BUREAU OF MATERIALS
MATERIALS PROCEDURES

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Testing of HMA Cores

PURPOSE:

To establish a standard procedure for the testing of HMA cores for thickness and air voids.

REFERNCES:

Special Provisions, NJDOT Standard Specifications
NJDOT B-3 in NJDOT Standard Specifications
NJDOT B-4 in NJDOT Standard Specifications
AASHTO T 166 Method A for Bulk Specific Gravity of Compacted HMA
AASHTO T 209 Theoretical Maximum Specific Gravity of HMA
AASHTO T 269 Percent Air Voids in Compacted Dense and Open Asphalt Mixtures

Instructions:

I. Receiving HMA cores

1. General Receiving Instructions

   A. Cores and the completed random location paperwork are delivered to the Density Lab no later than 2 pm unless special arrangements have been made.
   B. The cores are delivered in a ventilated container that has been sealed by the Resident Engineer with a NJDOT seal. The seal number is recorded on the random location paper that is placed in the container.
   C. Cores are delivered in a lot that consist of 5 cores. Lots that are missing a core or contain damaged cores will not be accepted. In certain circumstances, one core may

be delivered to replace a statistical outlier.

D. The random location paperwork that accompanies the cores must be complete, and any changes in the location(s) must be written on the form. The reason for the location change must also be noted on the paperwork.

E. Cores must be marked (numbered) for identification and the core numbers must match the number on the accompanying random location paperwork.

F. Cores must be free of foreign materials such as tape, foundation material, soil, paper, or foil. Refer to AASHTO T 166 section 4 for additional details regarding core specimens.

G. The random location form will indicate whether the cores are to be tested for thickness and air voids or air voids only.

2. Core Rejection

A. Cores that are damaged, unmarked, that have incomplete paperwork, or paperwork that is erroneous may be rejected.

B. Incomplete core lot(s) may be rejected.
NOTE: Prior to rejecting any cores check with the ME in the Coring Section to confirm rejection.

D. Rejected cores are placed back into the transport container along with the paperwork. The container is closed and a new seal is placed on it.

E. Return the sealed container to the transport person.

3. Core Acceptance

A. Cores that are deemed acceptable and that have complete paperwork are received into the Density Lab.

B. Accepted cores and the paperwork are placed in order on a cart and the drying process begins.

C. The core information is transferred into the black log book. The person delivering the cores must initial the entry.

D. The core information is then entered onto the “s” drive in the computer under the cores received section. A tentative test date is also entered.

E. A copy of the core paperwork is given to the Coring Unit.

F. Send an e-mail to Coring Unit that lists the sample numbers in Site Manager.

G. Cores that are accepted but appear different than others in the lot may be photographed.

H. If damaged cores are accepted because the Contractor doesn’t want to recore, they may be photographed.

I. No core(s) will be tested by the Density Lab until it has dried in the temperature controlled lab for a minimum of 48 hours.

II. Measuring the Individual Thickness of HMA Cores for Thickness Lots

A. Clean off Asphalt Stabilized Open Graded, soil or DGA from the bottom of the core.

B. Use a caliper measuring device. Make sure it is set to zero and to the correct units.
C. Take 4 length measurements approximately 90 degrees apart around the circumference of the core using the calipers to measure the distance from the top of the core to the bottom of the first lift. If the measuring point is not representative of the plane of the cores lift because of a small projection or depression, rotate the core slightly about its axis and take the measurement. Record measurements on the worksheet.
D. Read each of the 4 measurements for the lift to the nearest 0.01 inch and record on the worksheet (LB-286).
E. Repeat steps B and C for total thickness.
F. Calculate the total thickness by adding the individual lift thicknesses and record.

III. Splitting HMA core lifts for air void testing

A. If the core lot requires a thickness measurement make sure that the core has been measured prior to splitting.
B. Using a chisel and hammer, separate the core lifts and remove any part that is not necessary for testing.
C. Thin lift cores such as BRIC and HPTO and any core less than one inch (may or will) require wet saw cutting to avoid being damaged during the splitting process. If core comes in with no bottom lift the core won't need saw cutting. On rubber mixes that has extra material on bottom or cores with matting on bottom of lift, we will saw cut the core to clean off excess material without damaging the core. .Because of the wet sawing, the cores must be dried for 48 hours prior to being tested.
D. Once the lift to be tested has been separated. Take a thickness measurement using a ruler. Record the results to nearest 0.1 inch on the LB 286.
E. Cores to be tested are arranged in order by number and lot on a cart. The 48 hour drying process begins now.
F. Cores are tested in the order that they are received. Recores and Lot 1 cores are given priority over other lots once they have dried for 48 hours. These cores require a faster turnaround time.

IV. Bulk Specific Gravity of Compacted HMA (Method A)

A. Check cores and accompanying paperwork to ensure that they are correct and match.
B. Confirm that the cores are dry. If they are not dry, continue with drying process.
C. At the beginning of each workday, check the temperatures of the water baths in the lab to ensure that they are 25 +/- 1°C (77 +/- 1.8°F).
D. At the beginning of each workday, check the specific gravity of the water baths using a hydrometer. If the specific gravity is lower than 0.997 or higher than 1.0, change the water. Change the water when it appears dirty in order to avoid issues with the specific gravity.
E. Test the core sample for bulk specific gravity in accordance with AASTO T 166, Method A.
F. If the core specimen bubbles while immersed, record it on the worksheet.

G. Any questions and/or issues while performing this test for bulk specific gravity should be brought to the attention of the Principal Engineer of Bituminous Testing or Lead Technician of the Pavement Density Lab as they occur.
H. If an error occurs in the weighing of the core and the core has already been placed in the water bath, the core must be completely dried again before a retest can be done.
I. Test results are entered from the worksheet to the computers "S" drive upon completion.

