TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/TX-85/46+253-7		

4. Title and Subtitle MODIFIED TEST PROCEDURE FOR TEXAS FREEZE-THAW PEDESTAL TEST	5. Report Date November 1984 6. Performing Organization Code
7. Author(s) Thomas W. Kennedy and James N. Anagnos	8. Performing Organization Report No. Research Report 253-7
9. Performing Organization Name and Address Center for Transportation Research The University of Texas at Austin Austin, Texas 78712-1075	10. Work Unit No. 11. Contract or Grant No. Research Study 3-9-79-253
12. Sponsoring Agency Name and Address Texas State Department of Highways and Public Transportation; Transportation Planning Division P. O. Box 5051 Austin, Texas 78763	13. Type of Report and Period Covered Interim 14. Sponsoring Agency Code

15. Supplementary Notes

Study conducted in cooperation with the U. S. Department of Transportation, Federal Highway Administration

Research Study Title: "Moisture Effects on Asphalt Mixtures"

16. Abstract

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17. Key Words	18. Distribution Statement
stripping, water damage, Texas Freeze-Thaw Pedestal Test, asphalt, asphalt concrete mixtures, stripping aggregates, stripping mixtures	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	24	

Form DOT F 1700.7 (8-69)

MODIFIED TEST PROCEDURE FOR TEXAS FREEZE-THAW PEDESTAL TEST

by

Thomas W. Kennedy
James N. Anagnos

Research Report Number 253-7

Moisture Effects on Asphalt Mixtures

Research Project 3-9-79-253

conducted for

Texas State Department of Highways and Public Transportation

in cooperation with the
U.S. Department of Transportation
Federal Highway Administration

by the

CENTER FOR TRANSPORTATION RESEARCH

BUREAU OF ENGINEERING RESEARCH

THE UNIVERSITY OF TEXAS AT AUSTIN

November 1984

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

PREFACE

This is the seventh in a series of reports dealing with the findings of a research project concerned with moisture effects on asphalt mixtures. This report concerns modification of the Texas Freeze-Thaw Pedestal Test Procedure and includes a description of the test. A previous report, Report 253-3 entitled "Texas Freeze-Thaw Pedestal Test for Evaluating Moisture Susceptibility for Asphalt Mixtures," summarized the findings of a study to evaluate the test as originally proposed by the Laramie Energy Technology Center, adapt it for use by a highway agency, and evaluate the test results to determine if the test could distinguish between stripping and nonstripping asphalt mixtures, and contained a proposed preliminary test procedure. This report contains a modified test procedure based on project experience using the test.

The work required to develop this report was provided by many people. Special appreciation is extended to Messrs. Pat Hardeman and Eugene Betts for their assistance in the testing program. In addition, the authors would like to express their appreciation to Messrs. Billy R. Neeley and Paul Krugler, both of the Texas State Department of Highways and Public Transportation, for their suggestions, encouragement, and assistance in this research effort, and to other district personnel who provided information related to their experience using the test. Appreciation is also extended to the Center for Transportation Research staff who assisted in the preparation of the manuscript. The support of the Federal Highway Administration, Department of Transportation, is acknowledged.

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November 1984

LIST OF REPORTS

Report No. 253-1, "Stripping and Moisture Damage in Asphalt Mixtures," by Robert B. McGennis, Randy B. Machemehl, and Thomas W. Kennedy, summarizes a study to determine the extent, nature, and severity of moisture related damage to asphalt mixtures used in pavements in Texas.

Report No. 253-2, "An Evaluation of the Asphaltene Settling Test," by Thomas W. Kennedy and Chee-Chong Lin, summarizes a testing program designed to evaluate the Asphaltene Settling Test, the test procedure, factors affecting the test results, and relationships between settling time and asphalt characteristics.

Report No. 253-3, "Texas Freeze-Thaw Pedestal Test for Evaluating Moisture Susceptibility for Asphalt Mixtures," by Thomas W. Kennedy, Freddy L. Roberts, Kang W. Lee, and James N. Anagnos, includes a detailed description of the Texas Freeze-Thaw Pedestal Test and describes how it can be used to distinguish between stripping and nonstripping asphalt concrete mixtures or individual aggregates.

Report No. 253-4, "Lime Treatment of Asphalt Mixtures," by Thomas W. Kennedy and James N. Anagnos, summarizes information related to stripping of asphalt mixtures and the use of hydrated lime as an antistripping agent and makes recommendations concerning the construction techniques for adding lime.

Report No. 253-5, "Texas Boiling Test for Evaluating Moisture Susceptibility of Asphalt Mixtures," by Thomas W. Kennedy, Freddy L. Roberts, and James N. Anagnos, includes a detailed description and evaluation of the Texas Boiling Test Method and also describes how it can be used to distinguish between stripping and nonstripping asphalt concrete mixtures or individual aggregates.

