

specifications, which, instead of definitely specifying qualities and describing methods, will call for work being done satisfactory to the engineers. This type is a survival of the days when the chief engineer or competent assistants could give much time to details. I doubt if such specifications proved satisfactory even then. At any rate, in the present days they would be hazardous for both state and contractor. No man can satisfactorily handle all details in supervising the large amount of work being done at present, and much supervision has to be left to subordinates. It is a careless and unnecessary procedure to place the responsibility of deciding broad questions on men of limited experience. Furthermore, a reader of such specifications is impressed with the idea that the state presenting them was in ignorance of just what they did want.

#### Factors Affecting Contractor's Relationship

The main factors affecting the relationship between contractor and the state, therefore, might be enumerated as first, the type of specification under which the work is done, next the interpretation of these specifications, and finally their enforcement.

I have briefly discussed two general types of specifications to be avoided, and too much emphasis cannot be placed on these points. In order to play fair, the engineers or other officials responsible, on the part of the state, must see that their specifications are clear in the fact that methods are definitely stated, as far as it is practical to do so. If we expect to avoid friction during the progress of work, we must have a proper understanding of what is expected, and this information should be conveyed in the specification. We cannot expect a better class of materials and workmanship than is available. If we call for this latter, the result will be that if the contract is ever completed we will find that we have not met the specification requirement but will probably be faced with the fact that we paid the price for them. A reputable contractor will take the specifications in good faith and assume they will be enforced. If they are impractical, or not properly enforced, the state is the loser, as a successful contractor prepares for the worst condition and bids accordingly.

#### Interpretation of Specifications

Now all specifications must be interpreted in many points, and as it is within their authority, this is entirely controlled by the state representatives. The type of a man invested with this authority is a large factor in determining relationship with the contractor, and also has a great influence on future prices. A broad-minded man of experience insists upon an excellent quality of work, but he is reasonable enough not to insist on this being obtained in the most expensive way.

A certain amount of responsibility and some authority has to be given to the inspector on the contract. The experience of this man and his general type has a great influence on the work and the relationship maintained. This is the state employee who is most intimately associated with the contractor, and his decisions, although in many cases of a minor nature, are bound to have their effect on the subject under discussion. It is true, with a good specification, his individual opinions are reduced to the minimum, but we must realize that there are still many points on which he has very little to guide him except past experience and good practice.

#### Duties of Inspectors

An inspector first is to inspect and insist on quality and compliance with specification. Any failure on his part in this regard is an absolute neglect of duty. It can be said in praise of the engineer or inspector, from a moral standpoint, that a very small proportion deliberately err on the side of neglect of duty, so far as their understanding of the specifications are concerned. In fact, their main faults are improper interpretation of the specifications, insufficient detail knowledge of the different phases of the work, thereby making them uncertain in making decisions. Inexperience, thereby unfitting them to determine between a major or minor cause for complaint, and finally a lack of co-operation

with the contractor. This latter, with inexperience, is probably one of the main causes of delays on many contracts. By co-operation, I mean that the inspector should always see that the contract is performed in accordance with specifications, but instead of constantly complaining he should suggest methods for rectifying poor conditions. His aim should be to secure results and co-operate with the contractor in getting them. For example, in working local materials, the inspector is, or should be, informed on what is required, and having facilities for determining this, he can guide the contractor in working deposits so as to insure acceptable material being delivered at the site of the work. Here I wish to emphasize that there is no intention to interfere with the contractor's methods of working. The inspector should co-operate to the extent that no large amount of material will have to be rejected after hauling to the roadside. One can readily see how much co-operation on the part of the inspector, while at the same time maintaining quality, will reduce costs to the contractor, which in the end results in lower bids.

Another factor is, the state also maintains a reputation for fairness, thereby attracting the better and more reputable contractors. An inspector should avoid indecision; a firm, positive attitude on his part will command respect and maintain friendly relations to a greater extent than will the apparent indecision encountered on many contracts. The complaints from contractors on indecision of the engineer or inspector far outnumber those on positive directions, even though the latter are somewhat severe.

#### Should Furnish Reliable Information

Highway departments should furnish reliable information when calling for bids, as this gives some definite knowledge to the contractor and allows him to bid with intelligence and thereby reduce his so-called contingency or safety item. Under this head might be mentioned sources of approved materials for construction. It is expected that a contractor will inspect the highway before bidding, but having no facilities for determining quality, he must figure on sources of known quality, regardless of economy. All available material sources should be investigated by the state and full information furnished with the proposal or bidding sheet. This investigation of materials should be made as complete as possible. So far as I know, no attempt has ever been made to guarantee these sources in quality and quantity. It is a question for thought whether it may not pay in the end to do so, but regardless of this I know from past experience that the furnishing of full information on material sources without guarantee has proven economical. These sources, although not guaranteed, must be reliable, and great care and pains taken in their investigations or otherwise very little benefit will result.

Highway officials desire to be fair and hope to impress this sense of their fairness on the contractor, not only to attract bidders but from the general idea of fairness itself. In order to do this, we must impress the contractor with the fact that in giving due consideration to the legal side of a contract, we also know and consider the moral side.

The production of building materials in the province of Quebec increased considerably during the year 1919, compared with 1918. Its total value for the year amounted to \$7,974,084, compared with \$5,340,987 for 1918, an increase of \$2,633,097. Practically all the items show higher production, brick having doubled in value, while the quantity produced was 80% greater.

The Standard Tube & Fence Co., Ltd., of Woodstock, Ont., have acquired the Canadian patents of Marshall B. Lloyd, covering acetylene and electric welded tubing, and have formed a close working arrangement with the Standard Parts Co., of Cleveland, O., to manufacture many of the latter's line of welded products. Additions to the plant in Woodstock are contemplated. Meanwhile equipment is being installed in the company's present buildings.