

## THE PROTECTION AND UPKEEP OF ROAD EQUIPMENT.\*

By Daniel J. Hauer,

Construction Economist and Consulting Engineer.

**N**O matter whether roads are built by contractors or by day labor forces under the direction of engineers, the item of plant and equipment is one of the prominent factors of cost. Inadequate plant means to materially increase the cost of construction. Only recently the writer stood watching some road building upon which only a few tools were being used, and most of them were ill-adapted to the work. It was difficult to accurately calculate the exact amount of money that was wasted, due to a lack of road equipment, but it was easily estimated that the cost of construction was increased at least twenty-five per cent. Likewise, too much plant can make an added cost. Even with the proper plant, and handled in an efficient manner, the plant item in road construction is a larger per cent. of the total cost of the work than in most other classes of construction. This is due to two causes. First, the plant necessary to build a wagon road is much more expensive than that to build, to illustrate we will say, a railroad. With light grading on both, the same equipment will be needed to do the excavation. For the railroad a small concrete mixer may be needed, and some track-laying tools to complete the job. On the other hand, for the wagon road there will be much hauling of road materials, thus wagons and a traction engine will be needed, then road scrapers or graders, and spreading machines, water sprinklers, oil sprinklers, and heating apparatus will be necessary; scarifiers, harrows and rollers must be used, while for concrete culverts and bridges, mixers, derricks, buckets, barrows, and other appliances are called for to do the job in an efficient manner. The writer has constructed a section of a railroad costing about \$100,000, with a plant costing only about \$5,000, while a contract for less than \$50,000 of wagon road work took an outfit costing nearly \$20,000; forty per cent. of the total cost instead of five.

The second reason for the larger cost of plant for wagon road construction is that this class of work is let out in small scattered contracts that are uneconomical from a constructive standpoint. The season, too, for road building in nearly every section of the country is short.

Naturally the life of any machine is dependent upon the use and care given it. The longer the life, the less the annual depreciation, consequently some of the high plant cost can be eliminated from road construction by the proper care and upkeep of the equipment, and by selecting the most improved and economical types.

As far as possible the same machines should be used for many different purposes. This can be done in two ways: By trying out machines designed for one particular kind of work for other kinds, and by adding attachments to machines that thus adapt them to three or four different things.

To illustrate, a contractor once found by experimenting that a certain kind of road grader would spread crushed stone for macadam at a very much less cost than it could be done by any other known method, at that

time. Then a road roller that can be used as a traction engine, with a scarifier attachment, and likewise for operating a stone crusher, or other machines, can be said to be four tools in one; not that it is possible to use it for more than one purpose at a time but in the present method of building roads a roller is only used a small portion of the time, so it is economical to adapt it to as many uses as possible. In this manner the cost of plant, or rather the investment in plant, can be maintained at the minimum.

In like manner, wagons, which are an important factor in road building, should be of the most improved type, and adapted as far as possible to all kinds of hauling. So, too, with concrete mixers. Some contracts demand a hot mixer as well as one for mixing ordinary concrete. Money is saved when one mixer will answer for both purposes.

Another item in the cost of plant is in the character of the plant purchased. Cheap and poorly made plant means money lost to the contractor in several ways. Delays occur through breakdowns and these are always expensive. Cheaply made tools mean continual repairs and a short life, and are an added expense to any job. Only well made tools should be used. A guarantee as to the construction of a machine can and does mean little. It does not mean payment for delays caused by breakdowns nor for poor work being done. The ability of a manufacturer for swearing his product is a good one is not a help to a contractor or engineer in getting his work done, nor in showing that the machine in question is well built. The greatest asset is in buying from a firm or recognized responsibility, one of integrity, and one that is so well advertised that they must stand behind their products by putting into them only the best of materials and workmanship. This is the best guarantee possible. This means work done at a low cost. A firm with such a reputation means that thousands of dollars have been spent by them and their customers in obtaining these results. The new customer profits from these past expenditures.

These are all possible factors in plant and equipment, upkeep and maintenance cost. The problem that the contractor and construction engineer must solve in this connection is a very difficult one, owing to the many adverse conditions.

Road work is done in comparatively short stretches, usually in a single season, which varies in length from about one hundred to one hundred and eighty days, according to the climatic conditions. A contractor's plant is moved on to a job, and is used along the line of the work, part or all of the time during the season. Much of a contractor's plant is made up of transportation machinery, and even other items of plant are only working in one place for a few days at a time, so that to protect plant while at work on such jobs is very difficult, and in many cases any kind of a protection is a detriment, and a great hindrance to the free movement of the men and teams.

All machinery should be protected when it is not being used, and some when in use. Boilers at work, use much more fuel when not protected. Some kind of a house, built in sections should always be used to protect boilers. Such sheds can have one side left out, and a canvas curtain used when necessary. If the sides and tops are built in sections they can be hooked together with hooks and rods and staples so as to be rigid enough to stand up against the wind and weather.

\*Read at American Road Congress, held at Detroit, Mich., Sept. 29 to Oct. 4, 1913.