THE UNIVERSITY OF TEXAS AT AUSTIN ✦ COLLEGE OF ENGINEERING

TEXAS PAVEMENT PRESERVATION CENTER

Newsletter

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Our Mission

The mission of TPPC, in joint collaboration with the Center for Transportation Research (CTR) of the University of Texas at Austin and the Texas Transportation Institute (TTI) of Texas A&M University is to promote the use of pavement preservation strategies to provide the highest level of service to the traveling public at the lowest cost.

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2006 Pavement Preservation Seminar
October 2-3, 2006 - Austin, TX

Presented in Conjunction with the 23rd Annual AGC of Texas Trade & Equipment Show

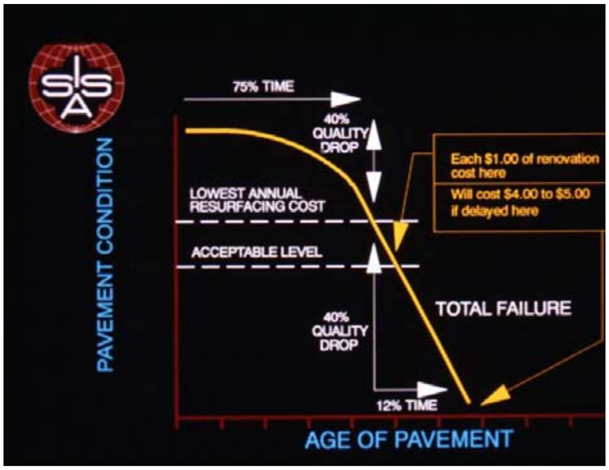
The 2006 Pavement Preservation Seminar was held on Monday and Tuesday, October 2-3, 2006 at the Austin Convention Center in conjunction with the 23rd Annual Association of General Contractors of Texas Trade & Equipment Show.

Sponsors for the Seminar were the Asphalt Emulsion Manufacturers Association (AEMA), the Associated General Contractors of Texas (AGC), the Foundation for Pavement Preservation (FP^2), the Texas Department of Transportation (TxDOT), the Texas Pavement Preservation Center (TPPC), and the UT Center for Lifelong Engineering Education (CLEE).

The seminar offered an excellent overview of the concepts, techniques and materials involved in pavement preservation, with a particular emphasis on preventive maintenance. Seminar topics included asphalt overlays, scrub and fog seals, crack sealing techniques and materials, chip seal best practices, recycled asphalt pavement, hot-in-place recycling, micro-surfacing and slurry seals and pavement management systems.

The seminar offered an excellent overview of the concepts, techniques and materials involved in pavement preservation, with a particular emphasis on preventive maintenance. At the conclusion of the Seminar, attendees were invited to a luncheon, followed by the opening of the 24th Annual AGC of Texas Trade & Equipment Show.

Barry Dunn – **Micro-Surfacing and Slurry Seals**



Barry Dunn presented on the best practices for micro-surfacing and applying slurry seals. Dunn defined conventional slurry seal as a designed mixture of emulsified asphalt, mineral aggregate, water and specified additives, proportioned, mixed and uniformly spread over a properly prepared surface. Historically, slurry sealing has been done in residential areas and served about the same purpose as single chip seal or single seal coat but without the undesirable characteristics of dust, tracking asphalt or loose rock. Dunn said that, with a lot of thin layer treatments, the aesthetics and success of the project have much to do with condition of a pavement. He stressed that the thin layers don't build a structure, or repair base failures, but rather preserve and prevent future deteriorations.
Slurry Seals have two primary uses: 1) preventive – to prevent surface deterioration and 2) corrective – to renew surface properties.
Preventive maintenance protects the existing pavement from the effects of ageing and weathering, thereby extending and maximizing the existing pavement's service life. Dunn stated that, if all funds are spent on the worst roads first, the money will be exhausted quickly and good roads will fall into fair conditions and fair roads into poor conditions.
The types of services slurry or micro-surfacing can provide for corrective maintenance are restoring or renewing desirable surface properties such as skid resistance, crack filling, weather proofing, surface loss of matrix or raveling, aesthetics, uniformity of surface, and leveling or rut filling.
Slurry Seal can, in one pass, deposit a bituminous seal according to the surface demand; fill the interface crack, place a modest wedge if the shoulders are low, place a weather tight seal, fill the surface voids, and provide color/texture delineation and high friction surface.
Slurry seals may be used as a part of a preventive maintenance program, but Dunn warned that slurry seals will not stop reflective cracking. How much slurry costs and how long it will last depend directly upon the condition of the existing pavement.
The difference micro-surfacing has from slurry seal is that micro-surfacing is a designed mixture of polymer modified emulsified asphalt. For each inch of applied micro-surface mix add 1/8 to 1/4 inch crown to each rutfill to compensate for return traffic compaction. Ruts with less than 1/2 inch may be filled with scratch course.
In conclusion, Dunn advised the use of slurry seal or micro-surfacing to weatherproof and delay age hardening caused by oxidation to maximize the life of existing asphalt pavements. In doing corrective maintenance, he advised to always define the cause of the defect, to correct the cause, and then correct the defect.

