

## BITUMEN EMULSIONS

### 1. INTRODUCTION

The purpose of this Technical Note is to provide an overview for the use of bitumen emulsions in road construction and maintenance work.

### 2. WHAT ARE BITUMEN EMULSIONS?

Bitumen emulsions are dispersions of fine droplets of bitumen in water. Standard grades of emulsion comprise approximately 60% bitumen and 40% water. Grades consisting of approximately 70% bitumen and 30% water are becoming popular for sprayed seal operations. Higher bitumen content (up to 85 - 90%) emulsions are being developed but these are not in general use.

Bitumen emulsions are used for various applications and some type of emulsions include additives such as polymer or cutter. Setting and curing of emulsion involves separation and removal of water leaving solid bitumen. The type and quantity of emulsifier determines the setting characteristics of the emulsion.

Particular procedures apply to the handling and storage of bitumen emulsions and a guide is provided in Austroads/ AAPA Pavement Work Tip No.2. *Emulsion Handling and Storage*.

Bitumen emulsion can be used in almost any application where cutback bitumen is used.

Advantages of bitumen emulsions include:

- the ability to handle with minimal or no heating; and
- the absence or significant reduction of cutter in the binder.

Disadvantages of bitumen emulsions include:

- slow initial curing rates; and
- higher cost.

### 3. APPLICATIONS IN SPRAYED SEAL TREATMENTS

#### 3.1 Seal Types

Standard grades of bitumen emulsion are very fluid at ambient temperatures. They are applied cold and hence suitable for skin patching in maintenance work or sprayed

seals involving small size aggregates (generally no more than 7 mm, but occasionally 10 mm depending on texture of surface being treated and required application rates).

A particular application for bitumen emulsions is in "pin down" seals that are applied to "lock down" a seal that is at risk of ravelling or stripping. Such seals can be applied in cool weather using emulsions as binders. Alternative "pin down" seals using cutback bitumen binders require the use of significant amounts of cutters which could increase the risk of bleeding following hot weather.

Standard bitumen emulsions are sometimes used with larger aggregates in multiple application seals that build up a well bound surfacing with successive applications of emulsion and smaller aggregates. Spraying temperature for standard grade emulsion is generally 40 - 60°C.

For single application seals using larger aggregates (10 mm and 14 mm) the emulsion binder content is often increased to 65 or 70%. Such emulsions require additional heating for effective spraying (generally 80 - 90°C) and are viscous enough to avoid excessive run-off. Higher binder content emulsions are often supplied as proprietary grades and may also include polymers for improved initial adhesion and enhanced performance. Manufacturer recommendations should be sought prior to using these grades.

#### 3.2 Design Application Rates

In principle, emulsion seals should be designed to produce the same residual binder application rates as for cutback bitumen seals. Emulsion seal binders however lack the extra volume and softer nature of cutback seal binders. These different properties mean that it may be desirable to add an extra 0.1 - 0.2 litres/m<sup>2</sup> to the emulsion binder application values when spraying emulsions in cool conditions. This is to provide additional aggregate retention and assist with traffic embedment early in the life of the seal.

#### 3.3 Construction Factors

A significant difference in the use of bitumen emulsion sealing binders and cutback bitumen is the time taken for the emulsion to gain sufficient strength to resist uncontrolled traffic. The breaking and curing of emulsion goes through two stages. The first stage, which occurs rapidly, is a breaking and adhesion of bitumen at the contact surface.

