CONSTRUCTION AND MAINTENANCE OF SMALL BRIDGES AND CULVERTS.

By W. J. Titus,
Bridge Engineer, Indiana State Highway Commission.

Section No. 16 of the Indiana State Highway Commission law states that “all drains, culverts and bridges shall be considered as a part of a State highway.” By including this section in its statutes, Indiana has taken a step forward in the effort to secure 100% efficient highways. In some states, the building and repair of bridges have not been the duty of the State Highway Commission until it is proposed to hard-surface the roads on which they are located, while in some other states, the bridges are not at any time under supervision of the State.

Most states are realizing the folly of a haphazard method of building and maintaining their bridges, especially those on the State highway systems, as it is evident that it is a great waste to spend huge sums on the highways and allow the bridges to shift for themselves. No highway is stronger than its weakest bridge. A secondary highway will carry an occasional heavy truck load without serious damage to the roadway surface, but a single heavy truck load may totally destroy a weak bridge, with great financial loss and sometimes loss of life.

Because they are the most permanent feature of modern highway construction with the possible exception of location and grade work, small bridges and culverts should be built for permanence and to withstand heavy truck usage of modern overland transportation. Bridges and culverts should be designed to stand 20 ton traffic because the truck business is general in Indiana, and for the second reason that many important county roads are designed later to be added to the state road system. Bridges and culverts properly constructed on country roads will not have to be strengthened, widened or rebuilt to handle the augmented traffic of state roads when they become a part of the state system, for they will be of identical utility of state built structures.

One of the big problems of state road construction is the thousands of small and weakly constructed bridges that are hazardous to increased traffic. Many were designed when roads were single track affairs, again many have foundations too weak for support of modern traffic. Under no condition should new bridges be less than 18 to 20 feet wide, and able to support 20 ton traffic. If this plan is adopted it means a great saving to taxpayers, for when roads with these modern bridges become a
part of the state system the bridge problem is solved. And after all the people pay for the improvement whether the state, county or township builds it. Many counties now co-operate with the commission and ask approval of their bridge plans when building on roads it is reasonable to expect will some day be a part of the state system.

Foundations are most important in bridge construction. The difficulty of today is that many smaller county bridges have foundations resting on sand or on stream beds. When there is a question of doubt foundations should always be on piling. The day of the tread board or “half sole” floor on bridges is past. Because motorized traffic can not keep on this track and is shunted to either side, the side walls of many bridges are destroyed. In building or repairing bridge floors, make the surface uniform.

Rigid inspection should be enforced when bridges go up. With few exceptions contractors would rather build properly than improperly, but the mistake of weak bridges, especially foundations, is largely due to faulty engineering. Often 35 to 40 percent of the bridge cost is beneath the water, so should be of the best construction.

Abutments for steel bridges have, during the past two years, been designed so as to afford the easiest possible access to the steel castings or shoes which support the trusses. This permits careful driving of the rivets in the ends of the trusses; the accurate setting of masonry plates, castings and anchor bolts and does not leave a closed-in space around the ends of trusses where dirt, leaves and other debris are sure to collect and retain moisture that soon induces rust to the extent of seriously reducing the strength of the steel trusses. With this design of abutment and bridge seat, the truss shoes and end posts are easily kept clean and properly painted. Our maintenance patrol forces are instructed to be on the look-out for danger from this source and regular inspections are made each spring and fall.

Our old steel bridges were mostly built more than twenty years ago and were designed for very light loads, as compared to the modern heavy truck loads. Where these old bridges show, upon investigation and analysis, that they will have a probable life of ten or fifteen years, it has been our policy to repair the steel work and to replace the floors with new ones of creosoted wood blocks, supported upon heavy creosoted planking. Floors of this type, if carefully treated with pure creosote oil, make a very satisfactory permanent floor without adding much dead weight to be supported by the old steel trusses and floor systems.