

Advancing the Pavement Preservation Movement

Federal Highway Administration Cultivates Partnerships

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Americans are traveling on roads in record numbers. In 2000, Americans traveled more than 2.7 trillion vehicle miles, nearly four times the amount in 1960, and more than half of the travel was in urban areas, on crowded and often congested highways.

Nonetheless, large, new road construction projects, once considered routine, have shrunk dramatically in number. Trends suggest that most road construction will be limited to improving the level of service and efficiency within highway corridors. The immediate need of preserving and maintaining the highway investment, therefore, has become a nationwide challenge.

The nation's highways, built by earlier generations, are valued at more than \$1.75 trillion. As responsible stewards of the highway system, present and future generations must not allow this investment to deteriorate.

Preservation Investments

Although the methods and assumptions for estimating highway and bridge investments are evolving, projects that preserve the infrastructure are good investments from a public policy perspective. Preser-



Crack sealing is a first line of defense in pavement preservation.

vation investments improve the condition and performance of the highway system and reduce the backlog of deficiencies.

The deficiencies projected for the next 20 years can be attributed primarily to pavement deterioration and travel growth. Since the early 1990s, when construction of the Interstate system wound down, the Federal Highway Administration (FHWA) has increased focus on preservation to address the deterioration of the nation's infrastructure. The approach combines traditional engineering-based analytical tools with sensible economic guidelines to preserve transportation investments.



Preservation activities make invested dollars go farther. Pavement and bridge preservation approaches select the most cost-effective action to address a specific condition and performance need, providing agencies with the optimal means of minimizing life-cycle costs. Preservation extends highway service life and provides smoother, safer, and more reliable roads. Preservation programs are important in implementing asset management concepts and are demonstrating good returns on investments.

Evolving Policy

Historically, the Federal-Aid Highway Program has centered on capital improvement projects. Starting in the 1950s, emphasis was on construction and rehabilitation of the Interstate Highway System; in the 1990s, attention turned to the National Highway System.

For many years, federal regulations restricted federal-aid highway funds to capital improvements, prohibiting use for most activities involving preservation and maintenance. Maintenance was considered necessary to ensure that the highway was safe and serviceable in fulfilling the expectations of the traveling public and in meeting functional needs. Maintaining highways generally was regarded as the responsibility of the state or local jurisdiction and was a condition for receiving federal-aid construction dollars.

3R to 4R

The 1976 Federal-Aid Highway Act changed that policy, giving greater flexibility to state and local highway agencies in the use of federal funds. The legislation allowed for funding of resurfacing, restoration, and rehabilitation projects and became known as the 3R program. An objective was to enhance highway safety on nonfreeway projects by having each state develop its own criteria and procedures for design.

In 1981, the Federal-Aid Highway Act redefined Interstate system construction to provide a minimum level of acceptable service and added a fourth R, reconstruction, to the 3R program. The 4R program applied specifically to the Interstate Highway System. Maintenance remained the responsibility of the states in the federal funding equation.



Macro-surfacing is a single-pass, cost-efficient treatment suitable for low- to high-volume roads in good condition but with minor surface distresses.

Funding Preservation

The landmark Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) restructured the Federal-Aid Highway Program in the post-Interstate era. ISTEA allowed federal-aid funds for preventive maintenance activities—but a state had to demonstrate, through its pavement management system, that the activities were cost-effective in extending the pavement life of the Interstate. ISTEA was the first federal funding mechanism for system preservation by FHWA.

The National Highway System Designation Act of 1995 presented another endorsement of system preservation. Preventive maintenance became eligible for federal assistance as a cost-effective means of extending the useful life of all federal-aid highways, not just the Interstates. The act gave flexibility to each state in determining the most cost-effective strategies to extend the service life of pavements, bridges, and highway appurtenances on federal-aid highways. With this legislation, Congress acknowledged and underscored the importance of preventive maintenance programs.

The Transportation Equity Act for the 21st Century (TEA-21), the 1998 reauthorization of ISTEA, removed some funding barriers, increased flexibility for addressing safety concerns, and substantially increased transportation funding. In May 2003, the Administration released the Safe, Accountable, Flexible, and Efficient Transportation Equity Act of 2003 (SAFETEA), a proposal to reauthorize the TEA-21 programs. The proposal makes preventive maintenance

nance on any federal-aid highway eligible for funding. As proposed, SAFETEA would increase federal transportation funding by approximately 19 percent above current levels.

