

3-1918

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### Recommended Citation

Seidman, Frank E. (1918) "Overhead Distribution for Cost-Plus Contracts," *Journal of Accountancy*. Vol. 25: Iss. 3, Article 1.

Available at: <https://egrove.olemiss.edu/jofa/vol25/iss3/1>

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# The Journal of Accountancy

Official Organ of the American Institute of Accountants

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Vol. 25

MARCH, 1918

No. 3

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## Overhead Distribution for Cost-Plus Contracts

BY FRANK E. SEIDMAN, C.P.A.

Since the outbreak of the European war, the cost-plus contract has come more and more into the limelight in business operations. This is accounted for, first, by the rapid rise in labor and material costs and, second, by the new products necessary for prosecuting the war. Because of the rapid advance both in labor and material costs it is impracticable for a manufacturer to place a fixed price upon any article with any degree of accuracy or assurance against loss. In fact, those companies which, in the early period of the war, made fixed price contracts, have rapidly accepted the cost-plus form since, because of the fact that they incurred serious losses on their earlier contracts. The second factor—that of production of new products, such as aeroplanes, guns, etc.—is perhaps the more important cause for the advent of the cost-plus contract. Because of the lack of experience in producing the new articles necessary to carry on the war, no contractor could calculate with any degree of accuracy the cost of these articles for the purpose of fixing a selling price. Our government, therefore, had to adopt the cost-plus form in order to get production rapidly and secure the contractor against loss.

The accountant is vitally interested in this change in the form of doing business. The ascertainment of costs for the purpose of payments under cost-plus contracts is primarily in the accountant's sphere. The accounting problems arising in ascertaining cost as required by the usual government cost-plus contracts are numerous and complicated.

Perhaps the most involved question is the method of arriving at the overhead applicable to the cost-plus contract under operation.

In ordinary circumstances the basis of overhead distribution is involved. Under the government cost-plus contract this question takes on an even more complicated form. To bring out the various problems that present themselves in determining the overhead applicable to a given cost-plus contract, we will take a specific yet comparatively simple example.

The American Flying Machine Company receives a contract from the army to produce a given number of aeroplanes as well as a list of spare parts to be paid for on a cost-plus basis. The company is partly a holding and partly an operating organization. It owns and operates three plants, i. e., A, B and C. All administration work of these three plants is carried on by one set of executives.

The operation connected with the cost-plus contract is to be confined entirely to plant "A." At this plant there will also be produced another government contract for the navy on a cost-plus basis, as well as other products which the company makes for itself and sells at a fixed price. Plant "A" is at present being expanded to accommodate these new orders and construction work is proceeding on a fairly large scale.

The army cost-plus contract requires not only that the costs of the finished product be ascertained, but that the cost of every part going into the finished product be determined.

We are required to lay out a plan of overhead distribution in order to arrive at the portion of overhead applicable to the army cost-plus contract and the portion to be assigned to each part that goes into the finished product of the army contract.

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### PRIMARY SEGREGATION

As a first step it will be necessary to make the following primary segregations:

- (1) All expenses applicable to more than one plant of the company will have to be divided so that the portion applicable to plant "A" (the one in which the army contract will be produced) will be determined.
- (2) When the amount of inter-plant expenses applicable to plant "A" is thus ascertained, this amount as well as the direct and indirect overhead will have to be divided between
  - (1) The army contract,
  - (2) The navy contract,
  - (3) The company's products.
- (3) Plant "A" overhead will have to be divided among productive departments and will consist of
  - (a) Direct overhead,
  - (b) Indirect overhead.
- (4) The process of allocation will then be:
  - (a) The determination of the total amount of overhead, direct and indirect, applicable to each productive department;
  - (b) The distribution of departmental overhead costs between contracts;
  - (c) The distribution of overhead assigned to the army contract to part cost within each department.

Plant "A" has approximately 20 productive departments and the present cost accounting system includes a definite outline for reporting material and direct labor costs between departments and job orders but does not include a method of distributing overhead to departments and jobs.

