



CHAPTER 3

Selection of Candidate Test Methods and Materials

Selection and Description of Test Methods

Laboratory tests are used to characterize aggregates as a construction material, to ensure specification compliance, and to evaluate the strength and durability properties. A number of laboratory tests have been developed, mostly along empirical lines, to estimate performance and to identify potentially poor performers. The proportions and properties of RAP and RCP in the unbound pavement layers define the performance of the unbound pavement layer. Due to the particulate nature of unbound aggregate layers, their mechanical properties also depend on stress state and environmental conditions. For pavement applications, tests have been developed to measure four categories of aggregate properties and characteristics: (1) stiffness or modulus, (2) shear strength, (3) permanent deformation, and (4) durability.

This section discusses the test methods selected to determine the performance-related properties of RAP and RCP. Performance predictability, precision, accuracy, practicality, and cost were considered. Laboratory tests recommended in *NCHRP Report 453 (1)* were re-evaluated for applicability to RAP and RCP; results are shown in Table 3.1.

Selected tests for laboratory investigation are shown in Table 3.2. These tests had a high composite rating in the evaluation shown in Table 3.1. The selected tests can be used to evaluate factors that influence the performance of recycled aggregate and differentiate between good and poor performance potential. The selected test methods could be performed by most state DOTs at a reasonable cost.

The tests listed in Table 3.2 are discussed in the following section; additional detail is provided elsewhere (1, 2).

Screening Tests

Screening tests included sieve analysis (AASHTO T 27 and T 11) and moisture-density relations (AASHTO T 180). Aggregate mass gradation is an indicator of aggregate perfor-

mance and is used by most agencies in aggregate selection. The gradation is an indicator of permeability, frost susceptibility, and shear strength.

Laboratory compaction is used to determine the anticipated density achievable in the field and for fabrication of laboratory specimens for other tests. Compaction of aggregate materials generally results in increasing density, shear strength, and stiffness and decreasing permeability. Density increases with increasing moisture content to a point of maximum density at the optimum moisture content (OMC), beyond which density decreases. The OMC is a function of compactive effort.

Shear Strength Tests

Shear strength was identified in *NCHRP Report 453 (1)* as the single most important property governing unbound pavement layer performance. The shear strength tests selected for the laboratory investigation were the static triaxial shear tests (AASHTO T 296) and the repeated load triaxial test recommended by *NCHRP Report 453*.

The static triaxial test is simple to conduct and is well accepted in geotechnical applications. The test is conducted on specimens compacted to 95 percent of the maximum dry density at the OMC as determined by AASHTO T 180.

Repeated load triaxial tests are conducted on triplicate samples prepared at 95 percent of the maximum dry density at OMC as determined by AASHTO T 180 and on saturated samples (prepared at OMC) using a closed-loop servo-hydraulic test system. The test provides a relative measure of an aggregate's ability to resist permanent deformation. The repeated load tests are conducted at a confining pressure of 15 psi. An array of load increments is applied, with 1,000 repetitions at each load level (Table 3.3). The load level is increased until the aggregate sample fails in shear or the permanent deformation reaches 10 percent. The test time depends on the selected number of load cycles per load level,

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