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TEXAS PAVEMENT PRESERVATION CENTER
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Inside This Issue:

The TPPC Seal Coat Training Course

TPPC Board of Directors

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. The executive sponsor for the TPPC is the Texas Department of Transportation (TxDOT).

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Issue Highlights

TPPC Seal Coat Training Course

As part of our continuing mission to advance the field of pavement preservation, the Texas Pavement Preservation Center has begun two new training courses on seal coats, the Texan term for chip seals. The courses are intended to serve two main groups: engineers and inspectors. The course designed for inspectors, entitled “Seal Coat Inspection and Applications,” focuses on proper inspection methods and the equipment used during chip seal construction. The other, “Seal Coat Planning and Design,” is intended to instruct engineers on planning, designing, and constructing chip seals. The purpose of both courses is to increase the awareness and understanding of pavement preservation by providing instruction on a common preservative maintenance treatment. This issue offers a summary of the material presented in the course, allowing those who are unable to attend an official class to still glean some knowledge from our efforts.

The first three rounds of courses were held in Fort Worth February 27 and 28, Austin March 18 and 19, and Lubbock, TX April 15 and 16, 2008.

Both sections of the course are approximately 8 hours in length and offer attendees 0.8 Continuing Education Units. To receive a certificate of completion for the course, all attendees must score a passing grade on a series of quizzes over the material covered. For more information on continuing education courses or to request a course in your area, please contact Tammy Sims at tsims@dot.state.tx.us.

Seal Coat Inspection and Applications, MNT 702

This course focuses on proper inspection methods and the equipment used in seal coat construction. The course is composed of six chapters, which will focus on the need for a pavement preservation strategy applied across the state in all seal coat applications, inspector duties and authority, equipment inspection and calibration, seal coat terminology, pre-seal coat repairs, seal coat defect identification and correction, seal coat preparation, and seal coat and surface treatment application. Additionally, attendees participate in two lab activities, one on binder application rates, and another explaining field inspection of a distributor. The following is a brief summary of each chapter from this course and the binder lab.

Chapter 1: Pavement Preservation Concepts

The first chapter relates the basic principles behind pavement preservation and explains the need for training in this area. The idea of pavement preservation is relatively new, and is therefore not fully understood by many maintenance professionals. This course is part of a nationwide effort to increase public awareness of the benefits of pavement preservation practices.

A pavement preservation (PP) program is defined by the Federal Highway Administration (FHWA) as a program that employs a network-level, long-term strategy that enhances pavement performance using an integrated, cost-effective set of practices that extend pavement life, improve safety, and meet motorist expectations. These programs use both preventive and routine maintenance, though the emphasis definitely lies with prevention. Basically, pavement preservation works because maintaining a road in good condition is easier and less expensive than repairing one in poor condition.

PP is a very effective strategy for many reasons. It extends pavement life and arrests or retards deterioration and progressive failure. PP keeps the road in good condition, which improves safety conditions and ride quality and increases road user satisfaction. Furthermore, the financial savings from using preventive maintenance as opposed to reactive maintenance are substantial.

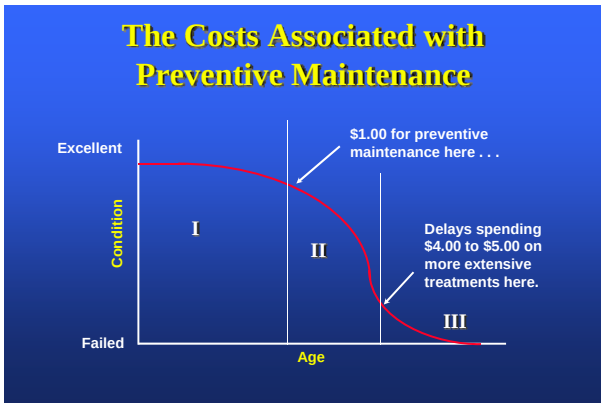


Figure showing the financial benefits of preventive maintenance

Pavement preservation treatments are used for planned maintenance, maintenance to retard future deterioration, and actions that maintain or improve the pavement's functional condition. The most common treatments include chip seals, slurry seals, fog seals, micro-surfacing, thin HMA overlays, crack sealing, and joint sealing.

