

## ENGINEERING FEES AND THEIR COMPONENTS\*

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It is extremely important for the engineer of today to keep up with technology after he has obtained his degree, not only for his own benefit but also for that of his employer and for his client.

Similarly a knowledge of the business and management aspects of an engineering firm is essential if the engineer is to move up in his work. The young engineers of today will be the leaders in our profession tomorrow and must have an opportunity to learn how an engineering fee is determined, what must be included in it, and the magnitude of costs involved.

By first educating our own engineering family, then through them our clients and the general public, a better understanding of the engineering profession should be achieved.

A fair fee, and one that all consulting engineers need and strive for, is a fee that returns to the consulting engineer the costs for doing the work plus a reasonable profit. The following are the components of a fee.

### **Basic Wages and Salary Burden = Salary Cost**

One of the most important costs is the amount of money that an engineer receives each week in his paycheck; that is the basic wage that is paid the people that work for the consulting engineer. In addition to the basic wage, what is known as "salary burden" becomes a cost to the firm. The salary burden includes paying an engineer's salary when he is sick, on vacation and for holidays, plus unemployment insurance costs, excise and payroll taxes, contributions for social security, workmen's compensation insurance and such fringe benefits as retirement and pension plan coverage, and medical and insurance benefits. As a percentage of direct wages paid to engineers, salary burden can range up to 30 percent or more. In other words, for every \$100 in salary an engineer receives, taxes, sick time, vacations, holiday pay, unemployment insurance, retirement benefits, pension plans, medical and life insurance benefits add up to an additional \$30 or more to the cost of doing business. Basic wages plus salary burden equals what is commonly known as salary cost.

Other costs in addition to salary cost that apply to a consulting engineering firm include what are called "overhead" costs and consist of *Physical Plant* costs, *Support* costs, *Professional* costs, *New Business* costs and *Miscellaneous* costs.

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## Overhead Costs

### *Physical Plant Costs*

The cost of maintaining an office, whether it be a rented office in the downtown part of a city or a building which the consulting engineering firm owns, is a physical cost. The cost of the office includes rent, heat, light, telephone, air conditioning, maintenance, and the fire and other insurance costs that go along with the plant.

### *Support Costs*

Consulting engineering offices must have secretaries, typists, telephone operators, administrative and personnel people, a library and a librarian. Many now also have computers. All the above plus liability insurance, office and drafting supplies, printing, legal and audit work, furniture, laboratory, employment advertising, interest on money due, employee tuition, subscriptions, etc., can all be described as essential support costs.

### *Professional Costs*

The cost of keeping up with the profession is also a cost which the consulting engineering firm must absorb if it is to grow. These costs vary with the consulting engineering firm, but could include such items as the payment of professional engineering dues and the cost of sending people to committee and society meetings including the cost of the man-days as well as the expenses of travel and attendance at such functions. The cost of the man days that the firm "gives up" by sending engineers to various meetings, plus the expenses, are costs that must be figured in the professional overhead of the firm if it is to have an accurate idea of how much money it takes to stay in business.

### *New Business Costs*

The cost of travel, man-days, printing, consulting, meeting, investigating, etc., necessary to prepare proposals and contracts for new or prospective work is a real cost, whether or not the prospective job is obtained. Many times, small services to cities and towns who are long-time clients are done when needed regardless of whether funds are available for payment at that time because a consulting engineer has a professional obligation to keep his client advised of what or what not to do.

### *Miscellaneous Costs*

Not all jobs, unfortunately, make money. Consulting engineers must have enough reserve to absorb losses and to pay for such items as Christmas parties, employee outings and a host of other costs not already mentioned.

### **Fee Determination**

All of the above costs, obviously, must be paid by the consulting engineer regardless of whether all his people are working full time on jobs (in which case all the basic wages paid can be classed as billable wages), or whether some employees are "marking time" or tying up loose ends on jobs (whose wages are not billable). In order to relate costs to a base that brings in funds to cover these costs, they must be related to billable wages. Simply stated, all costs (and profit) must be applied and received from projects for which wages are paid for productive (billable or chargeable) time.

