



Technical Direction

Pavements

PTD 2017/001 – RMS 17.457

Cutback bitumen chart for sprayed sealing

Summary:	Audience:
The purpose of this technical direction is to provide guidelines on the revised cutback bitumen chart for Class 170 and Class 240 bitumen.	<ul style="list-style-type: none">• Engineers• Asset Managers• Work Supervisors• Surveillance Officers• Councils

Introduction

The purpose of the cutback bitumen chart is to determine the proportion of cutter oil necessary to reduce the viscosity of bitumen to a target viscosity for pavement surface temperature ranging from 10 °C to 65 °C.

The new cutback chart, Roads and Maritime Services *Form 382* replaces the existing Roads and Maritime cutback bitumen chart, *RTA Form 382* (RTA, 1995) which is now withdrawn. In the new chart, a line or zone for unprecoated aggregate is not present because the use of precoated aggregate is standard practice.

The new chart recommends about 75% of the cutter oil required by the previous chart. Roads and Maritime does not recommended to reduce the cutter further. Below 20 °C the chart is dotted to reinforce the message of risk of low temperature sealing summarised in Notes 3 and 4 on the chart.

Unlike the previous chart, the new chart stops at a maximum of 10% cutter oil. The default cutter oil for use with this cutter chart is cutter oil according to *AS 3568-1999 Oils for reducing the viscosity of residual bitumen for pavements*.

Approvals:

Owner:	Sam Henwood Director Pavements and Geotechnical	Review Date:	28 August 2020
Authorised by:	Chris Harrison Director of Engineering	Effective Date:	28 August 2017

Background

Around 70% of the Roads and Maritime Services road network is covered by the most cost effective surfacing treatment; ie sprayed seals. It is important that an appropriate proportion of cutter oil is added to the bitumen for the existing pavement temperature and the condition of the precoated aggregate. If insufficient cutter oil is added, stone loss will occur due to lack of adhesion (commonly known as 'stripping'). If an excess of cutter oil is added, stone loss may occur due to cohesive failure within the binder (commonly known as 'plucking').

Purpose of cutter oil in sprayed sealing

The purposes of cutter oil in sprayed sealing especially for seals and reseals (Cunningham 2012) are as follows:

- To provide temporary viscosity reduction to allow a wide uniform spray jet without the need for excessive temperatures which cause increased cutter evaporation before reaching the road. Such evaporation at high temperature results in fuming
- To promote better initial aggregate adhesion
- To improve aggregate mosaic formation.

Ensure that an appropriate proportion of cutter oil is added to the binder for the existing pavement temperature and the condition of the precoated aggregate.

Cutter oil use in sprayed sealing

In New South Wales, cutter oil normally used in sprayed sealing is an aviation kerosene type product conforming to *AS 3568-1999 Oils for reducing the viscosity of residual bitumen for pavements*.

In the past, it was assumed that most cutter oil will evaporate in a short period of time. However a research from the Australian Road Research Board (Chester, 1987), conclusively proved that a significant proportion (around one third) of the cutter oil remains for a longer period of time, possibly exceeding twelve months.

For this reason, sprayed sealing carried out outside the normal sprayed sealing season (ie in autumn or winter) is strongly discouraged. The reason is during this cooler condition, a higher proportion of cutter oil is generally required to enable effective spraying and to ensure adequate wetting of the aggregate is achieved. As very little curing takes place during the cooler period, flushing and/or bleeding can occur in the first warm spell after sealing.

Therefore it is advisable to ensure that cutter oil used is no greater than the minimum required for a given situation. Excess cutter oil should never be used to address adhesion issues. The appropriate techniques for adhesion issue is to add sufficient adhesion agent, use precoated aggregate and ensure sufficient rolling of the aggregate during the sealing process.

The new cutback chart

An extract of the new cutback chart is shown in Figure 1.

Significant changes have been made to the existing cutback chart to reflect current field cutback practices adopted by practitioners in New South Wales. These changes include:

- Intended for use with C170 or C240 bitumen
- A reduction of between 20 – 30% cutter oil has been adopted. It is not necessary or advisable for practitioners to reduce this any further
- Only two lines have been used on the chart to determine the appropriate level of cutter oil to be used (previously four used)
- Reduce the amount of cutter oil used by up to 2% when sealing in early spring
- Add up to 2% extra cutter oil if sealing in late autumn
- Limit the maximum allowable cutter oil percentage to 10%
- Limit the use of cutback chart to a minimum expected pavement temperature of 20 °C to ensure good seal performance
- Highlighting the risks associated with sprayed sealing when expected pavement temperature is less than 20 °C
- Note the quantity on the ordinate (Y) axis is now in terms of % cutter in the mix.

References

Chester, J (1987) Cutter oils and their use in sprayed sealing, Austroads Internal Report No. 432-3, Vermont South, Vic.

Cunningham, J (2012) Review of cutback chart, Internal discussion paper, Sydney, NSW.

RTA (1995) RTA Form 382 - Sprayed bituminous surfacing cutback chart, Sydney, NSW – withdrawn.

Standard Australia (1999) AS 3568-1999 *Oils for reducing the viscosity of residual bitumen for pavements*.

