

Any municipal testing laboratory that fails to completely fulfil these duties neglects its useful field.

Clean cut competition, based on the contractor's ability to furnish the best of those materials desired can be obtained only by the use of clearly defined standards as set forth in the specifications and in their uniform and continuous enforcement by the testing laboratory. The Committee for the American Society of Civil Engineers in reporting on "Materials for Road Construction and on Standards for their Test and Use" (December, 1917) states, that "the description of a material by means of a trade name is permissible only in the most unusual cases and such a description as 'equal to' another similar material should never be used. Qualities of a material or methods of its use should not be left 'to the satisfaction of the engineer' or 'as determined by' or 'in the opinion of the engineer.' Specific tests and such description of methods of performing each test as will leave no room for doubt as to whether materials and methods proposed by a contractor will come within the limits of tolerance, should always be expressed in specifications, either in detail or by reference to the accessible standards of some reputable authorities." Thus has that national body placed itself on record in favor of unmistakable standards.

Insures Standard Desired

Many modern standards for materials have been developed by practical field experience and by laboratory analysis and research. Many of these standards have been set forth in the publications of our national technical societies. The consistent use of these, and other standards that should be developed by the local laboratory, establishes a fair basis for purchasing materials and reduces the risk cost to both the contractor and the city.

The laboratory's responsibility does not cease after it has determined which contractor has offered satisfactory materials. Able contractors realize the necessity for standards and not only willingly abide by the specifications but prefer to do so. Less scrupulous contractors, however, resent being held to the letter of the specifications and frequently find some way to deviate from them. So it is evident that picking the lowest bidder, with the aid of the careful comparison of the values offered, does not end the laboratory's responsibility. It must insist that contractors honestly furnish the same standards of materials as they proposed with their bids. If this is not done the less scrupulous contractors readily can underbid their competitors and yet make large profits. If the laboratory does not prevent this, the able contractor is compelled to make similar substitutions or else fail to be able to bid low enough to obtain contracts. The municipality does not get what it pays for when such conditions exist.

Furnishing staff advice to the various municipal departments and bureau heads on problems of specifications, etc., is another laboratory duty which properly cannot be disregarded.

The degree to which the laboratory fulfills its duties is reflected in the service and life, not only of the materials, but in the public work in which they are incorporated. Excessive maintenance is necessitated if the materials are not of the proper grade so that materials which had a relatively cheap first cost ultimately become unduly expensive.

Co-operation With Inspectors

The supervision over the use of materials is not complete without the assistance of the laboratory. Ordinary inspection aids in directing the proper use of the materials in public construction, but too much reliance cannot be placed on "practical judgment" in the field, because too frequently this results either in unfairness to the contractors, to the public, or both. Inspectors often put faith in the policy of "give and take" to cope with any tendency on the part of contractors to "put something over." Moreover, field inspectors do not have the opportunity to understand the effects of certain neglects or misuses that to them appear minor and unimportant. This latter condition not infrequently applies to the contractor who may have good

intentions. The most efficient method of ensuring the proper use of materials is for the laboratory specialists to co-operate with field inspectors, and thus not only protect the city but give valuable assistance to the contractor as well.

Guarantee Not Necessary

Many contractors justify themselves in slightly deviating from specifications when they furnish a guarantee on their work. This policy is not justifiable. Moreover, economy and fairness have made obsolete the practice of requiring a contractor to guarantee that the materials and products constructed by him, under specifications devised by others, will last for a definite length of time and render definite service. Such practice increases the first and ultimate costs of materials and work without any resulting benefit to those who pay the bill, because the contractor simply adds the cost of his guarantee to the cost of actual construction, and incorporates the sum of the two costs to him, (plus a profit on both), as his bid price for the work. The retention of this guarantee money creates a false feeling of safety on the part of the city that the contractor will furnish the best materials or construct the improvement to the best of his ability. The following quotation is from a written statement by a prominent engineer and former contractor:—

"It does not seem that at this late stage of the game it should be necessary for a city to exact a guarantee on any well-known type of pavement. City authorities have in their hands the drawings of the specifications for, and the full inspection of, all paving work; and to ask a guarantee, especially on a standard of well-known construction, would seem an admission of incompetence. . . . if in place of carefully drawn specifications and competent inspection, the five-year guarantee is substituted, the city may get a good pavement; again it may not. The odds are heavy that it will not. What it is most likely to get, when it relies on the five-year guarantee, is a pavement that will last five years and a day. And it should be added that usually the contractor has to make numerous repairs to the pavement in order that it may last the five years."

This same principle applies to all of the materials purchased by the city. The only excuse for using a guarantee is lack of faith by city officials and by the public in the specifications and in the system of inspection and laboratory control.

Moreover, according to law, if the methods to be employed in construction work are specified by the owner to the contractor, the contractor then cannot be held to guarantee the result of work done as according to those methods. The guarantee system originated when each contractor used his own "scheme" to perform work, and in many cities it is still adhered to in municipal work mainly because of inadequate supervision. The fact that methods have been standardized, that guarantee is an extra cost, and that adequate protection can be afforded by inspection (of which testing is a most essential part), makes it economically necessary that a testing laboratory do regular sample collection and sufficient analysis or testing to act as the staff control over the purchase of materials and over construction.

Fields of Service

The fields of service of the municipal testing laboratory are practically limitless. The first question that should be asked before entering any one field of service, or before expanding existing branches of service, is "What is the importance of this field relative to the others?"

The municipal laboratory usually originates in the engineering (or public works) departments because of the technical nature of the work done there. For this work the laboratory should not only do routine testing but should investigate local sources of materials such as sand pits, stone quarries, etc. But the laboratory should expand from a purely construction or engineering laboratory into the city's standard laboratory and be under the supervision of the Board of Contract and Supply for the city. It should serve, not only the engineering field, but also the city's fire, police, water, purchasing, and other bureaus, shops, garages