%

GRANULARMETRIC ANALYSIS OF AVERAGE SAND.

1. Amount retained on 20-mesh sieve.....31%, passed 69%
2. Amount retained on 40-mesh sieve.....31%, passed 38%
3. Amount retained on 60-mesh sieve.....18%, passed 20%
4. Amount retained on 80-mesh sieve.....13%, passed 7%
5. Amount retained on 100-mesh sieve..... 4%, passed 3%

GRANULARMETRIC ANALYSIS OF TISHOMINGO CITY GRAVEL. (87).

(See Page 75)

Sample No. 1

1. Amount retained on 1½-inch mesh sieve.....00.0%, passed 100.0%
2. Amount retained on 1-inch mesh sieve..... 3.1%, passed 96.9%
3. Amount retained on ½-inch mesh sieve..... 4.4%, passed 92.5%
4. Amount retained on 1/16-inch mesh sieve.....83.5%, passed 9.0%

GRANULARMETRIC ANALYSIS OF TISHOMINGO CITY GRAVEL.

Sample No. 2

1. Amount retained on 1½-inch mesh sieve.....07.5%, passed 92.5%
2. Amount retained on 1-inch mesh sieve.....39.5%, passed 53.0%
3. Amount retained on ½-inch mesh sieve.....45.3%, passed 7.7%
4. Amount retained on 1/16-inch mesh sieve..... 7.2%, passed 0.5%

The first sample was taken from the Norman pit, and the second from the Tishomingo City Gravel Company's pit.

ANALYSIS OF EAST PORT LIMESTONE. (88).

(See Page 75)

(By W. F. Hand, State Chemist, Analyst).

Constituent	%
Moisture (H_2O)	.40
Volatile Matter (CO_2, etc.)	5.06
Silicon Dioxide (SiO_2)	43.18
Iron Oxide (Fe_2O_3)	3.13
Aluminum Oxide (Al_2O_3)	3.43
Calcium Oxide (CaO)	39.47
Magnesium Oxide (MgO)	3.19
Sulphur Trioxide (SO_3)	2.23
Total	100.09

ANALYSIS OF CHERT FROM TISHOMINGO COUNTY, MISS. (89).

(See Page 76)

(W. F. Hand, State Chemist, Analyst).

	%
Silica (SiO_2)	96.10
Iron (Fe_2O_3)	2.20
Lime (CaO)	1.14
Magnesium (MgO)	trace
Phosphorous (P_2O_5)	.24
Sulphur (S)	.50

ANALYSIS OF ASPHALTIC SANDSTONE FROM TISHOMINGO COUNTY, MISSISSIPPI

(W. F. Hand, State Chemist, Analyst).

	%
Moisture	.19
Bitumen dried at 100° C.	4.08
Bitumen dissolved out by CS_2.	

TEST OF TISHOMINGO SANDSTONE. (90).

(See Page 76)

(Made by Robert W. Hunt & Co., Engineers, Chicago, Ill.)

ABSORPTION TEST

Percentage of absorption by weight after 48 hours immersion in water.....4.11

FIRE TEST

After exposure to a temperature of 2400° F for a period of half an hour a specimen of the stone softened somewhat but did not disintegrate.

FROST TEST

Under the action of the frost test no signs of checking or disintegrating were apparent.

Average specific gravity..... 2.422
Average crushing strength.....per sq. inch 12,790

ANALYSES OF VICKSBURG LIMESTONES, FROM VICKSBURG. (94).

(See Page 77)

(W. F. Hand, State Chemist, Analyst).

(The numbers of the analyses correspond to the numbers of the strata in the section on page 86.)

	2	3	5	7
Silica (SiO_2)	6.43	7.39	5.58	3.10
Alumina (Al_2O_3)	.31	1.02	1.00	.25
Iron Oxide (Fe_2O_3)	2.00	2.48	2.18	1.62
Lime (CaO)	50.25	47.50	49.97	50.63
Volatile Matter (CO)	39.00	38.65	36.26	41.00
Magnesium Oxide (MgO)	1.36	1.45	1.01	.99
Sulphur Trioxide (SO_3)	.36	.51	.30	.60
Moisture (H_2O)	.61	1.10	.82	.60
Total	100.32	100.10	100.12	98.79

* Sec. III—Pits, Quarries, and Undeveloped Deposits of Road Materials.

GRANULARMETRIC ANALYSIS OF WAYNESBORO SAND. (96).

1. Amount retained on 16-mesh sieve.....06.3%, passed 93.7%
2. Amount retained on 20-mesh sieve..... 1.6%, passed 92.1%
3. Amount retained on 40-mesh sieve.....26.2%, passed 65.9%
4. Amount retained on 60-mesh sieve.....42.3%, passed 23.6%
5. Amount retained on 80-mesh sieve.....17.1%, passed 6.5%
6. Amount retained on 100-mesh sieve..... 1.6%, passed 4.9%

The tensile strength of the cement mixture, 1 to 3 is given below:

	3 Days	90 Days
No. 1. Briquette	90 pounds	255 pounds
No. 2. Briquette	92 pounds	250 pounds
No. 3. Briquette	75 pounds	232 pounds
Average tensile strength	86 pounds	248.5 pounds

SEC. IV—PART 2

TABLES OF TESTS OF MISSISSIPPI ROAD-MAKING MATERIALS

Made by United States Department of Agriculture,
Bureau of Public Roads, Washington, D. C.

DIVISION OF TESTS

ADAMS COUNTY

REPORT ON SAMPLE NUMBER 6466, FROM NATCHEZ, ADAMS COUNTY, MISSISSIPPI

(Made at request of M. E. Worrell, U. S. Highway Engineer, Natchez, Miss.)

Material: Sand Gravel from St. Catherine's Creek.

MECHANICAL ANALYSIS

Retained on 1½" sieve	4.6%	Retained on No. 10 mesh	64.0%
Retained on 1¼" sieve	14.1%	Retained on No. 20 mesh	71.0%
Retained on 1" sieve	18.5%	Retained on No. 30 mesh	78.0%
Retained on ¾" sieve	26.8%	Retained on No. 40 mesh	87.2%
Retained on ½" sieve	36.5%	Retained on No. 50 mesh	94.5%
Retained on ¼" sieve	43.5%	Retained on No. 80 mesh	97.3%
Retained on ⅛" sieve	60.5%	Retained on No. 100 mesh	97.5%
		Retained on No. 200 mesh	97.6%
		Passing No. 200 mesh	2.4%

CEMENTING VALUE

Material over ⅛"	Low
Material under ⅛"	Fair
Entire sample	Low

Character: Specimen consists of about equal proportions of large rounded pebbles of quartz and chalcedony and fine quartz sand.

REMARKS: Should make a satisfactory aggregate for concrete without washing if screened and recombined in the correct proportions. About ten per cent clay or other binder should be added if used in road construction.

Respectfully,
(Signed) VERNON M. PEIRCE,
Acting Director.

FEDERAL AID

REPORT ON SAMPLE OF CHERT GRAVEL

Laboratory No. 14726

Name of material, Chert Gravel. Identification marks, "A". Submitted by L. M. Shumaker, Natchez, Miss. Sampled July 28, 1919. Received August 6, 1919. Sampled from creek bottom. Quantity represented, 5,000 cubic yards. Source of material, (Property of Calvin S. Bennett) Natchez, Miss. Location used or to be used, Mississippi Federal Aid Project No. 53.

Examined for use as surfacing material in gravel road construction and as aggregate in reinforced concrete road construction.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	
Retained on ¼" screen	56.2%
Passing ¼", retained on 10-mesh	12.1%
Passing 10, retained on 20-mesh	8.6%
Passing 20, retained on 30-mesh	7.8%
Passing 30, retained on 40-mesh	7.3%
Passing 40, retained on 50-mesh	3.0%
Passing 50, retained on 80-mesh	3.3%
Passing 80, retained on 100-mesh	.4%
Passing 100, retained on 200-mesh	.2%
Passing 200-mesh	1.1%
Total	100.0
Loss by washing (silt and clay)	0.7%

GRAVEL (Mechanical Analysis)

Fraction	
Passing 2" ret'ned on 1½" screen	4.4%
Passing 1½" ret'ned on 1" screen	10.9%
Passing 1" ret'ned on ¾" screen	13.5%
Passing ¾" ret'ned on ½" screen	12.6%
Passing ½" ret'ned on ¼" screen	14.8%
Passing ¼" screen	43.8%
Total	100.0%

TENSILE STRENGTH*
(Cement-sand briquets, 1:3)

Stan'rd Ottawa Sand		Sample Sand	
7 days	28 days	7 days	28 days
240	370	240	410
250	380	245	400
240	370	250	390
243	373	245	400
Str. Ratio		100.8%	107.2%

Character of material—Sample consists essentially of large rounded chert fragments with a considerable amount of rounded quartz sand.

*Tensile strength of sand fraction.

Respectfully submitted,

(signed) A. T. GOLDBECK,
Engineer of Tests

FEDERAL AID

REPORT ON SAMPLE OF CHERT GRAVEL

Laboratory No. 14727

Name of material, Chert Gravel. Identification marks, "D". Submitted by L. M. Shumaker, Natchez, Miss. Sampled, August 1, 1919. Received, August 6, 1919. Sampled from Creek bottom. Quantity represented, 2,500 cubic yards. Source of material, (Property of H. G. Morris), Selma plantation, Adams County, Mississippi. Location to be used, Mississippi Federal Aid Project No. 80.

Examined for use as surfacing in gravel road construction and as aggregate in reinforced concrete construction.

TEST RESULTS

SAND
(Mechanical Analysis)

Fraction	
Retained on ¼" screen	58.4%
Passing ¼" retained on 10-mesh	11.0%
Passing 10, retained on 20-mesh	7.0%
Passing 20, retained on 30-mesh	6.6%
Passing 30, retained on 40-mesh	7.4%
Passing 40, retained on 50-mesh	3.2%
Passing 50, retained on 80-mesh	2.5%
Passing 100 retained on 200-mesh	0.2%
Passing 200-mesh	3.6%
Total	100.0

Loss by washing (silt and clay) 2.6%

GRAVEL
(Mechanical Analysis)

Fraction	
Passing 1½" ret'ned on 1" screen	15.1%
Passing 1" ret'ned on ¾" screen	10.3%
Passing ¾" ret'ned on ½" screen	16.2%
Passing ½" ret'ned on ¼" screen	16.8%
Passing ¼" screen	41.6%
Total	100.0

TENSILE STRENGTH*
(Cement-sand briquets, 1:3)

Stan'rd Ottawa Sand		Sample Sand	
7 days	28 days	7 days	28 days
250	360	225	390
230	380	230	380
220	350	215	385
233	363	223	385
Str. Ratio		95.8%	106.1%

Character of material—Sample consists essentially of rounded chert fragments with a considerable amount of quartz sand and very little clay.

*Tensile strength of sand fraction.

Respectfully submitted,

(signed) A. T. GOLDBECK,
Engineer of Tests

FEDERAL AID

REPORT ON SAMPLE OF CHERT GRAVEL

Laboratory No. 14728

Name of material, Chert Gravel. Identification marks, "C". Submitted by L. M. Shumaker, Natchez, Miss. Sampled August 1, 1919. Received, August 6, 1919. Sampled from pit. Quantity represented, 20,000 cubic yards. Source of material, (Property of Mr. Bailey), Natchez, Adams County, Miss. Location used or to be used, Mississippi Federal Aid Project Number 53.

Examined for use as surfacing in gravel road construction and as aggregate in reinforced concrete construction.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	
Retained on ¼" screen	65.7%
Passing ¼" retained on 10-mesh	8.3%
Passing 10 retained on 20-mesh	4.1%
Passing 20 retained on 30-mesh	3.7%
Passing 30 retained on 40-mesh	3.9%
Passing 40 retained on 50-mesh	2.2%
Passing 50 retained on 80-mesh	3.3%
Passing 80 retained on 100-mesh	0.2%
Passing 100 retained on 200-mesh	0.4%
Passing 200-mesh	8.2%
Total	100.0
Loss by washing (silt and clay)	7.3%

GRAVEL (Mechanical Analysis)

Fraction	
Passing 2" ret'ned on 1½" screen	5.8%
Passing 1½" ret'ned on 1" screen	26.6%
Passing 1" ret'ned on ¾" screen	12.2%
Passing ¾" ret'ned on ½" screen	10.4%
Passing ½" ret'ned on ¼" screen	10.7%
Passing ¼" screen	34.3%
Total	100.0

TENSILE STRENGTH*
(Cement-sand briquets, 1:3)

Stan'rd Ottawa Sand		Sample Sand	
7 days	28 days	7 days	28 days
250	360	160	340
230	380	185	340
220	350	170	320
233	363	172	333
Str. Ratio	73.9%		91.7%

Character of material—Sample consists essentially of rounded chert fragments with a considerable amount of quartz sand and clay.

*Tensile strength of sand fraction.

Respectfully submitted,

(signed) A. T. GOLDBECK,
Engineer of Tests

REPORT ON SAMPLE OF CHERT GRAVEL

Laboratory No. 14729

Name of material, Chert Gravel. Identification marks, "B". Submitted by L. M. Shumaker, Natchez, Miss. Sampled, July 23, 1919. Received August 6, 1919. Sampled from creek bottom (Lynn Creek). Quantity represented, 20,000 cubic yards. Source of material, (property of J. O'Kelly) Natchez, Adams County, Miss. Location used or to be used, Mississippi Federal Aid Project No. 53.

Examined for use as surfacing material in gravel road construction and as aggregate for reinforced concrete construction.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	56.4
Passing ¼" retained on 10-mesh	16.1
Passing 10 retained on 20-mesh	10.1
Passing 20 retained on 30-mesh	6.9
Passing 30 retained on 40-mesh	5.7
Passing 40 retained on 50-mesh	1.5
Passing 50 retained on 80-mesh	1.1
Passing 80 retained on 100-mesh	0.1
Passing 100 retained on 200-mesh	0.1
Passing 200-mesh	2.0
Total	100.0
Loss by washing (silt and clay))	1.3%

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 1½" ret'ned on 1" screen	14.3
Passing 1" ret'ned on ¾" screen	12.6
Passing ¾" ret'ned on ½" screen	12.6
Passing ½" ret'ned on ¼" screen	16.9
Passing ¼" screen	43.6
Total	100.0

TENSILE STRENGTH*
(Cement-sand briquets, 1:3)

Stan'rd Ottawa Sand		Sample Sand	
7 days	28 days	7 days	28 days
250	360	300	450
230	380	270	440
220	350	250	460
233	363	273	450
Str. Ratio		117.2%	123.9%

Character of material—Sample consists essentially of rounded chert fragments with a considerable amount of quartz sand and very little clay.

*Tensile strength of sand fraction.

Respectfully submitted,
(signed) A. T. GOLDBECK,
Engineer of Tests

AMITE COUNTY

REPORT ON SAMPLE OF CHERT GRAVEL

(See Page 49)

Laboratory No. 15189

Name of material, Chert Gravel. Submitted by J. D. Fauntleroy, 501 Wheat Bldg., Fort Worth, Texas. Received November 1, 1919. Source of material, (property of Interstate Gravel Co.) Barney Spur, Amite County, Miss., (File in General).

