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Proper Use of Tack Coat

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Introduction

TxDOT has historically experienced a significant number of pavement failures that may be related to inadequate tack coat or improper application. Proper application of tack coat is a key ingredient to quality asphalt paving. A good tack coat provides the necessary bond to underlying layers, maximizes the strength of the pavement structure and helps ensure long-lasting performance. On the other hand, the lack of a good tack coat or poor adhesion can quickly lead to premature hot mix failures. Debonding (de-lamination) can result from an inadequate tack coat. This is usually followed by fatigue cracking in the wheel paths. It can progress to alligator cracking, potholes and other distresses such as rutting that greatly reduce the life of the pavement surface. In May 2001, **Flexible Pavements of Ohio (FPO)** recently published a Technical Bulletin entitled "Proper Tack Coat Application." The FPO technical bulletin deals primarily with the use of emulsions for tack coat; however, many of the ideas discussed in that bulletin also apply to cutbacks and asphalt cements. With their permission, that technical bulletin is linked to this Advisory.

Background

There are always a number of concerns regarding the use of tack coats. Over the years, various problems such as mat slipping and debonding have been reported. Cutback asphalts, emulsified asphalts, and straight asphalt cements (also referred to as "neat" asphalts) are all used for tack coats. Since emulsions are much easier to use, they have become the most common types of asphalt used for tack. Many of the reported tack coat problems may be due to improper use of emulsions; however, problems can also occur if cutback asphalts and neat asphalts are not used properly.

Regardless of what type of asphalt is used, there are several basic keys to follow to ensure a good tack coat is applied. Listed below are the main keys to applying a good tack coat.

- Start with a surface that is **thoroughly cleaned** before applying the tack coat.
- Apply a **uniform application** of tack. (This may require spreading via running a pneumatic tired roller over the tacked surface to ensure uniform distribution.)
- Verify that the proper amount of **residual** asphalt is applied. Table 1 of the attached PFO bulletin lists the typical application rates of **residual** asphalt that are recommended for various pavement conditions.
- Allow the tack coat enough time to thoroughly **break** and **set** (for emulsions) or **cure** (for cut back asphalts).
- **Verify** that the tack coat has **adequate adhesive properties** by using a "boot heel" evaluation or some other means. The tack should "stick" like glue not just

“coat” like motor oil. After the mix has been placed, check the roadway (QCQA) cores to ensure that a good bond exists between the new hot mix layer and the underlying pavement.

Special Considerations for Emulsions

Emulsified asphalts have essentially replaced the old cut back asphalts (such as RC 250) historically used in Texas. Although cutback asphalts are still used as tack coat in some areas of the state, the use of cutback asphalts is greatly restricted because of environmental concerns and restrictions in non-attainment areas. Neat asphalt cements such as AC 5, AC 10 and their performance grade equivalents (example: PG 58-16), are sometimes used for tack coat; however, emulsified asphalts such as SS1h and CSS1h make up the vast majority of the asphalts used for tack coat in Texas.

Emulsified asphalts can be a little more complicated to properly apply than other asphalts; however, if done correctly emulsified asphalts will work well as a tacking material. They also offer some inherent advantages over other asphalts, since they do not have to be heated and can be more uniformly applied compared to neat asphalts and cutback asphalts. It is important to remember that emulsions are actually neat asphalt cements that have been diluted (emulsified to be more exact) with water. The bottom line is that once the water has evaporated (after the emulsion breaks and sets), all that is left is the asphalt cement which should be black and sticky. No matter what material you choose to use for a tack coat, it must have adequate adhesive properties (i.e., it should be very sticky). As a rule of thumb, if you can walk on the tack coat without it sticking to your boots, the tacked surface is not ready to be paved over. Many seasoned inspectors will tell you that the tack coat should almost rip off your boot heel when you walk across it. If you can walk on the tack coat without feeling some discomfort, it may not have adequate adhesion. It is also important to remember that emulsified asphalts have a relatively short shelf life. If the emulsion is not used for extended periods of time, it can go bad by demulsifying into its base components.

Potential Problems

Knowing when a tacked surface is ready to pave over can literally mean the difference between a hot mix pavement that lasts for many years or a multimillion-dollar premature failure. Education and training on proper tack application are two keys to preventing premature hot mix failures. There are two common mistakes that can occur when using emulsified asphalt for tack coat. The first is knowing when the emulsion has “broken” and “set,” and the second is applying the proper rate of emulsion.

- ➔ **Ensuring the Emulsion has “Broken” and “Set”** — Shortly after an emulsion has been applied to a paving surface it begins the process of “breaking.” This is the process of water evaporation from the emulsion. When the water begins to evaporate, the emulsion will change from a brown color to black. The time required for the water to completely evaporate depends on many factors, but generally ranges from one to two hours under most circumstances. Once all of the water has evaporated, the emulsion is said to have “set” and paving can begin.
- ➔ **Selecting the Proper Application Rate** — The attached FPO bulletin covers this topic well. I will not repeat everything it contains, but I would like to add a few suggestions. Know how much residual asphalt cement is in the emulsion before you tack. If you are not sure, take a sample, cook off the water in an oven and calculate the residual. Normally SS1h and CSS1h contain about 40 percent water and about 60 percent residual asphalt. Diluting emulsions with water at a ratio of one to one used to be a very common practice; however, **it should be noted that beginning with the 2004 standard specifications, TxDOT no longer allows the practice of diluting emulsions for use as tack coat.** Various problems have resulted from improperly diluting emulsion. For example: If the supplier knew the material was going to be used for tack coat, they would often dilute the emulsion at a ratio of 1:1 with water. This result was an emulsion that was 70 percent water and 30 percent residual binder. Furthermore, if the contractor did not know that the emulsion had already been diluted, they would often add even more water. The result was often a residual asphalt cement percentage that was way too low. This should no longer be an issue since **TxDOT no longer allows the practice of diluting emulsions for use as tack coat;** however, some old traditions die hard. The bottom line is “do not assume anything.” Measure it and make sure the right amount of residual binder is placed. The current hot mix specifications (example: Item 341) specify a maximum rate of application of 0.10 percent residual and a minimum rate of application of 0.04 percent residual.

Conclusions

The importance of the tack coat is often overlooked, yet the tack coat is a critical component of a good hot mix pavement. TxDOT has historically experienced a significant number of pavement failures that may be related to an inadequate tack coat. Emulsions, cutback asphalts and neat asphalts can all be used successfully as tack coat materials if the basic keys to applying a proper tack coat are followed. It should also be noted that in the past few years, there are several companies that have developed special tack coat products. Under the 2004 standard specifications, these specialty tack coat products can be used "when shown on the plans or approved" by the engineer. If you have any questions on the use of tack coats, please contact Dale A. Rand, P.E. (512/506.5836) in the Flexible Pavements Branch of the Construction Division.

Acknowledgement

Special thanks are extended to **Flexible Pavements of Ohio** for contributing the attached technical bulletin, "[Proper Tack Coat Application](#)."