Joe Graff – **Texas Pavement Preservation Center**

Joe Graff presented at the Texas Pavement Preservation Center. Graff talked about pavement preservation, the development of the center and the services offered by the center.
Pavement condition deteriorates over time with a lot of traffic. Historically, many states wait until conditions get poor, to the point where they have to use reactive maintenance. Pavement preservation maintains pavement at a high level of service.
The goals of establishing the Texas Pavement Preservation Center are training, technology transfer and research implementation. Training includes new courses on pavement preservation, online courses and onsite training courses. Target audiences of the center are administrators, policy-makers, engineers and construction workers. Graff talked about highlights of the center and mentioned that its 1st training course would be offered on seal coat and would include topics such as roadway selection guidelines, materials selection, preconstruction activities, performance monitoring, etc.
The Texas Pavement Preservation Center is available to provide on-site training/demonstrations, online training, research and implementation.

Jim Brownridge – "**Reclamite" Preservation Seal**


West Coast Rejuvenator Application

Brownridge defined pavement preservation as a process of utilizing time proven preventive maintenance activities to extend the useful life of asphalt pavements and to lower annualized resurfacing costs as well as future resurfacing costs. Asphalt rejuvenators can be a maintenance department's lowest cost surface treatment alternative to extend pavement life. Asphalt consists of two main fractions: aslphaltenes—which are the hard brittle insoluble component, unaffected by oxidation and the highly reactive sub-fractions— and maltenes—which are oily and resinous in appearance.

An asphalt rejuvenator is a manufactured product, which has the ability to absorb or penetrate into the pavement and restore those reactive components that have been lost due to oxidation. Rejuvenators are manufactured as emulsions, typically 60-65% residual. They have the ability to "wet" the asphalt binder that is present.

An asphalt rejuvenator increases the penetration value of the asphalt cement in the top portion of the pavement, which extends the pavement's lifecycle, seals pavement against intrusion of air and water and thereby slows oxidation, preventing stripping and raveling, and protecting the pavement in-depth.

In conclusion, Brownridge stated that the "Reclimite" reverses the aging of asphalt pavements through in-depth correction of the asphalt's chemistry.

Dar Hao Chen — **Identification of Reflection Cracking**

Reflection cracking depends on the underlying and outer layer. In the underlying layer, cracking happens when there is movement induced by traffic, moisture or temperature. The question is how to determine what pavement has risk for reflective cracking. In order to do that, proper tools are needed to analyze movement.

Reflection cracking is the biggest problem in HMA overlays of PCC pavement. Crack retarding layers can bend very well as opposed to a polymer modified superpave mix, which can break easily. A crack retarding layer uses very high asphalt content, fine aggregate and is very dense. The problem with a crack retarding layer is that it is very soft with a thick asphalt on top that causes rutting to occur when a truck goes through. This material is also roughly twice the cost of a conventional mix.

Chen talked about an upgraded Overlay Tester that is fully computer-controlled to help design mixes that resist reflection cracking.

A rolling dynamic deflectometer (RDD) is an operational device, which can give continuous deformation. This device, which travels 1 mile per hour, is owned by The University of Texas at Austin and is the only one in the world. With the use of RDD, continuous deformation can be obtained to help identify risk for reflective cracking.

Based on the results obtained, the RDD and OT provide an objective evaluation that correlates to field performance data.

