

# Specifications for County Highway Construction and Purchasing of Equipment and Material

K. B. WOODS, Head School of Civil Engineering  
and

J. E. HITTLE, Associate Professor of Civil Engineering  
Purdue University

## INTRODUCTION

Since the early 1900s, this country has witnessed changes in communications, transportation, and materials unprecedented in the history of the world.

Furthermore, the tempo is increasing at an accelerated rate.

These changes should not be thought of only in terms of missiles and rockets. Advancements in science are constantly being reflected in the design and construction of roads, in the materials, both old and new being used in these roads, in equipment, and in development and use of specifications to control construction and quality of materials and equipment purchased.

In developing this subject, it is appropriate to review briefly (1) the history and methods of development of specifications; (2) the reasons why specifications must be used by counties; (3) some of the uses and methods of use of specifications; (4) types of specifications for design and construction; (5) specifications for materials; and (6) specifications for purchase or rental of equipment.

## HISTORY OF SPECIFICATIONS AND SPECIFICATION WRITING BODIES

Specifications for highway work are of two general types: (1) those developed for the control of the workmanship of construction and maintenance; i.e., soil compaction, mixing of bituminous and portland cement concretes, thickness and finishing of secondary and paved surfaces; and (2) those used for control of the quality of the materials or of the equipment being purchased. In either event, some kind of testing is generally required to see that the workmanship meets

the specification limits or that the materials are within stated requirements.

Most specifications for road construction utilize laboratory tests which are developed to simulate field conditions or field performance. As an example, consider for a moment the history of some of the specifications and tests used for the purchase of crushed stone or gravel by counties, highway departments, and cities. Many such specifications have limitations on the percentage of wear permitted under the laboratory test designated as the "Los Angeles abrasion" method. This test is an outgrowth of the French "Deval abrasion test" first described in 1879. The attempt then was to secure gravel and stone which would not wear excessively under the traffic of the metal shoes of horses and the iron rims of the vehicle wheels. Most of these same specifications will also have limitations on weight losses developed by a specified number of cycles of wetting and drying of the aggregate in a near-saturated solution of sodium sulfate or magnesium sulfate. Super saturation of these chemicals in the pores of the aggregate causes expansion in the pores as a result of crystallization. This is similar to the action of the 9 per cent or so volume change of water as it crystallizes to ice. Aggregates, which have the ability to resist this action, are considered sound, and those which cannot are unsound. The surprising item, however, is the fact that this test too is an old one—first developed in 1828.

It is possible to cite examples such as these in large numbers; however, it is sufficient here to note that all of our materials used in road building are almost always specified, and tests are used to confirm that all materials purchased meet the requirements of the specifications.

## AGENCIES DEVELOPING SPECIFICATIONS

As new techniques in methods of construction and new materials and expanding uses of old ones came into the picture, all kinds of governmental units, as well as private concerns and producers, became interested in developing specifications and methods of field and laboratory tests to insure the construction of a good quality product. Among the first national units to be organized at the turn of the century for this purpose was the American Society for Testing Materials. This great society has 80 technical committees composed of producers, consumers, and general interest members who work co-operatively to develop specifications and methods of tests for materials covering the entire construction and industrial fields. Another important specification body is the American Association of State Highway Officials

organized in 1914, made up entirely of public officials of the federal government and separate states. Many government agencies (Bureau of Reclamation, Corps of Engineers, etc.), develop their own specifications, as do state highway and county highway departments, many cities, and private groups such as the R.E.A.; however, all of these groups draw heavily on both the ASTM and AASHO for their basic specifications and methods of tests.

## WHY USE SPECIFICATIONS

It has been implied already that specifications and tests are required to insure the construction and operation of a good-quality product, in this instance a highway. Since the road is constructed, operated, owned, and used by the public, there is not only a moral obligation on the part of public officials but also a legal requirement to provide the taxpayer with the greatest benefits for the money expended. For roads in a county highway system, public officials now have ready reference to specifications and tests for the purchase and use of materials ranging from gravel and stone to portland cement and concrete, steel, paints and other traffic markings, metal and wood protective coatings, ice-control chemicals, weed-control chemicals, and a wide range of bituminous materials. Specifications must be used with skill to insure that the proper quality of material is purchased to fit the particular type of road being constructed. It is a waste of money and material, for instance, to specify a low-quality aggregate for the construction of a high-type pavement surface which will invariably produce an uneconomical pavement of short life; when for a small increase in original cost, a good-quality aggregate could have produced a good-quality pavement.

## SPECIFICATIONS FOR COUNTY WORK

The development of specifications for county highway work is indeed an important part of the overall evolution of progressive county highway management and operation. Only a few years ago our needs for road construction, equipment, and materials were relatively simple. Not only were our needs simple, but many operations were accomplished by crude methods with equipment and materials locally available. The opportunities to select or specify methods, equipment, or materials were, therefore, limited.

