

CEEN 043 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 3 - Superpave Mix Design

OBJECTIVE: To develop an HMA mix design following Superpave test protocols.

EQUIPMENT: Brookfield viscometer, gyratory compactor, balance, ovens.

PROCEDURES:

Part A - Viscosity Measurements

1. Prepare a vial of binder and place in thermocell chamber and bring the temperature up to 135 °C.
2. Collect viscosity readings in Pa-s at two or more rotational speeds.
3. Elevate the binder temperature to approximately 160 °C.
4. Collect viscosity readings in Pa-s at two or more rotational speeds.

Part B - Gyratory Compaction Analysis

1. Prepare a 4500 g specimen of HMA and heat in oven for 4 hours at the desired compaction temperature.
2. Transfer the specimen to the gyratory compactor and compact to a gyration level of N_{design} . Record the specimen height at selected numbers of gyrations.
3. Extrude the specimen and place on a flat surface to cool.
4. After cooling, obtain the mass of the compacted specimen in air. Bring the specimen to the saturated, surface dry (SSD) condition and obtain the mass in air and submerged in water.
5. Repeat Steps 1 - 4 for each replicate specimen.
6. Prepare a 2000 g specimen of uncompacted HMA and obtain the mass in air and submerged in water.

CEEN 043 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 3 - Superpave Mix Design

Report

1. Using the viscosity data from Part A, prepare a plot of viscosity versus temperature and determine the recommended mixing and compacting temperatures.
2. Using the weight data from Part B, determine the bulk specific gravity (G_{mb}), theoretical maximum specific gravity (G_{mm}), and percent air voids (%VTM).
3. Using the compaction data from Part B, prepare a plot of average % G_{mm} versus gyrations for each mixture. Based on the results of this plot and related volumetric analyses, provide your recommendations for which mixture should be selected for further testing.

CEEN 043 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 3 - Superpave Mix Design

Part A - Viscosity Readings

Test Temperature, °C	Rotational Speed, RPM	Viscosity, Pa-s

Part B – Volumetric Data

HMA Mixture Type	Compacted	Uncompacted
Mass in Air, g		
Mass SSD, g		
Mass Submerged, g		

CEEN 043 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 3 - Superpave Mix Design

Part B – Compaction Data

Gyrations	Mix 1a	Mix 1b	Mix 2a	Mix 2b	Mix 3a	Mix 3b
1						
5						
10						
15						
20						
30						
40						
50						
60						
70						
80						
90						
100						
110						
120						
125						
<i>Compacted Specimens</i>						
M_{air}, g						
M_{SSD}, g						
$M_{submerged}, g$						
<i>Uncompacted Specimens</i>						
M_{air}, g						
$M_{submerged}, g$						