Asphalt Emulsions

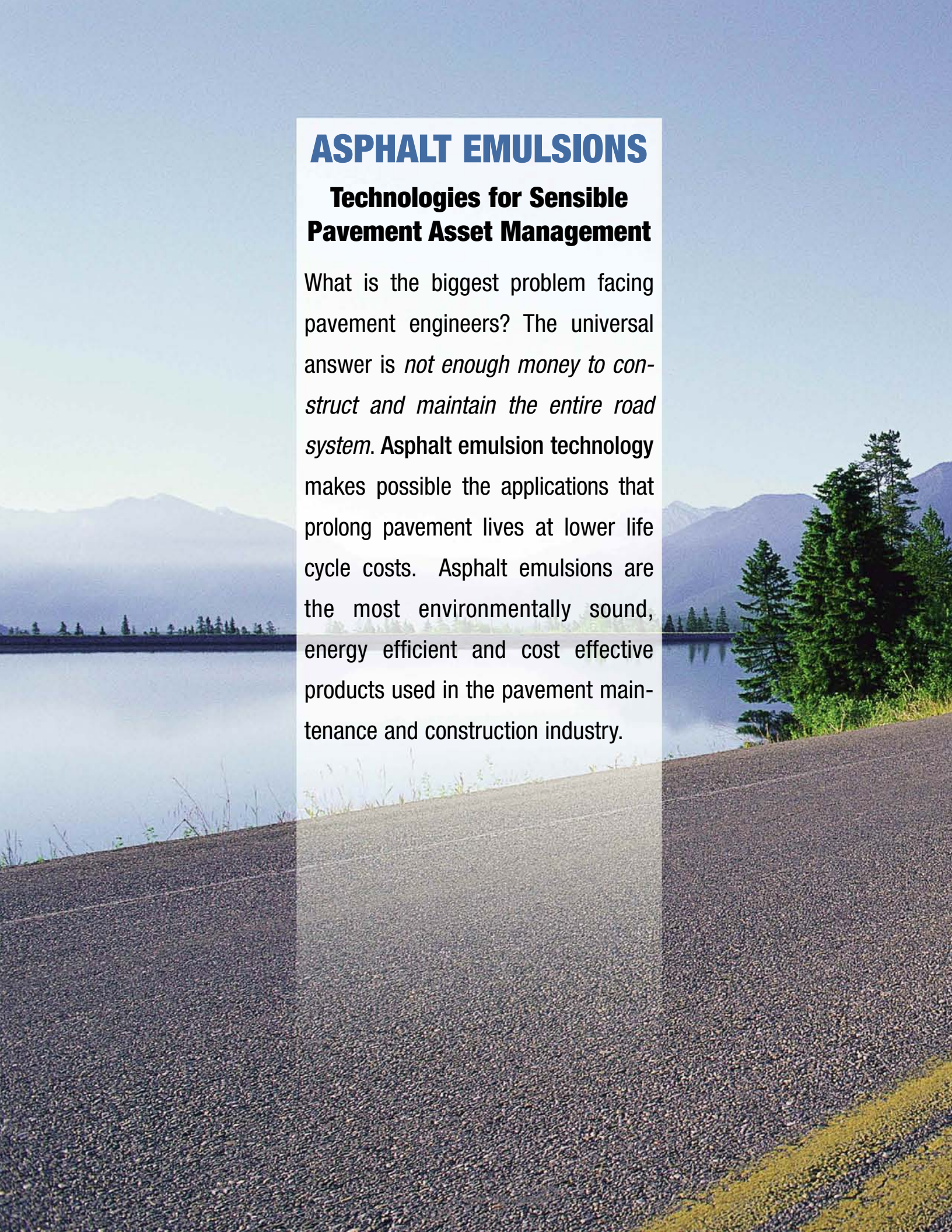
- Eco-Efficiency

- Engineered Solutions

- Progressive Technology

AEMA™

Asphalt Emulsion Manufacturers Association



ASPHALT EMULSIONS

Technologies for Sensible Pavement Asset Management

What is the biggest problem facing pavement engineers? The universal answer is *not enough money to construct and maintain the entire road system*. **Asphalt emulsion technology** makes possible the applications that prolong pavement lives at lower life cycle costs. Asphalt emulsions are the most environmentally sound, energy efficient and cost effective products used in the pavement maintenance and construction industry.

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AEMA™
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Overview

WHAT IS AN ASPHALT EMULSION?

EASY TO HANDLE

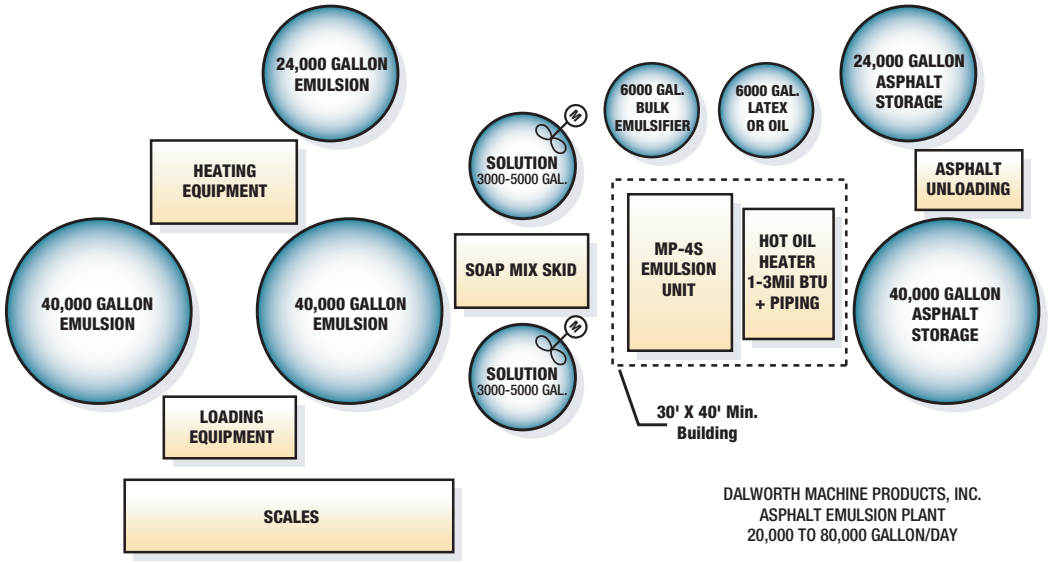
Asphalt has been used since before recorded history because of its outstanding adhesive and waterproofing properties. Ninety percent of today's asphalt is used in road construction to bind together aggregate and seal the pavement against damage from water. Liquid asphalt cement, however, is too stiff to use as is. There are three ways to make it easy to pump and apply: 1) heating to temperatures in excess of 300ºF (150ºC), as in hot mix asphalt, HMA; 2) diluting with a petroleum solvent, as in cutback asphalt; or 3) emulsifying it in water and creating an asphalt emulsion.

BETTER EMULSIONS THROUGH CHEMISTRY

Oil and water don't mix? It's the job of the emulsion chemist to make them mix. The asphalt is sheared into tiny particles with a colloid emulsion mill and the particles are surrounded by chemicals to keep them separated and suspended in the water. A chemically stabilized asphalt emulsion has three necessary components: asphalt, water and emulsifying agent. The asphalt cement must be selected for its desired end-use properties—cementing or bonding the aggregate and standing up to the traffic, environmental conditions and climate temperatures of the project. The water must not have impurities that would upset the chemical system. The emulsifying agent is sometimes called the "surfactant" (surface active agent), which is a chemical composed of very large molecules. These soap molecules are often pictured as tadpoles, with the hydrocarbon "tail" soluble in the asphalt and the electrically charged or ionic "head" soluble in the water. These soaps function in the same way as household soaps and detergents. The asphalt particles are surrounded by the ionic charge which causes the droplets to repel each other and stay suspended in the water. Formulators can use other additives to enhance properties of the emulsion during storage, shipping, application and the asphalt emulsion's end use.

DESIGNED TO BREAK

The chemist is challenged to formulate an emulsion that is stable when stored, pumped and mixed, but that will also develop strength, water resistance and durability when applied on the pavement. All asphalt emulsions are designed to eventually "break", or revert to asphalt and water phases. Some emulsions break by chemically destabilizing the surfactant, others by a simple evaporation of the water, and still others by a combination of chemical and evaporative break. As the water is separated from the emulsion, the asphalt begins the "curing" phase, where the particles flow together and bind to the aggregate and pavement. The challenge is to time the breaking for the most effective use. Today's emulsion manufacturers have many new chemistries available to design the emulsion for optimal break time and use. This adaptability and flexibility permit emulsions to be engineered to meet a wide variety of applications for building structural systems and for pavement preservation.

