

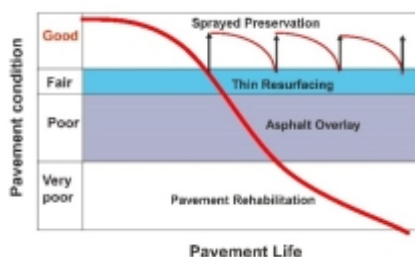
SPRAYED PRESERVATION SURFACING TREATMENTS

INTRODUCTION

The objective of this TECHnote is to provide guidance to assist Road Asset Managers select the most appropriate Sprayed Preservation treatment to extend the life of sealed road networks. A proactive Road Asset Management strategy utilises the full range of bituminous surfacing and pavement preservation treatment options to maximise the number of road segments treated annually whilst simultaneously improving the condition of their road network within existing budget constraints.

There are a range of proprietary treatment options that conform to the Sprayed Preservation Surfacing specification and it is incumbent on Road Asset Managers to ensure that the selected product is suitable for the intended outcome.

Road Asset Pavement Management Systems should be configured to select Sprayed Preservation treatments whilst the bituminous surfacing and the road section are in good condition. The extended life of the bituminous surfacing is shown in the below figure. Sprayed Preservation treatments retard the environmental effects which result in binder oxidation to preserve the pavement and extend the life of the surfacing subject to the treatments being reapplied on a regular frequency, typically 4 – 6 years.



Pavement life cycle with treatment strategies

Binder oxidation in asphalt causes gradual loss of the fine surface matrix leading to ravelling and loss of the larger exposed aggregate. If left untreated, fine cracks develop, and with repeated wet weather events will eventually lead to potholes resulting in localised pavement failure.

SPRAYED PRESERVATION SURFACING TREATMENTS

Sprayed Preservation Surfacing treatment options typically conform to one of the four categories detailed below and are applied to roads where the primary distress mode is due to environmental factors. These treatments do not improve the shape or ride quality, as their primary aim is to preserve and prolong the life of the bituminous surfacing that protects the underlying pavement from changes in moisture content.

SPRAY PRESERVATION TREATMENT OPTIONS

The options for Sprayed Preservation Surfacing treatments include:

- **Rejuvenation:** A sprayed applied treatment comprising maltenes and asphaltenes intended to penetrate into the asphalt surface and chemically reverse or halt the ageing of the bitumen binder on low volume roads. Following spraying of rejuvenators a fine sand is applied, however the experience in Australia, rejuvenators pose an unacceptable risk to road users resulting from vehicles losing traction and skidding on treated roads.
- **Enrichment:** A sprayed treatment also known as Spray Enrichment Surface Treatments (SEST) incorporate bitumen and proprietary additives applied to bituminous surfacing on low volume roads to provide a protective barrier against further binder oxidation. Enrichment treatments are usually applied to spray seals to increase the residual binder of the seal to minimise stripping. Enrichment treatments are typically non-sand filled and the nominal residual application rate range is 0.30 to 0.60 l/m². They are also applied to asphalt and microsurfacing, however when SEST treatments are applied to asphalt surfaces they can reduce the friction characteristics which may result in loss of traction and skidding. Materials used for surface enrichment include:
 - **Bitumen emulsion:** Slow and medium setting emulsions (ASS, AMS, CSS and CMS) are generally used for enrichment work. Rapid setting emulsions should not be used as they tend to break on the aggregate surface, reducing the amount of bitumen run-off available for filling the voids, and increasing the risk of tyre pick-up. Slow and medium setting grades of emulsion may be diluted with water to improve coverage and flow between the aggregate particles. Dilution, if required, must use compatible water and generally not exceed 1:1.
 - **Proprietary materials** incorporating combinations of rejuvenating agents and bitumen, to provide both rejuvenation of hardened binder and provide additional binder volume. The best results are achieved when enrichment treatments are applied before surface age is < 8 years.

To minimise the environmental effects and maintain the surfacing in good condition, Rejuvenation and Enrichment treatments must be reapplied at a frequency of 4 to 7 years. This will result in more than 40 years surfacing age achieved for the lowest whole of life cost.



Abbreviations

ASS: Anionic slow setting
 AMS: Anionic medium setting
 CSS: Cationic slow setting
 CMS: Cationic medium setting
 PME: Polymer modified emastic
 PAP: Penetrative Asphalt Preservative

Definition

Binder oxidation: The changes in the visco-elastic properties of the bituminous binder which cause the binder to harden and become more brittle.

Relevant publications

AAPA

Austrroads AP-PWT38 *Sprayed sealing – Surface enrichment*
 Sprayed Sealing - Surface Enrichment, Pavement Work Tip No. 38

Austrroads

AGPT Guide to pavement technology:
 Part 3 *Pavement surfacings*
 Part 4B *Pavement materials - Asphalt*
 Part 4F *Pavement materials - Bituminous binders*
 Part 4K *Pavement materials - selection and design of sprayed seals*
 Part 5 *Pavement evaluation and treatment design*

Relevant worksections

1143 *Sprayed bituminous surfacing*
 1146 *Microsurfacing*
 1147 *Sprayed preservation surfacing*
 1441 *Bituminous surfacing repairs (PBS)*
 1613 *Repairs to bituminous surfacing (PBS)*
 1614 *Crack sealing (PCS)*

SPRAYED PRESERVATION SURFACING TREATMENTS

Where the existing seal has less than 3% stone loss then the seal would generally be suitable for enrichment treatment.

