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ISSUE FOCUS - PAVEMENT PRESERVATION

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CAPE SEAL or "How I Learned to Love Slurry Seal"

by Mark Clark, Lake Havasu City, Transportaion Division Manager (Lake Havasu City Pavement Overview)

One of the major benefits that both LTAP and group interactions or networking such as the recent Maricopa Maintenance Fair provides is a chance to exchange ideas regarding the many different solutions to our numerous roadway maintenance needs. Lake Havasu City is happy to share some of what has worked for us.

Lake Havasu City reached an important threshold in our Pavement Management in 1995. Several chip seals had not performed as expected, our roadways were 30 years old and had been poorly maintained, poor choices such as thin (1" overlays) had not performed and we had over 400 miles of roadways and a limited budget. The public knew our roadways were bad (and so did we) but we didn't have a measure of what bad was. Lucky for us, we had some idea of where to go after talking with some of the bigger communities and exploring our pavement maintenance options.

The first step was to implement a Pavement Management System. In our case, this was as simple as measuring and quantifying what we had and what might work for us. There are examples of very large and comprehensive programs in the larger communities including Phoenix and Las Vegas, but at a minimum –

Step 1. **Measure what you have with regards to how much pavement and in what condition it is.** We utilize Micropaver only to develop the Pavement Condition Index and use a spreadsheet to work our plan. Also measure what your actual costs for treatments are.

Step 2. **Use what works for you in your area, don't be afraid to experiment, ask your neighbors, attend Pavement Maintenance Fairs and read the Milepost.** Cape Seals have worked for us do to some local advantages, including excellent native materials, limited truck traffic on most roadways and no moisture or freeze-thaw concerns. Chip Seals alone were abandoned due the concerns from the public with regards to rough roads and loose rock. Costs will vary from area to area and what might be cost effective at other locations may be prohibitive in your area.

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PRINCIPLES OF PAVEMENT PRESERVATION:

Definitions, Benefits, Issues, and Barriers

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Americans are accustomed to easy mobilityon safe, smooth, and well-maintained roads. These same roads play a critical role in the nation's economy, bolstering agriculture, industry, commerce, and recreation.

During the 1990s, the nation's highways experienced a 29 percent increase in use, and more growth is expected in the next 10 years. Large commercial truck traffic increased by nearly 40 percent, with growth projected to continue at more than 3 percent per year during the next 20 years. In addition, more than 95 percent of personal travel is by automobile.

Increasing the capacity of highways, therefore, is important in meeting the nation's needs. But can the United States finance future highway capacity while addressing the needs of the current system? Yes—by developing a strategic plan that includes pavement preservation.

TABLE 1 Public Highway Ownership by Miles

Jurisdiction	Miles (Thousands)	Percentage
Federal	118	3.0
States	775	19.6
Local	3,055	77.4
Total	3,948	100.0

Economical Alternative

Pavement preservation gives highway agencies an economical alternative for addressing pavement needs. Moreover, with pavement preservation, highway agencies gain the ability to improve pavement conditions and extend pavement life and performance without increasing expenditures. The focus is on preserving the pavement asset while maximizing the economic efficiency of the investment. Pavement preservation provides greater value to the highway system and improves the satisfaction of highway users.

Pavement preservation is not about a single treatment, nor is it a one-size-fits-all philosophy. Instead, pavement preservation must be tailored to each highway agency's system needs in the most cost-effective manner. This involves using a variety of treatments and pavement repairs to extend pavement life.

According to the Federal Highway Administration (FHWA), the United States maintains nearly 3.95 million miles of public roads (1). Table 1 shows highway mileage by agency ownership. The problem facing highway agencies is that many roads are wearing out because of increased traffic, environmental effects, and a lack of proper maintenance.

Every highway agency must deal with the effects of regional environments on pavement performance, in addition to the effects of traffic. Pavement sections originally projected to last many years can accumulate distress at an accelerated rate and fail prematurely. Most highway agencies experience and understand this problem but are daunted when budget allocations do not keep pace with the needs of highway pavement upkeep.

(continued on page 3)

PRINCIPLES OF PAVEMENT PRESERVATION (CONTINUED FROM PG. 2)

Toolbox Approach

In the past, many maintenance practices have not been effective, because they were applied reactively to roads in poor condition instead of proactively to roads still in good condition. Succinctly stated, the correct approach to preventive maintenance is to "place the right treatment on the right road at the right time."

Preservation became a topic in the early 1990s, when highway agencies examined effective maintenance practices. The preservation concept—whether for pavements or for bridges—is a departure from traditional approaches, which wait until deficiencies are evident and until reconstruction or major rehabilitation are the only means to correct the problem.

Preservation, however, addresses minor deficiencies early, before the defects become major problems, and extends the life of the asset at a relatively low cost. A strong preservation program is essential to asset management.

