The Importance of Asphalt Content Ignition Furnace Correction Factors

By Maria Knake, Laboratory Assessment Program Manager
Posted: October 2010

Thanks to new technology, many of our materials testing procedures are becoming more automated. It only makes sense that advancements in computing, measurement science, and electronics have had a positive effect on laboratory testing. Testing machines with a "set it and forget it" operation allow us to perform more testing with less staff in a shorter amount of time. These advancements certainly make life in a testing laboratory easier and, in many cases, the benefits directly correlate to cost savings. However, some testing equipment has become so easy to use that we tend to trust the data obtained without question. The truth of the matter is, no matter how easy a device is to use, it is still possible to introduce errors into the test results. These errors may be inherent to the test equipment or may be caused by the operator. In any case, in order to achieve meaningful test results, we must always determine where potential errors in testing exist and then find ways to eliminate, control, or correct for them.

The ignition furnace, used for the determination of the asphalt content of asphalt mixtures, is one example of technology that has significantly changed the construction materials testing industry. This device, developed by the National Center for Asphalt Technology (NCAT), is commonly used for quality control, research, and acceptance testing of asphalt mixtures. Popularity of the ignition furnace test (AASHTO T 308 and ASTM D6307) has increased in recent years due to elevated health and safety concerns associated with the use of solvent extraction testing. As an added benefit, the ignition furnace test procedure can reduce the time it takes to determine or verify the asphalt content of a test specimen by several hours. The theory behind the test is quite simple: an asphalt mixture sample is placed into the furnace and the asphalt is burned off the mixture at a very high temperature. The mass loss that occurs during the ignition process can be directly correlated to the asphalt content. Once cooled, the remaining aggregate can be used for further testing and analysis.

While the test procedure itself is straightforward, potential for errors still exist. One of the major contributors of error is the loss of fine aggregate particles in the ventilation system during ignition, which can cause the calculated asphalt content to be greater than the actual asphalt content. Another concern is that the high temperature in the furnace (approximately 538°C) sometimes causes breakdown of aggregate particles. In many cases, this breakdown is significant enough to change the aggregate gradation.

To account for errors in the calculated asphalt content, an asphalt correction factor must be determined and applied to the test results. While the procedures for determining the asphalt correction factor for AASHTO T 308 and ASTM D6307 vary slightly, the concept is essentially the same: laboratory-mixed specimens with a known asphalt content are burned in the furnace, the known asphalt content is compared with the test results, and a correction is determined. *[Editor's Note: ASTM refers to the correction as a "calibration factor."]*

To account for potential aggregate breakdown, AASHTO T 308 requires that a check be performed to determine whether an aggregate correction factor is needed in addition to the asphalt correction factor. *[Editor's Note: An aggregate correction factor is not required for ASTM D6307.]* The aggregate correction factor is determined by comparing burned aggregate samples to a "blank," non-burned sample. Both the burned and blank samples are sieved, and the sieve analysis results compared. An aggregate correction factor is required if there are significant differences between the two gradations.

To further complicate matters, studies have shown that asphalt and aggregate correction factors are unique to each ignition oven furnace, regardless of manufacturer. In addition, the correction factors may also vary by mix design and sample type. Asphalt binder content results may be affected by the type of aggregate in the mixture and the ignition furnace. Correction factors must be determined before any acceptance testing is completed, and should be redetermined each time a change in the mix ingredients or design occurs. Any changes greater than 5 percent in stockpiled aggregate proportions require a new correction factor. This can be a time-consuming and cumbersome process for laboratories that may test several different mix designs each paving season. However, AASHTO T 308 does allow for historical data or scientific studies to be used in lieu of using the described procedures, provided that the testing agency provides reference to the studies or data.

Some of the most common testing errors observed during AASTHO re:source on-site assessments of the ignition furnace test are related to the determination of correction factors. View the Ignition Furnace Table to see an explanation of these errors, as well as possible solutions.

The focus with any test procedure (automated or not) should always remain on obtaining reliable and meaningful results. Eliminating, controlling, or accounting for testing errors are problems that can be tricky to solve. If you have specific questions regarding ignition furnace correction factors, or any test procedure, please contact us.

Editor's Note: This article was updated in June 2016.