Dr. Yetkin Yildirim, director of the TPPC, explains the importance of pavement preservation at the Austin seal coat course.

The main philosophy behind pavement preservation can be summed up by the well-used mantra "the right treatment, the right road, and the right time." This catchphrase highlights the importance of careful planning in a preservation strategy. The best time and location for treatment must be identified, which often means selecting a pavement that does not have extensive or even minor visible damage. Once a project is chosen, maintenance professionals have to decide on the most effective treatment for the conditions at hand, including traffic levels, climatic conditions, treatment cost, and distress type and extent.

Because pavement preservation is a fairly new concept, many road agency personnel lack sufficient knowledge of when and where to apply a preventive maintenance treatment, what materials to use, and which methods are preferable. Unfortunately, there is currently only a limited number of resources providing formal training on preventive maintenance. This problem must be corrected, as education on pavement preservation is needed at all levels. Policymakers, field personnel, engineers, and taxpayers all affect road maintenance decisions, so all must learn about the advantages of pavement preservation. The aim of this course is to improve the current state of pavement preservation knowledge.

Chapter 2: General Principles

This chapter focuses on seal coat terminology, the need for and limitations of seal coats, the factors that could affect seal coat performance, and the defects that commonly occur in seal coats and surface treatments.

Seal coats are most commonly called chip seals, though they are known by many other names, such as a skin

coat and a spray and chip. They are inexpensive in comparison to other preventive maintenance treatments, and are usually very simple and highly effective. They compose a major part of TxDOT's pavement preservation program. A seal coat is a layer of asphalt binder covered with aggregate and is always applied to an existing pavement. If the same treatment is applied to a prepared compacted base, it is known as a surface treatment. Seal coats usually last about six to eight years, though some have been known to last as long as twenty.

A typical strip seal coat covers the right-hand lane of this road.

Seal coats have many useful functional characteristics: sealing an existing bituminous surface against water and air, enriching a dry or raveled surface, arresting light deterioration, providing skid-resistance, providing desirable surface texture, improving light-reflecting characteristics, enabling paved shoulders or other features to be demarcated by a different texture or color, and providing a uniform appearance. The aggregate layer successfully resists traffic abrasion and transmits wheel loads, creating a durable surface for the roadway on which it is applied.

Seal coats do have limitations, however. Although a seal coat can preserve the strength of an existing pavement and subgrade by preventing water infiltration, this treatment has little to no structural strength in and of itself. Seal coats are only a temporary fix for load-associated cracking and cannot effectively improve ride quality. Flushing and bleeding are difficult to repair with seal coats. Furthermore, although seal coats have been used successfully on roads with both low and high amounts of traffic, they are usually more effective on roads with low traffic volumes and are most effective on roads with low-volume truck traffic.

Many different factors can affect seal coat performance, though construction techniques are probably the most significant. Other factors affecting performance include the properties and amounts of binder and aggregate, the uniformity of the binder and aggregate application, and the initial amount of adhesion between the existing surface, the new binder, and the new stones. The condition of the existing pavement or strength of the underlying base, the amount and type of traffic traveling the roadway, and the environmental and drainage conditions can certainly influence seal coat performance, as well.

A surface treatment, which is a seal coat placed on a granular base rather than an existing paved surface, is mainly impacted by the materials and construction quality of the base course. Delamination of the surface treatment from the base is the most common failure associated with this treatment. To prevent delamination from beginning, the base finish must be performed with care. Slush rolling is not recommended: if too much water is used, the base may be weakened significantly.

The prime coat can also greatly affect the performance of a surface treatment. Surface treatments must be constructed with strong and durable binders, which do not have the low viscosity needed to penetrate and grip the base layer. The prime coat's primary purpose is to grip both the base and the surface treatment, holding them together and preventing debonding.