Because preservation activities include so many kinds of treatments, agencies should build their own preservation toolboxes to serve their particular needs. Just as a mechanic's toolbox contains many different tools, each designed for a specific job, a preservation toolbox should include a host of treatments to address specific conditions.

No treatment will be suitable for every location. For example, a chip seal may be a long-lasting, cost-effective surface treatment in a rural area, but not in a large urban area. Conversely, concrete ultrathin white-topping may be cost-effective in a large urban area, but not in a rural area. Similarly, performance and cost effectiveness should be evaluated in the context of the areas in which the preservation treatments are applied.

Definitions of Terms

A clear presentation of pavement preservation in the United States requires the development and adoption of standard definitions:

Asset Management

FHWA and the American Association of State Highway and Transportation Officials (AASHTO) define asset management as a systematic process of maintaining, upgrading, and operating physical assets cost-effectively (*2*). Asset management combines engineering principles with sound business practices and economic theory and provides tools to facilitate an organized, logical approach to decision-making. Asset management provides a framework for both short-and long-range planning.

Load transfer restoration on portland cement concrete pavement

(*left)* cutting a slot in the pavement

(*right*) inserting dowel

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PRINCIPLES OF PAVEMENT PRESERVATION (CONTINUED FROM PG. 3)

Asset management is important to state and local governments because of the Governmental Accounting Standards Board's (GASB) Policy Statement 34, "Basic Financial Statements for State and Local Governments," issued in June 1999. GASB 34 encourages government agencies to promote asset management practices and to report the value of capital assets such as utilities, roadways, and other infrastructure (*3*).

The value and maintenance of these assets eventually affects the bond ratings of government agencies, which in turn affect the government's ability to borrow the money to repair and replace the investments. The objective of an asset management program, therefore, is to:

- Consider various investment strategies,
- Provide a more rational decision process, and
- Improve the overall condition of the high

Microsurfacing on Interstate 75 in Michigan—one of 14 pavement preservation techniques in FHWA's program.

Preventive Maintenance

According to AASHTO, preventive maintenance is a planned strategy of cost-effective treatments that preserves and maintains or improves a roadway system and its appurtenances and retards deterioration, but without substantially increasing structural capacity (*3*). Preventive maintenance is a tool for pavement preservation—nonstructural treatments are applied early in the life of a pavement to prevent deterioration. In other words, preventive maintenance applies the right treatment to the right pavement at the right time.

Pavement Preservation

Pavement preservation is the sum of all the activities to provide and maintain serviceable roadways, including corrective and preventive maintenance, as well as minor rehabilitation. The strategy does not include new pavements or pavements that require major rehabilitation or reconstruction.

A pavement preservation program aims at preserving investment in the pavement network, extending pavement life, enhancing pavement performance, ensuring cost-effectiveness, and reducing user delays. In short, the goal is to meet customer needs.

Reactive Maintenance

Reactive maintenance comprises activities that respond to conditions beyond an agency's control— activities such as pothole patching, rut filling, or unplugging drainage facilities. Reactive maintenance, therefore, is unscheduled; sometimes immediate response is necessary, to avoid serious consequences.

Emergency Maintenance

Extreme conditions, when life and property are at risk, require emergency maintenance. Examples include washouts, rigid pavement blowups (the shattering or upward buckling of concrete slabs along a joint), and rockslides or earthslides.

Establishing Values

Understanding the costs and benefits of pavement preservation is important because the nation's highway system has matured—that is, the system has begun to deteriorate. Preservation requires a customer-focused program to provide and maintain serviceable roadways cost-effectively, encompassing preventive and corrective maintenance, as well as minor rehabilitation (Figure 1). *(continued on page 5)*

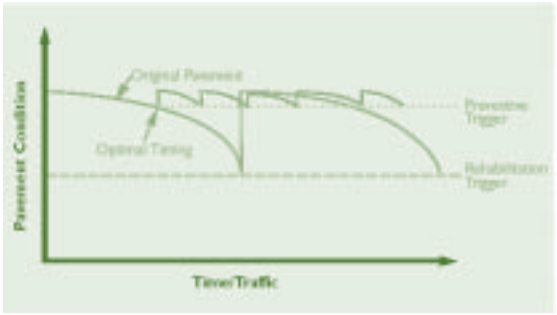

FIGURE 1 Pavement preservation concept.

The concept is gaining acceptance—initiatives in the business arena also are focusing on asset preservation, like the GASB policy emphasizing the preservation of infrastructure. GASB establishes requirements for the annual financial reports of state and local governments. Since June 1999, GASB 34 has required state and local agencies to provide more specific information in annual financial statements, following the model of the reports by private-sector companies and governmental utilities.

GASB recommends that state, county, and city government agencies apply historical costs to establish values for the transportation infrastructure. Agencies must identify the annual cost of maintaining and preserving the infrastructure assets at—or above—an established condition level. Pavement preservation, therefore, becomes integral to investment decision-making at highway agencies.

