Overview

As defined by the Federal Highway Administration (FHWA), pavement preservation involves a systematic approach to preserving the investment in existing roadways by improving pavement performance and extending pavement life in a cost-effective manner. It includes a variety of activities that are undertaken to provide and maintain serviceable roadways, including corrective and preventive maintenance as well as minor rehabilitation activities.

The Texas Department of Transportation’s (TxDOT) definition of pavement preservation is the extension of the life of good pavements via the application of timely preventive maintenance treatments, performed at the optimal time to preserve pavement condition throughout its service life or to extend the life of the pavement, and to reduce the amount of water infiltrating the pavement structure, protecting the pavement system, slowing the rate of deterioration, and correcting surface deficiencies.

An important part of a preservation program is the use of pavement preventive maintenance treatments to improve the condition of the pavement and delay the rate of deterioration. Since preventive maintenance treatments are relatively inexpensive in comparison to resurfacing or reconstruction projects, a pavement preservation program is a cost-effective means of meeting pavement performance goals. The use of preventive maintenance treatments also slows the rate of pavement deterioration, thereby delaying the need for major rehabilitation by several years. Other benefits in a pavement preservation program include:

- higher customer satisfaction
- ability to make better, more informed decisions
- a more appropriate use of maintenance techniques
- improved pavement conditions over time
- increased safety
- reduced overall maintenance costs.
TXDOT has a long history of highway pavement preservation. Beginning in the early 1900s, the department began using today’s pavement preservation strategy referred to as seal coat as a wearing course in the construction of low volume roads. Today, the department has a large arsenal of preservation treatments that are used on a continuous basis to keep highways fully operational and at a high level of service.
TxDOT management recognized the benefits of preventive maintenance and developed the formal “Preventive Maintenance Program” in 1987. Prior to the program’s adoption, TxDOT districts utilized the Safety and Betterment Program ($100M/yr) and their Routine Maintenance Budgets to perform preventive maintenance work.

TxDOT’s Preventive Maintenance Program was established on June 30, 1987 by Commission Minute Order 85883, which funded the program at $145 million annually for
preventive maintenance projects. In fiscal year 2006, the program was funded at $250 million.

Minute Order 86296, a supplement to the founding Minute Order, was issued on September 29, 1987 and defined that the purpose of the preventive maintenance program is “to prevent major deterioration to roadways and bridges through a planned cycle of repairs.” Typical projects eligible for this program include pavement preservation strategies such as seal coats, micro-surfacing, crack sealing, and thin asphaltic concrete pavement overlays.

**The Texas Highway System**

The Texas highway system consists of more than 190,000 lane miles and accommodates more than 460,000,000 daily vehicle miles. In fiscal year 2006 the department’s construction budget was well over $3.9 billion and its maintenance budget over $2.7 billion.

**Texas Pavement Preservation Techniques**

Seventy percent of all problems that develop with asphalt pavements can be attributed to the oxidation of oils in the asphalt binder and water penetration. Water, through chemical reaction and the freeze-thaw cycle, is asphalt pavement’s greatest enemy, causing the breakdown of the pavement structure. These problems can be virtually eliminated with a conscientious and timely program of carefully selected surface treatments.

An additional 25% of the problems that develop can be traced to base failures underneath the asphalt itself, basically defects in pavement design and/or construction practices. The result is that stresses on the pavement cause it to fail, requiring immediate and often costly repairs.

The remaining problems with asphalt pavement can be attributed to thermal expansion and contraction. The resulting cracks should be treated with approved crack-filling techniques to prevent potential damage caused by water infiltrating the surface of the pavement.

**Texas Seal Coat (Chip Seal)**

In fiscal year 2005, TxDOT seal coated 19,374 lane miles. Assuming that each lane mile averages 12 feet in width, this number represents more than 136 million square yards. At an average of 0.45 gallons per square yard, that equals more than 61 million gallons of asphalt or emulsion, and at one cubic yard per 100 square yards, that is more than 1.3 million cubic yards of aggregate.

Seal coating consists of spraying asphalt material (asphalt cement or emulsified asphalt), followed immediately by a thin aggregate cover, to existing pavement to
extend the life of the pavement. Seal coats are not intended as permanent pavement surfaces and have a life expectancy of six to eight years. The service life of seal coats varies depending on the condition of the existing surface and other variables such as traffic type and volume, weather, and climate. Seal coats serve to correct pavement deficiencies such as:

- lack of skid resistance,
- cracks (less than ¼”),
- raveling (or shelling),
- bleeding, and
- aged or oxidized pavement.