Chen strongly recommended that both tools be used for the rehabilitation of concrete pavement with an HMA overlay to evaluate the potential risks for reflective cracking

John O'Doherty — **Pavement Preservation: Preservation National Perspective**

John O'Doherty presented the topic of the national perspective of pavement preservation and the pavement maintenance life cycle cost analysis.

O'Doherty defined pavement preservation as an applied asset management that combines engineering with business and economic theory. The traditional reconstruction and rehabilitation initiates life, whereas pavement preservation extends life.

The original pavement deteriorates slowly, eventually hitting a preventive trigger, at which point minor change, preventive maintenance is done to restore it to its original condition and extend the life of the pavement.

According to the pavement option curve, pavement quality drops 40% in the first 75% of a road's life, and, in the next 12% of its life, the quality drops another 40%, therefore spending $1 before a pavement's condition drops significantly eliminates or delays spending $6 to $10 on rehabilitation or reconstruction in the future. O'Doherty explained pavement management basics using a pavement serviceability index.

O'Doherty's example on the quick assessment method of network evaluation establishes a network need, evaluates reconstruction, rehabilitation and preventive maintenance, and also incorporates design life with life extensions.

In conclusion, pavement preservation is a "decision" that will improve highway network condition at lower cost, and failure to adopt pavement preservation may have financial consequences.

Garry Fitts – **"PMA Applications and Performance"**

Garry Fitts spoke about applications of polymer modified asphalts (PMA), their performance compared to neat asphalt, particularly hot-mix, and practical/construction issues.

The main reason why asphalt is modified is to change the temperature effects on asphalt's physical properties; that is, to make asphalt stiffer at high service temperature and stronger at low-intermediate service temperature. In addition, modifying asphalt improves adhesion to aggregates and reduces effects of aging/oxidation on asphalt properties.

Some of the applications for PMA include seal coats, micro-surfacing, interlayers, dense-graded HMA, permeable friction course and stone matrix asphalt.

Applications for PMA have become wider and begun spreading to local governments as well.

A study on PMA Performance in Hot Mix Asphalt was performed by ARA for the Asphalt Institute and Association of Modified Asphalt Procedures, to compare the performance of polymer modified asphalt with comparable sections built with neat asphalt. The objective of the study was also to identify conditions that maximize the effects of PMA to increase HMA pavement and overlay life. The findings of this study suggest that the 25% and up increase in service life can be assumed using PMA mixes, along with 3 to 10 years increase in service life and reduced maintenance.

In conclusion, Fitts said that the use of PMA mixes extends the service life compared to unmodified HMA mixes, and that layer thickness should not be reduced when empirical thickness design methods are used.

Tom O'Leary – **"Seal Coats for Pavement Preservation"**

O'Leary gave a thorough overview of seal coat best practices. A seal coat is generally a single, double, or triple application of asphalt material covered with aggregate. Surface treatments are applied to prepared base courses or other surfaces. Seal coats are applied to existing pavements to extend the life of the pavements, but they are not intended as permanent pavement surfaces and have a life expectancy of approximately five years. The service life of a seal coat varies depending on situational conditions such as traffic volume and weather. Seal coats correct deficiencies such as cracks, raveling (or shelling), bleeding, aged or oxidized pavement, low skid resistance and also provide the appearance of a uniform surface. Seal coats, however, will not strengthen existing pavement, increase load-bearing capacity, smooth out rough pavement, bridge major cracks wider than 1/8" (cracks wider than this size must be crack sealed in advance), or eliminate the need for maintenance or reconstruction. Within the first three-quarters of the life cycle of a pavement, there is a 40% reduction in quality, but, in the following 12% of the life cycle, the quality of the pavement plummets into total failure. Thus, a seal coat should be applied during this initial three-quarter period. Some factors affecting seal coat quality are existing pavement surface condition, the experienced capability of workers applying the seal coat, equipment, materials, application technique, traffic, and weather. A raveled surface will require more binder; a slick surface will require a lighter binder and bleeding pavements a lighter application rate.

Seal coating is an art, not a science, and seal coat design is simply a starting point: be prepared to deviate from the design. It is necessary to have a good eye once you get out onto the road. The contractor superintendent, engineer designer, inspectors, operators, suppliers and taxpayers all play a role. Inspectors need to be adequately trained and have the freedom to make timely and informed field decisions. They need to develop partnering relationships with the contractor and suppliers and understand that plans are only a guide and that each road requires special considerations.

