

## FOURTH SESSION

FRIDAY, DECEMBER 3, 1926, AT 2:00 P. M.

A J BROSSÉAU

*Mack Trucks, Inc, New York, N Y*

CHAIRMAN BROSSÉAU We shall first hear the progress report on the Culvert Investigation

## PROGRESS REPORT ON CULVERT INVESTIGATION

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It is to be regretted, in view of the apparently great interest in this particular subject, that the progress of this Committee's work has not been more extensive this year. However, there has been and is going on a considerable amount of research work along the line of culverts which apparently will culminate soon, and by the time another year rolls around we will have an opportunity to review the very valuable data that will be published. The scope of this particular investigation so far as the Research Board is concerned is quite broad and aims to lead ultimately, if possible, to disseminating information about methods of design and construction for all kinds of small drainage structures.

The first objective of the field investigation has been to determine methods for arriving at the economic value of various types of small drainage structures and I find that that is a considerably bigger assignment than it sounds. The conditions surrounding these small drainage structures are so complicated, that arriving at the economic value in any one installation, is a pretty complicated affair. What we want to do as a result of this work is to examine the culverts in the field and be able to predict somewhere within reason how long they are going to last, and to be able to figure within reason what the annual cost is of keeping a culvert of that type in service in that particular place.

The preliminary work of this investigation, most of which was done last year, consisted in the examination of a number of structures in a number of different States. Some 14 States were visited and examinations made of some 500 culverts. Certain facts of age and installation were known and examined, and a record made

Many others were examined concerning which definite information was not available.

From this work we received some rather definite impressions which have more or less controlled our thinking to this point. One thing that impressed us in this work is the fact that small drainage structures are generally more or less of an orphan in the design and construction of even our improved highways and not very much attention has been paid to the design of these structures or to their construction. We believe that the importance of these structures is great enough that they ought to receive as careful design and construction as any other part of the highway.

Our examination led us to believe that all of the types in use at the present time have their proper place in the scheme of things, that is, there are conditions suitable for the use of any of the types we have examined at the present time. It remains, of course, to evaluate the conditions which are most suitable for the different types of culverts.

The first objective of the investigation was to be some method of putting a rating upon these small drainage structures, for use in determining economic value. An impression that we received was that in general the condition of a culvert was due primarily to some one force or agency, although there could be and were often contributing features which would affect the future life. The proposed tentative method of rating was based largely on our impression that the condition of the culvert was primarily due to some one force. With that in mind we have drawn up and suggested a rating method to use as a starting point for the future work of the investigation.

We divide these culverts into four stages more or less distinct. The first stage is that in which the culvert has actually failed. We still find them where their actual usefulness is gone, but still in existence.

There is another condition which is not so easy to define, which for want of a better term we will call technical failure. In this case the culvert is still in existence and functioning but in such a state that there would be no assurance of continued life, and such that the first freshet might take it out altogether.

The next class is the one from which most information can be obtained. It is the case in which a culvert is showing signs of deterioration but still has considerable use ahead of it. It is in the examination of such structures as these that we believe the most information as to progressive deterioration is to be gained.

The last class is to be those that are apparently unaffected. Very little information is to be gained from such a culvert.

I spoke of one particular factor being in general responsible for a culvert's condition. For instance, in the case of rigid material such as concrete and clay, generally the load upon the culvert structure is responsible for the defects. In the case of the metal culverts the ultimate failure seems to be quite often through corrosion and in some cases through erosion.

There are, of course, contributing factors which should be evaluated to establish a numerical rating for such a structure, such as the effects of external conditions or secondary forces. The condition of the headwalls, if any, on a culvert, the grade line, the joints in sectional culverts, whether or not the flow through the culvert is intermittent, constant or occasional—all those things affect it.

A rating scheme method for putting a numerical rating upon a structure has been devised and can be secured from the office of the Highway Research Board. The details of such a thing are largely a matter of opinion and I can see a large amount of work ahead of the Committee before they are finally thrashed out until they are satisfactory to the people most interested.

But now of what use is such a rating? After we secure it there is also something of a problem. The object in wanting a rating which in per cent will tell us something about the condition of the structure is two-fold. In the first place in examining the structure in the field it will be of great help in determining the value of the culvert to have some method of assigning a rating to it. This rating is stated as a percentage, that is, a rating of 90 would mean, in the judgment of the investigator, that the culvert was 90 per cent intact.

Another object in wanting this rating is to make a record for future use so that it would be of value in reminding anyone examining the data that it was the examiner's opinion of the value of that culvert at the time the examination was made.

We want to use this information ultimately to predict the future life of the culvert. We do not feel that we have enough information in the possession of this Committee to do this at this time. We may know that a structure is 10 years old and we may decide that it has 80 per cent of its value left. However, this does not necessarily mean that it is going to last 40 years longer. The rate of deterioration may accelerate as the culvert approaches its end, or conditions may be such that it will decelerate. This is one of the things that will have to be checked—by the examination of a very large number of examples. Of course, in arriving at the economic value of a given structure other things enter besides the life of a structure, and in comparing types and examples of the same type

the annual cost of keeping that structure in good condition is really the criterion as whether that particular structure should be used or whether some type that might be maintained at a lower cost should be used. This would involve the first cost, maintenance of the structure during its life, and cost of rebuilding at some future date.

A number of States have been making extensive examinations of their small drainage structures and we think the next phase of this work that is indicated is to go very thoroughly into the work done in these various States in order to verify our proposed rating methods, or modify or change them in view of their experience. The work that has been done ranges from Maine to California, so by taking the time to go over it thoroughly and carefully the Committee should be able to arrive at some comprehensive facts.