The overhead costs described above, including the physical plant costs, support costs, miscellaneous costs, the professional costs and new business costs, may add up to 120 percent or more of billable wages paid. In other words, the overhead costs may run more than the actual billable wages paid by consulting engineers. This is perhaps a bit difficult to understand, but it is so, and it is one of the facts that clients (cities and towns, smaller cities and towns especially) do not readily appreciate. If the city or town itself had the necessary qualified permanent engineering force, perhaps the consulting engineering profession as it relates to cities and towns would disappear. But the cost of maintaining an updated engineering division in a city or town, the cost of the rental of the space that they would occupy, the cost of equipment, employee benefits and other items, are usually too much for a municipality to support permanently. In other words, whether an engineer works for a consulting firm or private industry, or municipal, state or federal government, the costs are there. Sometimes, the costs may be "hidden" in some other budget, but they are still real costs.

It has been indicated that \$30 per \$100 on a salary may cover salary burden, and that perhaps \$120 or more per \$100 of billable wages may cover the overhead, and support and professional costs. This adds up, for every \$100 of billable wages, to \$250 of costs, but without any allowance for profit. If a consulting engineer hopes to make a 15 percent profit on his services before his own corporation taxes, then he should realize about 15 percent of this \$250, or about \$40 more. This \$40 added on to the \$250 totals \$290. In other words, in this example, for every \$100 of basic billable wages paid to an engineer, about 2.9 times that is needed in order to stay in business.

Smaller firms with less overhead may be able to make a reasonable profit at less than 2.9 markup. Many larger firms with more fixed costs (and the fact that a firm has more fixed costs doesn't mean it is more inefficient because the firm may be spending more to improve itself in the field) may require that the engineering fee be more than 2.9 times basic wages.

This is one reason why professional engineers do not competitively bid on the basis of cost for projects. A cost may be obtained from an engineering firm that is not as proficient in the work expected to be done mainly because it has not spent the money necessary to keep itself, its employees or its office abreast of the developments in the profession. What any client wants is the best work done, and therefore, should select a consulting engineer on the basis of experience, qualifications and reputation, and then negotiate a reasonable scope of work and fee. The ASCE Manual No. 45 indicates all of its bases of reasonable fees should be used as a guide, — and the work "guide" should be emphasized by the profession in dealing with prospective clients who have little knowledge of what is involved in engineering or in the costs of engineering.

In summary, using the above example, no matter what type of fee arrangement is used on a job, a consulting engineer cannot afford to pay out in wages and direct job expenses more than about \$34,500 on a project for which he will get \$100,000 in fees ( $2.9 \times 34,500 = 100,000$ ) if he is to make a 15 percent profit before taxes.

### **Major Types of Consulting Work**

There are four major areas of the consulting engineering business. Although there are many off-shoots and many other types of work done by consulting engineers, the major areas of work are:

1. Preliminary engineering investigations and reports
2. The preparation of design construction plans and specifications
3. The administration of the construction during the construction phase, and
4. A newer item that is becoming more important in municipal facility work, the start-up and operation including the preparation of operating manuals for the client.

The method of payment for these different parts of consulting work varies. It also may vary with the client, or it may vary because of federal or state grants in aid being offered to pay a portion of the work.

### Different Fee Bases

The different types of fees and how to determine them, and the portions of the major areas of consulting engineering to which they usually apply are as follows:

#### *Per Diem Fee*

The per diem fee, familiar to all of us, is simply so much per day for the different grades of individuals working on the job. Per diem fees are normally figured in the same manner as discussed above. If an engineer gets \$250 a week, the consulting engineer would have to charge about \$725 ( $250 \times 2.9$ ) a week for his services. Divided by five, this means \$145 a day for his services. That sounds like a great deal of money to the \$10,000 a year municipal employee, and it takes a bit of discussion to make him realize that \$145 a day isn't the engineer's salary. Per diem fees are used in many types of consulting engineering services where the scope of the work cannot be defined exactly or even anywhere near exactly. Most report work, investigative work, or preliminary engineering work is done on a per diem basis, many times with an upper limit. If an upper limit is required, a consulting engineer uses his experience and judgment and "track record" on previous similar investigations to determine what is a reasonable upper limit, keeping in mind all the time that whether or not the upper limit is high enough, he will have to do a complete job or run the risk of losing his reputation and his client. A per diem type of arrangement is flexible enough so if half way through an investigation other aspects should be investigated or more emphasis put on other parts of the study, the consulting engineer can more easily do this.

