Highway Engineering Materials - CE 400
Spring 2009
Mixture Labs
Draft Due April 22nd, 2009
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April 4th–15th, 2008

T1) AASHTO T312: Preparing HMA by Means of SGC

Test Summary

This standard covers the mixing and compaction of HMA specimens using the Superpave Gyratory Compactor (SGC).

Equipment needed:

Oven, mixer, aggregates, asphalt, bowls, mixing tools, pan, weigh scale, SGC, mold and plates, filter paper, lubricating dust, and a 3½ computer diskette. Also need gloves, glasses, and protective clothes.

Mixing Procedure

1. Weigh the appropriate aggregate fractions according to the gradation table below into a bowl and heat for 24 hrs at the mixing temperature. The aggregate weight shall be such that the compacted specimen has a dimension of 150 mm diameter by 115±5 mm height. Generally, this requires 4500 to 4700 gm of aggregates. ***Required****: complete the table below.*
2. Heat the binder at the mixing temperature, which is defined as the temperature at which the kinematic viscosity of the binder is approximately 0.17±0.02 Pa.s. Record the temperature.
3. Charge the mixing bowl with the heated aggregates and add the asphalt binder to achieve 5% by weight of total mix. ***Required***: *you will need to calculate the weight of binder to be added to the aggregates*.
4. Mix quickly and thoroughly to yield a mix having a uniform distribution of asphalt binder.
5. Place the mixture in a shallow flat pan and short-term age it for about 2 hrs at the compaction temperature.

Sieve Size	% Passing	Cumulative % retained	% retained	Weight Retained (g)
12.5				
9.5				
4.75				
2.36				
1.18				
0.6				
0.3				
0.15				
0.075				
Pan				
Total			100%	

Compaction Procedure

1. Preheat the mold and the loose sample for about 2 hrs at a temperature equal to the field compaction temperature, which is defined as the temperature at which the un-aged binder has a kinematic viscosity of 0.28 Pa.s (determined from the viscosity vs temperature chart). TA will provide you with the compaction temperature.
2. Set up the Gyaratory to perform a design number of gyrations N_{des}, which depends on the anticipated level of traffic (ESAL's). For the purpose of this lab, compact the specimen to 100 gyrations, which corresponds to 3 – 30 10^6 EASLs (AASHTO).
3. Let the sample cool to 60 ºC (use the fan) before extracting it to ensure it does not fall apart when you remove it. Make sure to remove the filter papers as soon as possible.
4. Record the final sample height and weigh the sample on the scale.
5. Use the sample height to estimate the G_{mb} from the volume of the sample and the recorded weight.

This test is to be performed by all groups. The output values are not accurate and need to be corrected with the measured G_{mb} in the following tests. The final output is the plot of the actual (corrected) $\%G_{mm}$ versus the number of gyrations (log scale). Note: you will need the G_{mm} value for this mix determined next week.

T2) AASHTO T308: Determination of Asphalt Content using the Ignition Oven

Test Summary

This procedure allows quick determination of asphalt binder content by heating the mix at a very high temperature and burning away the binder. It is ideally suited to field QC/QA applications.

Equipment needed

Oven, ignition oven, GLOVES, GLASSES, AND PROTECTIVE CLOTHES.

Procedure

1. Preheat a loose HMA sample in an oven to reduce the time it would take to heat in the ignition oven.
2. Weigh the sample (usually about 1½ Kg), place it in ignition oven, and turn it on.
3. Oven gives automatically the weight of the mix as the binder gets burned away.
4. At end of test and after the sample has cooled down, weigh again the remaining aggregate and calculate the percent binder content.

TA will perform this test for all groups.

T3) AASHTO T209: Maximum Theoretical Specific Gravity of HMA Mix

Test Summary

This test gives the Maximum Theoretical Specific Gravity (G_{mm}) or Rice Specific Gravity using loose mix. It is a property necessary for computing the Effective Specific Gravity of the aggregates (G_{se}), which is necessary to compute the amount of binder absorbed by the aggregate.

Equipment needed

Weigh scale, a larger flask (2.0 L), vacuum pump, vibration table, and pressure gauge.

Procedure

1. Weigh the loose mix in the air. The sample weight shall be according to the AASHTO T209 standard for the sample, which is based on the maximum aggregate size.
2. Weigh the flask filled to the mark with water.
3. Put the sample in the flask and partially fill it with water (about 1-2 in above the sample). Apply vacuum (27mm to 37mm of Hg) and vibration for about 15 minutes until all entrapped bubbles are removed.
4. Weight the flask filled with the sample and water to the mark.
5. Calculate the G_{mm} of the mix and the G_{se} of the aggregate blend (*You will need the P_b and G_b*).

T4) ASTM D6752: Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method

Test Summary

This procedure uses an automatic vacuum sealing apparatus (*CoreLok*) to seal asphalt concrete samples for the purpose of measuring the bulk volume, which is used to determine the Bulk Specific Gravity of the compacted mix, G_{mb}.

This standard deals with the compaction of HMA cylinders by means of the Superpave Gyratory Compactor (SGC) and the determination of the bulk specific gravity of asphalt concrete G_{mb} as a function of the number of gyrations.

Equipment needed

The *Corelok* device, including the bag, scale, and water bath.

Procedure

1. Weigh the compacted specimen dry.
2. Trim the sharp edges of the sample using sand paper.
3. Select a bag and check to make sure it is free of holes! Weigh the bag.
4. Carefully place the specimen inside the bag and place it inside the *Corelok* chamber.
5. Turn machine on to effectively seal the sample inside the bag.
6. Carefully remove specimen (bagged) and place it in the water bath at 25 ^{o}C and weigh it submerged.

7. Remove it from bag and weigh it again to make sure there was no leak in the bag. If the there is a difference of more than 5gm, dry the specimen in the oven and repeat the test.
8. Perform G_{mb} calculations and call this one the Corelok G_{mb}.

This test is to be performed by all groups. Typically this test and the following test are conducted on the compacted specimens 24 hours after compaction. For the purpose of this lab, we will perform this test on the specimens that were created last week.

T5) AASHTO T166: Bulk Specific Gravity of Compacted Bituminous Mixtures Using the Saturated Surface-Dry Specimens

Test Summary

This procedure determines the SSD bulk volume of the HMA compacted specimen, which is used to determine the Bulk Specific Gravity of the compacted mix, G_{mb}.

Equipment needed

Scale, water bath, and a towel.

Procedure

1. Weigh the compacted specimen dry.
2. Submerge in the water bath (25 ^{o}C) for 4±1 minutes and record the submerged mass.
3. Remove the specimen and quickly dry the surface and weigh. Record the SSD mass.
4. Perform G_{mb} calculations and call this one the SSD G_{mb}.

This test is to be performed by all groups. Typically this test is conducted on the compacted specimen 24 hours after compaction. For the purpose of this lab, we will use the specimens created last week.

Required (using all test results)

Do the following twice using the Corelok G_{mb} and SSD G_{mb} values and compare:

1- **Plot of the corrected %Gmm vs Number of Gyrations (on a log scale),**
2- **Determine %AV,**
3- **Calculate the VMA,**
4- **Calculate the VFA.**

No. of Gyration	Height (mm)	Gmb	% Gmm	% AV	VMA	VFA
8						
10						
20						
30						
40						
50						
60						
70						
80						
90						
100						