BITUMINOUS SURFACES
Ernest H. Coffin
Wayne County Road Supervisor, Richmond, Indiana

I have watched closely the different methods of construction of bituminous surfaces. Only recently, one of my road supervisor friends asked me the question, "Why do we find so many different methods of construction of bituminous surfaces in every county and state, with continual changes from year to year?" My answer was, "I am sure the construction of bituminous surfaces is still experimental and is due to see many changes."

Since being county road supervisor, I have spent as much time as possible in visiting the road supervisors of the state, getting their viewpoints, not only on bituminous surfaces, but on every problem of road supervising. I know of nothing that has meant more to me than this, even though I could put into effect only one idea I had learned from a day's visit.

I presume a number of you have found yourselves in my position, with an heritage of quite a number of miles of black-top surfaces which were costing an excessive amount in maintenance. Some of these roads were constructed several years ago when the idea prevailed that a road should have at least a six-inch crown. I do not mean to cast any reflections on our predecessors who built these roads, because I have no doubt that we are making some mistakes that in a few years will look worse than the mistakes they made. I will explain first the plan we have used in our county in resurfacing some of the roads just described where maintenance was excessive, the surface was very uneven, the edges were broken, and various heights of crown existed. First, we would patch all holes, using a cold mix. We used a concrete mixer to coat the 1/2-inch stone chips with A.E.S.3. Then, after sweeping all loose sand and dirt from the edge of the road, we put on 1 1/4-inch of 1/2-inch chips. We do this by using a home-made spreader-box, built in the shape of a hopper, placed on runners with an adjustable back. A truck backs up to this hopper, which is then hitched to the truck, and, dumping slowly into the hopper, the truck pulls it forward, leaving a windrow of the exact amount of stone necessary to provide 1 1/4-inch of loose stone over the road width. We have found this very essential in all our work of constructing bituminous surfaces, as this makes for an even distribution of material and an even mix. The stone is placed in a windrow with the box, then spread to a width of approximately 16 feet. In all our mixing, we use a motor grader equipped with the oil turn blade. By spreading the stone before making the application of 5-10 of a gallon of A.E.S.2, we find that the mixing is much simplified as half the mixing is accomplished by penetration. We found in most cases that after mixing, the middle of the road was so
well coated with bitumen on the base that it needed no prime. We usually prime each edge, using one spray bar, to insure that the surface is well prime coated before laying out the mix. The windrow is mixed just enough so that every particle of stone is thoroughly coated. The least excessive turning tends to cause the material to set, and this must be watched very carefully. The windrow is then flattened and split equally in two parts.

We then lay this out, one side at a time, with a Gledhill road shaper. This machine is an inexpensive attachment made by the Gledhill Manufacturing Company for any ordinary grader. The machine has a 24-foot straight edge which carries the inner end of the two blades and eliminates all waves, giving a uniform and smooth surface. It also has an attachment whereby any desired crown may be maintained by checking a spirit level.

Before the laying out of the surface, stakes are set to assure a straight edge and uniform width. The steering device of the grader with the attachment is set off center, or directly behind the outer end of the blade, which makes it easy for the operator to keep a straight edge and uniform width. By the use of this machine, we have been able to get an entirely new, smooth-riding surface, regardless of the roughness and unevenness of the old surface.

After the material is laid out, we roll immediately with a 5½-ton roller. Then the road is closed to traffic. The following morning, we apply to the strip previously laid 1-10 gallon per square yard of A.E.S.3, and cover with 10 pounds of buckshot pea gravel per square yard, and again roll. The road is kept closed to traffic from 1 to 3 days, according to weather and road conditions. In the constructing of the road I have just described, the bituminous material used was two distinct grades of emulsified asphalt. We have obtained the same results by using flux oil and powdered asphalt, using approximately 1½-gallon less in the mix and using 25% by weight of powdered asphalt. In making this explanation, I am not advertising any particular material, but am simply stating what we have used; and I would further say that I have no doubt the same results could be obtained by use of other bituminous material of proper specifications.

After the road is used for ten days or longer, and the traffic has kneaded the material well together, we again apply 1-10 gallon per square yard of A.E.S.3. From the truck end gate, approximately 12 pounds of refuse sand per square yard is then applied and the road is immediately opened for traffic. This gives a compact, waterproof, non-skid sand finish surface, which so far has shown no signs of peeling or picking loose, and we feel it will cut our maintenance cost to a minimum.

