



Volumetrics

**Section 10 T-166/ T-275 Bulk
Specific Gravity of Compacted
Bituminous Material
WYDOT MTM 415.0**

Bulk Specific Gravity T 166



Scope

- **Sequence of testing to determine in place density of compacted mix.**
- **Activities:**
 - ▶ **Coring Operation**
 - ▶ **Core Specimen testing with calculations for waxed and non-waxed specimens**
 - ▶ **Specific Gravities**
 - ▶ **and In-Place Density**

Apparatus

1. Coring machine

**2. Electronic scale
with a suspension**

3. Wire brush

4. Wet saw/chisel

**5. Wire basket with a
suspension wire**

**6. Water tank or
container**

7. Towels

8. Convection oven

9. Tank heater

Sampling

- **Sample locations will be randomly selected by the engineer.**
- **Use a table of random numbers as per WYDOT 800 or a random number generator.**
- **Stay one foot away from the pavement ribbon edge.**
- **If the surface texture is not in good shape to test, select a nearby location by engineer.**
- **Pavement sampling will be accomplished with a coring machine.**

Modification AASHTO T 166

- **Size of core bit depends on Nominal Maximum Aggregate Size (NMAS)**
- **If NMAS is less than 1 in., use 4 in. dia sample.**
- **If NMAS is more than 1 in., use 6 in. dia sample.**

Coring

- **Cores can be taken after mat cooled down to ambient temperature.**
- **If immediate coring needed, ice can be placed to cool down lower than 130°F.**
- **WYDOT inspector must be present during coring.**
- **If any core is damaged, drill another one nearby.**
- **Collect 2 cores at each location.**
- **The cores will be divided in presence of WYDOT inspector, and WYDOT will always keep their cores with them.**

Sample Preparation

- **Bring the sample to room temperature.**
- **Clean off any dirt or foreign materials other than compacted mix.**
- **Separate lifts for multi-lift pavements using wet saw.**
- **Clean of materials other than compacted mix, e.g., seal coat, tack coat, plant mix wearing course.**
- **Label each core with distinguished number.**
- **Date sampled, station sampled, section represented, lane taken, distance from centerline, and core thickness of the compacted test lift only.**

Non-Waxed Procedure

- **Use only individual weights from the desired lift for density determination.**
- **Record the core test sample weight (mass) to the nearest gram on Form.**
- **Weigh the core after the core has been immersed in water at 77 ± 1.8 °F for three to five minutes (E).**
- **To avoid error, use the same scale to obtain all weights.**

Non-Waxed Procedure (Cont..)

- **Remove the immersed core sample from the water.**
- **Immediately do surface dry using a damp towel, no more than 5 seconds and record as, B.**
- **This method is performed on samples with open or interconnected voids or on samples that have absorbed over 2 percent by volume**

Non-Waxed Procedure (Cont..)

- **Weigh the completely dried core sample in air, A.**
- **Oven at a temperature not to exceed 125 ± 5 °F.**
- **Weight of the sample is checked every 2 hours.**
- **If weight does not change more than 0.05%, then it can be considered as dry.**

MIX DESIGN WORKSHEET

LAB #: _____
 PIT NAME: _____
 PROJECT: _____
 TOWN: _____

ENGINEER: _____
 DATE: _____
 DESIGN: _____
 ASPHALT: _____

(T-166 water temp 25°±1°C, 77°±1.8°F)

SAMPLE:	3		AVG			AVG			AVG
DRY WT:									
SSD WT:									
WT. WATER:									
BULK SG:									
HEIGHT:									

(T-209 water temp 25°±0.5° C, 77°±1.8°F)

ASPHALT %			
VOLUME:			
S.G.			
P.C.F.			
F, M, WATER:			

GYRATIONS

Nini:	
Ndes:	
Nmax:	

TEMPERATURE

MIX:	
CURE:	
COMPACT:	

(T84 & T85 water temp 23° ± 1.7°C, 73° ± 1.8° F)