The most common faults found in seal coats or surface treatments are loss of aggregate, streaking, and flushing. Loss of aggregate is usually caused by poor adhesion between the binder and the stone, which is often due to insufficient binder temperature during application. If the aggregate is not placed before the asphalt begins to cool or an emulsified binder begins to cure, the stones cannot embed properly because the binder is already too hard. Similarly, late season application can cause problems. An insufficient amount or improper type of binder, dusty or moist aggregate, excessive rock application, and premature high-speed traffic can all result in chip loss, as well. Streaking is caused by a lack of uniformity in the binder application, and flushing is the result of too much binder. With proper construction and design, all three of these common defects can be avoided.

Non-uniform binder application can cause streaking.

Chapter 3: Duties of Inspector or Crew Chief

This chapter focuses on the authorities and duties of an inspector or crew chief and the specifications and plans a project must follow. Primarily, the inspector is a representative of the project engineer, whose duty is to

ensure that all aspects of the contract, including the plans, specifications, and other documents, are adhered to during the construction process. Inspectors therefore have the authority to shut down a project if all the requirements of the contract are not met. The inspector should have a firm grasp of the details of the contract, the plans, specifications, special provisions, and work schedule for the project and must inspect all work, materials, and equipment involved. Every material must be sampled, inspected, tested, and approved prior to use. Otherwise, the inspector may order the contractor to remove and replace the material.

Attendees answer questions about the previous chapter on a quiz at the seal coat course in Austin.

The inspector can reject materials or suspend construction if an issue arises between the contractor and inspector until the project engineer can resolve the conflict. The inspector does not have the authority to revoke, alter, or release the contractor from any part of the contract or approve any work that is not performed according to plan. The contractor is responsible for managing the work and supervising construction; the inspector should not interfere with the contractor's duties. If the seal coat work is being done by state forces, however, the crew chief must act as both the chief inspector and supervisor.

TxDOT specifically recommends assigning at least three inspectors to a team for any given seal coat project. A useful strategy can be to use the same inspection team throughout the district each year, which encourages consistency and allows the team to gain knowledge and improve seal coat construction over time. Every team should be equipped with a very experienced and knowledgeable chief inspector, whose duties are to inspect the entire job and determine the binder and aggregate application rates. The other two inspectors will each monitor either the binder or aggregate application and control application rates based on the chief inspector's instructions. All inspectors must report to the project engineer with updates on the progress of the work.

The specifications in the following contract documents must be adhered to in all aspects of the seal coat construction: TxDOT's Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges; Special Specifications; Special Provisions; and Plans. Standard Specifications address the quality of materials and equipment to be used, the method and manner of the work to be performed, and the method of measurement and payment upon completion of the project. Special Specifications are those that are not covered by the Standard Specs and are unique to the individual project. Special Provisions can either revise or supplement the Standard or Special Specs, and the Plans describe the work to be performed in detail.

Chapter 4: Pre-Seal Coat Activities

The goals of this chapter are to outline the preparation and repairs that may need to be performed prior to placing a seal coat, explain how to properly stockpile aggregate, and discuss the planning and execution of an effective preconstruction meeting. In preparation for a seal coat project, five main steps must be taken: repairs and patching; stockpiling, sampling, and testing aggregate; addressing traffic control needs, holding a preconstruction meeting, and selecting application rates.

Though there is no hard and fast rule as to when repairs should be performed prior to seal coat application, it is generally recommended that they be completed as far as eight months in advance. More important than the amount of time that has passed, however, is that the repair materials have fully cured before the seal coat is placed. Seal coating a fresh patch, for instance, may lead to aggregate loss later on. To ensure that repairs are well-timed, the repairs should be planned and coordinated as soon as possible.

Fresh patches should be fog sealed prior to seal coat application.

Some of the repairs that may be needed prior to seal coat application are milling/planing, level-up, pothole repair, base repair, edge repair, and crack sealing. Generally, all cracks greater than 1/8" wide must be sealed prior to seal coat placement.

TxDOT allows contractors to stockpile aggregate at certain approved locations on the project site, though some procedures must be followed before the stockpiles can be placed. The supplier must be identified to the engineer by the contractor after the contract is awarded. The aggregate must be tested according to the plans, specifications, and special provisions. Usually the

contractor requests locations for the stockpiles, and the project engineer either approves or denies their proposal. Standard Specifications in Texas require that the location be at least 30 feet from the roadway, does not obstruct traffic or sight distance, and does not interfere with road access from abutting property or with roadway drainage.

