

When a corporation wishes to instruct or advise with their engineer, it should be by properly convened meetings, at which they have power to act. The alderman or councillor who buttonholes an engineer, and would like this or that done, is not acting in an official capacity unless deputed by the council. He should be content to air his feelings before his brother members, where they may or may not be listened to; and not as a private member of society, take upon himself the functions of a full-grown corporation.

Instructions to the contractor should always be given through the engineer. When instructions are given direct it may have the effect of belittling the engineer in the eyes of the contractor. Especially is this the case when alterations are desired by the council. When a corporation orders alterations or deviations direct, they must remember that they remove all responsibility from the engineer and create in the mind of the contractor an opinion that he may trespass from the lines of the specification without the engineer's authority.

Diplomacy on Both Sides.

A corporation should always bear in mind that an engineer may be more or less of what is popularly called a crank, that is he has decided leanings to one line of thought, and as such should be treated tenderly. Care should be taken of his professional corns. You can always convince a good sound engineer, but you cannot bully him. The man you can bully you may be sure is not a sound engineer and deserves no respect. An engineer should always remember that nothing is gained in being unwisely dogmatic. The golden rule is that there is no rule. What is meant by this is that special circumstances and environment often require special treatment. Useful information may be gained by listening patiently to the opinions and expressions of information from people who know and are apt to continue to know more about the locality in which they have lived for years than the engineer will ever find out for himself. Common sense, as it is called, is very apt to be very common, and leagued with ignorance. But a common sense expression of opinion has at times been of valuable assistance to an engineer in either completely altering his thought-out design or in bringing it clear out of the eddies of probabilities.

The Letting of the Contract.

The axiom which must be kept in mind is, "That cheap work is generally of a cheap nature." "Good work will always command its price in the market." There are two chief methods by which a contract price can be obtained. They are (a) "The lump sum contract;" (b) "The quantity based contract."

"The Lump Sum Contract."

In this case it is the custom for the engineer to prepare plans and profiles together with a description of the character of the work called "specification." He gives no measurements as to amount of material required. The contractors view and study the documents, take their own measurements and arrive at what they consider the amount of material and labor required to complete the work. The advantages of this system is that it saves the engineer a large amount of trouble and responsibility. The objections to the system, however, are many. When a corporation receives bids or tenders, they can never be sure that such are based on the same amount of work and material. When there is a wide discrepancy in the tenders, it is impossible to say that the result is caused by one man being able to do cheaper work than the other, or is simply the result of a false estimate of the amount of work required. The tenders do not therefore stand on the same basis. The higher tender may be for the actual amount of work required, based on an experienced and intelligent estimate of the quantities required. The lower tender may be the result of inexperience and ignorance of a proper method of taking out quantities.

Again, when it is left to the contractor to take his own quantities from the plans, he is apt to be left with the unsatisfactory feeling that items may be left out, and he generally adds a sum to cover any such errors of judgment.

The argument is used, that if the contractor makes a mistake, and puts in too low an estimate, it is his own fault,

and he consequently suffers. However, the contractor not only suffers, but the character of the work suffers considerably. Half way through a contract, the contractor can tell whether the work is going to pay or not. If he finds that it is going to lose him money, then his whole efforts will be centred on cutting down expenses even at the cost of good work, whenever and wherever he can possibly escape the vigilance of the engineer. Nothing is more unsatisfactory than the struggle to obtain first-class work from a man who knows that he is losing so many dollars each day. "The laborer is worthy of his hire."

"The Quantity Based Contract."

In this case the engineer as well as preparing plans, specification, etc., also prepares a full list of the quantities of material required throughout the work. This Bill of Quantities, as it is called, itemizes every detail of the work. Against each item the contractor has simply to put his price, including an estimated sum for the labor required. The addition of the sums forming the total contract price. Every contractor wishing to tender is supplied with a full sheet of these quantities. Every tender is therefore based on exactly the same estimate of material. Each tender may therefore be compared not as a whole, but in detail. The corporation have the advantage of knowing what they are paying for every item of the work. Any extra work or diminution of work, can be correctly and easily audited. This is the system which is now generally being adopted in Great Britain. It is advantageous to all parties concerned. It brings work out of chaos into the plane of business exactitude. It is good for the engineer, as in taking out exact quantities, he familiarizes himself with every detail of his own general proposition. He can see the whole of the work in his mind's eye in every detail even before it is commenced.

It may be here objected that the engineer may make a mistake in taking out the quantities. Certainly! He is not infallible. But rather the engineer make a mistake than the contractor. Any error in the quantities is rectified as the work proceeds. Every completed item is measured and if less or more than given in the quantities is deducted from or added to as the case may be. As a rule it will be found that an engineer will prepare his estimate of quantities on the full side. He has no inducement to underestimate. It often, therefore, happens that the completed work costs less after being measured up than the original contract sum. The corporation getting, of course, the benefit of the difference.

The Resident Engineer.

The resident engineer, or clerk of works, as he is often called, is an essential in works of any magnitude. His business is never to be away from the works while there are men working. He should have a good understanding of the practical trades employed. Should be a competent judge of material and workmanship. He must have the plans and specifications in his mind. Be able to set out work, check levels, and measure up. Above all things he must have a back-bone and an individuality not liable to be absorbed in the human personality of the contractor. His wage should be of a sufficiency, to prevent him relying upon the philanthropy of the contractor for ordinary comforts.

Although there may be times when a clerk of the works may be justified in considering himself a much more able man than the chief engineer who has designed the work, as a simple form of etiquette, it is due to the engineer that his instructions be carried out.

Payment of salary to the clerk of works may either be made by the engineer or the council. This being a matter of arrangement between the council and the engineer.

On Completion.

On completion of the work the engineer should furnish the council with a complete bill of quantities, showing clearly every item for which the contractor has been paid with the price of the same, together with the original bill of quantities in corresponding columns, so that any diminution or addition may clearly stand out, and be audited.