STONE MASTIC ASPHALT SURFACING

The Australian Asphalt Pavement Association (AAPA) has been involved with state road authorities as they test and monitor the performance of SMA and other asphalt pavement products and continues to assist in determining the most appropriate and cost effective pavement surfacings as part of our state road authorities’ overall management of Australia’s primary road network.

Australia is moving forward in providing motorists with an opportunity to drive on what is emerging as the modern asphalt specialist surfacing product.

An Emerging International Surfacing Product – SMA

Stone Mastic Asphalt (SMA) is a tough, stable, rut resistant and durable asphalt surfacing mix. Originally developed in Germany in the early 1960s, it is now used extensively as a surfacing material across the total German road network, where it is a commonly specified surfacing material due to its improved stability relative to other asphalt mixes.

It is also becoming a more commonly specified surfacing material in other European countries, particularly the Scandinavian countries, and in the USA. In world terms it is considered to be a high quality flexible road surfacing when considering strength, long life and good return on investment despite higher initial costs.

Above Average Performance

SMA provides improved performance for high speed, heavily trafficked roads when compared to more conventional forms of asphalt such as Dense Graded (DG) asphalt. SMA provides a smooth, low noise pavement with sufficient texture to promote safety through reduced water splash and spray and good frictional resistance for vehicle traffic. Its durability and stability are enhanced by the higher bitumen content and it is able to support even heavier traffic loads with the use of polymer modified binders. At the end of its service life, like other asphalt, it is 100% recyclable.

Various Types of Asphalt

The primary division between asphalt mix types is in terms of particle size distribution (generally referred to as grading). Within each grading type, there are further variations in terms of binder type as well as types and proportions of component materials for particular applications such as ultra thin surfacing.

The principal mix types are:

♦ stone mastic asphalt (SMA)
♦ dense graded asphalt (DGA), also called asphaltic concrete (AC)
♦ open graded asphalt (OGA)
♦ fine gap graded asphalt (FGGA).
Stone Mastic Asphalt (SMA)
SMA is also a gap graded mix, but with a high proportion of coarse aggregate providing an interlocking stone-on-stone skeleton that resists permanent deformation. The coarse aggregate skeleton is filled with a mastic of bitumen, filler and fine aggregate. Generally, fibres or modified binders are used to prevent drainage of the relatively high binder content during transport and placing.

When used as a wearing course, SMA has the following advantages:
◆ high durability
◆ low permeability
◆ low traffic noise
◆ high resistance to reflection cracking
◆ high rut resistance.

Dense Graded Asphalt (DGA)
A dense graded asphalt mix has a continuous distribution of aggregate particle size and filler (i.e. evenly distributed from coarse to fine) and a low design air void content, generally in the range of 3 to 7%. Dense graded mixes are also often referred to as asphaltic concrete (AC) and represent the most widely used form of asphalt. This type of mix provides the greatest load carrying capacity for structural layers as well as a range of other properties appropriate to a wide variety of wearing course applications.

The durability and resistance to environmental degradation of DGA is largely determined by insitu air voids and binder content, and it is important that these be optimised for service conditions. Binder type, aggregate characteristics, filler type, and use of additives, all contribute to structural stiffness, fatigue, deformation resistance, surface texture and workability.

Dense graded mixes are usually mixed, spread and compacted while hot, although mixes incorporating cutback bitumen or bitumen emulsion binders may be mixed, placed and compacted at, or slightly above, ambient temperatures.

Open Graded Asphalt (OGA)
The particle size distribution of an OGA mix is characterised by a large proportion of coarse aggregate and only small amounts of fine aggregate and filler.

OGA has relatively high air voids, generally in the range 18 to 25%, and relies largely on mechanical interlock of aggregate particles for stability. Being permeable, they are less durable than dense type mixes although durability is assisted by an increase in binder film thickness around the individual aggregate particles using high binder contents, and the use of modified binders. Coarse textured aggregates with angular shape are desirable for surface texture and stability.
As OGA mixes are permeable, it is important that they are placed on a base that is:
♦ waterproof to minimise vertical movement of moisture into the pavement;
♦ free draining to provide lateral drainage to the edges of the pavement.

OGA is not recommended for use at intersections due to relatively low shear resistance and potential for oil droppings to soften the binder and fill the voids, reducing drainage ability.

**Fine Gap Graded Asphalt (FGGA)**
A fine gap graded asphalt mix is a dense (low air voids) mix but with intermediate sized fractions replaced by finer fractions. It may also contain more filler.

Fine gap graded mixes rely for stability on the stiffness of the fine aggregate / filler / binder mixture. When used in residential streets and other lightly trafficked applications, they provide a fine textured surface and a workable mix that is more readily compacted to low insitu air voids. The combination of low air voids and relatively high binder contents, provides an extremely durable surface as well as good fatigue resistance.

FGGA mixes are not generally used as wearing course in more heavily trafficked applications in Australasia due to poor rutting resistance at high surface temperatures.