SECTION 8
MISCELLANEOUS APPLICATIONS

The previous chapters in this manual have described the use of asphalt emulsions for mixes and various types of surface treatments or seal coats. Asphalt emulsions can also be used for a number of other applications connected with both the construction and maintenance of paved surfaces. This chapter does not cover every possible use, but it offers guidelines for the more common ones.

8.1 Tack Coat

A tack coat is a very light spray application of diluted asphalt emulsion (**Figure 8-1 Applying Tack Coat**). It is used to create a bond between an asphalt overlay being placed and the existing surface. A tack coat is recommended for all overlays. The only possible exception might be when an additional course is placed within two to three days on a freshly-laid asphalt surface.

Asphalt emulsions commonly used for tack coats are diluted SS-1, SS-1h, CSS-1 and CSS-1h. The emulsion is diluted by adding an equal amount of water. A test dilution is recommended to be certain that the water to be used is compatible with the emulsion. To prevent premature breaking, the water always is added to the emulsion and not the emulsion to the water. If practical, warm water is preferred for dilution. The diluted material typically is applied at a rate of 0.25 - 0.70 l/m^2 (0.05 - 0.15 gal/yd^2). Tack coat should be applied only to an area that can be covered by the same day's paving.

Figure 8-1 Applying Tack Coat

The best results are obtained when the tack coat is applied while the pavement surface is dry and the surface temperature is above 25°C (80°F). The surface to be tack coated must be clean and free of loose material so it will adhere. A good tack coat results in a very thin but uniform coating of residual asphalt on the surface when the emulsion has broken.

Too much tack coat can create a slippage plane between two pavement courses as the asphalt acts as a lubricant instead of an adhesive. Fat spots or bleeding could occur on the surface of the new pavement that are not only unsightly but can produce slick pavement conditions. Pneumatic-tired rolling of spotty or non-uniform tack coats will help spread the asphalt and lessen the probability of fat spots.

After spraying the tack coat, time must be allowed before the overlay is placed for the complete breaking of the diluted emulsion (brown to black color). Traffic should be kept off of the tacked area. Freshly tacked pavement is generally too slick for safe driving, particularly before the emulsion has broken.

A tack coat also is essential in a good patching operation. The area to be patched must be thoroughly cleaned and all loose material removed. A fairly heavy tack coat of asphalt emulsion is then sprayed or painted over the entire area to be patched, including vertical sides. The tack coat helps hold the patch and provides a watertight seal between the patch and surrounding pavement.

8.2 Mulch Treatment

Soil erosion presents a serious problem in the construction of embankments and areas adjacent to pavements. The most common method of preventing the erosion is the use of vegetation to stabilize these areas. However, during the time between the seeding and germination, seeds are susceptible to being washed and blown away.

Several procedures have been developed to protect the seeds until germination. An effective method is the use of asphalt emulsion as a spray mulch or a mulch tie-down. In these applications, asphalt emulsion leaves a thin membrane over the seeded area or holds a hay or straw mulch inplace. Both approaches have been successful and are designed to achieve the same result. Because they differ in procedure, each are discussed separately.

8.2.1 Asphalt Emulsion Spray Mulch

In this system, the asphalt emulsion is sprayed directly onto the seeded area and forms a thin membrane cover. The thin film of asphalt has three beneficial effects:

- The asphalt cover holds the seeds in-place and prevents their loss by erosion.
- Because of its dark color, the asphalt absorbs and holds solar heat during the germination period.
- The asphalt membrane holds moisture in the soil and promotes faster germination and growth.

As the young seedlings emerge from the soil, they can break through the thin asphalt cover. The membrane eventually disintegrates as the seedlings mature and cover the entire ground area.

Asphalt emulsion grades typical for this application are SS-1, SS-1h, CSS-1 and CSS-1h. The application rate is normally 0.70 - 1.35 l/m^2 (0.15 - 0.30 gal/yd^2). Special care is required to apply the optimum amount of asphalt emulsion. The nature of the soil and the slope of the area being treated determine the exact amount. Too little emulsion may not hold the soil against erosion and too much may leave a thick membrane and delay growth.