Report No. 253-6, "A Field Evaluation of Techniques for Treating Asphalt Mixtures with Lime," by Thomas W. Kennedy and James N. Anagnos details a field study to evaluate the use of dry lime and lime slurry in asphalt mixtures.

Report No. 253-7, "Modified Test Procedure for Texas Freeze-Thaw Pedestal Test," by Thomas W. Kennedy and James N. Anagnos updates and alters the test procedures contained in a previously published report, Report No. 253-3, on conducting the Texas freeze-thaw pedestal test.

ABSTRACT

This report describes the Texas Freeze-Thaw Pedestal Test and modifications of the test procedure. The test can be used to determine whether aggregate-asphalt combinations are susceptible to moisture damage such as stripping and to evaluate the effectiveness of proposed antistripping additives. A guide to the use of this procedure to evaluate both existing and proposed mixtures is included along with a discussion of the applicability of the test.

KEY WORDS: stripping, water damage, Texas Freeze-Thaw Pedestal Test, asphalt, asphalt concrete mixtures, stripping aggregates, stripping mixtures

SUMMARY

The Texas Freeze-Thaw Pedestal Test was developed as a laboratory test that could be used to determine if a proposed asphalt-aggregate mixture is prone to stripping. The procedure tests the water susceptibility characteristics of the mixture by determining the number of freeze-thaw cycles a specimen can withstand before cracking. A cylindrical specimen is compacted using the proposed mixture aggregates in proportion to the job mix formula with approximately 2 percent more asphalt than is prescribed in the field mixture. The specimen consists of uniformly sized aggregate which passes the No. 20 and is retained on the No. 40 sieves. Use of uniformly sized material minimizes the effect of aggregate interlock while maximizing the effect of bond between the aggregate and the asphalt cement and to a certain extent cohesion provided by the asphalt.

The purpose of this research was to evaluate the usefulness of the Water Susceptibility Test developed at the Laramie Energy Technology Center (LETC) to evaluate the water susceptibility of asphalt concrete paving mixtures. Comparisons between results of tests using the LETC procedure and those from the modified test provided a basis for determining the effects of modifying the length of the freeze-thaw cycle, gradations specified, and washing the ground aggregates. Using the results from these studies, the Texas procedure was prepared and is described in this report.

This report provides information related to modifications of the preliminary test procedure previously proposed in Research Report 253-3, "Texas Freeze-Thaw Pedestal Test for Evaluating Moisture Susceptibility for Asphalt Mixtures," and discusses the application of the test to evaluate the moisture susceptibility of asphalt-aggregate mixtures and the effectiveness of antistripping additives.

IMPLEMENTATION STATEMENT

Tentative evaluations indicate that the Texas Freeze-Thaw Pedestal Test can be used to determine whether a mixture is prone to stripping. Therefore, it is recommended that the Districts of the Texas State Department of Highways and Public Transportation use the test procedure to evaluate mixtures and antistripping additives. Modifications of the preliminary test procedure have been made based on the results of the districts and the experience of project personnel. As additional experience is obtained, additional modifications and improvements can be made to improve the ability of the test to detect mixtures which are susceptible to moisture damage and to evaluate antistripping agents.

Because of the long term nature of the test procedure, the test does not lend itself to job control or evaluations requiring immediate information. The test is basically intended for preconstruction evaluations and for evaluation of aggregate-asphalt sources and proposed antistripping additives.

TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION

Water-induced damage of asphalt mixtures has produced serious distress, reduced performance, and increased maintenance for pavements in Texas as well as other areas in the United States. This damage occurs due to stripping of asphalt from aggregate and in some cases possibly due to softening of the asphalt matrix. In an attempt to reduce the magnitude of the problem, various antistripping agents have been incorporated into asphalt mixtures. Unfortunately, there has been no way to evaluate their potential effectiveness or to evaluate proposed aggregate-asphalt combinations to determine their water susceptibility.

In response to the above problem, the Center for Transportation Research and the Texas State Department of Highways and Public Transportation through their cooperative research program initiated a research project to study water-induced damage to asphalt mixtures in Texas and, as part of this study, to evaluate various proposed test methods for ascertaining the water susceptibility of asphalt mixtures and the effectiveness of antistripping agents.

As a result of the study, three test methods were identified and based on preliminary tests were found capable of distinguishing between mixtures known to be susceptible and those known to be not susceptible to water damage. These tests are

1. Texas Freeze-Thaw Pedestal Test,
2. Texas Boiling Test, and
3. Indirect Tensile Test with moisture conditioning.

Based on an evaluation of the Texas Freeze-Thaw Pedestal Test, a preliminary test procedure (Ref 1) was proposed which has been used on a trial basis by various districts and by project personnel.

This report describes modification of the test procedure and discusses the application of the test to evaluate moisture susceptibility as asphalt-aggregate mixtures and the effectiveness of antistripping additives. Future laboratory and field evaluations may result in additional modifications to improve the efficiency and capabilities of the test.

