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Requirements of Employers

It requires that employers with 25 or more employees provide reasonable accommodation for disabled workers unless there is demonstrated undue hardship. That hardship may include significant difficulty or expense to the employer.

Definition of "disability"

The definition of "disability" comes from the definition of "handicap" which is contained in the amended 1973 Rehabilitation Act rules under section 504. The definition refers to individuals with "a physical or mental impairment that substantially limits one or more of the major life activities or "a record of such impairment."

Major life activities, according to Section 504, include functions such as caring for oneself, performing manual tasks, walking, seeing, hearing, speaking, breathing, learning, and working.

"Impairment" does not include physical characteristics such as eye color, hair color, left-handedness, or height, weight or muscle tone that are within "normal" range, and are not the result of a physiological disorder. Advanced age, in itself, is not an impairment.

For example, under the regulations, someone with hearing loss would be defined as having a disability even if the condition were correctable with the use of a hearing aid.

ADA does not require that unqualified individuals be hired. Employers can judge what functions of a job are essential.

Where to Get More Information

If you need information or technical assistance on the ADA, contact the Regional Disability and Business Technical Assistance Center at the Northeast DBTAC in Trenton, New Jersey, telephone 609-392-4004.

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Reasons for "Chip Seal" Failures

by Peter Messmer, Lab Engineer, Cornell Local Roads Program

Oil and stone surface treatments (chip seals) are steak and potatoes fare on the platter of most town and county construction menus. This article discusses why many chip seals are doomed to an early end.

The good news is that to be forewarned is to be forearmed. To get the most for your "chip seal" dollar, be on the alert for things that can go wrong, such as:

- the aggregate and emulsion spread rates
- construction techniques
- weather
- surface preparation
- traffic control
- material problems

A recent phone survey has shown that chip sealing is a fairly widespread paving and maintenance procedure. Since the survey was not announced, most agencies were unprepared to give accurate cost estimates. However, agencies indicated a range of $6,000 to $8,500 per mile for a single chip seal. Clearly, there is the potential for great financial losses when chip seals fail before a reasonable life expectancy of five years or so.

What constitutes failure?

The main reasons for chip sealing are:

- to provide an all-weather road surface (i.e., seal against entrance of water into base course and subgrade)
- improve skid-resistance
- rehabilitate an old, weathered asphalt surface
- provide demarcation of traffic lanes

If a chip seal ceases to perform these functions, it has failed. Failures occur in two primary forms:

- stripping (loss of cover stone)
- bleeding (excess asphalt on the road surface)

Both conditions ruin the ability of the chip seal to provide the stated functions.

Debunking a Myth

A reason commonly offered for chip seal failures is that the emulsion and aggregate are not well suited to each other.

This idea comes from the difference between ***anionic*** and ***cationic*** emulsions. All emulsions are a mix of asphalt cement, water, and an emulsifier. Mixing asphalt with water requires an emulsifying agent, since they do not readily mix. As the three ingredients are blended, a suspension of asphalt droplets in water occurs. The emulsifier creates a surface tension between the asphalt particles and surrounding water that permits the asphalt droplets to remain in suspension until the water evaporates. Emulsifiers create an electrical charge on the surface of the asphalt particles that cause them to repel each other, helping them to stay in suspension. An ***anionic*** emulsifier is one that makes a negative charge on the asphalt droplets, while a ***cationic*** emulsifier creates a positive charge on the droplets.

Traditionally engineers agree that anionic emulsions work best with aggregates having mostly positive surface charges, such as limestone. On the other hand, usually a cationic emulsion works best with aggregates having mostly negative surface charges, such as sandstone. However, recent studies have begun to challenge these concepts.