Describing the Benefits

The benefits of implementing a pavement preservation program are not immediate and dramatic but accrue over time. Roads that generally are in good condition do not register a major change in condition rating after a treatment is applied—the rating continues as good. What is important, however, is the condition rating several years later—roads that receive preservation treatments are in better condition than those left without treatments.

A comparison of the project life-cycle costs of identical pavement sections with and without treatments illustrates the benefits of pavement preservation. In the example of a traditional alternative, shown in Table 2, a highway is constructed for $508,000 per lane-mile to last 25 years without any preservation activity. After 25 years, the highway must be completely reconstructed at a cost of $490,000 per lane-mile.

In the preservation alternative, shown in Table 3, a highway is constructed with a 25-year design life, also at a cost of $508,000 per lane-mile. After 5 years, the first short-term preservation action is performed for $15,000 per lane-mile, extending the pavement life 2 years. A second preservation is applied 10 years after initial construction—a different treatment that costs $39,500 per lane-mile but that extends the pavement life an additional 8 years. A third preservation is applied in Year 14, a fourth in Year 20, and another in Year 25.

The preservation alternative offers potential savings in construction. In the traditional alternative, the pavement must be completely reconstructed after 25 years at a cost of $490,000 per lane-mile to extend the expected service life another 25 years. In contrast, preservation treatments cost $140,000 per lane-mile over 25 years and extend the expected service life another 18 years. Moreover, if the deterioration rate does not accelerate, pavement preservation can continue for more cycles, assuming that the pavement was designed and constructed properly. *(continued on page 6)*

Chip sealing protects new pavements, increases macrotexture, and prolongs the life of structurally sound pavements that show surface distress.

TABLE 2 Traditional Alternative: Project Life Cycle Cost

ACTIVITY	D.I. (Before)	D.I. (After)	AGE	LIFE EXTENDED (Years)	R.S.L. (Years)	COST (Lane-Mile)	COMMENTS
New Construction		0	0		25	$ 508,000 $ 21,000	Construction cost User cost
Major Reconstruction	51	0	25		25	$ 490,000 $ 19,000	Construction cost User cost
Total						$ 998,000 $ 40,000	Construction cost User cost

ACTIVITY	D.I. (Before)	D.I. (After)	AGE	LIFE EXTENDED (Years)	R.S.L. (Years)	COST (Lane-Mile)	COMMENTS
New Construction		0	0		25	$ 508,000 $ 21,000	Construction cost User cost
First Preservation	11	6	5	2	22	$ 15,000 $ 350	Construction cost User cost
Second Preservation	21	0	10	8	25	$ 39,500 $ 350	Construction cost User cost
Third Preservation	16	8	14	1	22	$ 15,000 $ 350	Construction cost User cost
Fourth Preservation	33	0	20	5	21	$ 55,500 $ 700	Construction cost User cost
Fifth Preservation	14	7	25	2	18	$ 15,000 $ 350	Construction cost User cost
Total						$ 648,000 $ 23,100	Construction cost User cost

Table 3 Preservation Alternative Project Life Cycle Cost

D.I. = distress index, a measure of pavement condition. Scale values: 0 = no distress, 50 = reconstruction required.

R.S.L. = remaining service life, the remaining time in which a pavement can be preserved.

Considering the user costs shown in the tables, additional savings will accrue. As shown in Figure 2, substantial savings can accrue with a well-planned pavement preservation program.

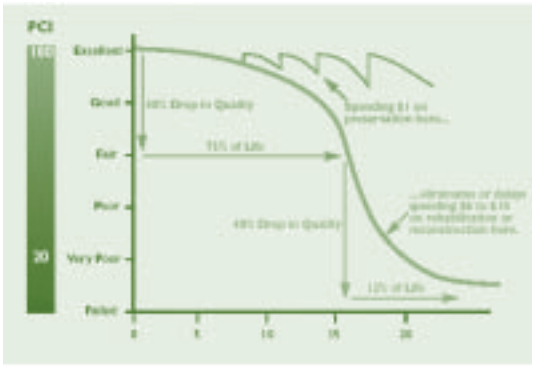

FIGURE 2 Pavement Option Curve (example). (PCI = Pavement Condition Index.)

Essentials for Success

Pavement preservation is not a maintenance program, but an agency program. Almost every part of an agency should be involved. Success depends on support and input from staff in planning, finance, design, construction, materials, and maintenance. Two other essentials for an effective program are long-term commitment from agency leadership and a dedicated annual budget.

Agency personnel must address many critical issues before implementing a pavement preservation program. For example, terminology must be defined clearly and concepts such as cost-effectiveness, optimal timing, and pavement performance should be understood. Integrating pavement management with pavement preservation, to maximize the benefits to the highway network, also is imperative. In addition, agency personnel should be instructed about each preservation treatment and its appropriate use.

After preparing the groundwork, the next step is to tailor a program that meets agency needs. People with a thorough understanding of pavement engineering should develop preservation guidelines that relate to various pavement conditions, the purpose and

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limitations of each treatment, and the expected performance. The guidelines will assist in treatment selection and program assessment.

