GOOD DIRT ROADS FOR MISSISSIPPI.

BY

J. W. FOX and W. L. HUTCHINSON.

Fig. I. Showing finished section of dirt road. See Fig. VI. for same section of road before working.

AGRICULTURAL COLLEGE, MISS.,
APRIL, 1901.

MISSISSIPPI STATIONERY CO., YAZOO CITY.
FIG. II. SECTION OF DIRT ROAD ON MISSISSIPPI A. & M. COLLEGE CAMPUS.
GOOD DIRT ROADS FOR MISSISSIPPI.

Introduction.—The rapid industrial development going on in the State, and the building of new railroads, to meet the demands of increasing business and traffic, are attracting some attention to the dirt roads and the necessity for improving them. Provided they will adopt the best business methods in making them, the people of the State may have good dirt roads in a comparatively short time. There probably is no good reason why supervisors should deal with this very important matter with less business ability and less system than they do other public matters that come before them.

The roads may be first properly shaped and drained and then graded; but such improvement should be made with the expectation that they will finally be surfaced with gravel or other material. To shape, drain and grade our dirt roads will improve them materially, and the cost will not be burdensome. Surfacing roads is expensive, and, in consequence, it takes years for any people to accomplish it.

Good roads can not be made nor maintained by doing a little work on them once or twice a year. This is not a businesslike way to deal with the matter, and no further comment is necessary on the present expensive and wasteful method of warning out hands for road duty at the very time, perhaps, when the least efficient work can be done. To have good roads it must be made the regular business of some one to make and maintain them, and this may be done by contract—specifying what is required.

Some of our roads should be located differently, so as to lessen the cost of grading, as roads should either go around steep hills or through them. Locate the roads properly and grading them will be a simple and easy matter. The people of this State should appreciate the comparative ease with which they can have good dirt roads; for surely our difficulties are not nearly so great as those that have to be overcome in many sections.
Present system defective.—Building and maintaining roads by statute labor, or what is commonly known as "warning out the hands," has always failed. It was never intended to be more than a makeshift for a plan of road making; having some merits, perhaps, for pioneer settlers. In every instance where a state, county, or district has built good roads, or made any progress toward permanent road improvement, the statute labor plan has been abandoned and a more efficient and businesslike method adopted.

The defects of the system are evident. The three most glaring are: (1) The labor tax is not honestly paid, being either avoided or slighted in various ways by the majority of the hands. A few do honest work and take an interest in it; but, as a general rule, the object seems to be either to get over the section of road in any style, and thus get a disagreeable job done, or else make the few days road work a time for recreation, in which to laugh and joke with their neighbors. As a result, the amount of labor tax collected and expended on the road is only a very small part of that assessed to it. (2) The labor that is given to the roads is not intelligently directed. There are about as many plans of working the roads as there are overseers; and, as a rule, all of these plans are more or less defective, resulting in a partial waste of such labor as is honestly applied. (3) The time and character of work is made to suit the convenience of the hands rather than the needs of the road. The laborers bring such tools as they happen to have regardless of their adaptability to road work. The teams are usually too small and are not trained for such work. The rule is to work the roads once a year after crops are laid by; but our heavy spring rains damage roads more or less, and such damage should be repaired promptly. This labor-tax plan leaves the roads at the end of the year about in the same condition they were in at the beginning, and, if continued, at the expiration of twenty or more years we will still have just such roads as we now have. This plan has been tried so long and so extensively that even the wayfaring man need not err in what to expect from it.

Roads by contract.—To have any kind of work properly done it must be put in charge of a competent person who is to be held solely responsible for its proper performance and completion. Supervisors recognize this fact in dealing with all the county work except the building and maintaining of the public roads. If the county needs a new court house it is built by contract, according to certain specifications. The contractor is required to give bond, and the county gets what it pays for. The same plan is followed in
building the bridges of the county, as well as certain parts of the roads that are intolerably bad. In this way, frequently, the worst sections of road in the county become the best. We probably will not have any permanent road improvement until we use the same business methods for making and maintaining our roads that we use in other cases where we want things done properly and at a minimum cost.