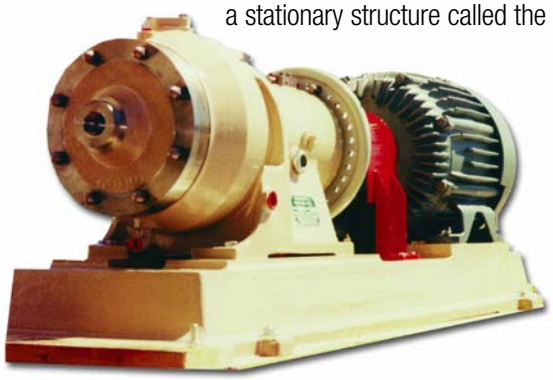


DALWORTH MACHINE PRODUCTS, INC.
ASPHALT EMULSION PLANT
20,000 TO 80,000 GALLON/DAY

HOW ARE EMULSIONS MANUFACTURED?

Asphalt emulsions are manufactured in specialized plants. The first step is making the soap. In most cases this is done in a separate tank where the surfactant is activated by chemically reacting it in water. The ionic charge on the surfactant molecule can be positive or negative. Generally an acid is added to the surfactant to activate the cationics (positive charge) and a base to activate the anionics (negative charge). Depending upon the chemistry of the aggregate, the emulsion charge can aid the attraction and adhesion of the asphalt to the aggregate. There is also one class of emulsifiers that is nonionic and needs no activation—one end of the molecule is already soluble in water.

Next the soap water solution and hot asphalt are separately metered into the mill at predetermined rates and temperatures. Mechanical energy is the fourth essential element in emulsion manufacture. Normally, a colloid mill provides the energy to shear the asphalt into the microscopic particles. The mill consists of a heavy duty shaft connected to a large electric motor on one end and a circular cutting blade, called a rotor, on the other end. The rotor spins at high speed in very close proximity to a stationary structure called the stator.



Colloid Mill

The 1- to 10-micron spheres are created by forcing asphalt through the small gap between the moving rotor and the stationary stator of the emulsion mill, in a manner similar to a pair of scissors. The gap between the rotor and the stator can be adjusted to produce larger or smaller asphalt particles. The size of the asphalt particles significantly affects the physical properties of the emulsion. All of this occurs in a fraction of a second in a violent environment of high torque, high temperatures and high pressure.

Sometimes other ingredients including latex, polymers, acids and other additives are introduced into the system to further modify the physical characteristics of the emulsion. These additives may be introduced to the soap water, injected into the system just before the milling process or mixed with the emulsion after milling.

HOW ARE EMULSIONS CLASSIFIED AND NAMED?

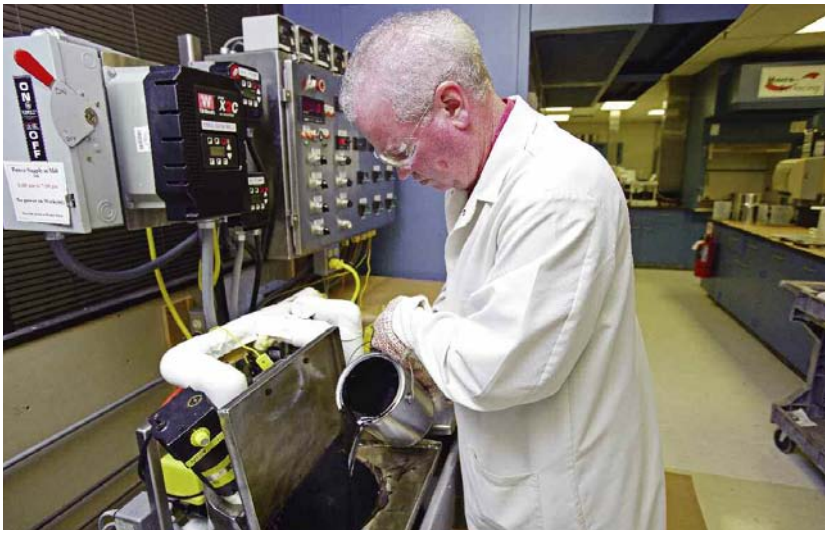
The American Society for Testing and Materials (ASTM) and the American Association of State and Highway Transportation Officials (AASHTO) have standardized asphalt emulsion nomenclature and specifications. Most state and local transportation departments have adopted these names, but several states and agencies have adapted the specifications to meet local needs, and several have their own naming conventions.

THE CHARGE

The emulsions are classified by their ionic charge. The names of cationic emulsions begin with a "C". If there is no C, the emulsion is usually an anionic. It may also be nonionic, but the use of nonionics is very small. The charge can be important when designing a paving system for compatibility with aggregates and other components of the system.

RAPID, MEDIUM, SLOW AND QUICK

After the charge designation, the next set of letters describes how quickly an emulsion will "set", or coalesce to a continuous asphalt mass. The coalescence is closely related to the speed with which an emulsion breaks



after contacting the surface of an aggregate. The standard terms are RS (Rapid Set), MS (Medium Set), SS (slow set), and QS (Quick Set).

RS emulsions are the least stable and break rapidly when in contact with aggregates. They have little or no ability to mix with aggregates. The break is primarily chemical. They are generally used for spray applications like chip seals, scrub seals and other surface treatments. A polymer may be added to these emulsions to increase adhesion and shorten return-to-traffic times.

MS emulsions are designed to mix with aggregates, and are often called "mixing grade" emulsions. Depending on the design, medium setting emulsions remain workable from a few minutes to several months. They are formulated so that they coat the aggregate during mixing, and then break soon after application to the pavement. They can be mixed in pug mills, travel plants or directly on the road. MS emulsions are used in cold recycling, cold and warm dense-graded aggregate mixes, stockpileable patch mixes and other mixes.

SS emulsions are designed to work with fine aggregates to allow for maximum mixing time and extended workability. They are the most stable emulsions, with the break caused primarily by water evaporation and engineered so that they can be mixed with many different types of fillers and additives. They can be used in dense-graded aggregate bases,

RS, SS, QS

slurry seals, soil stabilization, asphalt surface courses and some recycling. SS emulsions can be diluted with water to reduce their viscosity so they can be used for tack coats, fog seals and dust palliatives. SS emulsions are also used for a variety of other specialty applications including driveway sealers and automobile undercoating.

QS emulsions are also designed to work with fine aggregates but are formulated to break more quickly than SS emulsions. The most recently developed category, QS emulsions are used in micro-surfacing and slurry seal designs. The quick break allows for faster traffic return. A polymer and other additives are included in micro-surfacing emulsions to allow the mix to be placed in thicker lifts and still cure quickly. The result is a more durable product that can also be used for rut filling and some leveling.

HF preceding set designation indicates a High Float emulsion. Normally the emulsifier has little effect after the emulsion has cured. High Float emulsions are the exception, designed so the emulsifier forms a gel structure in the asphalt residue. As a result, high floats have a thicker asphalt film on the aggregate particles which allows them to perform better in a wider temperature range. The gel structure keeps the asphalt from flowing in hot temperatures and is less brittle at lower temperatures. High Float emulsions are also effective with dusty aggregates. High Floats are used in chip seals, cold mixes and road mixes. The term "High Float" refers to an ASTM test procedure where asphalt in an open thimble floats on top of a heated water bath for a minimum of 20 minutes.

VISCOSITY AND HARDNESS

Following the setting designation there is a series of numbers and letters that further describes the characteristics of the emulsion. A "1" or a "2" designates the viscosity of the emulsion, with "1" meaning lower viscosity and "2" meaning higher viscosity. If there is an "h" or "s" at the end of the name, it usually indicates the relative hardness of the base asphalt, with an "h" for a harder base and "s" for softer asphalt bases. There are some specifications where the "s" indicates a polymer.

POLYMERS

A "P" may be added to indicate the presence of polymer in the emulsion. An "L" indicates the presence of latex polymer. A few agencies also use an "s" for polymer emulsions. Polymers and latex can be used to add strength, elasticity, adhesion and durability to the asphalt on the road. Polymer asphalts can be less brittle at low temperatures to resist cracking and stiffer at high temperatures to resist rutting and bleeding.

OTHER NAMES

Many states have their own specifications that do not follow national guidelines for naming emulsions. For example, EA, AE, AES and HFE are all state-specific nomenclature for anionic emulsions. These are usually followed by a number which indicates the penetration of the residue from the emulsion, e.g. AE-300 for a 300+ pen mixing grade emulsion residue or EA-90 for a 90 penetration emulsion residue.

HOW ARE EMULSIONS USED?