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The method of distribution should be divided into two sections:

- (1) Distributing all costs of non-productive departments as well as general expenses to productive departments;
- (2) Distributing the departmental overhead between contracts and part costs.

### DISTRIBUTION OF OVERHEAD EXPENSES TO PRODUCTIVE DEPARTMENTS

In attempting to determine the amount of overhead applicable to each productive department, the first requirement is that overhead expenses be assigned directly to productive departments wherever possible. In other words it is desirable that wherever expense is incurred that can be assigned directly to an operating department at the time of the incurrence, this should be done, rather than lumped in a general expense account and distributed on an arbitrary basis.

By this method only items of an indirect nature that are not directly assignable as departmental cost will need to be apportioned. This cost will consist of:

- (1) Expenses of non-productive departments;
- (2) General expenses of the company.

Grouping these two classes of overhead by functions, we find that the following fairly covers all expenses in the above two groups:

- (1) General administration,
- (2) Factory administration,
- (3) Material expenses.
- (4) House service expenses.
- (5) Miscellaneous expenses.

We will investigate the elements of each of these sub-divisions and determine how to distribute each between:

First:

- (a) Plants,
- (b) Construction and operation,
- (c) Productive departments;

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Second:

- (d) Contracts,
- (e) Part costs.

### GENERAL ADMINISTRATION

Under general administration will be included costs relating to the general administration of the company, which will include the following classes of expenses:

- (1) Executive salaries;
- (2) Accounting and office salaries and expenses;
- (3) Telephone, telegraph, postage, etc.;
- (4) Garage expense of pleasure cars;
- (5) Pleasure car indemnity and payroll insurance;
- (6) Depreciation and repairs of office furniture and fixtures.

Items one to five inclusive are expenses which are incurred in connection with all plants. Item six can be definitely assigned to each plant without allocation.

Our first problem is to arrive at some basis for distribution of items one to five as between plants. Perhaps the fairest basis of allocation for such expenses between plants is the amount of production (output) at each plant. The best figure to take for this purpose is the amount of billing made by each plant. In other words, if plant "A's" output (amount billed) during a given period is \$100,000, plant "B's" \$200,000 and "C's" \$300,000, plant "A's" portion of administrative expenses for that period is one-sixth of the total of such expenses, plant "B's" one-third and plant "C's" one-half. By this method the portion of general administration expenses applicable to plant "A" (in which our army contract is being produced) will be ascertained.

The next step is to determine how much of this administration expense should be charged to construction and how much to operation. For this purpose the best measure of allocation is the direct labor charge to each of these classes. In other words, if the operating payroll for a given period is \$90,000, the amount of general administration to be charged to operation will be nine-tenths and the portion to construction one-tenth of the general administrative expenses assigned to plant "A."

Having thus eliminated the amount applicable to construction, the next step is to determine the basis of distributing the amount applicable to operation between productive departments.

The ratio of productive labor of each department to the productive labor of the entire plant is the best measure of division for this purpose. By applying this basis we will arrive at the amount of general administration expenses to be charged to each productive department at plant "A."

The method of distributing these departmental expenses between contracts and part costs will be discussed later.

#### FACTORY ADMINISTRATION

Under factory administration are included all expenses that are incurred in the administration of the factory. They include the following classes of expenses:

- (1) Factory manager,
- (2) Factory superintendents of divisions,
- (3) Planning and dispatching departments,
- (4) Employment department,
- (5) First aid,
- (6) Welfare work,
- (7) Cost and factory accounting,
- (8) Miscellaneous.

It is found that the factory manager is in charge of the management of all plants of the company. The superintendents of divisions, however, are assigned separately to each plant. It will, therefore, be necessary to distribute the factory manager's salary, the salaries of his stenographers and other assistants, as well as the cost of supplies and other overhead expenses assigned to the factory manager's department, between plants. This, as in the case of general administration, can be divided on the basis of output of each plant. When the portion of factory manager's expenses applicable to plant "A" is thus determined it should be added to the direct superintendence expenses at plant "A," and the total factory superintendence expenses at plant "A" will be thus determined. The cost of the planning department is a division of factory superintendence expenses.