CHAPTER 2. TEXAS FREEZE-THAW PEDESTAL TEST

STRIPPING

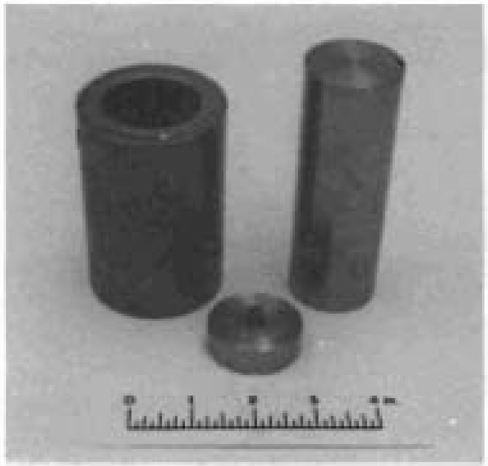
Stripping is the physical separation of the asphalt cement from the aggregate produced by the loss of adhesion between the asphalt cement and aggregate which is primarily due to the action of liquid water or water vapor and involves an interaction of the asphalt and aggregate surface. A loss of adhesion could also be due to

1. smooth aggregate surface texture, and
2. aggregate surface coatings.

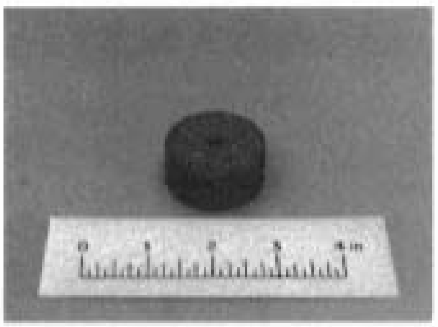
While all sizes of an aggregate may exhibit stripping, the finer aggregate is of primary concern. If stripping is confined to the larger aggregate, the damage is minimal; however, if the finer aggregate, which constitutes the basic matrix, strips, severe damage results.

TEXAS FREEZE-THAW PEDESTAL TEST

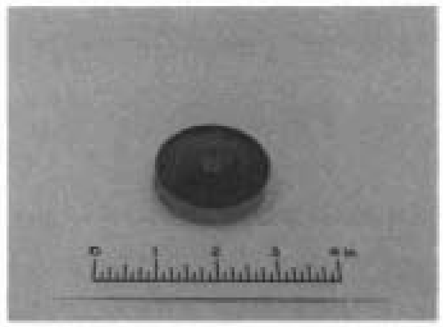
The Pedestal Test is based on the water susceptibility test developed at the Laramie Energy Technology Center (Ref 2) which was modified and evaluated with respect to Texas aggregate-asphalt mixtures. Figure 1 illustrates the compaction equipment, specimen, and freeze-thaw cycling. The resulting test determines the number of freeze-thaw cycles required to induce cracking on the surface of a specimen (Refs 1 and 3). The test procedure involves subjecting miniature asphalt-aggregate briquets to repeated freeze-thaw cycles (15 hours at 10°F and 9 hours at 120°F) while submerged in distilled water. The briquets, which are highly permeable, allow easy penetration of water and are designed to minimize mechanical interlocking of the aggregate particles by using a uniform aggregate size. Thus, the briquet properties are largely determined by the asphalt-aggregate bond. Moisture susceptibility of an asphalt concrete mixture is evaluated by determining the freeze-thaw cycles required to crack a briquet seated on a beveled pedestal. Mixtures requiring less than 10 cycles are considered to be very moisture susceptible while mixtures with values in excess of 25 to 35 are relatively resistant. Early work with the test was performed by Peterson and Plancher



(a) Compaction mold, base plate, and ram, from left to right.



(b) Specimen.



(c) Stress pedestal.

(d) Specimen in water.

Fig 1. Texas Freeze-Thaw Pedestal Test; special compaction equipment, specimen, stress pedestal, and prepared specimen ready for freeze-thaw cycling.

(Ref 2). Details of the preliminary test procedure are contained in Reference 1.

MODIFICATIONS

After evaluation and use of the preliminary test procedure (Ref 2), the following modifications of the test procedure are recommended to reduce field problems and to minimize the difficulty and cost of performing these tests.

Modification of the Aggregate Gradation (Section 3)

1. Original:
   a. Normal--Test conducted on material passing No. 20 sieve and retained on the No. 35 sieve.
   b. Finer Material--Test conducted on material passing the No. 40 sieve and retained on the No. 80 sieve.
2. Modification:
   a. Normal--Test conducted on material passing the No. 20 sieve and retained on the No. 40 sieve or the No. 35 sieve, whichever is normally used by the agency.
   b. Finer Material--Test conducted on material passing the No. 40 sieve and retained on the No. 60 sieve or passing the No. 60 sieve and retained on the No. 80 sieve.

