



## Best Practice for Placement of Stone Matrix Asphalt in Colorado

Stone Matrix Asphalt (SMA) is a tough, stable, rut-resistant mixture. The SMA design concept relies on stone-on-stone gap-graded aggregate to provide strength with a PG 76-28 polymer modified binder to provide durability. Because SMA mixes have a high asphalt binder content, as the mix sits in the HMA storage silos, transport trucks, and after it is placed, the asphalt binder has a tendency to drain off the aggregate—a phenomenon known as “mix draindown.” Mix draindown is typically combated by adding cellulose or mineral fibers to keep the asphalt binder in place.

### SMA Construction Season

SMA in Colorado is produced and generally available from May 1<sup>st</sup> thru Oct 31<sup>st</sup>. The availability of SMA is highly dependent on the production of PG 76-28 polymer modified binder, which is usually only produced in Colorado from May thru October.

Over 3 million tons of SMA have been placed on Colorado roads and highways since 1994. SMA is now the surface material of choice for high profile, high volume roadway where a highly durable, long lasting and skid resistant surface is required, including Interstate highways (I-25 & I-70), urban arterial roadways, high volume intersections and bridge decks. Local Agencies have also been successfully placing SMA on arterial roads since 2002.

- SMA pavements are only placed as surface course material and are typically 2”- 3” thick using a ½” – ¾” aggregate. Bridge deck SMA overlays are typically 3” thick.
- To achieve proper placement and compaction, SMA mixtures should not be placed in cold or inclement weather. A minimum surface temperature of 50°F is recommended for placement of SMA. However, the decision to place SMA will also depend on wind conditions, lift thickness being placed, and other environmental conditions prior to and during placement.
- Section 401.07 of CDOT’s Standard Specifications address Weather Limitations and Placement Temperatures. Hot mix asphalt shall be placed only on properly prepared unfrozen surfaces which are free of water, snow, and ice. The hot mix asphalt shall be placed only when both the air and surface temperatures equal or exceed the temperatures specified in Table 401-3 and the Engineer determines that the weather conditions permit the pavement to be properly placed and compacted. SMA is only placed as a wearing course (top lift) and the specifications require a minimum of 50°F to begin placement with rising temperatures during placement. The specification further states “If the temperature falls below the minimum air or surface temperatures, paving shall stop.”
- Haul times for SMA should be as short as possible. It is important that the temperature of the SMA mixture not be raised arbitrarily to facilitate a longer haul time. The increased temperature in conjunction with vibrations typical in haul vehicles can serve to separate the mortar from the coarse aggregate. The mixture should arrive at the paving site so that it is placed at temperatures of approximately 280–300°F. With polymer modifiers,

Some Local Agency Specifications require for the placement of mixtures with modified binder a ten degree increase in ambient and surface temperature from a non-modified binder mixture being placed.

slightly higher temperatures may be needed. These increased temperatures help ensure that proper compaction is achieved.

- SMA mixtures may adhere to truck beds to a greater extent than conventional HMA mixtures. This is particularly true when asphalt cement modifiers are employed. It is, therefore, prudent to use an approved, non-petroleum-based release agent and clean the truck beds frequently. Most agencies have approved lists of release agents. However, if not carefully used, these agents may cause problems with SMA mixtures. If the agent is allowed to pool in the bottom of the truck bed, it may cause the mortar to flush from the SMA pavement surface.
- Traditional segregation of aggregate is not a significant problem with most SMA mixtures. However, SMA already has a very high coarse aggregate content, so the problem becomes small local sections with insufficient coarse aggregate and excessive mortar, resulting in fat spots and rutting. Care should be taken to observe “good engineering practices” that minimize the potential for segregation.
- Immediately behind the paver, SMA mixtures are known to be harsh and very sticky. For this reason, a minimum amount of raking and other hand work should be performed. When it is absolutely necessary, hand placement of the material may be accomplished but should be performed with care.
- Minimum SMA density of 95% ( $\pm 2\%$ ) percent of maximum theoretical density is recommended. Application of compactive effort to the SMA mixture should be accomplished as quickly and efficiently as possible after placement. By its very nature, SMA becomes difficult to compact once it begins to cool. For this reason, it is imperative that the compaction equipment operate immediately behind the paver. Polymer-modified binders utilized in SMA have a narrower temperature window than do non-modified binder mixtures. Polymer mixtures should generally be completely compacted before they cool below 240°F.
- Roll-down or compression of SMA mixtures is approximately one-half that of conventional HMA mixtures. While conventional HMA mixtures roll-down approximately 20–25 percent of the lift thickness, SMA will normally roll-down only 10–15 percent of the lift thickness.
- Steel-wheeled rollers should be used when compacting the SMA mixture and the drive roll should be kept toward the paver. Multiple passes of the breakdown rollers should be sufficient to achieve the desired density. If it becomes necessary for the rollers to sit idle, they should be taken off the mat.
- Most experience with vibratory rollers indicates that they can be used successfully on SMA with the vibrator engaged. However, if vibrating is allowed, it must be used with caution. The vibration of the roller may break aggregate and/or force the mortar to the surface of the mat. CDOT does not allow the use of vibration for compaction on bridge decks.
- Pneumatic-tired rollers are not recommended for use on SMA. The rubber tires tend to pick up the mortar, causing surface defects. With the introduction of the newer, non-petroleum-based release agents, the use of rubber-tired rollers have been found to be effective as long as the materials are not being bound (picked up) on the tires.
- Fat spots or excessive binder in one location, are one of the most objectionable visible occurrences in SMA mixtures. They can be either cosmetic or functional. Cosmetic fat spots usually occur on only the surface of the mat and wear off under traffic. Functional fat spots usually extend throughout the thickness of the mat and may lead to early deformation and deterioration of the pavement. Fat spots may result from, inconsistent fiber distribution, excess release agent, excess temperature, excess tack coat, inconsistent mineral filler.