

that did not formerly exist. That is why the price of commodities regulated by the Government after scientific study of cost is usually raised, or at least, established on a higher basis than the prevailing level. For instance, the unit basis for moving dirt by hand may be 25 cents per cubic yard. The same operation may be performed by machine for 10 cents per cubic yard; but the overhead charges on the machine amount to all, if not more than, the saving of 15 cents per cubic yard, the only advantage of the machine being a gain in time and an escape from labor shortage.

I have here an analysis of overhead charges taken from a compilation of actual records during the last five years of one-half million dollars in sewer contracts, running better than the average in soil conditions, at better than the average price, handled with better than the average efficiency by a well equipped, well financed and well organized concern. I have purposely omitted the year 1917 from these records, because of unusual conditions and extra expense that would increase these overhead costs so much as to destroy their value as a record of average conditions.

TABLE 1.

Based on contract price which turned out to be gross cost as business yielded no net profit

Items of overhead.	Average cost for 5 years in per cent. of gross cost.	Estimated cost for 1918 in per cent. of gross cost.
Job expense	1.4	1.7
Maintenance6	.6
Plant repairs	1.5	1.8
Small tools and repairs	1.1	1.3
Depreciation	1.0	2.0
Incidental material	2.4	2.4
Bonds7	1.7
Insurance	1.6	1.9
Interest on jobs	1.1	1.3
Discount	1.0	2.0
Promotion expense	1.8	1.8
Office expense6	.7
Salaries	2.3	2.3
Traveling expense	1.3	1.5
War tax5
Interest on investment5
Total	18.4	24.0

In table 1, I have divided the overhead costs on one-half million dollars worth of sewer work and have predicted the probable increase in these costs for the year 1918. I should like to explain these items as follows:

Job Expense: This is the cost of freight on equipment, miscellaneous drayage, the transportation of men, the expense of lost time for men receiving steady pay, the cost of bunk houses, storage and job office rent.

Maintenance: Getting the job ready for acceptance after the main construction is completed, and daily cost sheets stopped; care of streets and trenches, repairs under guarantee.

Plant Repairs: The cost of repairs to machines and equipment, small tools and repairs, cost of tools lost and stolen, blacksmith repairs.

Depreciation: This is a cost that every contractor has on his machinery and equipment. This item should be doubled at least to meet the average conditions.

Consumed Material: This item represents the cost of lumber, jute, dynamite, coal, gasoline, kerosene, cement, sacks that are lost, rubber boots, etc.

Bonds: This item represents the cost of surety bonds, the rate for which is high because so many bond com-

panies have had to finish contracts for bidders who did not know how to estimate.

Insurance: This item represents the cost of workmen's compensation and public liability insurance, and will likely increase very materially every year.

Interest on jobs: This is not interest on investment, but interest only on money borrowed to carry on construction.

Discount: This item should be five times as much as it is to meet the average conditions of the average contractor, but as this is a true record of actual costs of one firm it is thus set out, and is probably a much smaller amount than can be shown by any other contractor doing business in this territory.

Other Items of Overhead

Promotion Expense: This item covers the expense of promoting jobs, dues to associations, etc.

Office Expense: This item represents postage, telephone and telegraph bills, and other expense of a like nature that every business must pay.

Salaries: This item is entirely too small to cover average conditions and is intended only to represent a very small salary drawn by the head of the firm who is sole owner of the business and gives his entire time to it. It probably should be called expense rather than salary.

Traveling Expense: This item represents the expense of traveling to bid on jobs that you do not get, the expense of trips to jobs under construction, and the many trips necessary to the town after the work is completed in order to get a final settlement.

War Tax: This item must be a part of all estimates for 1918 and represents taxes not only on profits, but also on postage, telegrams, telephone and freight bills.

Interest on Investment: This item must be a part of all estimates of cost. Even the tax department of the Government admits it is a legitimate cost.

With these proven figures for overhead, assuming that we have accurate data on quantities, costs of material and labor, there remains in an estimate but one item, profit.

Bearing in mind that a portion of the profit must be represented by investment in equipment on a reasonable basis of depreciation, what is a fair profit? The accepted basis of 10 per cent. This means that on a contract for \$100,000 there should be a profit of \$10,000 even though a portion of this is represented by equipment. I do not think this is enough to cover the hazards involved, but for the purpose of illustration we will use it.

Computations From Costs

In almost all lines of business except the construction business all computations are made back from the selling price and not up from the costs. As it seems necessary for us to work on the net cost of labor and material as a basis, we must make adjustments of percentage to produce the same result.

The table shows that overhead for 1918 is 24 per cent. of the gross cost. Then the net cost of labor and material was 76 per cent. of the given cost. 24 per cent. equals 31.7 per cent. of 76 per cent. In other words, using net cost as a basis, the overhead charge is 31.7 per cent. of the net cost of labor and material.

In order to yield 10 per cent. net on the contract price the following computation must be used, although an engineer would express the same thing in an algebraic formula:—