

Contractors must obey this rule or go out of business. Public officials must follow it or be kicked out of office.

The justification for buying equipment depends on the economy of what it will do as compared with other methods.

On public work and particularly on highway maintenance work there is another very good reason for the extensive use of labor saving equipment. Most all road repair operations are carried on with the road open to traffic. The work is done under the eye of every passer-by. The farmer, not very prosperous these last few years, is especially critical. Every time a laborer, even for a moment, rests on his shovel handle, several heavy tax-payers see him. And you know what happens. We depend upon public opinion for the support of an adequate highway program. I am, therefore, in favor of keeping the number of public employees on rural highways down to a minimum. Labor saving machinery is the best way to do this.

The volume of road maintenance and repair work on highways is growing by leaps and bounds. It offers a field of opportunity for the road equipment manufacturer and the road contractor.

The greatest loss in connection with equipment generally is the loss when it is not working. The purchaser of equipment, therefore, be he public official or private contractor must know that he has superintendents with ability and finances adequate to make that equipment earn more than it cost. I say this because no equipment can take the place of the man who has good judgment, initiative and energy to do things.

## HEAVY GRADING EQUIPMENT

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By S. N. Johnson,  
Clinton County Highway Superintendent.

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The outstanding cause of bad roads is poor drainage or no drainage at all. Road drainage is just as essential as farm drainage. The success of gravel road maintenance depends largely upon this factor.

Clinton county has 841½ miles of county roads, many of which were constructed more than 25 years ago. Very little attention was given to drainage in their construction.

Late in the year of 1924 we purchased a 10-ton tractor and a 12-foot blade grader, and began opening up side ditches on our gravel roads. About 65 miles were given just one

round. In May, 1925, we resumed our drainage and up to November 6th we had drained  $181\frac{1}{2}$  miles of road. Eighteen and three-fourths miles of this total was grade or what we call reclaimed work. We also did some maintenance during this time. On the  $18\frac{3}{4}$  miles of reclaimed road, ten rounds or more were made with the grader. In doing this work we follow about this procedure:

Round 1. Throw the gravel to the center of the road.

Round 2. Throw the sod off the berm to the side ditch or where it should be, cutting it as thin as possible.

Round 3. Dig a ditch in the berm, where sod has been removed, in which to bury the sod.

Round 4. Throw the sod out of the side ditch, at the same time cutting the remaining sod over the location of the final drainage ditch, turning it all back into the sod burial ditch made in the berm.

Round 5. Make the first ditch cut about 18" from the fence or property line.

Round 6. Make a second cut in the ditch by stepping the cut slightly toward the road.

Round 7. Make the first cut with a back-sloper. Sometimes a second cut with the back-sloper is necessary.

Round 8. First level is made on the berm, spreading the dirt which came from the ditch away from the gravel.

Round 9. Reverse blade and spread the dirt from the ditch toward gravel.

Round 10. Spread out the gravel from the center of the road to desired width.

During the several rounds, the tractor has traveled over the sod and loose earth so that there is very little settlement afterward. We do this work early in the season so it will become thoroughly settled before the fall rains set in.

On purely ditch work we make two rounds, as follows:

Round 1. Cut the ditch as deep as possible considering the condition of the road for drainage, throwing the dirt about a foot from the shoulder of the grade.

Round 2. Put on the back-sloper, step the ditch just a little toward the road and deepen a little more, throwing the loose dirt against and on top of the dirt and sod from the first cut. At the time this cut is made we run one side of the tractor over the dirt taken from the first cut to settle it as much as possible before the dirt from the second cut is put upon it. On this round we also use an ordinary road drag chained to the grader to level the dirt.

Early this year our district men will work this dirt and rotted sod and level it out on the berm. Care should be taken

not to cut the ditches too deep where the gravel is low so that the berm will not be built up higher than the graveled part of the road.

On our reconstruction or reclaiming work the length of the road to be graded as a unit depends upon local conditions. Inasmuch as the roads while being graded are almost impassable, it is desirable to work the road in short sections so that traffic interference will be reduced to a minimum. A length of one mile is recommended as a grading unit. On purely ditch work the roads are not torn up so much and we do our work in longer sections, sometimes as much as five miles.

Equipment for this work should be of the heaviest type of 12-ft. grader with special back-sloper not more than 2 feet in length, and not less than a 10-ton or "sixty" crawler type tractor. It is necessary that the equipment be operated efficiently. A good grader operator is a skilled mechanic and not an unskilled laborer. An operator always should be chosen because of his skill in operating grader machinery.

The grading crew consists of two machinery operators who receive a total of \$9.00 per day and the assistant superintendent at \$3.00 per day as helper to locate drains and remove mail boxes and any other obstructions. His wages are not included in the cost, as this labor is of a miscellaneous nature.

We kept an accurate record of the cost of the work in 1925 for labor, gas and oil, not considering depreciation or interest. Our cost per mile for reclaiming the 18 $\frac{3}{4}$  miles was from \$43.57 to \$75.00 per mile, or an average of \$54.00. On drainage alone for 162 $\frac{3}{4}$  miles the average cost was \$8.60 per mile of road.

## MAINTENANCE OF GRAVEL STREETS

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By E. D. Canatsey,  
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The maintenance of gravel streets embodies a number of elements and conditions not encountered in the regular maintenance routine on county and state gravel roads.

The greatest difference is due to the use of road oil on streets. Instead of a thin carpet of loose gravel to work with the ordinary maintenance tools, we have a smooth, hard sur-