

PLANT EQUIPMENT.*

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A score of years ago road building was a very simple business, requiring only a small amount of plant and very little expense was incurred by anyone who wanted to enter into it, and one in the business could withdraw from it at any time without sustaining a great loss due to the amount of capital tied up in the plant. During the last twenty years, the method of road building has gradually changed, until the plant now required by a contractor is large and varied, and the expense attached thereto is enormously large in proportion to the amount of work done per year.

It has become a business in which one should not enter without considering thoroughly the kind and amount of equipment required to do the work that he is contemplating, and only after a careful estimate has been made of the expense of plant and the proportionate charges that should be made for the same upon the work on which he is bidding. One must also realize that once in the business, he must remain in it for many years in order to get back the cost of his equipment, or else be willing to take a loss on the sale of it upon retiring. In other words, it is not a business that a man should enter upon with the idea of its being temporary, but with the idea of its being permanent. Failure to understand or obey this principle has been disastrous to many contractors. If the proper plant charges are not made, the contractor is deceiving himself just as surely as did the kind old lady who gave gingerbread to all the children in the neighborhood, and thought it did not cost anything because she had everything in the house to make it of.

The kind and amount of equipment which is required for building a road will vary in the different classes of roads to be constructed, and in order to make a correct estimate of the cost of equipment and the expenses incidental thereto, it is necessary to know the class of road which is to be built. For example, I am going to show you just what it actually costs to equip a road with proper construction plant. The road built was six miles in length, and surfaced with local stone grouted with bituminous binder. The stone was obtained from a quarry which was situated so that the average haul was about two miles. The whole contract amounted to \$60,000.00. A contract of this size is considered an average season's work for one gang of men and one set of equipment. I am going to omit from these calculations the cost of small tools, such as picks, shovels and scrapers, and confine myself to larger items of wagons and machinery. The total cost of equipment was \$18,240.00 or 30 per cent. of the contract price. The interest on the cost of equipment at 6 per cent. and depreciation at 10 per cent. per year makes a total of \$2,918.40 for fixed charges on equipment, necessary to do \$60,000 of work per year, or approximately 5 per cent. of the amount of the contract. Most of the expense of equipment was chargeable only to a few items in the contract which included the surfacing. The contract price for these items amounted to approximately \$32,000. The first cost of the equipment used in the work covered by these items was \$16,445 or 51 per cent. of the work done. The interest and depreciation upon the same amounted to \$2,631.20, or 8.2 per cent. of the amount of the work done.

This I believe to be a fair estimate of the amount of equipment and the charges which should be made in order

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to be safe in estimating upon work of this character. There is hardly any business conducted in which the investment for equipment is so large and the expense due to depreciation and upkeep so great as in road building. Every engineer and contractor in making estimates ought to take these charges into consideration, and contractors who expect to go into the road building business, should make a careful estimate of the amount of plant required and the expense attached thereto. It is not a business in which a man can expect, in these days of keen competition, to make enough profit to pay for a plant in one season's work, and a man entering upon this kind of work must expect to stay in the business a long time before the equipment can be paid for out of the earnings. Road building machinery should only be purchased after a thorough investigation, especially in regard to the liability of breakdown and the expense of the up-keep. The expense of repairs on road building machinery is very small in comparison with the loss which is occasioned by the disorganizing of working crews due to breakdowns. In deciding upon the purchase of machinery, too much weight should not be given to the item of first cost, as the more expensive machine in first cost may be a far cheaper machine to operate and may be depended upon to do its work day in and day out, where a cheaper machine, although it may not break down, is very liable to do so.

In this discussion of road building equipment, I am not going to make any recommendation. I do not expect that my remarks will meet with the full approval of any of the machinery men or the contractors. We all know that if a man purchases an automobile that whatever kind he purchases, be it a one-lunger or a six-sixty, that particular kind is the only automobile worthy of consideration, and it can travel more miles per day than any other make, with less gasoline and expense of up-keep, and the same views are taken by a man who purchases road building machinery. I am therefore only going to give you my own views, which are the result of personal experience.

Wagons.—Four kinds of wagons have been largely used upon road work. The four-wheeled bottom dumping wagon, the four-wheeled two-horse tip cart, the two-wheeled one-horse tip cart and the four-wheeled slat wagon. The slat wagon offers no advantages over the other type, except they are a little lower and easier to load. This advantage is altogether outweighed when the time lost in dumping and turning around is taken into consideration. The single horse tip cart is very economical on short hauls and for work in contracted space, and for making end and side dumps on embankments, or in hauling stone from the quarry to the crusher. The four-wheeled tip cart hauls and is handled very easily on road work, but the weight being all on the hind wheels it is very destructive to road surface and subgrade, and much time is lost in dumping and righting the wagon. The bottom dump wagon can be used anywhere that the two-horse slat wagon or tip cart can be used, and is more economical than either, the expense of maintaining roadway being very much less than with the other kind. Material can be dumped more quickly, it not being necessary to stop while dumping, and the material can be distributed to a better advantage than with any other type of wagon. Any wagon used on road work should have tires not less than four inches wide.

Road Machines.—A road machine can be used to advantage in digging side ditches, scraping shoulders and making light cuts in the roadway. A machine for this purpose should be built strong enough to be hauled with a steam roller or traction engine without danger of breaking the machine, and also be equipped with a steering device, so that the machine may be worked outside of the travelled roadway