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OF THE

Agricultural and Mechanical College,

AUBURN, ALA. - - - - - - - OCTOBER, 1890.

ROADS AND ROAD MAKING.

METEOROLOGY.

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ROADS AND ROAD-MAKIN

JAMES H. LANE, C. E., M. A., LL. D.,

Professor of Civil Engineering and Drawing.

At the request of the Board of Direction of the Experiment Station this paper was prepared by the Professor of Civil Engineering, and is issued as a bulletin conveying useful and practical information.

THE BEST METHODS OF CONSTRUCTING FARM ROADS, TURNPIKE ROADS, ETC.

Some of the advantages of good common roads in England are thus summed up in a report of a committee of the House of Commons: By the improvement of our roads, every branch of our agricultural, commercial and manufacturing industry would be materially benefitted. Every article brought to market would be diminished in price, and the number of horses would be so much reduced that, by these and other retrenchments, the expense of five millions (pounds sterling) would be annually saved to the public. The expense of repairing roads, and the wear and tear of carriages and horses would be essentially diminished; and thousands of acres, the produce of which is now wasted in feeding unnecessary horses, would be devoted to the production of food for man. In short, the public and private advantages which would result from effecting that great object, the improvement of our highways and turnpike roads, are incalculable; though, from their being spread over a wide surface, and available in various ways, such advantages will not be so apparent as those derived from other sources of improvement of a more restricted and a less general nature.

I have also seen it stated that the roads in Scotland, under the direction of Telford, produced a change in the state of the people which is probably unparalleled in the history of the country for the same space of time. Telford, himself, testifies that in the Highlands they greatly changed for the better the habits of the great working classes.

If good common roads have done so much for England and Scotland, surely they are worthy of our most thoughtful consideration.

A model road is one that will enable passengers, goods, farm products and other burdens to be transported over it in the least possible time, with the least possible labor, and with the least possible expense. Though the topography of the country and other circumstances may prevent our uniting and reconciling all three of these factors in any one combination, yet, in building a road we should endeavor to approximate this model as near as possible. To enable us to make this approximation, we must consider the direction, the grade, the cross section and the surface of the road.

As an unnecessarily long road would increase the cost of construction, the cost of repairs, and the cost of time and labor in travelling over it, it should, other things being equal, be perfectly straight, but straightness should always be sacrificed to obtain a level or to make the road less steep. This is one of the most important principles to be observed, and yet it is most often violated. I use the word straight here in its mathematical sense, and not as ordinarily applied to roads. We commonly call a road straight when it continues in a vertical plane, regardless of its deviations from a horizontal plane. Let us turn our planes through an angle of 90° and we will find that our straight road has become what we ordinarily call crooked. To illustrate further, if we place a hemisphere so as to rest on its base, the halves of great circles which join the two opposite points of this base are all equal, whether they pass horizontally or vertically—our vertical semi-circle is our so-called straight road, and our horizontal one is our crooked road. From this it will be readily seen that a road around a hill may not be longer than one over it. Even should it be longer within proper limits and be practically level, it would be better to go around than across; for on it a horse will draw a full load at his usual rate of speed, while on the road over the hill, the load must be diminished, or the horse must reduce his speed.

Roads should also be made to curve sometimes for economy in construction, such as to avoid swampy or bad ground, or to avoid large excavations, or to reach points on streams better suited for the approach of bridges.

Besides its substantial advantages, the gently curving road is much more pleasant to the traveller, for he is not fatigued by the tedious prospect of a long straight stretch to be traversed, but is met at each curve by a constantly varied view.

I have seen it stated that one of the reasons for this passion for so-called straightness of roads in some of the older States, is that the houses of the first settlers were usually built on hill tops to escape the poisonous miasmata and the scalping knives of hostile savages, and that the first roads—which were only trails or tracks for men and pack-horses—very properly followed the shortest though steepest routes. Wheel carriages were next used upon these steep tracks, and before sufficient attention was paid to the subject, the lands had been fenced off and appropriated, and these random tracks became the legal highways. And now, the evil is perpetuated by the unwillingness of farmers to allow a road to run through their farms in a winding line. They attach more importance to the squareness of their fields than to the improvement of their roads—not being aware how much more labor is wasted by them in travelling over the steep roads than there would be in cultivating an awkward corner of a field. I am informed that in some of the new Western States, the farmers have this squareness of fields on the brain to such an extent, that they have run their roads along the section and sub-section lines, so that if one of them wishes to pay his neighbor a social or business visit, he has often to travel in rectangular zigzags, after the manner of a sailing vessel when making a point against an adverse wind.

