PAVEMENT COATINGS TECHNOLOGY COUNCIL

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Benefits of Preventative Maintenance Pavement Sealers

Introduction

Pavement Sealers have been used successfully for around 60 years. Recently, environmental activists have claimed that pavement sealers are only used for cosmetic reasons, but this trivializes the important role that sealers play in pavement maintenance.

The benefits of sealers are best illustrated through examining the life cycle of asphalt pavement and the important role that asphalt sealers and refined tar sealers play in pavement protection programs.

Asphalt Pavement Basics

Any asset requires maintenance in order to maintain its value and to extend the useful life of the asset. An asphalt pavement driveway adds value to any home. An asphalt pavement parking lot adds value to a commercial lot. In the case of an airport, the asphalt pavement runway is an essential asset.

Asphalt hardening (the binder in the pavement) is an oxidation process and is a function of its exposure to air on the surface and within the pavement. If circulation of air through the interconnected void spaces in the pavement can be prevented or reduced, the rate of hardening of the asphalt will be slowed and the life of the pavement extended. Pavement sealers are used to do just that - close the surface pores to lengthen the life of the pavement[1].

Asphalt Pavement Preventative Maintenance

There are three components of a pavement preservation system (Figure 1): preventive maintenance, minor rehabilitation and routine maintenance.

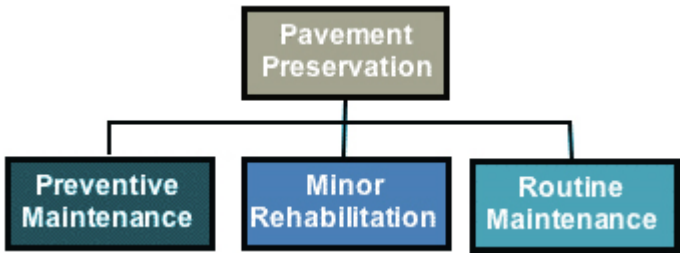

Figure 1-Pavement Preservation System

[1] http://www.faa.gov/airports/engineering/engineering_briefs/media/EB_44.pdf

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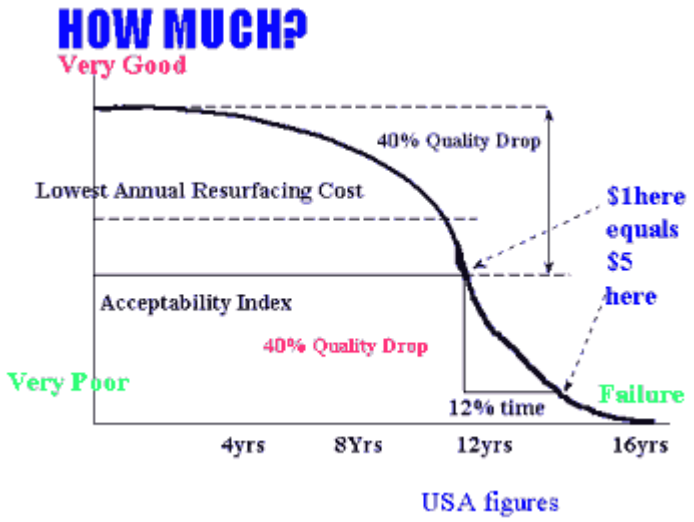
One method of preventative maintenance is the use of pavement sealers, which in turn makes minor rehabilitation and routine maintenance easier. Pavement sealers are applied to protect the surface of Hot Mix Asphalt (HMA) pavement from the corrosive effects of gasoline, diesel oil, motor oil, and grease that drip or are spilled onto an asphalt-based surfaces. Sealers also prolong the life of asphalt based pavements by decreasing oxidation (that occurs via exposure to air) and ultraviolet light bleaching (that occurs via exposure to sunlight) as well as preventing moisture from entering the pavement. The net effect is an extension of the performance life of new or existing asphalt-based pavement[2].

A study by the Washington State Department of Transportation (DOT) contains the following conclusion:

> An effective pavement preservation program integrates many preventive maintenance strategies and rehabilitation treatments. The goal of such a program is to extend pavement life and enhance system-wide performance in a cost-effective and efficient way. Studies show that preventive maintenance is six to ten times more cost-effective than a "do nothing" maintenance strategy[3]



Source: http://www.slurry.com/index.php/property-management/142-home-owners-and-commercial-pavement-preservation.html

A study by the University of Minnesota concluded the following:

> Historical cost data show that routing and sealing cracks on a 75-foot-wide runway costs anywhere from $2,000 to $5,000 per 1,000 feet. So maintaining a 5,000-foot runway could cost up to $25,000 for each crack repair project alone. This type of maintenance is done periodically over the life of the pavement, and may be repeated several times. Routing and sealing cracks prevents water from infiltrating the underlying pavement

[2] http://www.wsdot.wa.gov/biz/mats/pavement/Technotes/PavementSealer2007.pdf

[3] http://www.mnltap.umn.edu/pdf/asphalt.pdf

> layers and helps preserve the structural integrity as well as maintain a smooth ride. After several years, a thin overlay may be needed to address weathering or drying out of the pavement surface. Costs for this type of maintenance range from $40,000 to $50,000 per 1,000 feet. If the preventive maintenance program over a 20-year period included three crack-sealing projects and a 2-inch overlay, the airport owner would have spent approximately $325,000 for maintenance; at the end of the 20 years, however, the pavement would still be in good condition. Reconstruction might not be needed for many years. Without maintenance over a 20-year period, total reconstruction may be needed, at an estimated cost of about $140,000 to $315,000 per 1,000 feet. That same runway would cost anywhere from $750,000 to $1,375,000 to replace. The costs of a no maintenance strategy are at least two times higher in this simple case study[4].