Seal coats do not strengthen the existing pavement, increase its load-bearing capacity, smooth out rough pavement, or bridge major cracks wider than ¼ inch.
Asphalt Distributor

Applying Aggregate
Strip/Sport Seal Coat

Seal Coat Binders

Asphaltic cements commonly used in Texas seal coats include AC-5, AC-10, and AC-15 with additives such as polymers, tire rubber, CRS-2, CRS-2H, CRS-2P, and HFRS-2P. Commonly used emulsions include RS-1P, CRS-1P, RC-250, RC-800, RC-3000, MC-250, MC-800, MC-3000, and MC-2400L.

Emulsions are used for ease of application. They enable the use of much lower application temperatures that do not damage asphalt and are safer for field personnel.
According to the Asphalt Institute, asphalts used in Texas seal coats should have the following characteristics:

- when applied, the binder should be fluid enough to spray and cover the surface uniformly, not puddle in depressions or run off the pavement,
- it should retain the required consistency to wet the applied aggregate,
- it should develop adhesion quickly,
- it should hold the aggregate tightly to the roadway surface, and
- it should not bleed or strip under traffic.

FY 2000 - FY 2005
Seal Coat Dollars Spent
Texas Crack Sealing

Crack sealing consists of cleaning cracks in the pavement surface and placing specified materials into the cracks to reduce the infiltration of water. The pavement surface should be relatively new with no base failures or rutting.

The most common types of cracks sealed include longitudinal and transverse cracks. Longitudinal cracking is caused by inadequate bonding at lane joints and heavy loads or high tire pressure in wheel ruts. Transverse cracking is caused by temperature changes (freeze-thaw effect) and shrinkage of the asphalt.

Generally, cracks which have opened up more than ¼ to ½ inch are candidates for sealing. A wide variety of crack filler materials are in use today, but rubberized asphalt crack sealers have been found to be quite effective.
Crack Sealing Operations

FY 2000 - FY 2005
Crack Seal Dollars Spent

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Texas Micro-Surfacing

Micro-surfacing is a mixture of polymer modified asphalt emulsion, 100% crushed aggregate, mineral filler, water, and other additives. This preventive maintenance technique was introduced in Texas in 1989.

Micro-surfacing is applied to pavement to protect it from weathering. It is used more often on high traffic volume roadways to improve skid resistance and repair rutting.

A single course of micro-surfacing will:

- retard oxidation and moderate raveling,
- reduce the intrusion of water,
- improve surface friction, and
- remove minor surface irregularities in the pavement surface.

A multiple course of micro-surfacing is used to correct pavement surface deficiencies, including rutting and minor surface profile irregularities.
Micro-Surfacing
FY 2001 - FY 2005
Micro-Surfacing Dollars Spent

Fiscal Year

Dollars Spent

FY 2001 - FY 2005
Micro-Surfacing Cost/LM

Fiscal Year

Cost Per Lane Mile

17
Texas Thin Overlays

The traditional method for protecting a deteriorating pavement, reducing roughness, restoring skid resistance and strengthening the pavement structure of a flexible pavement is with a thin overlay of hot mix asphalt (HMA). A thin overlay is a preventive maintenance technique that provides some protection to the pavement structure. It will reduce the rate of pavement deterioration, reduce permeability, correct surface deficiencies to improve the ride quality and add some strength to the existing pavement structure.

It is typical practice to place thin overlays up to one inch thick when considering the need to restore skid resistance and protect a deteriorating pavement. Any attempt to correct roughness will require the use of a thick overlay.
Applying Thin Overlay

Motor Grader Applying Thin Overlay
Conclusion

A successful pavement preservation program requires that everyone have a clear understanding of what pavement preservation is and how it relates to existing maintenance activities. Pavement preservation includes all activities carried out to provide and maintain a high level of service on our roadways, preserve our investment, extend pavement life, and enhance pavement performance.

Preventive maintenance is a pavement preservation tool to provide cost effective treatment to the surface of a structurally sound pavement to preserve the system and retard future deterioration. Time is the element by which cost-effectiveness is defined. A preventive maintenance treatment placed on a road too late will result in poor performance because it is not designed to increase structural capacity. Conversely, placing the treatment too early will result in unnecessary costs and pavement problems such as flushing and rutting.