When a wagon rests on a horizontal road, its whole weight, or as we say in Natural Philosophy, its gravity, is supported by the road, and a horse in moving this wagon has only to exert a force sufficient to overcome the friction. But, if the road be tilted in the least, that is given a grade, the line along which gravity acts is no longer perpendicular to the surface of the road, and a part of the weight tends to roll the wagon down grade, so that a horse in going up grade will have to exert an extra force to overcome this downward tendency. In other words, he will have to exert an extra effort to overcome a weight which is such a part of the whole weight, as the height of the road is of its length. For example, if a road rises one foot in every thirty of its length, a horse drawing up it a load of one ton, is compelled to lift up one thirtieth of the whole weight, besides overcoming the friction.

The question now naturally arises, how steep can the slope up the side of a hill be most advantageously laid out. Engineers generally agree, from experiments made, that the maximum ascending grade on a broken stone road ought to be from one in thirty to one in thirty-five, though on some of our rough American roads it is much greater.

In descending a grade, gravity should not overcome the friction so far as to permit the wagon to press upon the horse. This limiting slope corresponds to the angle of repose in mechanical science, that is, the angle with the horizon at which that part of the gravity or weight which tends to pull the wagon down grade and its friction just balance. This angle has also been determined by experiment to be 1 in 35 on good broken stone roads, the same as the maximum ascending grade. Of course it must be remembered that the angle of repose varies with the smoothness of the road.

Although theoretically the road should be level, in practice it is not desirable that it should be so, on account of the difficulty of keeping the surface free from water. A moderate inclination is therefore to be selected as a minimum slope, and this slope is taken at 1 in 125; and in a level country it is recommended to form the road by artificial means into gentle undulations approaching this minimum.

We have then this rule, that the longitudinal grades of a road should be kept, if possible, between 1 in 35, and 1 in 125, never steeper than the former, nor nearer level than the latter.

There is a popular belief that a gently undulating road is less fatiguing to horses than one which is perfectly level. It is said that the alterations of ascent and descent call into play different muscles, allowing some to rest while others are exerted, and thus relieving each in turn. The distinguished Prof. Mahan inclined to this belief, while Gen'l. Wheeler, his successor at West Point, says it has no foundation in fact. Mr. Stevenson, another distinguished engineer, submitted this question to Dr. Jno. Barclay, of Edinburgh, an eminent and successful teacher of comparative anatomy, and he declares that it is demonstrably false that muscles can alternately rest and come into motion in cases of this kind. Where such distinguished gentlemen disagree, I think it unfortunate that the poor horse, which has had so much practical experience, can not speak for himself upon this vital point.

The proper width for a road depends, of course, upon its importance and the amount of travel upon it. The least width to enable two vehicles to pass with ease is assumed at 16½ feet. In England, the width of turnpikes approaching large towns is 60 feet. Ordinary turnpikes are 35 feet wide, and ordinary carriage roads across the country are given a width of 25 feet. In France, the roads vary in width from 66 feet to 26 feet; and all have the middle portion ballasted with stone. In New York, all public roads are laid out by the commissioners of highways and are not less than three rods wide between fences, and no more of them need be worked or formed into a surface for travelling upon than is deemed necessary.

When a road ascends a steep hill by zigzags, it should be wider on the curves connecting the tangents or straight portions—this increase of width being one-fourth when the angle between the straight portions is from 120° to 90°, and one half when the angle is between 90° and 60°.

All of the works on roads which I have read, agree that the best form for the uppper surface of the roadway—its cross section—is that of two inclined planes meeting in the centre of the road, and having their angles slightly rounded by a curve. The inclinations of the planes should be greatest where the surface is rough, and least where it is smoothest and hardest. A slope of 1-24, or half an inch to a foot, is given a road with a broken stone surface. The transverse slope should always exceed the longitudinal slope, so as to prevent the water from running too far in the direction of the length of the road.

Though engineers agree that the above is the best shape, the usual shape given to the cross-section is that of a convex curve, approaching in form a segment of a circle or an ellipse. Some of the objections to this form are that the water stands on the middle of the road; the road wears unequally and is apt to wear in holes and ruts in the middle; that vehicles have a slinding tendency when forced to travel on the sides; and that they have to ascend a considerable slope when obliged to cross the road.

Where the surface is made flat, it soon becomes concave from the wear of travel over it, and forms a receptacle for water, making a puddle, if on level ground, and a gully if the ground is inclined.