A good preservation program should establish continual monitoring to assure effective feedback for improvement of the guidelines. A process model is shown in Figure 3.

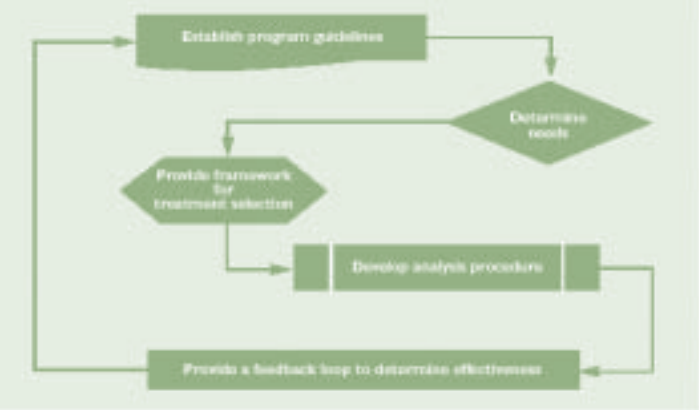

FIGURE 3 Pavement Preservation Process.

Issues and Barriers

Several issues and barriers may arise as an agency develops and implements a pavement preservation program. The issues and barriers, however, vary for each group involved.

Institutional Changes

Some of the issues and barriers from the transportation agency point of view may include the following:

♦ *Identifying a champion for the program.* Like any new effort or program within an agency, pavement preservation needs a champion. Without a champion to promote the importance and benefits, the new effort will not succeed.

♦ *Dealing with the paradigm shift from worst-first to best-first.* One of the biggest obstacles is convincing agency personnel to move from the tried and- true practice of fixing the worst pavement problems first to fixing good pavements while the bad ones continue to deteriorate.

♦ *Gaining commitment from the top management.* The program's success requires top management commitment. This includes a commitment for dedicated funding and for the resources needed to collect information on the effectiveness of preventive maintenance treatments. Pavement preservation projects will not warrant ribbon-cutting ceremonies—unless the top management recognizes the program's importance.

♦ *Showing early benefits.* Pavement management systems that can show the early effects of the preventive maintenance treatments on extending life or on reducing life-cycle costs are essential.

♦ *Selecting the right treatment for the right pavement at the right time.* Failure can result if the correct treatment is not used. For a new program, a single failure can overshadow hundreds of successes. The right treatment must be applied to the pavement in a timely manner.

Marketplace Pressures

The issues and barriers for industry groups mostly involve reluctance to disturb the status quo and include the following:

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Marketplace Pressures

The issues and barriers for industry groups mostly involve reluctance to disturb the status quo and include the following:

♦ *Competition between the suppliers of maintenance and rehabilitation treatments.* With the shift from the traditional rehabilitation programs of pavement overlays applied every 10 to 20 years to pavement preservation programs using new or different treatments, resistance can be expected from the suppliers of traditional rehabilitation materials. For example, hot-mix suppliers will resist new cold-mix treatments because of the likely loss in market share.

♦ *Competition between various suppliers of maintenance treatments.* When markets have been established for certain types of treatments and a new treatment type is being introduced, industry often works to block the new products, whether for technical reasons or for business reasons, again to avoid loss of market share.

♦ *Political lobbying to prevent use of new maintenance treatments.* In some cases, industry will rely on political lobbying to prevent new technologies from entering the market. Again the reasons may be technical but more than likely are related to the effect on the market if an agency adopts the new technology.

♦ *Establishing the benefits of new technologies or treatments.* Suppliers often introduce new technologies without adequate evidence of the benefits. The supplier must provide the agency with detailed documentation of the product's benefits and performance.

Convincing the Public

The introduction of preservation programs also affects the traveling public—the ultimate customer—raising a different set of issues and barriers:

♦ *Understanding the shift from repairing the worst pavements first to the best pavements first.* The public does not understand why

agencies would be working on good roads but letting the bad roads deteriorate. Most of the public understands the importance of maintaining a car or a house to prevent major repairs. Pavement preservation engineers should be able to explain the value of preventive maintenance treatments now compared with the cost of major repairs later.

♦ *Understanding the effects of the various maintenance and rehabilitation strategies on delays and vehicle costs.* Primary benefits of pavement preservation include the potential for reducing traffic delays by using faster repair techniques and for reducing user costs by maintaining pavement networks in better condition. Although widely acclaimed, these benefits still lack the documentation of national studies.

♦ *Understanding safety issues.* Increased safety for the traveling public and for workers in the work zone are other potential benefits from keeping roads in good condition through pavement preservation treatments; these benefits also need to be documented and communicated.

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EXTENDING PAVEMENT LIFE THROUGH THE USE OF FOG SEALS

Introduction

To address the problem of asphalt cement hardening in pavements, the FHWA currently has a study underway to evaluate the effects of sealer/ rejuvenators on the long-term performance of asphalt pavements. The study is designed to evaluate the effectiveness of this maintenance strategy.