Perhaps certain asphalt emulsions work better with certain aggregates. Seldom, if ever, is the degree of compatibility so poor that the asphalt will not coat the rocks. Furthermore, once the emulsion has broken, it behaves like an asphalt cement, and the charge on the asphalt film disappears. The fact is that

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the emulsion/stone matchmaking is rarely the cause of severe stripping failures. Indeed, most failures result from something gone wrong in the six aspects of chip seal construction, mentioned previously.

The Aggregate and Emulsion Spread Rates

A common practice is to use the same emulsion and aggregate spread rates for every project. This would be like issuing the same size uniform to an entire army! The spread rates must be tailored, like a fine suit, for each project. The source and gradation of stone used, as well as the surface condition and daily traffic of the road, will vary. The spread rates must be selected for each project to account for these conditions.

Ideally, the stones will be embedded in asphalt to a depth of about 70 percent of their height, after rolling and traffic has fully seated them. We will discuss some practical ways to control the spread rates in order to achieve this embedment. The ideal aggregate spread rate will result in a mat one stone deep which uniformly covers the road surface. To determine a good starting spread rate use a 3'x 3' board and cover it completely, one stone deep. Remove the aggregate and weigh it. This tells you the pounds per square yard of stone required. Do not increase this to add a "whip off" factor. You can adjust the starting rate on the job if necessary, but don't use any more aggregate than you need to just keep from "picking" stones on the wheels of the roller.

There is a good "rule of thumb" to figure the gallons per square yard of emulsion. The rule applies to a typical road that has an average daily traffic (ADT) count of approximately 500 to 1,000 vehicles on a surface that is not weathered and porous or excessively flushed with asphalt. It works best when the particle size ratio in the aggregate is two, as for a 1/4" x 1/2" gradation.

Divide the stone spread rate by the residual asphalt content of the emulsion. The residual asphalt content is the percentage, by weight, of asphalt left after the emulsion is fully cured. The vendor should be able to provide you with data on the residual asphalt content.

Example 1: you have a stone spread rate of 25 lbs/yd², and you are using an RS-2 with a residual asphalt content of 63 percent. You are chip sealing a road that has an ADT of 800, and does not have a surface that is absorbent or flushed. The Emulsion Spread Rate = Stone Spread Rate/Residual Asphalt Content (25/63 = 0.396 gal/yd²). For this example, 0.40 gal/yd² would be a good starting point.

The emulsion rate figured from the "rule of thumb" will have to be adjusted if the road surface is absorbent and weathered or flushed, and if the traffic is less than 500 or greater than 1,000 ADT.

For slightly weathered and absorbent surfaces, add 0.03 gals/yd², and up to 0.09 gals/yd² for badly weathered and absorbent conditions. For an ADT of 100, add 20 percent to the emulsion rate; 100-500 ADT, seven percent: 1,000 to 2,000 ADT, subtract seven percent; and 2,000 or more ADT, subtract 15 percent.

Example 2: you have a stone spread rate of 20 lbs/yd², and you are using an RS-2 with a residual asphalt content of 65 percent. You are chip sealing a road that has an ADT of 1,500, and has a badly weathered and absorbent surface.

First, figure the emulsion rate without adjusting for surface condition or traffic. Emulsion Spread Rate = 20/65 = 0.307 gals/yd². Round up to 0.31 gals/yd².

Second, subtract seven percent because there is 1,500 ADT, instead of 500-1,000: 0.31 gals/yd²-(0.07)(0.31) = 0.288. Round up to 0.29 gals/yd².

Third, add 0.09 gals/yd² for the badly weathered surface: 0.29 gals/yd² + 0.09 = 0.38 gals/yd².

When you spread stone and oil too lean or too heavy, failure occurs. Too little stone leads to insufficient cover and causes "picking." It also causes flushing since there will be excess oil due to the shortage of stone. Too much stone wastes money since it will end up in the ditch. Also, the stones are more easily dislodged if they are spread too heavily. The extra stones dislodge their neighbors under the force of many tires.

