ground. Great care should be exercised at this season as much damage can be done in a single day.

Each assistant is furnished with one gravel truck and driver whose duty it is to deliver gravel anywhere in the district as directed by the assistant. By this arrangement gravel is being placed continuously on the roads and especially on the places that need it most. In addition to these district trucks, we have a fleet of 6 gravel trucks directly under the control of our county highway superintendent. These trucks are available in each of the 8 districts when extra repair work is needed. They also are used in hauling or removing dirt, making fills, and widening approaches to bridges. Possibly the most important and economical use of these trucks is in road construction. Recently in the reconstruction of one of our county roads, some of these trucks delivered 60 yards of gravel each in a single day.

Another essential for economical operation of the department is competent clerical assistance in the office. A daily check on the cost of operation of all the equipment of our county has revealed to us the following astonishing facts:
(a) We have lowered the repair bills of our garage by 300 per cent.
(b) We can deliver gravel on the road at an average cost of $1.04 per cubic yard.
(c) Our new equipment can be operated at least 50 per cent more cheaply than our old equipment.
(d) We are able to save 20 per cent on gasoline and oils.
(e) In the seven months we have been operating under our new system (June 1st to December 31, 1930) we have been able to save $26,309.43 from what we spent in the same time under our old plan. Therefore we believe that, in order to have a good, economical road program, it is necessary to have good equipment, a daily patrol system, and an accurate, comprehensive system of records.

EFFICIENT USE OF ROAD IMPROVEMENT FUNDS

By A. F. Becker, DuBois County Commissioner

When planning your county road budget, it is important to give much time to determining the amount of traffic passing over certain of your roads so that you may make the proper allotment of funds. It would be unwise to prorate your repair money on the basis of the sum of money paid into the county road repair fund by a certain township, and spend just that much money in that township, divided equally on each mile of road therein. There are too many people
holding this view and probably there are some county officials who are like-minded on this question. It is the unqualified duty of the commissioners and road superintendent to determine which of their respective county roads are of primary traffic importance and to classify them in order of public service. You should then have a very good basis on which to fix your budget allotment according to the amount of use or travel on the several classes as you have designated them on your county map. This plan may be contrary to the wishes of some taxpayers who are inclined to tell the road officials just where and how the money should be used. But you as an official are held responsible for the condition of all the improved roads in your county, and that alone puts the question right up to you to use your own good judgment as to where the most work shall be done and how the money shall be spent.

It is true that all property holders pay a proportional amount of taxes as based on the valuation of their land. They generally feel that the road along their property is the one road needing much repair and that the superintendent should give it more attention than he does. If we were guided by these views, we would have only main or primary roads in our counties and the state would also have but one class of roads. You can readily see that such a plan would not be satisfactory to the citizenship of the community. Some roads are of great importance in their use and location, usually linking together important community centers or greater trading points and of necessity requiring greater expenditures per mile to keep them in good condition.

The best equipment and the manner in which it should be used is very much a question of soil and the various metals used in road construction in your territory. To some extent there enters the question of the kind of men that are employed to handle your equipment. If they are men who take a personal pride in the work, you should not experience much disappointment in the results obtained with almost any kind of suitable or standard equipment. However, if the payment of political debts is the only basis used in selecting your employees, there will no doubt be much inefficiency and waste; and a disappointed taxpaying public will heap righteous condemnation upon your head, and I say justly so.

Another picture of poor supervision of public road funds is the case where some anxious petitioners find there is a certain sum of money available for construction of roads and immediately set out to have the commissioners order their particular road built—then it is found that the improvement made under well recognized standards will cost more than the amount of money available. When the interested petitioners learn of this situation, then there is generally a demand for a revision of the plans and specifications to cheapen
the road. If this demand is entertained and accepted, it results in an inferior road. In the end it only means more trouble and annoyance for the commissioners and road superintendent because it will not stand up under traffic as expected and will be a constant source of maintenance expense. The county as a whole will be called upon to finish building this road from the road repair fund; otherwise it will stand as a black mark against those responsible for its construction.

Experience teaches that it is well to have a fair and liberal estimate for contract work of any kind. This is the first step toward being fair and honest with the contracting party. Thereafter you can demand of the contractor that he perform according to plans and specifications, and you should not fear to enforce your demands that he live up to his contract. You have offered him a fair price in the estimate; and if he bids too low on the job that should be his headache, not yours.

Inspection

The enforcement of the provisions contained in the plans and specifications adopted requires the proper supervision by a fair and competent superintendent of construction. And right here is another fly in the ointment—how can a competent construction superintendent be secured at $2.00 a day? Did you ever see any such animals in your county? We have had some that took the $2.00 but I could not tell you how much they earned for the county. They were honest men in their intentions, but often sadly lacking the knowledge necessary for the work under their supervision. Our county engineer recognizes the laxity of the unfair law pertaining to pay for construction superintendents on roads and he takes it upon himself to make the necessary inspection on bridge construction and the grade on roadways before the metal is placed. We try to get a competent person to watch so that we get the required amount of metal on the road. The engineer also checks up on this item from time to time.