Based on the Water Susceptibility Test developed at the Laramie Energy Technology Center, the preliminary procedure specified that the aggregate normally should be in the size range passing the No. 20 sieve and retained on the No. 35 sieve. Many agencies, however, normally do not use the No. 35 sieve. Thus, the test requirement often caused a need for special handling and the purchase of an additional sieve.

Tests to evaluate this factor indicated that the use of the No. 40 sieve rather than the No. 35 produced no significant effect on test results. Thus, the size range was modified to include material passing the No. 20 sieve and retained on the No. 40 sieve or No. 35 sieve, whichever is normally used by the agency.

The original method also provided an option that allowed material in a finer size range, passing the No. 40 sieve and retained on the No. 80 sieve, to be tested. Experience indicated that the size range was too large and that inconsistent results could be expected. Thus, the procedure was modified to allow material finer than the No. 40 sieve to be tested as follows:

1. Material passing the No. 40 sieve and retained on the No. 60 sieve.
2. Material passing the No. 60 sieve and retained on the No. 80 sieve.

Modification of Crushing Requirement (Section 3)

1. Original: The preliminary procedure suggested that the aggregate should be crushed to produce the required size distribution, but allowed uncrushed material to be used.
2. Modification: The aggregate should be tested in the form that will be used in construction. Crushing is not recommended unless the material is to be crushed in the field or the finer materials are not representative of the coarse material.

The original procedure suggested that the aggregate should be crushed to the required size range, but allowed for testing of uncrushed material. This assured that aggregates were representative of the finer material, which is normally responsible for severe stripping of a mixture, that crushing does not change the stripping characteristics of the aggregate, and that the aggregate is coarser than required.

The modified procedure recommends sieving the aggregate to obtain material meeting the specified gradation. This assures that the material constituting the aggregate sample is the same in all respects except size and that the aggregate is not already finer than the specified size range. Crushing is only recommended if the required size range is not available or if the aggregate is to be crushed during construction. In the latter, it is still preferred that material in the required size range be obtained by sieving the actual crushed material rather than crushing the aggregate in the laboratory.

Modification of Washing Requirement (Section 3)

1. Original: The preliminary procedure suggested that the aggregate should be washed prior to testing, but allowed unwashed material to be tested.

2. Modification: The aggregate should be tested in the form that will be used in construction. Washing is not recommended unless the materials are to be washed in the field.

Since field aggregates are not always washed prior to mixing and since surface coatings contribute to stripping, aggregate should be tested in a manner similar to the field use of the aggregate. This allows the test to evaluate the effect of aggregate coatings in the field. Therefore, the modified Texas Freeze-Thaw Pedestal Test procedure provides for testing of both washed and unwashed aggregates.

Modification of Compaction Procedure (Section 3)

1. Original: The preliminary procedure required a constant compaction load of 6200 lbs. applied for 20 minutes.
2. Modification: The constant compaction load of 6200 lbs. should be applied for 15 minutes.

Testing indicated that after 15 minutes no additional compaction occurred; preparation time is thus significantly reduced.

Modification of the Freeze and Thaw Cycle (Section 4)

1. Original: One cycle--12 hours at 10°F followed by 12 hours at 120°F.
2. Modification: One cycle--15 hours at 10°F followed by 9 hours at 120°F.

The preliminary test procedure requiring a 24-hour cycle consisting of 12 hours at 10°F followed by 12 hours at 120°F required personnel to be available at times which were not part of normal working hours unless automatic temperature chambers were available. Thus, the 24-hour freeze-thaw cycle was modified to consist of 15 hours at 10°F followed by 9 hours at 120°F, thus allowing the test to be conducted during the normal work day. The results of a study to evaluate this change indicated that the change did not significantly affect test results.

TEXAS FREEZE-THAW PEDESTAL TEST PROCEDURE

Scope

1.1 The method is used to evaluate the moisture susceptibility of asphalt aggregate mixtures or the effectiveness of antistripping additives by determining the freeze-thaw cycles required to crack a briquet seated on a beveled pedestal.

Apparatus

2.1 Ovens--An electric oven capable of maintaining temperatures of 302 ± 5°F is used to heat the asphalts and to heat or dry the aggregates. An oven capable of maintaining temperatures of 120 ± 5°F is used to perform the thaw cycle portion of the test procedure. A suitable environmental chamber can be used for complete freeze and thaw cycling.

2.2 Sample Mixing Apparatus--Suitable equipment for hand mixing the aggregate and bituminous materials is required and includes round mixing pans of various sizes, bowl-shaped dishes such as porcelain evaporating dishes, stainless steel teaspoons, small masonry pointing trowels, and spatulas.

2.3 Balance--A balance with a capacity of 5 kg or more and sensitive to at least 0.01 grams.

2.4 Briquet Mold--A 1018 cold rolled steel molding cylinder with 1.626 in. inside diameter and 3.5 in. height, as shown in Figure 2.

2.5 Base Plate--A 1018 cold rolled steel cylindrical molding base plate with 1.624 in. base diameter and height of at least 0.5 in. as shown in Figure 2. The nipple on the top is 0.25 in. in both diameter and height.

