

Testing Bituminous Materials*

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It has been observed that bituminous materials failing to meet standard test requirements often make a good road. Tests on the bituminous materials themselves do not always guarantee good results in actual use. It seems that despite specifications and tests for bituminous materials, errors in the preparation of mixtures, or in mixture composition cause more failures in work than any inherent faults in the bituminous material itself. Yet, the user is prone to look for faults in the ingredients rather than in the selection, the method of mixing, or in the amounts of ingredients used. If tested and approved materials are employed, the user has on hand information telling him the probable cause of failure does not rest entirely on the materials.

It is often truly said there is no test for asphalt that guarantees quality. It should be stated, however, we have not known of any failures in asphalt directly caused by the asphalt cement itself if the material was found to meet specifications for penetration, loss on heating with penetration of the residue from this test, solubility, flash point, ductility and oliensis spot test. All of these tests have had long use. The American Society for Testing Materials standardized many of them as early as 1911. Later the American Association of State Highway Officials adopted specifications based on these tests.

Continuous efforts are being made to develop tests that will better guarantee quality. Asphalt technologists feel they are getting nearer to this goal each year. The tests, currently in use, probably guarantee uniformity in the basic materials, petroleums, and for refining as the best safeguard to the user. We do not intend to present elaborate descriptions of each test. Selection of penetration determines to a large extent the hardening and softening effect of atmospheric temperature on the asphaltic mixtures. We normally use AP-5 (60-70 penetration) in hot-mix asphaltic pavements. Due to the dense nature of these mixtures, an asphalt cement must be selected that will not get too brittle in cold weather or soft in warmer weather. In open graded

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mixtures this condition is changed, so softer grades may be used to advantage. The loss on heating and penetration of residue after heating requirements prevent trick manipulation such as adding solvents to pass a penetration test.

Solubility usually means a measure of purity. The benefits of a ductility requirement are much debated, but the results of a ductility test generally line up with penetration to insure a product of the right "stickiness" or consistency. The Oliensis Spot Test also comes in for its share of debate. The test was, and still remains, one of the best tests to determine if proper refining methods have been used to get a homogeneous, "noncracked" product. The only cause for question is that asphalt from some petroleums will react with a positive spot, meaning undesirable, even when properly refined. Yet, the unfailing ability of the test to produce positive spot results on cracked, overheated products, that are not desirable for asphalt cements, still makes its use significant, in spite of exceptions mentioned. Flash point is also an indication of the presence of light fractions used to adjust penetration and also is a safety factor.

The liquid asphalts and emulsions are prepared basically from these asphalt cements obtained by refining petroleum. There are two methods employed to liquify asphalts so they can be mixed cold or at lower temperatures than the 300 F usually used in a hot mix: One method is to thin or "cut-back" the cement with a solvent; the other is to emulsify the cement with water and an emulsifying agent. The questions of viscosity and relative amounts of solvent or water become important testing considerations. It is only the asphalt cement that does the effective binding or cementing. The solvent or water makes for easy mixing at lower temperatures. In specifications for these materials distillation test requirements are introduced with limits for amount of solvents or water as the case may be. Viscosity tests are also introduced to get desired working qualities since much of this material is applied by distributors and must be fluid enough to spray. In the case of RS-2 emulsion for sealing, the material must also have enough body (higher viscosity) to stay on the surface and hold chips. These tests have a practical value in predicting satisfactory behavior.

The residue after distillation is tested to indicate whether the proper asphalt cement was used in making either the emulsion or liquid asphalt; so tests normally applied to asphalt cements (penetration, ductility, solubility, and spot test) are used. With asphalt emulsions, the rate of setting (separation of water and asphalt cement in

the emulsion) is determined by the stone-coating test. This test distinguishes between quick breaking, medium breaking, and slow breaking emulsions by observing the mixing characteristics of the emulsion and a reference stone aggregate. The test also indicates the completeness of separation or "break" by washing the mixture with water and noting the percentage of aggregate remaining coated. This is a very important feature to the user if work is in progress and an unexpected shower hits the spread mixture. There are other tests, but the above represent the principal ones. We feel that the Materials Laboratory can do much for you in getting a satisfactory ingredient for your use. These are not merely tests to be used to form the basis for payment; these are safeguard tests, and if tested material is used you have at least crossed one hurdle for a successful job.

There is nothing likely to be more harmful and to cause more poor work as too little or too much bitumen. The preparation of AH Mixtures is indeed a carefully considered job. One must have something that will not push around in summer weather, a fault often caused by too much asphalt, and still have sufficient coating to prevent the ravages of winter ravel. We have recently added much equipment to the Laboratory which is designed to help arrive at proper bitumen contents giving the best combination of durability and stability. The tendency on maintenance applications, since the gradations are often open and not very susceptible to getting too much asphalt, is to judge the bitumen content visually often leading to an insufficient coating to prevent ravel. The lack of coating is not the sole cause of ravel; very open mixtures not properly sealed with asphalt and chips are susceptible, and many leanlays of coated aggregate can be protected with adequate seals. Here is a time when we can help you again in the field. [We have known satisfactory limits of bitumen for bituminous coated aggregate, and tests of the retained bitumen on the mixed aggregate as applied, particularly to moto paver work, can improve quality.] It is not desirable to have bitumen coatings of two per cent where four per cent or five per cent is indicated. We have had one season of field testing on this kind of work and propose to continue with the coming season. The cooperation of the Maintenance Department in this work is much appreciated.

The work done during the first year was not always perfect. One of the most difficult parts of the test is getting a representative sample from a spread of a road mixture. If you will see that the contractor has equipment to deliver aggregate and bituminous materials in proper proportions; if you will also see that conditions of dampness of aggre-

gate is not excessive, then our tests will be better. Our tests with asphalt emulsion will soon show whether there is too much or too little bituminous material on the aggregate. Design based on such test results is safer and better to follow than someone's visual opinion. Due to the tendency of excess bitumen to drain off the aggregate in these open mixtures, it becomes more difficult to get too much than too little on the aggregate. Due to costly waste of materials, it obviously is not desirable to apply more than is necessary. The use of tested bituminous materials in tested amounts for proportions with aggregate will remove the uncertainties of guessing, and will improve the durability of your work.