



Background Notes on SMA Manufacture and Placement (Stone Mastic Asphalt)

There are major differences in the design, manufacture and placement of SMA compared to conventional asphaltic concrete. As its use is relatively new in Australia, often problems are encountered in the field. Even though Road Authorities have slightly varying Specifications, the overall principles remain the same.

The following notes have been prepared for the field personnel for quick familiarization of the issues and assessment of the reasons for likely non-conformances:

- 1 The mix design and the subsequent production process must ensure that the voids in the coarse aggregate skeleton are sufficient to contain the mastic and the appropriate air voids if performance is to be realized.
- 2 Aggregates from river gravels are not a preferred SMA constituent unless crushed from larger spalls to eliminate rounded surfaces.
- 3 The proportion of fine aggregate (<5 mm) derived from crushed hard rock quarry material affects the deformation resistance of SMA. A minimum of 50% is usually specified, however, this may be increased to 100% to achieve acceptable deformation resistance.
- 4 The Contractor must verify the volumetric suitability of the grading by design procedures which involve iteration of incremental adjustment of fine aggregate content. The QMR specifies a test for mix volume ratio for which is set a limit of 1.00. This compares the volume of voids in the coarse aggregate fraction to the volume of binder and fines available to fill those voids. (My assessment is that it should be lower than 1.00 to allow for tolerances and likely minor non-uniformity).
- 5 The grading preference should be to keep it on the coarser side of the approved envelope.
- 6 The performance of SMA is dependent on the mix volumetrics and consistency of the lab compacted air voids and the voids in the mineral aggregate (VMA).
- 7 VMA is calculated as the sum of air voids and effective binder content. Thus, for given air voids, a reduction in VMA effectively means reduced binder film thickness and increased risk in to the asphalt durability in service. The corollary is that instability of the mix may also result.

- 8 Production should be reliable and consistent for quality SMA. There are facilities that do not necessarily have this capacity.
- 9 175°C is regarded as the maximum manufacturing temperature. Although, 190°C is acceptable for aggregates.
- 10 For placing, pavement temperatures should be >25°C for various wind conditions, but can be lowered to 15°C if special techniques are used.
- 11 SMA will need to be placed and subject to initial compaction at >140°C. (The target laying temperature should be at least 160°C).
- 12 Good field compaction is essential.
- 13 The coarse aggregate content means that it tends to achieve stone to stone contact fairly quickly and so **effective compaction rather than excessive compaction is the key to success.**
- 14 With the design air voids target of 5%, the field target should be no more than 6.5% in order to achieve 98% relative compaction. This is important. (If the in situ voids are <4% problems will result).
- 15 The layer thickness should be in the ranges:
 - 10 mm SMA: ≥25 mm to ≤35 mm, with tolerances of -0 and +6
 - 14 mm SMA: ≥35 mm to ≤50 mm, with tolerances of -0 and +8
- 16 Thinner layers of SMA will tend to be more rut resistant than thicker ones.
- 17 Thinner layers are less workable, but more stable under compaction rollers.
- 18 Long haul distances can cause binder segregation.
- 19 Binder segregation and flushing can also be caused vibrations of the steel rollers and action of rubber tyred rollers.
- 20 Rubber tyred rollers are not recommended, but may be used for final rolling at relatively low temperatures.
- 21 Large steel rollers (10 to 15 t) give best compactive effort without the need for vibration.
- 22 Final rolling should follow the initial rolling and be completed by the time the SMA has cooled to 90°C.
- 23 Cooling of the SMA by water spray is not permitted.
- 24 Mat temperatures must be monitored and recorded at all times.
- 25 It is normal to use a bitumen emulsion tack coat, unless there is a risk of lamination. The latter may occur with thin layers and then a PMB emulsion may be specified.