

DISCUSSION OF PROGRESS REPORT ON LOW-COST IMPROVED ROADS INVESTIGATION

Opened by C H MOOREFIELD

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Mr. Conner has emphasized in his paper the urgent need for the development of low-cost types of improved roads and has said enough to justify amply the investigational work which he is doing. He has certainly not overstated the importance of his task, however. The problem he is working on is one that concerns not only the State highway departments in their relation to a very large proportion of the aggregate State highway mileage of the country, but also the county and township road officials who are responsible for a very large part of the gross public road mileage which needs to be developed in order to care for present-day traffic.

As I see the situation, the development of low-cost roads that will give satisfactory service under moderate traffic will contribute more to the economical advancement of motor transport and to the general well being of rural communities than is likely to be contributed by any other development in the science of road improvement.

Mr. Conner has apparently begun at the beginning in tackling his problem by assembling and tabulating available results of research, experiment and practice in the treatment of earth type roads surfaced with such local materials as crushed stone, gravel, sand-clay and top-soil. He has thus assumed, and properly so, that the problem of producing low-cost roads is to treat local materials utilized in the surfacing. This has been the general assumption and for the present at least seems warranted.

The data presented by Mr. Conner have been well prepared and appear to cover most of the different methods of treatment that have been tried to date. He has properly discussed some methods that so far have given little promise of economical advantage, but has devoted most of his paper to the presentation of facts about methods that have at least given good results in some localities.

In South Carolina we have experimented with several different methods, including the use of calcium chloride and sulphite liquor as dust layer, and bituminous treatments. Of the methods tried under our conditions the bituminous treatments have given much the best results.

The first bituminous treatment tried by us consisted simply in treating sand-clay and top-soil roads with a light oil applied cold which contained about fifty to sixty per cent of asphalt of one hun-

dred penetration .. These treatments have been repeated from time to time with variation, including the mixing of the oil down into the earth surfacing material, and in some cases we have secured fairly satisfactory results. The best results we have obtained, however, have been with a double-surface treatment, using tar suitable for cold application as a prime coat and asphaltic oil as a cover coat, with crushed stone as the stabilizer. This method of treatment has produced a satisfactory road surface for traffic up to 1,500 vehicles per day where the original road surfacing consisted of firm material with a relatively large content of gravel or sand and only sufficient clay to serve as a binder and where the road is well drained. The method of treatment which we have followed in such cases to the extent of about 120 miles is briefly as follows:

- 1 Scarify the old road surface, add new surfacing material as needed, road machine to standard cross section, then maintain carefully under traffic until the road surface is smooth and well bonded
- 2 Then, while dry and before waves have had a chance to develop, sweep all loose material from the road surface and apply from one-fourth to one-third gallon per square yard of tar suitable for cold application, viscosity 8 to 13 at 40° C
- 3 After the tar, which is applied as a priming coat, has had 24 hours to penetrate, heated asphalt of 150-200 penetration is applied at a rate of one-third gallon per square yard
- 4 The asphalt coat is immediately covered with about 50 lbs per square yard of crushed stone, graded 1¼ inches to one-fourth inch, and rolled thoroughly with a 5 to 6 ton power roller
- 5 The road is then opened to traffic. The surface under a few months' exposure gradually changes its appearance from a plain crushed stone surface to a bituminous surface with many exposed stones
- 6 The surface is then given a seal coat of a rather light asphaltic oil, applied hot (oil containing about 60 per cent of 100 penetration asphalt), at a rate of about one-fifth gallon per square yard, this coat being covered with from 15 to 20 lbs of coarse sand per square yard to prevent picking up under traffic

The original cost of this treatment is about \$2,000 per mile for a treated width of 20 feet. This cost does not include interest or depreciation on the equipment used, nor cost of engineering supervision. Roads treated in this way are carrying 1,500 vehicles per day in a very satisfactory manner. Maintenance costs are about \$400 per mile for the first year and about \$300 per mile per year for the second and third years. Beyond the third year we are not yet

able to forecast what will be required. On one short stretch treated in this way, where the traffic was well above 2,000 per day, a retreatment was necessary after about 18 months. When the retreatment was made the old bituminous material was scarified down into the earth surfacing material, and it appears that additional stability for the roadbed was secured in this way. Before applying the retreatment, however, gravel was added to the original surfacing, so that the results of mixing the bituminous material with the earth material will not be evident in the life of the new treatment. In this case the condition of the roadbed was greatly improved between the two treatments and the last one has now served for some six months without the least sign of failure under increasing traffic.

We feel assured that when our original treatments break up or otherwise fail the roads can be scarified, reshaped and retreated with the expectation of securing at least as good results for the second treatment as for the first.

We are planning to continue the surface treatment work while attempting to develop by experimentation further information that will help in adapting the treatment to various classes of earth roads. We are also watching with much interest the information made available by the Research Board and believe we are profiting by its work.

CHAIRMAN BROSSAU We shall now listen to a paper on "The Methods and Possibilities of Road-Soil Investigations" by Dr. Charles Terzaghi of the Massachusetts Institute of Technology