If a special project, such as expert testimony, will involve senior people in a firm, per diem fees are sometimes higher than standard because the people involved are "tied up", and their normal duties are interfered with.

#### *Multiple of Salary Fee*

In many ways, this type of fee is the same as a per diem fee except that instead of spelling out so much per day per grade of engineer, the multiplier of basic wages, or salary cost plus a multiplier of salary cost, is indicated. This method allows the consulting engineer a little flexibility because increases in wages are automatically passed on to the client (as long as the upper limit is not exceeded).

### *Cost Plus a Fixed Fee and Cost Plus a Percentage Fee*

These two types of fees are very similar and are the sum of salary costs and normal overhead, plus a fixed fee for profit in the one instance or plus a percentage of cost for profit in the other. When a cost plus a fixed fee or a cost plus a percentage is used as the basis for doing work, reimbursable costs must be carefully defined in advance so that there is no misunderstanding about whether they are or they are not included in the fixed fee, the percentage, or whether these are additional costs for which the client should reimburse the consulting engineer with or without a separate markup.

The above four fee arrangements are commonly used in the preliminary engineering investigative phase, for pilot plant work, or other special investigations. Once in a while, if the scope of work for a preliminary report can be defined in detail and is specific enough so that there is no misunderstanding and everything is covered, the consulting engineer may agree to a lump sum payment for the work.

### *Percentage of Construction Cost*

The preparation of detailed construction plans and specifications is one of the larger (fee wise) types of work in which the consulting engineer becomes involved. Usually the final design is the result of a preliminary report which he has prepared for the same client, and therefore the requirements of the work are known. Here again, the consulting engineer must set up a fee that will be reasonable to cover all costs plus a reasonable profit. The ASCE Manual No. 45 contains median curves for two different types of work: Curve A is a curve that will give a higher percentage of construction costs than Curve B, and the types of work applicable to each curve are also indicated. It may be difficult for people to understand why fees from a curve can be applicable to many, many jobs. They are not. However, these curves are offered to the general public by ASCE as a guide so that clients not familiar with consulting work or fees can determine whether the fee requested in a specific instance is reasonable or whether more definition or more explanation of it is needed. Naturally, on any project, a consulting engineer cannot determine a fee blindly from these curves but should always check it by some other means.

Final design work is often done on a percentage of construction cost or on a lump sum arrangement.

During the construction phase, the contract administration portion of a consulting engineer's work, which includes attendance at bid openings, tabulating, checking, interviewing and recommending contract awards, the reviewing and checking of shop drawings, the general administration of the contract, the preparation of periodic payments and certifying that they are

due the contractor, taking care of the many items during construction for the client, and the overseeing of the final testing are paid for in many instances as another percent of construction cost.

Other costs such as the cost of a resident engineer or inspector on the project and for start-up and operation are usually paid for on a per diem or a cost times a multiplier plus expenses because of the difficulty in determining how long these services are needed. The type of contractor, his efficiency, strikes, acts of God and other such items can delay construction and require the engineer or inspector to be on the job for many more weeks or months than what could be anticipated beforehand.

### **General Comments**

Some firms allow the prospective project engineer for the job, wherever possible, to work up the proposed engineering agreement and fee. In this manner, he has more involvement with the fee with which he will have to work. It also gives him experience in determining where the costs are and makes him consider all of the things that might be involved.

Finally, the writing of an engineering agreement is just as important as the fee. The fee should cover what the agreement says will be done. The agreement must be clear about payment for items directly connected with engineering work but involving necessary work to be done by others such as surveying, borings, material testing, etc., and whether they are in the fee or whether they are extra items that will be paid for separately, or whether the client will furnish them itself. That's only logical. But, if this is forgotten, the least that will happen is that relations with the client will deteriorate, and many times money will be lost. Clients are looking to the consulting engineer to guide them, to advise them, and to do all that is necessary to get the job done. There is good faith involved, and if the agreement does not spell out and make it entirely clear as to who pays for what all the way through, everyone concerned will wish it had.

It is difficult to arrive at a fair fee that returns to the consulting engineer all the costs for doing the work plus a reasonable profit, but it is essential.