Before applying a seal coat, an old roadway should be patched, crack sealed, and thoroughly cleaned. Likewise, unpaved surfaces need to be primed unless inverted prime techniques are being used. Keep in mind that hot or cold mix patches need adequate curing time. If this is not possible, then a fog seal should be considered instead of a chip seal. Herbicide should be applied to surrounding vegetation, and gutter areas and curbs should be vacuumed, particularly in urban environments.

To prepare for seal coating, it is necessary to calibrate equipment, know proper design rates, understand factors affecting rate adjustments, determine rock lands, strap the distributor for accurate readings, and ensure that proper signing and traffic control are in place. Calibrate the distributor's spray bar height, nozzle angle, spray bar pressure, and computer or asphalt meter. A double coverage spray bar is most commonly used; a triple coverage spray bar is not recommended because it is susceptible to wind, which will affect binder consistency. Computer-controlled aggregate spreaders need to be calibrated for proper rate distribution, and the gates and hitch need to operate properly. The shot should be set to the size of the aggregate rather than the size of the distributor so that binder gets covered in a timely fashion. Stockpiles should be placed in strategic locations for better production.

It is extremely important that trained operators drive the aggregate spreader at a controlled ground speed to reduce skids and prevent rock from turning over. It cannot be overemphasized that the aggregate spreader should never move faster than the distributor. The spreader box should be directly behind the distributor (the quicker the aggregate gets applied, the better the bond will be). On high heat afternoons, however, the spreader box should back off slightly.

Trucks should be of adequate size and quantity. Measure and record the volume within each truck. Control the trucks' speed throughout the project. Stagger the dump trucks in and out of the wheel paths or station them down the roadway. Check tires periodically for proper inflation and cleanliness.

Rollers should be pneumatic only (three medium or four light pneumatic rollers are recommended), and tires should be clean and properly inflated. Rolling must take place immediately after the spreading of aggregate. The slower the roller moves the better, and rollers should always be moving because if it is sitting, it will squeeze aggregate down and push binder up. When a job is delayed for more than 10 minutes, rollers and trucks should be moved off of the fresh seal.

For traffic control, flagmen, signs, and a pilot car are needed. The flagging stations should be constantly moved, and the pilot car should maintain slow speeds. Traffic control should also clean up messes; clean-up must be done immediately because on a hot day, a mess will get tracked through the whole job.

The proper aggregate for seal coating should be clean, single-sized, and cubical for optimum performance; avoid flat particle shapes and uncrushed gravel since these do not offer skid resistance. Do not use pre-coated aggregate with emulsion binder because it has a tendency to dramatically slow the break of the emulsion and will stay tender for a very long time. Pre-coated aggregates should only be used with hot AC binders. The cost of single-sized aggregate deters their usage in most states, but a method to determine the number of "flatter" particles should be used when using graded aggregates. Aggregate with minimal fines should be used since fines will settle at the bottom if there are too many in the mix, preventing the proper embedment of larger aggregate into the binder and resulting in the loss of cover stone and bleeding. Natural and synthetic aggregate can be used. Aggregate selection depends on the type of roadway, volume of traffic, existing weather conditions, availability of aggregate, and cost.

Voids are the spaces between the aggregate particles; as aggregate particles are dropped into wet asphalt settling should occur in disoriented positions. After rolling and traffic, aggregate will be seated in their flattest position. Voids should account for 20-30% of the area before rolling and should account for roughly 20% of the area after rolling. For good performance, voids should not be filled completely with asphalt binder. On low volume roads, voids should generally be 40-50% full. On higher volume roads, voids should be only 30-40% full. Hot AC is typically applied at 320-350°F. Hot AC loses 150-200°F in the first 30-45 sec. after application, so it is imperative to apply aggregate on AC while it is still very hot. The more fluid the binder is, the better it will adhere to the aggregate. Application of aggregate should be one rock thick, and if aggregate is applied correctly, there should be little or no remaining excess to sweep after a job.

To avoid excess joints, asphalt should be applied to the entire area of intersections and widenings first before applying aggregate. Paper the joints at all starting and stopping points, and shoot on clean surfaces only. Use 1/2 nozzles or end nozzles on longitudinal joints. Nozzles should never be squared because doing so will actually produce a double shot; two nozzles are needed for a proper shot.

