FINAL REPORT

DETECTION OF ANTISTRIPPING ADDITIVES WITH QUICK BOTTLE TEST

by

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(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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SUMMARY

Several variations of the quick bottle test were evaluated to determine the procedure having the best repeatability. Naphtha was selected over kerosene and white gas as the solvent for use in the test, and room temperature was selected over 140°F as the test temperature.

The procedure incorporating these variables was used to test several concentrations of three additives. The results revealed that in some cases the presence of additives was indicated in concentrations considerably less than the dosages specified in the field in Virginia. For this reason, the test is useful to check for the presence of additive, but not to indicate the concentration.

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INTRODUCTION

New methods of combining antistripping additives with asphalt cement necessitate a test to determine if an additive is present in the proper amount, if it has been thoroughly mixed, and that it is effective. Antistripping additives are required in all plant mix with the exception of that containing carbonaceous aggregate; therefore, the cost warrants attention to proper handling procedures. Although guidelines for handling and mixing are offered by the manufacturers of the additives, there is a gray area concerning the methods of mixing and heat instability. It is generally accepted that asphalt-additive blends are unstable at prolonged high temperature; however, instability appears to be dependent on asphalt and additive types, time of exposure, and storage temperature.

A quick test for evaluating the presence of additive in the asphalt immediately before it is mixed with aggregate would be helpful. Variations of a quick bottle test have been used by various state agencies and additive manufacturers, and this investigation considered several of these. In selecting the conditions of the test, those that appeared to meet the needs of the Department of Highways and Transportation were given precedence.

PURPOSE AND SCOPE

The objectives of the investigation were as follows:

1. Determine whether kerosene is a satisfactory substitute for naphtha as a solvent.

2. Determine whether tests performed at room temperature give results consistent with those from tests performed with a 140°F water bath.

3. Determine the repeatability of the test method.

4. Evaluate current approved list of 12 antistripping additives.

After preliminary testing, objective 1 was modified to include white gas and objective 4 was modified to limit the evaluation to only three additives, but the additives were tested at several concentrations. All tests were performed in the laboratory on samples blended and prepared there.

LABORATORY PROCEDURE

The quick bottle test is performed in the following basic steps.

1. The asphalt cement is cut with a solvent to a workable consistency. Naphtha is used most frequently, but kerosene and Coleman fuel have been used.

2. About 50 grams of Ottawa sand are placed in a small glass jar and covered with water. The jar is often placed in a water bath to attain a specified test temperature. Test temperatures that have been used are room temperature, 140°F, and 160°F.

3. One gram of the cutback asphalt-additive blend is added to the jar and the jar is shaken for approximately 30 seconds.

4. The water is poured from the jar and the asphalt-sand mixture placed on a paper towel and examined for coating. The degree of asphalt coating on the sand particles is a qualitative determination.

The initial steps of the investigation were (1) to determine the amount and type of solvent that satisfactorily diluted the asphalt cement to a workable consistency, and (2) to determine the test temperature that yielded satisfactory repeatability. The resulting procedure was used to test three additives at several concentrations to gain an indication of the minimum concentration of additive that would give a positive test result.

RESULTS

Solvent

Naphtha and white gas mixed better with asphalt cement than did kerosene. Naphtha was selected because the composition of white gas would be more variable than naphtha and possibly affect

the final consistency of the blend of asphalt cement and solvent. Caution should be exercised when mixing naphtha with asphalt cement because of the flammability of naphtha. It should be used in a well ventilated area and preferably under a hood.

It was found best to add 18 grams (approximately 25 ml) of naphtha to 100 grams of asphalt at a temperature of 150°-175°F. After mixing, the mixture should be weighed and additional solvent added if necessary to compensate for evaporation.

Test Temperature

The test was performed at test temperatures of 140°F and room temperature, which was approximately 72°F. Room temperature is preferable because no water bath would be required; however, 140°F water baths are available in district labs. The results indicated that tests at room temperature were comparable in repeatability to tests performed at 140°F; therefore, room temperature was selected as the test temperature.

Detection of Additive

The test method using naphtha and room temperature, described later under RECOMMENDATIONS, was used to test several concentrations of three additives. This part of the investigation was expected to reveal the minimum concentration that indicates the presence of additive in the asphalt.

Table 1 reveals that additive is indicated as being present with a minimum concentration of 0.1% to 0.2%. Specified field doses are usually no less than 0.25%; therefore, if the procedure described is used as a field test, it will not indicate whether the specified amount is present.

CONCLUSIONS

1. The quick bottle test can be used to detect the presence of antistripping additives.

2. The quick bottle test indicates the presence of additive when the concentration is less than the concentration usually specified in Virginia.

Table 1. Results of Bottle Tests on Various Concentrations of Additives

Type of Additive	Concentration, % by weight of asphalt cement					
	0.05	0.10	0.12	0.15	0.20	0.50
Pave Bond Special	Negative	Positive	-	-	-	Positive
ACRA 500	-	Negative	-	Positive	-	Positive
Kling Beta XP-251	Negative	-	Negative	-	Positive	Positive

RECOMMENDATIONS

The following test procedure can be used to check asphalt cement for the presence of antistripping additives. The test would be useful to ensure that additive is not excluded inadvertently and that blending equipment is functioning properly.

1. Place 50 grams ± 1 gram of C-190 Ottawa sand into a 2-oz. capacity glass bottle, and add enough distilled water at room temperature to cover the sand 1/2 in.

2. Prepare a cutback asphalt. Weigh 100 grams ± 1 gram of the asphalt to be tested and heat until thoroughly liquid. Cool the asphalt to 150° to 175°F and add 18 grams ± 1 gram (approximately 25 ml) of VM and P naphtha and mix thoroughly. When mixing is complete, check weight of cutback. Add naphtha to compensate for evaporation if necessary, and remix.

3. When cutback is 90° to 100°F, add 1 gram ± .1 gram to the jar containing sand and water at room temperature. Place cap on jar and shake vigorously for 20 to 30 seconds.

4. Examine mixture in jar for coating; then drain water, spread mixture onto a paper towel, and examine again for coating.

5. If the sand is completely coated, the test result shall be reported as positive. If the coating is irregular and deficient, the test result shall be reported as negative.