In so far as the employment department is concerned, a record is usually kept at the central office of the number of men hired

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and discharged at each plant. Since the employment department takes care of both hiring and discharging employees, the best method of allocation of the costs of the employment department between plants is the total number of employees hired and discharged during a given period for each plant. By this method the employment expenses applicable to plant "A" can be determined.

The cost of first aid and welfare work can be assigned directly to plant "A" without allocation.

In factory cost accounting it is found that the general head of the cost accounting department and his two assistants are in charge of all factory cost accounts of all plants. In addition there is a factory accounting organization at each plant, taking care of the detailed cost accounts of each plant.

The costs of the general factory accountant and his staff, as well as all expenses and other indirect costs assigned to his department, should be distributed between plants on the basis of output. By this method the portion applicable to plant "A" will be determined. To this cost should be added the direct cost of the factory accounting department at plant "A," thus arriving at the total factory accounting expenses applicable to plant "A."

By gathering all the above expenses and any other miscellaneous factory expenses we ascertain the portion of all factory administration expenses applicable to plant "A."

The next step is to apportion these expenses between operation and construction, which, as in the case of general administration, will be divided on the basis of direct payroll for each.

When the amount applicable to operation is thus determined it should be divided between operating departments on the basis of the operating payroll of each productive department.

#### MATERIAL EXPENSES

The various costs of purchasing, handling, protecting and shipping of all materials coming into and going out of the plant should be grouped so that the total cost incurred for material will be determined. The following expenses will come in this class:

- (1) Purchasing department costs,
- (2) Receiving departments costs,
- (3) Stock and storeroom,



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- (4) Traffic department costs,
- (5) Testing division,
- (6) Inspection,
- (7) Shipping department,
- (8) Personal property taxes,
- (9) Freight and express,
- (10) Cash discounts (credit),
- (11) Scrap (credit).

It is found that the costs of purchasing department, traffic department, freight and express and cash discounts will have to be distributed between plants because these items affect all plants. The other items enumerated above are all directly incurred and kept for each plant.

The general purchasing department buys materials for production as well as for construction for all the plants. The purchasing department should be required to make up a list showing the total purchases for all plants during a given period divided between:

- (a) Construction,
- (b) Operation.

The cost of the general purchasing organization can then be distributed between plants on the basis of the purchases for each plant and apportioned between these two divisions. Owing to the fact that purchases may be made for one plant and then reshipped to another, it will be necessary when transshipping to credit the amount of the transshipment to the plant to which it was originally shipped and debit the plant that receives it. By this method the amount of purchase costs applicable to plant "A" divided between construction and operation can be determined.

The traffic department does all trucking, routing, tracing, rate-checking, etc., for all shipments whether by freight, express or to and from plants. The total cost of the traffic department should be apportioned between:

- (1) Inbound shipments, operation;
- (2) Inbound shipments, construction;
- (3) Outbound shipments.

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For the purpose of this distribution, a grand total of all purchases for all plants (exclusive of construction), a total of all purchases chargeable to construction and a total of all sales for a given period should be determined. The relation of each of these totals to the grand total of purchases and sales for all the plants will establish the portion of general costs chargeable to each of these divisions. The amount thus determined as applicable to incoming shipments should be distributed between plants on the basis of the ratio of purchases for each plant (exclusive of construction) to the total purchases of all plants. By the same method the amount applicable to construction for each plant will be determined in the ratio of construction material for each plant to total construction material purchased, thus arriving at the amount of each of these two items applicable to plant "A."

The portion of traffic expenses applicable to outgoing shipments chargeable to plant "A" can be determined by dividing the traffic expenses assigned to shipments between plants on the basis of output of each plant. The total incoming and outgoing traffic expenses applicable to plant "A" will thus be determined.

Freight and express costs on material purchases used directly in producing the product should be ascertained for each item of material purchased. If more than one class of material is included under one freight bill, it is usually simple to determine the portion applicable to each item by an apportionment on the basis of weight, value, etc. The amount of freight thus ascertained as applicable to each item of material purchased should be treated as a direct material cost and added to the unit price of material costs—not as an overhead. Freight and express charges on indirect materials and supplies should be carried in a general freight account, treated as an overhead expense and distributed between plants on the basis of such material purchased for each plant.

