

develop, they can be cut out after rains and the road will assume its original smoothness. Incidentally, these pot holes will not develop if the original mixing is done thoroughly and the proper amount of crown put into the road and maintained there. But this cutting must be done at the right time, and that is either during, or immediately after, a fairly heavy rain. If it is only a light rain, leave your road alone. Without sufficient moisture to reincorporate the bladed material, it will remain loose on the surface and be lost. Whatever you do, don't blade such roads in dry weather!

Our Board of Commissioners is very favorably impressed and has under consideration a plan to surface-consolidate several miles of gravel road next year. We believe this type of maintenance is going to reduce our former maintenance costs of loose gravel surfaces to such an extent that we can afford to give good safe roads to all our people and still make high-type improvements on those roads that need them.

## USE OF ROAD OIL IN ROAD SURFACING

Glen Brown,

Huntington County Road Supervisor

I am surprised that one with so few years' experience should be called upon to address this group. I realize, however, that only by discussions such as these can we as a group profit by the trials and errors of others. Before getting too far into my subject, I would like to take a moment to express my thanks to Professor Petty for the very excellent work he has done in connection with the Road School and extension work. If others have benefited as much as I by attendance at these sessions, then I feel that I may speak for all of us. His yearly visits to our counties to inspect our roads and bridges are a tremendous undertaking for him and a definite advantage to us. During these visits, we receive the benefit of his experience in the form of sound advice and instructions, which are of the greatest value to the highway supervisor and his aides in maintaining our county highway system.

Thousands of miles of existing stone and gravel highways provide an excellent base for bituminous roadmix wearing courses. It is the purpose of this paper to touch briefly on the more important aspects of this economical type of construction for all-weather roads.

Because of experience gained over many years, we are taught that the first point to be considered in road building is the proper construction and maintenance of a subgrade. This embraces such important features as correct gradation of aggregates and proper drainage of the subgrade.

Experience has proved the desirability of keeping a constant year-to-year record of road conditions, since unmarked or unrecorded base failures which occur during the spring thaws are often impossible to locate during the following working season and are, consequently, passed by as being satisfactory. Bituminous road-mix mats should never be placed on an unstable or improperly built base, as you cannot expect a 1½ to 2½-inch flexible wearing surface to bridge over base failures. These faulty base failures even cause the break-up of 6-in. and 8-in. rigid-type pavements. It is far better to disappoint a few taxpayers by withholding the construction of a bituminous mat for an additional year until corrective measures have been applied, than to incur criticism a year or so later when the road shows signs of failure because the base was incapable of carrying the traffic load placed upon it.

When base and subgrade conditions are as nearly correct as we can make them, our next problem is the selection of materials to be used. Limited funds and large mileage necessitate economy; economy in turn necessitates, at least for most of us, the use of local aggregates whenever possible. These local materials vary somewhat according to locality, and it has been my experience that one of the most versatile bitumens to use with this variable aggregate is S. C. Road Oil as listed in the Indiana State Highway Specifications. I call it versatile because of its adaptability to use with a wide range of gravels, and also because this same material may be used for prime and surface mixtures and, if necessary, for seal coat work.

## METHODS

In Huntington County we follow a definite procedure in our construction, depending entirely upon the requirements of traffic on a given highway. Where the elimination of dust is the major consideration, it has been our practice to prepare the existing road by blading the loose material to the shoulders and, at the same time, to smooth the road surface. S. C. 1 at a rate of .3 to .5 gallon per square yard is then applied to the cleaned surface, after which the loose material is brought back over the freshly applied road oil. This tends to build up a light surface-mat, eliminating the dust problem.

Where the traffic is sufficiently heavy to justify the construction of a road-mix mat, the following method is used: After the existing roadway has been shaped to proper crown and cross-section and the required amount of aggregate has been added, a prime of S. C. 3 at a rate of .3 or .5 gallon per square yard is applied to the cleaned surface. This prime is applied six to eight inches wider on each side of the road than the contemplated width of the wearing surface, and allowed to penetrate for three to six hours before the windrowed aggre-

gate is moved to the treated side. This same procedure is then followed in priming the other half of the roadway. After the prime has had ample time to penetrate, the windrowed material is spread to a width of 10 to 12 feet and S. C. 3 is applied to the aggregate at approximately .6 gallons per square yard. The treated material is then brought to an inverted V windrow in the center of the road by means of power graders. We follow this step by using a multiple-blade maintainer to obtain thorough mixing and to eliminate segregation of the material. The above procedure is repeated until approximately 1.25 gallons per square yard of S. C. 3 have been added and incorporated in the mix.

This thoroughly-coated material is placed as nearly in the center of the roadway as possible, and from this position the mixture is spread over the primed surface by means of a power grader. The edges of our mats are thickened to a minimum of three inches to compensate for the extra weight which this area must carry and also as protection against traffic raveling.

The oil mat is then rolled, by starting at the outside edges and moving toward the center and overlapping on successive trips. When the rolling has been completed, the roadway shoulders are brought to grade with the edges of the bituminous mat, as a means of protecting the latter and also to facilitate the drainage of surface water into the side ditches.

This road-oil mat is then opened to traffic for a period of three to five months to complete the curing process. This period also allows time for the examination and repair of any possible defects which may appear before the application of a seal coat.

When all conditions appear favorable for the application of a seal coat, a more rapidly curing bituminous material is applied at a rate of about .35 of a gallon per square yard and covered immediately with stone chips, after which it is broom-dragged and rolled.

We place this type of bituminous mat on roads having a minimum right-of-way of 40 feet. This enables us to adhere to a minimum width of 18 feet for the bituminous mats. The procedure for the construction of road-mix mats, as outlined above, based upon our general average of 18-foot wearing surfaces, requires about 500 tons of aggregate per mile. The resultant mat is approximately  $1\frac{1}{2}$  inches thick when compacted.

Bituminous roads, if well constructed and properly maintained, are economical from the standpoint of both construction and maintenance and provide all-weather roads for rural communities.