2.6 Ram--A 1018 cold rolled steel ram 1.625 in. in diameter by 4.5 in. in height, as shown in Figure 2.

2.7 Stress Pedestal--A 10° beveled acrylic plastic (Lucite) pedestal 2.00 in. in diameter by 0.45 in. in height with a nipple on the top 0.25 in. in diameter by 0.14 in. in height as shown in Figure 3. If flat bottomed jars are used in the freeze-thaw cycling, the bottom of the stress pedestal can be flat.

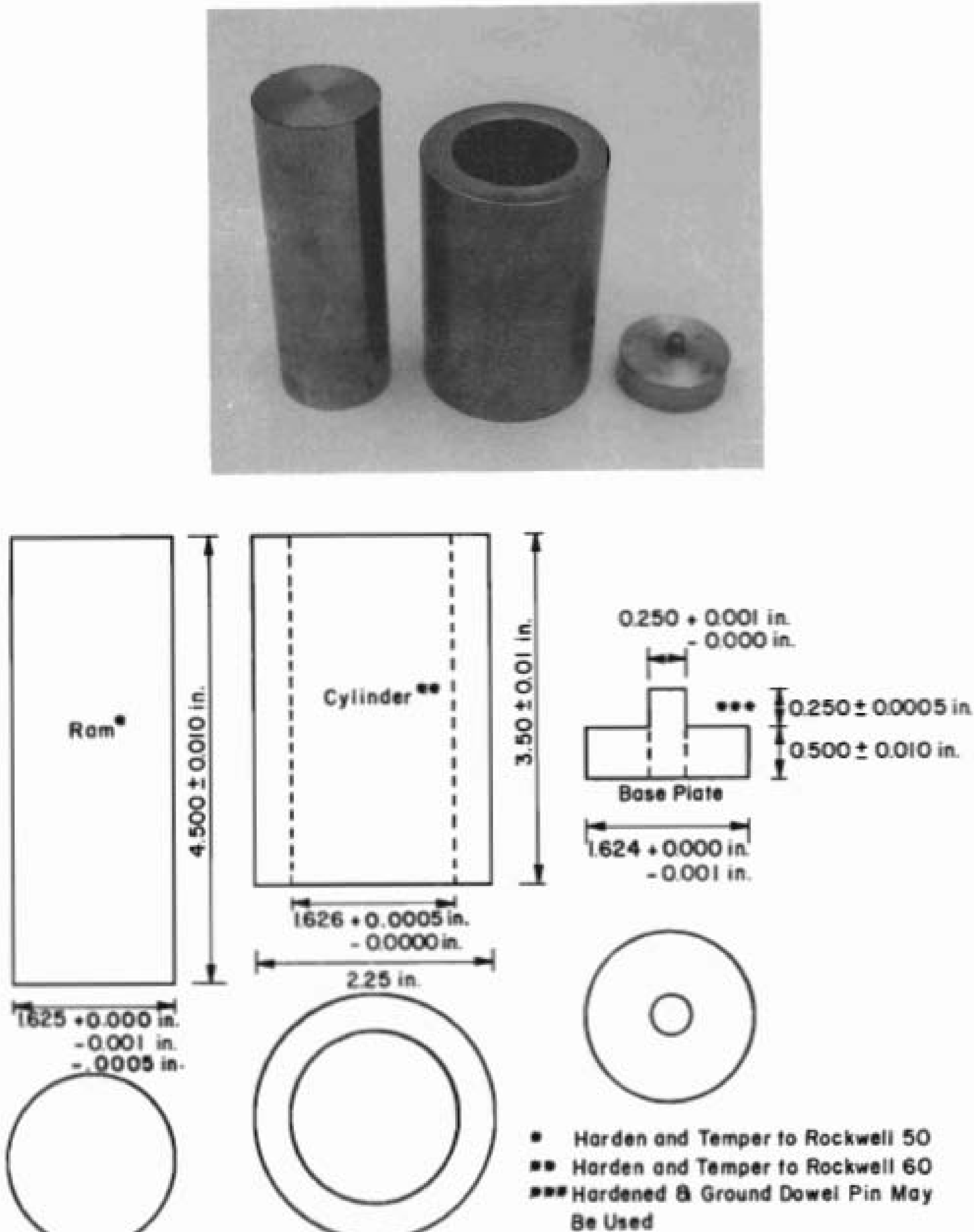
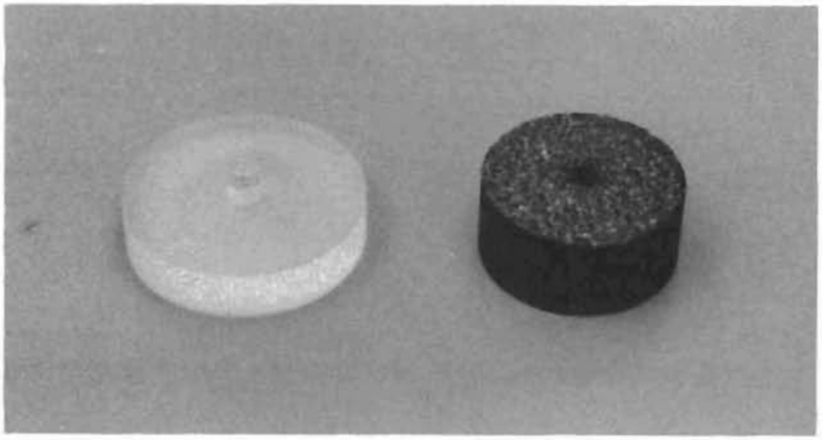