Marginal surface temperature requires excellent construction techniques. Do not shoot too late in the day if working under questionable weather conditions; there needs to be plenty of time for proper curing before nightfall, since it is typically the wet or cold nighttime conditions that will ruin a seal coat.

Operators are often under pressure to get a job done and may be inclined to rush. Under these conditions, when tracking occurs, the first instinct is to raise the aggregate rate. This is the wrong thing to do. In reality, trimming the rock rate will stop the tracking. Aggregate rate is extremely important and affects more than just the look of the road. Too much aggregate will cause binder to push up.

In a high traffic situation, skid marks occur where trucks have to stop for traffic. An innovative way to solve this problem is to break up the application. Shoot three miles, and then skip a shot for the next 3,000 feet. This way, traffic always starts and stops on the old surface. At the end of the day, fill in the parts that were skipped. By doing this, skid marks can be avoided and patching will be unnecessary. In a day, one transport load of production may be lost, but no patching will be required.

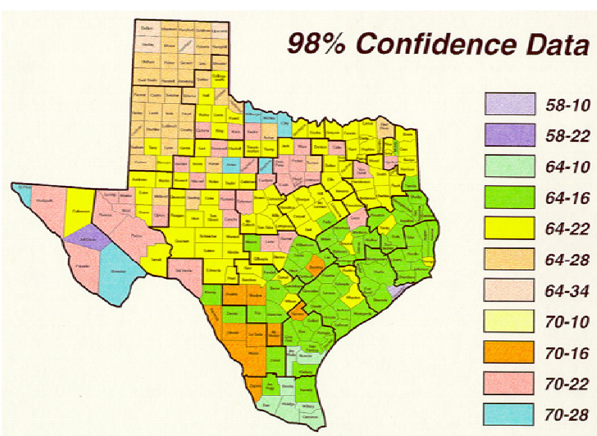
John Christensen – **"Asphalt Production"**

John Christensen talked about how to get asphalt from crude refined products. Almost all asphalt comes from crude refined petroleum. Crude varies widely depending upon viscosity, sulfur content with low sulfur specifications as required by environmentalists, and asphaltenes. Three types of crude variables are Venezuelan, Arabian-Heavy, and Nigerian-Light.

Typical refining runs between 50 to 300,000 barrels per day. Crude is heated up to 650-700°F, then injected into Crude Tower at which point crude boils, and gas starts to rise up to the top of the tower as liquids fall into the bottom. Kerosene, light gas oil, and heavy gas oils are then condescended out of the tower through appropriate plates. All of these are then inject into the Vacuum

Tower to pull out all the remaining air so that thermal cracker and coker come out from the Vacuum Tower Bottom asphalt. Asphalt that comes out of Vacuum Tower is blended with Pitch and some heavy oil making base asphalt for pavement.
Asphalt molecules consist of asphaltenes, which have components such as polar aromatics, naphthalene aromatics and saturates. Asphaltenes are the largest, heaviest molecules, and give the asphalt its solid nature at room temperature.
Asphalts are graded by the temperature they resist distresses according to Performance Graded (PG) specifications. The reason modified asphalts are produced is to increase the performance of one criteria (criteria for rutting, fatigue and thermal cracking) without losing another, and this is usually done by increasing the PG temperature spread.
Most commonly used elastic modifiers are stryrene butadiene stryrene (SBS), tire rubber (TR), latex (SBR) and reactive elastometric terpolymer (Evaloy). SBS and tire rubber are elastic modifiers mostly used in Texas.
SBS is thermoplastic elastomer polymer, which consists of thermoplastics that have properties such as melting when heated and hardening when cooled, while still recovering properties when heat is removed. Additionally, SBS consists of elastomers, which exhibit elastic properties that return to original shape when stress is removed. SBS is thermoplastic elastomer that exhibits properties of thermoplastics and elastomers in the same molecule.
Polymer modified asphalt production starts with low temperature, followed by introducing and milling polymer. By agitation and heating processes, SBS molecules are dissolved and linked, and, in the final process, PG grading, homogeneous asphalt and consistency are sought.

