

This type of specification makes it easier for the contractor to make an intelligent proposal. It protects him, makes him feel that he is dealing with a fair-minded person, and that he is not wasting his good time in making up his proposal only to be excluded when the bids are opened, as he might be if he were bidding from an inferior set of specifications that could be variously interpreted as the contractor sees fit. It is my belief that if specifications were gotten up along these or similar lines, it would ease the minds of those responsible for letting contracts, providing the low bidder accompanies his bid with a suitable bond, because, if the contractor for any reason did not prove satisfactory, his bondsman would have to carry out the intent of the contract.

PREPARATION WORK WHICH SHOULD PRECEDE BITUMINOUS MULCH TREATMENTS

By J. Ray Stout, Union County Surveyor

In a discussion of this subject, I shall limit my remarks to our experience during the past summer in the preparation of the road for a bituminous surface in Union County.

Our program involved three different roads. The problem on each was to provide adequate drainage, shoulders of proper alignment, and a hard, smooth road surface of proper cross-section. Each road required slightly different preparations to meet these requirements, and consequently the unit costs varied.

The first road prepared was the Velocipede Pike, running due west out of College Corner. The work consisted of widening culverts and installing new ones where needed, cutting and grubbing bushes and trees along the right of way, side ditching, and widening shoulders. The greatest item of expense in this work was the widening of shoulders. In this construction, the sod was worked to the outer edge to stabilize the fill and to prevent erosion.

The shaping of the road consisted of grading down a portion of the crown and blading the loose material toward the edges of the roadway. This thickened and stabilized the outer edge and improved the riding qualities. Thus, the traffic was inclined to make use of the entire roadway, packing the loose material very rapidly. Care was taken at all times not to cut through the surfacing material and impair the base in any way. The stone which interfered with this work was taken out by hand labor.

We moved next to the College Corner and Richmond Pike, lying in the eastern part of the county and connecting State

Road No. 21 with State Road No. 27. This road had fairly good drainage. Other than installing a few new culverts and widening the existing ones, we devoted most of our time to the grading and shaping of the roadbed. Besides being rough because of the number of large stones in the base, it had the unusual feature of having a grade or rise of about 4 to 7 inches in 40 feet and a fall of the same amount in the next 40 feet, a feature which prevailed with surprising regularity the entire length of the road. This waviness was very noticeable to motorists. As correction of this feature would require considerable disturbance of the roadbed, we were faced with a rather serious problem, owing to the short period of time available for the disturbed roadbed to again stabilize and attain the hard and compact surface desired as a base for the bituminous top to be applied four or five months later.

We proceeded with the work by marking the high and low sections of the roadway, then setting the grader blade at right angles to the center line of the road and cutting heavily on the high sections and depositing the loose material in the depressions. This process was continued until the roadbed was comparatively smooth and level, and the cross-section had reached the shape desired. The elements were in our favor during this work, as it rained just enough to keep the road slightly softened, a condition that was necessary to accomplish the work in the most satisfactory manner. The stone which interfered with blading was picked loose by hand labor and all oversized stone was raked into piles and hauled away by truck.

During the month of September, three miles of the Billingsville Road were put into condition for black-topping in 1934. This work consisted of widening, side ditching, and construction of shoulders. During the work of preparation for the bituminous surface, shoulders of about 4-foot width were supplied with $\frac{1}{2}$ -inch to 1-foot slope. The bottoms of the side ditches were cut not less than 2 feet below the crown of the roadway, with special attention given to the grade in order to be sure of adequate drainage. The road was crowned to a slope of about $\frac{1}{4}$ inch to 1 foot and a width of 18 feet.

Tar was the bituminous material used in the treatment. Washed gravel was specified with 95 to 100 per cent passing a 1-inch round screen, 35 to 70 per cent passing a $\frac{1}{2}$ -inch screen, and 0 to 5 per cent passing a $\frac{1}{4}$ -inch screen. We required that 35 to 40 per cent of the material be crushed.

COSTS

The cost per mile of preparation for a bituminous surface will vary according to the amount of work to be done and the methods used. A check-up on our county trucks with three men per truck hauling earth for shoulders and embankments an average distance of $\frac{1}{2}$ mile, showed an expense of 35 cents

to 40 cents per cubic yard of earth moved, depending on the conditions.

By using a tractor and a two-wheeled "maney" scraper in connection with our earth-moving activities, we were able to cut down our expense and speed up the work. In side ditching and construction of shoulders, we marked the sections where it was desirable to use the wheel-scraper and left the rest to hand labor. As a result, in most cases the bulk of the earth was handled by equipment. The main factor governing the use of the wheel-scraper is the distance necessary to move the earth. We consider 600 feet the maximum distance practicable to haul. On a number of our county roads where the shoulders are too high and an excess of earth exists, the surplus can usually be used to advantage for widening embankments and shoulders within a haul of 600 feet.

On a section of road with high shoulders and no side ditches, we proceeded by cutting down the shoulders to a depth of 6 or 8 inches below the desired finished surface, and then cutting the side ditches with the grader and turning the loose material over into the shoulder depression. An experienced grader operator can judge with reasonable accuracy the amount of material to be taken out of the shoulder to make room for that which comes from the side ditch. This method eliminates hand labor and the use of trucks to haul material.

The number of yards moved per hour by this method will depend upon the class of material to be moved and the distance hauled. Where no difficulty is experienced in scooping and a tractor is used with a speed of $6\frac{1}{2}$ miles per hour on an average haul of 300 feet, twenty trips per hour can be made with ample time to turn and load.

Cost per cubic yard of moving earth by this method can be figured in the following manner:

Cost per hour, 2 men @ 30c.....	\$0.60
Cost of gas. per hour @ 15c.....	0.375
Depreciation and upkeep per hour.....	0.30
	\$1.275

Twenty trips with a $1\frac{1}{4}$ -yard wheel-scraper will move 25 cubic yards of material for about 5 cents per cubic yard. This is an economical method up to 15 cents per cubic yard.

In this work of preparation of the roadbed, there are three important items to be taken into consideration in securing a successful bituminous surface; namely, adequate drainage, ample shoulders, and a hard, smooth riding surface of the proper cross-section. As I stated in the beginning, good roads depend not only upon good engineering principles and theories, but upon their best application with the equipment and funds that are available.