(+4) Specific Gravity

OVEN DRY:		BULK S.G.	
S.S.D:		APP. S.G.	
WT. WATER:		ABSORB	

(-4) Specific Gravity

OVEN DRY:		BULK S.G.	
FLASK:		APP. S.G.	
F, M, H2O:		ABSORB	

Filler Specific Gravity

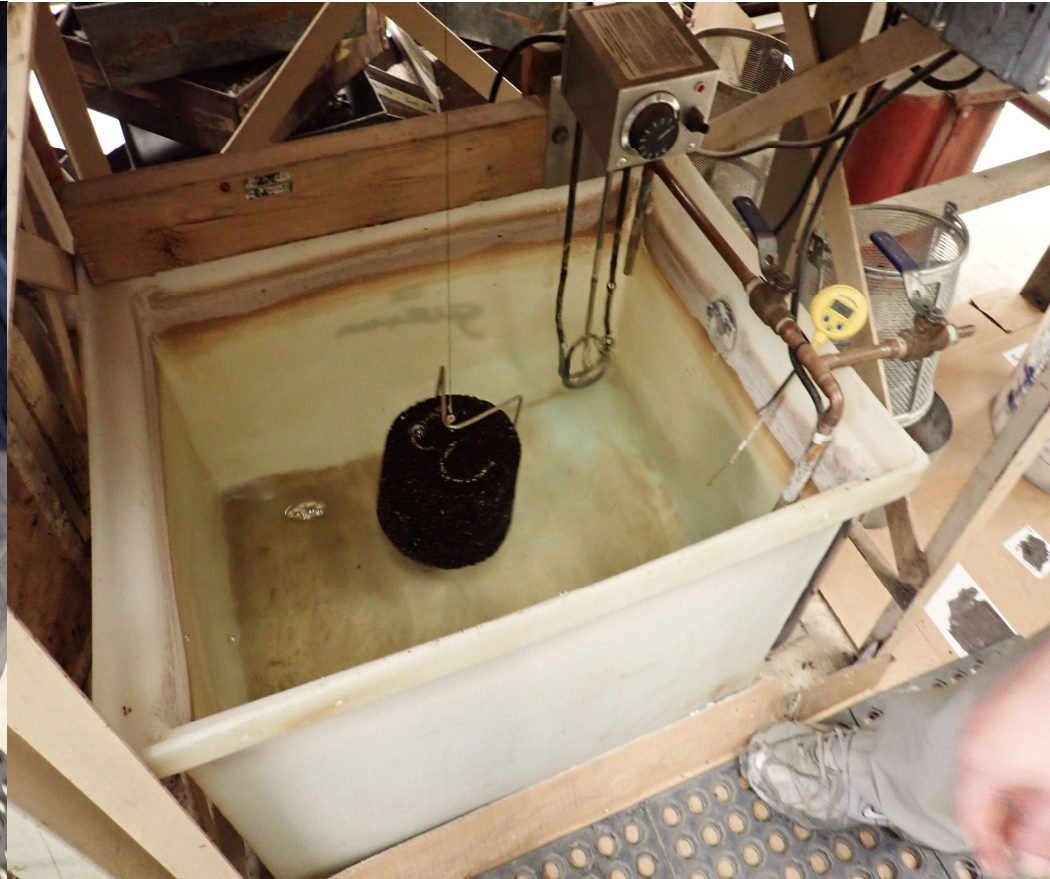
OVEN DRY:		BULK S.G.	
FLASK:		APP. S.G.	
F, M, H2O:		ABSORB	

REMARKS: _____

Dry Weight A



Submerged Weight B



Procedure (Continued)

- **Suspend the container and contents in a water bath at $25 \pm 1^{\circ}\text{C}$ ($77 \pm 2^{\circ}\text{F}$)**
- **Determine and record the mass after a 10 ± 1 min immersion (C)**

SSD condition



SSD Weight C



Calculation

➤ Specific Gravity

$$SG = \frac{A}{(B - E)}$$

➤ Unit Weight

$$UW = \frac{A}{(B - E)} \times Cd$$

➤ Percent Density

$$\frac{UW}{VUW} \times 100$$

➤ Percent Absorption

$$\frac{B - A}{B - E} \times 100$$

- SG = Specific Gravity; round to three places past the decimal
- A = Mass of sample in air after drying, g
- B = Mass of saturated surface dry (SSD) sample in air, g
- E = Mass of sample in water (wet weight), g
- Cd = 62.4 for English units lb/ft³
- UW = Unit Weight in lb/ft³
- VUW = Voidless Unit Weight from the construction volumetric

Waxed Procedure

- **Waxed procedure is used when absorption is more than 2%.**
- **Weigh the completely dried core sample in air, A.**
- **Put wax in a pan and put in a hot water tank to melt.**
- **Put the specimen in hot wax and cover with wax.**
- **Wait 30 minutes or more to cool down.**
- **Take the weight and record as B.**

Waxed Procedure (Cont...)

- **Weigh the waxed sample immersed in water at 77 ± 1.8 °F (E).**
- **Each specimen will be immersed and weighed individually.**
- **Use the same scale as used to find the weight in air.**

Calculation

➤ Specific Gravity

$$SG = \frac{A}{(B - E) - \frac{(B - A)}{D}}$$

➤ Unit Weight

$$UW = \frac{A}{(B - E) - \frac{(B - A)}{D}} \times Cd$$

➤ Percent Density

$$\frac{UW}{VUW} \times 100$$

- SG = Specific Gravity; round to three places past the decimal
- A = Mass of sample in air after drying, g
- B = Mass of waxed core sample (SSD) sample in air, g
- D = Specific gravity of the wax; round to four places past the decimal for weights
- E = Mass of waxed core sample in water (wet weight), g
- Cd = 62.4 for English units lb/ft³
- UW = Unit Weight in lb/ft³; truncate to 1 decimal place, tenth