Cash discounts on material purchases used directly in producing the product should be deducted from material costs, so that the unit figure thus resulting will give the net unit cost of each item of material purchased. Cash discounts on indirect material should be apportioned between plants on the same basis

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as freight. When the amount applicable to plant "A" is determined it should be treated as an overhead credit in "material expenses."

All sales of scrap should be credited directly to the job to which the material was charged originally when put into operation. If 100 pieces of a given job are started and only 90 good ones are completed, the original material cost of the 100 less the revenue from sale of scrap from the 10 spoiled pieces will give the material cost of the 90 good ones, the latter thus standing the net loss of the 10 scrapped pieces. When scrap cannot be identified with any job number, such as turnings, borings and other small scrap, the revenue resulting from this item should be treated as an overhead credit item in material expenses.

When the total material expense for plant "A" is thus ascertained, it will be compared with the total material value used at the plant for a given period and a percentage will thus be determined of material expense to material used. Every item of material that has gone from stores to a job will then be loaded with this percentage. By this method the amount of material expenses applicable to each contract and each piece in the contract will be directly ascertainable. For instance, it is determined that during a given period material expenses were equal to 3 per cent. of the value of material used during the period. All material drawn from stores during that period will be loaded with 3 per cent. of their value and each piece will be charged with this percentage when drawn from stores for use on a given part.

### HOUSE SERVICE EXPENSES

Various costs of maintaining and protecting the company's plants may be grouped in one class under the heading "House service expenses." In this class will come items which in normal business practice are included in the rent paid to landlords, such as heating, lighting and maintaining buildings, as well as return upon capital. In the cost-plus contract a return upon capital is usually not included as a part of cost, for the fixed percentage of profit allowed is supposed to cover a return upon the investment.

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The following are some of the items to be included under house service:

- (1) Heating,
- (2) Lighting,
- (3) Watchmen and janitor,
- (4) Repairs to buildings,
- (5) Depreciation on buildings,
- (6) Fire, elevator and other liability insurance,
- (7) Taxes on real property.

There is no problem as to segregation between plants in regard to these expenses.

If a company produces its own heat, all expenses in connection with the heating plant, including labor, coal, miscellaneous supplies, repairs, supervision and all direct and indirect overhead applicable to the steam plant, will represent the cost of heating.

Lighting costs can usually be ascertained from the lighting company's bills, if the company buys its electricity. If it generates its own electricity, the cost will be found in the same manner as heating costs.

Repairs should include repairs to buildings only and not repairs to machinery, tools, etc. Only normal and reasonable repairs should be included, as any wholesale repairs, improvements or betterments should be spread over a longer period than that during which the repairs, etc., are made.

Depreciation should include depreciation on permanent buildings, etc., only, and not on machinery, tools, etc. Only normal depreciation rates should be allowed as cost under this item. Any items allowable for amortization of plant values should not be included under depreciation, even if they are allowable under the contract. Many companies have been required to construct new plants under unusual conditions at a higher than normal cost to accommodate the present war demands. The difference between the normal value and present high cost of these buildings should be written off during the present abnormal period. This element, however, is not a real depreciation (i. e., wear and tear, obsolescence or inadequacy) but represents a factor which may be termed "commercial" depreciation. This element should be treated as a general deduction from income rather than as a cost of production.

Real estate tax bills usually give the taxes for each building. The taxes applicable to each plant can, therefore, be directly determined.

When all the costs represented by this class of expenses for plant "A" are ascertained, the total should be divided by the total square feet of floor area in the plant and the cost per square foot for house service will be found. The area occupied by each department, both productive and non-productive, should then be determined. The departmental charge for house service can be ascertained by multiplying the area by the rate per square foot, determined as above. In computing the square feet area of the plant, halls, aisles, etc., should be eliminated so that the sum of the area of all departments will equal the total area of the plant.

It should be possible to work out a rate per square foot which may be used for a comparatively long time. This rate may be checked and adjusted at intervals of three or four months or whenever a material change takes place in the make-up of the house service expense costs.

