GUIDELINES ON THE USE OF FOG SEALS AND REJUVENATOR SEALS

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DISCLAIMER

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BACKGROUND

Intended Function of a Fog Seal

The purpose of a fog seal is to coat, protect, and/or rejuvenate the existing asphalt pavement. Also, a fog seal can be used to decrease the permeability to water and air. To the extent the treatments are effective in reducing permeability, a pavement's waterproofing ability will be improved and the susceptibility of binder to oxidation will be reduced.

Intended Function of a Rejuvenator Seal

Rejuvenating emulsions contain oils that are intended to reduce the viscosity of the existing asphalt, thereby reducing its cohesive failure as the flexibility of binder is improved. This change should result in less cracking. In addition, rejuvenating oils are hypothesized to penetrate and to fill voids in the pavement and to minimize further binder oxidation because the rate of asphalt oxidation is highly dependent on the voids in the total mixture. An effective rejuvenator must penetrate into the pavement surface and then be absorbed by the age-hardened asphalt.

GUIDELINES

These guidelines derive from Texas Department of Transportation (TxDOT) Project 0-5091 and Report 0-5091-3. Replicate cores of both treated and untreated highway and general aviation pavement sections were analyzed in this extensive study. Whole cores were assessed by water permeability and by susceptibility to permanent deformation. Replicate cores were sawed into approximately one-quarter-inch slices that were individually analyzed for total air voids, accessible (or interconnected) air voids, binder content, oxidative aging and rheology, and the presence of fog seal material. The fog seal materials used in this project were emulsions of asphalt materials and coal tar type materials typically used by TxDOT. No assessments were made of the effect of the treatment on raveling of a recently placed seal coat or to the appearance of the pavement.

Use of Treatments to Prevent Raveling

Fog seals are used routinely by TxDOT to stop the further raveling (sometimes called shelling) of a recent seal coat. While this use of fog seals was not studied in this project, the

surveys of TxDOT personnel that were conducted during this study indicated that this was an effective use of the treatments.

Use of Treatments to Improve Pavement Appearance

Fog seals and rejuvenators are also used to restore the dark surface of the pavement and help delineate and sharpen the contrast between the travel lane and shoulder. This attribute of fog seals was not explicitly studied in this project; however, the pictures taken during the project, especially on the airfield pavements, demonstrate the effectiveness of the treatments in providing this benefit. Due to the types of treatments used on airfield pavements, the darkening effect of the treatment is long lasting.

Use of Treatments to Reduce Permeability of the Surface

Permeability testing was done on treated and untreated cores. The fog seals and rejuvenators had little to no effect on the permeability.

Use of Treatments to Protect and Seal against Binder Oxidation

The fog seals and rejuvenators showed very little to no ability to reduce or retard binder oxidation.

Use of Treatments to Rejuvenate Pavement Binders

The testing in this project demonstrated that fog seals and rejuvenators had very little, or no, ability to rejuvenate in-situ binders.

Seal Materials

The binders used in fog seal materials in Texas span a wide range of properties. Most are asphalt materials, but also there are much lighter coal-tar aromatic materials. The polymer-modified surface sealer (PASS) material was a polymer-modified asphalt with a 60 ^{o}C low shear rate viscosity of approximately 1000 poise. The medium-set emulsion (MS-2) and asphalt emulsion materials had 60 ^{o}C low shear rate viscosities of 2000 and 3000 poise, respectively. The COS-50 60 ^{o}C low shear rate viscosity was much higher at 30,000 poise, approximating that of a newly placed pavement binder. Thus, this binder may be expected to better withstand traffic stresses at the surface and to protect against raveling, provided that adhesion to the aggregate is adequate. The coal-tar materials used on airfield pavements seem to serve well to darken pavement surfaces

Summary Table

Fog seal properties, including their advantages and disadvantages are summarized in the accompanying table.

Fog Seal Emulsion Summary Table

Treatment Material	Example Grades	Solvent	Application Rate* (Gal/SY)	Residual Viscosity* (Poise) @ 60 C, 0.1 rad/s	Field Performance		Remarks
					Advantage	Disadvantage	
Slow Setting emulsion	- CSS-1 - SS-1	Water	0.09 - 0.1	2,200[a]	- Low cost - Easily applied	- No pavement penetration detected - No water sealing effect detected	- Slow-set emulsions typically are better for coating dust or fine aggregate; the faster setting the emulsion, the cleaner the surface should be
Medium Setting Emulsion	- MS-2 - CMS-2	Water	0.15	2,000[b]	- Low cost - Easily applied	- No pavement penetration detected - No water sealing effect detected	- Most commonly used product for both seal coats and HMAC - Slow-set emulsions typically are better for coating dust or fine aggregate; the faster setting the emulsion, the cleaner the surface should be
Hard Residual Emulsion	- COS-50 - SS-1H - CSS-1H	Water	0.14	30,000[c]	- May possibly be more durable, unlikely to bleed or flush	- In some cases, it may provide a less skid resistant surface - No pavement penetration detected - No water sealing effect detected - Cost may be higher	- For COS-50, only used experimentally - Slow-set emulsions typically are better for coating dust or fine aggregate; the faster setting the emulsion, the cleaner the surface should be
Polymer Modified Emulsion	- PASS (CMS-1P) - SS-1P - CSS-1P	Water	0.10 - 0.16	1,100[d]	- Break rapidly after application	- No pavement penetration detected - No water sealing effect detected - Cost may be higher	- Used often, especially on HMAC - Most common rejuvenator used - Slow-set emulsions typically are better for coating dust or fine aggregate; the faster setting the emulsion, the cleaner the surface should be
Coal-Tar Sealer	- PDC - EB44	Naphtha / Antracene	0.04 - 0.1	< 1,000[e]	- Hard, fuel-resistant surface; retains black color for longer	- Environmental concerns with runoff/solvent - No pavement penetration detected - No water sealing effect detected	- Used extensively on airports

* Approximate Values From Field and Laboratory Data

[a] Viscosity Measured From CSS-1

[b] Viscosity Measured From MS-2

[c] Viscosity Measured From COS-50

[d] Viscosity Measured From PASS

[e] Viscosity Measured From PDC