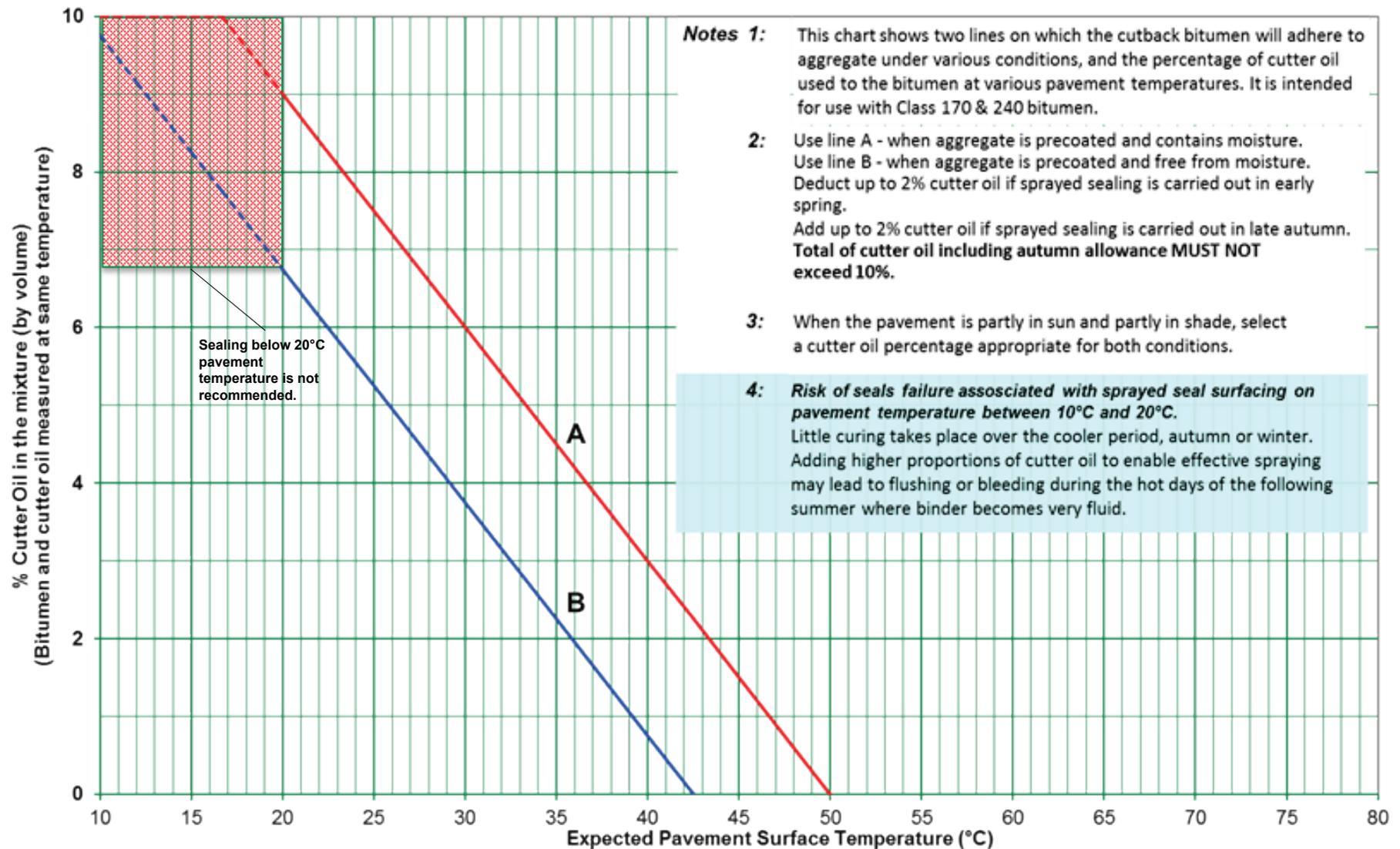


Figure 1 Sprayed bituminous cutback bitumen chart - Seals and reseals with Class 170 and Class 240 bitumen

Determination of application rate of hot cutback bitumen for seals and reseals

The two steps in calculating the application rate of hot cutback bitumen are outlined below:

1. Determination of application rate of cold cutback bitumen

$$\boxed{\text{Application rate of cold cutback bitumen}} = \boxed{\text{Application rate of cold residual bitumen}} \times \boxed{\frac{100}{100 - \% \text{ of cutter oil}}}$$

2. Determination of application rate of hot cutback bitumen

$$\boxed{\text{Application rate of hot cutback bitumen}} = \boxed{\text{Application rate of cold cutback bitumen}} \times \boxed{\text{Multiplier from RMS Form 500C spraying temperature}}$$

Example 1	Example 2
<p>If the cold residual bitumen application rate is 0.95 L/m² and the selected cutter oil content to be used is 6%, then</p> <p>Application Rate of Cold Cutback Bitumen:</p> $0.95 \times [100 / (100-6)] = 1.01 \text{ L/m}^2$ <p>If the proposed spraying temperature is 150°C and the Cold Cutback Bitumen application rate of mixture is 1.01 L/m², then</p> <p>Application Rate of Hot Cutback Bitumen (@150°C using multiplier from RMS Form 500C Table 500C.2)</p> $1.01 \times 1.0897 = 1.10 \text{ L/m}^2$	<p>If the cold residue bitumen application rate is 0.60 L/m² and the selected cutter oil content to be used is 10%, then</p> <p>Application Rate of Cold Cutback Bitumen:</p> $0.60 \times [100 / (100-10)] = 0.67 \text{ L/m}^2$ <p>If the proposed spraying temperature is 135°C and the Cold Cutback Bitumen application rate of mixture is 0.67 L/m², then</p> <p>Application Rate of Hot Cutback Bitumen (@135°C using multiplier from RMS Form 500C Table 500C.2)</p> $0.67 \times 1.0792 = 0.72 \text{ L/m}^2$