

who is without authority to advise others than state officials. This private opinion was not for publication.

Therefore, I believe that after you have sold your commissioners on the merits and economy of the project and they have supplemented the highway equipment with a suitable machine of the type described above, you are ready to secure consent of landowners involved and proceed with the cleaning and straightening of waterways at all bridges and culverts in the county. Then we will have many less failures of these old landmarks.

## CLEANING AND STRAIGHTENING WATERWAYS AT BRIDGES AND CULVERTS

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At many places in my county, and perhaps in the majority of the counties of the state, much money could be saved by straightening the waterways at bridges and culverts.

When I was serving as county surveyor in 1913, we had the greatest flood in March of that year that my county has ever experienced, 67 bridges having been destroyed or seriously damaged.

In making the preliminary surveys of these sites preparatory to making plans and specifications for the replacement or repair of these bridges, I was convinced that, in more than half the failures, had channel corrections been made before the flood, many of the bridges would probably not have collapsed.

Later, as a bridge contractor, I had experience in straightening several channels as part of the bridge contracts, sometimes cutting a new channel for a distance of 300 or 400 feet both above and below the bridge.

We have always thought that the cost of making these changes represented money well spent and have since included provisions for such straightening, when needed, in bridge specifications.

We lost a 50-foot span steel bridge two years ago in the flood which occurred during the Road School, which loss was due almost entirely to the channel change which had taken place over a period of years since the bridge was constructed, and which caused the water, by cutting under one abutment and wing wall, to let the abutment down and to throw the steel superstructure into the stream.

It was replaced with a new structure at a cost of \$3,700, but the old structure could have been saved and would have served for an indefinite period had \$200 been expended in cutting a new channel for a distance of 150 or 200 feet.

In many instances, a smaller structure, properly constructed as to depth of footings, skew, etc., and with the channel properly cleaned and straightened, will serve the location better than a much larger structure with a channel that is crooked, or filled with sand bars or islands, and in which the water strikes the road grade or wingwalls first, and then meanders to the bridge opening.

It is fully as important to clean and straighten the channel below the structure, if needed, as it is above, because it is useless to carry the water to the bridge opening unless provision is made to carry it on down stream away from the structure and the road grade.

I have noticed, in driving over my county, and also in other counties, that many culverts do not serve the purpose intended, because it is almost impossible for the water to enter them, and if it does eventually enter, it can not drain away below.

Many of the small bridges and culverts could be greatly benefited by handwork on the channels, and a crew of men could be employed for some time in doing this work. Their work would be valuable, not only in providing better drainage of road grades, but no doubt in saving many small structures from destruction in flood times.

Many of these small bridges were constructed 30 or 40 years ago. The construction was not of the best, in many cases, very crude. But there are hundreds of them in our county, as well as in many of the counties of the state, and it would require many thousands of dollars to replace them all with modern structures.

If these structures can be made to serve another 10 or 20 years by an expenditure of \$25 to \$50 in channel work, it should be considered a good investment.

The larger channels call for dredge work, and it is surprising the amount of this kind of work that can be accomplished at a bridge site for the expenditure of a few hundred dollars.

## A PROGRAM OF EARTH ROAD IMPROVEMENT

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In discussing this subject, it might be well to review briefly the cause for my county's suddenly finding itself the owner of a large number of unimproved earth roads. Exclusive of state highways, we have approximately 900 miles of roads in Ripley County. Prior to 1932, some 400 miles of these roads constituted the county system, all of which were surfaced with crushed stone.