U.S. Department of Transportation
Federal Highway Administration

ENHANCED IN-PLACE DENSITY:

Accurate measurements help to ensure adequate density.

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Although several factors can influence the performance of an asphalt pavement, one of the most important is in-place density. A small increase in density can potentially lead to a significant increase in service life of asphalt. Highway agencies use specifications to achieve acceptable in-place density on their asphalt pavements. Density acceptance test results were analyzed from several State Departments of Transportation across the country to determine the state of practice for achieving in-place density. The results were used to identify States with effective in-place density specifications that minimized the amount of test results below the 92.0 percent threshold. Most agencies with highly effective specifications measured density using core specimens from the roadway along with frequent mixture samples.

MEASUREMENT OF IN-PLACE DENSITY

The accurate measurement of in-place density by the agency during production is vital to attaining long-lasting asphalt pavements. In-place density cannot be adequately managed, improved, or paid for without accurate measurement. Two key specification properties were found in all of the effective in-place density specifications identified by the study:

Density obtained by measuring the mixture bulk specific gravity (G_{mb}) of roadway cores at least once per sublot.
The measurement of the G_{mb} from cores continues to be the most widely accepted way to accurately determine the specific gravity of the in-place material. Emerging technologies like the density profiling systems have the potential to provide wider measurement of in-place density, but use of core samples continues continues to be utilized in effective specifications.

Density calculation uses a maximum theoretical specific gravity (G_{mm}) value measured at least once per day or once per sublot.
Changes in the G_{mm} value of a mixture have an impact on the density values, as in-place density is calculated as G_{mb}/G_{mm}. The G_{mm} value of a mixture is affected by asphalt content, aggregate gravities, and gradation of the mixture. The maximum specific gravity of a mixture can change by as much as +/- 0.030 under production. If a static value of G_{mm} is used (like from a mix design) for mix design calculations, changes from G_{mm} can result in significant errors to the calculation of density. The plot shows an example of the error that can be encountered in the density values due to changes in the G_{mm}.

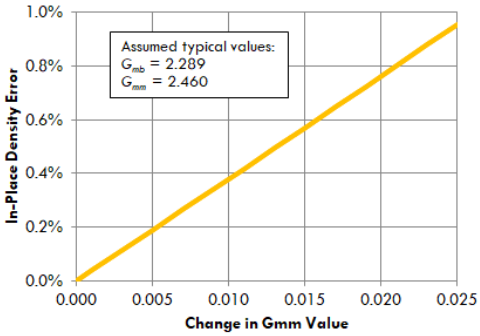

Image Credit: FHWA

Visit https://www.fhwa.dot.gov/pavement/asphalt/density/index.cfm to access the full series

For more information or technical assistance on improved density, please contact: Derek Nener-Plante, FHWA Resource Center, derek.nenerplante@dot.gov