U.S. Department of Transportation
Federal Highway Administration

ENHANCED IN-PLACE DENSITY:

Example approaches to obtain acceptable in-place density.

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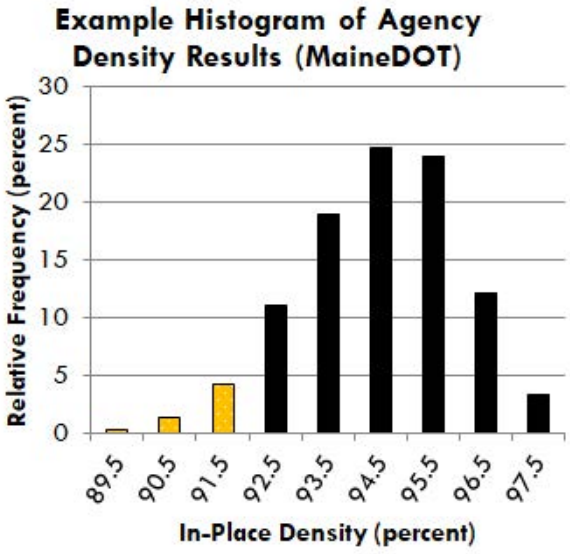
Although several factors can influence the performance of an asphalt pavement, one of the most important is in-place density. A small increase in density can potentially lead to a significant increase in service life of asphalt. Highway agencies use specifications to achieve acceptable in-place density on their asphalt pavements. Density acceptance test results were analyzed from several 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, which are summarized in the table below:

DOT	Specification Type	Lower Limit (Percent G_{mm})	Upper Limit (Percent G_{mm})	Who Performs Acceptance Testing?	Average (Percent G_{mm})	Less than 92 Percent G_{mm}
AZ	PWL	93.0	N/A	Agency	94.9	5.6%
MD	Lot Avg.*	02.0	97.0	Contractor***	94.0	5.3%
ME	PWL	92.5	97.5	Agency	94.5	5.8%
MI	PWL	92.5	N/A	Agency	94.4	5.5%
MO	PWL	92.0	97.0	Contractor***	93.7	5.0%
MT	Lot Avg.**	93.0	N/A	Agency	94.3	6.6%
NJ	PD	92.0	98.0	Agency	94.9	5.4%
NY	PWL	92.0	97.0	Agency	94.2	5.0%
PA	PWL	92.0	98.0	Agency	94.4	3.1%
PR	PWL	92.0	99.0	Agency	94.6	3.6%

G_{mm} = Theoretical Maximum Specific Gravity, PWL = Percent Within Limits, Lot Avg. = Lot Average, PD = Percent Defective
* Lot Average with an Individual Sublot Requirement, ** Lot Average with a Maximum Range Requirement, *** Agency validates Contractor Acceptance Results



The effective in-place density specifications commonly used a percent within limits approach with the agency conducting all Acceptance testing. DOTs that used contractor values within acceptance are validating results through their own testing. The lower limits used ranged between 92.0 and 93.0 percent. The different approaches all resulted in average density values near 94.0 percent and less than 7.0 percent of all results below the 92.0 percent threshold.

Examine the effectiveness of your in-place density specification by calculating the percent of individual results below 92.0 percent as well as the average, as shown in the histogram to the left.

There are many different approaches that can be taken to obtain acceptable in-place density.

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.

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