By referring to the reports from the states that have good roads, it appears that in every instance these roads have been made by contract. The matter of road improvement is entirely in the hands of the county board of supervisors, who, if they will, can change from the labor-tax system to the contract system.

Road laws.—Only such sections of road laws as relate to the working of public roads by contract will be cited. Section 3929, Annotated Code of 1892, is as follows: "The board of supervisors may determine to work the public roads, or some part thereof, by contract, and may thereafter so work the same, letting the contracts in such cases as other contracts are let by the board of supervisors, each road or division under a separate contract. * * * " Sections 3930 and 3931 provide for the raising of the necessary funds to put in operation the above section. In effect, they provide that if a public road is to be worked and kept up by contract the road hands shall work under the contractor, not to exceed five days in any one year, or pay to him $2.50 commutation tax; unless under a general order of the board of supervisors, who may require all road hands to work under the contractor any number of days not to exceed ten in any one year, or pay a commutation tax in proportion not to exceed $5.00. Section 3931 provides that the board of supervisors may levy an additional tax, not to exceed one mill on the dollar, upon all the taxable property in the county, to be used as a separate road fund. The taxes so collected on property within a municipality, the streets of which are worked by municipal authority, shall be equally divided between the county road fund and the city street fund.

Section 3932, Code of 1892, provides for the working of the county convicts on the public roads.

Several counties in the State have taken advantage of the above road laws to abolish the old plan of working roads by labor tax. Madison county may be cited as one that has used the contract system of working roads with successful results, the roads made by contract being greatly improved. Rather than work the roads, the road hands prefer to pay the commutation tax.
The road law, approved March 12th 1900, is very similar to the ones cited above. It embraces the same general plan, but is more complete and explicit, and provides for a uniform system throughout each county that adopts it. The law is as follows; viz.:

CHAPTER 119.

AN ACT to provide for the working of public roads by contract.

SECTION 1. Be it enacted by the Legislature of the State of Mississippi, that the board of supervisors of the various counties of the State of Mississippi, may, at the regular April term of their meeting, or any other regular meeting, after the passage of this act, meet and classify the public roads in their respective counties as roads of the first class and roads of the second class, which are to be divided into convenient links and are to be worked by contract, as hereinafter provided for.

SEC. 2. The board of supervisors of each county is hereby authorized and empowered, if they consider it necessary, to the better working of the roads, and the general interest of the county, to employ a competent person to serve as road and bridge commissioner, whose compensation shall not exceed $5.00 per day, for each day actually put in, in the active discharge of his duties as defined by the board of supervisors in each county.

SEC. 3. The supervisors of each district in each county is to have and is required to exercise general supervision over the public highways of his district, for which service he is to have a salary of $20.00 per annum, if a road commissioner is employed during the year; if no road commissioner is employed during the year, he shall receive for said extra service a total sum of $50.00 per annum.

SEC. 4. The members of the board of supervisors, together with a road commissioner, if there be one, as they may agree, shall inspect each section of the road as sub-divided, together with all bridges in said section, and carefully note the character and amount of work needed on same, and all else necessary to make same a good and acceptable highway, and then prepare detailed plans and specifications for the working of same by contract filed for record with the clerk of the board of supervisors for the inspection of prospective bidders, prior to the first public letting under the terms thereof at a regular meeting to be named, and if the inspection is not made by all members of the board, the board may alter the plans and specifications submitted.

SEC. 5. The letting of the contract or contracts for the working and keeping in condition in its entirety of the public roads or any section thereof shall be done as in cases of letting other public contracts, as is especially provided for in sections 340 and 341 of the Annotated Code of 1892, except that the board shall have the right
to reject any and all bids, and said contracts or contract shall be let for a term of not less than two nor more than four years.