Darren Hazlett – **"Asphalt Binder Selection"**



PG binder specific grade selection is based on a climate based grade that can be developed by the computer program and maps that were created by TxDOT, and it is also based on changes to high temperature designation.
Loading rates that were assumed when building a highway are relatively low when there is a traffic jam, which is why there has to be change in PG grading according to the speed and volume of traffic.
Surface layers are very important to concentrate in terms of when changes to high temperature occur, because, when the weather is hot and traffic is heavy, the surface layer binder is expected to resist the failure.
Hazlett talked about the materials used in surface treatment, including modified and unmodified hot applied binders and emulsions. Hot applied binders are 100% binder. Road to the traffic can be opened on hot applied binders as soon as the rock is rolled and the binder has cooled. Some of the disadvantages of hot applied binders are that they must be applied at high temperatures which can be dangerous for field personnel. Also, hot applied binders do not work well with wet or dusty aggregates and therefore usually require pre-coated aggregate. Emulsions, on the other hand, require more elapsed time before opening to traffic and are applied at a lower temperature than hot applied binders. Polymer modified versions of hot applied binders and emulsions help early chip retention, handle higher traffic volumes, and perform in wider temperature extremes.

Brett Budris **– "Crack Sealing"**

Budris presented an overview of crack sealing. According to an FHWA report, potholes and additional cracking form at 75% to 80% of unsealed cracks compared to 1% of sealed cracks (FHWA/UT-85/1). The Utah DOT also found that effective crack sealing significantly reduces the pothole formation and development of additional cracking.
The importance of crack sealing is that it prevents water intrusion into sub-base, prevents incompressible intrusion and results in pavement humping, improves ride quality and smoothness, and extends pavement life by slowing down deterioration.

Crack sealing application procedures for training, which were put together by TxDOT and UT-Austin, includes setting up proper traffic control, routing cracks if needed, cleaning and drying the crack before applying the treatment and allowing material to cool before opening to traffic.

Bud Smallwood – **"In-Place Recycling of Asphalt Pavement Projects"**

Smallwood presented in-place recycling of asphalt pavement projects in University Park. He gave thorough information about the town and the projects done in the town.

Smallwood stated that one of the benefits of in-place recycling to the residents is the short process of applying in-place recycling.

Based on the pavement lifecycle cost per year diagram, the cost of pavement service had dropped from $4.93 in 1992 to $0.35 per yard in 2006.

Steven Muncy **– "Cold Recycling and Cold-in Place Recycling"**

Cold in-place recycling is useful because it is environmentally sound, gives enhanced performance and is cost effective. Cold in-place recycling is a straight forward process, in which existing asphalt pavement is pulverized, reclaimed asphalt is sized, the addition of new asphalt binders and the mixing of all component materials are then placed and compacted.

There are a variety of equipment and ways of putting cold in-place recycling units together. A multi-unit train has liquids, modifiers, emulsions in the front, and a milling machine, pressuring unit, pugmills and compaction equipments that follow.

All reclaimed asphalt pavement (RAP) is screened to a maximum size requirement, and the oversized material is crushed and returned to the screen deck for total sizing control.

Cold in-place recycling mix design procedure includes obtaining sample of reclaimed asphalt pavement from field; determining RAP gradation, binder and aged binder properties; selecting amount and gradation of additional aggregate; selecting type and grade of recycling additive; and also testing trial mixtures.

Selection of additives depends on type of soils, aggregates and, among the bituminous additives, asphalt emulsion (with or without polymer) is in the biggest use.

From chemical additives, Portland Cement and Hydrated Lime have been used in conjunction with asphalt emulsion to improve early strength, increase rut resistance and improve moisture resistance.

Thermal cracking, poor rideability, raveled pavements, and fatigue cracking are good candidates for CIR.

There are many CIR benefits: CIR conserves energy and materials, it improves mix characteristics, it eliminates or reduces cracks; it improves geometrics and most importantly it is cost effective.

Muncy stated that the weather condition is not the big factor in considering CIR, except for a lot of rain.

Watch the video of the 2006 Pavement Preservation Seminar proceedings at www.utexas.edu/research/tppc/conf

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Upcoming event

MNT704 - Seal Coat Design, Construction, and Inspection

This course will provide engineering guidelines for planning, desiging, constructing, and inspecting seal coats. Specifically, the course will cover roadway selection, materials selection, material specification and test requirements, plan preparation, inspector duties and authority, equipment inspection and calibration, seal coat design methodologies and field adjustments, inspection requirements, construction process, and performance monitoring.

For updates visit the Texas Pavement Preservation Center (TPPC) website: www.utexas.edu/research/tppc.