Traditionally, these treatments, often called fog or flush seals, are applied to pavements to arrest pitting or raveling, to reduce shrinkage tendencies, to decrease permeability, to decrease traffic and snow plow damage, and to rejuvenate the properties of the existing asphalt cement.

A number of different types of sealers and rejuvenators are available in the market place and can be readily attained. Sealers such as SS-1 or CSS-1 are commonly used to "seal" the pavement surface or to "bind" or "lock" cover material or fines in place reducing surface attrition. rejuvenators, on the other hand, are designed to penetrate into the existing asphalt cement and modify and improve existing chemical and rheological properties.

The determination of which product to use where is dependent upon the problem being solved and the existing pavement type. The most prevalent use of rejuvenator products is on dense graded asphalt surfaces. Sealer type products are more commonly used on chip seals and friction courses where binding or enrichment is the main purpose.

To better understand the process of age hardening in flexible pavements, it should be remembered that aging of the asphalt occurs during both the construction phase and during the service life of the pavement. Age hardening during the construction operation is accounted for, to a large degree, by the specifications and construction processes. The long term aging of the asphalt is much more difficult to determine. It is closely linked to the crude sources of the asphalt, the environment, and the quality of construction.

The use of sealers/rejuvenators as a preventive maintenance strategy has evolved as a result of a commonly held view that the aging of a pavement can be represented by a curve such as shown in Figure 1. At the time of construction the pavement has an initial stiffness shown as point 1 in the figure. As the pavement ages the stiffness increases at a slow rate until point 2 when it has reached a condition where the aging is beginning to accelerate. By the time the pavement reaches point 3 in its life, it has reached its limiting stiffness and cracking is beginning to appear. As cracks develop, the aging is accelerated even further due to infiltration of moisture and oxygen.

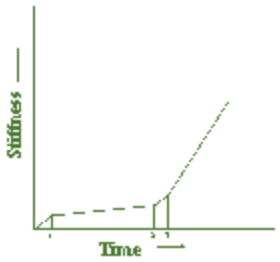

Figure 1: Historical Concept of How Pavements Age

Preventive maintenance concepts would suggest that application of a sealer/rejuvenator should occur before the pavement has reached the condition represented by point 3. Many believe that the intervention point should be prior to the condition represented by point 2.

With this concept in mind, rejuvenators were developed in the late 1950s to "turn back time" on the aging process. In the western United States the use of rejuvenators and sealers has continued since that time.

Aging of Asphalt

There are two types of hardening in asphalt pavements: steric hardening and chemical oxidation hardening. Steric hardening takes place as a result of prolonged time frames without imposed stresses. Polar molecules slowly align themselves into a stable state and this results in a stiffening of the pavement. Fortunately, this process is reversible through heat and stress. Since traffic typically provides the stress, this is why the driving lanes often time crack less than the shoulders on lightly loaded roadways. The traffic disrupts the formation of steric hardening. A special case of steric hardening

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can also occur with waxy crudes. At low service temperatures they tend to promote further stiffening often times contributing to thermal cracking.

The most important aging in asphalt pavement occurs as a result of chemical oxidation. This oxidation occurs as a result of exposure to air and loss of oily components by volatility or absorption. This aging produces a stiffening of the pavement and some shrinkage. These effects are permanent and can only be altered through the introduction of some form of rejuvenator, if at all. The oxidative aging of asphalt eventually levels off. However, the viscosity at which one asphalt levels off may be many times higher than another asphalt of the same grade but from different crudes.

The factors most commonly associated with oxidative aging are: susceptibility of asphalt to aging (i.e. crude source), depth in pavement structure, air void content, permeability, asphalt content or film thickness and climatic conditions. It should be noted that the priority of these factors differs depending on the pavement type. That is, film thickness is a more important consideration for open graded friction courses than for dense graded mixtures, while for permeability the reverse is true.

When studying the effectiveness of sealer/rejuvenators, the depth within the pavement structure is one of the most important considerations. Research has shown that below 1 ½ to 2 inches from the surface, little or no oxidative hardening (i.e. aging) occurs in a well-constructed dense graded pavement. Most aging occurs in the top ½ inch of the pavement structure. For chip seals and open graded friction courses the aging is confined to the asphalt surface in contact with or surrounding the aggregate so it is on the order of microns.

For dense graded pavements the depth of aging is important for several reasons: First, to determine the overall effect on a pavement's structure. That is if only ½ inch of pavement is modified with time, will it have a significant impact on overall performance. Second, because you need to be able to able to penetrate to the depth of the aging to improve it through rejuvenation. Third, to management a pavement's performance from cradle to grave you need to be able to evaluate this effect. This requires that the equipment or test proce dures used to evaluate the pavement must be able to detect these changes.