Sec. 6. There shall be required annually in each county eight days special work service on the public roads under the contractor, but any person in lieu of said special work service may pay a commutation tax for road purposes of $3.00, and said special work service on the public roads or commutation tax for road purposes in lieu thereof shall be imposed on all male persons over the age of eighteen years and under the age of fifty years, who are not blind, nor deaf, nor dumb, nor otherwise disabled by disease or loss of limb, and who are not ministers in charge of churches, rabbis, nor students in actual attendance in some school or college. In addition to the commutation tax, there shall be an advalorem tax on all taxable property in the county not to exceed one mill on the dollar, in any one year, all of which tax is to be collected as other taxes, and paid over to the county treasurer, who shall keep all such taxes as a separate road fund, to be used exclusively as such in compliance with the terms hereof, and only upon the warrant of the board of supervisors. All of the commutation tax shall be expended in the district or incorporated village, town or city, from which the same was collected, and such commutation tax for road purposes paid by the residents of such municipality shall be turned over to the treasurer of such municipality and be expended by the proper authorities thereof for that purpose, but the advalorem tax shall be treated as a general road fund for use anywhere in the county, except the taxes so collected on property within the municipality, the streets of which are worked at the expense of the municipal treasury, which shall be equally divided between the county road fund and the municipal street fund.

Sec. 7. Any person, in lieu of the commutation tax of $3.00 shall have the right to perform eight days work under the contractor, for which the board shall receive allowance of $3.00 on contract, and make provisions therefor in letting of contract, on the nearest unworked road contiguous to his residence provided said work is done prior to September 1st, of each year, at which time each contractor shall report the names of those that have worked out their time under him, to the board of supervisors, who in turn shall make a report of same to the sheriff and tax collector, who shall then regularly proceed to the collection of all delinquent road tax; and any person who fails to perform the required amount of work or to pay said tax shall be guilty of a misdemeanor, and punished by the courts as other misdemeanors. The provisions of this act relating to commutation tax shall not apply to municipalities which work the streets at the expense of the municipal treasury.

Sec. 8. The board of supervisors may require the contractor of any road to take and work the convicts sentenced to the county jail or committed to same to pay fine and cost imposed upon them, upon such terms and conditions as the said board and contractor may agree upon.
SEC. 9. On the first Monday of January, April, July and October of each year, each supervisor shall make a true and complete report to the board of supervisors of the needs and conditions of the public highways in his district, together with such recommendations as he may deem necessary, which report shall be spread upon the minutes of that particular meeting.

SEC. 10. The circuit judge shall on each term of the court especially charge the grand jury to inquire into the condition of the roads of any county, and any contractor or supervisor who neglects his duty shall be guilty of a misdemeanor and be liable to indictment, and upon conviction, shall be fined not more than $100.00.

SEC. 11. The provisions of this act shall not apply to any county in the State, except by an order of the board of supervisors to that effect, same to be duly entered upon the minutes of said board.

SEC. 12. The county assessor shall provide lists upon which he shall address all persons in his county subject to the commutation tax for road purposes, which list shall be copied upon the personal assessment roll of the county, which roll shall be so ruled as to provide for such list and the assessor shall be allowed for such service one cent for each commutation tax assessment made under this act.

SEC. 13. This act shall not apply to any county that is already working its roads under special contract unless the board of supervisors of said county elects to come under the provisions of this act.

SEC. 14. That this act take effect and be in full force from and after its passage.

Approved March 12, 1900.

**Funds.**—By reference to the above laws it will be seen that the money necessary to pay contractors may be derived from the following sources; viz.:

(1) Each road hand shall pay a commutation tax of $3.00 or work under the contractor eight days, the tax on labor to be expended in the district in which it is collected.

(2) A tax, not to exceed one mill on the dollar, to constitute a separate road fund for use anywhere in the county except that the taxes so collected on the property in a municipality, the streets of which are worked at the expense of the municipal treasury, which shall be equally divided between the county road fund and the municipal street fund.

(3) The county convicts may be worked on the public roads on such terms and conditions as may be agreed upon by the contractor and the board.

(4) The teams and tools of persons not liable to road duty, as
provided in Section 3910, Code of 1892, are also liable under the act of 1900, according to an opinion given by the Attorney-General to the board of supervisors of Oktibbeha Co. The Attorney-General has also ruled that the act of March 12th, 1900, providing for the working of public roads by contract, does not limit the funds for roads and bridges to the one mill advalorem tax mentioned in the act. The funds raised by the one mill tax may be supplemented by any other funds which heretofore might have been properly appropriated to such purposes. If the one mill tax is not sufficient to keep up both roads and bridges, it may be used entirely on the roads and the bridges kept up as heretofore.