On a steep hill-side the surface should be a single slope, inclining inwards to the face of the hill. A ditch on the side next to the hill receives the surface water, which should be carried, at proper intervals, under the road to its outside. This form is also advantageous when the road curves rapidly around the hill, as it counteracts the dangerous centrifugal force of the vehicle.

Near large cities, roads have foot-paths on both sides for the convenience of pedestrians. They should be from 5 to 6 feet wide and raised about 6 inches above the roadway. The upper surface should have an inclination towards the side channels to allow the water to flow into them and thence into the ditches.

The drainage of a road by suitable ditches is one of the most important elements. All attempts at improvement are useless till the water is thoroughly got rid of. These ditches are sunk to a depth of about three feet below the roadway, so as to thoroughly drain off the water which may pass through the surface of the roadway. They should lead to the natural water courses of the country, and have a slope corresponding to the minimum longitudinal slope of the road. Their size will depend upon circumstances, being greater when they are required to carry off the water from side hills or where they are made in wet ground. A width of one foot at the bottom will generally be found sufficient. There should be a ditch on each side of the road on level ground and in cuttings. One is sufficient where the road is on a hillside.

The most common and almost the only kind of roads in this country have their surfaces covered with the natural soil, which makes them deficient in hardness and smoothness. In wet weather and under much travel, they become almost impassable. The principal means of improvement for these roads, are to reduce the grades, thoroughly drain the roadway and freely expose the same to the action of the sun and wind. In a flat country it is advisable to raise the roadway above the general level of the ground.

If the soil be a loose sand, a coating of 6 inches of clay carted upon it, will be the most effective and cheapest way of improving it, if the clay can be obtained within a moderate distance. Only one half of the width need be covered with clay, thus forming a road for the summer travel, leaving the other sandy portion untouched, to serve for the travel in the rainy season. If the soil be an adhesive clay, the application of sand in a similar manner will produce equally beneficial results. On a steep hill these improvements will be particularly valuable.

In repairing these roads the earth used should be as gravelly as posssible and free from vegetable earth. Sod or turf, though at first tough, soon decays and forms the softest mud in wet weather. Stones of considerable size should not be used, as they will not wear uniformly with the rest of the road, and will produce hard bumps and ridges.

When a dirt road passes over a soft, swampy ground which can not be drained without too much expense, a corduroy road is often used. This road is made by laying straight logs of timber either round or split, side by side across the road at right angles to its length. Those of

Gen'l Lee's veterans who were so unfortunate as to be wounded in the battles near Fredericksburg, know something of the pleasures? of travelling over such roads, as they doubtless have vivid recollections of their rides in springless army wagons to the railway stations, where box-cars took them to some of the many hospitals in Richmond, and elsewhere.

To diminish the resistance or friction on earth roads, it is necessary to cover their surface with some material such as gravel, stone, slag, shells, wood, &c., which will not only make them hard and smooth, but protect the ground beneath from the action of the rain water, which by penetrating to it and remaining upon it, would not only impede the progress of vehicles, but render the road too weak to bear their weight.

In Michigan and Wisconsin good roads have been made through swampy forests, by felling and burning the timber and covering the surface with the charcoal thus prepared. The timber is cut and piled up lengthwise in the centre of the road, and then covered with straw and earth in the manner of coal kilns. The earth required to cover the piles, taken from each side, leaves two good sized ditches. When the timber is charred, the earth is removed to the sides of the ditches, and the coal is raked down to a width of fifteen feet, leaving it two feet thick at the center and one at the sides.

In districts where lumber is cheap, road coverings of plank have been used. The method most generally adopted in constructing a road of this kind, consists in laying a flooring or track, eight feet wide, of boards fron nine to twelve inches in width and three inches thick. The planks rest upon two parallel rows of sleepers or sills laid lengthwise of the road and having their centre lines about four feet apart, or two feet from the axis of the road. The sleepers are embedded in the earth, and the planks are laid perpendicular to the axis of the road, as this position is as favorable to their durability as any other, and is also most economical. Deep ditches are dug on the sides of these roads to ensure perfect drainage.

