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# Accounts for Material on Engineering Construction

BY LESLIE H. ALLEN

In a previous article (*JOURNAL OF ACCOUNTANCY*, July, 1914, page 38) the writer's method of distributing the payroll of the construction force was outlined. It is the purpose of this paper to deal with the accounting for the cost of materials used and sub-contracts made in construction work, to be followed by a further article on the apportionment of indirect expense.

The accountant will find that the problems to be considered are very different to cost accounting in factory operations. A machine shop, hardware factory or textile mill will buy large supplies of stock or raw material, and will charge them to stores account and from stores will issue them in large or small quantities from time to time against requisitions from the various departments using them. At first sight it might seem that this would be a suitable method to use on construction work. But it has been found that owing to the entirely different character of building operations a general stores account is a very difficult thing to handle correctly on a construction contract, and other methods can be utilized which give quicker and more accurate results.

A building construction contract generally lasts from six months to two years and seldom occupies a longer time than this. During this time the character of the operations is constantly changing. Excavation and foundation work will occupy the first six weeks or more; then brick work, concrete and carpentry will be carried on for two or three months; then will follow roofing, painting, glazing, steam fitting, pipe lines and fire mains, etc., each trade having its own place in the order of operations, some being carried on simultaneously, and all calling for different kinds of material in varying quantities.

Unlike factory operations—in which many materials are ordered in bulk without regard to the ultimate use to which they are to be put—in a construction contract, occupying as it does a short space of time and having its character and extent definitely decided in advance, the quantities of all materials required are scheduled and ordered for the specific requirements of the various parts of the work. The amount of waste is usually small and

### *Accounts for Material on Engineering Construction*

the quantity of brick, steel, cement, lumber, etc., for each part of the work can be and is carefully scheduled in advance with a small allowance for the permissible waste, and the total quantities thus determined are ordered for the work. If changes are made in the plans, supplementary orders or schedules are made, but at no time is there any uncertainty as to the use of the materials ordered, and materials are not ordered in bulk without knowing to what they will be charged. When the materials arrive, the quantities ordered for each part of the work can be charged to the accounts for their operations without the necessity of charging into and out of a stores account. On a well conducted job, the amount of unused material on hand at the completion of the work will be very small and its value negligible.

The basis of the account should be the engineer's estimate of the quantities and cost of the work (referred to in the previous article), which is made before the work is started. An account should be opened for each of the principal divisions of the work shown in this estimate, and no account should be started that will not tie up finally with some part of this estimate. In fact, this estimate may be treated like a budget, and the amounts shown for the different parts of the work be considered as appropriations for the various parts of the work. If the accountant sets at the head of each account the amount estimated for total expenditure he will be enabled to watch more closely the comparison of actual and estimated expenditures and to detect at once if any item is exceeding the estimated cost. It is very desirable that the engineer be consulted before the accounts are set up, as a few explanations from him as to the scope of the work and the programme of operations will give a clear understanding of the work at the outset, and possible mistakes will be thus avoided.

In the construction of a large cotton mill or factory, or a hydro-electric development, or other piece of construction work, the larger portions of the materials supplied fall under several main headings or are connected with the major operations or divisions of the work, viz., excavation, foundations, structural steel framing, brick work, stone work, concrete work, reinforced concrete, wood framing of roofs and floors, partitions, and so on, followed by the items of building equipment, such as plumbing, heating, etc., and building finish such as carpenter trim, flooring, painting, etc. A material account should be opened for each of

## *The Journal of Accountancy*

these headings with sub-headings for each item composing same on which a special record is desired.

For instance, in the account for excavation, there would be a sub-account for drills, boilers, steam hose, and other equipment for rock drilling. Then there would be a sub-account for dynamite, fuses, blasting caps and batteries, and other explosive supplies. Then a sub-account for tools and general supplies, such as picks, shovels, rubber boots for working in water, etc. If work was in wet ground there would be a sub-account for steam pumps and supplies for same, and so on. If the job were a small one these sub-accounts would not be divided, but could all be kept in the one general excavation account. At the end of the job the total of this account would be divided by the number of cubic yards of material excavated, and the cost of this material would be apportioned to the various buildings according to the amounts of earth and rock removed when excavating for the foundations. Similarly, the account for brickwork would contain sub-accounts for the brick, lime, cement, sand, tools, staging lumber, and so on, and the totals of these would finally be brought together and divided by the number of cubic feet of brickwork laid (which would be ascertained from the labor cost accounts), and a division between buildings or parts of the structure made in accordance with the divisions shown on the original estimate (referred to in the previous article).

It will be readily seen that this method of keeping costs according to operations and not according to buildings will save a great deal of clerical work, for if a plant containing ten or fifteen buildings were built and the accountant attempted to separate the cost of each building, it would be necessary to have one storekeeper at the brick pile to book out the bricks as taken to the different buildings, another man in the cement shed to book out cement in a similar way, which might be going out continuously to three or four buildings at once, another man or two to check the lumber piles, another man on fuel and power supplies, and so on.

There are one or two articles which have to be distributed between two or three of these accounts. One of these is the item of cement, some of which is charged to concrete work in foundations, some would be charged to reinforced concrete in the superstructure, and some to brickwork, some to plastering,

### *Accounts for Material on Engineering Construction*

and so on. Another item would be lumber, some of which would be used for temporary form work for concrete, some would be used for staging, some for cofferdams, some for sheeting of trenches, and some for work in the permanent structure, such as roof beams and plank, etc. In the case of the cement, which is ordered in bulk, it is best to charge the whole quantity to the account which takes the largest amount of same and to transfer by credit and debit entries the amounts used on the smaller items of the work. In the case of the lumber, this is generally ordered from time to time in special orders for the specific parts of the work, and there is no difficulty in identifying the items as they come in and charging them to the right accounts. Each sub-account should include its own freight charges.