Overseeing Improvements

FHWA, working with state departments of transportation (DOTs), is responsible for the general management and administration of the federal requirements governing highway maintenance (Title 23, United States Code, Section 116). Each state DOT is responsible for maintaining each project constructed with federal-aid funds. FHWA provides general oversight of the state DOT programs, including maintenance and preservation.

If FHWA finds that a state DOT is not properly maintaining a federal-aid highway and that the state DOT is not restoring the highway to proper condition after receiving notice, FHWA may withhold project approvals. Only once, however, has FHWA withheld federal-aid funds from a state DOT because of poor maintenance—a tribute to the partnership between the state DOTs and FHWA.

Through this FHWA–state DOT partnership, the expansion of highway funding, and the introduction of preventive maintenance concepts, roadway conditions on the nation's network generally are improving. For example, the percentage of rural Interstate miles in poor condition has declined from 8.7 percent in 1990 to 1.9 percent in 2001. Other functional classes of rural roads and highways have recorded similar success.

Goals and Approaches

Meeting customer demands and improving customer satisfaction are primary goals of FHWA's pavement preservation program. When capital investments can

be made to last longer, available funding can stretch farther, and the number of costly, time-consuming, traffic-disrupting rehabilitation and reconstruction projects can be reduced.

Preservation is the best way to provide safe, smooth, and quiet pavements. In 1995, a survey indicated that 50 percent of U.S. motorists were satisfied with the nation's highway system. A similar survey conducted in 2000 indicated that 65 percent were satisfied. This improvement correlates with improved ride quality for rural and urban roadways, as measured by the International Roughness Index.

A single urban road segment in poor condition can taint opinions about the overall condition of the network. In the past, some favored the approach of fixing "bad" roads first. This "worst first" approach, however, has proved costly for many jurisdictions—by the time the bad roads were fixed, many other roadways had slipped from fair into poor condition.

The lesson showed that it is significantly less expensive to "keep good roads good" and to improve and maintain the other roads from falling into poor condition. "Keep the good roads in good condition" is a fundamental tenet of roadway asset management.

The concept applies to evaluating nearly all infrastructure assets, including bridges, water systems, sewer and drainage systems, buildings, waterways, and airports. Many agencies are moving toward comprehensive asset management programs for several reasons, including

- ◆ Funding constraints,
- ◆ Aging infrastructure,
- ◆ User demands,
- ◆ Loss of experienced senior staff, and
- ◆ Public demands for accountability and for returns on investments.

Preventive Maintenance

The American Association of State Highway and Transportation Officials (AASHTO) recently adopted a definition of preventive maintenance. Preventive maintenance activities include work that

- ◆ Prevents the intrusion of water into the pavement structure—for example, with seal coats, joint seals, crack seals, and thin overlays;
- ◆ Provides for the removal of water from the pavement structure—for example, with underdrains and restoration of drainage systems;
- ◆ Restores pavement rideability—for example, with profiling and milling; and

Hot in-place recycling asphalt train replacing roadway surface in one pass.



◆ Prevents deterioration of bridges—for example, with cleaning and painting, scour countermeasures, deck rehabilitation, and deck drain cleaning.

Under this definition, pavement preservation includes preventive maintenance activities for pavements, minor rehabilitation, and some routine maintenance. In contrast, pavement preservation does not include new pavement construction, reconstruction, major rehabilitation, or corrective maintenance.

Partners in the Cause

FHWA is developing partnerships with other federal agencies, state and local governments, industry associations, academia, and others to support and direct the pavement preservation movement. FHWA has committed staff for the effort and is providing funds to assist partners in developing new technology and curricula to manage public assets effectively.

AASHTO

In January 2002, AASHTO launched a community-of-practice website offering a comprehensive source of information on transportation asset management, with 15 topic areas, including information on pavement preservation, as well as activities and studies by FHWA and state DOTs, plus chat rooms.¹ In addition, the Pavements Task Force of the AASHTO Subcommittee on Maintenance has adopted several resolutions supporting pavement preservation.

Expert Task Group

FHWA established the Pavement Preservation Expert Task Group (PPETG) in 1991, with members representing government agencies and industry. The PPETG provided support and technical assistance to FHWA on how to apply and implement performance findings from the Specific Pavement Studies of the Strategic Highway Research Program.