The area to be mulched must be reasonably smooth so that uniform coating is possible. Depressions in the surface may collect pools of asphalt and ridges may be coated only on one side or with no asphalt on the other side. The asphalt emulsion can be applied with a hand-held spray nozzle or with an offset spray bar attached to an asphalt distributor.

8.2.2 Asphalt Emulsion Mulch Tie-Down

Asphalt emulsion can be used for anchoring straw or hay to a seeded area. There are two procedures that can be used.

In one procedure, the straw or hay mulch is distributed over the prepared area at a rate of 3.4 - 4.5 tonnes/ha (1.5 - 2 tons/acre). The seed is then mixed with water and liquid fertilizer and applied with a hydraulic seeder. A spray application of about 0.45 l/m^2 (0.10 gal/yd^2) of asphalt emulsion follows (**Figure 8-2 Using Asphalt Emulsion to Tie**

Down Mulch). The emulsion can be applied in a solid pattern or a saw-tooth checker-board or perpendicular pattern. The solid pattern is the most effective, especially when the wind velocity is high. If the amount of mulch is increased, the quantity of emulsion must be increased proportionally.

Figure 8-2 Using Asphalt Emulsion to Tie Down Mulch

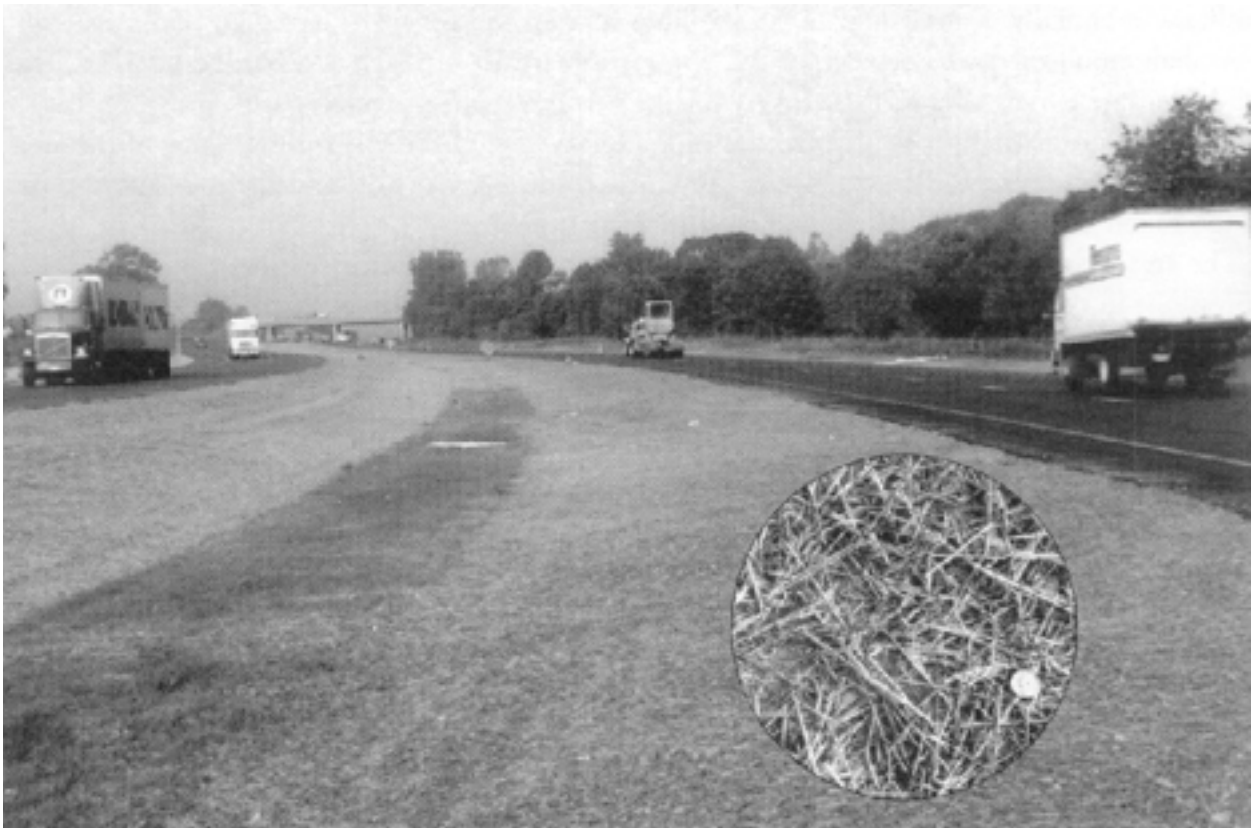

Figure 8-3 Completed Section of Interstate Highway With Asphalt Emulsion Mulch on Median and Close-Up

