cost. Let me suggest the following slogan to the supporters of stage construction: “Build highways where needed in the measure needed.”

THE USE OF HEAVY EQUIPMENT IN COUNTY ROAD MAINTENANCE

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This topic is worthy of more serious discussion than it has had the good fortune to receive at previous Road Schools. To many people the word “construction” applies almost entirely to projects under the jurisdiction of the state highway commission, while they consider that county highway departments should concern themselves, for the main part, with maintenance work merely.

This idea would be practical, if the state highway commission could be prevailed upon to take over those roads which, by their importance to the traveling public, merit changes in location and type which cannot properly be made under the heading of maintenance. We have found, however, that in our locality the state prefers to take over those roads which, by their condition, require the least cost to make them a part of their secondary road system. This leaves us with the problem of maintaining those roads upon which the burden of ever-increasing traffic demands not only a better type of surface, but, in many cases, the elimination of steep grades, narrow fills, and sharp turns, or, in other words, practically the construction of a new road.

In the past four years, we have found a place in our budget for this type of work without materially crippling the work on our other roads, which consists principally of ditching and maintaining the road surface.

Franklin County lies at the southern edge of the east central section of the state, the county seat, Brookville, being some 40 miles south of the National Road. The east part of the county is level, the roads being laid out on the rectangular system, while the western and southern parts of the county are more or less hilly and typical of all southern Indiana counties.

Our maintenance material consists chiefly of bank and creek gravel. Our county road system comprises some 700 miles of road, and our budget totals approximately $80,000 per year, derived from the gasoline fund. Our maintenance equipment includes five dump trucks, ranging in size from 1 1/2- to 3 1/2-ton capacity, 1 five-ton Caterpillar, 1 five-ton Allis-Chalmers tractor, several maintainers, drags, and small grad-
ers. Our heavier equipment consists of a 60 Caterpillar, 2 12-foot Adams graders, and a 5/8-cu. yd. Universal shovel.

During the past four years we have constructed about 100 miles of new grade, built approximately 60 miles of blacktop surface, and at the same time kept the remainder of our road system well metaled and well dragged.

TYPICAL EXAMPLES

Of the new construction work, there are two projects in particular which prove the logic of my topic. One project, known as Trenton Hill, lies in the southeast section of our county. This section of road has been heavily traveled for a number of years, though still on a narrow steep grade with a creek following the lower course of the road. The length was approximately 3/4-mile. To widen the roadway necessitated the moving of about 15,000 cu. yds. of earth, the greater part of which was to be sidecast. At the time this project was undertaken, our equipment did not include a power shovel. We contracted, therefore, with the owner of one on an hourly rental basis of $4.50 for the use of a 1-yard shovel. This outfit worked approximately 6 weeks at a cost of $1,800 for the shovel work. The remainder of the equipment and labor was furnished by the county highway department. In addition to the widening of the right-of-way, we placed on the project one 48-inch corrugated culvert 60 feet long and several smaller pipes from 12 to 18 inches in diameter. Since then we have made it a practice to use corrugated iron culverts only when a culvert of less than 30 inches in diameter is required, and concrete boxes when the size goes beyond this. The result of this project was a clear roadway of 36 feet with an 18-foot metaled surface. Upon completion of the grade we first metaled the roadway with 6 inches of creek-run gravel, following it a few months later with a course of approximately 2 inches of screened gravel from 1-inch to sand. The complete cost of the project was $4,000.

Having gained the experience of this project, we were ready to tackle another more important and much larger job, that of the Brookville-Oldenburg Road, running west from Brookville, some 17 miles in length. It is the only direct route between the two towns, the next nearest route being about 10 miles longer. In 1926 the people of the Oldenburg Community persuaded the county commissioners to contract for and build four miles of waterbound macadam from Brookville west. The project was then dropped; but in 1933 we placed on this four-mile stretch, a two-inch tar, mixed-in-place surface. During the fall of the same year, we graded an additional four miles, and the following year surfaced it with a tar top. This brought us to that section of the road which had originally inspired the movement for a new high-
way. Here, the road followed a ravine down a long, winding hill, crossed a creek, and followed up a steep, crooked grade into the town of St. Mary's, which lies midway between Brookville and Oldenburg. This section of the road at no point was over 12 feet in width, and, for at least a half mile, would not permit two cars to pass. It was not possible to widen the road without going into a heavy construction project comprising heavy cuts and deep fills. A contract proposition was out of the question because of the limited funds in our county highway budget and because we had no recourse to a bond issue.

Our county engineer made an extensive survey of this section of the road; and, through the co-operation of the county commissioners, the county council, and me, a plan for the project was agreed upon. In addition to earth moving, this plan called for the building of a five-by-five foot box culvert and the installation of two 30-inch corrugated iron pipes and several smaller pipes. This new box culvert cost $400, including all labor, steel, cement, forms, and other materials. This culvert replaced one of the same size that had been built by contract a few years previous at a cost of $1,100. The earth moving figured 40,000 cubic yards for cuts, some to be used in making fills, and approximately 7,500 cubic yards of borrow. In estimating the cost of earthwork, we decided that it would be economy to purchase a shovel of our own for this amount of work. We were able to find a used, rebuilt Universal ¾-yd. shovel at a price of $2,500. Our costs on the project show that at the rate of $4.50 per hour this shovel paid for itself on this one project.

The maximum cut was 34 feet and the maximum fill 40 feet. The cost of moving earth, approximately 40 per cent of which was side casting and the remainder hauled less than 1,000 feet, was 18 cents per cubic yard. The shovel work was not by any means ideal, as we encountered considerable shale and rock in the hillsides. All labor involved, such as required in sloping banks, installing culvert, etc., was furnished from our maintenance crew; and trucks, tractors, graders, etc., were all our own equipment.

For the road surface, we spread approximately 12 feet of creek gravel, and subsequently we have applied about three courses of crusher-run stone from 1-inch to dust. We were at work on the job exactly 146 working days, and the cost was approximately $12,500 for the completed job.

The road was opened to traffic in the early fall of 1934, and it is our intention to place a black top on it during 1936.

In checking over our list of equipment, I find that the total cost thereof will not exceed $30,000. This equipment has been purchased over a period of five years, making our average annual outlay approximately $6,000 for new equipment. We are now in a position to tackle almost any job, large or small.