Stockpile locations should prevent contamination, and the techniques utilized should prevent or minimize segregation and degradation. If necessary, the contractor may have to prepare the stockpile area before the aggregate is placed by dozing or clearing away debris.

The preconstruction meeting is an important part of the preparation necessary to effectively plan a seal coat. During this meeting, all the personnel involved in the project should be introduced to one another and establish a working relationship. The responsibilities of all project personnel must be clearly defined, the work schedule must be planned, traffic control procedures need to be reviewed, the number of work days and holidays should be identified, and any other pertinent information should be discussed at the preconstruction meeting. All personnel available should attend, but it is highly recommended that at least the project engineer, area engineer, maintenance supervisor, director of maintenance, district laboratory engineer, and inspectors all be at the meeting.

Binder Application Rate Determination Lab

A hands-on activity accompanied Chapter 4 of the Seal Coat Inspection and Applications course. The exercise is intended to demonstrate how binder application rates are determined.

Attendees conducted a Board Test with samples of aggregate, in which the rock was poured out onto a flat metal sheet until the person pouring felt that a good rock spread for a seal coat had been achieved. Gerald Peterson, who was leading the activity, pointed out that each board had a slightly different amount of rock, showing that “good” rock spread can be a subjective matter. Therefore, a standard for aggregate spread should be set at the preconstruction meeting.

Once the rock spread rate has been determined, the binder application rate can be calculated. If there are fewer voids between the rocks, less binder should be used to avoid flushing.

To check embedment, a single rock can be extracted from the binder, making it easy to see how much of the rock was encased in asphalt. The rock will become more deeply embedded once traffic has traveled over it. If the aggregate is not achieving adequate embedment, the binder may not be hot enough or the aggregate spreader may be too far behind the asphalt distributor.

The second part of the lab consisted of examining several binder samples. One sample was cutback asphalt. With cutbacks, water contamination may be a significant problem, but one of the biggest drawbacks to this type of binder is the volatility of the solvent used. All maintenance personnel must be aware of the potential for ignition from any type of spark or fire.

Cutbacks are not the only dangerous type of binder, however. Modified asphalt binder must be heated to about 350° F for application, making it very hazardous to the maintenance crew spraying it.

When using emulsions, it is important to note that cationic and anionic emulsions cannot be mixed: the result is a gooey ball that cannot be applied to the road. Therefore, the distributor must be cleaned thoroughly if switching between these two different types of emulsion. As for rapid versus medium setting (RS and MS) emulsions, Peterson recommends spraying RS emulsions as soon as possible, while slower-setting emulsions can be stored for a few months. The best way to avoid using binders that are no longer effective is to sample them frequently.

Gerald Peterson, P.E. pours a binder sample during the lab in Fort Worth.

Chapter 5: Equipment Inspection

In this chapter, the typical pieces of equipment required for a seal coat application are listed, and their general inspection procedures are described. This lesson covers rotary brooms, asphalt distributors, aggregate spreaders, haul trucks, rollers, front-end loaders, and heater and storage units. Though the inspector should come to the project with a thorough knowledge of the equipment that will be used, the contractor is responsible for providing a manufacturer’s manual for each piece. These manuals should be used as a reference whenever the inspector needs to verify or look up information on proper equipment inspection techniques.

The contractor and engineer usually decide on a start date for construction and select a date and time for equipment inspection. At least half a day should be set aside for initial equipment inspection, and inspection should be performed at least one day before construction. Visual inspection for leaks should be

performed on all equipment both before the project begins and throughout the entire construction process. Not only could a leak be a possible safety issue, but the leaking substance might contaminate the asphalt or aggregate, preventing proper adhesion.

Safety is of the utmost importance on the job site. The manufacturer's safety procedures for inspection and operation of each piece of equipment should be followed at all times. Working with asphalt materials is nearly always somewhat dangerous. Cutback asphalt binders are the most risky due to the extremely flammable nature of the solvents in the mix. The main safety concern with asphalt cement is the high temperature of the binder, which can cause severe burns. A copy of the Material Safety Data Sheet (MSDS) should be kept with the asphalt distributor truck.