Fig 2. Briquet compaction mold, ram, and base plate dimensions (Ref 1).



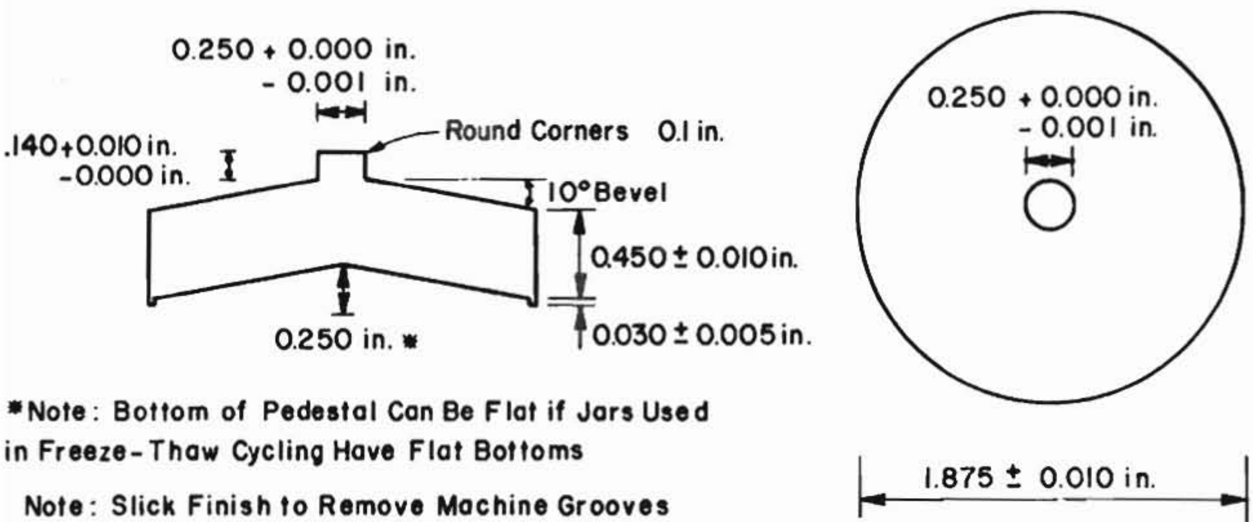


Fig 3. Stress pedestal dimensions (Ref 1).

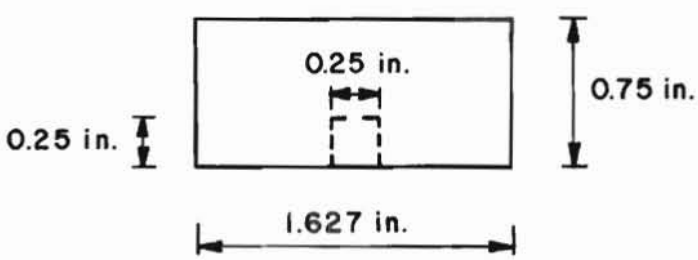


Fig 4. Briquet dimensions (Ref 1).

2.8 Molding Press--A compression testing machine capable of maintaining a constant force of 6200 ± 50 lb on the specimen for 15 minutes.

2.9 Jars--Clear polystyrene, 8 oz., straight side, wide mouth, 2-3/8 in. diameter x 3-3/8 in. high, with plastic cap (Scientific and Industrial Sales and Services, Inc., Fort Worth, Texas, catalog no. 70-400).

2.10 Environmental Chamber or Refrigerator--The freezing cycle of the test procedure is performed in an environmental chamber or refrigerator capable of maintaining 10 ± 5°F.

2.11 Miscellaneous Apparatus--Thermometers, scoops, gloves, and tweezers.

Test Specimens

3.1 Selection of Asphalt Content for Specimens--Determine the optimum asphalt content for the paving mixture for which the individual aggregate or mixture is a part by performing Test Method Tex-204-F (Ref 6). The asphalt content for a trial mixture specimen is recommended to be the optimum from Tex-204-F plus 2.0 percent. If some of the aggregate is not coated well, if the mixture appears wet, or if the mixture appears dry, adjust the asphalt content until satisfactory coating is achieved. For tests of individual aggregates, the first trial specimen can be prepared at the design asphalt content for the mixture in which the aggregate is to be used. Based on the results, subsequent specimens should be prepared at one percent increments above or below this initial trial value. The objective is to coat the particles with approximately the same asphalt film thickness as in mixture design method Tex-204-F. As a general guide, there should be very little asphalt left on the mixing bowl after the material is removed for compaction.