Asphalt emulsions can be used for virtually any pavement application, and several applications are suited only for emulsions. They can be used for preventive maintenance and corrective maintenance on both asphalt and concrete pavements, stabilizing and reclaiming bases, building structural pavements and recycling worn out pavements. For successful paving, putting the right application on the right road at the right time is critical. For optimal cost and performance benefits, site selection is the most important first step in all asphalt emulsion treatments.

WHY USE ASPHALT EMULSIONS?

Asphalt emulsions were created in the early 1900's, mainly for dust control and other spray applications. The emulsifiers were natural products ranging from dried blood to lye saponified hog fat. Since these humble beginnings, emulsions have evolved through advances in material science and engineering as well as good old-fashioned trial and error. Emulsion technologies are now developed for just about every road construction and pavement preservation application.

HIGHLY ADAPTABLE AND FLEXIBLE

- Emulsions' physical properties can be modified to optimize storage, curing, mixing, traffic return and bonding strength.
- Emulsions readily accept additives such as polymers, latex, fillers, anti-strips, stabilizers and other modifiers to enhance the physical properties of both the emulsion and the cured asphalt.
- An emulsion's charge can be positive, negative or neutral to improve compatibility with available aggregates and meet other design parameters.
- Emulsions can be engineered for a wide variety of conditions such as working in cooler temperatures or with wet or dusty aggregates.

ENVIRONMENTALLY-FRIENDLY

- Emulsification requires no petroleum solvents. (Some mixing grade emulsions may have small amounts of solvent to enhance mixing qualities.)
- Asphalt emulsion applications produce no or minimal hydrocarbon emissions.
- Used at ambient temperatures, emulsions require no added heat for most applications and produce minimal fumes.
- Emulsions are ideal for non-attainment areas where fume emissions are limited.
- Emulsions are ideal for remote locations where there are no hot mix plants.
- Asphalt emulsions readily coat damp aggregate surfaces, reducing the fuel required for drying aggregates.
- Pavement preservation applications greatly reduce needs for raw materials and energy for corrective maintenance and reconstruction.
- Preserved, smoother pavements reduce vehicle repair and fuel needs.
- In-situ processes reduce material transport.

- Recycling processes reuse existing materials, reducing the need for consumption, production and transportation of new raw materials.
- Asphalt emulsions can recycle and can be recycled. They are being used extensively in a variety of recycling systems, and are particularly suited to in-place recycling. Pavements constructed with asphalt emulsions will also be able to be recycled in the future.

SAFER FOR WORKERS

- Asphalt emulsions are handled at lower temperatures than traditional hot mix asphalt, reducing the risks of burns.
- The water-based emulsions are non-flammable.

SAFETY FOR THE DRIVING PUBLIC

- Emulsion surface treatments are the most cost-effective techniques for improving skid resistance and surface texture.
- Emulsion applications reduce traffic delays with faster repair techniques.
- Open surface applications can reduce hydroplaning and improve visibility by reducing splash spray.

THE BOTTOM LINE

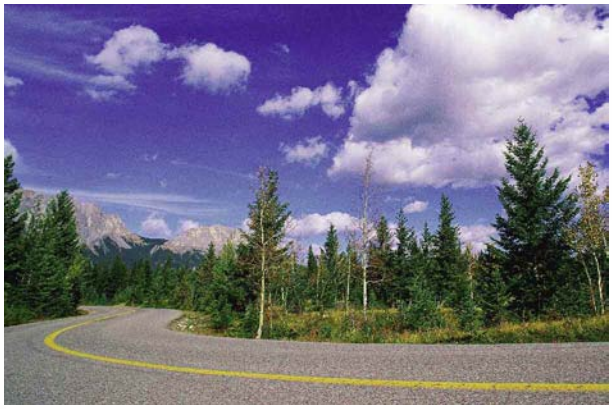
- Each dollar spent on emulsion pavement preservation techniques can save up to $10 over corrective maintenance and reconstruction.
- Asphalt emulsion surface treatments cost less than traditional thin hot mix asphalt overlay maintenance or whitetopping.
- Maintaining better overall pavement condition reduces user vehicle repair and fuel costs.
- Emulsion maintenance and in-place recycling treatments reduce user delay costs with quick construction and reduce the time needed for reconstruction.
- Emulsion preventive maintenance applications reduce overall life cycle costs of pavements while providing superior ride characteristics.

WHAT ARE POLYMER MODIFIED EMULSIONS?

Polymer modified technology is used in asphalt emulsions to improve physical properties, performance and durability. Polymer asphalt emulsions provide increased service life and cost savings, allowing the use of emulsions in applications where conventional asphalt emulsions or cutback asphalts have not worked in the past. Researchers have developed new applications, such as micro-surfacing, ultrathin bonded wearing course and high performance chip seal with modified emulsions. The enhanced physical properties also improve the performance of the most commonly used asphalt emulsion applications.

FORMULATED TO IMPROVE PERFORMANCE FOR OLD AND NEW APPLICATIONS

Polymers are very large molecules made by chemically reacting smaller molecules together. The physical properties of a polymer are determined by the starting smaller molecules. A polymer can be elastic like rubber or hard like bowling balls. When polymers are added to asphalt, the properties of the finished product depend on the asphalt and the polymer used. Emulsion manufacturers select the polymers, most usually elastomeric polymers such as natural or SBR (styrene-butadiene-rubber) latex or SBS (styrene-butadiene-styrene) block co-polymers, to give the desired handling characteristics and field performance. Elastomeric polymers impart durability, flexibility, elasticity and varying amounts of strength to the asphalt, giving better performance to resist both cracking and permanent deformation. Many of the polymers also improve both the adhesion to the aggregate and the cohesion of the asphalt film. Polymers are often added for a quicker or more controlled emulsion break. For example, polymer modified chip seal emulsions often have an earlier chip retention. The polymers may be preblended with the asphalt prior to milling, or latex emulsions may be co-milled with the asphalt and soap or post-added after the emulsion has been milled.



WATER BASED EMULSIONS ARE ENVIRONMENTALLY FRIENDLY

Polymer modified asphalt emulsions provide the same environmental benefits as other emulsions, with the addition of durability and therefore longer service life of the treatment. When it is time to rehabilitate an aged pavement, polymer modified emulsions can be recycled without restrictions. Polymer modified emulsions come out ahead in terms of overall cost savings, too. Major highways and other high traffic roads now can be treated with seal coats instead of a hot mix overlay or other higher-cost method. More projects can be treated with polymer emulsion maintenance techniques instead of waiting until reconstruction becomes necessary. Those projects can often use locally available aggregates instead of having to transport more costly ones.

CONSTRUCTION

Polymer modified asphalt emulsions look, apply and store like conventional emulsions, but the elasticity will be evident as the emulsion is curing and throughout the life of the pavement. The adhesion to the aggregate will occur faster and often allow the use of local aggregates that have not given acceptable results with unmodified emulsions. Polymer modified emulsions are "more forgiving" in tough weather and construction conditions.

APPLICATION	BENEFITS OF POLYMER MODIFICATION
Chip Seals, Sand Seals, Scrub Seals and Sandwich Seals	Early chip retention; reduced bleeding and flushing; better adhesion and elasticity at low temperatures; enables the use of chip seals for high volume roads
Quick Set Slurry Seals	Higher stability allows earlier release to traffic; improves durability
Micro-Surfacing	Allows rutfilling, thicker application and very quick cure and traffic return
Ultrathin Bonded Wearing Course	Thick polymer emulsion membrane has superior bond of the open mix to the existing surface and provides a moisture barrier
Cold and Hot In-Place Recycling	Improved adhesion, cohesion, strength and durability of recycled mix
Base Stabilization / Full Depth Reclamation	Improved adhesion, cohesion, strength and durability of the stabilized mix
Cold and Warm Emulsion Mixes	Excellent moisture resistance; better adhesion to surface to prevent delamination; better cohesive strength to prevent shoving; elasticity to extend durability
Premium Patch Mix	Improved adhesion to the pothole; cohesive strength to prevent deformation and raveling; and elasticity allowing permanent patching
Crack Sealers	Elasticity and adhesion of polymers effectively keep cracks sealed
Fog Seals	Prevents raveling (especially useful on open graded friction courses) and extends pavement life
Tack Coats and Moisture Barriers	Adhesive property of the polymer prevents delamination between hot mix layers; the polymer modified asphalt is an effective moisture barrier
Emulsions for Specialty Applications	Whether used as a base for a recreational surface coating, autobody undercoating, soil reclamation, or whatever application that uses asphalt emulsions, polymer modified emulsions will be easy to handle and give improved durability

ECO-EFFICIENCY

Asphalt emulsions are the most environmentally-friendly products used in the paving industry. Many of the environmental benefits are listed on the previous pages. Recent eco-efficiency studies provide data demonstrating the differences between asphalt emulsion technologies and other, more traditional paving methods.