To illustrate, let us suppose the conditions in a certain county to be as follows:

Number of miles of road in the county, 400
Number of road hands, 3,000
Total taxable property, $2,500,000
One town or city, taxable property, $500,000

Funds for road purposes:
3,000 road hands, $3.00 commutation tax each, $9,000
$2,500,000 at one mill on the dollar, 2,500

Total, $11,500
Less ½ mill on $500,000, retained in city 250

Net amount for 400 miles of road each year, $11,250
Average amount per mile each year, $28.12½

Remembering that the county convicts may be worked on the public roads, and that the usual amount of county funds, in addition to the above, may be expended in building bridges, purchasing road machinery, etc., and that the teams and tools of persons not liable to road duty may be used on the roads, it is easy to get a definite idea of the funds available for road purposes under the law of 1900.

In making the above estimate we had no way of determining the number of road hands nor the number of miles of public roads in the counties. The figures for these two items are taken from Clay county. According to a recently published statement of Auditor Cole, giving the taxable property in the several counties, it appears that the average for all of the counties is $2,876,879 which is more than the amount used in the above illustrative statement.

Good Earth Roads.

Drainage.—It is desirable to have roads with a hard, smooth surface, and as wet soil is soft, thorough drainage is an essential for
good roads. In this State good surface drainage is all that will usually be needed, and this may be accomplished by making good side ditches and giving the roads the proper shape. The center of a road should be enough higher than the sides to make it act like a roof,

Fig. III. Cross section of a good form of earth road.

so that all water that falls on it will quickly run into the side ditches or gutters. A fall of one inch to the foot from the center to the sides will usually be sufficient, but on steep grades the slope should be

Fig IV. Section of trial road before working. See Fig. V.

enough to make the water run toward the sides instead of down the road. The diagram shows the proper shape for the surface.
Cost per mile.—Where road machines are used, the average cost for properly shaping a road and making good side ditches should not exceed $25.00 per mile. The judicious expenditure of $15.00 per mile will give very much better roads than we now have. To get an idea of the cost of making and maintaining dirt roads we selected a mile of what appeared to be an average road. There were five small bridges on the piece of road selected, showing that the road was somewhat hilly. The road machine was run for ten hours. Four men and six mules with plow and dump scrapers worked for half a day filling on each side of the bridges and completing such ditches as could not be finished with the road machine. The above represents the normal work on the road, but in addition the same force worked one whole day filling at one of the bridges. This last day's work should be classed under the head of grading.

Eight mules were worked to the road machine. Two men were used to drive the team and one to operate the blade. One driver should be able to handle a trained team. To operate a road machine should not cost more than $5.00 a day or $1,200 to $1,500 a year. We tried to have our trial represent average conditions; yet, for shaping the road and making good side ditches the cost was only about $10.00 per mile. We will probably spend, during the year,
$5.00 more keeping this road in good repair and the surface smooth. We have traveled fifteen hundred miles over the dirt roads in different parts of the State, and we know that there are hundreds of miles of these roads that can be worked entirely with a road machine at a cost not exceeding eight to ten dollars per mile.

Road machinery.—For making and maintaining dirt roads the only machinery needed is a road machine, or road grader. As the sickle compares with the reaper for harvesting grain, or as the hand loom compares with a modern factory for making cloth, so, for road work, does a one horse plow and a hoe compare with a road machine. It is a significant fact that most of the dirt roads in the State, that are good because of the work that has been done on them, have been made and maintained with a road machine. It would be interesting, and doubtless very profitable to the State, to know just what one machine with six to eight mules and two men could accomplish if kept constantly at work on the public roads for one year.

Reports from counties.—We wrote to every chancery clerk in the State, enclosing a directed, stamped envelope for reply, asking for certain information concerning the use of road machines and the working of public roads in their respective counties. The clerks in about thirty counties failed to reply to our letter. Seventeen coun-
ties reported that there was no disposition on the part of their boards to have the roads worked by contract, or to change from the present method of warning out the hands once or twice a year. A number of counties reported that there was more or less disposition on the part of their boards of supervisors to have the roads worked by contract.