Examined for use as road gravel.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	52.5
Passing ¼" retained on 10-mesh	15.7
Passing 10 retained on 20-mesh	4.6
Passing 20 retained on 30-mesh	1.0
Passing 30 retained on 40-mesh	1.0
Passing 40 retained on 50-mesh	1.5
Passing 50 retained on 80-mesh	7.7
Passing 80 retained on 100-mesh	1.3
Passing 100 retained on 200-mesh	4.6
Passing 200-mesh	10.1
Total	100.0
Loss by washing (silt and clay)	9.5
Cementing value	65

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 1½" ret'ned on 1" screen	7.3
Passing 1" ret'ned on ¾" screen	9.1
Passing ¾" ret'ned on ½" screen	12.9
Passing ½" ret'ned on ¼" screen	23.2
Passing ¼" screen	47.5
Total	100.0

Character of material—Sample consists essentially of subangular chert fragments with considerable quartz sand and ferrugineous clay.

Respectfully submitted,
(signed) A. T. GOLDBECK,
Engineer of Tests

REPORT ON SAMPLE No. 3826 OF ROAD MATERIAL FROM AMITE COUNTY—PROPERTY FOSTER CREEK CONCRETE GRAVEL CO.

(See Page 48)

(Made at request of F. M. Kerr, State Engineer, Room 402, New Orleans Cotton Exchange Building, New Orleans, La.)

Material: Gravel

DETERMINATIONS

Specific gravity	*
Weight per cubic foot	*
Water absorbed per cubic foot	*
Per cent of wear	*
French coefficient of wear	*
Hardness	*
Toughness	*
Cementing value	Good

Remarks: Specimen consists of hard, fresh chert pebbles associated with highly decomposed chert fragments and a considerable amount of ferruginous clay sand. Should give satisfactory results under light or medium traffic, but on account of the decomposed material present it would probably show considerable wear under heavy traffic.

Respectfully,

(signed) L. W. PAGE, Director

DESOTO COUNTY

REPORT ON SAMPLE No. 3131 OF ROAD MATERIAL FROM DE SOTO COUNTY, MISS.—PROPERTY OF FLINN SAND & GRAVEL CO., OLIVE BRANCH, MISSISSIPPI.

Made at request of Bates & Gillespie, 134 Randolph Bldg., Memphis, Tenn., through Hon. H. D. Money, U. S. Senate.

Material: Sandy-clay Gravel

DETERMINATIONS

Specific gravity	*
Weight per cubic foot	*
Water absorbed per cubic foot	*
Per cent of wear	*
French coefficient of wear	*
Hardness	*
Toughness	*
Cementing value	Excellent (113)

Maximum, minimum, and average results on all rock species tested up to date indicated are given in the accompanying table.

Mechanical Analysis—

Size Sieve—	1″	7-8″	1-2″	1-4″	1-8″	1-10″	1-20″	1-30″	1-49″	1-50″	1-80″	1-100
% Passing—	80.0	76.6	58.0	43.0	32.3	28.9	19.0	7.6	3.1	2.7	1.2	

Remarks: A satisfactory material for building gravel roads.

Respectfully

(signed) A. S. CUSHMAN, Acting Director

*Not suitable for this test.

FORREST COUNTY

REPORT OF TESTS ON SAMPLES Nos. 6723-6727 (inclusive) FROM FORREST COUNTY, MISSISSIPPI.

Made at the request of F. T. Myers, Engineer, Highway Commission of Forrest County, Hattiesburg, Miss.

Materials: Siliceous clays, containing quartz, amorphous silica, and varying proportions of iron oxide.

Identification—

6723—from property of Mr. Dunn.
6724—from property of J. P. Carter.
6725—from property of Mississippi Normal College.
6726—from property of T. M. Ferguson.
6727—no mark.

Time of Slacking—

6723—3 minutes.
6724—2 minutes, 30 seconds.
6725—1 minute.
6726—30 seconds.
6727—1 minute.

Cementing Value—Three parts of No. 6722 with one part of:

6723—31	6725—75	6727—105
6724—63	6726—39	

Remarks: These are low binding, slaking siliceous clays and not well suited for use as binders in gravel or sand-clay construction. No. 6727 seems best suited as a binder.

Very respectfully,
(signed) PAUL D. SARGENT,
Acting Director.

AMITE COUNTY

REPORT ON SAMPLE No. 5591 FROM AMITE COUNTY, MISS.

Made at request of Foster Creek Concrete Gravel Co., New Orleans, La.

Material: Chert Clay Gravel

Per cent of voids	26.2
Weight per cubic foot (packed)	110 lbs.
Mechanical Analysis: (Figures represent per cent orig. weight).	
Retained on "1 sieve	2.4
Between 1" and ¾" sieve	15.8
Between ¾" and ½" sieve	31.0
Between ½" and ¼" sieve	18.2
Between ¼" and ⅛" sieve	6.9
Between ⅛" and 40-mesh	3.3
Between 40-mesh and 80-mesh	3.4
Passing 80-mesh	19.0
	100

Cementing value:

On material over ½" in size is fair.
On material under 80-mesh is excellent.

Remarks: Material is a chert clay gravel composed essentially of large rounded chert fragments with a considerable amount of siliceous clay.

Respectfully,
(signed) CHAS. H. HOYT,
Acting Director.

REPORT ON SAMPLE No. 10404 OF ROAD MATERIAL FROM GLOSTER, AMITE COUNTY, MISS.—MISS. GRAVEL CO.

Made at request of T. S. Shields, Baton Rouge, La.

Material: Chert Gravel

MECHANICAL ANALYSIS

Totals Retained on Screens		BETWEEN SCREENS		
		Sample		Coarse Aggregate
1¼"	2.9%	1½"-1¼"	2.9%	4.4%
1"	11.0%	1¼"-1"	8.1%	12.2%
¾"	21.8%	1" - ¾"	10.8%	16.2%
½"	41.6%	¾"- ½"	19.8%	29.7%
¼"	66.6%	½"- ¼"	25.0%	37.5%
				100.0%
				Fine Aggregate
10-mesh	77.9%	¼"- 10	11.3%	33.8%
20-mesh	82.3%	10 - 20	4.4%	13.2%
30-mesh	84.3%	20 - 30	2.0%	6.0%
40-mesh	85.4%	30 - 40	1.1%	3.3%
50-mesh	86.0%	40 - 50	0.6%	1.8%
80-mesh	86.9%	50 - 80	0.9%	2.7%
100-mesh	87.1%	80 -100	0.2%	0.6%
200-mesh	87.9%	100 -200	0.8%	2.4%
		200 and under	12.1%	36.2%
			100.0%	100.0%

Retained on ¼" screen..... 7
Passing ¼" screen.....87
As Received.....93

Character: Sample consists essentially of rounded and subangular fragments of chert with some sand and clay.

Remarks: Should prove satisfactory for use in gravel road construction.

Respectfully,
(signed) P. ST. J. WILSON,
Assistant Director.

REPORT ON SAMPLE OF SAND CLAY GRAVEL

Laboratory No. 14212
(See Page 49)

Name of material, Sand Clay Gravel. Submitted by Foster Creek Lumber & Manufacturing Co., Stephenson, Miss. Received May 2, 1919. Source of material, Stephenson, Amite County, Miss.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	45.8
Passing ¼" retained on 10-mesh	19.6
Passing 10 retained on 20-mesh	8.3
Passing 20 retained on 30-mesh	10.0
Passing 30 retained on 40-mesh	6.0
Passing 40 retained on 50-mesh	1.4
Passing 50 retained on 80-mesh	1.6
Passing 80 retained on 100-mesh	1.8
Passing 100 retained on 200-mesh	1.3
Passing 200-mesh	4.7
Total	100.0
Loss by washing (silt and clay)	4.2
Cementing value	15

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 2½" ret'ned on 2" screen	5.5
Passing 2" ret'ned on 1½" screen	0.0
Passing 1½" ret'ned on 1" screen	1.9
Passing 1" ret'ned on ¾" screen	3.6
Passing ¾" ret'ned on ½" screen	7.0
Passing ½" ret'ned on ¼" screen	27.3
Passing ¼" screen	54.7
	100.0

Character of material—Sample consists essentially of subangular fragments of chert and quartz with considerable quartz sand and some ferrugineous clay.

Respectfully submitted,
(signed) P. St. J. WILSON,
Acting Director.

CARROLL COUNTY

REPORT ON SAMPLE No. 7128 FROM CARROLL COUNTY, MISSISSIPPI. VALLEY HILL—PROPERTY OF MRS J. L. LeFLORE.

(See Page 51)

Made at request of H. H. Lotter, Sr., Highway Engineer, Greenwood, Miss.

Material: Sand-Gravel

MECHANICAL ANALYSIS

Retained on 1" sieve	6.5%	Retained on No. 10 sieve	47.5%
Retained on ¾" sieve	13.3%	Retained on No. 20 sieve	56.0%
Retained on ½" sieve	24.3%	Retained on No. 30 sieve	69.5%
Retained on ¼" sieve	37.0%	Retained on No. 40 sieve	80.4%
Retained on ⅛" sieve	45.0%	Retained on No. 50 sieve	88.1%
Tot'l passing ⅛" sieve	55.0%	Retained on No. 80 sieve	89.8%
		Retained on No. 100 sieve	90.0%
		Retained on No. 200 sieve	90.4%
		Passing 200 sieve	9.6%

Cementing Value—
On material over ⅛" in size.....Good
On material under ⅛" in size.....Excellent
On material as received.....Good

Character: Sample consists essentially of rounded fragments of quartz and chert, coarse sand and ferruginous clay.

Remarks: Material contains too much sand to be entirely satisfactory in gravel road construction. The amount of sand should be reduced to about 30% of the whole for the best results.

Respectfully submitted,

(signed) VERNON M. PEIRCE,
Acting Director

REPORT ON SAMPLE No. 7308 FROM CARROLL COUNTY, MISS.

(See Page 50)

Made at request of T. H. Somerville, Miss. Geological Survey, Jackson, Miss.

Material: Sand Gravel

	Percent		Percent
Retained on ¾" sieve	1.2	Retained on No. 10 sieve	12.6
Retained on ½" sieve	5.3	Retained on No. 20 sieve	31.3
Retained on ¼" sieve	9.0	Retained on No. 30 sieve	73.5
Retained on ⅛" sieve	11.3	Retained on No. 40 sieve	85.4
Total passed ⅛" sieve	88.7	Retained on No. 50 sieve	91.4
		Retained on No. 80 sieve	94.0
		Retained on No. 100 sieve	94.1
Cementing Value—		Retained on No. 200 sieve	94.5
On material over ⅛" in size—Fair.		Retained on No. 200 sieve	
On mat'l under ⅛" in size—Excellent		By analysis	0.2
On material as received—Excellent.		By washing	5.3

Character—Sample consists essentially of large fragments of chert and quartz, with a large amount of quartz sand and some ferruginous clay. Remarks:—Material shows altogether too large a proportion of sand to be satisfactory in gravel road construction. The amount of sand should be reduced to about 30% of the whole for best results.

Respectfully,

(signed) P. St. J. WILSON, Acting Director.

COVINGTON COUNTY

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 14846

Name of material, Chert Gravel. Submitted by W. H. Pickering, Collins, Miss. Received August 22, 1919. Source of material ¼mi., from main line of Gulf & Ship Island R. R., Covington, Miss.

Examined for use as road surfacing material.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	22.0
Passing ¼" retained on 10-mesh	19.0
Passing 10 retained on 20-mesh	17.5
Passing 20 retained on 30-mesh	17.5
Passing 30 retained on 40-mesh	7.1
Passing 40 retained on 50-mesh	1.3
Passing 50 retained on 80-mesh	0.3
Passing 80 retained on 100-mesh	1.3
Passing 100 retained on 200-mesh	0.3
Passing 200-mesh	13.7
Total	100.0%
Loss by washing (silt and clay)	13.4%
Cementing Value	89

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 2" ret'ned on 1½" screen	1.8
Passing 1½" ret'ned on 1" screen	1.4
Passing 1" ret'ned on ¾" screen	1.3
Passing ¾" ret'ned on ½" screen	6.3
Passing ½" ret'ned on ¼" screen	11.2
Passing ¼" screen	88.0
Total	100.0%

Character of material—Sample consists essentially of subangular chert fragments with a large amount of quartz sand and considerable ferrugineous clay.

Respectfully submitted,

(Signed) A. T. GOLDBECK,
Engineer of Tests.

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 15334.

Material: Gravel. Submitted by W. T. Mitchell, Sanford, Miss. Sampled Nov., 17, 1919. Received November 24, 1919. Quantity represented 80 acres, 30' deep. Source of material (Prop. of W. T. Mitchell) Sandford, Covington Co., Miss.

Examined for use as road surfacing material.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	37.5
Passing ¼" retained on 10-mesh	13.9
Passing 10 retained on 20-mesh	5.0
Passing 20 retained on 30-mesh	3.0
Passing 30 retained on 40-mesh	5.0
Passing 40 retained on 50-mesh	6.4
Passing 50 retained on 80-mesh	19.7
Passing 80 retained on 100-mesh	2.7
Passing 100 retained on 200-mesh	5.3
Passing 200-mesh	30.0
Total	100.0%
Cementing value	119

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 1½" ret'ned on 1" screen	23.5
Passing 1" ret'ned on ¾" screen	25.6
Passing ¾" ret'ned on ½" screen	19.7
Passing ½" ret'ned on ¼" screen	31.2
Passing ¼" screen	62.5
Total	100.0%

Character of material—Sample consists essentially of large rounded fragments of weathered chert with some sand and ferrugineous clay.

Respectfully submitted,

(signed) A. T. GOLDBECK,
Engineer of Tests.

REPORT ON SAMPLES NOS. 3151A, 3152B, 3153C, 3156F, 3157G.

From: 3151, DeSoto County, Miss., property Flinn Bros.; 3152, Shelby Co., Tenn., Brunswick Mining and Gravel Co.; 3153, Tishomingo Co., Tenn., Property Mobile and Ohio Rd.; 3156, Benton Co., Tenn., Property Camden Gravel Co.; 3157, McCracken Co., Tenn., property I. C. R. R.

Name		C.V.	MECHANICAL ANALYSIS—% BY WEIGHT UNDER										
		(96)	1"	⅞"	½"	¼"	⅛"	1-10"	1-20"	1-30"	1-40"	1-50"	1-80"	1-100"
A	Gravel & sand	Very good	84.2	80.1	57.8	39.7	30.2	27.0	20.0	11.2	5.7	5.1	2.2	1.4
B	Gravel & sand	Good (71)	73.5	68.9	49.6	37.3	31.0	29.1	24.1	15.1	7.6	6.4	2.8	1.7
C	Gravel & clay	Fair (14)	77.3	73.2	51.0	29.2	15.1	12.3	8.8	7.2	5.8	5.4	3.8	3.4
F	Chert gravel	Fair (12)	90.4	85.8	62.3	30.0	16.7	13.3	8.7	5.8	3.9	3.4	2.0	1.6
G	Chert gravel	Fair (22)	84.4	80.1	67.4	42.6	24.8	19.8	13.7	11.1	9.8	9.5	8.3	8.0

Remarks—From results of these tests Nos. 3151 and 3152 show up a little the best, but the chert gravels usually improve on the roads and are often far superior to the clay gravels. We do not think there is enough difference in quality to overcome a great difference in price, but other things equal, would prefer the chert gravels.

Respectfully,

(Signed) A. S. CUSHMAN, Acting Director.

FORREST COUNTY

REPORT OF TESTS ON SAMPLES NO. 6722, FROM FORREST COUNTY, MISSISSIPPI.

Made at request of F. T. Myers, Engineer, Highway Commission of Forrest County, Hattiesburg, Mississippi.