The BASF eco-efficiency analysis methodology was developed in 1996 and has been used on over 240 studies to date. It is based on the life-cycle analysis principles of ISO 14040, comparing alternatives. The studies evaluate six environmental categories:

- Raw materials consumption
- Energy consumption
- Land use
- Air, water and solid waste emissions
- Toxic potential of the substances employed and released
- Potential for misuse and risk potential.

These categories are further broken down to such variables as global warming potential and photochemical ozone creation potential, as shown here.

Life-cycle data are compiled for all of the categories, a weighting scheme is used to aggregate the results, and they are normalized in order to generate the ecological fingerprint. The fingerprint depicts the relative impacts of the alternatives in each of the environmental categories.

The total environmental impact is then combined with an economic analysis that addresses costs over the product life-cycle. The Eco-efficiency Portfolio depicts relative environmental impacts on one axis, and the economic impacts on the second axis. The most eco-efficient products will provide both environmental and cost benefits.

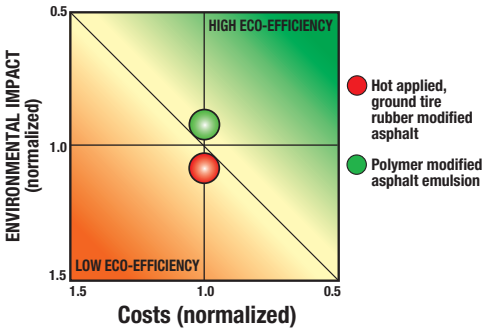
The charts illustrate the balance between relative costs and the environmental impact for emulsion vs. hot applied chip seals and for emulsion micro-surfacing vs thin hot mix overlays, both with and without polymer modification. In both cases shown here, the emulsion applications had significantly higher eco-efficiency for similar relative costs.

The goal of these analyses is to offer pavement engineers the best possible alternatives with the least environmental impact—at the best cost. More information on these studies is on the AEMA website.

Eco-efficiency portfolio combines environmental impact with annual treatment costs.

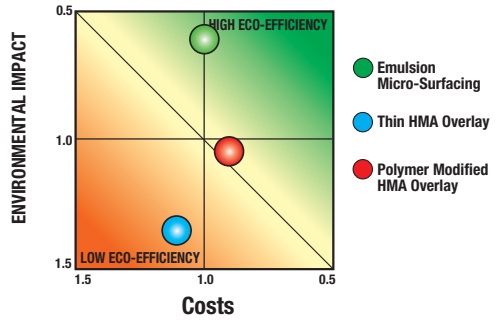
CHIP SEAL ECO-EFFICIENCY

Chip seal resurfacing of 1-mile, 22-ft. wide, (7-year life)



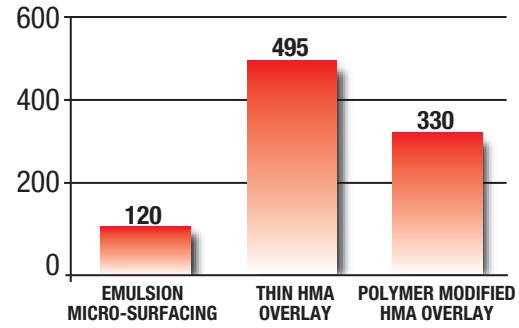
MAINTENANCE SURFACING ECO-EFFICIENCY

Maintenance of 1 lane-mile for 40 years of service
(includes all treatments over period)



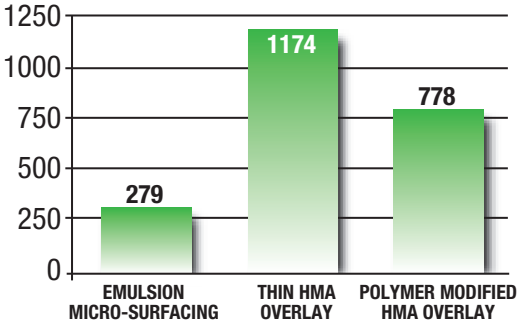
GLOBAL WARMING POTENTIAL

(in t CO_2-equivalents per lane mile)



PHOTOCHEMICAL OZONE CREATION POTENTIAL

(in kg ethene equivalents per lane mile)



Recycling

When an asphalt pavement is reaching the end of its life cycle or is showing early distress, it can be overlaid with a new surface, or it can be recycled using a number of different techniques. A recent FHWA policy statement states that "Recycling and reuse can offer engineering, economic and environmental benefits. Recycled materials should get first consideration in materials selection." Recycling with asphalt emulsions is an ideal eco-efficient solution to reduce costs by reusing valuable paving materials.

There are several obvious advantages to recycling, and some that are not so obvious. The aged, distressed pavement is replaced with a safe, smooth, durable surface, and cracked pavement is removed, preventing future reflective cracking. Recycling reuses the existing aggregate and asphalt, cutting down on new raw material costs. When done in-place, hauling costs are reduced. Clearances under bridges and curb height can be restored. With the proper choice of materials, aged asphalt can be rejuvenated, and poor aggregate gradations can be corrected. In-place recycling minimizes the time a lane is closed for re-construction. The recycled pavement can, itself, be recycled when its time has come. There have been successful emulsion recycling projects on rural roads, busy city intersections and Interstate highways.

Several asphalt emulsion recycling techniques have been developed. The key to a successful project is an analysis of the existing conditions and selection of the best available materials and method. The existing asphalt concrete should be tested, and the pavement structure and causes for distress understood. The mistakes which caused premature distresses--such as using stripping sensitive materials or sub-base problems—should be corrected. A knowledge of the pavement structure, the asphalt content, the quality and gradation of the aggregate and available technologies are essential to designing a new pavement which will be cost-effective, smooth and durable.

HOT IN-PLACE RECYCLING

Hot in-place recycling rehabilitates asphalt pavements on site and in-place. The process typically removes 1 to 1 1/2 inches (2.54-3.8 cm) of the existing pavement, mixes it with new emulsion binder and places the recycled mix on the pavement, all in a continuous operation. The process minimizes the uses of additional virgin materials and demonstrates the ability of asphalt pavements to be recycled economically and quickly.

THE PROCESS

The pavement is heated to approximately 300°F (150°C) to soften the surface which is then scarified to prepare it for milling. Typically, the top 1 to 1 1/2 inches (2.54-3.8 cm) of the scarified pavement is milled and mixed with an emulsion that replaces the attributes that have been lost in the old material. The original material is completely coated with the emulsified asphalt. The mixture is then placed by a paver with a vibratory screed. The mix is compacted using traditional hot mix rollers.

Hot in-place recycling may be performed as either a single-pass or a two-pass operation. In the single-pass operation the rehabilitated material is combined with some virgin material and replaced. In the two-pass operation the existing material is restored and replaced and then, after a curing period, is covered with a new wearing surface.

SITE SELECTION

Hot In-Place Recycling can be used on pavements displaying advanced surface distress and oxidation. But since the process rehabilitates less than the top 3 inches (7.6 cm), it is important that the structure and base of the pavement be in good condition. Traditionally HIR has been only done less than 2 inches (5 cm). New technology has very recently been developed for deeper recycling. Furthermore, it is important to understand the root causes of the pavement distress since this process addresses surface issues and will not solve more serious pavement structural, base or drainage issues.

BENEFITS

- *Drainage and crowns are re-established.*
- *Cracks are interrupted and filled.*
- *Flexibility is restored by chemically rejuvenating the aged and brittle pavement.*
- *The skid resistance in increased.*
- *Deformations such as potholes, ruts, bumps and shoved pavement are leveled.*
- *Clearances under bridges and curb height are retained.*
- *There is excellent public acceptance of recycled materials.*

COLD IN-PLACE RECYCLING

Cold recycling is nearly complete reconstruction of an asphalt pavement experiencing severe distresses including transverse cracking, wheel rutting, potholes, and other surface irregularities. The process involves removal, crushing, and rehabilitation of the existing pavement materials into a new pavement structure.

THE PROCESS

The first step is testing samples taken from the road to be recycled. A design is then performed to determine the formulation of the emulsions and other materials required for the recycling process. The next step is to determine a rolling pattern that will achieve target densities. It may be necessary to field test the rolling procedure to ensure proper compaction.