In making a gravel road, the roadway is first prepared by removing the soft and loose earth, and thoroughly draining the road. The bed is sometimes of the shape of the upper surface and sometimes level. On this a layer of gravel about four inches in thickness is laid, and when compacted by the travel over it, or better still, with a heavy iron roller, another layer is laid, and so on until a thickness of sixteen inches at the centre has been reached. It is sometimes advisable to compress the bed by rolling it well with a heavy iron roller before beginning to lay the gravel. In some cases a bed of broken stone has been used. Gravel from river shores is generally too clean, there not being enough clayey material mixed with it to bind the grains together. That from pits is apt to be too dirty and requires partial cleansing. The gravel used should be sifted through screens and all pebbles over two inches in diameter should be broken into small pieces or rejected. It is an erroneous practice to put the larger gravel at the bottom and the smaller at the surface.

A gravel road carefully made, with good side ditches to thoroughly drain the road bed, forms an excellent road. Some gravel roads are very poor, caused in a great measure by using dirty gravel, which is carelessly thrown on the road in spots, which causes the road to soon wear into deep ruts and hard ridges.

There are excellent but expensive roads in this country and in Europe, whose covering is composed of stone broken into small angular fragments. The road beds are prepared as in gravel roads, and these fragments are placed on these natural beds, or on rough pavements of irregular blocks of stone. The former are called McAdam and the latter are known as Telford roads. These two kinds of roads have been the subject of violent partisanship on several disputed points, the most important one being the necessity of a paved foundation beneath the coverings of stones.

In the McAdam road, the roadway after having received its proper shape and been thoroughly drained, and rolled if necessary, is covered with a layer of broken stones from three to four inches thick. This layer is thoroughly compacted by allowing the travel to go over it, or by rolling it with heavy iron rollers. Successive layers of broken stone are then spread over the road and treated in the same way, until a thickness of from eight to twelve inches is obtained. Should the layers be too thick, it will be difficult if not impossible to compact the stones sufficiently well.

In the Telford road the bed is prepared as in gravel and McAdam roads, and on it is laid a pavement of blocks of stone of an irregular pyramidal shape; the base of each block being not more than five inches and the top not less than four inches. These blocks are set by hand as closely together as possible—the largest blocks being in the centre and the smaller ones on the sides so as to give the surface a slightly convex shape. The spaces between the blocks are filled with chippings of stone compactly set with a small hammer. Layers of broken stone are then laid over this pavement and treated as in the McAdam road. The stone for the pavement of this road may be of an inferior quality, as it is but little exposed to the wear and tear occasioned by travelling; but the stone used for the small angular fragments of both these roads should be selected from those which absorb the least water and are hard and tough. There is a diversity of opinion as to the size of the stones used. Some say $2\frac{1}{2}$ inches in longest direction—they should be as cubical in shape as possible—and others only an inch and a half through. The French engineers value uniformity of size much less than McAdam, and call it rather an evil than a good. They, therefore, use equally all sizes from an inch and a half to dust.

It is recommended by some that when fresh material is added in repairing these roads, the surface on which it is spread should be broken with a pick to the depth of half an inch, and the fresh material be well settled by ramming, a small quantity of clean sand being added to make the stone pack better. If practicable, the road surface should at all times be kept free from an accumulation of mud and dust, and uniformly even by the daily addition of fresh material whenever the wear is sufficient to call for it. When not daily repaired by persons whose sole business is to keep the road in good order, general repairs should be made in the Spring and Autumn by removing all accumulations of mud, cleaning out the side channels and other drains and adding fresh material when requisite. Without constant supervision, the best constructed road will, in a short time, be unfit for travel.

Those of us who followed General Lee in his brilliant campaigns through the Valley of Virginia into Maryland and Pennsylvania, frequently marched on some of these broken stone roads, and in dry weather we always kicked up such a dust that we each eat our peck of dirt in much less than the allotted time.

Shells, slag and other hard and tough substances may be used for road coverings. They are applied like gravel and broken stones.

This paper "on the best methods of constructing farm roads, turnpike roads, &c"—written at the request of the Board of Direction—is compiled largely from standard works, with which all professional engineers are doubtless familiar.

Appendix to Bulletin No. 19, of the Alabama Experiment Station.

REPORT

OF THE

ALABAMA WEATHER SERVICE.

Co-operating with the U. S. Signal Service.

SEPTEMBER, 1890.

STATE POLYTECHNIC INSTITUTE,
Auburn, Ala., October 15th, 1890.

The rainfall was unusually large during the month, and complaints have come from all parts of the State that the cotton crop has been greatly damaged by the continued wet weather. In many places the bolls are rotting and the staple is much stained. The average precipitation for the entire State was 3 28 inches above the normal.

The nights during September were cool and pleasant, but in South Alabama some of the days were warm; the observers at Pine Apple and Union Springs reported temperatures as high as 97°. There were only two or three days of such weather, and the temperature for the State was below the normal 5.°8.