Material: Sand Gravel:—

Retained on 1" sieve	1.3%	Retained on No. 10 sieve	50.5%
Retained on ¾" sieve	11.0%	Retained on No. 20 sieve	55.1%
Retained on ½" sieve	25.9%	Retained on No. 30 sieve	59.0%
Retained on ¼" sieve	38.9%	Retained on No. 40 sieve	66.2%
Retained on ⅛" sieve	48.1%	Retained on No. 50 sieve	86.7%
Total pass'g. ⅛" sieve	51.9%	Retained on No. 80 sieve	97.9%
		Retained on No. 100 sieve	98.8%
		Retained on No. 200 sieve	99.2%
		Passing 200 sieve	0.8%

Cementing Value—Low.

Remarks:—Sample consists essentially of rounded fragments of quartz and chert together with a large amount of quartz sand. This material contains no binder and too much sand to be satisfactory for gravel road construction. Could be improved by the removal of about half of the material under ⅛". About 10 per cent of clay should be added as a binder. Clay No. 6727 seems best suited for this purpose.

Respectfully submitted,

(Signed) PAUL D. SARGENT,

Acting Director.

Report on Sample No. 7088, from Forrest Co., Mississippi. Hattiesburg, Property Leaf River Gravel Co.

Made at the request of Mr. W. E. Atkinson, State Highway Engineer, New Orleans.

Material: Chert Gravel.

MECHANICAL ANALYSIS

	Percent		Percent
Retained on 1¼" sieve	0.0	Retained on No. 10 sieve	70.1
Retained on 1" sieve	2.0	Retained on No. 20 sieve	71.4
Retained on ¾" sieve	8.6	Retained on No. 30 sieve	72.2
Retained on ½" sieve	31.2	Retained on No. 40 sieve	73.2
Retained on ¼" sieve	62.3	Retained on No. 50 sieve	74.6
Retained on ⅛" sieve	69.3	Retained on No. 80 sieve	76.2
Total passing ⅛" sieve	30.7	Retained on No. 100 sieve	76.6
		Retained on No. 200 sieve	77.9
		Passing 200 sieve	22.1

Cementing Value:—

On material over ⅛" in size.....Good
On material under ⅛" in size.....Excellent
On material as received.....Fair

Character: Sample consists essentially of rounded fragments of chert coated with clay.

Remarks:—Should prove fairly satisfactory, although the amount of clay present is somewhat in excess of that usually considered sufficient for best results.

Respectfully submitted,
(Signed) VERNON M. PEIRCE,
Acting Director.

REPORT ON SAMPLE NO. 9745 OF ROAD MATERIAL FROM PIT OF LOUISIANA SAND AND GRAVEL CO., FORREST CO., MISS.
(See Page 56)

Made at the request of Association of American Portland Cement Mfgrs., Bellevue Court Bldg., Philadelphia, Pa.

Material:—Chert Gravel

Totals Retained on Screens	BETWEEN SCREENS		Coarse Aggregate
		Sample	
1" 4.7%	1¼"-1"	4.7%	6.1%
¾" 14.4%	1" - ¾"	9.7%	12.5%
½" 34.0%	¾"- ½"	19.6%	25.4%
¼" 77.3%	½"- ¼"	43.3%	56.0%
			100.0%
			Fine Aggregate
10-mesh 98.9%	¼"- 10	21.6%	95.2%
20-mesh 99.9%	10 - 20	1.0%	4.4%
30-mesh 100.0%	20 - 30	0.1%	0.4%
		100.0%	100.0%

Character:—Sample consists essentially of rounded chert fragments with some quartz and furnace cinder.

(Signed) P. ST. J. WILSON,
Assistant Director.

REPORT ON SAMPLE OF SAND.
Laboratory No. 14963.

Name of material, Sand. Submitted by E. C. Brown, Box 779, Jackson, Miss. Sampled September 2, 1919. Received September 18, 1919. Sampled from car. Quantity represented car. Source of material, (Prop. Louisiana Gravel & Sand Co.) Forrest Co., Miss.

Examined for use in concrete road construction.

TEST RESULTS

SAND
(Mechanical Analysis)
Fraction

	Percent
Retained on ¼" screen	0.0
Passing ¼" retained on 10-mesh	3.5
Passing 10 retained on 20-mesh	21.0
Passing 20 retained on 30-mesh	28.0
Passing 30 retained on 40-mesh	20.0
Passing 40 retained on 50-mesh	10.5
Passing 50 retained on 80-mesh	14.0
Passing 80 retained on 100-mesh	1.0
Passing 100 retained on 200-mesh	1.0
Passing 200-mesh	1.0
Total	100.0%
Loss by washing (silt and clay)	0.5%

TENSILE STRENGTH
(Cement-sand briquets, 1:3)

	Stan'rd Ottawa Sand		Sample Sand	
	7 days	28 days	7 days	28 days
	290	360	280	380
	285	350	285	400
	270	345	285	395
	282	352	283	392
Str. Ratio			100.4%	111.4%

Character of material: Sample consists essentially of rounded quartz sand containing a few grains of chert and feldspar.

Respectfully submitted,
(Signed) A. T. GOLDBECK,
Engineer of Tests.

REPORT ON SAMPLE OF CHERT GRAVEL.
Laboratory No. 15263.

Name of Material: Chert Gravel.

Submitted by J. H. Hobson, Louisiana Gravel & Sand Co., Hattisburg, Miss. Sampled October 27, 1919. Received November 7, 1919. Source of material, Louisiana Gravel and Sand Co., Hattisburg, Forrest Co., Miss. Location used or to be used, Gulfport, Biloxi, Pass Christian and Corinth, Mississippi.

Examined for use as coarse aggregate in concrete road construction.

TEST RESULTS
(Mechanical Analysis)

	Percent
Passing 1½" retained on 1" screen	12.3
Passing 1" retained on ¾" screen	21.5
Passing ¾" retained on ½" screen	29.6
Passing ½" retained on ¼" screen	28.4
Passing ¼" screen	8.2
Total	100.0

Character of material: Sample consists essentially of rounded fragments of chert with a few quartz pebbles.

Respectfully submitted,
(Signed) A. T. GOLDBECK,
Engineer of Tests.

REPORT ON SAMPLE OF SAND.
Laboratory No. 15262

Name of material, Sand. Submitted by La. Sand & Gravel Co., Hattiesburg, Miss. Sampled October 27, 1919. Received November 7, 1919. Sampled from car. Source of material (La. Gravel & Sand Co.) Hattiesburg, Forrest Co., Miss.

Examined for use as fine aggregate in concrete road construction.

TEST RESULTS

SAND
(Mechanical Analysis)
Fraction

	Percent
Retained on ¼" screen	0.0
Passing ¼" retained on 10-mesh	3.0
Passing 10 retained on 20-mesh	10.0
Passing 20 retained on 30-mesh	21.5
Passing 30 retained on 40-mesh	26.5
Passing 40 retained on 50-mesh	18.0
Passing 50 retained on 80-mesh	18.5
Passing 80 retained on 100-mesh	1.5
Passing 100 retained on 200-mesh	0.5
Passing 200-mesh	0.5
Total	100.0
Loss by washing (silt and clay)	0.5

TENSILE STRENGTH
(Cement-sand briquets, 1:3)

Stan'rd Ottawa Sand		Sample Sand	
7 days	28 days	7 days	28 days
280	330	240	320
280	320	250	300
280	335	240	320
280	328	243	313
Str. Ratio		86.9%	95.4%

Character of material: Sample consists essentially of rounded quartz sand containing some feldspar grains.

Respectfully submitted,

(Signed) A. T. GOLDBECK,
Engineer of Tests.

HARRISON COUNTY

REPORT ON SAMPLE NO. 9936 OF ROAD MATERIAL FROM HARRISON COUNTY, MISSISSIPPI

(Made at the request of E. O. Hathaway, State Highway Engineer, Gulfport, Mississippi)

Material: Sand Gravel.

MECHANICAL ANALYSIS

Totals Retained on Screens	BETWEEN SCREENS		Coarse Aggregate
		Sample	
1" —— %	1¼"-1"	1.9%	
¾" 8.8%	1" - ¾"	6.9%	
½" 18.2%	¾"- ½"	9.4%	
¼" 37.8%	½"- ¼"	19.6%	
10-mesh 63.7%	¼"- 10	25.9%	
20-mesh 71.4%	10 - 20	7.7%	
30-mesh 74.5%	20 - 30	3.1%	
40-mesh 79.6%	30 - 40	5.1%	
50-mesh 86.1%	40 - 50	6.5%	
80-mesh 95.9%	50 - 80	9.8%	
100-mesh 96.6%	80 -100	0.7%	
200-mesh 99.4%	100 -200	2.8%	
	200 & under	0.7%	
		100.0%	

Character: Sample consists essentially of rounded and subangular fragments of chert and quartz, with a large amount of quartz sand.

REMARKS: Material contains altogether too much sand to be used without screening. If screened, the screened gravel and sand would be satisfactory for use in concrete road construction.

Respectfully,

(Signed) P. ST. J. WILSON,
Assistant Director.

REPORT ON SAMPLE NO. 11448 OF ROAD MATERIAL FROM HARRISON COUNTY, MISSISSIPPI.

Pass Christian, Mississippi.

(Made at the request of J. F. Galloway, Co. Engr., Address Gulfport, Miss.)

Material: Gravel

MECHANICAL ANALYSIS

Totals Retained on Screens	BETWEEN SCREENS	
	Sample	Coarse Aggregate
1½" 5.4%	2" -1½" 5.4%	
1¼" 12.2%	1½"-1¼" 6.8%	
1" 22.2%	1¼"-1" 10.0%	
¾" 36.1%	1" - ¾" 13.9%	
½" 46.8%	¾"- ½" 10.7%	
¼" 74.1%	½"- ¼" 27.3%	
	under ¼" 25.9%	
	100.0%	

Character: Sample consists essentially of rounded and subangular fragments of chert and quartz with small amount of coarse quartz sand.

Respectfully,
(Signed) L. W. PAGE,
Director.

SAMPLE NO. 11449, road material from Harrison County, Mississippi.

Material: Fine Sand.

Totals Retained on Screens		Between Screens—Sample	
	Percent.		Percent
10-mesh	0.2	¼"- 10	0.2
20-mesh	0.4	20 - 20	0.2
30-mesh	0.4	20 - 30	0.0
40-mesh	0.4	30 - 40	0.0
50-mesh	0.4	40 - 50	0.0
80-mesh	21.0	50 - 80	20.6
100-mesh	66.8	80 -100	45.8
200-mesh	98.4	100 -200	31.6
		200 and under	1.6
	100.0		100.0

Character—Sample consists essentially of very fine angular fragments of quartz and mica with a considerable amount of carbonaceous matter.

REPORT ON SAMPLE NO. 11450 OF ROAD MATERIAL FROM HARRISON COUNTY, MISSISSIPPI.

Material: Sand.

Total Retained on Screens		Between Screens—Sample	
	Percent		
10-mesh	5.8	¼"- 10	5.8
20-mesh	14.6	10 - 20	8.8
30-mesh	31.2	20 - 30	16.6
40-mesh	53.8	30 - 40	22.6
50-mesh	75.2	40 - 50	21.4
80-mesh	96.8	50 - 80	21.6
100-mesh	98.6	80 -100	1.8
200-mesh	99.4	100 -200	.8
		200 and under	.6
			100.0

N. B. These tests were made at the request of J. F. Galloway, County Engr., Gulfport, Miss.

Character: Sample consists of rounded and sub-angular grains of quartz (essentially)

Respectfully,
(Signed) L. W. PAGE,
Director.

REPORT ON SAMPLE No. 9936 OF ROAD MATERIAL FROM HARRISON COUNTY, MISSISSIPPI—PASS CHRISTIAN.

(See Page 72)

(Made at the request of J. F. Galloway, Co. Engr, Address Gulfport, Miss.)

Material: Sand Gravel.

MECHANICAL ANALYSIS

Totals Retained on Screens	Percent	Between Screens—Sample	Percent
1½"	3.3	2" -1½"	3.3
1¼"	7.5	1½"-1¼"	4.2
1"	13.7	1¼"-1"	6.2
¾"	22.3	1" - ¾"	8.6
½"	28.9	¾"- ½"	6.6
¼"	45.7	½"- ¼"	16.8
10-mesh	63.0	¼"- 10	17.3
20-mesh	65.0	10- 20	2.0
30-mesh	68.8	20- 30	3.8
40-mesh	74.0	30- 40	5.2
50-mesh	78.9	40- 50	4.9
80-mesh	87.0	50- 80	8.1
100-mesh	94.5	80-100	7.5
200-mesh	99.5	100-200	5.0
		200 and under	.5
			100.0

Character: Mixture of samples 11448, 11449 and 11450 in the proportion 8:2:3.

REMARKS: Per cent. voids—16.5.

Respectfully,

(Signed) L. W. PAGE,
Director.

HINDS COUNTY

REPORT ON SAMPLE NO. 9744 OF ROAD MATERIAL FROM HINDS COUNTY, MISSISSIPPI—JACKSON.

(Made at the request of Association of American Portland Cement Manufacturers, Bellevue Court Bld'g., Philadelphia, Pa.)

Material: Sand

MECHANICAL ANALYSIS

Totals retained on Screens	Percent	Between Screens—Sample	Percent
10-mesh	0.5	¼"- 10	0.5
20-mesh	2.3	10- 20	1.8
30-mesh	19.9	20- 30	17.6
40-mesh	50.7	30- 40	30.8
50-mesh	76.3	40- 50	25.6
80-mesh	96.2	50- 80	19.9
100-mesh	98.2	80-100	2.0
200-mesh	99.8	100-200	1.6
			100.0

Character: Sample consists essentially of very fine, angular quartz sand with a large amount of silt.

Respectfully,

(Signed) P. ST. J. WILSON,
Assistant Director.

HOLMES COUNTY

REPORT ON SAMPLE NO. 10484, FROM HOLMES COUNTY, MISSISSIPPI.

(Sent by J. D. Gwin, Lexington, Miss. Copy of report to H. H. Lotter, Lexington, Miss.)

Material: Sand Gravel.

MECHANICAL ANALYSIS

Totals Retained on Screens	BETWEEN SCREENS		
	Sample		Coarse Aggregate
2" 11.3%	Over 2"	11.3%	13.5%
1½" 11.3%	2" -1½"	0.0%	0.0%
1¼" 20.1%	1½"-1¼"	8.8%	10.6%
1" 27.4%	1¼"-1"	7.3%	8.8%
¾" 38.8%	1" - ¾"	11.4%	13.7%
½" 61.6%	¾"- ½"	22.8%	27.3%
¼" 83.4%	½"- ¼"	21.8%	26.1%
			100.0%
			Fine Aggregate
10-mesh 92.4%	¼ - 10	9.0%	54.2%
20-mesh 94.4%	10- 20	2.0%	12.1%
30-mesh 95.7%	20- 30	1.3%	7.8%
40-mesh 96.7%	30- 40	1.0%	6.0%
50-mesh 97.3%	40- 50	.6%	3.6%
80-mesh 97.5%	50- 80	.2%	1.2%
100-mesh 97.5%	80-100	.1%	0.0%
200-mesh 97.6%	100-200	.1%	.6%
	200 and under	2.4%	14.5%
		100.0%	100.0%

Character: Sample consists essentially of rounded and angular fragments of chert and quartz with a large amount of sand and very little ferruginous clay.

REMARKS: Will probably prove fairly satisfactory for use in gravel road construction although sample is somewhat deficient in binder.

(Cementing value: Retained on ¼" screen—9; passing ¼" screen—30; as received—34).

Respectfully,
(Signed) P. ST. J. WILSON,
Assistant Director.