After the mix design and rolling patterns are determined, the construction process can proceed. A cold recycle train involves several pieces of equipment each performing a specialized task. The train can be up to 100 yards (90 m) in length. The first operation is to mill the existing pavement to about 5 to 10 percent remaining; a small amount of pavement is left to support the equipment during the construction process. Next, the material is crushed and screened. Depending on the mix design, virgin aggregates or additional recycled asphalt pavement may be required. The aggregates, emulsion and other additives are combined and thoroughly mixed in a pug mill. This material is then placed by a lay down machine and quickly compacted using the predetermined rolling pattern.

The final step is to cover the cold in-place recycled material with a surface course within three to five days of placing the original material. Cold in-place recycled material has a higher void percentage than standard mixes and should be sealed with a wearing course.

SITE SELECTION

Cold in-place recycling is the ideal solution for severely distressed pavements with potholes, cracking, shoving, ruts, and/or oxidation. Recycling candidates are normally 15 to 20 years old. The pavements need to have a structurally sound base as this process does not correct base failures. The pavements should be sufficiently thick (5-6 inches, 12-15 cm) to leave at least 1 inch (2.54 cm) of pavement to support the equipment.

BENEFITS

- *Pavements experiencing severe distresses can be rehabilitated.*
- *Using materials in-place minimizes hauling and use of virgin materials.*
- *CIR can use reclaimed asphalt pavement (RAP) milled from other pavements.*
- *Drainage and crowns are re-established.*
- *Cracks are interrupted and filled.*
- *Flexibility is restored by chemically rejuvenating the aged and brittle pavement.*
- *Surface characteristics such as skid resistance are improved.*
- *Deformations such as potholes, ruts, bumps and shoved pavement are leveled.*
- *Clearances under bridges and curb height are retained.*
- *There is excellent public acceptance of recycled materials.*

CENTRAL PLANT COLD RECYCLING

Central plant cold recycling is the same as cold in-place recycling, with the exception that the sizing, screening and mixing with emulsion is done at a central location. The RAP can be freshly milled, or it may come from a stockpile. The plant can be a fixed plant or a portable plant. The recycled material can be replaced on the original pavement or transported to a different road. It is an ideal low-cost paving material for improving low volume, previously unpaved roads or poor quality roads. It is also an ideal use for accumulated RAP.

ASPHALT
100% RECYCLABLE

Building Pavement Structure

Asphalt emulsions are used in virtually all paving applications. When building structural pavements, emulsions can be used to stabilize or rehabilitate bases, for tack to firmly bond pavement layers, in cold mixes ideal for remote locations, or in the newest technologies for warm mix asphalt. The emulsion applications reduce energy needs, fumes, emissions and hauling costs while providing increased safety. In recent years AEMA members have developed new materials and technologies for designing, testing and using performance-related specifications for improving asphalt emulsion structural applications. Asphalt emulsion structural treatments are becoming increasingly effective and increasingly important to meet needs for eco-efficiency and worker safety.

Asphalt emulsion applications are very versatile – emulsion mixtures can be made at a central plant or using a variety of on-site techniques, including traveling plants, reclaimers, blades and portable pugmills. The mixtures can be mixed during the construction process, they can be trucked from the plant to the job-site or they can be stockpiled for later use.

Successful projects are built after a thorough site selection process to determine the right design and construction method. As with any structural paving, the base must be prepared with good drainage and sufficient structure for the expected traffic.

FULL DEPTH RECLAMATION

Full Depth Reclamation is a cost-effective technique for correcting deficiencies, reclaiming distressed pavements and providing structurally sound bases for existing roads. Structure is built down into the pavement structure during the process.

THE PROCESS

Following laboratory testing of materials from the road, an emulsion mix design is performed. Based on that design, a reclaimer pulverizes the existing pavement and its base uniformly four to 10 inches deep (10-25 cm) and mixes in the asphalt emulsion. The stabilized material is compacted with a padfoot compactor to work out the moisture. The road is then bladed to level the surface and compacted in preparation for a new surface.

SITE SELECTION

Full depth reclamation is an ideal treatment for thin bituminous pavements needing upgrading or rehabilitation. The candidate may have high severity distresses such as ruts, cracks, potholes and base problems. Depending upon the severity of the base distress, base corrections may need to be made or base rock added. The base should be strong enough to support the equipment. The road should have good drainage, or provision made for correcting the drainage. Full depth reclamation is also a good choice for strengthening shoulders.

BENEFITS

- *Pavements experiencing severe distresses can be reclaimed.*
- *Using materials in-place minimizes hauling and use of virgin materials.*
- *Drainage and crowns can be re-established.*
- *The existing road material is reused and recycled.*
- *The process builds structure down into pavement, minimizing needs for road re-alignment.*
- *Reclamation can be used as a first step in stage construction, adding more structure as needed to meet increasing traffic.*
- *Reclamation is a low cost process for improving road structure and widening roads.*

ASPHALT EMULSION MIXTURES

Emulsion cold and warm mix overlays have been used for decades, especially on rural roads. Many county engineers have found them ideal for remote locations. Warm sand mixes have also been used on high traffic volume interstates. With today's concerns about energy, fumes and emissions, emulsion mixes are an attractive alternative.

THE PROCESS

There are several asphalt emulsion mix processes. The mixes may be made using a stationary plant at a central location, at a portable plant in a pugmill, at a hot mix plant (run at lower temperatures) or with a blade, recycler or mix paver on the road. For all these processes, the first step is a laboratory mix design with the project aggregate. The emulsion is formulated to coat the aggregate and conform to the needs of the manufacturing process. An emulsion mixed cold on the road with a blade is formulated for different characteristics than an emulsion mixed warm at a central plant and transported to the job site. Cold mixes can be placed with a blade or a paver. The emulsion supplier should be able to help to provide the right emulsion for the proposed project. While emulsions have traditionally been used primarily for dense-graded aggregate mixtures, relatively recent technologies including polymers have been developed for open-graded emulsion mix overlays.

SITE SELECTION

While asphalt emulsion mixes have traditionally been used on local roads, current research and new technologies may make them an alternative on higher traffic volume roads. As with any overlay, the existing base or pavement should be in good condition, with repairs made to any serious distresses.

BENEFITS

- *Emulsion mix overlays improve surface characteristics such as smoothness, rideability and skid resistance.*
- *Emulsion mix overlays improve profile, crown, and cross-slope.*
- *Emulsion mix overlays improve the structural capacity of a road.*
- *Emulsion mixes reduce energy needs and fume production.*
- *Water based emulsions mix easily with aggregates.*
- *The cured asphalt increases strength and stability.*
- *Lower temperatures are used for mixing and laydown.*
- *Emulsion mixes can be mixed on-site, in portable plants or at a central plant.*
- *On-site mixes are ideal for remote locations.*
- *Emulsion mixes can be formulated to be stockpiled for later use.*

WARM MIX ASPHALT

The industry has recently introduced innovative technologies for warm mix asphalt. Warm mix asphalt (WMA) technology is used to construct thick-lift, load-bearing asphalt pavements for base, intermediate and surface layers at lower temperatures than conventional hot mix asphalt. Mix and construction temperatures typically range from 140°F to 230°F (60°C to 110°C). The process uses viscosity-graded, penetration-graded, or performance-graded asphalts free of volatile solvents and cutter stocks and meeting the same industry and agency specifications as for hot mix asphalt. Mineral aggregates used in warm mix asphalt have the same mineralogy, gradation, hardness, cleanliness and other material properties as aggregates specified for hot mix asphalt pavements. Reclaimed asphalt pavement may also be used in production of warm mix asphalts. WMA uses Superpave hot mix asphalt (HMA) materials and design criteria.

THE PROCESS

A new chemistry package including additives to improve coating and workability, adhesion promoters and emulsification agents is used to make a high-residue (typically 70%) asphalt emulsion. The warm mix asphalt process uses conventional hot mix asphalt processing equipment, including batch plants, parallel-flow and counter-flow drum plants and dual plants.

In contrast to hot mix asphalt production, the process uses lower burner temperatures, typically 140-230°F (60-110°C). Warm mix asphalt pavement construction uses the same hauling, extension and compaction equipment currently used in construction of hot mix pavements. Finished pavement properties, such as in-place densities, smoothness and moisture resistance, meet specifications for comparable hot mix asphalt applied at temperatures generally at or above 302°F (150°C).

SITE SELECTION

WMA technology is designed for use anywhere hot mix asphalt or traditional emulsion mixtures have been used. They are ideally suited for areas where emissions and fumes are a concern. As with any overlay, the existing base or pavement should be prepared such that it is in good condition, with adequate drainage and with repairs made to any serious distresses.