3.2 Preparation of Aggregates--The aggregates should be sieved to obtain material passing the No. 20 and retained on the No. 40* sieves. The material should be dried to a constant weight at 302 ± 5°F), and cooled at room temperature.

* The No. 35 sieve can be used in place of the No. 40 sieve.

Note: If a field mixture of several aggregate components is to be evaluated, the pedestal specimen should have components that represent each of the aggregate sources and sizes. All materials should be combined into the specimen mixture in the same proportions as in the field mixture. Aggregates should be sieved to obtain the material retained between the No. 20 and the No. 40* sieves. Crushing is not recommended unless the material is to be crushed in the field or the finer materials are not representative of the coarse material. Since some aggregates contain surface coatings, the tests should be conducted without washing the aggregates prior to specimen preparation unless the materials are to be washed in the field. If individual components of the aggregate mixture are to be evaluated, the material should be tested without crushing, if the proper size of the aggregate is available. Finer crushed or noncrushed components can be tested, if necessary, by sieving to the interval between the No. 40 and No. 60 sieves or the No. 60 and No. 80 sieves.

3.3 Preparation of Mixtures--Weigh out about 60 g of aggregate for each test specimen 0.75 ± 0.005 in. in height. Multiple specimens may be prepared at the same time. Heat the dry aggregate and the asphalt cement at 302 ± 5°F for one hour. After both materials are hot, pour the required asphalt cement into the preweighed aggregate. Mix the aggregate and asphalt as thoroughly and rapaidly as possible. Reheat the mixture at 302 ± 5°F for one hour; stir the mixture; heat the mixture for an additional hour at 302 ± 5°F. Stir the mixture and divide into small dishes each containing about 60 g if multiple specimens are to be fabricated; heat the mixture in each dish for an additional one-half hour; remove from the oven, and cool for over 30 minutes before compaction begins. Discard all of the unused mixture that is not compacted into specimens during the same day it is prepared.

3.4 Trial Mixture to Secure Proper Height of Specimens--Test briquets are to be 1.627 in. in diameter and 0.75 ± 0.005 in. high. Each specimen has a mounting hole in the bottom, 0.25 in. in both

* The No. 35 sieve can be used in place of the No. 40 sieve.

diameter and height (see Fig 4). Trial pedestal briquets are to be prepared to determine the quantity of material that is required to meet height restrictions. Because of the required accuracy on the height of the specimens, an initial trial mixture is to be prepared for each test material. Once the weight of mixture required to obtain the sample height of 0.75 ± 0.005 in. is determined, the record testing can be completed. To determine the weight of mixtures required to obtain the sample height, the following procedure is recommended. Prepare sufficient material for 3 to 5 briquets according to Section 3.3. Compact the first specimen using 55 g of asphalt mixture according to Section 3.5, and measure the height of the specimen. If the specimen lies outside the height tolerance of from 0.745 to 0.755 in., adjust the weight of the specimen according to the following proportioning scheme and prepare a second specimen:

$$W_2 = W_1 \quad \frac{.75}{h_1}$$

where

W_2 = weight of mixture required to secure a .75 in. pedestal specimen, g ,

W_1 = weight of mixture in first specimen, g , and

h_1 = height of first specimen, in.

Compact the second specimen according to Section 3.5 and measure the height. If the height is within tolerances, prepare a third specimen using the weight of the second specimen, W_2 , according to Section 3.5 and use these two specimens for record testing. Discard all remaining material. If the height of the second specimen lies outside the height interval, prepare a third specimen by proportioning in the same way as for the second specimen, compact according to Section 3.5, and measure the height for compliance. Usually three specimens are sufficient to determine the volume of mixture required to produce a height within the tolerable range. Prepare at least two specimens and test using the procedure described in Section 4 and use the average as the test result for the individual material or mixture.

3.5 Compaction of Specimens--Remove the dish containing 50 to 60 g of the asphalt mixture, which has been heated at 302 ± 5°F for 20 minutes. Place the assembled cylinder mold and base plate on the balance; quickly transfer the amount of the asphalt mixture required to produce a 0.75 ± 0.005 in. high compacted briquet into the cylinder mold; insert the molding ram; and compact by applying a constant load of 6200 ± 50 lb. for 15 minutes. Less than two minutes should elapse between the time that the mixture is removed from the oven and the time that the load of 6200 ± 50 lb. is reached. Extract briquet from mold and allow to cool. Measure height of briquet. Cure the briquet on a flat surface at 75 ± 5°F for three days before freeze-thaw cycling.

