DHT-3

Unburned Fuels in Drum Mix Asphalt Plants

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Introduction

Incomplete combustion of liquid fuel oils in drum mix plants often results in contamination of the asphalt cement. Unburned fuel becomes dissolved in the asphalt and may soften it, causing unstable mixtures which lead to rutting, shoving, flushing, etc. This study was an effort to conduct a field survey to determine the magnitude of this problem in hot mixes.

Currently, the specification governing the quality of fuels used in asphalt mixing plants reads as follows: "The burner or combination of burners, and type of fuel used shall be such that in the process of heating the aggregate to the desired or specified temperature, no residue from the fuel shall adhere to the heated aggregate." This study will also determine if a specification change for the quality of fuel used is needed and if so, it will be prepared and submitted to the Department.

Report

The concern is unburned fuels in drum-mix asphalt plants and the effects of these unburned fuels on mix properties and performance. There have been problems associated with certain hot-mix jobs that have been blamed on unburned fuels; however, it is often hard to confirm these theories. Unburned-fuel mix-related problems are mostly isolated problems and often appear to be a lack of quality control on the contractor's part. Also, many of these quality control problems are being blamed on the quality of the fuels being used by the contractors.

If unburned fuels are a suspected problem, there needs to be some quick, easy way to detect this problem. Several components of the plant and/or properties of the mix that may suggest unburned fuels are present include:

1. The burner - A properly operating burner will have a constant uniform roar. A coughing, sputtering, spitting burner is a sign of incomplete combustion. If there is incomplete combustion, the number of BTU's available to heat and dry the aggregate decreases, thus the possibility of additional problems exists. Therefore the sound of the burner is very important in proper plant operation.

2. The color of the aggregate leaving the drum mixer - If there are brown stains on the aggregate and those aggregates do not have a coating of asphalt cement, beware. This coloration is a good indication that a problem exists.

3. Bag house problems (if so equipped) - The bag house bags become coated and, thus, unable to remove dust particles from the stack discharge. This coating of the bags also increases the potential for a fire.

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4. Other behavior of the mix - If the mix doesn't seem to lay or roll properly; if the mix leaves an oil residue on one's hand after it is squeezed; or if the unburned fuel can be smelled in the mix, possible problems exist. (Ref. 1, 3, & 4)

If these signs are present, and especially if density is a problem, it might be wise to explore the possibility of unburned fuels. In addition to recognizing some of these symptoms, there are tests that can be run on the mix to determine if unburned fuels are present. At the present time, most District labs do not have the equipment to run those tests; however, D-9 does have the equipment and knowledge to properly conduct these tests. Tests that D-9 would suggest running on the mix include:

1. Recovery of asphalt from bituminous mixtures by the Abson Process. (Tex-211-F)

2. Determination of hydrocarbon volatile content of bituminous mixtures. (Tex-213-F)

3. Test for flash and fire points of petroleum materials by Cleveland Open Cup. (Tex-504-C) (Ref. 2)

These tests and others may be used to confirm the presence of unburned fuels; however, the quantity needed to cause problems to a mix still remains unknown. As stated earlier, it is thought that unburned fuel is a quality control problem. This would include problems ranging from not preheating heavy fuels, to incorrect fuel rates to the burner, to physical burner problems. With such a range of potential causes of problems, there appears to be no single answer. The best that can be expected is that if problems are suspected and confirmed, they be corrected as soon as possible.

Some Districts have thought that the quality control problems were due to the quality of the fuels used. With this in mind, these Districts have added a note to their General Notes and Specification Data Sheets to limit the types of fuels permitted. The additional note reads: "The burner fuel for this project shall consist of natural gas, liquified natural gas, fuel oil (ASTM D-396, Grades number 1 and 2), butane and/or propane." Thus, these Districts are eliminating the heavy fuels that must be pre-heated and the other types and grades of fuels with known contaminates. This does not guarantee that the problem of unburned fuel will not occur, but it does reduce the possibility of the problem being caused by the fuel quality. The Districts that use this note verify the fuel quality by the Contractor's invoices. These Districts have not encountered any major problems with Contractors not being able to follow the additional note. (Ref. 3)

In summary, if unburned fuel oil is suspected as a cause in a mix problem, it should be confirmed by tests as mentioned above. To trace this problem to its source, particular attention must be paid to the type of fuel oil being used, burner fuel rate, and burner efficiency.

REFERENCE LIST

1. Kennedy, Thomas W.; Scherocman, James A.; and Tahmoressi, Maghsoud. Drum Mix Plants — Equipment and Operations, FHWA/TX-87/54+440-1F, Austin: University of Texas Press, 1987.

2. Materials and Tests Division of the Texas State Department of Highways and Public Transportation. Manual of Testing Procedures, Austin: Texas State Department of Highways and Public Transportation, Vols. I-II, 1983.

3. Interviews with various personnel in Districts 6, 7, 8, 13, 14, 15, 16, 21, 23 during 1987.

4. Interviews with Materials and Tests Division personnel in 1987.