BENEFITS

- *The lower warm mix asphalt production temperatures reduce emissions at mix plants.*
- *Warm mix asphalt reduces fume exposure for workers at the plant and job site.*
- *The lower construction temperatures reduce heat and burn hazards for workers.*
- *Warm mix asphalt production and construction conserve fuel by requiring significantly less energy.*
- *Warm mix asphalt overlays minimize user delays. Cure rates can be similar to hot mix asphalt.*
- *Mixture voids are similar to hot mix asphalt (typically lower than conventional emulsion asphalt mixtures).*
- *WMA has the same traffic-readiness, rideability, strength and stability as similarly formulated hot mix asphalt.*

TACK OR BOND COATS

A tack or bond coat is a spray application of asphalt emulsion to eliminate slippage planes and provide a bond between the existing pavement and new overlays or patches. New technologies have been developed to improve tack coats, including the incorporation of polymers and systems that cause immediate breaking of the tack coat emulsion as it is applied. Recent research has demonstrated that effective tack coats significantly increase the strength and fatigue life of pavements at a very low cost.

THE PROCESS

The existing surface is prepared with any necessary repairs and is cleaned free of dust, loose or foreign matter, or any other material which would hinder the adhesion of the emulsified asphalt. Sometimes a pre-application of a very light water spray (0.15 gallons per square yard, 0.68 l/m^2) can improve the adhesion of the tack. The goal is uniform coverage of just enough asphalt to give a thin, tacky, adhesive film without running off the road's surface, or causing slippage between the old pavement and the new surface. The emulsions may be diluted prior to the application to reduce the viscosity for spraying, to allow filling of small cracks or voids and to more accurately apply very small quantities of residual asphalt per square yard. Some emulsions may need to be diluted with soap solutions to prevent the emulsion from premature breaking or clogging nozzles. The emulsion is sprayed at a uniform rate from a properly calibrated pressure distributor, without splattering or drilling from the spray bar. Nozzle angle and spray bar height are adjusted to insure that the spray pattern is even and will give the best tack. The emulsion is allowed to break before the new surface is applied. Traffic is also strictly controlled to prevent damage to the newly applied tack.

BENEFITS

- *Low cost treatment significantly increases bond strength between pavement layers*
- *Stronger bond between layers increases pavement structural strength and fatigue life.*
- *Asphalt emulsion tack prevents slippage and reduces pushing and shoving.*

Pavement Preservation

"Keep good roads in good condition." Nothing lasts forever. Every road surface eventually deteriorates. The key to prolonging a pavement's lifespan is to protect it from exposure, mechanical wear and water. Pavement preservation is a strategy of managing pavement condition to maximize the pavement's lifespan at the minimum cost. This is achieved by careful planning and selection of the right protective application at the optimum time. In most cases that is before the pavement shows visual signs of distress.

A pavement preservation program provides significant benefits. Pavements will remain structurally sound and provide maximum traffic availability and optimum safety. Crack sealing, pothole patching and other corrective maintenance techniques can be reduced or eliminated. Disruptive, time-consuming and expensive pavement replacement can be postponed. A pavement preservation program provides the driving public with a higher level of pavement quality while reducing life cycle costs and user delays.

Pavement preservation is a philosophy that can be applied to all types of roads, from basic gravel roads to the most heavily trafficked Superpave pavements. Through a variety of applications, emulsions play a vital role in maintaining pavements in the best possible condition with the minimum investment.

DUST PALLIATIVES

Controlling fugitive dust has been an issue for gravel roads, quarries and construction sites for years. It is estimated that a single vehicle traveling at thirty miles per hour on a mile of gravel road produces four and one half pounds of dust. While asphalt emulsion dust palliatives are designed to reduce the particulates emitted into the air, the asphalt deposited also provides a certain amount of protection to the integrity of the road surface.

THE PROCESS

Dust palliatives are diluted emulsions applied to surfaces to reduce fugitive dust. Most dust palliatives are sprayed by a distributor onto the surface with little additional surface preparation. Generally, application rates can vary from 0.1 to 0.35 gallons per square yard (0.45-1.6 l/m^2).

SITE SELECTION

Dust suppressants should be used on low traffic volume roads where paving is not economically feasible or when stage construction is planned. For optimal performance of dust suppressants, the road surface material must be mechanically stable.

BENEFITS

- *Application of asphalt emulsion dust control reduces maintenance grading costs from 25 to 75 percent.*
- *The emulsion significantly reduces gravel loss.*
- *The treatment reduces sediment runoff.*
- *The treatment can reduce vehicle accidents caused by deteriorating surface conditions.*
- *Asphalt emulsion treated roads have reduced vehicle damage caused by flying gravel.*
- *The asphalt emulsion results in a higher quality of life and property values for those working and living next to a treated road, reducing cleaning costs, dust-related health problems and impact on dust sensitive vegetation.*

FOG SEALS

A fog seal is a light application of a slow-setting asphalt emulsion diluted with water and applied by a distributor. Fog seals cover small cracks and surface voids, reduce raveling, and enrich dry pavements. A fog seal is an inexpensive way to rejuvenate and seal pavement surfaces. Fog seals are often applied on a routine schedule (typically every three to five years) to prolong pavement life.

CONSTRUCTION PROCESS

Fog seals can be applied using conventional distributors and should be spread as evenly as possible to achieve optimum coverage and penetration of surface cracks. The rate of application depends on surface texture, dryness, and degree of cracking. The application rate of a fog seal ranges from 0.1 to 0.15 gallon per square yard (0.45-0.7 l/m^2) of diluted emulsion. The emulsion and fog seals are typically diluted with water by 25 to 75%.

SITE SELECTION

Fog seals are best suited as a short-term maintenance or corrective measure. They can be used to buy time until a permanent solution can be applied. Since there is no aggregate used in a fog seal, their life span can be quite short—less than a year—under heavy traffic. If used on an active roadway it may be necessary to close the road for four to six hours to allow the emulsion to cure. Fog seals can also be used in a corrective mode to darken pavements, seal pavements after rumble strips have been milled or reduce aggregate loss on chip seals.

BENEFITS

- *Fog seals are an inexpensive way to cover large surface areas.*
- *The asphalt emulsion seals the pavement from water penetration.*
- *The treatment blackens pavement, adding differentiation to pavement lanes.*
- *The asphalt renews aged asphalt pavements that have become dry and brittle.*
- *The low viscosity material flows into cracks and surface voids.*
- *Fog seals can prevent damage to pavements placed in cold weather.*
- *Fog seals can be used in conjunction with chip seals to prevent or repair raveling, snow plow damage and darken the seal.*
- *Fog seals are the least expensive pavement preservation treatment to prolong pavement life and delay major maintenance or reconstruction.*

BROOM SEALS/ SAND SEALS/SCRUB SEALS

Sometimes aged and cracked pavements need a more aggressive treatment than a fog seal. Broom seals, sand seals and scrub seals are related treatments that combine emulsion seal spray applications and aggregates.

THE PROCESS

The surface should be swept and cleaned prior to construction. Sand seals and broom seals begin with a distributor spraying a light application of emulsion binder. A chip spreader spreads an application of fine aggregate completely covering the emulsion. The aggregate is embedded in the emulsion by a tractor pulling a broom sled. The process may be followed by pneumatic tire rollers. The road is usually opened to traffic after sweeping.

Scrub Sealing is a more advanced multi-stage process. A distributor sprays a polymer modified emulsion across an entire lane. Next, a broom sled scrubs the emulsion into voids and cracks. Then a layer of aggregate is applied using a chip spreader. While fine aggregates have generally been used, newer technologies accommodate larger aggregate, as well. The broom sled is pulled across the pavement for a second pass to embed the aggregate into the emulsion. A pneumatic tire roller follows to help further embed the aggregate. The road is swept to remove excess aggregate before the road is opened for traffic.

SITE SELECTION

Broom seals, sand seals, and scrub seals can be applied to aged and low severity cracked pavements. The pavement and base should be in good condition. The pavement can be returned to traffic after the rolling operation is complete. In some cases it is advisable to allow the material to cure several days before excess material is removed.

BENEFITS

- *Sand, broom and scrub seals may be used to improve the skid resistance of slippery pavements.*
- *These seals are inexpensive ways to cover large surface areas.*

- *The treatments seal pavements from water penetration.*
- *They renew aged asphalt pavements that have become dry and brittle.*
- *The asphalt emulsion is pushed into cracks and voids by brooming, further sealing and protecting the pavement.*
- *The seals can prevent damage to pavements placed in cold weather.*
- *When used on the right roads, these asphalt emulsion seals are effective pavement preservation treatments to prolong pavement life and delay major maintenance or reconstruction.*

CHIP SEALS/SEAL COATS/ BITUMINOUS SURFACE TREATMENTS

Chip seals are economical surface treatments designed to protect and prolong the lives of pavements. Chip seals can be used to protect new pavements, to increase surface macrotexture and skid resistance and to prolong the life of a pavement which is structurally sound but is beginning to age and may have some minor surface distress. Long term pavement performance studies have shown that chip seals are one of the most cost-effective methods of pavement preservation. Polymer modified emulsions, tighter specifications on the use of single-size aggregate, inclusion of fiberglass fibers, crumb rubber additives and new application equipment have all been recently developed to improve the construction and reliability of high performance chip seals and extend their use to high traffic volume roads.

