AUSTRALIAN ASPHALT PAVEMENT ASSOCIATION

advisory note 15

BITUMINOUS SURFACING FOR INTERSECTIONS ON LIGHT & MEDIUM DUTY FLEXIBLE PAVEMENTS

Introduction

This advisory note provides a guide to selection of surfacing at intersections, including roundabouts, for pavements that are designed for sprayed seals or thin, non-structural, asphalt surfacing and subject to light and medium traffic levels.

A further advisory note in this series discusses asphalt for roundabouts on heavy duty pavements.

Background

A large percentage of the Australian road system, particularly in rural areas, is surfaced with sprayed seals and other thin bituminous treatments over unbound and lightly bound granular pavements.

Sprayed seals provide an effective and economical surfacing in a large number of applications but have limitations in their ability to resist the effects of heavy traffic. Turning and braking of heavy vehicles at intersections, median openings and roundabouts can cause aggregate to roll, leading to loss of aggregate and bleeding of the seal. Concentrations of heavy traffic at intersections may cause aggregate embedment, leading to flushing of the binder.

Sprayed seals may also be modified to enhance performance but a more effective remedy is to supplement the sprayed seal with a thin layer of hot mix asphalt. Hot mix asphalt surfacing can also provide improved smoothness and appearance, and reduced maintenance costs.

Sprayed Seals

Performance of sprayed seals for high stress situations can be enhanced by:

- Use of polymer modified binders
- Multiple applications of binder and aggregate
- Multiple application of aggregate (“racked in” or “dry lock” techniques).

Polymer modified binders (PMBs) improve sprayed seals through increased binder cohesion, toughness and reduced temperature susceptibility. This provides improved resistance to aggregate being dislodged or rolled over by turning stresses and resistance to flushing and bleeding. Such seals are also termed High Stress Seals (HSS).

Guidelines to PMBs for HSS applications are provided in APRG Report 19, Austroads Specification Framework for Polymer Modified Binders.

Multiple applications of binder and aggregate are used to provide a stronger sprayed seal treatment. Generally the second application of aggregate is half the size of the first. This enables the smaller aggregate to lodge in the void spaces in the larger aggregate, holding the larger aggregate in place and providing a strong mechanical key against traffic shearing forces. Typical combinations are 10/5 and 14/7 aggregates.

The “racked in” and “dry lock” techniques involve a light application of a small size aggregate (generally 5 mm) over a coarser aggregate sprayed seal. This is applied before trafficking and serves to reduce rolling over of coarse aggregate particles during the critical initial aggregate reorientation stages of seal compaction.

The terms “racked in” and “dry lock” are used somewhat interchangeably. Generally, the former is intended to apply where the initial aggregate spread rate is reduced so that the second application is firmly held as a permanent part of the seal, whereas in the latter technique the initial aggregate application rate is unchanged and most of the second application is dislodged during the process of compaction of the primary aggregate.

Both techniques are particularly used in sealing with bitumen emulsions to reduce risk of aggregate dislodgement before the emulsion is fully cured.

Asphalt

Guidelines for thin asphalt surfaces for intersection areas and roundabouts are as follows.

continued

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Lightly trafficked pavements

Typically these are residential streets, car parks and other areas subject to car traffic with only occasional heavy vehicles.

The granular surface should be primed. A tack coat may not be required, or may be reduced, over recently primed, clean surfaces that are in good condition.

Primary requirements for asphalt mixes are a dense surface finish and durability. Generally, small sized, fine textured and workable mixes are used.

Medium trafficked pavements

These cover a large range of applications from residential feeder routes to significant urban and rural arterials, including rural highways and freeways. A common application is to the construction of sprayed seal pavements, but with asphalt surfacing applied to median openings, intersections and roundabouts where the turning of large vehicles can cause damage to the sprayed seal.

The granular pavement should be first surfaced with a primerseal or prime and seal. Granular pavements should be allowed to dry back to a moisture content no greater than 70% of optimum before priming or primersealing. Generally, a PMB seal as a strain alleviating interlayer (SAMI) is not required except where there is a risk of reflection cracking where cemented base materials are used.

The time between sealing and asphalt surfacing will depend on cutter content of the binder and site requirements. Cutters and oils in the seal binder can cause bleeding of asphalt surfacing. Generally binders with a high cutter content, such as cutback bitumen primerseals, should be left for at least three months in warmer weather and may require longer in cooler weather. Where a PMB has been used as the binder in the seal, the use of any aromatic oils in the manufacture of the PMB as well as any cutter added at time of spraying should be taken into account. Seals without oils or cutter in the binder, or with bitumen emulsions, can be surfaced with asphalt within a few days.

Where possible, the seal should be trafficked for a time before placing asphalt. This enables compaction of the seal and evaporation of cutters as well as allowing the pavement to settle in and identify any minor surface weaknesses. Seals should be kept under observation in early stages and gritted if necessary to prevent traffic damage due to turning, etc. at intersections. Minor traffic damage to the seal in this period should not necessarily be viewed with concern.

The asphalt surfacing mix should be chosen according to site requirements. For most medium to heavy traffic applications, 10 or 14 mm size dense graded asphalt mixes with Class 320 bitumen should be used. The greatest influence on mix performance is achieved though optimisation of volumetric properties, i.e. the characteristics of the mineral aggregate, grading and binder content. Good mix design enables good performance under all but the most extreme operating conditions without the use of modified binders.

Increasing interest is also developing in the use of stone mastic asphalt (SMA) for heavily trafficked applications. SMA uses a large proportion of coarse aggregate to provide a strong aggregate skeleton that gives good resistance to rutting and shoving.

With the development of PMBs and other modified binders for heavy duty applications, a trend has developed for modified materials to be specified for every application where higher performance is perceived to be required.

In many cases, the use of modified binders is unwarranted and unnecessary. All that is required is attention to selection of materials, mix design and construction techniques. In addition, for small jobs, PMBs may be neither practical nor achieve the desired result. It is generally not feasible to transport and store PMBs in quantities less than that required for about 500t of asphalt. PMBs can reduce workability, thereby increasing the risk of poor compacted density or poor finish. In some circumstances this can result in a poorer performance than that from well constructed conventional materials.

APRG Report No.18 gives a detailed guide to the selection and design of asphalt mixes. Further guidance on selection of PMBs can be obtained from APRG Report No. 19.

References

AAPA Advisory Note 3 – A guide to Asphalt Mixes for Roundabouts.

APRG Report No.18 – Selection and Design of Asphalt Mixes – Australian Provisional Guide.

APRG Report No. 19 – Austroads Specification Framework for Polymer Modified Binders.

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