At first thought, it may seem that losing the top ½ inch to oxidation may not be detrimental to a well-designed pavement. However, it has been found that surface oxidation contributes to top down cracking and may be providing the mechanism for initiation of cracking. Once cracking is initiated it provides for additional deterioration.

Although aging may be principally confined to the top ½ inch of pavement surface, aging is not uniform. The material at the surface is the most highly aged material due to the interaction with traffic and the environment. It exists at significantly higher oxidation levels than the rest of the structure. Since ultra violet light is only considered to be capable of penetrating asphalt to 2-3 microns it can affect little more than the surface. However, this affect is dramatic and may contribute to crack initiation as previously mentioned. For friction courses and chip seals, the surface oxidation effects are critical.

Perhaps one of the most important questions surrounding the research of oxidation in pavements is its effect on moisture damage. One of the by products of oxidation is the increased ability of the asphalt to incorporate water into it. This could result in moisture damage further accelerating the oxidation process. This suggests that a highly oxidized surface that can exacerbate moisture damage might be more important than its thickness alone would suggest.

FHWA Sealer/Rejuvenator Study

The FHWA study has a two-tiered research approach consisting of a technology transfer phase and a traditional research phase. The technology transfer phase consists of organizing workshops at both the beginning of the research and at the end of the research. At the beginning of the research, national and local workshops were held to promote the current state-of-the art. Upon completion of the research, a lessons-learned workshop will be conducted to transfer the findings into practice.

Upon completion of the first technology transfer activity the research phase began. This phase was designed to evaluate the effectiveness of sealers/rejuvenators, the effect of application timing on product effectiveness, and to evaluate technologies for determining intervention points for when to apply to

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treatments to existing roadways based upon engineering properties.

To accomplish the research goals, field test sections have been constructed in four states to evaluate different products and different pavement surface types. These test sections provide insight into the capabilities of assessing in-service pavement conditions prior to treatment application, and the capability of the industry to apply treatments correctly.

Four approaches are used in evaluating treatment performance: They are:

- Chemical and Rheological Analysis
- Non Destructive Testing
- Destructive Testing
- Pavement Performance Assessment

Chemical and Rheological Testing

The chemical and rheological analysis, conducted by the Western Research Institute, consists of:

♦ Chemical Compatibility Study

This study will determine the chemical compatibility of each rejuvenator /sealant with the roadway asphalt using an Automated Flocculation Titrimeter to acquire the Heithaus parameters. The compatibility influences important physical properties of these materials, including the rheological properties, (e.g. phase angle, viscosity and aging propensity) of asphalts. Highly compatible asphalts differ in fundamental properties from incompatible asphalts, but binders of either type are used regularly. However, asphalts that are or become incompatible often fail quickly. That is why it is necessary to make sure the sealer/rejuvenator is compatible with the existing roadway asphalt.

♦ Oxidation and Aging Propensity Study

The aging prediction portiony consists of evaluating the existing roadway asphalt by first extracting it from cores prior to treatment and then aging it using pressure-aging vessel (PAV) techniques. Cores obtained after treatment will also be obtained and the process repeated on the treated materials. After PAV aging, dynamic shear rheology testing at two temperatures will be conducted to determine the change in properties. Both samples will also be analyzed by infrared spectroscopy to measure the concentration of oxygen containing functional groups which will be related to the oxidation levels. The intent of the oxidation and aging propensity study is to determine how well a laboratory-aging procedure predicts field-aging properties.

♦ Performance Assessment Study

The performance assessment study will assess both the chemical and rheological changes that occur in each section compared with an untreated section.

♦ Compositional Similarity of Products

This testing is analogous to finger printing the materials. By finger printing the materials differences between laboratory materials and field materials can be identified as well as differences between field materials from site to site.

♦ Non-Destructive Testing (NDT)

NDT testing consists primarily of evaluating the existing pavement modulus using a portable seismic pavement analyzer (PSPA). This device is used to evaluate the dynamic modulus of the pavements prior to and after treatment application. This approach allows the device to evaluate both the effect of the treatment and the homogeneity of each of the sites.

An additional NDT device that is being evaluated is the use of a portable nuclear magnetic resonance device. The use of both devices is intended to determine if an NDT device can be used to define an intervention point (e.g. when to apply a treatment) based upon the properties evident in the pavement.

♦ Destructive Testing

This testing consists of first retrieving cores from the field and then slicing them to remove two 3/8 inch slices from the top of the core. From each of the slices a rectangular specimen is then cut and tested using a Dynamic Shear Rheometer. This test is being explored as a means for evaluating treatment effectiveness. *(continued on page 12)*

EXTENDING PAVEMENT LIFE THROUGH THE USE OF FOG SEALS

♦ ¨**Pavement Performance Assessment**:

This testing consists of assessing the pavement texture using a CT Meter, the frictional properties using a dynamic friction tester, the infiltration properties using a skid abrader outflow meter.