A rotary broom is a self-propelled, four-wheeled piece of equipment with a bristle brush that can be raised, lowered, and rotated horizontally that is used to clean the pavement prior to construction. The first step when inspecting this piece of equipment is to identify the relevant data, such as the manufacturer's name, model number, and serial number. Safety markings, lights, and flags, are especially important for this piece of equipment, as it usually travels well ahead of the rest of the construction operations. The bristles on the sweeper should be checked to ensure that they are in good condition, and the width of the brush should be checked for evenness. The rotary and hydraulic lift controls should all be fully functional.

An example of a rotary broom

An asphalt distributor, arguably the most complex piece of equipment used for seal coat construction, is a truck-mounted, insulated tank with a number of special attachments. The asphalt distributor is composed of an asphalt tank, a heating system, a circulating and pumping system, filterscreens, a spray bar and nozzles, a hand sprayer, and controls and gauges. Each component must be thoroughly inspected, and the inspector should review all the procedures for doing so.

The aggregate spreader, also known as the "spreader box," spreads aggregate evenly over the layer of asphalt applied by the asphalt distributor. It consists of several major components that require inspection: truck hitch, receiving hopper, belt conveyors, spreading hopper, discharge gates, and discharge roller.

Haul trucks are used to transport and deposit the aggregate in the spreader. They are usually end-dump, tandem-axle or single axle trucks. The size of the truck bed should be noted, as well as the condition of the truck in general. Every truck should have a hitch compatible with the one on the aggregate spreader; the tailgate and hoist of the truck must also be inspected and approved. The haul trucks are required to have a unique identifying number to allow the inspector to easily recognize each truck.

A pneumatic roller

The rollers orient the aggregate in its flattest dimension and seat it firmly into the binder. For seal coats and surface treatments, TxDOT recommends a pneumatic roller to avoid crushing the aggregate. The identifying data should be recorded by the inspector, as well as the weight of the rollers. The contact pressure exerted by each tire must be calculated, and the inspector should ensure that each tire is inflated so that there is no more than 5 psi variation between them. The number of tires, area of coverage, and several other factors, such as the amount of wheel wobble, must meet specifications.

Front-end loaders move aggregate from the stockpile to the haul truck. The inspector should check the condition of the machine visually and record its identifying information. There are no particular components that require inspection; rather, the overall condition must be acceptable.

A contractor will sometimes set up a heater and storage unit for a large project. This unit is filled with asphalt, which is then pumped into a transporter or directly into an asphalt distributor. There is no standard configuration for this piece of equipment, and it may not even have identifying data if it has been manufactured by the contractor. The person operating the heater and storage unit must be aware of the flash point, or the temperature at which ignition could occur, of the binder in the unit. The inspector should check the storage tank for cleanliness and ensure that there is a continuous-reading thermometer on the tank and a way to adjust

the burner on the heater. The entire unit should be inspected for safety.

Chapter 6: Seal Coat/Surface Treatment Application Process

This chapter covers the sequence of events that occur during the application of a full-width seal coat, a strip or spot seal, and a surface treatment application. During this process, it is essential that the three inspectors assigned to the project work as an efficient and alert team.

During application, weather conditions must be thoroughly monitored. Construction should begin only if the temperature, humidity, wind, and rain conditions are suitable. Traffic control techniques must be followed according to the project plans or as specified in the Texas Manual on Uniform Traffic Control Devices (TMUTCD). The traffic control devices commonly used include signs, cones, flaggers, pilot vehicles, and arrow boards. Proper traffic control is of the utmost importance, as it directly impacts safety for the road users as well as the construction crew.

Before construction begins, raised pavement markers may need to be removed. A motor grader, front-end loader, or other acceptable method may be used. The best time of day to remove raised pavement markers is the morning when temperatures are cooler. Next, the pavement must be cleaned and swept. This step must be performed at the correct time: before application begins, but not too far in advance. Any vegetation and soil on the edge of the pavement should be removed at this time as well. After the pavement is cleaned, temporary flexible-reflective roadway marker tabs can be placed to designate lane lines according to the traffic control plans.

