mostly on underpinning old bridge abutments and wing walls. He has a crew of eight hand-picked and experienced bridge men. The county pays him as foreman, the only WPA foreman paid by the county. This man carries a concrete mixer, mounted on automobile wheels, three 18-inch jacks, one 1-ton hydraulic jack, pumps, and many other tools necessary in bridge construction. They go to work all over the county in an old pick-up truck. They haul some material, but a county truck hauls for them when necessary. Our surveyor helps to make plans for almost all culverts and bridges. The foreman keeps a complete record on cost of material and labor on bridge jobs. The results are quite satisfactory.

We buy our bridge lumber at the mill; but usually when we have a bridge floor to lay, we have the lumber delivered. We pay $2.50 for red oak and $3.00 for white oak at the mill. Delivered, the prices are $2.75 and $3.25. We have various stations over the county where we keep an extra supply of lumber on hand.

CLEANING AND STRAIGHTENING WATERWAYS AT BRIDGES AND CULVERTS

Arthur Buerkle,
Tippecanoe County Surveyor,
Lafayette, Indiana

I am sure most of you will agree that, from an engineering standpoint, it is the duty of the highway maintenance forces to keep all drainage structures clear of debris, sandbars, and other obstructions which tend to reduce the waterways in time of heavy rains and floods. You will also agree that a long, straight channel will be less damaging to the structure through or under which the flood must pass.

Tippecanoe County is 24 miles long and 21 miles wide and has 850 miles of county roads. We have about 38 miles of rivers, the Wabash running diagonally across the county and the Tippecanoe traversing the upper northeast portion. There are eight large creeks, the Wildcat with three forks, the Wea with two branches, and Burnetts, Indian, Lauramie, Flint, Moots, and Sugar creeks. There are some 500 miles of court ditches in this county, including 200 miles of open ditches, besides numerous small ravines which carry considerable water in wet seasons and must have drainage structures of some type at all road crossings.

These conditions are probably quite similar to those in most of the 92 counties. The exact number of drainage structures was unknown in most counties until the Statewide Highway Planning Survey was completed. Our county was listed with 50 to 60 structures having spans of 50 feet or over and 125 or more spans of 20 to 50 feet in length, in addition to the many

corrugated metal, concrete, and other types of pipe and box culverts. This represents an investment that all officials responsible for highways, as well as all public-spirited citizens, should be interested in protecting.

SOME TYPICAL EXAMPLES

During my tenure of office, Tippecanoe County has lost two old iron-span structures of 100-foot and 116-foot lengths because of clogged channel conditions. True, they were old spans and not suited for modern traffic, either as to size or weight, having only 14-foot roadways with four and five-ton limits; but they were on secondary roads and would be standing today had the channels been kept open. The first failure occurred in the fall of 1936 when a heavy rainfall flooded Moots Creek. Directly above the structure the channel had shifted to the west, and a sand and gravel bar some 600 feet long and 60 to 75 feet wide, overgrown with numerous poplar trees some 12 to 15 inches in diameter, had developed in the old channel. Unable to get through the structure readily, the flood flow caused a washout behind the east abutment. Although warning signs were posted, a truck was driven through and dropped down into this washout with a load of cattle. A wrecker was called from Lafayette, who viewed the situation, then anchored his wrecker car to the west-end corner post of the structure, and proceeded to pull the bridge into the swollen stream.

Against my recommendations, a 16-foot roadway structure was built, using the old abutments after one had been encased with new concrete. The levee was protected with a series of piles. A total of $9,158.85 was spent on this project with the channel still clogged by the island directly in front of the structure opening!

The other serious washout occurred last July. One abutment of a bridge was washed out as a direct result of the approach's shifting some 50 or 60 feet over a number of years. If state highway specifications are necessary in the rebuilding of this 100-foot structure by use of the gasoline tax funds (all we have in our budget for this year), my estimate of the cost of replacement, after cutting the span to an 84-foot length, is $12,500. This possibly can be cut to between $10,000 and $11,000 if a roadway of 16 feet can be specified without state approval.

EQUIPMENT NEEDED

There are other structures in your counties, as well as in mine, which may go out the very next time "old man river" goes on a "bender." It would be money well spent to add a ⅜- or ½-yard dragline to the county highway equipment to use in remedying all of these clogged channels promptly. The cost of replacement in either of the above-mentioned cases

would pay for a new machine of this size. When not being used for this service, it could be used for other purposes, such as dipping and loading gravel, and digging and cleaning road ditches. It also may be used on clean-out work on some of the county court ditches, in which case the county would receive compensation as does a private contractor. The list price of a dragline with a 30-foot boom, 14-inch shoes, 63 H.P. engine, equipped with a ½-yard bucket, is $6,535. A special built, easy-loading trailer, meeting state highway specifications, equipped with eight 32″ by 6″, 10-ply tires, lists at $960. A ½-yard shovel attachment for a dragline complete costs $1,050. The ½-yard hoe attachment costs $850. This makes a total cost of $9,395, which, under competitive bidding, would likely be reduced. The gasoline consumption for such a machine having six cylinders with 3½″ bore and 4¾″ stroke for heavy duty is 3.7 gallons per hour, and the yardage output for an eight-hour day for dragline duty is 960 cubic yards, and for the shovel 500 cubic yards, estimated conservatively.

RIGHT TO ENTER

We have the right of entry onto the adjoining land wherever a court drain is involved, as indicated by Sections 39 and 58 of the 1933 Drainage Act. In the opinion of many attorneys, this does not apply to natural ditches, ravines, creeks, and rivers. It, therefore, becomes necessary for us to secure the consent of the adjoining landowners when contemplating the cleaning or straightening of waterways at structures. In most cases consent will be given readily. I believe it is a good practice to contact the landowners or tenants involved, even when making repairs on court ditches. When a landowner objects to this entry and the making of channel changes, if reasonable grounds can be shown for the necessity of such entry and channel changes to save the structure from damage or total loss, in the opinion of several of my local attorney friends, any court having jurisdiction would grant permission to enter at once.

It will be necessary to confine such changes to the natural bed of the stream involved. In the case of overflow on land below the structure due to these changes above, it will be necessary to remedy the conditions below so as to take care of the water properly. If the owner of the land below the structure refuses to allow you to make such changes, it is his funeral. By refusing you entry to remedy conditions, he would sacrifice his rights to damages.

I wrote the State Attorney General for an official opinion on this matter of entry into lands for needed channel changes, and a deputy, in his answer of January 3, 1939, stated that the opinion expressed therein was his private opinion and should not be considered as an official opinion of the attorney general,

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

Gil C. Winslow,
Hancock County Surveyor,
Greenfield, Indiana

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.