

# Construction of Bituminous Plant-Mixes Using Pit-Run Gravel

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In discussing this subject, I want to assure you that my remarks are going to be brief and in common road language.

I am not sure just when the first bituminous roads were constructed in Indiana. I do know that our good friend Mr. A. H. Hinkle, who is now connected with the Asphalt Institute, pioneered a bituminous surfacing when he was State Superintendent of Maintenance. Thirty years would pretty nearly cover the beginning and the progress that has been made in bituminous surfaces in Indiana.

The original purpose was to construct a dustless, all-weather road at a low cost. In the beginning the principal material used was road tar. So firmly was this term impressed on the public mind that even today any surfacing that is black is called a tar road by the general public.

About all conceivable procedures were followed in the early construction of these roads. One strange thing about it is that many of these first-constructed roads are still in use and are fulfilling the purpose for which they were constructed—that of being dustless all-weather roads. During this period of years, much advancement was made in the development of various bituminous materials, and today we have in our state highway systems, city streets, and a few county roads some of the finest roads one could wish for. However, in later high-type construction, the original thought of producing low-cost roads has been set aside.

One of the uppermost factors in county highway construction of dustless roads still does involve the cost problem. As one drives over Indiana county highways, one finds a vast difference in the methods of construction as well as the materials being used. One also finds a vast difference in the quality of the roads thus produced. However, all of them are serving, to a certain degree, the purpose for which they were constructed. At least they are dustless.

If each of you road men were asked to step up here and state in detail your construction procedure, the chances are we would have just that many different ideas.

To my way of thinking the main purpose of the Purdue Road School is that we can meet here, discuss these various problems, and, as Calvin Coolidge once said to Thomas Marshall, "compare our ignorances." I don't think any of us know all the answers—I am sure I do not; but maybe each one here has some good idea, and when these good thoughts from the experiences of all are collected, much good and improvement should come from these discussions.

It is because we have never been quite satisfied with our results that we are continually looking for some better method. As I have stated before, one of the main factors that we must consider is cost; whatever the lasting qualities, the cost of maintenance and the riding qualities must be given consideration. I have long since learned that a road that rides well, and stays free from holes, creates a much more favorable impression on the motoring public than anything else. Motorists are not so much concerned whether the road cost \$1,000, \$2,000, or even \$5,000 per mile.

Of all the factors entering into the construction of a bituminous road, there is one on which we all must agree—the road must have an adequate base and proper drainage before any type of bituminous construction will hold up. Hence starting with a good, preconditioned, well-drained base is the prerequisite before starting with the bituminous surface from pit-run gravel.

What little I know about this subject I have learned from reading, from observations, from discussions at the Purdue Road School, and more from my good friend, W. L. Magaw, who has been in this type of construction almost from its inception.

I have tried penetration jobs, road-mixes, and about everything else that many of you have tried. All have proved to a certain degree successful, but none have been all that I would like.

After discussing this problem with Mr. Magaw, we decided on a departure from many of my old methods, bearing in mind three points. We wanted a durable road, one with the best riding-quality possible, and yet at a reasonable cost. We selected two different pieces of road which had been preconditioned, and which we felt had a good base, realizing that a road, like a house, can be no better than its foundation.

After shaping this base in proper cross-section, with the use of maintainers and a planer-type drag, we primed with 0.5 gallon of AES-3 emulsified asphalt of Indiana State Highway Specifications.

From this point on we had in mind to eliminate as many as possible of the objectionable features of previously constructed roads. To produce a low-cost road, one must of necessity use local materials that are easily accessible, necessitating the shortest possible hauls. With this in

mind, we selected pit-run gravel from a source that was free from dirt and contained a goodly portion of fines. This we screened to pass a  $\frac{3}{4}$ -inch sieve.

To eliminate the objectionable features we have found and observed in road-mix jobs, we stabilized this gravel with 12.5 gallons per ton of AE-200 emulsified asphalt, Indiana State Highway Specifications, using a regular mixing plant which gave us a uniform mix. Next, to eliminate the objectionable features we have found in laying out mats with either a motor grader or a maintainer, we selected a regular cut-off paver. We placed this mat at the rate of 200 pounds per square yard, which gave a 2-inch mat of compressed material. This was rolled the same day it was laid out, with a repeat rolling the next day. To eliminate the objectionable features of having a mat marked with horse tracks, mower tracks, or wagon tracks after a few days of curing, we sealed this mat with 0.15 to 0.2 gallons of AE 150 per square yard. We applied to this seal 15 to 18 pounds of shot-sand, a byproduct of one of our gravel plants. We immediately opened the road for traffic.

This gave us what we felt was the lowest possible cost, since we used only local aggregate. Our gravel cost us 15 cents per ton, our asphalt 11 cents per gallon. This gave us a cost, for materials only, of \$1.52 per ton for the mix. This is approximately 15 cents per square yard for the mat. The material for the prime and seal cost approximately 10 cents per square yard, making a total cost for material only of 25 cents per square yard. This type of road will cost us, counting the mixing and laying, \$3,500 per mile, not counting the cost of the trucks for hauling.

The two sections of road constructed under this plan last fall came through the winter with scarcely any flaws. In riding qualities, they compare very favorably with the highest-type road that could be constructed at any cost. They are as non-skid as can be constructed.

The mixing plant is a movable plant that can be set up at any local gravel pit or at a stock pile and placed at the site of the road to be reconstructed. This eliminates expensive hauls, and cuts cost to the minimum. This road is open for your inspection, approval, or disapproval.