V SPECIAL FEATURES

In two states the erosion of the berms, and in one of these states the excessive wear of berms, is reduced by use of elevated shoulders, and in the one state by a raised curb integral with the pavement, on heavy grades

The general practice, however, is to accept erosion and wear of berm as incidental to the usual slope of berm and as necessarily incidental to the principle of shedding water from the pavement to provide a dry wheel way and to facilitate maintenance operations, especially snow removal (Pennsylvania's practice is to use paved gutter or riprap where excessive erosion would, otherwise, be anticipated.)

DISCUSSION

REPORT OF COMMITTEE ON MAINTENANCE

C P Owens
Missouri State Highway Commission

The short notice of my assignment allowed me only a very brief time in which to study the committee's report and to prepare a discussion worthy of this meeting Having not had the opportunity for careful study, nor the benefits of prior association with the Highway Research Board; it will be necessary to state that my remarks are from my personal observation and experience, rather than from any extensive or intensive investigation and research.

I find very little in the report that might be criticized, rather, the report contains several points which should be emphasized Other portions of the report might be expanded

GENERAL

Mr Root's statement that of the one hundred seventy-two questionnaires sent out, only 40 were returned, is discouraging It appears as if some drastic steps should be taken to awaken the various states, Highway Departments and other organizations to the importance of this work More interest should be aroused and the various individuals who should be interested, be made to see the importance of the work and to cooperate more fully with the members of the committee.

The committee has divided its report into 5 topics as a matter of convenience I will follow the same outline in my discussion

GRAVEL MAINTENANCE—SURFACE TREATMENTS

Due to the fast growing demand for more roads and the limited funds with which to meet that demand, the problem of surface treating low cost roads, at low cost, to obtain a smooth dustless semi rigid pavement capable of carrying fairly heavy traffic is a problem well worth intensive and exhaustive research

1 The Skin Method Our experience in Missouri with the skin method of surface treatment as outlined in the report, has been limited to a short project treated in the summer of 1925. This treatment cost about $1800 per mile and after passing through two of the severest winters on roads on record in our state, the surface can still be reported as being in fair condition. Some patching has been necessary each spring Next spring we contemplate another treatment of a higher type.

2 Mulch Method From actual experience I cannot discuss this method of surface treatment as outlined in the report However, I have inspected completed roads of this type in Wisconsin, Minnesota, Indiana, and Ohio and can report that these roads had every appearance of being successful considering the service being rendered to traffic, the cost of the road, etc

3. Retread Method This year in Missouri we have experimented to considerable extent with the retread method of treating gravel and stone We built a section 12½ miles in length. A portion of the section, 10½ miles in length, has a base of traffic-bound stone and gravel The remaining portion, 2 miles in length, has a base of penetration macadam which was very rough and wavy We used as many different kinds of aggregates and bituminous materials as could be conveniently obtained. One section was built of 1½—¾-inch stone, another of 2½—1-inch stone, and another of 2—1-inch crushed flint. We used both tar and cut-back asphalt on each section We used various methods of application and various amounts of bitumen. In connection with this work we also constructed short sections of rock asphalt, ameisite and pavona We took numerous pictures of the work, and marked the sections in the field We propose to continue with notes of observation and with the taking of pictures from time to time These data were not complete nor available for Mr Root's report nor for Mr. Connor's report. However, these data will be completed in the near future and ready for distribution to those interested.

BRIDGE MAINTENANCE

I do not entirely agree with the statement made in the report that bridges, even concrete bridges, should be allowed to serve for a relatively long period without proper maintenance. It is agreed that bridges do stand for a long time without maintenance, but it is not real economy to allow them to do so The need for systematic inspection by competent inspectors, followed up by inspections after repairs are made, cannot be too greatly emphasized.

The committee reports that a careful check of all bridges affected after every serious flood is advisable. It might be well to add that it is even advisable to make checks during the flood. Many bridges owe their present life to work done during periods of high water.

It is true that concrete superstructures do not require a great amount of maintenance However, it is well to make annual inspections, to keep cracks closed, expansion joints free, and bearing plates clean, etc. Also, it is well to check bridge-approach slabs and watch for crowding, especially in hilly sections, where pavements have a tendency to move down grade

The report states that concrete in many of the early bridges is of inferior quality, and no proper provision for expansion is made, and that there is no remedy for this except reconstruction I am inclined to question the latter portion of this statement and to ask if there are not many cases where remedy is to be had

The committee has pointed out the desirability of designing steel bridges with thought being given to future maintenance The design of steel superstructures should be simple, open and accessible From a maintenance standpoint, these features cannot be given too much importance, and are here mentioned for the purpose of greater emphasis.

I think it well to emphasize the suggestion that the study of the results obtained by the use of bituminous materials applied in various styles to bridge floors, should be a promising field for research, especially for bridges with wooden floors.

In the concluding paragraph of the report on bridge maintenance, several important items are mentioned which I believe are stated in their relative order of importance, I am calling these to your attention for the purpose of emphasis and for giving them my approval

In regard to the matter of cleaning and repainting steel structures, I believe there is a field for further research in order to develop the most economical and satisfactory ways of cleaning and painting.

Maintenance of Berms. I feel it important to add that it is very desirable to plant low-growing grasses which form heavy sods, yet which are not objectionable to the property adjoining the highway A great amount of favorable publicity can be created for the various highway departments if they will work in close cooperation with their State Departments of Agriculture with respect to choice and selection of grass seed. I concur in the committee's report as to the desirability of sodding the berms and slopes, especially through rural sections.

Where pavements are narrow or traffic is heavy, it is often impossible to keep sod growing. Under such conditions it is necessary to cover the shoulder or berm with stone or gravel Under such conditions I believe it will be found quite desirable to bind this material in place by use of bitumen The proper maintenance of the berm, particularly adjacent to the edge of the pavement, is important as a safety measure

In many sections of the country, where topography is rough or rolling and the soils are easily eroded, the question of preventing excessive erosion of the side ditches is a serious problem It appears that this question might offer an interesting field for research

REPORT ON CULVERT INVESTIGATION

R W Crum
Iowa Highway Commission

Further consideration has been given to the possibility of outlining a method of rating small drainage structures for use in arriving at the economic values of various types A small additional amount of field work has been done, for the purpose of comparing various suggested rating schemes, and as a basis for discussion of the various factors involved

The principal conclusions at this stage of the investigation are as follows:

1 In order to assign a numerical rating to a structure, which in connection with the age will indicate the probable future life, there must be evidence of continuous progressive deterioration
2 Small drainage structures are divided into two general types which must be separately considered These are flexible type and rigid type culverts.