Today, of course, we have a wide selection of construction standards available, as well as an ever increasing selection of equipment and materials to execute these construction standards. The increased

travel and use of our county road systems has clearly indicated the need for higher standards of county highway construction. As our needs for higher standards have developed, so likewise have our needs for clear, concise specifications that accurately describe county highway construction, or the equipment and materials to be purchased for county highway use.

Specifications for county highway operations need not be complicated to be effective, concise, accurate descriptions in keeping with the standards employed is one of the prime objectives. On the other hand, short, loosely-worded descriptions or requirements give little, if any, assurance to the county highway departments that even minimum standards will be followed, or that a *bona fide* contract is in force.

To be effective and to serve the intended purpose, the specifications, along with drawings if these are required, must give the contractor a clear and complete picture of work to be performed, materials to be furnished, and equipment to be furnished, and should contain all information necessary to make a cost estimate. In short, the primary object of all specifications is to define the work to be done, or the equipment and materials to be furnished, so any competent contractor may submit an intelligent bid on it.

## HIGHWAY CONSTRUCTION SPECIFICATIONS

The fastest and most convenient way for a county highway department to establish construction specifications is to adopt those already in use by their state highway department which can be used appropriately. In adapting the Indiana State Highway Department Standard Specifications to county highway projects let to contract, it is important and necessary that the county highway department develop its own set of general provisions, covering the contractor's liability, the consideration in the contract, provisions for payment, provisions relative to default or delay, the responsibility for negligence, and any other statutory requirements such as wage agreements, non-collusion affidavits, financial statements, etc. Likewise, for the particular project it may often be desirable to develop special provisions which will modify standard specifications to suit the local job-site conditions or local needs and requirements. For example, certain features of a standard specification may not be practical for a particular locality, or the cost incurred by rigorous adherence to it may be prohibitive. In these situations, where the need is clearly indicated, and where an equally satisfactory result can be achieved at less cost, the special provisions of the contract should modify the standard specifications to take full advantage of the

economics of local materials, lower minimum requirements, or greater tolerances, as the case might be.

It must be emphasized that even though county roads are normally considered of a lower standard than state highways because of the lower volumes of traffic involved, it does not follow that the design and specification requirements of such highways are always less than that required on state highways. Indeed there may be special cases where the design and construction standards on county highways should be higher than for certain types of state highway projects.

Finally, if the full benefits of the contract and specifications are to be realized, the owner or agency paying for the work should have sufficient inspection to determine that the minimum requirements of the specifications have been met. This is true whether the contract covers a county building or a county highway.

## PURCHASE OF EQUIPMENT

County highway departments also have need for clear, concise specifications in the purchase of equipment. Here the problem of preparing specifications has to be approached in a different manner than for highway construction. Constant advancements and improvements are being made in the mechanical design of all types of highway equipment. Planetary gear trains, hydraulic mechanisms, torque converters, and automatic transmissions are now either optional or standard with many lines of highway equipment. For this reason the purchaser must rely rather heavily on the manufacturer's specifications. Therefore, if the county highway departments are going to take full advantage of these mechanical improvements, it is suggested that each county highway department maintain an up-to-date job file of the manufacturer's specifications on each of the important classes of highway equipment such as dump trucks, front-end loaders, patrol graders and asphalt equipment.

There are other items closely related to equipment specifications that should also be considered in connection with the purchase of equipment. For example, there is the matter of local availability of maintenance and parts service. This may at times be equally important as the specification itself. It is only reasonable to expect that all highway equipment will at some time during its life require maintenance and parts replacement. It is important to determine that prompt, efficient maintenance and parts service is also available from the prospective bidders.

Another extremely important item to be considered is the rating and sizing of equipment to fit the job to be done. There is always a

tendency to get the most out of road equipment by crowding or exceeding its design capacity. This may temporarily increase production or get one through an emergency situation, but eventually the equipment life is shortened.

## PURCHASE OF MATERIALS

The third and last major area where county highway departments have a continuing need for specifications is in the purchase of road materials. Here again the standard specifications of the Indiana State Highway Department can and do serve a very useful purpose for county highway purchasing of road materials. In this state practically all of the counties use the same designations for aggregate and bituminous materials that are set forth in the standard specifications. This is an excellent start made possible through the fact that most material suppliers process and stock materials in accordance with these groupings and designations.

While it is relatively easy to specify that road materials purchased and delivered meet the requirements of the State Highway Department standard specifications, it is also necessary that these materials be inspected and tested to determine whether or not they comply with the requirements set forth in the specifications.

## SUMMARY

To summarize these ideas on specifications, it should again be stressed that the county highway departments have an excellent opportunity to adapt the State Highway Specifications to both county highway construction and the purchase of highway materials. In both cases it is recognized that the county highway departments need to be better organized to administer these specifications. Even so this should not lessen or detract from the use of clear, concise specifications on highway construction or highway materials.

With regard to specific details of specifications and their application to county highway problems, discussion between county highway officials here at the Road School offers an excellent opportunity to explore the most practical and workable specifications for county highway use.

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