

EXPERIENCE WITH THREE-INCH BITUMINOUS  
GRAVEL MIXTURE

By George Brown, Starke County Highway Superintendent

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Bass Lake is a very popular resort center responsible for excessive traffic over our gravel roads in its vicinity, especially during the summer season. In view of the mounting costs of daily dragging and continuous renewal of gravel, in addition to the increasing clamor for elimination of the dust nuisance, it became necessary for us to do something radically to improve this very important 1½ mile road around one side of the lake. This Bass Lake road during the past few years cost Starke County an average of \$700 per mile annually for maintenance. After considering ordinary surface treatments and plain road oiling to correct the dust nuisance, we came to the conclusion, after thorough investigation, that probably the oil mixed-in-place method would be the best and cheapest for our road.

We inspected a road of this type that had been in use for over two years and were very favorably impressed when informed of its composition and cost. We decided to experiment on this type of construction.

A check-up of the equipment we had on hand was made to determine whether or not this work could be done without purchasing any new equipment. We had a distributor and, considering this with other equipment available, we could see nothing in the way of our performing a first-class job. We had expected to re-surface the entire road last year with gravel as a necessary maintenance operation; therefore, this item should not be charged entirely to cost of new black-top. We used gravel of which 50 to 80 per cent passed through a No. 4 screen, as being best suited for this bituminous-mix type.

The road was graded smooth and widened, then covered with gravel to a depth of approximately 3 inches. After this had been spread upon the surface of the old road, we were ready to apply the heavy asphaltic road oil purchased from one of the large Indiana companies and known as No. 5 asphaltic road oil.

The equipment used consisted of a disc harrow, a spring tooth harrow, a tractor-drawn blade grader of 16-foot wheel base with a twelve-foot blade, two trucks, and an oil distributor.

The asphaltic road oil was applied at the rate of 0.5 gallon per square yard in each of three applications. The disc harrow and spring tooth harrow were used to mix each application of this oil thoroughly with the gravel on the surface of the road. After all of the oil was applied, we immediately

began blading operations, turning the mixture from side to side in windrows, making sure to get entirely across the center of the road so that there would be no area of unmixed material. We continuously mixed and turned this material until it attained a uniform color throughout.

Unfortunately, while we were in the midst of the construction of this road, with only two applications of the heavy oil made and the material not yet thoroughly mixed, a very hard rain storm set in which, of course, gave us considerable trouble by washing out some of the oil and making it much harder for us to get the correct percentage back into the mixture. The color had already changed to a dark chocolate brown. Nevertheless, the presence of oil in sufficient quantity was not visible, so it was necessary to make further additions of oil in small quantities until we felt we had met the specifications calling for a total of  $1\frac{1}{2}$  gallons to the square yard for a three-inch thickness.

After the oil and gravel were thoroughly mixed, we spread the mixture to a uniform thickness from one side of the road to the other and immediately permitted the traffic to go over the oiled surface. The road opened just at the 4th of July holiday period and it therefore immediately carried the heaviest traffic of the year, amounting to several thousand cars per day. We heard no complaints whatsoever from the travelling public as to the throwing of oil or the spattering of cars in any way. I drove my car over the newly mixed mass of material and could find nothing objectionable from this source. This, of course, is worth thinking about, especially where the road is opened to fast traffic immediately after treating. As a result of keeping the smaller blade grader working to keep the material smoothed out while it was being compressed by traffic, the road became thoroughly packed and exceptionally smooth after the first day.

The length of the oiled road as above described is  $1\frac{1}{2}$  miles, and the surface which was oiled averaged from 18 to 20 feet wide. The gravel, oil, and labor cost was as follows:

30,000 gallons of No. 5 Standard road oil at	
$2\frac{3}{4}$ cents per gallon.....	\$825.00
Freight on the road oil.....	270.00
Heating oil in the cars at \$10 per day.....	60.00
1,146 cubic yards of dry screened gravel at	
40 cents per yard.....	458.40
Hauling the gravel at 15 cents per yard mile	1,203.30
Extra for grading, berming, and widening of	
the road, and for extra gravel used.....	2,642.05

Total cost ..... \$5,458.75, or  
\$3,640 per mile.

Further economy in the construction of the road was made by the co-operation of the property owners, who saved the

county highway department a large sum of money by donating and defraying the cost of the purchase of land for the road, moving buildings back, disposing of the trees and defraying the cost of drainage consisting of an 8-inch tile running parallel with the road, and also defraying the cost of catch basins and the glazed tile which was laid to cross the road at every 200 feet. The estimated cost of the drainage along the highway if the County bore this expense would be \$1.50 per front foot, but this was paid by the property owners.

In view of my experience in doing a small amount of this work, and considering its first cost, the maintenance after completion, and the compliments received from the travelling public, I have come to the conclusion that anyone building this type of road according to specifications in detail cannot help getting a good road satisfactory to the taxpayers.

### EFFICIENT OPERATION OF A COUNTY ROAD DEPARTMENT

By O. S. Hess, Engineer-Manager, Kent County Road  
Commission, Grand Rapids, Michigan

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A discussion of this subject will, no doubt, prove to be of greater interest if a specific example is used throughout. Accordingly, we will take Kent County, Michigan, as the example and explain more or less in detail the methods of operation in this county.

Kent County lies near the middle of the western side of the Lower Peninsula. It is 24 miles wide and 36 miles long, and has 24 townships. The valuation of the county is approximately \$350,000,000, and Grand Rapids is its principal city.

Before going into details of the operation of this county's highway department, we should know something of the administrative setup of the highway organization as well as the governmental structure which controls it. The governing body of the county consists of 52 supervisors—one from each of the 24 townships, 24 from the city of Grand Rapids, and 4 from the city of East Grand Rapids. The board of county road commissioners consists of 3 members who are appointed by the board of supervisors. The road commissioners are appointed for terms of six years each, alternating so that one commissioner must be either reappointed or replaced every two years. The board of county road commissioners is an administrative body only, and does not directly handle the details of the county highway work. This board is required by law to employ a competent engineer to act as the executive head of the county road activities. The road commissioners do not receive high salaries and meet only one day each week