Some small grain was sown during the month and is doing well, although the season generally was unfavorable to all other farming interests.

J. M. QUARLES,
Assistant.

P. H. MELL,
Director.

MONTHLY SUMMARY.

Atmospheric pressure (in inches).—Monthly mean, 30.049; maximum observed, 30.291 at Auburn on 1st; minimum observed, 29.860 at Union town on 23rd; range, .431.

Temperature (Degrees F.)—Monthly mean, 74.1; highest monthly mean, 78.8 at Goodwater; lowest monthly mean, 69.60 at Valley Head; maximum, 97 at Pine Apple on 10th, and at Union Springs 19th, 20th and 21st; minimum, 50 at Florence on 28th, and at Valley Head on 17th and 18th; range for the State, 47; greatest local monthly range, 45 at Union Springs.

Precipitation, including melting snow (in inches).—Average for the State, 6.02; greatest, 10.07, at Valley Head; least, 3.08, at Goodwater.

Mean relative humidity, 87.7, at Auburn; 83.1, at Uniontown; 83, at Montgomery, and 89.7 at Valley Head.

Wind—Prevailing direction, E. Miles traveled, 2,678, at Chattanooga; 4,323, at Mobile; 3,259, at Montgomery; 2,826, at Auburn.

TABLE OF SOIL TEMPERATURES—September, 1890.

(The observations for this table were taken at Auburn, Ala.)

A. M. LLOYD, Observer.

NOTE—There are three sets of thermometers—Nos. 1 and 2 are situated on a hill in sandy soil, and No. 3 is placed near a small stream in bottom land. The depth of instruments range from 1 inch to 96 inches below the surface, and the observations are made three times each day—morning, noon, and evening.

Depth in Inches.	Set No. 1, on hill.	Set No. 2, on hill.	Set No. 3, in bottom.
1	77.1	76.8	77.8
3	77.0	77.1	78.4
6	76.9	77.4	78.0
9	76.5	77.3	77.1
12	76.3	76.3	76.6
24	77.0	76.8	77.0
36	76.7	76.5	76.5
48	76.4	76 3	76.4
60	75 9	76.0	75.5
72	....	75 4	....
84	....	75.1	....
96	....	78.2	....

Monthly Summary of Meteorological Reports of the Alabama Weather Service, September, 1890.