#### MISCELLANEOUS EXPENSES

In addition to the above general classes of expenses there are miscellaneous expenses which call for mention.

##### *Power.*

It is usually found that power current of the entire plant is registered on one meter. It is, therefore, necessary to get a basis for distributing power between departments.

The following are some of the bases that may be used for this purpose:

- (1) The installation of a temporary meter in each department long enough to get the average amount of power used during a normal period.
- (2) Ascertaining the total horse-power units of each department by adding the horse-power rating of each power unit in each department. The total power cost can then be distributed between departments on the horse-power requirements.

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- (3) Ascertaining the total horse-power of all power units in each department. Have the departments keep a record of the number of hours that each machine is operated. Multiply the horse-power of each machine by the operating hours it is used. Adding total machine horse-power hours in each department we get horse-power hours of departments. The horse-power hours for all departments divided into the total power cost will give the rate per horse-power hour, which, multiplied by horse-power hours for each department, gives total power cost for each department.

The second method, that of taking the horse-power requirements, is the one usually adopted, as it is the simplest.

#### *Depreciation and repairs of machinery and tools.*

The value of machinery and tools should be subdivided to show the value for each operating department. When the rate of depreciation of each class of tools of each department is fixed, the depreciation applicable to each department for this element can be determined and treated as a direct overhead of the department. In the same way all repairs to machinery and tools can be charged to the department in which the repair takes place and treated as a direct overhead of that department.

#### *Engineering costs.*

All costs connected with designing, tracing, blue-printing, etc., of items to be produced can usually be treated so as to show the time spent on each model or contract. The supervisory expense of the engineering department can be distributed between models or contracts on the basis of the direct charges to each model or contract. Thus, the amount of engineering cost applicable to the army contract can be definitely determined. This cost should then be distributed between departments in which the army contract is being carried out, on the basis of productive labor put on the army contract in each department.

*Construction.*

The portion of general overhead expenses assigned to construction should be added to the asset account on which the construction took place. Only that portion of construction expense allowed through depreciation is to be included as cost.

DISTRIBUTION OF DEPARTMENTAL OVERHEAD TO CONTRACTS  
AND PARTS

We have covered in a general way the method of distributing the important costs of non-productive departments and general expenses to productive departments. When this distribution is made all expenses of whatever nature that have not been directly assigned to productive departments in the first place should find their way to these departments through the distribution above outlined.

The total amount of these indirect overhead expenses determined as applicable to each operating department plus the direct overhead carried in each operating department will give the total overhead expenses for each operating department. An overhead rate can now be established for each department. This rate is usually computed in relation to the productive labor of each department.

The next step is to divide the overhead applicable to each department between contracts (for this purpose the company's own production will be considered as a contract). This can best be done on the basis of amount of productive labor charged to each contract in each department. While in some departments, where most of the production work is done by power machines, the machine hour basis might be used, and in departments where the rate of pay of operatives has a wide range, the number of productive hours should be used, yet it has been found in practice that a distribution on the amount of productive labor will in the long run give fair results.

By this method the amount of overhead applicable to the army contract in each operating department can be determined. To the amount thus determined should be added the direct overhead applicable to the army contract as indicated earlier in this article. The total of these two amounts will establish an overhead rate to be applied for army purposes in each operating

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department. Having this rate for each operating department, the overhead to be applied to each part can then be ascertained by loading each part going through each department with the overhead rate of that department on the basis of productive labor spent on each part.

It is desirable that an average rate be used throughout the life of a contract in distributing overhead expenses to part costs. In other words, the relatively small production of the early months should not be burdened with the full amount of overhead incurred during the preliminary period. All preliminary costs should be studied, therefore, and those that apply to the entire contract, rather than to production during the early period, should be spread over the estimated life of the contract and not be included wholly in the overhead rate of the period in which the expenses are incurred.

Because of the wide scope of the subject which this article attempts to cover, it was necessary to give conclusions rather than discussion. Only the more important problems of overhead distribution have been mentioned, for obviously a book rather than a magazine article would be required for discussion of this subject in full.