

Standard Practice for Testing and Evaluating Cold Mix Patching Materials

AASHTO DESIGNATION: PP21-94^{1,2} (Reapproved 1996)

1. Scope

1.1 This standard provides direction concerning: determination of the potential suitability of components proposed for use in the production of cold mix patching material for roadways; acceptance of cold mix patching materials produced for later use; specifications for cold mix patching materials; and evaluation of the performance of cold mix patching materials in place.

1.2 This standard is applicable to cold mixes manufactured with modified or unmodified asphalt emulsions, cutback asphalts, or combinations. It is also applicable to cold mix patching materials that will be stockpiled, subjected to various climatic conditions, and later retrieved for use in roadway patching operations.

1.3 *This test may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 AASHTO Standards

- R9 Acceptance Sampling Plans for Highway Construction
- TP40 Determining the Percent Asphalt Required for Coating Aggregates Used in Cold Mix Patching
- TP41 Determining the Percent Asphalt Required Based on Stripping of Aggregates Used in Cold Mix Patching Materials
- TP42 Percent Asphalt Based on Drainability of Aggregates Used in Cold Mix Patching Materials
- TP43 Workability of Cold Mix Patching Materials

TP44 Cohesion of Cold Mix Patching Materials

2.2 ASTM Standards

- D8 Definitions of Terms Relating to Materials for Roads and Pavements
- D3665 Random Sampling of Construction Materials
- E105 Probability Sampling of Materials
- E122 Choice of Sample Size to Estimate the Average Quality of a Lot or Process.
- E141 Acceptance of Evidence Based on the Results of Probability Sampling.

2.3 Traffic Control

MUTCD Manual of Uniform Traffic Control Devices

3. Terminology

3.1 Pothole - A localized hole in a pavement surface resulting from breakup of the pavement surface, and possibly the base course, due to the effects of water, temperature, and traffic loading.

3.2 Definitions for other terms used in this standard may be found in ASTM D8 or a standard unabridged dictionary.

4. Summary of Practice - This standard provides for determining the suitability of combinations of aggregate and asphalt binder for use in producing cold mix patching materials; acceptance of cold mix patching materials after production; specifications for cold mix patching materials; and evaluation of the performance of in-place cold mix patching materials.

5. Significance and Use - The requirements contained in this standard may be used to determine compatibility of new or different combinations of cold mix components; to determine the acceptability of

¹ This standard is based on SHRP Product H-348.

² Approved in October 1994, this provisional standard was first published in March 1995.

cold mix materials produced; to compile specifications for cold mix patching materials; and to evaluate the performance of cold mix patching materials that have been placed in the field.

6. Interferences - Differences in the aggregate gradation, geometry, surface properties, and the residual asphalt binder can affect the values obtained when following this standard. Procedural variances can also affect the values obtained. Careful adherence to the standard procedure indicated will decrease the likelihood of differences caused by departures from required procedures.

7. Apparatus

7.1 Apparatus for laboratory tests - Apparatus required is specified by the particular standards referenced herein.

7.2 Apparatus for field evaluations

7.2.1 Traffic control system in accordance with the MUTCD.

7.2.2 Personal safety equipment required for work performed on roadways open to traffic (i.e. hard hat, reflective clothing etc.).

7.2.3 Devices needed for recording the information concerning the observed performance of cold mix patches on the roadway.

8. Materials - Any materials required are specified by the particular standards referenced herein.

9. Standardization - Standardize all equipment used in accordance with the standards referenced for each activity.

10. Hazards

10.1 Observe standard laboratory safety precautions when handling cold mix asphalt in the laboratory.

10.2 Observe the safety procedures required by the Agency and OSHA for activities performed on roadways open to traffic.

11. Sampling, Test Specimens, and Test Units

11.1 Laboratory Tests - Follow the sampling requirements of the referenced standards.

11.2 Field Evaluation - Classifying patches for sampling.

11.2.1 Classify or group together for evaluation purposes the patches that contain the same cold mix material and were installed using the same general procedure.