ITAWAMBA COUNTY

FEDERAL AID.

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 15293.

Name of material: Chert Gravel. Identification marks, River gravel. Submitted by W. C. Lindley, Engineer, Fulton, Miss. Sampled November 5, 1919. Received November 13, 1919. Sampled from river. Quantity represented 25,155 tons (?) Source of material (property of Philip Stovall) Fulton, Itawamba Co., Miss. Location used or to be used Miss. F. A. Project No. 1. Examined for use in construction of concrete head walls and box culverts.

TEST RESULTS

SAND
(Mechanical Analysis)

Fraction	Percent
Retained on ¼" scree.....n.....	62.5
Passing ¼" retained on 10-mesh.....	10.2
Passing 10 retained on 20-mesh.....	1.0
Passing 20 retained on 30-mesh.....	0.8
Passing 30 retained on 40-mesh.....	1.6
Passing 40 retained on 50-mesh.....	3.4
Passing 50 retained on 80-mesh.....	11.5
Passing 80 retained on 100-mesh.....	1.3
Passing 100 retained on 200-mesh.....	2.1
Passing 200-mesh.....	5.6
Total.....	100.0
Loss by washing (silt and clay).....	5.4

GRAVEL
(Mechanical Analysis)

Fraction	Percent
Passing 1" ret'ned on ¾" screen..	6.5
Passing ¾" ret'ned on ½" screen..	20.0
Passing ½" ret'ned on ¼" screen..	36.0
Passing ¼" screen.....	37.5
Total.....	100.0

TENSILE STRENGTH*
(Cement-sand briquets, 1:3)

Stan'rd Ottawa Sand		Sample Sand	
7 days	28 days	7 days	28 days
270	315	240	310
270	320	240	300
260	310	250	320
267	315	243	310
Str. Ratio		91.0%	98.4%

Character of material—Sample consists essentially of rounded fragments of weathered chert with some angular quartz sand and considerable ferrugineous clay.

*Test of sand fraction.

Respectfully submitted,
(signed) A. T. GOLDBECK,
Engineer of Tests.

JASPER COUNTY

REPORT ON SAMPLE NO. 7411, FROM JASPER COUNTY, MISSISSIPPI. —MONTROSE.

(See Page 60)

(Made at the request of E. N. Lowe, Director ,Mississippi Geological Survey, Jackson, Miss.)

Material: Sand Clay Gravel.

MECHANICAL ANALYSIS

Fraction	Percent
Retained on ¾" sieve	5.6
Retained on ½" sieve	20.3
Retained on ¼" sieve	50.8
Retained on ⅛" sieve	65.5
Total passing ⅛" sieve	34.5

Cementing Value—
On material over ⅛" in size—Fair.
On material under ⅛" in size—Excellent
As received—Very good.

Fraction	Percent
Retained on No. 10 sieve	68.3
Retained on No. 20 sieve	71.4
Retained on No. 30 sieve	72.3
Retained on No. 40 sieve	72.9
Retained on No. 50 sieve	74.2
Retained on No. 80 sieve	76.4
Retained on No. 100 sieve	77.0
Retained on No. 200 sieve	77.8
By analysis	0.5
By washing	21.7
Total	22.2

Character: Sample consists essentially of rounded fragments of chert and quartz with a small amount of quartz sand and large quantity of ferrugineous clay.

REMARKS: Should make a good road building gravel.

Respectfully submitted,
(Signed) P. ST. J. WILSON,
Assistant Director.

REPORT ON SAMPLE NO. 7412, FROM JASPER COUNTY, MISSISSIPPI. MONTROSE.

(See Page 60)

(Made at request of E. N. Lowe, Director, Mississippi Geological Survey, Jackson, Mississippi).

Material: Sand Clay Gravel.

MECHANICAL ANALYSIS

Fraction	Percent
Retained on ¼" sieve	1.8
Retained on ⅛" sieve	10.7
Total passing ⅛" sieve	89.3

Cementing Value—

On material under ⅛" in size—Very good
On material as received—Very good.

Fraction	Percent
Retained on No. 10 sieve	16.9
Retained on No. 20 sieve	44.7
Retained on No. 30 sieve	69.0
Retained on No. 40 sieve	74.5
Retained on No. 50 sieve	76.5
Retained on No. 80 sieve	78.3
Retained on No. 100 sieve	78.8
Retained on No. 200 sieve	79.0
By analysis	1.0
By washing	20.0
Total	21.0

Character: Sample consists essentially of rounded quartz pebbles with a large amount of coarse quartz sand and ferrugineous clay.

REMARKS: Material contains altogether too large a percentage of sand to be satisfactory in gravel road construction.

Respectfully submitted,
(Signed) P. ST. J. WILSON,
Assistant Director.

LEFLORE COUNTY

REPORT ON SAMPLE NO. 11134 (No. 2) OF ROAD MATERIAL FROM LEFLORE COUNTY, MISSISSIPPI—GREENWOOD (YAZOO RIVER).

(Made at the request of T. F. Walker, City Engineer, Greenwood, Miss.

Material: Chert Gravel.

MECHANICAL ANALYSIS

Totals Retained on Screens Fraction	Percent	Fraction	Percent
1½"	13.2	2" -1½"	13.2
1¼"	34.1	1½"-1¼"	20.9
1"	43.2	1¾"-1"	9.1
¾"	58.5	1" - ¾"	15.3
½"	71.0	¾" ½"	12.5
¼"	87.1	½"- ¼"	16.1
		Under ¼"	12.9
			100.0

Character: Sample consists essentially of rounded and subangular fragments of chert with some quartz.

Respectfully submitted,
(Signed) L. W. PAGE,
Director.

REPORT ON SAMPLE NO. 11135 (No. 1) OF ROAD MATERIAL FROM LEFLORE COUNTY, MISSISSIPPI—GREENWOOD (YAZOO RIVER.)

(Made at the request of T. F. Walker, City Engineer, Greenwood, Miss.—

Material: Sand.

Character: Sample consists essentially of rounded grains of quartz and chert with a small amount of carbonaceous matter.

REMARKS: Tensile strength 1:3 mortar, lbs. per sq. in. Age 7 days. Sand 11135, 205. Ottawa sand 218. Strength Ratio 94.2 per cent. Age 28 days. Sand 11135, 306. Ottawa Sand 324. Strength Ratio 94.5 per cent.

Respectfully submitted,
(Signed) L. W. PAGE,
Director.

LINCOLN COUNTY

REPORT ON SAMPLE NO. 5253, FROM LINCOLN COUNTY, MISSISSIPPI.

(Made at the request of the Southern Gravel and Material Co., Brookhaven, Miss.)

Material: Ferrugineous sand-clay gravel.

MECHANICAL ANALYSIS

Between 1" - ¾"		16.2
Over 1"		0.0
¾"- ½"		15.9
½"- ¼"		11.2
¼"- ⅛"		10.3
⅛"-10		3.1
10 -20		2.1
20 -30		4.5
30 -40		14.7
40 -50		7.6
50 -80		2.9
Under 80		11.5
	Total	100.0

Character of Material: Specimen consists essentially of rounded chert fragments with a considerable amount of quartz sand and a relatively small amount of ferrugineous clay.

Per centage of voids: 32.4. Cementing value: Excellent. Weight per cubic foot dry: 109 lbs.

REMARKS: Should be an excellent material for gravel road construction.

Respectfully submitted,

(Signed) PAUL D. SARGENT,
Acting Director.

REPORT ON SAMPLE NO. 7542, FROM LINCOLN COUNTY, MISSISSIPPI.

(Made at the request of Morrison Coal Co., Jackson, Mississippi).

Material: Sand Gravel.

Character: Sample consists essentially of rounded fragments of chert, quartz and sandstone, with a large amount of fine quartz sand and some little ferrugineous clay.

MECHANICAL ANALYSIS

	Fraction	Percent		Fraction	Percent
Retained on	1¼" sieve	16.5	Retained on No.	10 seive	63.6
	1" "	18.9		20 "	67.8
	¾" "	32.5		30 "	75.3
	½" "	43.0		40 "	85.6
	¼" "	55.5		50 "	94.2
	⅛" "	62.2		80 "	96.0
Total passing	⅛" "	37.8		100 "	96.2
				200 "	96.4
			By washing		3.6
				Total	100.0

CEMENTING VALUE

On material over ⅛" in size ..... Low.
On material under ⅛" in size ..... Good.
On material as received ..... Fair.

REMARKS: This material contains too much sand and too little clay for best results. Approximately 30 per cent under 1-8 inch and 10 per cent. under No. 200 sieve, is considered a good proportion.

Respectfully submitted,

(Signed) L. W. PAGE,
Director.

REPORT ON SAMPLE NO. 7579 FROM LINCOLN COUNTY, MISSISSIPPI.

(Made at the request of Morrison Coal Company, Jackson, Miss.)

Material: Sand Gravel.

Character: Sample consists essentially of rounded fragments of chert and quartz with a large amount of quartz sand and some little ferruginous clay.

MECHANICAL ANALYSIS

	Fraction	Percent		Fraction	Percent
Retained on	2" sieve	-----	Retained on No.	10 sieve	64.9
	1½" "	4.8		20 "	67.3
	1¼" "	10.7		30 "	73.2
	1" "	18.8		40 "	83.9
	¾" "	32.0		50 "	92.1
	½" "	41.5		80 "	94.2
	¼" "	54.1		100 "	94.2
	⅛" "	63.0		200 "	94.4
Total passing	⅛" "	37.0	Total passing	200 "	94.9
			By analysis		0.2
			By washing		4.9

CEMENTING VALUE

On material over ⅛" in size ..... Low
On material under ⅛" in size ..... Excellent
On material as received ..... Good

REMARKS: This material contains too much sand and too little clay for best results. Approximately 30 per cent. under 1-8 inch and 10 per cent. under No. 200 sieve is considered a good proportion.

Respectfully submitted,
(signed) V. M. PEIRCE,
Acting Director.

REPORT ON SAMPLE NO. 7580, FROM LINCOLN COUNTY, MISSISSIPPI.

(Made at the request of Morrison Coal Co., Jackson, Miss.)

Material: Sand Gravel.

Character: Sample consists essentially of rounded fragments of chert and quartz with a large amount of fine quartz sand.

MECHANICAL ANALYSIS

	Fraction	Percent		Fraction	Percent
Retained on	1¼" sieve	9.1	Retained on	No. 10 sieve	58.7
	1" "	21.5		20 "	62.4
	¾" "	30.2		30 "	70.0
	½" "	38.8		40 "	81.8
	¼" "	49.8		50 "	94.7
	¼" "	57.0		80 "	97.5
	⅛" "			100 "	97.8
Total passing	⅛" "	43.0		200 "	98.0
			Passing	200 "	
			By analysis		0.1
			By washing		1.9

CEMENTING VALUE

On material over ⅛" in size	8
On material unde ⅛" in size	12
On material as received	8

REMARKS: This material contains too much sand and too little clay for best results. Approximately 30 per cent. under 1-8 inch and 10 per cent. under No. 200 sieve is considered a good proportion.

Respectfully submitted,
(Signed) V. M. PEIRCE,
Acting Director.

REPORT ON SAMPLE NO. 7581, FROM LINCOLN COUNTY, MISSISSIPPI.

(Made at request of Morrison Coal Co., Jackson, Miss.)

(See Page 63)

Material: Sand gravel.

Character: Sample consists essentially of large rounded fragments of chert and quartz with a large amount of fine quartz sand.

MECHANICAL ANALYSIS

	Fraction	Percent		Fraction	Percent
Retained on	2" sieve		Retained on	No. 10 sieve	61.0
Retained on	1½" "	2.6	Retained on	No. 20 "	65.4
Retained on	1¼" "	15.4	Retained on	No. 30 "	74.0
Retained on	1" "	23.8	Retained on	No. 40 "	86.1
Retained on	¾" "	30.8	Retained on	No. 50 "	95.2
Retained on	½" "	39.2	Retained on	No. 80 "	97.3
Retained on	½" "	50.8	Retained on	No. 100 "	97.4
Retained on	¼" "	59.0	Retained on	No. 200 "	97.6
Retained on	⅛" "		Passing	200 "	
Total passing	⅛" "	41.0	By Washing		2.4

CEMENTING VALUE

	(Packed)
Voids (loose).	
On material over ⅛" in size	5 Low
On material under ⅛" in size	26 Good.
On material as received	10 Fair

REMARKS: This material contains too much sand and too little clay for best results. Approximately 30 per cent. under 1-8 inch and 10 per cent. under No. 200 Sieve is considered a good proportion.

Respectfully submitted,
(Signed) V. M. PEIRCE,
Acting Director.

REPORT ON SAMPLE NO. 7839, FROM LINCOLN COUNTY, MISSISSIPPI.

(Made at the request of Mr. W. E. Atkinson, State Highway Engineer, New Orleans Court Bld'g., New Orleans, La.

Material: Sand Gravel.

Character: Sample consists essentially of large rounded fragments of chert, with a considerable amount of quartz sand and very little ferrugineous clay.

MECHANICAL ANALYSIS

	Fraction	Percent		Fraction	Percent
Retained on	1½" sieve	2.5	Retained on No.	10 sieve	66.3
Retained on	1¼" "	6.5	Retained on No.	20 "	68.7
Retained on	1" "	20.0	Retained on No.	30 "	72.4
Retained on	¾" "	31.1	Retained on No.	40 "	79.4
Retained on	½" "	41.5	Retained on No.	50 "	87.6
Retained on	¼" "	55.8	Retained on No.	80 "	89.8
Retained on	⅛" "	64.9	Retained on No.	100 "	90.1
Total passing	⅛" "	35.2	Retained on No.	200 "	90.2
			Passing	200 "	
			By analysis		.1
			By washing		9.7
			Total		100.0

CEMENTING VALUE

On material over ⅛" in size ..... Good.
On material under ⅛" in size ..... Excellent.
On material as received ..... Good.

REMARKS: This gravel should prove satisfactory as a road building material.

Respectfully submitted,

(Signed) P. ST. J. WILSON,
Assistant Director.

REPORT ON SAMPLE NO. 8094, FROM LINCOLN COUNTY, MISSISSIPPI.

(Made at the request of Morrison Coal Company, Jackson, Miss.)

Material: Sand Clay Gravel.

Character: Sample consists essentially of large rounded fragments of chert, sandstone and quartz, with a large amount of quartz sand and ferrugineous clay.

MECHANICAL ANALYSIS

	Fraction	Percent		Fraction	Percent
Retained on	1¼" sieve	3.9	Retained on No.	10 sieve	56.8
Retained on	1" "	16.1	Retained on No.	20 "	60.8
Retained on	½" "	35.3	Retained on No.	30 "	69.0
Retained on	¼" "	46.7	Retained on No.	40 "	81.0
Retained on	¾" "	26.4	Retained on No.	50 "	90.0
Retained on	⅛" "	54.9	Retained on No.	80 "	92.3
Total passing	⅛" "	45.1	Retained on No.	100 "	92.5
			Retained on No.	200 "	93.6
			Passing	200 "	
			By analysis		.6
			By washing		5.8
			Total		100.0

CEMENTING VALUE

On material over ⅛" in size ..... Good.
On material under ⅛" in size ..... Excellent.
On material as received ..... Excellent.
Non-slaking.

REMARKS: Sample contains too much sand for best results in gravel road construction. By reducing the percent of material under ⅛ inch in size to about 30, better results should be obtained.

Respectfully submitted,

(Signed) P. ST. J. WILSON,
Assistant Director.

FEDERAL AID.

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 13513.