V. Calibration of Pycnometers

A. Every Monday or whenever the water is changed, calibrate all eight pycnometers that are in use. Record the calibration (weight of the pycnometer in water) on the calibration sheet. Distribute a copy to all personnel in the Density Lab. Keep the results of previous calibrations in a file in the Density Lab.
B. Once every year, calibrate the pycnometers according to Procedure BIT-13. Fill out proper paperwork and put in file with all calibration sheets.

VI. Theoretical Maximum Specific Gravity of HMA

A. Testing for maximum specific gravity will be performed in accordance with AASHTO T 209.
B. Use test method NJDOT B-3 to randomly select the core samples on which the maximum specific gravity will be determined for use in air voids calculation. NOTE: For Recore Lots, do not randomly select a core for maximum specific gravity testing. All cores must be tested for maximum specific gravity.
C. Sample size that is listed in AASTO T 209 may be waived in order to use a six inch diameter core, as stated in Section 401.03.03H of NJDOT Standard Specifications for Road and Bridge Construction.
D. Randomly select 1 core sample from a 5 core lot using a computer generated random number selection program.
E. Place the core specimen into a pan lined with paper that is marked with the sample number.
F. Place the core and pan into the oven set at 165 °C until the particles of the HMA can be separated by hand. Take care to avoid fracturing the aggregate. Separate the fine aggregate portion until it's not larger than ¼ inch. If the HMA sample is not sufficiently soft to be separated manually, place it back into the oven until it can be separated as described.
G. Place the pycnometer on the scale and zero the scale.
H. Place room temperature separated HMA sample into the clean and zeroed pycnometer. .Record the weight on the worksheet.
I. Remove the sample from the scale and place it onto the vibrating table.
J. Add water at the approximate temperature of 25 degrees Celsius (77F) to the pycnometer to sufficiently cover the sample. Usually three fourths full.
K. Place the top on the pycometer and make sure that the rubber seal is in full contact with the vessel.

L. Check the vacuum gauges and tubing prior to and after using to ensure that they are connected and functioning properly.

M. Turn on the vacuum gradually increasing until it reaches 3.7+/- 0.3 kPa (27.5+/-2.5 mmHg).Maintain this residual pressure for 15 +/- 2 minutes.

N. Once vacuum pressure is achieved, turn on vibration device and maintain it during the vacuum period.

O. At the end of the vacuum period (15 +/- 2 minutes), release the vacuum by increasing the pressure at a rate not to exceed 8 kPa (60 mmHg) per second.

P. Remove the lid from the pycometer. The sample must remain covered with water to prevent air from entering.

Q. Check the water bath that's used for this test to ensure that the temperature is 25 +/- 1°C (77+/-2°F) and that the scale is at zero.

R. Transfer the pycometer with the sample from the vibrating table to the water bath to obtain its weight. Slowly submerge the pycometer into the bath so that no part of the sample is exposed to air and set it into the hanging basket.

S. Once the sample is submerged and placed on the weighing device, allow the sample to sit in the bath for 10+/-1 minute and then record the weight on the worksheet.

T. Enter the test result into the spreadsheet on S: drive and calculate the air void results.

U. Determine the air void comparison limit based on air void acceptance limits for the mix being tested. Add 0.5 percent to the lower acceptance limit for the lower comparison limit and subtract 0.5 from the upper acceptance limit for the upper comparison limit.

V. Calculate the air voids of each core in the lot using the maximum specific gravity of the randomly selected core and the individual bulk specific gravities of each of the five cores in the lot.

W. If the air voids of all of the 5 cores calculated using the maximum specific gravity of the randomly selected core are within the lower and upper comparison limits, use the maximum specific gravity of the randomly selected core and the individual bulk specific gravities to determine the air void content of the cores in the lot.

X. If the air voids of all of the 5 cores calculated using the maximum specific gravity of the randomly selected core are within the lower and upper comparison limits, but shows on outlier, the entire core lot must be tested for maximum specific gravity. Calculate air voids using each individual core maximum specific gravity and bulk specific gravity.

Y. If the air content of any of the cores falls outside of the comparison limits, the entire core lot must be tested for maximum specific gravity. Calculate air voids using each individual core maximum specific gravity and bulk specific gravity.

Z. For Recore lots, calculate air voids using each individual core maximum specific gravity and bulk specific gravity.

AA. All test results are entered into Site Manager.

VII. Completion of Paperwork and Review

A. The Principal Engineer, Bituminous Testing Section or his designee will ensure that test results have been entered into SiteManager on the computer. Any core testing

issues and/or questions must be resolved prior to the results being entered into SiteManager.

B. Core lots that contain a statistical outlier (NJDOT Standard Specification section 401.03.03 H-5), will not be recorded as "Test Complete" in SiteManager. The Principal Engineer, Bituminous Testing Section or his designee will notify the Coring Unit that a specific core has determined to be an outlier. The lot will not be deemed "complete" until either a replacement core is cut or the Contractor notifies the Coring Unit that a replacement core will not be taken.

C. When an outlier core is replaced and tested the new core results are entered into SiteManager. The lot can now be recorded as complete.

D. Once the acceptance core lot has been completed and the results are in SiteManager, the receiving log in the black book is updated to reflect the actual date that the lot was tested.

VIII. Distribution of Acceptance Lot Core Results

A. The Principal Engineer, Bituminous Testing Section or his designee will review the tests and mark them complete in SiteManager.

B. The Principal Engineer, Bituminous Testing Section or his designee e will notify the Coring Section when testing is complete for each lot/sample.

C. The Coring Section is responsible for authorizing samples in SiteManager and distributing the results.