11.2.2 Classify cold mix material based on mix production using the same job mix formula. For example: the same aggregate source and gradation; the same asphalt binder source, type, and percentage; and the same additives or modifiers would be used in the mix production.

11.2.3 Classify the installation procedure in accordance with the following criteria.

11.2.3.1 Throw and go. Cold mix material is placed into a pothole which may or may not be filled with water and/or contain other debris. The only compaction of the cold mix is applied by traffic using the roadway.

11.2.3.2 Throw and roll. Cold mix material is placed into a pothole which may or may not be filled with water and/or contain other debris. The quantity of cold mix placed in the pothole is sufficient to provide some crown, say 3 to 10 mm, after rolling. Compaction of the patching material is performed by running the wheel of the maintenance patching vehicle over the patch.

11.2.3.3 Semi-permanent. Water and debris is removed from the pothole. Sides of the patch area is squared until vertical sides existed in reasonably sound pavement. The mix is placed into the pothole. The cold mix is compacted with a device smaller than the patch area (i.e. single-drum vibratory roller or vibratory plate compactor).

11.2.3.4 Spray-injection. Water and debris is blown from the pothole. A tack coat of binder is sprayed on the sides and bottom of the pothole. Asphalt binder and aggregate is blown into the pothole. The patched area is covered with a layer of aggregate.

11.2.3.5 Other. Any pothole patching procedure that the agency feels is sufficiently different, from the

four classes previously described, to warrant a separate classification.

11.2.4 Determine the number of patches (samples) needed based on the number of cold mix patching materials under investigation and the purpose for which the test data will be used.

11.2.5 When the number of patches available from 1 class of cold mix material/installation procedure is 30 or less, use all available patches for the evaluation.

11.2.6 When the number of patches from 1 class of cold mix material/installation procedure exceeds the number that can be practically included in the evaluation process, determine the length of pavement that is available for evaluation of the cold mix patch performance. Group together pavement sections that have patches using the same type of cold mix and the same installation procedures for evaluation. When different classes of materials or installation procedures are to be compared, each is evaluated separately.

11.2.6.1 Using a stratified random selection procedure, locate segments of the pavement, which contain, as a minimum, the number of patches required for evaluation as determined in Section 11.1. The segments will have a minimum width equal to the width of the traveled way in one direction, for testing.

Note 1 - When the configuration of the patches under evaluation is such that a stratified random procedure is undesirable, a non-stratified random procedure may be used.

11.2.7 When subsequent evaluations are made of pavement patches that have previously been evaluated, locate, for reevaluation, the same sample segments that were randomly selected for the first evaluation. This allows previous tables and graphs to be updated for valid comparisons.

Note 2 - ASTM D3665 contains a table of random numbers, including instructions for use. R9 and ASTM E105, E122, and E141 contain additional information concerning sampling practices.

12. Procedure

12.1 Laboratory Tests - Job Mix Formula Tests.

12.1.1 When designing the job mix formula to produce cold-mix patching materials, the following items are included among those to be considered. The residual asphalt binder used needs to coat the aggregate well and the aggregate used needs to remain coated after stockpiling and exposure to various climatic conditions; The stockpiled material needs to remain workable and easy to handle with hand shovels (i.e. the outside crust of the stockpile may harden as the residual asphalt binder ages, but this crust needs to prevent the underlying material from hardening, so that when a loader breaks through the outer crust, the material is workable again); and the material needs to remain in the holes when it is placed.

The standard tests specified in this Section (12.1) provide the data required to design cold job mixes that satisfy the above noted needs. These standards can also identify a range of optimum residual asphalt binder contents for job mix designs.

12.1.2 Using the aggregates and asphalt binder material that are proposed for cold mix patching material production, determine the minimum percent residual asphalt required that provides a 90 percent or more coating, and the total asphalt binder material content required to yield said percentage, in accordance with TP40.