By the adoption of standard plans and specifications, with a fair and liberal estimate, you can expect fair competition in the number of bidders attracted. This in turn usually means a fair price for the job, with consequent good workmanship and the least possible delay in construction.

A fair and honest estimate of proposed work to be done, a fair and honest group of bidders, and a fair and honest engineer and superintendent on jobs to be done go a long way to make satisfied taxpayers. We should not take advantage of a contractor after having entered into a contract by requiring him to do more than his contract calls for. Instead of making it unpleasant for him if he should refuse our demands, we should be honest enough to admit our own
mistakes in approving plans and specifications which do not contain what we want after the work is in progress of construction. This policy also holds good in the event error is discovered in the plans after construction is under way.

I have no sympathy or respect for any officer who would wilfully take advantage of a contractor on a faulty plan, and the same is equally true of a contractor who does not subscribe to fair play in arriving at an adjustment of a defective plan that would allow him some undue advantage with a great loss to the taxpayer.

Another outstanding piece of neglect on the part of public officials involves their failure to clean and paint all steel bridges at regular intervals. These have been constructed in many instances at a great cost to the taxpayers and should not be neglected. This may not be true in many counties of the state, but I can say without fear of contradiction that such a condition exists in the counties surrounding DuBois. Our board members have been endeavoring for the last two years to encourage and stimulate our township trustees to clean and paint all bridges which the county has constructed for them. That has not been a very pleasant task. It seems to be the opinion of most trustees that the county must take care of all bridges built by the county for the townships. Of course you know that any expense over $100.00 on bridge building or repair must be borne by the county, but most structures can be repaired or painted for less than $100.00 if the work is done at the proper time. In all fairness to our trustees, with a few exceptions they have responded well to the demands of the board of commissioners in the program of keeping township bridge structures in repair and paint.

Concerning the "gap law" as it is commonly known, or the law which permits townships to grade and drain roadways and then have them taken over by the county for a metal surfacing, I want to give you my observation on this practice in a neighboring county of which I have been taking notice the last two years. Our county, so far, has not been called upon to take over any of the above-designated projects; so I had to go to a neighboring county for my observations. The information I gathered from the auditor was that the county in question had graveled some 12 or 14 miles of roadway this year. Most all of this mileage was on flat lands; consequently not much grading was required. There were no waterways which called for bridge construction. You can readily see that no great expense was encountered by the township in preparing the roadway; therefore a lot of mileage could be turned over for county upkeep and repair.

On first consideration this method appears attractive, but you cannot get something for nothing. The county has no funds available to be used for surfacing roads except the gasoline tax funds, which may be used for construction as well
as repair of highways. This fund derived from the state gas tax is used for the above-mentioned township road improvements, but I seriously doubt the economy of the practice and I seriously question whether the real intent of the law was to supersede the present laws providing ways and means to establish and improve roads in counties and townships. It may be reasonable and sensible to use some of the gas funds in certain cases, for instance, where there remains an open and unimproved gap in a road and the township has reached its bonded debt limit. But even so there remains the county unit law which can be applied in such cases. It is my opinion that it was the intention of the county unit law to provide for the use of county funds to construct roads connecting improved roads where the township funds are not available or in townships not having a great sum of taxable valuation.

I find that the mileage is increased in improving township roads with county funds but that this is done at the expense of the roads already built in the regular way which are entitled to the necessary repair and replacement of metals for which the repair fund was created. The gas tax is a part of the repair fund. It is very noticeable in the above-mentioned case that the other roads are suffering for lack of material and attention because of the depletion of funds caused by the county's using its repair money for placing metal on roads taken over from the township. How much benefit does a road receive from a layer of gravel or stone 1 1/2 to 2 inches in thickness when wet weather comes? This is the usual amount of metal which I observed on these roads.

SECURING LOWER CONSTRUCTION COSTS THROUGH THE MEDIUM OF COMPLETE, ACCURATE PLANS AND SPECIFICATIONS

By W. E. Morthland, Porter County Surveyor

Plans and specifications are an attempt on the part of the engineer to express his idea of proper construction. They are an attempt on his part to provide the construction he would do himself if, instead of being a designer, he were a builder turned loose to do the building and had no other consideration than the needs of the community and a regard for its ability to pay. It is the dream of some that this would be the ideal of municipal building but, sad to relate, many a good engineer might prove an extravagant builder. On the other hand if all designing was attempted by some worthy and reputable contractor, according to his ideas of good construction, we would find that many a good builder is a poor designer.