THE PROCESS

The first step is a chip seal design done in the laboratory using the project aggregate. The emulsion should be formulated to break quickly with the chip application, and the shot rate calculated to achieve optimal embedment of the chip in the residual asphalt. In the field, the shot rate should be adjusted for the surface condition of the existing pavement. In a single chip seal, an asphalt emulsion is sprayed on the pavement with a distributor, then immediately covered by a single layer of uniformly sized chips from a chip spreader. A double chip seal repeats the same procedure using lower emulsion and aggregate application rates, and the second aggregate is a smaller size than the first. The new surface treatment is then rolled to seat the aggregate, and broomed to remove any loose chips. Traffic should be controlled so that the new surface is not disturbed until after the final sweeping.

SITE SELECTION

Since chip sealing does not significantly increase structural capacity, the existing pavement must be structurally sound. Any moderate severity cracks or other distresses should be sealed or repaired and the surface should be cleaned prior to the treatment. The treatment is ideal for pavements with loss of surface texture and as a preventive maintenance treatment on aging pavements in good condition with minimal surface distress.

BENEFITS

- *Chip seals waterproof and seal small cracks and imperfections in the pavement surface.*
- *The surface treatment enriches hardened and oxidized asphalt.*
- *The treatment improves skid resistance and surface macrotexture.*
- *The seal protects the underlying pavement from oxidation, aging and traffic wear.*
- *The emulsion treatment is environmentally-friendly and safe for workers.*
- *Asphalt emulsion chip seal is one of the most cost-effective preventive maintenance techniques.*
- *High performance chip seals are the lowest cost preventive maintenance treatment designed for high volume roads.*
- *When used on the right roads, these asphalt emulsion seals are effective pavement preservation treatments to prolong pavement life and delay major maintenance or reconstruction.*

SLURRY SEALS

A slurry seal is a mixture of aggregate, emulsion and mineral fillers which is mixed and placed by the same machine. The slurry is designed to seal pavements, restore uniform texture and color and provide good skid resistance. Slurry seals are one of the oldest and most widely used surface treatments.

THE PROCESS

The project materials are tested in a laboratory for the slurry seal design. Before construction, any surface distresses are patched and crack filled and pavement structural deficiencies are repaired.

The pavement is swept and cleaned. The slurry seal emulsion, the aggregate and the mineral fillers are stored in holding tanks on a purpose-built truck and metered into a pug mill at predetermined rates. After thoroughly mixing in the pug mill, the slurry mixture is poured into a sled. As the truck moves forward, the slurry mixture is extruded from the back side of the sled. The sled is capable of spreading the slurry seal over the width of a traffic lane in a single pass, resulting in uniform application. The application system naturally supplies what the road demands. The slurry cures as the water evaporates, leaving only the asphalt to bond with the aggregate. Traffic can be returned once the slurry has cured, usually within four to six hours. Slurry seals are available in three aggregate sizes.

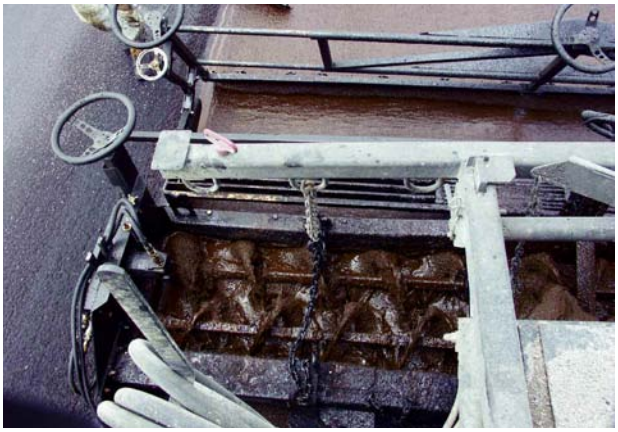
Type I uses a fine aggregate and is designed for parking lots and taxiways.

Type II, the most commonly used type, uses a coarser aggregate and can be used for all applications including arterial roads, residential areas and highways.

Type III uses the coarsest aggregate and is used on freeways, high speed roads, industrial applications and runways.

SITE SELECTION

Ideally, a slurry seal maintenance program should be undertaken before significant pavement deterioration becomes apparent. Slurry can be applied to oxidized pavements with moderate distresses. The slurry seal will fill small cracks and voids and provide some leveling of the road surface. Slurry seals are not designed to fill large depressions or ruts. Slurry can be placed on many pavement types including residential driveways, public roads, highways, airport runways and parking lots.



BENEFITS

- *The seal provides a weather-resistant surface that protects the pavement and base from water.*
- *Slurry seals protect the existing pavement structure from UV damage, oxidation, mechanical wear and exposure to road salts and other chemicals.*
- *Slurry surfaces provide excellent skid resistance.*
- *The treatment has an aesthetically pleasing deep black color and uniform texture.*
- *Slurry seals fill minor cracks and voids and provide minor leveling.*
- *Slurry seals are economical to apply.*
- *The new surface is ready for use just hours after application.*
- *When used on the right roads, asphalt emulsion slurry seals are effective pavement preservation treatments to prolong pavement life and delay major maintenance or reconstruction.*

MICRO-SURFACING

Micro-surfacing is a mixture of dense-graded aggregate, polymer modified asphalt emulsion, water, mineral fillers and other additives. The polymer modified emulsion and other additives allow micro-surfacing to cure more quickly so it can be placed in greater depths — from 3/8 to 1 1/2 inches (0.95-3.8 cm) per pass. Micro-surfacing is designed to be stronger and to provide superior durability to slurry seal. The quicker cure reduces user delays with traffic return often within an hour of construction.

THE PROCESS

The micro-surfacing design is performed in the laboratory using instrumentation developed to determine optimal emulsion curing time and additive rates for the project aggregate. A continuously run machine is used for mixing the components. The material flow rates are continuously monitored as the components are fed into the pug mill where they are thoroughly mixed. The mix is then poured into a sled that is pulled behind the machine. The sled is equipped with augers to move the relatively stiff material to the full width of the sled. The material is extruded from the backside of the sled at a predetermined depth. The quick setting micro-surfacing emulsion allows traffic to return in about an hour. Micro-surfacing is typically available in two aggregate sizes.

Type II, the most commonly used type, uses a coarse aggregate and is used for all applications including arterial roads, residential areas, highways and airports.

Type III uses the coarsest aggregate and is used on higher traffic pavements, including freeways, high speed roads, industrial applications and runways.

SITE SELECTION

Pavement candidates may be asphalt or concrete pavements in good structural condition with low severity surface distresses, polished surfaces, raveling and minor rutting. Micro-surfacing is well suited for high traffic arterial roads because its quick setting emulsions allow both quick traffic return and night construction. Micro-surfacing also works well for runways and taxiways on airports. The high friction surface provides excellent skid resistance with no loose aggregates to damage engines or propellers. Micro-surfacing is ideal for residential streets because of its deep black color that enhances the

appeal of the neighborhood and a smooth surface that is conducive to biking and rollerblading. Micro-surfacing is one of the few surface treatments that can be used to fill ruts and deeper depressions with a purpose-built sled called a rut box.

BENEFITS

- *The quick setting emulsion reduces user delay by allowing traffic in about an hour after construction.*
- *Micro-surfacing may be used for surface improvement and protection of both asphalt or concrete pavements (tack coat required).*
- *The surface increases skid resistance.*
- *Micro-surfacing has an attractive, smooth black surface which aids in lane delineation.*
- *Micro-surfacing emulsions have a chemical break, allowing them to be successfully applied in a broad range of temperatures and weather conditions, effectively lengthening the paving season.*
- *The quick setting emulsion makes micro-surfacing suitable for night application on heavy-traffic streets, highways and airfields.*
- *Micro-surfacing fills depressions, small cracks and ruts, and provides some surface leveling.*
- *Micro-surfacing is a cost-effective, long-lasting pavement preservation treatment that seals the road surface and protects the pavement from water, weathering, UV deterioration, mechanical wear and road salts, prolonging the lifespan of the underlying pavement.*

ULTRATHIN BONDED WEARING COURSE

Ultrathin bonded wearing course is a surface treatment that can be used for maintenance on asphalt or concrete pavements or as a surface course on new construction. The one-pass paving process uses a special machine that both sprays a polymer modified asphalt emulsion and places the ultrathin hot mix with a special screed. The thick polymer asphalt emulsion membrane seals and protects the surface and provides superior bonding of the ultrathin mix to the pavement. The high quality gap-graded aggregate is designed for a durable macro-texture surface. The asphalt binder in the mix is selected for climate and traffic. The ultrathin mat (3/4", 1.9 cm) optimizes the use of the high quality aggregates, while maintaining overhead clearances and curb reveal. The one pass construction process moves quickly, allowing immediate traffic return.