Name of material: Gravel. Identification marks, None. Submitted by S. A. Gano, Contractor, Jackson, Miss. Sampled, Sept. 2, 1918. Received, Sept. 10, 1918. Sampled from 2 cars. Quantity represented, 2 cars from pit. Source of material, Brookhaven, Lincoln Co., Miss. Location used or to be used, Miss. F. A. Project No. 13. Examined for mechanical analysis.

TEST RESULTS

MECHANICAL ANALYSIS—SAND.

Retained on ¼" screen	37.0
Passing ¼", retained on 10-mesh	9.3
" 10 " " 20 "	2.5
" 20 " " 30 "	4.1
" 30 " " 40 "	7.9
" 40 " " 50 "	6.6
" 50 " " 80 "	3.9
" 80 " " 100 "	0.6
" 100 " " 200 "	1.0
" 200-mesh	27.0
Total	100.0

Loss by washing (silt and clay) 26.6
Cementing value 33

Character of material. Sample consists essentially of subangular fragments of chert with a large amount of sand and ferrugineous clay.

Respectfully submitted,

(Signed) L. W. PAGE,
Director.

FEDERAL AID.

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 13919.

Name of material: Gravel. Identification marks, none. Submitted by Miss. State Highway Dept., Jackson, Miss. Sampled February 13, 1919. Received February 24, 1919. Sampled from pit. Quantity represented 10,000 cu. yds. Source of material, Bogue Chitto, Lincoln Co., Miss. Location used or to be used, Miss. F.A., No. 10. Examined for suitability for use in surfacing.

TEST RESULTS

SAND (Mechanical analysis)

	Fraction	Percent
Retained on ¼" screen		55.5
Passing ¼", retained on	10-mesh	14.0
" 10 " "	20 "	4.3
" 20 " "	30 "	1.7
" 30 " "	40 "	2.1
" 40 " "	50 "	2.5
" 50 " "	80 "	3.7
" 80 " "	100 "	1.3
" 100 " "	200 "	1.6
" 200-mesh		13.3
Total		100.0

GRAVEL—(Mechanical analysis.)

	Fraction	Percent
Passing 1½" retained on	1" screen	4.6
" 1" " "	¾" "	13.0
" ¾" " "	½" "	15.7
" ½" " "	¼" "	22.2
" ¼" screen		44.5
Total		100.0

Loss by washing (silt and clay) 12.2
Cementing value 97

Character of material. Sample consists essentially of rounded fragments of weathered chert with some angular quartz sand and ferrugineous clay.

Respectfully submitted,

(Signed) P. ST. J. WILSON,
Assistant Director.

REPORT ON SAMPLE NO. 10092, OF ROAD MATERIAL FROM LINCOLN COUNTY, MISSISSIPPI.

(Made at the request of Morrison Coal Co., Jackson, Miss.)

Material:_ Sand Clay Gravel.

Totals Retained on Screens	BETWEEN SCREENS Sample	Coarse Aggregate
1½" 7.1%	2 "-1½" 7.1%	18.1%
1¼" 10.1%	1½"-1¼" 3.0%	7.6%
1" 14.3%	1¼"-1" 4.2%	10.7%
¾" 21.5%	1" -¾" 7.2%	18.4%
½" 30.9%	¾" -½" 9.4%	24.0%
¼" 39.2%	½" -¼" 8.3%	21.2%
		100.0%
		Fine Aggregate
10-mesh 47.4%	¼- 10 ..... 8.2%	13.5%
20-mesh 53.3%	10- 20 ..... 5.9%	9.7%
30-mesh 63.3%	20- 30 ..... 10.0%	16.5%
40-mesh 76.8%	30- 40 ..... 13.5%	22.2%
50-mesh 85.5%	40- 50 ..... 8.7%	14.3%
80-mesh 87.1%	50- 80 ..... 1.6%	2.6%
100-mesh 87.3%	80-100 ..... 0.2%	0.3%
200-mesh 87.7%	100-200 ..... 0.4%	0.7%
..... -	200 and under 12.3%	20.2%
	100.0%	100.0%

Cementing value: Retained on ¼" screen—low; passing ¼" screen—high.

Character: Sample consists essentially of rounded chert fragments with a large amount of sand and ferrugineous clay.

REMARKS: Sample contains more sand than is ordinarily considered desirable for use in gravel road construction. It is otherwise satisfactory.

Respectfully submitted,

(Signed) P. ST. J. WILSON,
Acting Director.

REPORT ON SAMPLE OF GRAVEL.

Laboratory No. 15184.

Name of material: Chert Gravel. Submitted by Good Roads Commission, St. Tammany Parish, Louisiana. Sampled September 24, 1919. Received October 29, 1919. Sampled from, pit. Source of material, Brookhaven, Lincoln County, Mississippi. Examined for use as surfacing material.

TEST RESULTS

SAND—(Mechanical analysis.)

Fraction	Percent
Retained on ¼" screen	59.3
Passing ¼", retained on 10-mesh	7.8
" 10 " " 20 "	2.1
" 20 " " 30 "	3.8
" 30 " " 40 "	10.6
" 40 " " 50 "	6.6
" 50 " " 80 "	3.3
" 80 " " 100 "	.2
" 100 " " 200 "	.2
" 200-mesh " "	6.1
Total	100.0%

GRAVEL—(Mechanical analysis.)

Fraction	Percent
Passing 2" retained on 1½" screen	12.4
" 1½" " " 1" "	21.3
" 1" " " ¾" "	7.6
" ¾" " " ½" "	7.3
" ½" " " ¼" "	10.7
" ¼" screen	40.7
Total	100.0%

Loss by washing (silt and clay) 6.0%
Cementing value ..... 47 %

Character of material. Sample consists essentially of rounded fragments of weathered chert with some quartz sand and a little ferrugineous clay.

Respectfully submitted,

(Signed) A. T. GOLDBECK,
Engineer of Test.

LOWNDES COUNTY

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 15019.

Name of material: Chert Gravel. Identification marks, "Vaughn." Submitted by Chas. L. Wood, Co., Engr., Columbus, Miss. Sampled Sept. 25, 1919. Received Oct. 1, 1919. Sampled from pit. Quantity represented, ¼ acre. Source of material (Prop. of F. M. Vaughn), Lowndes Co., Miss. Location used or to be used, Mississippi F. A., Project No. 21. Examined for, use as surfacing material.

TEST RESULTS

SAND—(Mechanical analysis.)

Fraction	Percent
Retained on ¼" screen	33.1
Passing ¼", retained on 10-mesh	7.0
" 10 " " " 20 "	3.3
" 20 " " " 30 "	6.2
" 30 " " " 40 "	11.2
" 40 " " " 50 "	10.9
" 50 " " " 80 "	9.6
" 80 " " " 100 "	0.7
" 100 " " " 200 "	2.1
" 200-mesh	15.9
Total	100.0

GRAVEL—(Mechanical analysis.)

Fraction	Percent
Passing 1½", retained on 1" screen	0.9
" 1" " " ¾" "	5.1
" ¾" " " ½" "	10.0
" ½" " " ¼" "	17.1
" ¼" screen	66.9
Total	100.0

Loss by washing (silt and clay) 15.2%
Cementing value ..... 69 %

Character of material: Sample consists essentially of subangular chert fragments with a considerable amount of fine quartz sand, silt, and ferruginous clay.

Respectfully submitted,
(Signed) A. J. GOLDBECK,
Engineer of Tests

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 15020.

Name of material: Chert Gravel. Submitted by Chas. L. Wood, Co., Engr., Columbus, Miss. Sampled, Sept. 25th, 1919. Received October 1, 1919. Sampled from pit. Quantity represented ½ acre, 4 feet deep. Source of material (Prop. of Mrs. T. B. Acher), Lowndes County, Miss. Location used or to be used, Mississippi F. A. Project No. 21. Examined for use as surfacing material.

TEST RESULTS

SAND—(Mechanical analysis.)

Fraction	Percent
Retained on ¼" screen	61.3
Passing ¼", retained on 10-mesh	8.8
" 10 " " " 20 "	4.7
" 20 " " " 30 "	5.9
" 30 " " " 40 "	2.4
" 40 " " " 50 "	0.9
" 50 " " " 80 "	1.6
" 80 " " " 100 "	0.5
" 100 " " " 200 "	0.8
" 200-mesh	13.1
Total	100.0

GRAVEL—(Mechanical analysis.)

Fraction	Percent
Passing 1½" retained on 1" screen	4.1
" 1" " " ¾" "	12.3
" ¾" " " ½" "	23.2
" ½" " " ¼" "	21.7
" ¼" screen	38.7
Total	100.0

Loss by washing (silt and clay) 12.0%
Cementing value ..... 62 %

Character of material: Sample consists essentially of subangular chert fragments with a considerable amount of fine quartz sand, silt, and ferruginous clay.

Respectfully submitted,
(Signed) A. J. GOLDBECK,
Engineer of Tests

REPORT OF SAMPLE OF CHERT GRAVEL.

Laboratory No. 15021.

Name of material, Chert Gravel. Submitted by Chas. L. Wood, County Engineer, Columbus Mississippi. Sampled September 25th, 1919. Received Oct. 1, 1919. Sampled from pit. Quantity represented ½ acre. Source of material, (Prop. of Geo. Boyd), Lowndes Co., Miss. Location used or to be used, Mississippi F. A. Project No. 21. Examined for use as surfacing material.

TEST RESULTS

SAND—(Mechanical analysis.)

Fraction	Percent
Retained on ¼" screen	36.7
Passing ¼", retained on 10-mesh	6.0
" 10 " " 20 "	4.5
" 20 " " 30 "	3.9
" 30 " " 40 "	2.6
" 40 " " 50 "	1.5
" 50 " " 80 "	5.4
" 80 " " 100 "	1.8
" 100 " " 200 "	6.1
" 200-mesh	30.7
Total	100.0

GRAVEL—(Mechanical analysis.)

Fraction	Percent
Passing 1½" retained on 1" screen	3.2
" 1" " " ¾" "	8.2
" ¾" " " ½" "	10.7
" ½" " " ¼" "	14.6
" ¼" screen	63.3
Total	100.0

Loss by washing (silt and clay) 30.4%
Cementing value ..... 268 %

Character of material: Sample consists essentially of subangular fragments of weathered chert, with some fine quartz sand, and a large amount of ferrugineous clay.

Respectfully submitted,

(Signed) A. J. GOLDBECK,
Engineer of Tests

REPORT OF SAMPLE OF CHERT GRAVEL.

Laboratory No. 15022.

Name of material: Chert Gravel. Identification marks, "Craddock." Submitted by Chas. L. Wood, Co. Engr., Columbus, Miss. Sampled Sept. 25, 1919. Received Oct. 1, 1919. Sampled from, pit. Quantity represented, ⅛ acre. Source of material, (Prop. of J. N. Craddock), Lowndes Co., Miss. Location used or to be used, Mississippi F. A. Project No. 21. Examined for use as surfacing material.

TEST RESULTS

SAND—(Mechanical analysis.)

Fraction	Percent
Retained on ¼" screen	41.8
Passing ¼", retained on 10-mesh	5.7
" 10 " " 20 "	2.7
" 20 " " 30 "	2.1
" 30 " " 40 "	1.3
" 40 " " 50 "	1.1
" 50 " " 80 "	8.8
" 80 " " 100 "	3.0
" 100 " " 200 "	8.9
" 200-mesh	24.6
Total	100.0

GRAVEL—(Mechanical analysis.)

Fraction	Percent
Passing 1½" retained on 1" screen	5.6
" 1" " " ¾" "	7.3
" ¾" " " ½" "	14.4
" ½" " " ¼" "	14.5
" ¼" screen	58.2
Total	100.0

Loss by washing (silt and clay) 22.5%
Cementing value ..... 353 %

Character of material: Sample consists essentially of subangular fragments of weathered chert, with a considerable amount of quartz sand and ferruginous clay.

Respectfully submitted,

(Signed) A. J. GOLDBECK,
Engineer of Tests

REPORT OF SAMPLE OF CHERT GRAVEL.

Laboratory No. 15023.

Name of material: Chert Gravel. Submitted by Chas. L. Wood, County Engineer, Columbus, Mississippi. Sampled September 25th, 1919. Received October 1, 1919. Sampled from pit. Quantity represented, ¼ acre, 4 feet deep. Source of material, (prop. of J. H. Harper), Lowndes Co., Miss. Location used or to be used, Mississippi F. A. Project No. 21. Examined for use as surfacing material.

TEST RESULTS

SAND—(Mechanical analysis.)

Fraction	Percent
Retained on ¼" screen	47.1
Passing ¼", retained on 10-mesh	5.7
" 10 " " 20 "	2.5
" 20 " " 30 "	4.5
" 30 " " 40 "	5.7
" 40 " " 50 "	3.0
" 50 " " 80 "	12.9
" 80 " " 100 "	2.7
" 100 " " 200 "	7.3
"200-mesh	8.6
Total	100.0

GRAVEL—(Mechanical analysis.)

Fraction	Percent
Passing 1½" retained on 1" screen	2.5
" 1" " ¾" "	9.9
" ¾" " ½" "	15.1
" ½" " ¼" "	19.6
" ¼" screen	52.9
Total	100.0

Loss by washing (silt and clay) 7.5%
Cementing value ..... 55 %

Character of material: Sample consists essentially of subangular fragments of weathered chert with some quartz sand and ferrugineous clay.

Respectfully submitted,

(Signed) A. J. GOLDBECK,
Engineer of Tests

REPORT ON SAMPLE NO. 7543, FROM LOWNDES COUNTY, MISSISSIPPI

(Made at the request of Columbus Brick Co., Columbus, Mississippi.)

Material: Sand Gravel.

Character: Sample consists essentially of rounded fragments of weathered chert, sandstone and quartz with a large amount of quartz sand and some ferrugineous clay.

MECHANICAL ANALYSIS

Fraction	Percent
Retained on 1¼" sieve	1.7
Retained on 1" "	6.3
Retained on ¾" "	14.1
Retained on ½" "	28.2
Retained on ¼" "	52.9
Retained on ⅛" "	66.2
Total passing ⅛" "	33.8

	Percent
Retained on No. 10 sieve	69.4
Retained on No. 20 "	74.8
Retained on No. 30 "	80.5
Retained on No. 40 "	86.0
Retained on No. 50 "	93.5
Retained on No. 80 "	97.8
Retained on No. 100 "	98.1
Retained on No. 200 "	98.5
Passing 200 "	
By washing	1.5
Total	100.0

CEMENTING VALUE

On material over ⅛" in size	Good.
On material under ⅛" in size	Fair.
On material as received	Fair.

REMARKS: This material is somewhat fine for use in gravel road construction. The per cent of clay is also somewhat low for best results.

Respectfully submitted,

(Signed) L. W. PAGE,
Director.

REPORT ON SAMPLE NO 9035 OF ROAD MATERIAL FROM LOWNDES COUNTY, MISSISSIPPI—COLUMBUS

(Made at the request of J. T. Armstrong, Columbus, Miss.)

Material: Sand-Clay Gravel.