Unfortunately, the application of sealers/rejuvenators almost always reduces roadway friction. Friction can be reduced between 25-50% from the original value. Therefore it is very important to determine the degree of initial friction loss, the time for the friction to be restored, and the shape of the friction return curve. As is often the case, preservation and safety become a trade off that needs to be managed properly.

Conclusions

Pavement preservation should be a cradle to grave endeavor. With the soon to be released AASHTO 2002 Pavement Design Guide, agencies will have the ability to predict distress levels as a function of pavement age/loading. This will enable cradle to grave management of the pavement networks. Having the ability to predict distress and then compare them to actual performance provides the ability to directly link, and manage, pavement design and pavement maintenance through a comprehensive pavement management system. Through the FHWA sealer/rejuvenator research, it may yet be possible to predict both the benefit derived from this strategy as well as the proper time to apply it, and the proper materials to apply.

Written by Larry Scofield, Transportation Project Manager, Arizona Department of Trnsportation

UNIVERSITY CENTER PAVES THE WAY

Michigan State University (MSU) has established a National Center for Pavement Preservation-the first of its kind-within the department of Civil and Environmental Engineering focusing on activities such as routine maintenance, preventive maintenance and minor rehabilitation to offer sound solutions for the highway system. MSU is providing the facilities, services, and amenities for the center located in the University's Engineering Research Facility in Clemons.

The center offers specialized services to government agencies and to the private sector and will lead to collaborations among government industry and academia to advance and improve pavement preservation practices through education, research and outreach. The objectives of the center are to:

- ♦ Serve as a resource advice on pavement preservation activities
- ♦ Promote the benefits of pavement preservation, in partnership which the foundation for Pavement Preservation
- ♦ Enhance pavement preservation knowledge through research and
- ♦ Provide advice and assistance to other groups establishing pavements preservation programs.

For mopre information contact Larry Galehouse, telephone (517)432-8220, e-mail ncpp@egr.msu.edu or visit

...preserving the nation's pavment investment

CAPE SEAL (CONTINUED FROM COVER)

Step 3. **Measure what you have again and evaluate if what you are doing is working both in the public's mind, and from an engineering and maintenance standpoint. Repeat.**

These steps can be fancy and formatted in a written policy or as informal as spreadsheets and data lists. The important part is to measure and evaluate.

The standard PCI ratings chart indicates the following:

PCI Rating Range	Condition
86-100	Excellent
71-85	Very Good
56-70	Good
41-55	Fair
26-40	Poor
11-25	Very Poor
0-10	Failed

Lake Havasu City's roadways had a PCI rating of 71 and a standard deviation of 19 in 1995. So although the overall average roadway condition was just in the Very Good range, we had roadway segments with PCI ratings as low as 8. **Typically we found that even though the standard PCI chart stated that Good was from 56-70 and Very Good was 71-85, our citizens complained when roadways were below 70.**

By shifting to the Cape Seal Program and by utilizing those Pavement Maintenance Funds available on a less expensive treatment that worked in our community, we were able to repair and rehabilitate between 40 and 60 miles of roadways a year.

In 1999, we again measured and rated all of our roadways and the PCI average had risen to 77 with a standard deviation of 11. Not only had we raised the average condition of the roadways, but we were able to eliminate the wide variance in condition by repairing the roadways on the lower end.

Typical costs for the slurry and chip seal portions of this work have averaged between $0.78 to $0.86 per square yard for slurry seals and $0.61 to $0.78 per square yard for chip seals over the last several years. We have also determined that it has been more cost effective to improve the quality of our treatments incrementally by having latex or other modifiers included in both the slurry and chip treatments.

Another PCI ratings review is being completed this year. We anticipate that the overall PCI rating average would have been maintained.

ROAD SCHOLAR GRADUATES

Congratulations to our recent Road Scholar graduates!

Town of Queen Creek

Luis Padilla
Chris Panetta

Their successful completion in the Level I, Road Scholar Program represents a level of professional achievement and demonstrates their commitment to self improvement, personal and professional developement.

Sponsored by

ADOT

AZ LTAP

ERGON

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KOCH

SOUTHWEST SLURRY SEAL

A Special Thank you to Koch who will provide their chuck wagon lunch cookout!

MARK YOUR CALENDARS!!!!!!!!!!

March 10, 2004

AZ LTAP is hosting a Pavement Maintenance Fair

Particpants who attend the fair may be eligible to recieve Road Scholar Level II credits for the Asphalt Pavement Maintenance course.

CRAFCO Pavement Preservation Products

Fair objectives include:

- ♦ Identifying the causes
- ♦ Identification of the distresses
- ♦ Proper repairs methods, materials and equipment
  - • Cracks, potholes, base failures, depressions, corrugations
- ♦ Fog Seals
- ♦ Chip Seals
- ♦ Slurry Seals
- ♦ Microsurfacing
  - • Preparation
    - • Materials
      - • Equipment
        - • Operations
          - • Safety
- ♦ Pavement Management
  - ♦ Determining Optimum Timing

Ergon Asphalt Products, Inc.

