Importance of Air Voids and Compaction

Mix Properties

Density = 100% - Air Voids
(6% Air Voids = 94% Density)
Definitions

• **Density** — the measurement of mass per unit volume

• **Compaction** — the action of compressing HMA to achieve a higher density
Density

\[ \text{DENSITY} = \frac{\text{Mass (lbs)}}{\text{Volume (cu ft)}} \]
Density

- Theoretical Maximum Density (Rice)
  - TMD
  - “Reference Density”

- Bulk Density (Cores or Nuclear Gauge)
Theoretical **Maximum Density**
What is it?

- Density at 100% compaction
- Rock + Oil....No Air
Measuring Density

Bulk Density: measured by:

- Cores
- Nuclear Gage
Compaction

\[
\text{%Compaction} = \frac{\text{Bulk Density}}{\text{Max. Density(TMD)}} \times 100
\]

Most agencies require 92% minimum density (average)
Reasons that Good Compaction is Needed

- To minimize additional densification by traffic
- To minimize permeability
- To limit oxidation of the asphalt pavement
- To provide adequate shear strength
If everything else is unchanged, roadway performance will be a function of construction compaction.
One of the Essentials for a Consistent and High Quality Asphalt Pavement is to Provide for a Continuous Operation
Density Behind the Paver

Rule of Thumb: the HMA density behind the screed should be about 85% of Gmm (85% Density)
Time Available for Compaction
(TAC)
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