

## **414 ASPHALTIC CONCRETE FRICTION COURSE (ASPHALT-RUBBER)**

Asphalt-rubber asphaltic concrete friction course (ARACFC) is the asphalt rubber version of the 407 Standard Specifications for ACFC. Crumb rubber is blended with the asphalt cement to form an asphalt-rubber binder. The blending takes place in a reaction tank at temperatures between 325°F (163°C) and 375°F (191°C) for at least one hour. During this time, the rubber partially melts and is thoroughly mixed with the asphalt cement to form a binder material.

ARACFC Standard Specifications are similar to the 407 Standard Specifications for ACFC in both plant and field inspection requirements. Subsection 1009 (Asphalt Rubber Material) of the ADOT Standard Specifications will also be useful. The other plant processes and field operations are nearly identical to non-AR asphalt paving. Most of the inspection procedures and documentation requirements are covered in Subsection 407 and the "Asphaltic Concrete" section of this manual. This subsection of the manual contains additional inspection procedures and contract administration requirements for specification 414.

### **414-3 Materials**

#### **414-3.03 Mineral Admixture**

Like ARAC, ARACFC uses 1.0% mineral admixture to help prevent stripping. The type will be stipulated in the mix design. Mineral admixture certification and documentation requirements are identical to those in the "Mineral Admixture" subsection of the "Asphalt Concrete" section of this manual.

#### **414-3.04 Bituminous Material**

The requirements for asphalt-rubber are found in Subsection 1009 of the Standard Specifications. Type B crumb rubber is the only type allowed for ARACFC. Material properties, as well as mixing, temperature, storage, and certification requirements are all found in Subsection 1009.

The Contractors must submit an asphalt-rubber design showing the amount of rubber that will be blended with the asphalt cement. This must be done before a mix design can be developed.

### **414-4 Mix Design**

ADOT produces a mix design for all asphalt-rubber products. The mix design procedure is the same as described in Subsection 413-4 of this manual. The Resident Engineer is responsible for ensuring that the time periods for reviewing and verifying a mix design by the Department are strictly followed unless different arrangements are made in writing with the Contractor. Therefore, it is important that the Resident Engineer check with the acceptance lab to ensure that they can complete the verification testing within the prescribed time.

### **414-5 Mix Design Revisions**

Occasionally, a revision to the mix design will be required to adjust for unanticipated or changing field conditions, or for a change in aggregate properties. When the change to a mix design is an adjustment to the asphalt-rubber content, then the Contractor is not entitled to any additional costs for operating the plant or equipment. If more asphalt-rubber is needed, the Department will pay for the material at a unit price below or at the contract unit price.

Cases where a Contractor is entitled to additional plant and operating costs include changes in the aggregate source, required changes in the asphalt-rubber properties, or changes in the aggregate properties themselves without changing sources. These are situations where the properties of the mix may change significantly enough to affect plant procedures and lay down or compaction methods.

#### **414-6 Acceptance of Materials**

One of the primary functions of field personnel in any asphalt paving operation is the acceptance of the materials used to produce the pavement. Specifications 407, 413 and 414 are based on instructing the Contractor how to produce the asphalt and how to place it. The Department takes a very active role in overseeing production and placement. The Inspector must be actively involved in the acceptance of materials as they are both produced and placed. This is especially true for asphalt-rubber products.

Mineral aggregate must be sampled and tested on a daily basis as the stockpiles are being produced. Don't wait until asphalt production to start aggregate testing; it is usually too late. Experienced Inspectors in asphalt paving know that the crushing operation has the single biggest influence on mix properties and will concentrate their efforts in that area to ensure uniformity and consistency.

If there is an existing stockpile the Contractor wishes to use, then the stockpile should be sampled in several places and tested for gradation, sand equivalent, and fractured course aggregate (crushed faces). Ask the Contractor for test results that were performed on that stockpile.

Asphalt-rubber content for process control must be measured by the Contractor and witnessed by the Inspector at least four times per shift using the Contractor's nuclear gage. It is important for the Inspector to check the Contractor's nuclear gage at the beginning of the job for correlation with the Department's gages. The daily standard counts should be checked for significant variations. Nuclear gages are required to be calibrated for each asphalt mix.

Subsection 1009 of the Standard Specifications requires the Contractor to have equipment at the plant that can be used for checking the viscosity of the asphalt-rubber. The Contractor must test each batch of asphalt-rubber binder and the results documented.