Next, the rock lands must be set. A rock land is the area covered by one preset size truckload of aggregate at the desired aggregate application rate. If the truck is empty when it reaches the marker at the end of the rock land, the aggregate application rate has been followed correctly.

Once the rock lands have been set, the asphalt shots may be set as well. An asphalt shot should equal the length of a predetermined number of full rock lands. The asphalt application rate in the plans is just an estimate and should not replace good engineering judgment. When setting the asphalt shot, the capacity of the distributor must be taken into consideration. The distributor should never be completely emptied by an asphalt shot, especially if emulsions are used as they tend to foam easily. The asphalt application should not begin until the haul trucks are loaded with enough aggregate to cover the shot and are placed behind the aggregate spreader box. The production rates of the asphalt distributors, spreader, and rollers must all be equally matched.

Pilot vehicle guides traffic through construction site.

The loader operation is an essential component of a successful seal coat application; it is often overlooked, however, because it is somewhat removed from the main activity of a project. The inspector must check the loader operation activity early and often to ensure that the operator is penetrating the stockpile deeply enough and close enough to the bottom that a representative scoop of aggregate is taken with each bucket. Contamination must be watched for, and the inspector should also make sure the operator is keeping the equipment off the aggregate to avoid degradation. The operator should fill the truck to its specified level each time so that the contractor will be paid correctly and the aggregate is applied at the correct rate. Finally, inspectors must look out for excessive dust problems and correct them with a light sprinkling of water.

Before the asphalt can be shot, many checks must be made. First the distributor must be prepared and the nozzles should be blown out to ensure that none of them are clogged. Then the spray bar height, paper joints, all equipment, and transverse alignment of the distributor must be inspected. Once these checks are performed, the application of the asphalt may begin.

Before and after each load of asphalt is sprayed, the distributor should be strapped. “Strapping” means using a calibrated measuring stick to measure the asphalt in the tank. Strapping allows the contractor to be paid correctly and the inspector to determine the average asphalt application rate for each shot. The application rate can be adjusted from one shot to the next if strapping is performed between each shot.

Course attendees look at an asphalt distributor in Fort Worth, TX.

Before the asphalt distributor begins shooting the binder, the aggregate spreader and all other equipment should be in position so that the rock can be placed immediately after the asphalt. A useful tip is to apply a short test strip on bare pavement to visually check for uniform aggregate spread before placing the rock on asphalt. As the aggregate is being spread over the asphalt, the inspector should watch closely to be sure that a thin and uniform "curtain" of aggregate is dropping through the spreader gates. The inspector should check behind the spreader as well to see if the pavement is getting contaminated or if there is any aggregate streaking. If the spreader or haul trucks are picking up any asphalt as they move across the new surface, this problem must be corrected immediately.

As for timing the aggregate application, the general rule of thumb is that it should be placed immediately after the asphalt is shot, as early placement maximizes embedment. Therefore, the spreader should follow very closely behind the distributor. Rolling should occur immediately after the aggregate has been laid with one exception: if an emulsion is used, the inspector should allow the emulsion to break before rolling to keep the roller tires clean.

This chapter also covers the following application procedures: patching and hand work, intersections and irregular shapes, brooming the excess aggregate, opening the road to traffic, placing temporary or permanent pavement markings, placing raised pavement markers, and cleaning up the worksite.

Seal Coat Planning and Design, MNT 703

The Seal Coat Planning and Design course is intended to provide engineering guidelines for planning, designing, and constructing seal coats. The specific topics that this course deals with are as follows: the need for a comprehensive consistent pavement preservation strategy; roadway selection criteria; material selection specification and test requirements; determining the proper seal coat or surface treatment for each project; traffic volume effects on seal coat projects; communication and coordination requirements during planning and application; and how to handle customer complaints. The first two chapters cover the same material as the first two chapters in the Seal Coat Inspection and Applications course; therefore the summary of this course will begin with the third chapter.