Totals Retained on Screens	BETWEEN SCREENS		
	Sample		Coarse Aggregate
1" 2.6%	1¼"-1"	2.6%	8.2%
¾" 7.5%	1" - ¾"	4.9%	15.4%
½" 15.7%	¾"- ½"	8.2%	25.9%
¼" 31.7%	½"- ¼"	16.0%	50.5%
			100.0%
			Fine Aggregate
10-mesh 45.8%	¼"- 10	14.1%	20.7
20-mesh 48.5%	10- 20	2.7%	4.0
30-mesh 51.8%	20- 30	3.3%	4.8
40-mesh 57.0%	30- 40	5.2%	7.6
50-mesh 66.0%	40- 50	9.0%	13.2
80-mesh 75.8%	50- 80	9.8%	14.3
100-mesh 76.5%	80-100	0.7%	1.0
200-mesh 78.8%	100-200	2.3%	3.4
	200 and under	21.2%	31.0
		100.0%	100.0%

(Cementing value: Retained on ¼" screen—6; passing ¼" screen—56; as received—41.)

Character: Sample consists essentially of rounded subangular fragments of weathered chert and quartz with a considerable amount of quartz sand and highly ferrugineous clay.

REMARKS: Material contains too much sand for best results in gravel road construction. Should prove satisfactory for use as a natural sand-clay surfacing material.

Respectfully submitted,
(Signed) VERNON M. PEIRCE,
Acting Director.

REPORT ON SAMPLE OF GRAVEL.

Laboratory No. 10883.

Name of Material: Sand Clay Gravel. Submitted by, R. B. Claggett, Columbus Railway, Light & Power Company, Columbus. Sampled: Received, October 13, 1918. Source of material: Columbus, Lowndes Co., Miss. Examined for use as surfacing material.

Character of Material: Sample consists essentially of subangular fragments of chert and sandstone, with a large amount of quartz sand and considerable ferruginous clay.

TEST RESULTS

SAND—(Mechanical analysis.)

Fraction	Percent
Retained on ¼" screen	60.7
Passing ¼", retained on 10-mesh	6.4
" 10 " " 20 "	2.4
" 20 " " 30 "	6.3
" 30 " " 40 "	7.0
" 40 " " 50 "	4.6
" 50 " " 80 "	4.7
" 80 " " 100 "	0.9
" 100 " " 200 "	0.5
" 200-mesh	6.5
Total	100.0

GRAVEL—(Mechanical analysis.)

Fraction	Percent
Passing 2" , retained on 1½" screen	6.3
" 1½" " " 1" "	14.0
" 1" " " ¾" "	12.0
" ¾" " " ½" "	13.5
" ½" " " ¼" "	14.9
" ¼" screen	39.3
Total	100.0

Loss by washing (silt and clay) Cementing value 49

REMARKS: Should make a very good gravel road material.

Respectfully submitted,
(Signed) P. ST. J. WILSON,
Acting Director

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 15458.

Name of material: Chert Gravel. Submitted by Washington County Highway Commission, Greenville Mississippi. Sampled January 5, 1920. Received January 10th, 1920. Sampled from pit. Quantity represented approximately 1,000,000 yards. Source of material, (Property of Vann Smith) Columbus, Lowndes County, Miss. Examined for use in concrete road construction.

TENSILE STRENGTH.
(Cement-sand briquets, 1:3.)

Standard Ottawa Sand.		Sample Sand.	
7 days	28 days	7 days	28 days
255	340	385	510
255	340	375	515
255	340	390	525
---	---	---	---
255	340	383	517
Str. Ratio		130.9%	

Respectfully submitted,
(Signed) A. T. GOLDBECK,
Engineer of Tests.

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 15460.

Name of material: Chert Gravel. Submitted by Washington County Highway Commission, Greenville, Miss. Sampled Jan. 5, 1920. Received Jan. 10, 1920. Sampled from pit. Quantity represented, approximately 1,000,000 yds. Source of material (Prop. Vann Smith), Columbus, Lowndes County, Miss. Examined for use in concrete road construction.

TENSILE STRENGTH.
(Cement-sand briquets, 1:3.)

Standard Ottawa Sand	Sample Sand
28 days	28 days
340	455
340	440
340	440
---	---
340	445
Str. Ratio	134.7%

Respectfully submitted,
(Signed) A. T. GOLDBECK,
Engineer of Tests.

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 15459.

Name of material: Chert Gravel. Submitted by, Washington County Highway Commission, Greenville, Miss. Sampled from pit. Quantity represented, approximately 1,000,000 yards. Source of material (Prop. Vann Smith) Columbus, Lowndes County, Miss. Examined for use in concrete road construction.

TENSILE STRENGTH.
(Cement-sand briquets, 1:3.)

Standard Ottawa Sand	Sample Sand	
28 days	28 days	
340	470	
340	450	
340	455	
---	---	
340	458	
Str. Ratio	150.2%	152.1%

Respectfully submitted,
(Signed) A. T. GOLDBECK,
Engineer of Tests.

REPORT ON SAMPLE OF CHERT GRAVEL.
Laboratory No. 15473.

Name of material: Chert Gravel. Submitted by Battle Bell, Office of Tax Collector, Columbus, Mississippi. Sampled January 12, 1920. Received January 19, 1920. Source of material, not shown (File in Lowndes Co., Miss.) Examined for use as road surfacing material.

TEST RESULTS

SAND. (Mechanical analysis.)

Fraction	Percent
Retained on ¼" screen	39.3
Passing ¼", retained on 10-mesh	14.7
" 10 " " 20 "	5.6
" 20 " " 30 "	8.3
" 30 " " 40 "	14.3
" 40 " " 50 "	9.4
" 50 " " 80 "	9.7
" 80 " " 100 "	1.0
" 100 " " 200 "	2.6
" 200-mesh	34.4
Total	100.0
Cementing value	118%

GRAVEL. (Mechanical analysis.)

Fraction	Percent
Passing 1½" retained on 1" screen	8.9
" 1" " " ¾" "	24.7
" ¾" " " ½" "	26.7
" ½" " " ¼" "	39.7
" ¼" screen	60.7
Total	100.0

Character of material: Sample consists essentially of rounded fragments of weathered chert with a large amount of quartz sand and ferrugineous clay.

Respectfully submitted,
(Signed) A. T. GOLDBECK,
Engineer of Tests.

REPORT ON SAMPLE NO. 9689 OF ROAD MATERIAL FROM LOWNDES COUNTY, MISSISSIPPI—BED OF TOMBIGBEE, AT COLUMBUS.

(Made at the request of Association of American Portland Cement M'frs.)

Material: Sand Gravel.

Totals Retained on Screens	BETWEEN SCREENS: Sample	BETWEEN SCREENS: Coarse Aggregate
1¼" 3.0%	1½"-1¼" 3.0%	3,9%
1" 11.1%	1¼"-1" 8.1%	10,4%
¾" 22.3%	1" - ¾" 11.2%	14,4%
½" 55.0%	¾"- ½" 32.7%	42,1%
¼" 77.7%	½"- ¼" 22.7%	29,2%
		100.0%
		Fine Aggregate
10-mesh 89.4%	¼"- 10 11.7%	52.4%
20-mesh 91.6%	10- 20 2 2%	9.9%
30-mesh 93.3%	20- 30 1.7%	7.6%
40-mesh 96.1%	30- 40 2.8%	12.5%
50-mesh 97.2%	40- 50 1.1%	4.9%
80-mesh 99.8%	50- 80 2.6%	11.7%
100-mesh 99.9%	80-100 0.1%	0.5%
200-mesh 100.0%	100-200 0.1%	0.5%
	200 and under 0.0%	
	100.0%	100.0%

Character: Sample consists essentially of large rounded and subangular fragments of chert and quartz with a considerable amount of quartz sand.

Respectfully submitted,
(Signed) P. ST. J. WILSON,
Assistant Director.

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 14522.

Name of material: Chert Gravel. Submitted by P. W. Maer, Dispatch Building, Columbus, Miss. Sampled, May 30, 1919. Received, July 8, 1919. Sampled from pit. Source of material, Columbus, Lowndes Co., Miss. Examined for use in concrete road construction.

TEST RESULTS

SAND. (Mechanical analysis.)

Fraction	Percent
Retained on ¼" screen	53.6
Passing ¼", retained on 10-mesh	12.5
" 10 " " 20 "	3.1
" 20 " " 30 "	3.9
" 30 " " 40 "	8.6
" 40 " " 50 "	7.1
" 50 " " 80 "	6.4
" 80 " " 100 "	0.4
" 100 " " 200 "	0.9
" 200-mesh	3.5
Total	100.0

GRAVEL. (Mechanical analysis.)

Fraction	Percent
Passing 3" retained on 1½" screen	3.6
" 1½" " " 1" "	0.9
" 1" " " ¾" "	8.7
" ¾" " " ½" "	16.4
" ½" " " ¼" "	24.0
" ¼" screen	46.4
Total	100.0

Loss by washing (silt and clay) 3.3%
Cementing value ..... 20 %

Character of material: Sample consists essentially of rounded chert fragments with a large amount of angular quartz sand and some clay and organic matter.

Respectfully submitted,

(Signed) THOS. H. MacDONALD,
Chief of Bureau.

MARSHALL COUNTY

REPORT OF TESTS ON SAMPLE NO. 9161, FROM HOLLY SPRINGS, MARSHALL COUNTY, MISSISSIPPI

(Made at the request of Association of American Portland Cement M'frs., Philadelphia.)

Material: Sand.

Tensile strength—lbs. per. sq. in. 7 days.

Ottawa Sand	Sand 9161
260	280
265	300
280	270

Note:—Cement No. 9340, submitted with sand No. 9161, used in these tests.

Character: Sample consists essentially of angular fragments of quartz and feldspar, coated with iron oxide.

REMARKS: Results of 7-day strength test indicates that this sand should prove satisfactory for use in concrete road construction.

Respectfully submitted,

(Signed) P. ST. J. WILSON,
Assistant Director.

NOXUBEE COUNTY

REPORT OF TESTS ON SAMPLE NO. 5884, BIGBEE GRAVEL PIT, FROM NOXUBEE COUNTY, MISSISSIPPI.

(See Page 67)

(Submitted by Mr. F. M. McClure, Macon, Mississippi.)

Material: Chert Gravel.

MECHANICAL ANALYSIS

Fraction	Percent
Material between 1" & ¾"	9.1
Material between ¾" & ½"	17.1
Material between ½" & ¼"	24.4
Material between ¼" & ⅛"	13.1
Total over ⅛" (gravel)	63.7
Material between ⅛" & No. 10	4.1
Material between No. 10 & No. 20	4.8
Material between No. 20 & No. 30	6.2
Material between No. 30 & No. 40	8.3
Material between No. 40 & No. 50	5.7
Material between No. 50 & No. 80	4.9
Total between ⅛" & No. 80	34.0
Between No. 80 & No. 100	0.6
Between No. 100 & No. 200	1.2
Under No. 200	0.5
Total under No. 80 (clay)	2.3

Cementing Value—

Material over ⅛"	13
Material under ⅛"	90
Untreated sample	127

Character: Sample consists of rounded chert fragments and a considerable portion of ferruginous sand and some argillaceous material.

REMARKS: Should make a good road material.

Respectfully submitted,
(Signed) VERNON M. PEIRCE,
Acting Director.

PANOLA COUNTY

REPORT ON SAMPLE NO. 7450, FROM PANOLA COUNTY, MISSISSIPPI.

(Made at the request of Batesville Gravel and Material Co., Memphis, Tenn.)

(See Page 69)

Material: Sand Clay Gravel.

MECHANICAL ANALYSIS

Fraction	Percent
Retained on 1¼" sieve	5.4
Retained on 1" sieve	16.2
Retained on ¾" sieve	28.3
Retained on ½" sieve	41.7
Retained on ¼" sieve	50.3
Retained on ⅛" sieve	59.4
Total passing ⅛" sieve	40.6
Retained on No. 10 sieve	61.2
Retained on No. 20 sieve	71.1
Retained on No. 30 sieve	81.9
Retained on No. 40 sieve	85.9
Retained on No 50 sieve	88.0
Retained on No. 80 sieve	88.8
Retained on No. 100 sieve	88.9
Retained on No. 200 sieve	89.0
Passing No. 200 sieve	11.0

CEMENTING VALUE

On material over ⅛" in size	Good
On material under ⅛" in size	Excellent
On material as received	Excellent

Character: Sample consists essentially of rounded fragments of chert and quartz with a large amount of quartz sand and considerable amount of clay.

REMARKS: Should prove satisfactory for gravel road construction, although the amount of sand present is somewhat in excess of the 30% usually considered sufficient for best results.

(Signed) P. ST. J. WILSON,
Assistant Director.

PERRY COUNTY

REPORT ON SAMPLE NO. 7272, FROM PERRY COUNTY, MISSISSIPPI.

(Made at the request of Richton Land and Development Company, Richton, Mississippi.)

(See Page 70)

Material: Ferrugineous sand-clay gravel.

MECHANICAL ANALYSIS

Fraction	Percent		Percent
Retained on 1" sieve	0.3	Retained on No. 10 sieve	43.2
Retained on ¾" sieve	5.9	Retained on No. 20 sieve	57.2
Retained on ½" sieve	9.0	Retained on No. 30 sieve	70.5
Retained on ¼" sieve	24.3	Retained on No. 40 sieve	79.6
Retained on ⅛" sieve	39.1	Retained on No. 50 sieve	87.2
Total passing ⅛" sieve	60.9	Retained on No. 80 sieve	89.6
		Retained on No. 100 sieve	90.2
		Retained on No. 200 sieve	90.3
		Total passing No. 200 sieve	9.7

CEMENTING VALUE

On material over ⅛" in size.....Low
On material under ⅛" in size.....Very Good
On material as received.....Excellent

Character: Sample consists essentially of rounded fragments of chert quartzite and quartz with a large proportion of quartz sand and ferrugineous clay.

REMARKS: A fairly good road building gravel. Would probably give better results if the amount of material over ⅛ in. in size was increased to about 7% of the whole.

Respectfully submitted,
(Signed) VERNON M. PEIRCE,
Acting Director.

REPORT ON SAMPLE NO. 7689, FROM PERRY COUNTY, MISSISSIPPI—RICHTON.

(Made at the request of Richton Lumber Company, Richton, Mississippi.)

Material: Sand Clay Gravel.

MECHANICAL ANALYSIS

Fraction	Percent		Percent
Retained on 1" sieve	.4	Retained on No. 10 sieve	55.7
Retained on ¾" sieve	10.3	Retained on No. 20 sieve	61.5
Retained on ½" sieve	27.2	Retained on No. 30 sieve	68.1
Retained on ¼" sieve	43.6	Retained on No. 40 sieve	73.5
Retained on ⅛" sieve	53.4	Retained on No. 50 sieve	81.7
Total Passing ⅛" sieve	46.6	Retained on No. 80 sieve	88.0
		Retained on No. 100 sieve	89.0
		Retained on No. 200 sieve	91.2
		Passing No. 200 sieve	
		By analysis	.7
		By washing	8.1
		Total	100.0

CEMENTING VALUE

On material over ⅛" in size.....Low
On material under ⅛" in size.....Good
On material as received.....Good

Character: Sample consists essentially of rounded fragments of chert and quartz, with a large amount of quartz sand and considerable ferrugineous clay.

REMARKS: This material contains too much sand to be satisfactory for use in road construction. May be made satisfactory by removing the sand and, after the road has been constructed of the remaining gravel, spreading a mixture of this sand and a good bonding clay over the road to a depth of about one-third the thickness of the road. (Sand is all material under ⅛ inch in size).

Respectfully submitted,
(Signed) P. ST. J. WILSON,
Assistant Director.

PIKE COUNTY

REPORT ON SAMPLE NO. 3935 OF ROAD MATERIAL FROM PIKE COUNTY, MISSISSIPPI.

Property of C. Julian Bartlett.

(Made at the request of F. M. Kerr, Ch. State Engineer, 402 Cotton Exchange B'ldg., New Orleans, La.)