FHWA

ADOT

Equipment Demo's and Product Displays

In addition to excellent class room instruction, there will also be equipment demonstrations from a host of well know vendors, including demonstrations on

- ♦ Fog Seal
- ♦ Crack Seal
- ♦ Patching Repair
- ♦ Slurry Seal

Southwest SLURRY SEAL, Inc.

HURRY REGISTRATION IS LIMITED

REGISTER NOW!!

Check out the AZ LTAP website for weekly updates on this event
www.azltap.org

CALENDAR OF EVENTS

January 11-15, 2004: Transportation Research Board 83rd Annual Meeting. For more information visit http://gulliver.trb.org/news/blurb_detail.asp?id=1907

January 15-16, 2004 : AACE Meeting at Harrah's Ak-Chin Casino. For more information, go to http://www.azace.org/metting_04.htm

January 18-21, 2004: NAPA's 29th Annual Convention in Phoenix, AZ. For more information, go to http://www.hotmix.org/view_article.php?ID=72

January 30- February 3, 2004: ATSSA'S 34th Annual Convention and Traffic Expo. For more information visit http://www.atssa.com/meetevents/expo/Default.htm

February 3-6, 2004: Slurry Systems Workshop; Hands on Program for Engineers, Inspectors, and Industry Personnel. For more information contact International Slurry Surfacing Association at krissoff@slurry.org or www.slurry.org.

February 9-12, 2004 : 18th Annual National Reservation Economic Summit & American Indian Business Trade Fair in Las Vegas, NV. For more information go to http://www.ncaied.org/res2004/.

February 22-28, 2004: National Engineers Week. For more information contact National Engineers Week Headquarters at (703) 684-2852 or eweek@nspe.org, http://www.eweek.org/index.shtml

February 25-28, 2004: ARRA's 28th Annual Meeting in conjunction with AEMA and ISSA in San Diego, CA. For more information visit http://www.arra.org/preservationteaser.htm.

February 27- March 2: NACo's 2004 Legislative Conference in Washington, D.C. For more information, go to http://www.naco.org/Template.cfm?Section=Home&template=/ContentManagement/ContentDisplay.cfm&ContentID=10560.

February 29- March 3. 2004: 6th Annual National Tribal Road Conference, Albuquerque, NM. For more information contact the Tribal Technical Assistance Program at Colorado State University at (800) 262-7623, ronald.hall@colostate.edu or http://ttap.colostate.edu/

March 10, 2004: Pavement Maintenance Fair (Sponsored by AZ LTAP) For more information contact AZ LTAP at (602)712-8461or www.azltap.org

March 10-13, 2004: 85th Annual Convention/ Constructor Exposition in Orlando, FL. For more information, go to http://www.agc.org/Member_Resources/2004convention_front.asp.

March 22-24, 2004: Roadway Management Conference (Sponsored by the DE, MD, PA, VA, WV LTAP Centers), in Newark, DE. For more information contact Delaware T2 Center at (302) 831-6241 or lklepner@ce.udel.edu.

March 28-31, 2004: ITE Technical Conference and Exposition, Invine, CA. For more information contact the Institute of Transportation Engineers at (202) 289-0222 or ite_staff@ite.org or http://www.ite.org

AZ LTAP HOST'S NATIONAL WORK ZONE MEMORIAL, FEB. 9 - 13, 2004

Respect and Remembrance

"Reflections of Life on the Road"

Memorials have become an icon of the American culture - a touchstone that helps individuals deal with the inexpressible to hopefully stir gratitude for the good that often results from the supreme sacrifice. Whether in the elegant granite face of the Vietnam Veteran's Memorial in Washington, D.C., or through the spontaneous decoration of a fence outside Columbine High School in Colorado, memorials have come to reflect grief, pride, and humility in the shadow of a power far greater than ourselves. Since the early days of our nation's roadways, men, women and children have senselessly died in work zones. The number of deaths has increased significantly - from 868 in 1999 to over 1,000 in 2000. These unseen faces and lives have in many cases been forgotten - until now. Unveiled in April 2002, the National Work Zone Memorial is a living tribute to their memory, traveling to communities cross-country year-round to raise public awareness of the need to respect and stay safe in America's roadway work zones.

AZ LTAP will host the National Work Zone Memorial, February 9-13, 2004. Location of where the Memorial will be displayed has yet to be determined. Please visit our websit for updated information regarding this event. We invite you to stop by and join us in paying tribute to the memory of the men, women and children who have lost their lives in work zone related accidents.

Arizona LTAP Center
1130 N. 22nd Avenue
Phoenix Arizona 85009

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Please share this newsletter with others.

- Ä Supervisors
- Ä Council Members
- Ä Public Works Dept.
- Ä Road/Maintenance Crew
- Ä Managers
- Ä City/County Engineers
- Ä Mayors
- Ä Others