#### **414-7 Construction Requirements**

Please note that the requirements for incorporation of the mineral admixture into the mix are the same as for most other types of asphalt. Refer to the "Construction Requirements" sub-section in "Asphalt Concrete" section of this manual for further information and instructions.

The method in which the asphalt-rubber is introduced into the mix must be carefully inspected. On a typical batch mix or drum mix plant (refer to Exhibit AC-3), asphalt cement is stored in a storage tank and a series of lines and pumps move the asphalt cement from the storage tank to the pugmill or drum mixer. There is an automatic feedback system that controls the amount of asphalt cement based on flow of mineral aggregate and admixture. When asphalt-rubber is used, a reaction tank is introduced between the asphalt cement storage tank and the pugmill or drum mixer. The reaction tank is used to blend together the asphalt cement and crumb rubber. Typically a line will lead directly from the reaction tank to the pugmill or drum mixer with no automated control system that regulates the flow of the asphalt-rubber based on the flow of the mineral aggregate and admixture. This type of set up is unacceptable to the Department. An automated control system needs to be in place for asphalt-rubber asphaltic concrete mixing just like it does for regular asphaltic concrete mixing. Do not allow the Contractor to manually control the addition of asphalt-rubber. This method is imprecise and prone to human error that will adversely affect the consistency of the mix produced by the

plant. It is recommended that the Resident Engineer address this issue at the pre-paving conference.

Another important difference in asphalt-rubber paving is that surfaces need to be tacked with asphalt cement; no cutbacks or emulsions are to be used. Although not harmful to asphalt-rubber, volatiles in asphalt-rubber can react with cutbacks and emulsions, so they will not bond as well as asphalt cement.

The temperature requirements and placement dates are much more restrictive for ARACFC than for other types of asphaltic concrete. Strict adherence to the temperature specifications is required because ARACFC is placed in thin lifts that cool very rapidly. The rate of cooling is directly related to surface temperatures and weather conditions.

This quick cooling characteristic makes early compaction of the mix an important task. It is important that the right equipment be used and kept within the prescribed speed and distance from the paver. The compaction process should be well documented. Pick up of the material is often a problem with compaction equipment. Do not use blotter sand to prevent pick up since the sand only clogs the pores of ARACFC and reduces its drainage ability. The specifications address this problem by requiring the compactor wheels to be wetted with water to prevent pick-up. Specifications also permit soapy water, or a product approved by the Resident Engineer. The Department discourages the use of lime water since it can't be sprayed in a fine mist. The high alkalinity of the lime tends to sterilize the surrounding soils and makes landscaping or re-vegetation more difficult later on.

The specifications require construction of a transverse construction joint if the paver is stopped for more than three minutes. This is to ensure that there is adequate time to place and compact the mix that is held in the laydown machine before the mix cools. The thin lift as well as the greater surface area due to the voids will cause this mix to cool very rapidly.

Some other inspection points include:

1. Verify that the crumb rubber and asphalt cement have been in the reaction tank for at least one hour prior to use in the mix.
2. Keep a daily count of the number of bags of crumb rubber used.
3. Asphalt-rubber that has been kept in the reaction tank for more than 10 hours at temperatures above 325°F (163°C) should not be used. "Carry-over" should be allowed to cool before the 10-hour time limit and then re-heated. In some cases, the Central Lab can test carry-over to see if it is still suitable. See Subsection 1009 of the Standard Specifications for further information.

For asphalt-rubber paving, the Department generally requires a full time Inspector at the plant to oversee the stockpiling and batching operations including the blending of the asphalt-rubber. The Project Supervisor should carefully outline the duties of the Inspector at the plant so that the most effective use can be made of this person. Section 304 of the ADOT's Training Manual for the Inspection of Bituminous Roadway Construction should serve as a guideline for assigning inspection duties.

#### **414-8 & 9 Method of Measurement & Basis of Payment**

The method of measurement for ARACFC is the same as for Specification 407 ACFC, except as follows;

1. Asphalt-rubber is measured and paid instead of asphalt cement.

2. Subsection 414-9 does not allow the 414-6.03(B) nuclear gauge test results to be used as a method of measurement for asphalt-rubber. Asphalt-rubber must be weight directly, or calculated from the weight of asphalt cement and crumb rubber used minus the waste.
3. There are no price adjustments for compaction since the acceptance is based on rolling pattern only.