Too little asphalt emulsion prevents the stones from embedding properly, and the stones will be lost eventually. Too much emulsion drowns the stone in asphalt and reduces the skid resistance one hopes to achieve. Bleeding will cause "fatty" patches to increase as time goes on, creating a skidding hazard.

Checking Application Rates

To check the emulsion spread rate, stick the tank at the start of the job. At the end of the job, restick the tank. You can determine the gallons applied from the difference in the stick readings. Divide this number by the square yards of the job, and the result is the average application rate. Or if the distributor produces a trip ticket, simply read the gallons applied. The amount of the emulsion applied should be within ± 5 percent of the calculated amount for the area of the job.

Example: A lane 10 ft. wide and 500 ft. long has 555 yd² of area. You need 167 gallons of emulsion at an application rate of 0.30 gals/yd². If the trip ticket indicates that 174 gallons were used, this was 7 gallons extra. You calculate that 7/167 equals 4.2 percent. This is within the 5 percent range and is acceptable.

To check the emulsion spread rate another way, use a square yard of material, such as filter fabric. Weigh it, place it on the road, and drive over it with the emulsion distributor. You may find it helpful to tape the fabric to a 3'x 3' piece of sheet metal. Use double-stick carpet tape at the corners to help hold it in place. Weigh it again after the emulsion is sprayed on it. The difference of the weight before and after is the weight of emulsion spread per square yard. Divide this weight by the weight of 1 gallon of emulsion (8.33 lbs/gal), to find the spread rate in gals/yd2. If the rate is too high or too low, adjust the distributor application.

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To check the stone application rate, measure the area that the weighed truckload of material covers. Divide the weight of the load in pounds by the area covered in square yards, to get the pounds per square yard.

Example: a spread rate of 25 lbs/yd^2 is desired. A 12,000-pound truck load is spread along 300 ft. of a 12-ft. wide lane (i.e., 400 yd^2). The rate actually spread is 12,000 pounds/400 yds^2 = 30 lbs/yd^2. This is 5 lbs/yd^2 too much. The gate opening and truck/spreader speed must be adjusted to decrease the spread rate.

Drive a truck or spreader over a square yard of cloth for a quick spot check of the stone spread rate. Weigh the stone dropped on it. The result is pounds of stone per square yard.

Other factors for chip seal failures:

Construction Techniques, Weather, Surface Preparation, Traffic Control, and Material Problems.

Construction Techniques

A sure way to ruin a chip seal job is to have the chip spreader/truck too far behind the emulsion distributor. The aggregate must be spread on the emulsion within 30 seconds after it is applied. Good teamwork between the emulsion distributor operator, aggregate spreader operator, and truck drivers is essential. If the chips are spread too late they will not be adequately "glued" by the breaking asphalt, and stripping will result. If the stone is slightly damp, this will enhance the wetting by the asphalt emulsion.

Another critical operation in the procedure is rolling, which seats the aggregate in the emulsion and enhances good bonding. You should roll the aggregate immediately after spreading with a pneumatic tired roller. A steel wheel roller will ride on the high spots, crushing the aggregate, and pass over the low spots, failing to adequately seat the stone. It is harmful to roll the aggregate after the emulsion sets. It may dislodge the stones.

During the rolling operation, "picking" may occur. If the problem is great, then increase the aggregate spread rate a little bit. Light brooming is often necessary to remove loose stones. If the sweeping operation is begun too soon, before the emulsion sets hard, it will strip away properly seated pieces also. To prevent this problem, broom during the cool of the next morning after the emulsion sets.

Another common problem associated with construction is an improperly adjusted spray bar. "Fatty" streaks can result where emulsion is applied too heavily, and in between where it is too lean. The stone will strip in the lean areas, and bleeding may occur in the heavy areas. Proper adjustment of spray bar height and nozzle angles will provide a double or triple overlap of the emulsion fans, assuring a uniform distribution.

