U.S. Department of Transportation
Federal Highway Administration

ENHANCED IN-PLACE DENSITY:

Obstacles to achieving in-place density - material challenges

FHWA-HIF-22-064

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. There are a number of challenges to achieving desirable in-place density when placing asphalt mixtures. These obstacles are primarily classified into two groups: (1) material challenges and (2) challenges with field placement. The three major sources of material challenges are discussed below.

STIFF MIXTURES

Stiff mixtures can result from changes in aggregate properties, asphalt binder stiffness, and mixture temperatures and can present challenges to reach in-place density. Some strategies found to help mitigate for stiff mixtures include (1) compacting while the stiff mixture is the hottest and has the lowest stiffness and (2) using breakdown rollers in echelon. Paying close attention to variables such as the speed, temperature of the mix, vibration amplitude, and ambient conditions is essential.

TENDER MIXTURES

Tender mixtures can present challenges in compaction, and typically result from soft binders, properties of the mixture, and the possible presence of additional fluids. When dealing with a tender mixture, it is essential to make adjustments to the plant. For example, care should be taken to remove moisture during the drying process and properly account for additional fluids added to the mixture by additives (warm-mix, anti-strips, etc). Also, the tender zone, which occurs through a specific temperature range for any given mixture, is where the delicate behavior happens.

AGGREGATE DEGRADATION

Aggregate quality can present challenges to obtaining the desired level of in-place density. Aggregates that are susceptible to degradation can result in areas of the mat with lower density, despite using normal compaction processes. Mixture design, compaction temperature, vibration amplitude, and the use of pneumatic rollers can improve compaction. The image shows the use of tandem pneumatic rollers that provide compactive effort without causing further aggregate degradation.

Image Credit: University of Nevada Reno

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