No doubt a lot of you men think this costs too much money, but if it will eliminate continual patching and provide a
smooth, non-skid surface, regardless of the unevenness of the old road, then we believe it is far cheaper in the long run than some of the easier and cheaper methods.

We used 1 1/2 gallons of bituminous material per square yard at 7 1/2c per gallon. The stone chips cost $1.25 per cubic yard, and we used 300 cubic yards per mile for an 18-foot road.

After fine aggregate was added to fill the voids as I have described, the road surface shows not the least sign of peeling, while those with more open and less compact surfaces are peeling badly, and in many large spots the aggregate is half gone. This leads me to believe that in all bituminous surfaces, all voids should be filled to secure a waterproof surface as nearly as possible.

We are not attempting to do a large amount of new surface work, believing that, until more funds are available, we can better serve the whole county by spreading our money over our entire mileage, rather than spending excessive amounts on a few miles. I have been very much impressed by, and have given much consideration to, this statement, recently made in my presence: "If every road in the county could be black-topped free of charge, we could not afford to accept the gift, for the simple reason that we could not maintain them with the road funds we are now getting." However, by the use of cheaper materials, we can by careful planning maintain our roads and keep them passable for approximately 51 weeks in the year.

I know of a few counties wherein during most of the past summer a major part of the road money was spent in trying to maintain a large mileage of bituminous surfaces, which necessitated neglecting many miles of gravel roads that serve a lot of the population. We have within our own county several incorporated towns which have black topped all streets by taxation and donation under the false illusion that they would be permanent, but now find themselves unable to maintain them with the funds received from the gasoline tax, which are the only moneys available. With these facts in mind, we are persuaded to believe that unless a road has approximately 200 vehicle miles of traffic per day, it can be more cheaply maintained as a gravel or stone road than with a bituminous surface.

Much work should be done on a road before the bituminous material is laid. Much of the success depends on the condition of the road before the bituminous material is laid. We have in most instances widened roads to be black topped to a 50-foot right-of-way, reditching and regrading, and placing new culverts where needed. This should be done at least 1 or 2 years before the bituminous surface is laid. To the surface should be added from 300 to 500 cubic yards of good gravel per mile. Where over 300 cubic yards are used, I would sug-
gest two applications. This should be maintained with a planer-type machine from 1 to 3 times a week, depending on the amount of traffic, for a period of six months to a year. I am of the opinion that, by doing this, we will have less trouble with our bituminous surfaces. We have had very good success with our mats following this type of preparation, using the exact equipment and practically the same process as described in our resurface work. Where you have thus prepared a road and have provided ample base and have good drainage, I have very little fear of the mat failing, even though it be a thin mat. At least a thin mat will have more chances under these conditions than on a road having little or no base and poor drainage.

On a road thus put in shape, and maintained until the base is well set and all culvert fills are settled, we put the surface in shape by using a motor grader and Gledhill shaper, cutting the surface to the desired crown. We then prime by using at least .25 gallon of bituminous material per square yard, and close the road from 2 to 4 days. On a road thus primed, we would put a new mat exactly the same as the resurface described, using stone or washed gravel up to three-quarter-inch to the desired thickness wanted. In every case, we finish the surface with a finer aggregate, making it as near waterproof as possible.

Your location geographically might justify a different plan. These conditions differ, even on roads within the same county, but the basic principles will always be the same. They are:

1. You must have adequate drainage.
2. You must have enough base material, well compacted, to support your road.

I think most of us have made mistakes in attempting to build a black-top surface where we knew the conditions were unfavorable. This is caused frequently by influences beyond our control as road supervisors.

USE OF POWDERED ASPHALT IN LOW-COST ROAD WORK

Peter Draper, Madison County Road Supervisor,
Anderson, Indiana

We first used powdered asphalt in 1937. Therefore, I am not wholly prepared to give final conclusions. Naturally, we were favorably impressed by the many claimed advantages of this product, and the scientific facts demonstrating economy, greater durability, adaptability to varying road conditions, and so forth.

The staff of the contractor was augmented by field engineers of the company, who surveyed the work to be done