Other construction techniques, besides those mentioned, can go wrong on the job. Head them all off before they happen! How about conducting planning and training sessions for everyone from truck driver to foreman? Establish a chip seal construction routine that ensures construction is done properly.

Weather Conditions

A key to successful chip sealing is that the weather be hot and dry for proper setting and curing of the emulsion. Many specifications require at least 50° F in the shade. In New Hampshire the prime time for chip seal construction is during July and August.

Chip seals built before Memorial Day or after Labor Day have a reduced chance of success because during this time humidity is high and temperatures are low. Therefore, evaporation is slight or nonexistent. Under such conditions the emulsion cannot cure properly and the stone will not adhere to the road. Severe stripping will result. To avoid the potential for great losses, plan all chip seal work for July and August, and monitor daily weather forecasts to work around thunder showers.

Surface Preparation

Since a chip seal is a "thin skin" and not a "coat of armor" you cannot expect to remedy the serious faults of an existing pavement. For example, if you chip seal over an array of alligator cracks, you can soon expect to see a new alligator born.

There are cases where a chip seal was placed on an aggregate road that had a clayed fines layer on top. Tires pealed up the chip seal in strips on hot days. The wheel paths were mostly bare within several months. This happened because the emulsion did not penetrate the "dirt" on top and adhere to the aggregate below.

Before chip sealing, you should repair and clean the road surface, fill potholes, level ruts, seal large cracks, repair broken edges, prime excessively absorbent surfaces, and scarify and recompact or stabilize an aggregate base, if necessary.

Traffic Control

We have all heard the war stories. Junior steps into the garage and fires up his hot-rod. In a show of bravado, with his girl friend next to him, he guns the engine and peels out of the driveway spraying stone and oil in a rooster tail that would make a water skier envious. Several repetitions later, a new chip seal looks like a battle-scarred veteran.

This problem is not easy to prevent. But normal traffic can be controlled! For a chip seal program costing some $6,000 to $8,000 per mile, the added cost of traffic control is economical. The goal is to keep traffic under 25 mph, with warning signs, pilot cars, and flagmen until the emulsion sets. A detour is even better.

Remember to control your own construction equipment. Especially avoid having them turn around on the new surface treatment.

Material Problems

Dirty aggregate is a serious concern. Emulsion will not adhere to stones that are coated with fines. This will lead to stripping. The ideal solution is to buy washed stone. Some use stone that has been pretreated with a high application of dilute asphalt emulsion, although it's unnecessary if the stone is clean and

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handled carefully.

Another aggregate problem is stone that is too soft. Such material will crush when rolled and under traffic, and it will not stand up well to freeze-thaw cycles or to abrasion by snow plow blades. You should use aggregates from State DOT-approved sources to beat this problem.

The emulsion should be an RS-1, RS-2, CRS-1, or CRS-2, all of which break quickly. For both the stone and emulsion you should take samples. If a serious question concerning material quality arises, you can have the samples tested, although you should recognize that the "shelf life" of a rapid-setting asphalt emulsion is only a few weeks. Furthermore, just taking the samples, when the supplier is watching, will keep them on their toes.

Summary

We have reviewed six aspects of chip seal work where things often go wrong. Extensive failures can occur for a single reason, for example, constructing in cold, wet weather. However, usually they result from a combination of the problems discussed.

The range of problems mentioned cannot be prevented by a single "superman" foreman or highway superintendent. Perhaps the best way to ensure a quality product every time is through team work. Everyone on the job must know what the finished product should look like. They must know how to do their parts correctly and it helps if they know what their work mates are responsible for -- then everyone can help each other to get the job done right.

Chip seal planning and training sessions can build such a team. That's something to plan and do now, before the construction season returns! Happy chip sealing!

Suggested references for further reading:

- A Basic Asphalt Emulsion Manual, Asphalt Institute, Manual Series No. 19, Second Edition
- Surface Treatment Manual, Chevron, Chevron USA, 1985

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