WSDOT SOP 730
Correlation of Nuclear Gauge Densities With Hot Mix Asphalt (HMA) Cores

1. When evaluating HMA compaction:
   1.1 A gauge correlation is required:
      a. For each combination of gauge and HMA Mix Design (initial JMF).
      b. When gauge mode changes (i.e., direct transmission to thin layer).
      c. When wearing course lift thickness changes per Note 1.
      d. When a gauge is recalibrated.

      *Note 1:* For density determined with the “Thin Layer Mode,” a layer thickness change
      of greater than 0.08 feet requires a new correlation. For density determined with the
      “Direct Transmission Mode,” a layer thickness change of greater than 0.15 feet requires
      a new gauge correlation.

   1.2 A gauge correlation is not required but may be considered by the Regional Materials
      Engineer when:
      a. Base material changes from the original correlation base (i.e., from a surfacing base
ten asphalt base).
      b. The same gauge HMA Mix Design (Reference Mix Design) combination are used
         on a different contract within the same construction year.
      c. When JMF has been adjusted in accordance with *Standard Specifications*
         Section 9-03.8(7)A.

2. Gauge correlation is based on ten in-place HMA densities and ten cores taken at the same
   location as the in-place density.

   2.1 In-place HMA densities shall be determined in accordance with WSDOT FOP for
      WAQTC TM 8.

   2.2 Cores should be taken no later than the day following paving and before traffic has
      been allowed on roadway. Correlation cores are not required to be taken at record density
      locations. Therefore, a site outside the traveled way should be considered for worker
      safety, as long as the lift thickness matches that of the plan lift thickness of the record
      density locations.

   *Note 2:* If a core becomes damaged, it shall be eliminated from the average.

   *Note 3:* Cores may be taken sooner than the day after paving if the HMA is cooled to prevent
   damage during coring and removal of cores. Water, ice, or dry-ice may be used to cool the
   pavement. Another method of cooling that may be used is substitution of nitrogen gas or
   CO₂ for drilling fluids.
3. Obtain a pavement core from each of the test sites in accordance with WSDOT SOP 734. The core shall be taken in the nuclear gauge footprint.

   3.1 For “direct transmission mode,” locate the core at least 1 in (25 mm) away from the edge of the drive pin hole.

   3.2 For “thin layer mode,” locate the core in the approximate center of the nuclear gauge footprint. If the core thickness exceeds the plan pavement thickness by more than 0.04 feet, then the core shall be saw cut to the plan thickness prior to performing density testing. If a core thickness is less than the plan thickness by more than 0.04 feet, it shall be eliminated from the average.

4. **Bulk Specific Gravity (G_{mb}) of core** shall be determined in conformance with WSDOT FOP for AASHTO T 166 Bulk Specific Gravity of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface-Dry Specimens.

   Calculate core density as follows, round to the nearest 0.1 pcf:
   \[
   \text{Core Density} = G_{mb} \times 62.245 \text{ pcf}
   \]

   Calculate gauge correlation factor as follows:
   \[
   \text{Density Ratio} = \frac{\text{core density}}{\text{nuclear gauge density}}
   \]

   Round Density Ratio to the nearest 0.001
   \[
   \text{Gauge correlation factor} = \frac{\text{(Sum of ratios)}}{\text{(number of cores)}}
   \]

5. Gauge Correlation Factor shall be determined to 0.001.

6. Report the Gauge Correlation Factor using MATS or DOT Form 350-112 EF.