Spray Enrichment Surface Treatments (SEST) refer to Austroads AP-PWT38 and AAPA Pavement Work Tip No. 38.

- **Seal Coat or PME treatments** Include mineral fillers to create a thixotropic coating intended to replace the fine matrix lost from the surface of oxidised asphalt surfaces. PME treatments form a protective layer on the surface of the asphalt, however they may reduce both the surface texture and friction characteristics. The action of traffic and environmental effects will require PME treatments to be reapplied every 4 – 6 years to continue to protect asphalt surfaces from environmental effects. They are typically applied to low traffic local roads with posted speed limits < 50km/h.

Treatments applied at the optimum time in the life cycle of low traffic roads will extend the life of the bituminous surfacing by a further 5 – 7 years. Conditions that trigger programming of treatments include pavement < 5 % of the area exhibiting pavement failures. Depending on the level of oxidation and extent of raveling, the nominal application rate range for PME treatments is 0.80 to 1.1 L/m². On extremely raveled surfaces higher application rates > than 1.2 L/m² may be suitable, however this will impact the curing/drying time and delay the time before the road may be reopened to traffic.

- **Penetrative Asphalt Preservative (PAP):** Also known as Rhinophalt have recently been introduced in Australia, however they have been used internationally for over 20 years. PAP treatments can be applied on all asphalt surfacing types and any road classifications during either day or night operations. PAP treatments penetrate the asphalt surface through micro-cracks and interconnecting voids to provide a protective barrier inhibiting further oxidation of the binder for up to 5-6 years. This results in reduced water permeability and improved aggregate retention. PAP treatments are applied 'early life' to maintain the visco-elastic properties of the binder.

APPLICATION CONSIDERATIONS FOR SPRAY PRESERVATION SURFACING TREATMENTS

- **Weather conditions:** Spray preservation treatments require dry conditions and should not be applied in wet weather or when rain is imminent. Rejuvenation, Enrichment and PME treatments require a minimum pavement temperature of 20°C. PAP treatments can be applied when the ambient temp is 5°C allowing for night operations.

To minimise the impact to residents and road users, Rejuvenation, Enrichment and PME treatments should be applied in optimum weather conditions including warm and dry with low humidity. Advice should be sought from your service provider in regard to timing of application to ensure adequate drying/curing time.

- **Surface characteristics** The application of Spray Preservation Treatments (Rejuvenation, Enrichment and PME) may impact the surface characteristics of the road surface. Advice should be sought from your service provider prior to treatment selection to ensure that this process will not result in a reduction to either surface friction or surface texture characteristics. On the contrary, PAP treatments are applied with a specialist combi sprayer that synchronously applies a small quantity of fine grit (<1mm) to maintain the surface friction characteristics to pre-application levels. PAP treatments are not recommended on roads with low scrim values.

Guide treatment matrix to select the most appropriate sprayed preservation treatment

| | Rejuvenation | Enrichment | PME/SealCoat | PAP (Rhinophalt) |
|--|----------------------------|----------------------------|---------------------------------|---|
| Road Hierarchy | Local Access Grade < 5% | Local Access Grade < 5% | Local Access Local Collector | Local Collector Regional Arterials Industrial estates |
| Surfacing age (yrs) | < 8 | < 10 | 8 - 12 | 8 – 20 |
| Structural condition ¹ | Good | Good | Good | Good |
| Cracking ² (environmental or age related) | Low | Low | Slight | Slight |
| Surface raveling | Low | Slight | Moderate | Slight to Moderate |

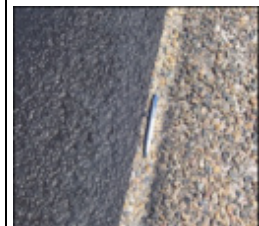
Note:

- Treatments do not provide ride or shape improvement
- ¹ Patch failed areas prior to treatment
- ² Crack filling recommended post treatment

SUMMARY

The most appropriate surface preservation treatment options should be selected based on the condition and age of the low traffic local roads to achieve the desired outcomes. The AUS-SPEC 1147 *Sprayed preservation surfacing* worksection is designed to assist Road Asset Managers with suitable specification guidelines to ensure that the selected surface preservation treatment aids in preserving and prolonging the life of the pavement.

Examples of sprayed preservation treatments



PME applied to stripping seal



PME applied to local road to preserve ravelled asphalt surface



Left side shows condition of 20 yr asphalt surfacing due to binder oxidation



Condition at 18yrs - no treatment



Same age asphalt surface following 3 applications of Enrichment treatment



Treated and untreated surface to reduce water infiltration