Chapter 3: Guidelines for Treatment Selection

Chapter 3 covers the roadway factors that affect the decision of whether or not to use a seal coat, the type of surface defects that can be mitigated by seal coats, the effect of traffic volume on a typical treatment, the various types of seal coats and surface treatments, and the Modified Kearby Design Method.

The main factors that often affect the decision to use a seal coat on a particular roadway include the condition of the existing pavement, the types of defects the pavement exhibits and the efficiency of the treatment at addressing these defects, the cost of the seal coat in comparison to other treatments, the traffic volume, the percentage of truck traffic, and the repairs that would be needed prior to placing the seal.

The structural adequacy of the existing pavement is a major factor affecting whether or not a seal coat should be used. Seal coats can only correct minor surface deficiencies, such as cracks less than 1/8 of an inch, raveling, and a lack of skid resistance. With the right design, seal coats may be able to treat bleeding, although they are usually not recommended for that type of distress.

Seal coats can be applied to roads with all traffic volumes, although low volume roads are usually the most common recipients of this treatment. On a high-traffic volume road (ADT>10,000), short-term aggregate loss, vehicular damage from loose asphalt, flushing, increased tire noise, and extended traffic control during construction may occur.

Attendees listen to a lecture at the Fort Worth course.

Short-term aggregate loss can take place a few hours or days after construction and may be due to inadequate amounts of binder, inadequate embedment, or cold temperature applications. Vehicular damage can be minimized by allowing only slow-moving traffic on a new seal coat, and tire noise can be mitigated by applying a second application of the seal coat using smaller aggregate for the top layer. Using a modified binder may allow traffic to travel without restriction over a new seal coat much sooner than if an emulsion is used.

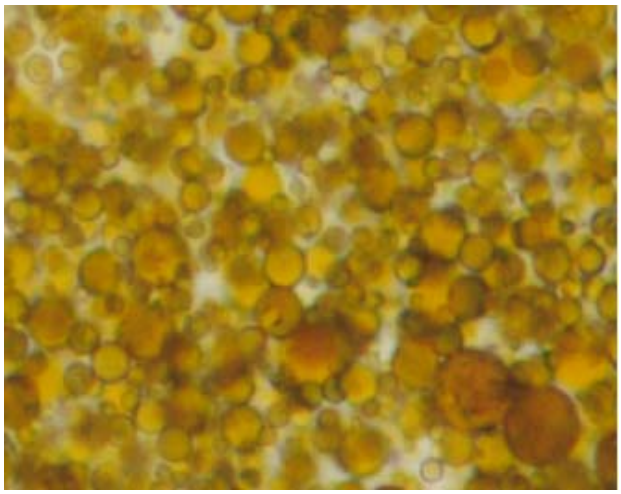
Strip or spot sealing is a maintenance treatment used to address longitudinal or transverse cracking, early signs of alligator or block cracking, flushing, low skid resistance, and segregated spots in asphalt concrete. All of these defects must be addressed immediately before they become too problematic to correct with minor maintenance. Surface treatments are seal coats that are placed on a prepared base rather than an existing pavement. Fog seals consist of a light application of asphalt, usually emulsion, over an asphalt concrete surface. This treatment is often used over a new seal coat to prevent chip loss.

The modified Kearby design method is an altered version of the original Kearby method recommended to TxDOT by the Texas Transportation Institute in 1981. This modified method is the most commonly used by TxDOT today. To use this design method, three laboratory tests are required: the Dry Loose Unit Weight, Bulk Specific Gravity, and Board Test. Although initial binder and aggregate application rates can be determined using the Kearby design method, good engineering judgment should always be followed; often, field conditions require the adjustment of both binder and aggregate rates.

Chapter 4: Material Selection and Plan Preparation

This chapter focuses on the process of communication and coordination between personnel during a seal coat project, the properties and specifications of various types of binders and aggregates to determine proper selection for each seal coat project, and ways to plan and contract a seal coat project.

Once a roadway has been selected for a seal coat treatment, the project design office, the area engineer, the maintenance supervisor, and any other district personnel involved in the project must establish a method of communication and coordination. Then they will be able to discuss important issues such as lessons learned from previous seal coat applications, which materials to use, and whether repairs and patching should be performed by state force or contract.



