EXTRACTION OF ARAMID FIBERS FROM FIBER REINFORCED ASPHALT CONCRETE - SPECIAL TEST METHOD

Prepared by

Waleed Zeiada, Ph.D.
Postdoctoral Scholar

Shane Underwood, Ph.D.
Assistant Professor

School of Sustainable Engineering and the Built Environment
Department of Civil, Environmental, and Sustainable Engineering
Arizona State University, Tempe, AZ 85287-5306

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FORTA Corporation
100 Forta Drive
Grove City, PA 16127-9990

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1.0 Summary

The purpose of the test method is to determine the amount of recovered fiber from fiber reinforced asphalt concrete (FRAC). The test method utilizes ASTM D-2172 to extract the asphalt binder from FRAC samples. The amount of fiber remaining after extraction is measured by washing, sieving, manually removing the fiber, and recording total fiber mass. Due to the light weight nature of aramid fiber and residual AC binder present on the fiber after extraction, the extracted fiber content will measure higher than the amount of fiber added at the time of mixing. The amount of extracted fiber is reported as a percentage of total sample size. CAUTION: Solvents used as part of ASTM D2172 are dangerous and specific safety concerns and procedures in ASTM D2172 must be followed. This document provides an overview of the procedure but more details and background involving the extraction process can be found elsewhere[1].

2.0 Sample

Samples shall be obtained from plant mixed FRAC. Sample size should be determined based on Table 1 of ASTM D2172. A minimum of three samples should be tested for each plant mixed FRAC sampled.

3.0 Solvent Type

The recommended solvent for this process is Trichloryl Ethylene, which was found to yield no negative reaction with the fiber produce. If this solvent is not available then the chosen solvent should be verified for no reaction to reinforcing fibers. To test reactivity, soak a minimum 0.5 g sample of fibers in solvent overnight (12 hours minimum). Record the mass of fibers before and after soaking to the nearest 0.01g. Fiber loss to solvent should be determined as a percentage loss compared to the original mass by Equation (1):

$$L = \frac{M_1 - M_2}{M_1} \times 100 \qquad (1)$$

M_1 = Mass of the fibers prior to soaking (g),
M_2 = Mass of the fibers after soaking (g), and
L = Loss (%).

Loss must not exceed 1.0 percent of original mass.

4.0 Procedure

4.1 Complete extraction in accordance with ASTM D2172 with the exception that the ashing method, or any method that heats the sample above 400°F must not be used.

4.2 Dry and record the extract as directed in ASTM D2172. Transfer extract to a suitable sized mixing bowl and add sufficient water to immerse the extract. Add a few drops of soap to the extract and thoroughly agitate using hand methods for a minimum of 90 seconds. After agitation, wash the extract over a stacked No. 50 and No. 200 sieve for a minimum of 120

seconds until soap solution is removed. Pick up the extracted fibers manually using tweezers and store them in a clean can with a closed top.

4.3 Perform a sieve analysis of the washed and dried extract, utilizing sieve sizes from the original asphalt concrete mix design. Manually separate out fibers during weighing of separated sizes and add to fibers previously separated in step 4.2.

4.4 Soak the extracted fibers in the solvent for an hour at room temperature. Then remove the remaining solvent and dry the washed extract and separated fibers to a constant mass at 230 ± 9°F. Record the mass of the separated fibers to the nearest 0.01 g.

4.5 Calculate the extracted fiber percentage by Equation (2):

$$F = \frac{M_2}{M_1} \times 100 \tag{2}$$

M_1 = Total sample mass prior to extraction (g),
M_2 = Mass of separated fibers (g), and
F = Extracted fibers (%).

4.6 Report the percentage of extracted fibers to the nearest 0.001 percent.

[1]Kaloush, E.K., Biligiri, K.P., Zeiada, W.A., Cary, C., Dwivedi, S., Reed, J., and Rodezno, C., "Evaluation of FORTA Fiber-Reinforced Asphalt Mixtures Using Advanced Material Characterization Tests – Evergreen Drive, Tempe, Arizona", Final Report Submitted to FORTA Corporation, Grove City, PA, April 2008.