Material: Ferrugineous Sand-Gravel.

Cementing value.....Good (53)

REMARKS: Specimen consists of rounded fragments of chert and quartz associated with a considerable amount of sand and some ferrugineous clay. Should make a satisfactory road material.

Respectfully submitted,

(Signed) J. E. PENNYBACKER,
Acting Director.

REPORT ON SAMPLE NO. 11126 OF ROAD MATERIAL FROM PIKE COUNTY, MISSISSIPPI.

(Made at the request of J. D. Weatherby, McComb, Mississippi).

MECHANICAL ANALYSIS

Totals Retained on Screens		BETWEEN SCREENS		
		Sample		Coarse Aggregate
¾"	4.3%	1" - ¾"	4.3%	11.5%
½"	17.5%	¾"- ½"	13.2%	35.4%
¼"	37.3%	½"- ¼"	19.8%	53.1%
				100.0%
				Fine Aggregate
10-mesh	58.3%	¼"- 10	21.0%	33.5%
20-mesh	66.9%	10- 20	8.6%	13.7%
30-mesh	76.2%	20- 30	9.3%	14.8%
40-mesh	85.1%	30- 40	8.9%	14.2%
50-mesh	91.7%	40- 50	6.6%	10.5%
80-mesh	96.0%	50- 80	4.3%	6.9%
100-mesh	96.3%	80-100	0.3%	0.5%
200-mesh	96.7%	100-200	0.4%	0.6%
		200 and under	3.3%	5.3%
			100.0%	100.0%

Cementing Value.....25%

Character: Sample consists essentially of subangular chert fragments with some sand and ferrugineous clay.

Respectfully submitted,

(Signed) L. W. PAGE,
Director.

SCOTT COUNTY

REPORT ON SAMPLE NO. 10892, OR ROAD MATERIAL FROM SCOTT COUNTY, MISSISSIPPI—FOREST

(Made at the request of W. C. Blossom, Forest, Miss.)

Material: Sand Clay Gravel.

MECHANICAL ANALYSIS

Total Retained on Screens	Percent	Between Screens—Sample	Percent
½"	0.8	¾"-½"	0.8
¼"	18.1	½"-¼"	17.3
10-mesh	54.2	¼"- 10	36.1
20-mesh	73.5	10- 20	19.3
30-mesh	82.4	20- 30	8.9
40-mesh	84.3	30- 40	1.9
50-mesh	84.9	40- 50	0.6
80-mesh	86.5	50- 80	1.6
100-mesh	87.1	80-100	0.6
200-mesh	88.2	100-200	1.1
		200 and under	11.8
			100.0

Cementing value of material passing ¼" screen.....50

Character: Sample consists essentially of subangular and rounded fragments of quartz and chert with a large amount of quartz sand and considerable clay.

REMARKS: Contains entirely too much sand to be satisfactorily used in gravel road construction.

Respectfully submitted,

(Signed) P. ST. J. WILSON,
Acting Director.

REPORT ON SAMPLE OF GRAVEL.

Laboratory No. 13572.

Name of material: Gravel. Submitted by W. C. Blossom, Forest, Mississippi. Received September 24, 1918. Sampled from pit. Source of material, Forest, Scott Co., Miss. Examined for use in construction of gravel road

TEST RESULTS

SAND (Mechanical Analysis)		GRAVEL (Mechanical Analysis)	
Fraction	Percent	Fraction	Percent
Retained on ¼" screen	36.0	Passing ¾" retained on ½" screen	6.9
Passing ¼" retained on 10-mesh	26.9	Passing ½" retained on ¼" screen	29.1
Passing 10 retained on 20-mesh	16.1	Passing ¼" screen	64.0
Passing 20 retained on 30-mesh	7.1	Total	100.0
Passing 30 retained on 40-mesh	1.3		
Passing 40 retained on 50-mesh	0.5		
Passing 50 retained on 80-mesh	2.2		
Passing 80 retained on 100-mesh	1.4		
Passing 100 retained on 200-mesh	0.8		
Passing 200-mesh	7.7		
Total	100.0		
Loss by washing (silt and clay)	6.5		
Cementing value	19		

Character of material—Sample consists essentially of subangular fragments of chert and quartz in part cemented together by a matrix of quartz sand and ferrugineous clay.

Respectfully submitted,

(Signed) L. W. PAGE,
Director.

SIMPSON COUNTY

REPORT OF TEST ON SAMPLE No. 6768, FROM SIMPSON COUNTY, MISSISSIPPI—WEATHERSBY.

(Made at the request of P. M. Seay, Hattiesburg, Mississippi).

Material: Clay Gravel.

MECHANICAL ANALYSIS

Fraction	Percent	Fraction	Percent
Retained on 1¼" sieve	1.1	Retained on No. 10 sieve	67.0
Retained on 1 " sieve	3.7	Retained on No. 20 sieve	74.8
Retained on ¾" sieve	10.3	Retained on No. 30 sieve	77.1
Retained on ½" sieve	18.9	Retained on No. 40 sieve	78.0
Retained on ¼" sieve	40.0	Retained on No. 50 sieve	79.5
Retained on ⅛" sieve	61.6	Retained on No. 80 sieve	81.9
Total passing ⅛" sieve	38.4	Retained on No. 100 sieve	82.3
		Retained on No. 200 sieve	82.8
		Passing No. 200 sieve	17.2

CEMENTING VALUE

On material over ⅛" in size	Low
On material under ⅛" in size	Good
On material as received	Good

Character: Sample consists essentially of rounded fragments of chert and quartz, quartz sand and ferrugineous clay.

REMARKS: Should be satisfactory for use in gravel road construction. Too much clay is present to permit of drainage when used as ballast.

Respectfully submitted,

(signed) PANE D. SARGENT,
Acting Director.

REPORT ON SAMPLE OF SAND-CLAY GRAVEL.

Laboratory No. 14357.

Name of material: Sand-Clay Gravel. Submitted by Simpson County Gravel Company, Mendenhall, Miss. Sampled, about May 25, 1919. Received, June 3, 1919. Sampled from test hole. Source of material Saratoga, Simpson County, Mississippi. Examined for use in road construction.

TEST RESULTS

SAND
(Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	58.9
Passing ¼" retained on 10-mesh	13.4
Passing 10 retained on 20-mesh	1.6
Passing 20 retained on 30-mesh	0.3
Passing 30 retained on 40-mesh	0.1
Passing 40 retained on 50-mesh	0.2
Passing 50 retained on 80-mesh	1.9
Passing 80 retained on 100-mesh	0.5
Passing 100 retained on 200-mesh	1.6
Passing 200-mesh	21.5
Total	100.0
Loss by washing (silt and clay)	21.5
Cementing value	39

GRAVEL
(Mechanical Analysis)

Fraction	Percent
Passing 1½" retained on 1 " screen	1.3
Passing 1 " retained on ¾" screen	3.9
Passing ¾" retained on ½" screen	18.8
Passing ½" retained on ¼" screen	34.9
Passing ¼" screen	41.1
Total	100.0

Character of material—Sample consists essentially of subangular fragments of chert and quartz with some fine quartz sand and considerable highly plastic ferrugineous clay.

Respectfully submitted,

(Signed) P. ST. J. WILSON,
Acting Director.

REPORT ON SAMPLE OF SAND-CLAY GRAVEL.

Laboratory No. 14688.

(See Page 71)

Name of material: Sand Clay Gravel. Submitted by Simpson Co. Gravel Co., Mendenhall, Miss. Received July 30, 1919. Source of material, Simpson Co., Miss.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	65.4
Passing ¼" retained on 10-mesh	3.6
Passing 10 retained on 20-mesh	1.4
Passing 20 retained on 30-mesh	1.2
Passing 30 retained on 40-mesh	3.5
Passing 40 retained on 50-mesh	3.2
Passing 50 retained on 80-mesh	7.4
Passing 80 retained on 100-mesh	1.1
Passing 100 retained on 200-mesh	2.8
Passing 200-mesh	10.4
Total	100.0
Loss by washing (silt and clay)	9.7
Cementing value	64

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 1½" retained on 1 " screen	12.5
Passing 1 " retained on ¾" screen	20.4
Passing ¾" retained on ½" screen	23.6
Passing ½" retained on ¼" screen	8.9
Passing ¼" screen	34.6
Total	100.0

Character of material—Sample consists of rounded fragments of chert and quartz with considerable amount of sand and ferrugineous clay.

Respectfully submitted,

(Signed) A. I. GOLDBECK,
Chief of Bureau.

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 15400.

Name of material: Chert Gravel. Submitted by J. M. McBeath, Meridian, Misissippi. Sampled, Dec. 16, 1919. Received, Dec. 29, 1919. Source of material (Prop. Mississippi Gravel Co.), Simpson Co., Mississippi. Examined for use in building gravel roads.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	51.5
Passing ¼" retained on 10-mesh	30.3
Passing 10 retained on 20-mesh	10.3
Passing 20 retained on 30-mesh	4.7
Passing 30 retained on 40-mesh	4.3
Passing 40 retained on 50-mesh	8.3
Passing 50 retained on 80-mesh	26.0
Passing 80 retained on 100-mesh	0.8
Passing 100 retained on 200-mesh	1.7
Passing 200-mesh	13.6
Total	100.0
Cementing value	10

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 1½" retained on 1 " screen	12.1
Passing 1 " retained on ¾" screen	16.1
Passing ¾" retained on ½" screen	25.2
Passing ½" retained on ¼" screen	46.6
Passing ¼" screen	48.5
Total	100.0

Character of material—Sample consists essentially of rounded fragments of chert with a considerable amount of quartz sand and some ferrugineous clay.

Respectfully submitted,

(Signed) A. T. GOLDBECK,
Engineer of Tests.

TATE COUNTY

REPORT ON SAMPLE OF SAND-CLAY GRAVEL.

Laboratory No. 13186.

(See Page 73)

Name of material: Sand-Clay Gravel. Identification marks, none. Submitted by L. W. Moshburn, Clarksdale, Miss. Sampled July 3, 1918. Received, July 16, 1918. Sampled from quarry. Quantity represented 2,000,000 yds. Source of material, Sarah, Tate County, Mississippi. Location used or to be used, Tunica Co., Miss., and on F. A. Project. Examined for use on gravel road.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	56.0
Passing ¼" retained on 10-mesh	11.0
Passing 10 retained on 20-mesh	4.6
Passing 20 retained on 30-mesh	3.2
Passing 30 retained on 40-mesh	2.9
Passing 40 retained on 50-mesh	2.4
Passing 50 retained on 80-mesh	3.6
Passing 80 retained on 100-mesh	2.4
Passing 100 retained on 200-mesh	3.4
Passing 200-mesh	10.5
Total	100.0
Loss by washing (silt and clay)	10.2
Cementing value	125

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 3 " retained on 1½" screen	5.3
Passing 1½" retained on 1 " screen	16.2
Passing 1 " retained on ¾" screen	4.3
Passing ¾" retained on ½" screen	14.1
Passing ½" retained on ¼" screen	16.1
Passing ¼" screen	44.0
Total	100.0

Percent of wear (material over ¼") ..... insufficient material

Character of material—Sample consists essentially of rounded and subangular fragments of chert and quartz with a considerable amount of quartz sand and ferrugineous clay.

Respectfully submitted,

(Signed) P. St. J. WILSON, Acting Director.

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 13399.

(See Page 73)

Name of material: Chert Gravel. Submitted by S. N. Moshburn. Sampled August 16, 1918. Received August 22, 1918. Sampled from quarry or pit. Quantity represented 500,000 yds. Source of material, Buxton, Tate Co., Miss.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	54.3
Passing ¼" retained on 10-mesh	5.3
Passing 10 retained on 20-mesh	1.7
Passing 20 retained on 30-mesh	2.2
Passing 30 retained on 40-mesh	2.7
Passing 40 retained on 50-mesh	2.3
Passing 50 retained on 80-mesh	2.9
Passing 80 retained on 100-mesh	2.0
Passing 100 retained on 200-mesh	4.3
Passing 200-mesh	22.3
Total	100.0
Loss by washing (silt and clay)	21.7
Cementing value	189

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 2 " retained on 1½" screen	10.3
Passing 1½" retained on 1 " screen	11.7
Passing 1 " retained on ¾" screen	9.7
Passing ¾" retained on ½" screen	11.4
Passing ½" retained on ¼" screen	11.2
Passing ¼" screen	45.7
Total	100.0

Character of material—Sample consists essentially of subangular fragments of partly weathered chert with a considerable amount of angular quartz sand and some little ferrugineous clay.

REMARKS: Should make a satisfactory road building gravel.

Respectfully submitted,

(Signed) L. W. PAGE,
Director.

TISHOMINGO COUNTY

REPORT ON SAMPLE No. 7559, FROM TISHOMINGO COUNTY, MISS.

(Made at request of Allen Gravel Company, Iuka, Mississippi).

(See Page 74)

Material: Chert Gravel

MECHANICAL ANALYSIS

Retained on 2 " sieve		Retained on No. 10 sieve	82.2
Retained on 1½" sieve	1.02	Retained on No. 20 sieve	88.0
Retained on 1¼" sieve	18.5	Retained on No. 30 sieve	89.6
Retained on 1 " sieve	26.5	Retained on No. 40 sieve	90.5
Retained on ¾" sieve	35.4	Retained on No. 50 sieve	91.7
Retained on ½" sieve	45.3	Retained on No. 80 sieve	92.5
Retained on ¼" sieve	65.3	Retained on No. 100 sieve	92.7
Retained on ⅛" sieve	78.6	Retained on No. 200 sieve	93.0
Total passing ⅛" sieve	21.4	Passing No. 200 sieve	
		By analysis	0.5
		By washing	6.5
		Total	

CEMENTING VALUE

On material over ⅛" in size, 12 ..... Fair
On material under ⅛" in size, 139 ..... Excellent
On material as received, 35 ..... Good

Character: Sample consists essentially of rounded fragments of chert with small amount of ferrugineous clay.

REMARKS: Should prove satisfactory for gravel road construction.

Respectfully submitted,

(Signed) VERNON M. PEIRCE,
Acting Director.

WARREN COUNTY

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 14509.

Name of material: Chert Gravel. Submitted by Dr. E. R. Cook, Bovina, Miss. Sampled June 27, 1919. Received July 2, 1919. Sampled from pit. Quantity represented, 30 lbs. Source of material, Bovina, Warren Co., Miss. Examined for use in road construction.

TEST RESULTS

SAND
(Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	44.0
Passing ¼" retained on 10-mesh	7.3
Passing 10 retained on 20-mesh	5.3
Passing 20 retained on 30-mesh	6.1
Passing 30 retained on 40-mesh	8.9
Passing 40 retained on 50-mesh	6.2
Passing 50 retained on 80-mesh	9.1
Passing 80 retained on 100-mesh	0.9
Passing 100 retained on 200-mesh	1.8
Passing 200-mesh	10.4
Total	100.0
Loss by washing (silt and clay)	10.0
Cementing value	74

GRAVEL
(Mechanical Analysis)

Fraction	Percent
Passing 2 " retained on 1½" screen	2.6
Passing 1½" retained on 1 " screen	9.4
Passing 1 " retained on ¾" screen	9.9
Passing ¾" retained on ½" screen	11.9
Passing ½" retained on ¼" screen	10.2
Passing ¼" screen	56.0
Total	100.0

Character of material—Sample consists essentially of rounded chert fragments with a considerable amount of angular quartz sand and ferrugineous clay.

(Signed) THOS. H. MacDONALD,
Chief of Bureau.

REPORT ON SAMPLE OF SAND-CLAY GRAVEL.