In Holmes county there are five road machines. The roads are worked by contract at $20.00 per mile.

Madison county works the roads in two districts by contract, the contractor getting about $16.00 per mile and being required to work the roads not less than sixteen feet wide, giving them an oval shape with good side ditches. The contractor is also required to repair all small bridges, the county furnishing the material for the same.

Tunica county pays $75.00 per mile and contracts for two years. Five road machines are in use in the county.

The county convicts are worked on some of the roads in Lauderdale county, while other roads are worked by contract. The average price per mile is about $10.00. The contractor is required to make good side ditches, properly shape the road, and repair small bridges, the material for the bridges being furnished by the county. Swamps are to be causewayed with heavy brush or poles and these covered with dirt.

Four of the principal roads in Lowndes county are worked by contract, the necessary funds being obtained by taxing property along the road, as provided in Section 3931, Code of 1892. Three commissioners are appointed for each road, and they collect the funds and have the roads worked.

Adams county reports comparatively good roads, but that only certain bad pieces of road are worked by contract.

The roads of Clay county are being worked by contract, the average price paid per mile being about $20.00.

The roads in Lincoln county are worked by contract, but we have been unable to get an official report in regard to this work. While in Brookhaven last summer we were told that the county paid $45.00 per mile and that the contracts were for four years.

In Pike county a lumber company has a road machine and has made and maintained a certain amount of road in good condition.

Quitman county reports that the board of supervisors has adopted the plan of having the roads worked by contract, but as yet no work has been done.
Maintaining roads.—When a road is once made good it should be kept so by keeping it constantly in repair, and this work may be done almost entirely with a road machine. If the surface is cut into ruts by travel during wet weather, it should be smoothed as soon as it is dry enough for the machine to work well. It is cheaper to do a few hours work at the right time than to wait until it will require days to repair the damage.

In some sections of the State where the roads get very muddy in winter—e.g. in the flatwoods, delta and prairies—a large amount of loose earth in the middle of the road in the winter season may become very troublesome. Winter is the time to keep such roads in good repair.

Sand beds.—As sand is firmer when it is wet than when it is dry, sand beds should not be drained. By mixing clay with sand a very good earth road may be made, and where the clay is convenient sand beds may be improved by spreading clay over the surface.

Roads on side of slope.—Hill-side roads or mountain-side roads should not slope both ways from the center but should be made so that the slope is from the lower to the upper side of the road. As this arrangement makes one ditch control all the water that falls on the road, the necessary precaution should be taken so that this ditch is not taxed beyond its capacity.

Hard-surface roads.—The object of this bulletin is to furnish information that may be of service in the building of good earth roads, and until this is done it is useless to discuss the surfacing of roads; yet, in some parts of the State, as in the prairies, flatwoods and delta, the people are ready to build more or less hard-surface roads provided they can get good material at reasonable cost. The same is true of city streets and the main roads leading into important towns. It is, therefore, not out of place to describe briefly in this bulletin the making of surfaced roads.

Stone roads are out of the question, as this material is not available, but there is any amount of gravel in different parts of the State. While the gravel pits have never been examined with this end in view, there can be but little doubt that, with so much of this material, we have an abundance of good clay gravel well suited for road purposes. As the railroads are also interested in good country roads they will, most likely, render such aid as they may by giving reasonable rates on gravel for surfacing roads. As embodying the information most needed on this subject we give a report by Mr. J. W. Fox
on the graveled roads of Montgomery county, Alabama. This report was made in August 1899 and is as follows:

REPORT OF THE GRAVEL ROADS OF MONTGOMERY COUNTY, ALABAMA.

The citizens of this county began the building of gravel roads about six years ago, and they now have one hundred miles of these roads completed. They have tried different kinds of gravel, also screen and unscreened gravel. Their experience has been somewhat costly; but the result is that they are now making a road at a reasonable cost, over which two horses pull from two to three tons at any time of the year, which is smoother than a macadam road, which needs very little repairs, and which they think, (judging from their six years experience), is durable. The method by which these results have been accomplished will be of interest to those sections of our State which are now ready to make a beginning in the construction of hard-surface roads.