THE PROCESS

The construction process is similar to traditional hot mix paving, with the addition of an emulsion tank and spray bar to the paver. The paver applies a heavy application of polymer modified asphalt emulsion inches before the hot mix placed. The hot mix can be placed as thin as 0.5 inch (1.27 cm) with a maximum depth of 1.5 inches (3.8 cm). The emulsion bonds to the pavement and the new hot mix and quickly cools. The material is compacted with a static 8 to 10 ton roller, depending on the thickness of the mat. The road can be opened for traffic after rolling is complete.

SITE SELECTION

The ultrathin bonded wearing course should be placed on asphalt or concrete pavements with structurally sound bases. It is not designed to bridge weak spots or to cover underlying pavement deficiencies. The treatment provides a durable, open graded, drainable wearing surface. It can be used as the final wearing course on reconstruction, rehabilitation, and resurfacing projects. It is an ideal surface for airports. Ultrathin bonded wearing course is particularly effective in areas with poor skid resistance, back spray problems and where tire noise is a problem. The open-graded mat drains water quickly. Ultrathin bonded wearing course can be used as a preventive maintenance or a surface rehabilitation treatment.

BENEFITS

- *There is excellent bonding strength between the ultra-thin bonded wearing course and the existing pavement, preventing delamination and raveling.*
- *The surface is thinner than traditional hot mix overlays, minimizing adjustments to curbing, catch basins, manholes and shoulders.*
- *The surface is placed in one pass, without milling.*
- *Construction is quick and traffic return is typically within about 5 minutes after rolling.*
- *Work can proceed at two to three times the rate of a typical hot mix process.*
- *The open graded aggregate matrix results in reduced back spray for greater visibility in wet weather.*
- *The process uses one-half to one-third the amount of aggregate of typical hot mix*
- *The surface is quieter than normal dense graded hot mix asphalt - almost three decibels lower.*
- *The surface gives long lasting pavement preservation, with service life up to 10 years or longer with crack sealing.*

SEALERS/MIXES/FILLERS

ASPHALT EMULSION-BASED DRIVEWAY SEALER

Asphalt emulsion-based driveway sealers are made by adding fillers and polymers to a polymer modified asphalt emulsion. The sealer renews, blackens and protects driveway and parking lot surfaces.

THE PROCESS

After the surface is cleaned and swept, the sealers can be applied by distributor to large surfaces such as parking lots, or by hand to driveways. Normally the sealers are spread and smoothed by squeegees.

SITE SELECTION

The existing asphalt surface should be in good condition, and any cracks or surface distresses should be repaired before treatment.

BENEFITS

- *Asphalt emulsion-based driveway sealers are environmentally friendly, with no coal tar.*
- *The sealers blacken the surface for an aesthetically pleasing appearance.*
- *Asphalt-based driveway sealers rejuvenate slightly aged surfaces, seal out water and protect driveways and parking lots from the environment.*

PATCH MIXES

Asphalt emulsion patch mixes are formulated for optimal aggregate coating, water resistance and workability. The asphalt emulsion is mixed with the aggregate (normally warm in a hot mix plant) and then either trucked to the job sites or stockpiled for future use. With a proper gradation of a well-crushed aggregate and a properly formulated emulsion, a stockpile patching mix is workable at low temperatures and maintains good stability at summer temperatures.

THE PROCESS

Although warm, dry conditions are preferable, patching can be done in less than ideal weather. The hole to be repaired should be free of standing water, and preferably should be completely dry. Pavement fragments, loose debris and dirt are removed. Spraying with an air hose is an effective method of both drying and cleaning the hole. An emulsified asphalt tack is applied to the sides and bottom of the hole to improve the adhesion of the patch. The mix is placed at the sides of the hole first, then the bottom filled in. If the patch is to be hand-tamped, sufficient patch mix should be placed in the hole so that it will be slightly above the road surface after tamping. Traffic will eventually compact it to the level of the surface. The patch is then leveled or tamped. If a roller, vibratory compactor or the wheels of the maintenance truck are used for compaction, the finished patch should be level with the road surface. After compaction, the surface may be lightly sanded to prevent tracking and help tighten the surface bond.

Some new processes have also been developed. In one, a specially designed machine blows air to clean and dry the crack, then delivers alternate layers of asphalt emulsion and aggregates to fill and seal the pothole.

BENEFITS

- *Emulsion stockpile patch mixes are convenient for filling holes quickly.*
- *Emulsion stockpile patch mixes can be manufactured during slow seasons.*
- *Repairing the potholes prevents water from entering the base further weakening the pavement structure.*

COLD POUR CRACK FILLERS

Cold pour crack fillers are made by the addition of fillers to heavily polymer modified asphalt emulsions. They are designed for easy application to fill and seal cracks in pavement. The polymer modified asphalt residue seals out water and incompressibles.

THE PROCESS

Normally, the cracks are cleaned of debris and the crack filler poured from pour pots into the crack and allowed to cure.

SITE SELECTION

Cold pour crack fillers can be used to fill low or moderate severity cracks on asphalt or concrete pavements. The cracks should be cleaned before treatment.

BENEFITS

- *The convenient water-based product is used at ambient temperatures, requiring no special heating equipment.*
- *The crack filler prevents intrusion of water and incompressible materials.*
- *The high polymer content means the residue stays pliable in cold weather and retains its integrity at high temperatures.*
- *The crack filler retards deterioration and is an effective pavement preservation treatment.*

Exciting New Technologies

Almost all of the applications discussed here involve new technologies, including—but not limited to—warm asphalt mixes, high performance chip seals, in-place and central plant recycling, micro-surfacing, dust control, bond and tack coats, and full depth reclamation. Of specific interest is the increasing use of performance-related tests and specifications that will remove some of the variables introduced in coordinating formulation, manufacture, transportation and construction, yield better performance and reduce the risk of failures.

Controlling Pavement Cracking. One of the newest processes to be introduced to the asphalt industry in years – a stress absorbing fiber-reinforced membrane designed to delay reflective and seal alligator cracks. An in-place spray applied process produces a membrane that not only waterproofs the surface but also controls the stresses generated in the pavement structure. The final surface may be opened to traffic as a wearing course or additional surface treatments such as an ultrathin wearing course can be applied at a later date.

Fiber and Asphalt

New FiberMat Machine

The combination of polymer-modified asphalt emulsion and glass fibers improves overall performance of the surface several times over – proven in the field and laboratory studies.

The members of the Asphalt Emulsion Manufacturers Association are actively researching other innovations which will provide paving professionals with even more alternatives in the future. The multitude of types of asphalt emulsion applications allows pavement engineers to select the most effective treatment for specific road needs. The asphalt emulsion industry strives to continue serving the driving public well with products that provide a smoother, safer and lower cost highway network.

Asphalt Emulsion Manufac

The Asphalt Emulsion Manufacturers Association is a proactive organization dedicated to the advancement of the asphalt emulsion industry, constantly focusing on system preservation and the construction of the world's infrastructure. The members of the Association include manufacturers as well as other industries supporting the use of innovative emulsion technologies, including equipment manufacturers, chemical suppliers, contractors, researchers, consultants and the people responsible for providing the pavement infrastructure to their constituents.

Association members work together to provide information and training on innovations and the best use of asphalt emulsion technology. Annual meetings include technical sessions for users and producers, and the Association actively sponsors, promotes and supports such events as the International Symposium on Asphalt

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Emulsions Technology and the World Emulsion Congress, and such organizations as the Foundation for Pavement Preservation and the National Center for Pavement Preservation.

For many years, the Association has written, produced and regularly revised the *Basic Asphalt Emulsion Manual* in print and more recently in CD media. The *Recommended Performance Guidelines for Asphalt Emulsions* is a publication giving more detailed information on the use of specific techniques. The Association has produced educational videos on asphalt emulsions and their uses. AEMA recently launched an interactive technical forum on the website.

For more information about the Association, our member companies and available publications, visit our website at www.AEMA.org.

NOTES

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