Freeze-Thaw Test Procedures

4.1 Water Immersion--Place the briquet on the stress pedestal with a gentle twisting motion. Place the stress pedestal with briquet in a jar and add distilled water until it is approximately one-half inch over the briquet. Seal the jar.

4.2 Freeze-Thaw Cycling--Place the jar in a temperature controlled room or refrigerator at 10 ± 5°F for 15 hours. Remove the jar from the freezer and submerge it in warm water for about 45 minutes. The warm water is to be at room temperature, approximately 75 ± 10°F. Place the jar in a 120 ± 5°F oven for 9 hours.

4.3 Visual Observation--At the end of each complete cycle, carefully examine the briquet surface for appearance of cracks. If no crack is visible, subject the specimen to an additional freeze-thaw cycle and examine again for cracks. Repeat this cycling until a surface crack appears.

Report

5.1 Report the number of freeze-thaw cycles required to crack the briquet. The value reported is to be an average of all test results and is to be in whole cycles.

CHAPTER 3. APPLICATION AND USE OF TEXAS FREEZE-THAW PEDESTAL TEST

The Texas Freeze-Thaw Pedestal Test is one of three tests recommended for the evaluation of the moisture susceptibility of asphalt-aggregate mixtures. The other two tests are the wet-dry Indirect Tensile Test (Ref 4) and the Texas Boiling Test (Ref 5).

The Texas Freeze-Thaw Pedestal Test can evaluate the moisture susceptibility of an aggregate-asphalt mixture and the effectiveness of antistripping additives prior to use of the mixture in a pavement.

This evaluation can occur in a number of forms, such as

1. evaluating proposed field mixtures;
2. evaluating the various components of the aggregate mixture;
3. determining the amount of moisture susceptible aggregate which is allowable;
4. evaluating new aggregate sources; and
5. evaluating the effectiveness of proposed remedial measures, such as
    - a. washing aggregate,
    - b. crushing aggregate,
    - c. using antistripping additives, such as
        - (1) liquid antistripping agents,
        - (2) hydrated lime, and
        - (3) Portland cement.

Since the basic use of the results from this test procedure is to analyze the water susceptibility of asphalt mixtures, tests should be on mixtures with components in the proportions of the job mix formula. If test results indicate that the mixture strips or is a borderline stripper, then tests can be performed on the individual components of the mixture to determine which aggregate is causing the problem. Since the severity of stripping is determined largely by the extent to which the fine aggregate strips, these tests should concentrate on the fine aggregate.

Experience to date indicates that the test is relatively accurate; however, the testing procedure is time consuming and thus is more applicable to preconstruction evaluations or evaluations of proposed aggregate sources or common aggregate asphalt combinations with or without antistripping additives.

The wet-dry Indirect Tensile Test provides an evaluation of the mixture with the proper proportions of aggregates and asphalt and at a density simulating constructed mixtures. This test is relatively easy to conduct, but does require a moderate amount of time. The results are also sensitive to differences in moisture content. The Texas Boiling Test, while probably not as accurate, is a very quick and easy test to conduct and thus can be used during construction. In addition, as with the Pedestal Test, individual aggregates can be tested with the proposed asphalt.

Generally, it has been found that the Pedestal and Indirect Tensile Tests will produce results which are more favorable to the use of hydrated lime as compared to liquid additives. The results of the Boiling Test, on the other hand, will produce results which are more favorable to the use of liquid additives.

REFERENCES

1. Kennedy, T. W., F. L. Roberts, K. W. Lee, and J. N. Anagnos, "Texas Freeze-Thaw Pedestal Test for Evaluating Moisture Susceptibility for Asphalt Mixtures," Research Report 253-3, Center for Transportation Research, Bureau of Engineering Research, The University of Texas at Austin, February 1982.

2. Plancher, H., G. Miyake, R. L. Venable, and J. C. Peterson, "A Simple Laboratory Test to Indicate the Susceptibility of Asphalt-Aggregate Mixtures to Moisture Damage During Repeated Freeze-Thaw Cycling," Proceedings, Canadian Technical Asphalt Association Meeting, Victoria, B.C., 1980.

3. Kennedy, T. W., "Use of Hydrated Lime in Asphalt Paving Mixtures," Bulletin No. 325, National Lime Association, March 1984.

4. Kennedy, T. W., and J. N. Anagnos, "Wet-Dry Indirect Tensile Test for Evaluating Moisture Susceptibility of Asphalt Mixtures," Research Report 253-8, Center for Transportation Research, Bureau of Engineering Research, The University of Texas at Austin, December 1984.

5. Kennedy, T. W., F. L. Roberts, and J. N. Anagnos, "Texas Boiling Test for Evaluating Moisture Susceptibility of Asphalt Mixtures," Research Report 253-5, Center for Transportation Research, Bureau of Engineering Research, The University of Texas at Austin, January 1984.

6. Texas State Department of Highways and Public Transportation, "Manual of Testing Procedures," Bituminous Section, 200-F Series, 1978.