

TREATMENT OF LOW COST ROADS

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The present method of progressively building crushed stone or gravel roads by applying the material as needed, in thin loose layers and maintaining a smooth surface by frequent dragging or blading is a marked improvement over the older method of building and maintaining a bonded surface. The present method, with proper maintenance, gives a smooth and easy riding surface that proves highly satisfactory to traffic up to about 600 vehicles per day.

This type of surfacing is coming into extensive favor and is being used on roads carrying light traffic and on others where for economic reasons a higher type is temporarily prohibited.

The better practise in the construction of these roads seems to be briefly as follows: After the subgrade has been prepared the surfacing material is dumped on the roadway in such quantity as to give a depth of two to three inches or more, depending upon the condition of the subgrade. Spreading and mixing is done with a grader after which any excess material is bladed to the edges in windrows. As consolidation develops under traffic and weak places appear, additional material is bladed in from the windrows or piles along the edges. By this progressive method of construction the wearing surface finally becomes thoroughly compacted and stabilized under traffic.

Since it is necessary to maintain a thin layer of loose material on the surface it is very important that the gravel or stones in the topping should not contain any large amount of clay or other bonding material. Experience has shown that the use of a loose topping composed of material too large in size gives a surface difficult to maintain and unsatisfactory to traffic. The loose topping should not exceed $\frac{3}{4}$ -inch in thickness and should be composed of material ranging from that retained on the 10 mesh sieve up to not over $\frac{3}{4}$ -inch.

In the case of the top soil and the sand clay type, improved service has resulted because of the greater care given to the selection of materials for construction and maintenance. Uniformity in the material of the surfacing course is most important and is being obtained by early blading of the material from one side of the road to the other.

Although these low cost roads have an important place in the highway system, they have certain disadvantages. They become dusty during dry weather and the maintenance cost increases greatly

as traffic increases beyond 400 or 500 vehicles per day. To remove these disadvantages and put certain of these roads in condition to carry a larger volume of traffic, various types of bituminous surface treatment have been tried.

A large amount of this work has been done in a number of states during the last few years. Because of the wide differences in the conditions under which such treatments were made, not only in character of the bituminous materials and the road surface, but also in the climatic conditions encountered and in the construction methods used, widely different results have been obtained. The survey made by the Highway Research Board and reported by Mr. Conner as well as the survey on the surface treatment of the low cost type roads in the western states, made recently by the California Highway Commission in cooperation with the Bureau of Public Roads,¹ should aid in determining the type of treatment best adapted for a given particular condition.

The present status of surface treatment work on the low type roads has not been attained without a large amount of experimental study. In many sections of the country, the conditions peculiar to a given locality are, in many cases, such that it has been necessary to make extensive preliminary studies before undertaking any large amount of surface treatment work.

The experimental surface treatment work carried out in South Carolina during the past three years serves as an apt illustration. The condition existing there necessitated careful preliminary study to develop methods not only for treating the well bonded top soil, but also the poorly bonded as well as the loose fine sand-clay roads near the Atlantic Coast.

Of the three distinct types of treatments used in these experiments, the double surface and the mixed-in-place treatments will be briefly described here.

THE DOUBLE SURFACE TREATMENT

The double surface treatment consisted essentially of building a bituminous carpet over and in bond with the top-soil road surface. In preparing this mat the top-soil surface was swept clean of all loose material, after which a prime coat of light tar or cut-back asphalt was applied at the rate of about $\frac{1}{4}$ gallon per square yard. This application was left to penetrate and set up for a day or two during which

¹ Light Asphaltic Oil Road Surfaces, by C. L. McKesson and W. N. Frickstad, Public Roads, Sept. 1927

time any breaks or depressions occurring in the surface were repaired by filling with loose stone or, in certain cases, with bituminous cold-patch mix. A heavy tar or asphalt was next applied hot at the rate of about $\frac{1}{3}$ gallon per square yard and immediately covered with about 50 pounds of crushed stone per square yard. The surface was then rolled with a 5 ton roller and the road immediately opened to traffic. For a period of two or three weeks, while compaction of the surface was taking place, stone thrown to the sides by traffic was collected and respread in places where bleeding and picking up indicated a deficiency of covering.

Surface treatments of this type have been in service since 1924 and are proving highly satisfactory on well bonded top-soil roads.

Records kept on the older treatments since construction in 1924 and 1925 show lower maintenance costs than on untreated top-soil roads carrying the same amount of traffic, thus indicating the economic value of this treatment on the well bonded top-soil roads particularly when they carry considerable traffic.

A supplementary treatment which will seal and enrich any small breaks or areas not sufficiently covered by the first treatment has been shown to be desirable after the original construction. The question of how often such retreatments will be required for this type of work has not been determined but will depend to some extent on the traffic and climatic conditions. South Carolina has several miles of this type of surface which have been in service for three years and which have received only the original retreatment. However, it is possible that retreatments as often as every other year may prove economical in keeping the patrol maintenance cost at a minimum.

The extent of the benefit to be derived from this type of treatment depends almost as much upon correct maintenance as upon the original construction. Careful attention should therefore be given to the details involved in the later maintenance treatments and repair.

MIXING TREATMENTS

The object of the mixing treatment was to stabilize the road surfaces lacking in bond, either as a base for surface treatment or as a wearing course suitable for machine maintenance, by incorporating a bituminous material as a binder.

The general procedure was to scarify and pulverize the road surface to a sufficient depth, after which the bituminous material was added in several applications. After each application, a small amount

of discing was done which aided somewhat in the mixing but served primarily to prevent early loss of the lighter constituents particularly when using a quick drying oil.

Mixing was done most successfully with a grader. The procedure was to carry the material from one edge to the other until a uniform mix was secured.

At first it was thought that the mixture should be sufficiently rich in bitumen to seal itself under traffic, but this plan did not work out successfully in practise because of the shoving that developed. The indications are that better results will be obtained by making the mixture fairly lean and depending on an added application to enrich and seal the surface.

Numerous types of bituminous materials have been used in these treatments. Several grades of refined tar have been used as well as various types of slow and quick drying asphaltic oils.

The amount of bituminous materials necessary for binder depends on the grading and composition of the soil as well as on the type of bituminous material used. The actual quantity required for the different conditions ranged from 1.5 to 2.9 gallons per square yard for a two inch mix. Experience has shown that a deficiency in clay binder must be compensated for by added bituminous material. A relatively clean, very fine sandy soil requires a comparatively large amount of binder. When a highly volatile cut-back bituminous product is used in the mixture, an excess must be provided to compensate for the early loss of the fluxing material.

Although it is not possible at this time to draw definite conclusions regarding the economic value of this method of treatment on fine sand soils, indications at the present time are favorable.