MAINTENANCE AND PAINTING OF HIGHWAY BRIDGES*

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No maintenance of bridges will be as effective as maintenance applied regularly each year and the necessary repairs determined by periodical inspection of the structures. Every structure, concrete, steel, wood or pipe, should be inspected at least once every year and a detailed report made upon its condition. More frequent inspections should be made of structures in a bad state of repair, while small culverts should be inspected after every hard rain. By such a system repairs can be made where and when needed. The cost of repairs will not be allowed to accumulate nor will the structure be allowed to suffer from the lack of repairs.

Classification of Structures According to Conditions

I will explain what I should do with the funds you may have available were I county road engineer in your county, and will try to suggest something helpful which may be done by everyone and which must be done if existing structures are to be preserved in suitable condition for traffic.

First—A complete inspection would be made as heretofore suggested and a complete report made of every existing structure within the county.

Second—The structures would then be subdivided into three classes: (A) Structures needing no repair or maintenance; (B) structures which must be rebuilt immediately; (C) structures which may be repaired or strengthened.

Third—The classes noted under (B) and (C) would again be subdivided, the class noted under (B) under three subheads as follows:—

1. Structures which must be permanently renewed, both the substructures and superstructures.
2. Structures in which the substructure only shall be renewed permanently and a temporary superstructure built thereon.
3. Structures in which the substructures are serviceable and require a permanent superstructure.

The bridges noted under (C) would be subdivided as follows:—

1. Bridges requiring strengthening to trusses and floor systems.
2. Bridges requiring no strengthening but new floors.
3. Bridges requiring only painting.
4. Bridges requiring partial painting and repairs to floor.
5. Bridges requiring complete repainting and new floors.
6. Bridges requiring repairs to the substructure.

Would Show Many Things

What would be the value of such a complex system of dividing and subdividing? There are many things it would show quickly. First, it would give a complete list of structures in your county with a classification which would allow the only correct distribution of the bridge fund. Second, it would show your court what was necessary on every bridge in the county during the coming year. Third, it would quickly afford a basis for estimating the money necessary for this maintenance and construction during the year and would be in such a form that it would appeal to every business man in the county because he would know you had investigated conditions. Fourth, it would emphasize the want of funds for this work. Fifth, it would outline this work for your men in advance for the year in every district and eliminate bringing the forces back and forth as these conditions were discovered or reported.

Having completed the report and an estimate of the cost of the work, it should be published in every newspaper within the county with a statement of the funds available and your policy for expending such funds in each district. Everyone would then see that the money had been allotted where needed. This is the only reason for a common pool of the county's funds in the county treasury, and the only equitable way of spending money raised by taxation.

Strengthening and Repairing Old Bridges

Only class (C) structures will be discussed under maintenance. These are bridges which are to be strengthened, painted, refloored, or upon which work is required on the substructure. This work through necessity must be handled both by force account and by contract, and it is well that we consider the most important features of such work—namely, strengthening old bridges, reflooring and repainting.

The old wooden trusses if too light for modern traffic do not offer much opportunity for strengthening at an economical cost. These trusses should be temporarily repaired and their floor systems brought up to the maximum capacities of the trusses. These bridges should be posted with signs warning the travelling public against overloading. The maximum allowable load should be clearly stated on the sign. It is possible that the floor systems can be increased by increasing the number of the floor beams and stringers, or else by increasing the size of floor beams and stringers. This can be economically done at a time when the floor has been removed for stringer repair or reflooring.

Many of the light steel truss bridges can be strengthened by changing the sizes of floor beams and increasing the number of stringers so that they may be made to carry safely double or perhaps three times the present wagon or truck loading. It may be necessary to make changes in connections and in certain web members to increase the capacity, but it can be done far cheaper than rebuilding in many cases. It is far cheaper to spend a few dollars in strengthening than to allow structures to be daily overloaded and their cost of maintenance to soar. There is a certain bridge I have in mind in which it is impossible to keep the floor nailed down in place, due to the fact that the stringers and floor beams deflect so great under the heavy loads that they pull the nails.

There is a suggestion, too, with regard to strengthening bridges which may be accomplished with little additional expenditure. It is more important to be able to get your loads over a structure than it is to save time getting them over. It is possible in some cases to reduce both the dead load on a structure and to confine the moving load to the centre of the bridge and thus carry over with safety greater loads. This can be accomplished by reducing the width of travel way of the bridge. The proper fences and guard rails must be installed to prevent accident or traffic from using the remainder of the structure.

Bridge Floors

The day when bridge floors 2½ ins. to 3 ins. thickness can be economically used for modern traffic has passed. For heavy traffic the maximum span for 4-in. flooring should be about 27 ins. This span can be somewhat increased for loads of 10 tons or less, or 3-in. floor used when the spacing of stringers does not exceed 24 ins. Investigation of your bridge floors will show that few of them remain long enough for decay to destroy, but instead traffic wears them out. In replacing wooden floors, if the span is not strong enough and cannot be economically strengthened to carry a better type of floor, it is to be recommended that a 2-in. x 4-in. wooden floor be used, the lumber being laid on edge and all contact surfaces thoroughly swabbed with hot tar and cambered to shed water. This type of floor has been extensively employed on new structures and is giving complete satisfaction. I have just recently had occasion to inspect such a floor which had been down for a period of nearly 6 years and it showed no signs of decay or wear, yet it was subjected daily to a large volume of heavy traffic, both horse and motor drawn. The cost of this type of floor is about 50 cents per square foot of floor surface. In laying this type of floor on old truss bridges whose stringers in the end panels merely rest on the concrete or masonry, it will be necessary to anchor at least the outside stringers to the masonry or else the floor will lift these stringers. About one barrel of tar is required for every 30 ft. of length if the bridge has a 16-ft. roadway.

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