The first gravel road in this county was made of screened gravel; that is, the clay and small gravel, under five-eights of an inch in diameter, were sifted out and only the clean and large stones were used. During the first two years this road was unsatisfactory; the wheels cut into it, and consequently a load was hard to pull over it. Six inches of clay was put on a part of this road, and the remainder was left for the vehicles to pack. It finally became smooth and hard, and after six years use, without repairs, is to-day in excellent condition.

The next roads were made of unscreened clay gravel (sand gravel is considered unsuitable and is never used). It is put on just as it is taken from the pit, but it must test 50% gravel over a % inch screen. These roads, as compared with those made of screened gravel are much cheaper, and the clay gravel cements into a compact solid mass immediately, or, as soon as it is traveled over to any extent; and the test shows that they are durable, having needed no repairs, except to keep side ditches open during the three years which they have been in use.

These gravel roads are constructed in the following way:

The dirt road bed is made about eighteen feet wide, with side ditches sufficient to carry the water. The road is elevated in the center and slopes gradually towards the ditches. If it is necessary to secure the proper drainage, the entire road bed is elevated, the idea being to secure as dry a foundation for the gravel as possible. Ordinarily this is done very satisfactorily and very cheaply with the road machine one team of six or eight mules and two men making about one mile per day. If a considerable embankment has to be made it will cost from five to ten cents per cubic yard, varying with the character of the earth to be moved. As it would be poor economy to build an expensive road up and down steep hills, the road should be relocated to avoid them; or, if this is not practicable, the hills should be cut down to a 5% grade; that is, they should have a maximum rise of five feet to the hundred feet. In some localities this would,
of course, be expensive; but it is not so great an undertaking as one would at first suppose.

After this preparation, the method of gravelling the road is as follows:

Two planks seven inches wide are placed on either side of the center of the road parallel to each other and fifteen feet apart. Midway between them, or along the center of the roadway, iron pins are driven showing nine inches above the ground. Gravel is then dumped from wagons, filling this space to the top of the planks and the pins, thus giving a thickness of gravel of seven inches on sides and nine inches in the center. Earth is then thrown from the ditches filling the spaces between them and the planks. These are called retaining banks and their purpose is to hold the gravel in place until it becomes compact. The planks and the pins are now taken up and moved forward, and another similar section is made, and so on until the road is completed. In two or three days after the road is made the wheels will have cut into it and displaced the gravel to some extent; over it a road machine is then run once each way, smoothing the gravel and putting it slightly towards the center. The road is now complete and is ready for the heaviest traffic and for any kind of weather.

The cost of this road is made up of the following items:

1848 cubic yards to the mile at $8.00 per car of 20 cubic yards, delivered on railroad at the nearest point of the dirt road; cost of hauling, which will vary with the distance, and the cost of putting on the gravel, which is small.

In our State the cost of gravel delivered on railroad will vary with different localities, but the railroads will doubtless co-operate with any community wishing to make gravel roads. While gravel is not found in every county, the supply in Mississippi seems to be abundant. The roads described above were fifteen feet wide. Our country roads need be graveled only eight feet wide, having a dirt track of the same width. Besides giving a soft road for use during the summer and fall, this arrangement would cause gravel tracks to last twice as long, and would reduce the original cost almost one-half. In this way a first class gravel road may be built for less than $1,000 per mile.

I deem it unnecessary to discuss in this report the benefits of good roads, but there is one good result of the roads just described that is so striking that I shall mention it here. It is a fact that as soon as these roads were built, or as soon as any particular road was completed, property along this road invariably advanced from 25% to 60% in value; and, better still, farmers who were dissatisfied with their homes and had advertised them for sale took them off the market as soon as the road was completed.

My observation has convinced me of two things; (1) that gravel makes a first class hard-surface road, and (2), that the road problem in Mississippi will be solved eventually by the use of gravel.