Maximum Specific Gravity, G_{mm}, Using the CoreLok™ Method

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Introduction:

Maximum specific gravity, G_{mm}, is routinely determined for hot mix asphalt (HMA). The value determined by this test is used as the basis for calculation of air voids for compacted HMA samples. This application brief provides information for an alternative method that can be performed in five minutes with the CoreLok vacuum system.

The current method (Rice Test), ASTM D2041 and AASHTO T209, although repeatable for a particular site, can encounter the following problems:

a- The results can vary between laboratories if the same vibration equipment is not employed.
b- The aggregates with high absorption potential can absorb water during this test, requiring a 2 to 2.5 hour "Dry Back" method.
c- During the vacuum and agitation process, liquid asphalt can strip from the aggregates, causing higher than actual G_{mm} values.

The CoreLok system provides the private and public testing agencies an alternative to the current test method with a uniform vacuum system and a testing process that requires minimal sample exposure to water.

The CoreLok Method:

The CoreLok G_{mm} procedure involves placing a sample of dry mixture into a plastic, puncture resistant bag which is placed inside another plastic bag. The sample is then placed into the CoreLok chamber. Closing the chamber door will automatically start the vacuum process. In approximately 2 minutes, the sample is evacuated to 29.7 in Hg. The sample is now sealed within the bag in an evacuated state.

The sample is then completely immersed in water and cut open. This allows the water to enter the bag and subsequently fill all void spaces completely saturating the material. Once water has completely filled the bag the sample and bag are weighed under water. Knowledge of the weight of the bag, sample, and the combined weight of the bag and sample under water allows for calculation of the maximum specific gravity.
The entire process takes less than five minutes with very high degree of repeatability.

Benefits of the CoreLok Method:

The efficiency of the existing Rice test depends on the vibration system, the vacuum pump condition, the amount of water that is absorbed by the aggregate material and asphalt stripping that occurs during the test. As the vacuum level is increased in the container, bubbles will begin to form, releasing water vapor. To maintain the appropriate

vacuum level within the container, the sample has to be agitated effectively during this process. Also, water is constantly drawn into the vacuum pump and the mix, deteriorating the pump performance and requiring a lengthy water absorption correction (Dry Back Method) to be performed on mixes with high absorption potential.

The CoreLok method offers the following advantages over the standard (Rice Method):

1- The test procedure is extremely simple and intuitive and can be done in less than five minutes.
2- A two hour material absorption correction (Dry Back) is no longer necessary, since exposure to water under vacuum is significantly reduced in the CoreLok method.
3- The CoreLok vacuum system is automatic with predetermined settings. The results do not depend on the vibration system and the varying equipment used, reducing the potential variability between test sites.
4- Vacuum is applied while the sample is dry, reducing the chance of water absorption by the aggregates and eliminating the damaging water vapor effect on the vacuum pump.
5- The sample "self compaction" is eliminated during this process. Samples with high percent AC can "self compact" when piled in the container for the G_{mm} test, prior to inducing vacuum.
6- Potential of asphalt stripping is eliminated in this method since the vacuum operation is performed with dry sample and no vibration.

Data:

Table 1 is a summary of typical data taken by InstroTek and other agencies. The maximum specific gravity calculated by the CoreLok method and the Rice test is reported in g/cm^3. The estimated error between the current test and the CoreLok method is ±0.004 for variety of mix types reported in this brief.

TABLE I: Typical comparisons of G_{mm} results for variety of asphalt mixes.

Sample	Gmm CoreLok	AASHTO T-209	Difference
12 mm mix	2.504	2.500	0.004
19 mm mix	2.607	2.608	-0.001
25 mm, Base mix	2.578	2.578	0.000
12 mm mix	2.537	2.534	0.003
SuperPave, 25 mm	2.602	2.610	-0.008
		Estimated Error	**±0.004**