U.S. Department of Transportation
Federal Highway Administration

# ENHANCED IN-PLACE DENSITY:

## Different specification types can be used to achieve performance.

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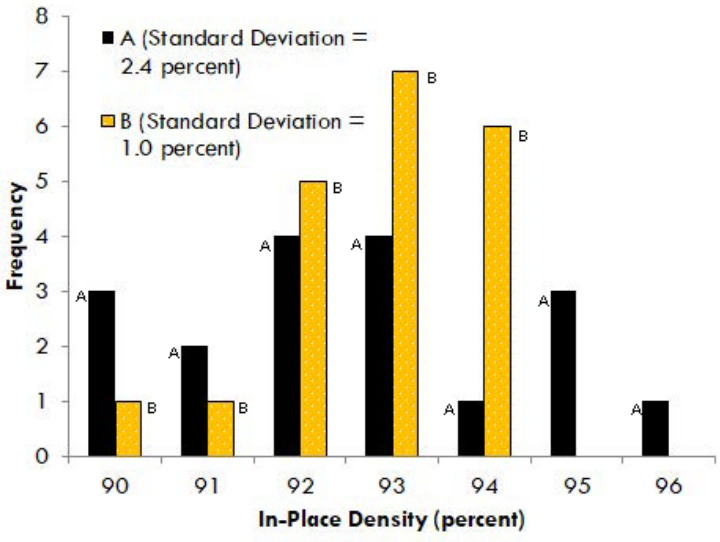
Although several factors can influence the performance of an asphalt pavement, one of the most important is in-place density. A small increase in density can potentially lead to a significant increase in service life of asphalt. Highway agencies use specifications to achieve acceptable in-place density on their asphalt pavements. Density acceptance test results were analyzed from several Departments of Transportation (DOTs) across the country to determine the state of practice for achieving in-place density. The results were used to identify DOTs 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 used either percent within limits (PWL) or a lot average approach.

### PERCENT WITHIN LIMITS

The PWL approach (similarly the percent defective approach) uses statistical concepts like mean and standard deviation to calculate the percent of the pavement with in-place density within the specification limits. Rather than solely using an average density, PWL incorporates variability of density into the quality characteristic. Most agencies using PWL approach typically pay 100 percent of the contract price when the contractor achieves 90 PWL in a lot.

### LOT AVERAGE

The lot average approach simply calculates the average in-place density of a lot to determine payment. Using only an average calculation can result in lots which exhibit a high degree of variability, negatively impacting pavement performance. Some agencies found using a minimum sublot requirement in conjunction with the lot average was effective in reducing the observed variability.




The histogram shows two sets of in-place density results (20 data points each). The two sets have the exact same average density (93.4 percent), but the variability between the two is significant. Dataset A includes significantly more results that fall below the 92 percent threshold than dataset B. The simple lot average approach does not catch the difference between the A and B datasets without a minimum sublot requirement (or something similar). Reducing variability often leads to fewer pavements with less than 92 percent density.

**VARIABILITY MATTERS.**

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

The Asphalt Pavement Density Series briefs present major findings and positive practices that resulted from FHWA demonstration projects.

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