The PPETG continues to evaluate and support activities to promote and institutionalize pavement preservation concepts and practices. The group has assisted in the development of pavement preservation training programs for managers and practitioners, of videos and other media outreaches, and of national and regional workshops on pavement preservation.

Foundation for Pavement Preservation

In 1992, related industry associations formed the

University Center Paves the Way

LARRY GALEHOUSE

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 Okemos.



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 and provide advice on pavement preservation activities;
- ◆ Promote the benefits of pavement preservation, in partnership with the Foundation for Pavement Preservation;
- ◆ Enhance pavement preservation knowledge through research; and
- ◆ Provide advice and assistance to other groups establishing pavement preservation programs.

For more information contact Larry Galehouse, telephone 517-432-8220, e-mail ncpp@egr.msu.edu, or visit www.pavementpreservation.org.

Foundation for Pavement Rehabilitation and Maintenance Research to promote research and education on pavement preservation. Renamed the Foundation for Pavement Preservation (FP²) in 1999, the group provides the funding, research, and training for the appropriate selection, design, and construction of pavement treatments and keeps agency and industry practitioners informed about pavement preservation.

FHWA has worked with FP² to foster and advance pavement preservation programs and applications. The foundation also supports the activities of the PPETG. FHWA and FP² meet with industry trade organizations throughout the year to promote effective public-private cooperation in advancing pavement preservation strategies.

An FP² partner, the University of Illinois at Urbana-Champaign, has developed an upper-level college course on pavement preservation; a web-based version should be available later this year. The course supplied a curriculum need, since engineering students receive minimal training in maintenance, pavement preservation, or infrastructure renewal.

¹ <http://assetmanagement.transportation.org>

Directions for Research

Managing and preserving the nation's investment in the highway system is a goal for state DOTs. The benefits of a sound pavement preservation program range from improved performance and increased highway safety to reduced life-cycle costs. Because applying pavement preservation treatments is faster than rehabilitating or reconstructing pavements, preservation can contribute to increased mobility, improved work zone safety, and overall customer satisfaction.

Transportation departments establishing pavement preservation programs face the challenge of determining which pavement treatments are best. Preservation treatments must be carefully selected and must be applied when the pavement is still in good condition with no structural damage. New and innovative research therefore is necessary to assist agencies in applying the right treatment to the right road at the right time.

Research, however, has lagged behind the demand for knowledge. To meet this challenge and increase the knowledge available to state and local agencies, FHWA is building partnerships among states, industry, academia, and the Transportation Research Board.

FHWA also is exploring options for launching a multiyear, coordinated pavement preservation research program to address the research, development, and technology needs of the nation's transportation departments and to meet the safety, efficiency, and mobility requirements of the public.

Expanding the Vision

Pavement preservation has been an active federal program for the past 12 years. The vision is expanding to embrace preservation for all roadway assets. FHWA has initiated a national program on transportation system preservation (TSP) to address all components of the highway transportation infrastructure, such as bridges, roadside hardware, and safety features.

The FHWA Office of Bridge Technology has expanded the use of federal bridge replacement funds for acceptable preservation activities, advancing preservation as a business strategy to protect the public investment. The policy does not offer additional funding but allows state DOTs flexibility to spend federal-aid funds on appropriate projects.

A TSP team was formed to guide and advance the entire preservation program. The team has developed a website compiling information on best practices, promoting new materials to extend service life,

offering technical guidance and policy, identifying and developing the necessary training, and linking to related websites.²

Research Activities

Several research activities relating to pavement preservation are under way—on sealers and rejuvenators and on emulsified sealers and binders for extending the service life of asphalt pavements. The National Cooperative Highway Research Program (NCHRP) is developing a Guide for Optimal Timing of Pavement Preventive Maintenance Treatment Application (NCHRP Project 14-14) for flexible and rigid pavements.

FHWA is supporting a multistate pool-funded research project on the design and application of slurry seal and microsurfacing treatments, as well as a study of crack sealant materials and application specifications. Managed by the California Department of Transportation, this study is in its initial stages.