12.1.3 Using the aggregates and asphalt binder material that are proposed for cold mix patching material production, determine the minimum percent residual asphalt required that provides a coating ≥ 90 percent after stripping, and the total asphalt binder material content required to yield said percentage, in accordance with TP41.

12.1.4 Using the aggregates and asphalt binder material that are proposed for cold mix patching material production, determine the maximum percent residual asphalt that provides a less than 4 percent drainability, and the total asphalt binder material content required to yield said percentage, in accordance with TP42.

12.1.5 TP40, TP41, and TP42 each require certain standardized curing procedures. The user may wish to determine, in certain specific cases, the properties of a cold mix that has not been cured to a standard

condition. Such a need may be more likely to occur with regard to TP41 or TP42. In such cases, the data needed may be derived by proceeding in accordance with 12.1.5.1 through 12.1.5.4.

12.1.5.1 Prepare 3 to 5 times the minimum number of test samples/specimens required by the standard.

12.1.5.2 Using a random selection procedure, arrange the samples/specimens into 3 to 5 sets for further testing. Each set to contain the minimum number of samples/specimens required by the standard.

12.1.5.3 Test all sets in accordance with the standard except for the curing procedure. Cure 1 set in full accordance with the standard procedure specified. Cure each of the other sets in accordance with the standard procedure except that each of the remaining sets is cured for a different time period in lieu of the endpoint required by the standard. For example, if 4 sets of samples/specimens were prepared, set number 1 is cured in full accordance with the standard; set number 2 is cured $\frac{3}{4}$ of the time required to cure set number 1; set number 3 is cured $\frac{1}{2}$ the time required to cure set number 1; and set number 4 is cured $\frac{1}{4}$ of the time required to cure set number 1.

12.1.5.4 Final test data obtained from each of the 4 sets is then plotted on a graph using curing time as the ordinate and the value of interest as the abscissa. The resulting plots may be used as an aid to judgment in job mix design and field applications.

12.1.6 When the data obtained from completion of Sections 12.1.2 through 12.1.4 is available, the values of the residual asphalt contents determined by coating and stripping represent lower boundaries for the optimum residual asphalt content and the asphalt content determined by drainage represents an upper boundary. As these tests are performed, the compatibility of the particular asphalt and aggregate combination is apparent. If the residual asphalt content for acceptable drainability is less than that for stripping and coating, the combination is unlikely to perform well in the field.

The specified standards allow a range for the optimum asphalt content to be determined and identification of those combinations of asphalt binder and aggregate that would perform poorly in the field in terms of coating, stripping, and drainability.

Note 3 - Reasonable values for the different tests do not guarantee that the material will perform satisfactorily in actual patching applications.

12.2 Acceptance Tests.

12.2.1 Cold mix patching materials produced in accordance with a job mix designed to meet the requirements of Section 12.1 need to be tested to ensure that the material will not perform poorly in the field. This requires quantification of two important characteristics of cold mix patching materials, workability and cohesion.

12.2.2 The standard tests specified in this Section (12.2) provide the data required for acceptance of cold mix patching materials that satisfy the above noted needs. If the cold mix material under consideration was not designed in accordance with Section 12.1, it should be subjected to the tests contained therein to verify the properties needed for acceptable performance.

Note 4 - Tests specified in this Section do not guarantee successful performance of the materials tested; rather, they indicate when the potential for poor performance exists in the proposed materials.

12.2.3 Determine the workability of cold mix patching materials in accordance with TP43. Compare the data obtained with the specification requirements in Section 12.3.

12.2.4 Determine the cohesion of cold mix patching materials in accordance with TP44.

Compare the data obtained with the specification requirements in Section 12.3.

12.3 Specifications.

12.3.1 Cold mix patching material specifications are listed in Table 1.

12.3.2 If a history of laboratory testing and field evaluation has demonstrated that particular local material combinations require different values than those indicated in Table 1 to provide satisfactory performance, modify the values when applied to said materials.