Another University of Minnesota study states,

> Typically, pavements perform well under loads until a particular point in their life spans, at which time they deteriorate precipitously and rapidly to failure. Experience shows that spending $1 on pavement preservation before that point eliminates or delays spending $6 to $10 dollars on future rehabilitation or reconstruction costs[5].

A Federal Highway Administration report states,

> Conclusive history shows that a properly formulated asphalt rejuvenator meets stipulated requirements and is a proven method to extend pavement life at a low cost[6].

As a final example, a study focused on evaluating the effectiveness of preservation methods concluded,

> The cost analyses show that many preventative maintenance treatments are cost-effective compared to HMA (Hot Mix Asphalt Pavement) overlays, particularly if performed when the pavement condition prior to treat is fair (or better)[7].

Choice of Pavement Maintenance Sealers

TYPES OF SEALERS

The two basic types of sealers are (1) refined tar based sealer (2) asphalt based sealer. Both are emulsions which mean they are formulated to be applied as water-based liquid. Aggregates added to the emulsions include sand, mineral filler, or a blend of these. The addition of aggregate to the emulsion increases the density of the mixture and provides a friction component to the sealed pavement surface[8]. The two types of emulsions are described as follows:

[4] http://www.airtap.umn.edu/Publications/Briefings/2005/Briefings-2005-Summer.pdf

[5] http://www.fhwa.dot.gov/pavement/preservation/ppc0605.cfm

[6] http://www.techtransfer.berkeley.edu/icpp/papers/47_2010.pdf

[7] http://www.techtransfer.berkeley.edu/icpp/papers/28_2010.pdf

[8] http://www.wsdot.wa.gov/biz/mats/pavement/Technotes/PavementSealer2007.pdf

Refined Tar-Based Sealer

Refined tar is a by-product of the distillation of crude coal tar. Refined tar differs from crude coal tar in that during the distillation process, the lighter end oils are removed from the refined tar. Refined tar based sealer is resistant to attack from petroleum based products. This property makes it ideally suited for parking lots or other locations where concentrations of oil and grease leaks are common. Refined tar-based sealer is also highly resistant to ultraviolet light bleaching. It is stable, homogeneous, easy to apply, and has been handled safely by professionals and do-it-yourselfers for decades. Refined tar based sealer has traditionally been used at gas stations, truck and bus terminals, airport aprons and taxiways[9] as well as on residential driveways and commercial parking lots.

Asphalt based emulsions

Asphalt-based emulsions have many of the same beneficial properties as refined tar-based emulsions, but they are less resistant to corrosion by petroleum-based products, ultraviolet bleaching, and salts. An asphalt emulsion is a mixture of liquid asphalt and water. Manufacturers add special chemicals and pigments to the asphalt emulsions to improve performance but they remain susceptible to the damage caused by petroleum products[10].

Service Life of Preventative Maintenance Sealers

Many factors determine the service life of a protective sealer. First of all, use of the proper product specification is critical. An example of a poor product specification would be using an asphalt based emulsion at a gas station, where gasoline spillage would be virtually unavoidable.

Just to name a few other factors that affect the service life of a sealer are:

-amount of UV light exposure
-traffic volume and loads
-exposure to petroleum products
-coating age
-thermal expansion
-water
-pavement condition at time of sealing

Generally the pavement sealer industry uses general service lives of 1-3 years for asphalt-based sealer and 3-5 years for refined tar-based sealer.

[9] http://www.wsdot.wa.gov/biz/mats/pavement/Technotes/PavementSealer2007.pdf

[10] http://www.wsdot.wa.gov/biz/mats/pavement/Technotes/PavementSealer2007.pdf

A study conducted by the Washington State DOT suggests that the service life of both sealers used in rest areas in Washington State were as follows:

Refined Tar Based Sealer	8-10 years
Asphalt Based Sealer	4-6 years[11]

In the Texas Engineering Extension Service publication *Lone Star Roads* suggests that

> Seal coats are the best tool for preventing or arresting pavement deterioration. As the name implies, a seal coat "seals" the pavement. No different than putting a new roof on a house, the seal coat fills voids and cracks, keeping water out of the pavement structure. It is said that the only reason for the rock [that is, aggregate added to the emulsion] is to keep tires out of the asphalt! This is not totally true, because it also creates a great skid resistant surface for traffic[12].

A study conducted by the U.S. Army Corps of Engineers concluded that

> Tar-based [Refined tar] materials have been used for many years as seal coats to prevent damage to pavement from fuel spillage. Tar [Refined tar], unlike asphalt is not a petroleum product and is not greatly affected by petroleum fuel spillage[13]…. Military installations have all of these problems, with fuel spillage plus the possibility of a sabotage scenario. Such a scenario could involve fuel being intentionally dumped on an airfield in order to interfere with airplane operations[14].

Conclusion

Contrary to the claims of environmental activists, pavement sealers allow homeowners; businesses and other infrastructure facilities such as airports to maintain their asphalt pavements safely and economically. Research has shown that shown that when asphalt pavement is maintained properly, the owner can extend the life of their pavement and delay costly reconstruction.

[11] http://www.wsdot.wa.gov/biz/mats/pavement/Technotes/PavementSealer2007.pdf

[12] http://www.utexas.edu/research/tppc/pubs/graff_TEEX.pdf

[13] http://dx.doi.org/10.1061/(ASCE)0899-1561(1994)6:1(137)
[14] http://dx.doi.org/10.1061/(ASCE)0899-1561(1994)6:1(137)