In keeping accounts for lumber used for temporary purposes, it is sometimes found that lumber bought for sheeting a trench or bracing structural steel framing is afterwards re-used for staging or centering on other portions of the work. The proper practice in such a case is to credit the second-hand value of the lumber to the account to which it was originally charged, and to transfer the same cost as a debit to the new account to which it belongs.

It frequently happens on large engineering structures, such as dams and power plants, that a temporary boiler and compressor plant is installed to serve the whole of the construction work—drills, pumps, mixers, derricks, and so on—all being operated from the same power house. In this case it will be necessary to set up an account for the temporary power plant, and to it charge the cost or depreciation of the boilers and the whole cost of fuel, oil and waste, and the cost of mechanics and laborers setting up and mechanics and firemen operating same. This cost would be finally distributed according to the amount of power supplied to the different operations of the work, as described later.

Unloading, teaming and freight charges are items which should present no difficulty; they are considered part of the cost of material and should be entered to each account with the materials to which they belong. Most of the principal items come by rail, and prices are usually quoted with railroad freight allowed to destination. When material has to be teamed from the railroad, this may be done by sub-contract with a local teamster who unloads and teams material to the site at a fixed unit price

per ton, per barrel, or per other unit, as the case may be. Or the contractor may haul with teams hired by the day. In the former case, no difficulty is found in charging teaming to the item to which it belongs. In the latter case, the teams should be entered on the payroll sheets with the labor and treated as a labor item, and each kind of material should finally be charged with the cost of labor expended on it. In like manner, the final unloading of railroad cars or teams at the job is done by the contractor's men, and their time appears on the payroll. Their labor is added to the direct cost of the material before it is distributed. If horses, mules and wagons are purchased for job account, it will be necessary to set up an account for same similar to that for the temporary power plant. To this account will be charged cost of live stock and feed for same, erection of stables, wages of stablemen and farriers and blacksmiths' expense. The time worked by the horses and mules will be kept in hours or days, and their value distributed among the operations of the work at a rate based on the cost of the account as itemized above, divided by the total number of horse hours or days worked. As it is desirable for current use in the cost accounts to determine this rate in advance (in order to get complete daily costs on teaming), it will be necessary to estimate and establish a provisional rate at the start of the job, which can be corrected and adjusted when the job accounts are closed.

Many of the important items of material are not only furnished but erected by specialist firms. These are known as sub-contractors, and usually contract with the general contractor to do their portion of the work. (Sometimes, however, they have contracts direct with the owner, but they are always spoken of among engineers as sub-contractors.) Among important operations which are almost invariably sub-contracted for are structural steel framing, painting, roofing, plumbing, etc. Sub-contracts are nearly always let on a lump sum basis or on a unit price basis of so much per ton, per yard, etc., as the case may be. The distribution of their costs among the parts of the undertaking is a simple matter, but it will be obvious that it is not possible to keep separate records of the labor and material expended by the sub-contractors, as their payrolls and bills for materials do not appear upon the books of the general contractor or the owner. He has to pay in installments from time to time according to the

### *Accounts for Material on Engineering Construction*

progress of the sub-contractor's work. For convenience, the contractor's accountant usually classes his sub-contract payments with his material accounts, in order to preserve a clean distinction between labor, by which the contractor means his own payroll labor, and other expense which he has roughly classed as material.

The accountant should keep in close touch with the purchasing agent of the contractor's organization, and should keep a careful record of all the important orders placed. Sub-contracts for steel, plastering, and orders for glass, windows, brick, etc., may often be placed months before delivery, and a proper statement of expense incurred, but not paid out under this head, is a material help to a proper review of the financial condition of the job.

The contractor's material clerk should be supplied with a list of the accounts and divisions with their numbers or code symbols, and he should be instructed to mark every bill with the numbers or symbols, so that the entering of them on the cost records should be only a routine matter of clerical work.

At the close of operations, the depreciation on plant will have to be allowed for before crediting the construction plant. On work of any magnitude, it is the usual practice to buy new contractor's plant, such as boilers, hoisting engines, derricks, concrete mixers and towers, industrial track and cars, etc., and also a complete new outfit of tools. On smaller work, it is customary to buy second-hand plant or to rent it from a firm which makes a specialty of this. The writer's company, however, makes a practice of renting its construction equipment to the owners for which it works, the rental value being based upon its estimated life and cost of renovations. In the former case, when allowing for depreciation at the close of the work, it must be remembered that the life of construction plant is very short and depreciation is very much more rapid than depreciation of equipment in a factory. The contractor's plant is set up in the open: it is subjected to very rough usage, often improperly set, improperly housed, and not properly cared for. In very few cases can the life of a piece of construction plant be reckoned at more than two years, and in this space of time it would call for extensive renewals of worn parts and repairs.

In construction work far from a town it is necessary to build a camp and either board the workmen or run a commissary store at which they can purchase food and merchandise. The cost of

*The Journal of Accountancy*

building, furnishing and caring for the camp, with its sanitation, etc., should be a separate account. And the cook house (if men are boarded) and the commissary (if they board themselves) should be another account. The latter should be at least self-sustaining, if not profitable.

Cash discounts should be deducted from the cost of each item of material, and not shown as assets or profit as they would be in accounting in a manufacturing plant, as the whole expense of construction work is in the establishing of an asset for the owner, and not a piece of merchandise for him to sell.