Laboratory No.-14153.

Name of material: Sand-Clay Gravel. Submitted by, J. J. Hayes, Mayor, Vicksburg, Miss. Received Apr. 15, 1919. Source of material, Vicksburg, Warren County, Miss. Examined for use in road construction.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	57.3
Passing ¼" retained on 10-mesh	9.6
Passing 10 retained on 20-mesh	3.7
Passing 20 retained on 30-mesh	2.9
Passing 30 retained on 40-mesh	4.3
Passing 40 retained on 50-mesh	3.1
Passing 50 retained on 80-mesh	5.5
Passing 80 retained on100-mesh	0.7
Passing 100 retained on 200-mesh	1.2
Passing 200-mesh	11.7
Total	100.0
Loss by washing (silt and clay)	11.3
Cementing value	118

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 1½" retained on 1 " screen	12.5
Passing 1 " retained on ¾" screen	13.1
Passing ¾" retained on ½" screen	16.3
Passing ½" retained on ¼" screen	15.4
Passing ¼" screen	42.7
Total	100.0

Character of material—Sample consists essentially of subangular fragments of chert with a large amount of rounded quartz sand and considerable ferrugineous clay.

Respectfully submitted,

(signed) P. St. J. WILSON, Acting Director.

REPORT ON SAMPLE OF SAND-CLAY GRAVEL.

Laboratory No. 14155.

Name of material: Sand-Clay Gravel. Submitted by, J. J. Hayes, Mayor, Vicksburg, Miss. Received Apr. 15, 1919. Source of material, Vicksburg, Warren County, Miss. Examined for use in road construction.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	51.4
Passing ¼" retained on 10-mesh	1.5
Passing 10 retained on 20-mesh	0.4
Passing 20 retained on 30-mesh	0.7
Passing 30 retained on 40-mesh	2.4
Passing 40 retained on 50-mesh	4.4
Passing 50 retained on 80-mesh	14.1
Passing 80 retained on 100-mesh	4.5
Passing 100 retained on 200-mesh	4.2
Passing 200-mesh	16.4
Total	100.0

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 2 " retained on 1½" screen	2.3
Passing 1½" retained on 1 " screen	20.0
Passing 1 " retained on ¾" screen	13.5
Passing ¾" retained on ½" screen	10.0
Passing ½" retained on ¼" screen	5.6
Passing ¼" screen	48.6
Total	100.0

Character of material—Sample consists essentially of subangular fragments of chert and quartz with a considerable amount of angular quartz sand and clay.

Respectfully submitted,

(Signed) P. ST. J. WILSON,
Acting Director.

REPORT ON SAMPLE OF CHERT GRAVEL.

Laboratory No. 14247.

Name of material: Chert Gravel. Submitted by Julius C. Fohs, 814 Belmont Street, Vicksburg, Mississippi. Received May 13, 1919. Source of material, unknown. (File in Warren County, Miss.)

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	71.5
Passing ¼" retained on 10-mesh	3.6
Passing 10 retained on 20-mesh	1.1
Passing 20 retained on 30-mesh	0.8
Passing 30 retained on 40-mesh	1.3
Passing 40 retained on 50-mesh	1.0
Passing 50 retained on 80-mesh	1.5
Passing 80 retained on 100-mesh	1.2
Passing 100 retained on 200-mesh	1.1
Passing 200-mesh	16.9
Total	100.0
Loss by washing (silt and clay)	16.6
Cementing value	33

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 2 " retained on 1½" screen	8.8
Passing 1½" retained on 1 " screen	31.8
Passing 1 " retained on ¾" screen	11.4
Passing ¾" retained on ½" screen	11.2
Passing ½" retained on ¼" screen	8.8
Passing ¼" screen	28.5
Total	100.0

Character of material—Sample consists essentially of subangular chert fragments with some angular quartz sand and clay.

Respectfully submitted,

(Signed) P. ST. J. WILSON,
Acting Director.

REPORT ON SAMPLE OF SAND GRAVEL

Laboratory No. 14323

Name of material: Sand Gravel. Submitted by Edward Klaus, Vicksburg, Miss. Sampled May 19, 1919. Received May 27, 1919. Quantity represented unknown. Source of material one mile south of Yokena, Warren County, Miss.

Examined for use in road construction.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	23.0
Passing ¼" retained on 10-mesh	8.8
Passing 10 retained on 20-mesh	4.8
Passing 20 retained on 30-mesh	7.5
Passing 30 retained on 40-mesh	10.6
Passing 40 retained on 50-mesh	7.3
Passing 50 retained on 80-mesh	8.4
Passing 80 retained on 100-mesh	0.4
Passing 100 retained on 200-mesh	0.5
Passing 200-mesh	28.7
Total	100.0
Loss by washing (silt and clay)	28.6
Cementing value	37

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 1½" retained on 1 " screen	3.6
Passing 1 " retained on ¾" screen	2.9
Passing ¾" retained on ½" screen	7.4
Passing ½" retained on ¼" screen	9.1
Passing ¼" screen	77.0
Total	100.0

Character of material—Sample consists of subangular fragments of chert and quartz with a large amount of angular quartz sand stained by iron oxide.

Respectfully submitted,

(signed) P. St. J. WILSON, Acting Director.

WASHINGTON COUNTY

REPORT ON SAMPLE No. 10470HC3 OF ROAD MATERIAL FROM WASHINGTON COUNTY, GREENVILLE, MISS.

Made at the request of J. S. Allen, Chief Engineer, Greenville, Miss.

Material: Chert Gravel

MECHANICAL ANALYSIS

Totals Retained on Screens	Percent	Between Screens—Sample	Percent
1¼"	32.2	1½"-1¼"	32.2
1 "	58.9	1¼"-1 "	26.7
¾"	82.8	1 "- ¾"	23.9
½"	97.3	¾"- ½"	14.5
		½"- ¼"	2.7
		Total	100.0

Character—Sample consists essentially of subangular fragments of chert with a few rounded quartz pebbles.

REMARKS—Should prove satisfactory for use as coarse aggregate in Portland cement or bituminous concrete road construction.

Respectfully submitted,
(signed) P. St. J. WILSON, Acting Director.

REPORT ON SAMPLE No. 10471HC4 OF ROAD MATERIAL FROM WASHINGTON COUNTY, GREENVILLE, MISS.

Made at the request of J. S. Allen, Chief Engineer, Greenville, Miss.

Material: Chert Gravel

MECHANICAL ANALYSIS

Totals Retained on Screens		Between Screens—Sample	
1½"	3.8	2 "-1½"	3.8
1¼"	3.8	1½"-1¼"	0.0
1 "	27.7	1¼"-1 "	23.9
¾"	60.5	1 "- ¾"	32.8
½"	88.5	¾"- ½"	28.0
¼"	99.7	½"- ¼"	11.2
Passing ¼"		under ¼"	0.3
		Total	100.0

Character—Sample consists essentially of subangular fragments of chert.

REMARKS—Should prove satisfactory for use as coarse aggregate in Portland cement or bituminous concrete road construction.

Respectfully submitted,
(signed) P. St. J. WILSON, Acting Director.

REPORT ON SAMPLE OF SAND GRAVEL

Laboratory No. 14177

Name of material: Sand Gravel. Submitted by D. K. Caldwell, Highway Engineer, Box 750, Montgomery, Ala. Sampled April 12, 1919. Received April 22, 1919. Sampled from Mississippi River bed. Quantity represented, unlimited. Source of material, Mississippi river at Greenville, Washington County, Miss. Location used or to be used, Mississippi Federal Aid road work. (General federal aid).

Examined for use in concrete road construction.

TEST RESULTS

TENSILE STRENGTH.
(Cement-sand briquets, 1:3.)

Standard Ottawa Sand	Sample Sand
28 days	28 days
320	275
310	275
315	280
—	—
315	277
Str. Ratio	87.9%

Respectfully submitted,
(signed) P. St. J. WILSON, Acting Director.

REPORT ON SAMPLE OF CHERT GRAVEL.
Laboratory No. 14442.

Name of material, Chert Gravel. Submitted by D. K. Caldwell, Highway Engineer, Box 779, Jackson, Miss. Sampled June 13, 1919. Received June 19, 1919. Sampled from car. Quantity represented, unlimited. Source of material, Bed of Mississippi River, Greenville, Washington County, Miss. Location used or to be used, Mississippi Federal Aid, General Projects.

Examined for use in concrete road construction.

TENSILE STRENGTH.
(Cement-sand briquets, 1:3.)

Standard Ottawa Sand	Sample Sand
28 days	28 days
320	425
320	425
320	425
320	425
Str. Ratio	139.1%

Respectfully submitted,

(signed) THOS. H. MacDONALD, Chief of Bureau.

WAYNE COUNTY

REPORT ON SAMPLE OF CHERT GRAVEL.
Laboratory No. 14178

Name of material, Chert Gravel. Submitted by J. M. McBeath, Meridian, Miss. Received April 22, 1919. Source of material, Waynesboro, Wayne County, Mississippi.

TEST RESULTS

SAND
(Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	40.2
Passing ¼" retained on 10-mesh	25.9
Passing 10 retained on 20-mesh	12.3
Passing 20 retained on 30-mesh	4.9
Passing 30 retained on 40-mesh	1.2
Passing 40 retained on 50-mesh	0.6
Passing 50 retained on 80-mesh	5.1
Passing 80 retained on 100-mesh	2.6
Passing 100 retained on 200-mesh	4.1
Passing 200-mesh	3.1
Total	100.0
Loss by washing (silt and clay)	2.4
Cementing value	8

GRAVEL
(Mechanical Analysis)

Fraction	Percent
Passing ¾" retained on ½" screen	5.1
Passing ½" retained on ¼" screen	35.1
Passing ¼" screen	59.8
Total	100.0

Character of material—Sample consists essentially of subangular fragments of chert and quartz with some fine angular quartz sand.

Respectfully submitted,

(signed) P. St. J. WILSON, Acting Director.

REPORT ON SAMPLE OF GRAVEL.

Laboratory No. 15266

Name of material: Sand-Clay Gravel. Submitted by J. M. McBeath, State Highway Commissioner, Meridian, Miss. Received Nov. 7, 1919. Sampled from (Prop. Waterford Lumber Co.) West King, Wayne Co., Miss. Source of Material, West King, Wayne County, Miss. Location used or to be used, Quitman and Shubuta, Miss.

Examined for use in bonding roads.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	42.9
Passing ¼" retained on 10-mesh	16.8
Passing 10 retained on 20-mesh	8.8
Passing 20 retained on 30-mesh	2.8
Passing 30 retained on 40-mesh	0.5
Passing 40 retained on 50-mesh	0.2
Passing 50 retained on 80-mesh	8.3
Passing 80 retained on 100-mesh	3.8
Passing 100 retained on 200-mesh	8.3
Passing 200-mesh	7.6
Total	100.0
Loss by washing (silt and clay)	6.8
Cementing value	45

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing ¾" retained on ½" screen	3.8
Passing ½" retained on ¼" screen	39.1
Passing ¼" screen	57.1
Total	100.0

Character of material—Sample consists essentially of rounded fragments of weathered chert and quartz with a considerable amount of fine quartz sand and ferrugineous clay.

Respectfully submitted,

(signed) A. W. GOLDBECK, Engineer of Tests.

WILKINSON COUNTY

REPORT ON SAMPLE OF CHERT GRAVEL

Laboratory No. 14098.

Name of material, Chert Gravel. Submitted by W. W. Hutchison, Woodville, Miss. Sampled March 11, 1919. Received April 2, 1919. Sampled from pit. Quantity represented, 7,000 cubic yards. Source of material, Woodville, Wilkinson County, Miss.

Examined for suitability for use in gravel road construction.

TEST RESULTS

SAND (Mechanical Analysis)

Fraction	Percent
Retained on ¼" screen	41.2
Passing ¼" retained on 10-mesh	8.8
Passing 10 retained on 20-mesh	3.1
Passing 20 retained on 30-mesh	1.9
Passing 30 retained on 40-mesh	3.7
Passing 40 retained on 50-mesh	5.7
Passing 50 retained on 80-mesh	9.4
Passing 80 retained on 100-mesh	1.0
Passing 100 retained on 200-mesh	0.8
Passing 200-mesh	24.4
Total	100.0
Loss by washing (silt and clay)	2.34
Cementing value	92

GRAVEL (Mechanical Analysis)

Fraction	Percent
Passing 1½" retained on 1 " screen	3.6
Passing 1 " retained on ¾" screen	10.8
Passing ¾" retained on ½" screen	14.4
Passing ½" retained on ¼" screen	12.4
Passing ¼" screen	58.8
Total	100.0

Character of material—Sample consists essentially of subangular fragments of chert with a small amount of fine sand and ferrugineous clay.

Respectfully submitted,

(signed) P. St. J. WILSON, Acting Director.

YAZOO COUNTY

REPORT ON SAMPLE No. 7630, FROM YAZOO COUNTY MISSISSIPPI.
(Loose Sample)

Made at the request of Morrison Coal Co., Jackson, Miss.

Material: Sand-Clay Gravel.

MECHANICAL ANALYSIS

	Percent		Percent
Retained on 1½" sieve	7.5	Retained on No. 10 sieve	65.0
Retained on 1¼" sieve	8.7	Retained on No. 20 sieve	67.8
Retained on 1" sieve	17.9	Retained on No. 30 sieve	70.4
Retained on ¾" sieve	33.8	Retained on No. 40 sieve	73.7
Retained on ½" sieve	45.0	Retained on No. 50 sieve	82.4
Retained on ¼" sieve	56.7	Retained on No. 80 sieve	86.0
Retained on ⅛" sieve	63.3	Retained on No. 100 sieve	86.2
Total passing ⅛" sieve	36.7	Retained on No. 200 sieve	86.4
		Passing No. 200 sieve	
		By analysis	.1
		By washing	13.5
		Total	100.0

CEMENTING VALUE

On material over ⅛" in size	Fair
On material under ⅛" in size	Excellent
On material as received	Good

Character—Sample consists essentially of rounded fragments of chert, with a large proportion of sand and clay.

REMARKS—Should make a satisfactory road material.

Respectfully submitted,

(Signed) P. St. J. WILSON, Acting Director.

REPORT ON SAMPLE No. 7304, FROM YAZOO CITY, MISSISSIPPI
(No other locality given.)

Made at request of E. N. Lowe, State Geologist, Mississippi Geological Survey, Jackson, Miss.

Material: Sand Gravel.

MECHANICAL ANALYSIS

	Percent		Percent
Retained on ¾" sieve	1.9	Retained on No. 10 sieve	11.8
Retained on ½" sieve	3.8	Retained on No. 20 sieve	17.9
Retained on ¼" sieve	7.9	Retained on No. 30 sieve	36.0
Retained on ⅛" sieve	10.8	Retained on No. 40 sieve	61.0
Total passing ⅛" sieve	89.2	Retained on No. 50 sieve	86.0
		Retained on No. 80 sieve	91.8
		Retained on No. 100 sieve	92.0
		Retained on No. 200 sieve	93.0
		Passing No. 200 sieve	
		By analysis	0.6
		By Washing	6.4

CEMENTING VALUE

On material under ⅛" in size	Excellent
On material as received	Excellent

Character—Sample consists essentially of large fragments of chert with a large amount of quartz sand and some ferruginous clay.

REMARKS—Material shows altogether too large a proportion of sand to be satisfactory in gravel road construction. The amount of sand should be reduced to about 30% of the whole for best results.

Respectfully submitted,

(Signed) P. St. J. WILSON, Acting Director.