Stations.	Counties.	Altitude.	Latitude N.	Longitude N.	Barometer. Monthly Mean.	Barometer. Max. Height.	Barometer. Max. Date.	Barometer. Min. Height.	Barometer. Min. Date.	Temperature. Monthly Mean.	Temperature. Mean of Max.	Temperature. Mean of Min.	Temperature. Max. Degrees.	Temperature. Max. Date.	Temperature. Min. Degrees.	Temperature. Min. Date.	Temperature. Monthly Range.	Temperature. Me'n Daily Range	Total Precipitation.	Clear Days.	Fair Days.	Cloudy Days.	Days of Rain.	Prevailing Wind.	Observers.
Ielma......	Dallas........	......	......	......	.....	......	...	......	....	76.3	85.5	67 1	93	10	56	29	37	18.4	5 37	..					†
Valley Head..	DeKalb	1058	34.30	85.30	.....	......	...	......	...	69.6	78.8	60 4	90	8	50	17–18	40	18.4	10 07	13	8	16	9	E..	E. P. Nicholson.
Pine Apple....	....	......	.....	.....	.....	...	..	.....	..	75 6	84.8	66 4	97	10	53	28	44	18 4	6.26		....	....	....	..	†
Florence.	....	......	34 48	87.37	.....		..	......		72 5	80.5	64.5	92	6	50	28	42	16	7.87			..	9		C. W. Ashcraft.
Chattanooga ..	Tennessee...	783	35.03	85.14	30.097	30.283	2	29.963	12	71.5	78 9	64	90	8	55	18	35	14.9	7 10	6	14	10	16	N e	L. M. Pindell.
Montgomery ..	Montgomery	219	32.22	86.23	30.044	30.169	5	29.923	23	75.9	84.2	67.6	91	6	57	28	34	16.6	6 03	5	8	17	18	E..	*L. Dunne.
Marion	Perry,........	......	......	....	......	..	....	......	....	73 2	84.3	62.1	92	10	50	29	42	22 2	6.54	...	...	..	..		†
Jnion Springs.	Bullock	516	32.12	85.39	.....	....	..	......		75.4	.....	.....	97	28–29–	52	28, 29, 30	45	...	6.13	9	6	15	8	E..	R J. Grady.
Bermuda......	Monroe......	......	31.43	87.12	...	..	...	......	....	73.1	.....	.....	89	30] 10	56	29	33	...	6.01	...	...	..	13	...	Wm. Fowler.
Mobile.........	Mobile	30	30.41	88.20	30.028	30.142	8	29.922	23	76.6	84.2	69	90	9-17	54	29	36	15 2	3.61	4	19	7	15	N ..	*A. Pritchard.
Carrollton.....	Pickens......	..	33.14	88.01	.....	......		......	...	73.7	..	......	84	9–19	56	28–29	28		4 93		...		14	S e	M. L Stansel.
Auburn.......	Lee..........	826	32.40	85.30	30.053	30.291	1	29.867	28	73 7	80.6	66.9	88	20	56	30	32	13.7	5.53	7	8	15	8	E..	J. M. Quarles.
Livingston	Sumter..	150	32.34	88.05	30.070	30.170	8	29.940	24	72	....	....	87	.....	51	.. ....	36	....	5.93	...	....	..	17	N w	J. W. A. Wright.
Greensboro .	Hale.........	220	32.41	87.36	......	......	...	......	....	73.5	....	..	90	9	54	28	36	....	8.98	...	10	20	14	N w	M. H. Yerby.
Mt. Willing ..	Lowndes.....	......	32.07	87.00	.....	......	...	.....		76	85	67.3	89	7–8	60	29	29	17.7	6.65				11	....	Wm. M. Garrett.
Uniontown....	Perry	273	32 28	86.44	30.002	30.160	8	29.860	23	74.5	83	66	90	6	51	27–28	39	17	6 84	8	6	16	14	E..	W. H. Newman.
Citronelle	Mobile.......	352	31.03	87.30	......	.....	...	.....	....	77.4	87 6	67.2	95	19	53	29	42	20.4	3.33	11	2	17	12	....	J. G. Michael.
Fayette.......	Fayette	......	33.42	83 12	.....	......	...	.....			..	.	..	......	..	....	..	......	.....	..			..	....	Dan Collier
Opelika........	Lee	....	....	.....	....	.....	...	......	....	72 6	81.7	63.7	93	8	52	29	41	18	4.79	...	...	....			†
Huntersville...	Marshall ..	.....	34.24	86.20	......	......	..	......	..		..	...	..	......	...	....	.....	......	...	..	...	.....	..	...	A. J. Baker.
Chepultepec...	Blount,......	......	......	......	...	......	..	......	...			....	..	.....	..	... .	..	.....	......	..	..	..		....	W. B. Allgood.
Columbiana ..	Shelby	.....	33.15	86.56	......		..	.....	....	72.2	81.4	63 1	91	9	54	28	37	18 3	6.90	..		..	16	...	W. D. Lovett.
Centre.........	Cherokee ...	729	34.10	86.30	.....	......	...	.....	....	....	....	..	...	......	..	....	....	..	....		....		..	...	Thos. Bradford.
D'ble Springs	Winston	.....	34.09	85.35	.....	......	..	.....		...		..	..	......	....	....	....	....	.....	..	..	....			A. M. Weiler.
Butler.........	Choctaw.....	.....	32.05	87.24	......	......	..	......	....	....		....	...	....		..		....	4.90				10	....	B. F. Gilder.
Jasper........	Walker......	310	33.49	88.12	......	......	..	.....	..	72.3	79.4	65.2	86	8–9	55	28–29	31	14.2	6.59	5	11	14	11	S...	Howard Lamar.
Wiggins........	Covington...	......	......		.....	......	..	.....	...	...	....		..	......	...	......			.	....	....		....		M D. Jones.
Goodwater ...	Coosa........	......	......	......	.....	......	..	.....	...	78.8	83 7	73.9	91	9	62	30	29	9.8	3.08	...		...	8	..	J. W. Batson,
Eufaula........	Barbour	......	......	.....	..	......	..	.....	....	73	85	61	90	6	54	8, 26, 27	36	24	5.14	...	...	...	..	..	†
Camden.......	....	......	......	......	.....	......	....	......	....	..	....	..	..	.....	..	......	....		.....		..	..	..	....	S. D. Bloch.
Means.....	....	......	......	30.049	......	...	....	......	....	74.1	82	65.7	..	......		....	36.6	17.4	6.02	7	9	14	...	E..	

NOTE.—*Sergeants Signal Service. †Cotton Belt Stations.