enable the investigator to study effectively in the field the experiments completed or under way in many sections of the country

Thus far the following work has been done

- 1 Statistical material has been collected for determining the mileage of and expenditure on earth roads in the States
- 2 Through the kindness of the Chief Bibliographei of the Library of Congress, and with the aid of the U S Bureau of Public Roads, a bibliography on earth roads and earth road treatments has been prepared
- 3. A search has been made in the Patent Office of all patents granted on earth road treatments of which about a hundred have been assembled
- 4. Information has been gathered of research on earth roads now under way in various States and by universities
- 5 Through the State contact men of the Highway Research Board information has been secured as to methods of earth road treatment now in use in the States
- 6 By correspondence and conferences interest in the earth road problem has been aroused among highway engineers and researchers
- 7 By radio talks and by articles in the press, the attention of the public has been called to the importance of the present investigation

I desire to express to the State highway departments and to the universities my appreciation for their cooperation in the study thus far Not only have they shown a readiness to supply all information they possess, but they have expressed a desire to be informed as to how they might contribute by research toward the success of this investigation. With such united effort the solution to this important problem can not be far distant

We would appreciate your suggestions and any information you may have concerned with this study

DISCUSSION OF PROGRESS REPORT OF INVESTI-GATION ON DEVELOPMENT OF EARTH ROADS

Led by W B CATCHINGS

North Carolina Highway Commission, Raleigh, North Carolina

It gives me great deal of pleasure to have this opportunity of bringing up for your consideration the methods of treating soil roads we are using in North Carolina This includes sand clay, top soil, shale, chert, marl, spar, etc By this method we get results in appearance very closely resembling sheet or sand asphalt, with practically no failures This season we will complete approximately 400 miles

Before attempting to treat a road, it is absolutely necessary to put the road bed and surface in condition to withstand the traffic it is The finished surface will ride no smoother nor will expected to carry it carry any heavier vehicles than the base provides, this means that we should take every precaution in strengthening the base and use all possible care in putting the surface in as smooth a condition as is possible The entire road should be gone over, repairing all weak places with good Skin patching alone is not sufficient, as nine times out soil or gravel of ten the patch does not bond with the base and will later scale under traffic, causing a failure in the surface All curves from 900 feet down should be banked, and all material required to give the necessary depth for strength and to overcome faulty sections should be hauled in and placed where needed After the base is patched, reinforced, and built up, and the curves banked, the entire surface should be scarified. machined, and kept dragged, retaining a crown on tangents from onefourth to one-half inch per foot until the base is thoroughly compacted Dragging from side to side rather than to the center, is under traffic A sectional drag that will follow the contour of the recommended surface is also advised, rather than one that cuts the quarters only This preparation is best accomplished in the spring of the year

We stockpile most of our sand in piles one-half to one mile apart during the winter so as not to be delayed during the construction season This sand is hauled out and piled along the side of the road and cut back in a windrow ahead of the distributing outfit The cutting back in a windrow allows the sand to dry quickly and places it in a convenient place for spreading

Prior to applying the prime coat, all loose material is removed from the road surface, first by road machining and then brooming with a rotary street sweeper A specially prepared tar is then applied at the rate of three or four tenths of a gallon per square yard and covered with sand at the rate of 12 to 15 pounds per square yard After about six hours this surface is dragged with a sectional broom drag made of steel bristle push brooms This distributes the sand uniformly, which is necessary to get a smooth surface The prime or first coat is allowed to set up under traffic from five to ten days in order to allow the volatile oils to evaporate and to get the full colloidal effect of the tar

All loose sand is then swept to the side and four to five tenths of a gallon of specially prepared asphalt is applied and covered with 30 to 35 pounds of sand per square yard and broom dragged after four or five hours Broom dragging and touching up with sand is carried on until the asphalt is set up and will take no more sand

During 1924 and 1925 we tried asphaltic oils ranging from 45 to 65

per cent 100 penetration, some straight penetration asphalts and several ars with varying results from which we arrived at our present materialst and methods.

G F Schlesinger, Ohio State Highway Department, in discussing the report, called attention to the need of an organization to educate local officials, such as township supervisors and county commissioners, who have charge of secondary roads, in the proper methods to follow in their construction and maintenance

S H Webster, Rhode Island State College, stated that in Rhode Island there was organized a few years ago a higher association which recognizes as its fundamental duty the education of township highway commissioners and the people in general in good methods of road construction and maintenance. Mr. Webster also pointed out that in view of the great mileage of local roads we must look to gravel as a cheap means for surfacing them, and called attention to the advisability of treating gravel roads with a yearly or seasonal application of bituminous material. He stated that this method has been followed by many towns in Rhode Island and that after several years' application it is difficult to distinguish these gravel roads from the old bituminous macadam roads

P M. Tebbs, Pennsylvania State Highway Department, stated that the Legislature of Pennsylvania has authorized the State highway department to establish within its organization a department of township highways, which acts in an advisory capacity to township officials. In addition to standardizing methods, issuing bulletins and preparing plans for roads and bridges when requested, annual meetings are held at which local officials are instructed in highway matters. In each district office of the State highway department there is at least one, and sometimes two men, assigned to township work.

T H MacDonald, U S Bureau of Public Roads, in discussing the report pointed out that the matter of the development of earth roads is not a simple problem, but rather one of the most complicated that highway research workers have yet attacked.

Chairman Mehren. We shall next hear the Progress Report on the Culvert Investigation