Emulsified asphalt (greatly magnified)

There are three types of binders commonly used for seal coats: asphalt cement, cutback asphalt, and emulsified asphalt. Each form takes a slightly different approach to liquefying the asphalt and enabling it to be applied in spray form from an asphalt distributor. Asphalt cement is heated at a very high temperature until it becomes fluid, while cutback asphalt uses a petroleum solvent such as naphtha or kerosene. Emulsified asphalt is asphalt that has been broken into minute particles and dispersed in water with an emulsifier. When the emulsified asphalt breaks, the tiny droplets of asphalt are released.

The most important requirements in the specifications for asphalt cements are the viscosity, penetration, and aged viscosity. When using a cutback asphalt, TxDOT generally uses either the rapid curing (RC) or medium curing (MC) varieties. RC cutbacks cure faster because the solvent used, gasoline-naphtha, is more volatile than the kerosene solvent found in MC cutbacks. Asphalt emulsions are often used because they can be applied at a much lower temperature than asphalt cement. An emulsion can either be anionic, cationic, and non-ionic, though only the first two are used for surface treatments and seal coats. When using an emulsion, pre-coated aggregates should not be used because the coating inhibits the chemical break, absorption, and adhesion of the emulsion to the stones.

Aggregate breakdown during coring operation

In a seal coat or surface treatment, the aggregate serves to resist abrasion from moving wheels and transfers wheel loads to the lower layers of the pavement. Aggregate also provides skid resistance, light-reflecting qualities, and a difference in texture or color to demarcate shoulders or other distinct areas of the road. Aggregates can be either natural (such as crushed gravel, crushed stone, and natural limestone rock asphalt) or synthetic (including light weight aggregate made of shale, clay, or slate, and crushed slag made as a by-product of steel production).

The characteristics of aggregates that affect seal coat performance are maximum particle size and gradation, cleanliness, and shape, which includes the Average Least Dimension (ALD). ALD is the overall average of the smallest dimensions of the stone particles and controls the quantity of cover stone and asphalt binder that should be applied. Other aggregate factors affecting performance include toughness, or resistance to abrasion and degradation, aggregate absorption (only applies to uncoated aggregate), and precoated aggregate. Aggregates are precoated with asphalt binder to maximize adhesion, reduce the accumulation of dust on the aggregate surface, maximize aggregate absorption, and increase color contrast between the striping and the road surface.

Other than the above characteristics, aggregates are selected for their ability to meet the frictional demands of the roadway and their relative costs.

When planning a seal coat, one of the first priorities should be determining the quantity of the materials needed. Before the quantity can be set, the area of the roadway to be covered must be calculated. Though the actual binder and aggregate application rates should be based on a design procedure after the materials are delivered but before the start of construction, it is only necessary to estimate these rates during the planning stage. Estimates should be based on site-specific conditions and local experience.

Plans for seal coat contracts should consist of at least the following: a title sheet, general notes, specification data, a summary of quantities, project location and limits, and standard sheets. Before construction begins, costs should be estimated using the Construction Division's (CST) monthly report for construction and maintenance contracts.

Chapter 5: Public Perception and Complaints

The final chapter in the Seal Coat Planning and Design course covers how to handle customer complaints that may occur during or after seal coat construction. Anytime a maintenance professional must handle a complaint, he or she should do so in a courteous, professional, and timely manner.

Most complaints about seal coats are due to vehicle damage from loose aggregate or asphalt sticking to vehicles. Complaints related to either of these problems should be directed to the contractor during contract work and to the local TxDOT office once the work is complete. If state forces are handling the seal coat work, each complaint should be investigated by district personnel.

Because seal coats and surface treatments are used extensively, it is important that the public understand how effective they are at preserving the road system. Sometimes complaints are made about seal coats in general, as the public often dislikes the tire noise or loose aggregate sometimes seen with this treatment, or they simply consider it to be inferior to an asphalt concrete overlay. A complaint of this nature can actually be seen as an opportunity to educate the public and improve customer satisfaction. Coordinating with the district's Public Information Office is often helpful when dealing with complaints and attempting to educate the district's customers.

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