The Pavement Preservation Research Consortium—a working group of FHWA, state DOTs, academia, and FP²—met in June 2001 to identify and prioritize more than 50 preservation-related research topics. The consortium drafted research problem statements for 22 projects, published in a January 2002 report.³

Technology Transfer

FHWA supports the development and distribution of publications and other products to promote the concept and applications of pavement preservation. Following is a sample of the products:

◆ *Fact sheets.* The fact sheets relate the experiences of Ohio and North Carolina DOTs in pavement preservation, advanced performance-related specifications, accelerated reconstruction, and contract administration.

◆ *Checklists.* FHWA is preparing checklists for the pavement preservation products in common use around the United States. To aid agency inspectors and contractors, the checklists include best practices and are printed pocket-size, for easy use in the field.

◆ *Videos.* In conjunction with FP², FHWA has produced a video, *Concepts of Pavement Preservation and the Selection of Proper Treatments*, which received an award from the Public Relations Society of America. More videos are planned.

² www.fhwa.dot.gov/preservation

³ www.fhwa.dot.gov/preservation

◆ **Toolbox.** A resource toolbox, developed in cooperation with FP² and available from FP², contains publications, CDs, and videos from industry and government sources.

◆ **CD-ROMs.** FHWA has updated a state-of-the-practice CD of publications and resources on pavement preservation. In addition, a CD with the presentations and background materials from the National Pavement Preservation Forum II, held in November 2001, is available, and another CD, with all of the materials in the toolbox, is in production and will be available later this year.

Websites. FHWA websites offer extensive information about pavement preservation.⁴

In addition, FHWA and its partners are cooperating to provide national and regional workshops on pavement preservation materials, application techniques, specifications, and systems integration.

Best Practices

In summer 2001, FHWA and AASHTO conducted an international scanning tour of pavement preservation technologies. A team of government and industry professionals visited three nations that are implementing innovative programs and new treatments for pavement preservation—Australia, France, and South Africa. The scanning tour reviewed and documented the techniques, materials, procedures, and equipment used for pavement preservation and evaluated applications in the United States (see related article, page 29).

The team discovered that U.S. pavement preservation initiatives are on target, sharing many techniques and a similar focus with countries at the leading edge of the technologies. The team identified several technologies for further evaluation and possible implementation, including innovative chip seal design and construction procedures and contract maintenance techniques. Demonstrations of these technologies are planned.

Training Courses

FHWA's National Highway Institute (NHI) is working with state DOTs and the pavement industry to develop a series of courses in pavement preservation. The series will consist of four courses (Table 1), offering a comprehensive understanding of preservation strategies and treatments. Two courses are available now for transportation departments initiating preservation programs.

⁴ www.fhwa.dot.gov/preservation and www.fhwa.dot.gov/construction

TABLE 1 NHI Pavement Preservation Training Courses

Course	Status
Pavement Preservation: The Preventive Maintenance Concept (NHI 131054)	Available
Pavement Preservation: Selecting Pavements for Preventive Maintenance (NHI 131058)	Available
Pavement Preservation: Design and Construction of Quality Preventive Maintenance Treatments (NHI 131103)	2004
Pavement Preservation: Integrating Preventive Maintenance with Pavement Management Systems (NHI 131104)	Late 2003

A 15-minute video, *Preventive Maintenance: Protecting Our Pavements*, supports the first training course and presents the case for preventive maintenance programs. A 30-minute video, *Preventive Maintenance: Project Selection*, supports the second training course, focusing on selection of the right treatment for the right pavement at the right time.⁵

Continuing Commitment

Public transportation agencies are responsible for maintaining, replacing, and preserving the country's largest publicly owned assets—nearly 4 million miles of streets, roads, and highways and more than 590,000 bridges. The agencies have limited resources and are accountable to their stakeholders, the American public.

To advance the momentum in promoting and applying pavement preservation, FHWA will continue to strengthen and build partnerships with state and local government agencies, industry, academia, and other parties. The partnerships have shown the advantages of pavement preservation in maintaining the nation's highway infrastructure. Drawing on the strengths and perspectives of all levels of government and the private sector, as well as from technologies in development abroad, the partnerships can determine ways to enhance the decision-making process, preserve transportation assets, and meet the traveling public's present and future needs.

FHWA is committed to providing focus, policy, technical assistance, and support in technology deployment to states and local agencies. The implementation of improved asset management concepts, such as a cost-effective pavement preservation program, is here to stay.

⁵ Videos and other products are available without charge to agencies, from the FHWA Office of Infrastructure, Division of Asset Management; e-mail requests to Steve.Mueller@fhwa.dot.gov.