The second method begins with the hydraulic application of seed and fertilizer directly to the prepared soil. The mulch and emulsion are discharged together through a special blower equipped with twin jets and the two materials are mixed in flight (**Figure 8-3 Completed Section of Interstate Highway With Asphalt Emulsion Mulch on Median and Close-Up**). This procedure has at least two advantages:

- Mulch and asphalt emulsion are applied in a single application reducing both cost and time required
- It results in better bonding between the emulsion and the hay/straw mulch

The asphalt emulsions used with mulch tie-down are SS-1, SS-1h, CSS-1, and CSS-1h.

8.3 Crack Sealing

A maintenance department can devote a large amount of time and money sealing cracks in pavement surfaces. Depending upon the location and size of the cracks, this maintenance may be considered either corrective or preventive. In either case, the technique for sealing cracks is the same.

Cracking occurs in many forms, from small hairline cracks to major cracks having a width of 25 mm (0 in.) or more. Larger cracks or more severely cracked areas may not always be correctable crack sealing. It is often necessary to completely remove the cracked material and repair the area with a full-depth or deep asphalt patch.

Knowledge about the more common types of cracking helps determine the proper maintenance procedure. Cracks generally fall into one of these following categories:

Alligator cracks: Interconnected cracks forming a series of small blocks resembling an alligator's skin or chicken wire.

- Edge cracking: Cracking that occurs along the outer edge of the pavement, usually within 300 to 600 mm (1 to 2 ft.) of the edge and when paved shoulders do not exist.
- Reflective cracks: Cracks in asphalt overlays and surface treatments that reflect the crack pattern in the pavement structure below.
- Shrinkage or block cracks: Interconnected cracks forming a series of large blocks, usually with sharp corners or angles.
- Slippage cracks: Crescent shaped cracks that point in the direction of the thrust of the wheels on the pavement surface.
- Linear cracks: A crack that may be parallel or transverse to the centerline, or randomly located in the pavement surface.

If cracking results from a defect beneath the pavement surface, it is doubtful that sealing the cracks will provide a long-term solution. In many instances, correction of the defect in the underlying pavement is necessary to solve the cracking problem. This section only addresses the type of cracking that can be addressed with asphalt emulsion as a sealant, (i.e., longitudinal, reflective, shrinkage and linear cracks). For more information on pavement repair procedures, refer to Asphalt in Pavement Maintenance, Manual Series No. 16 (MS-16), Asphalt Institute.

The best time for sealing is as soon as possible after a crack develops. A crack can continue to widen, so crack sealing must be continued to be effective. The failure to seal cracks properly can lead to further and more severe pavement damage from water intrusion and freeze-thaw. Sealing cracks with asphalt emulsion is relatively simple and inexpensive and can delay or postpone major maintenance if properly used.

Before cracks are to be filled, loose material in the crack should be blown out using compressed air. Foreign material not removal by blowing should be removed by steel wire brush or router.

Crack sealing may begin when the cracks have been properly prepared. Small cracks, less than 6 mm (1/4 in.) width, are difficult to seal effectively. For large cracks, an asphalt emulsion slurry, or emulsion mixed with sand, should be forced into the crack until it is about 3 - 6 mm (1/8 - 1/4 in.) from the surface. After curing has occurred, finish sealing by filling the remaining depth of the crack with asphalt emulsion (Figure 8.3-1). The surface of the sealed crack should be covered with a light application of dry sand to prevent pickup by traffic.

The asphalt emulsion grades used for crack sealing are SS-1, SS-1h, CSS-1 and CSS-1h.

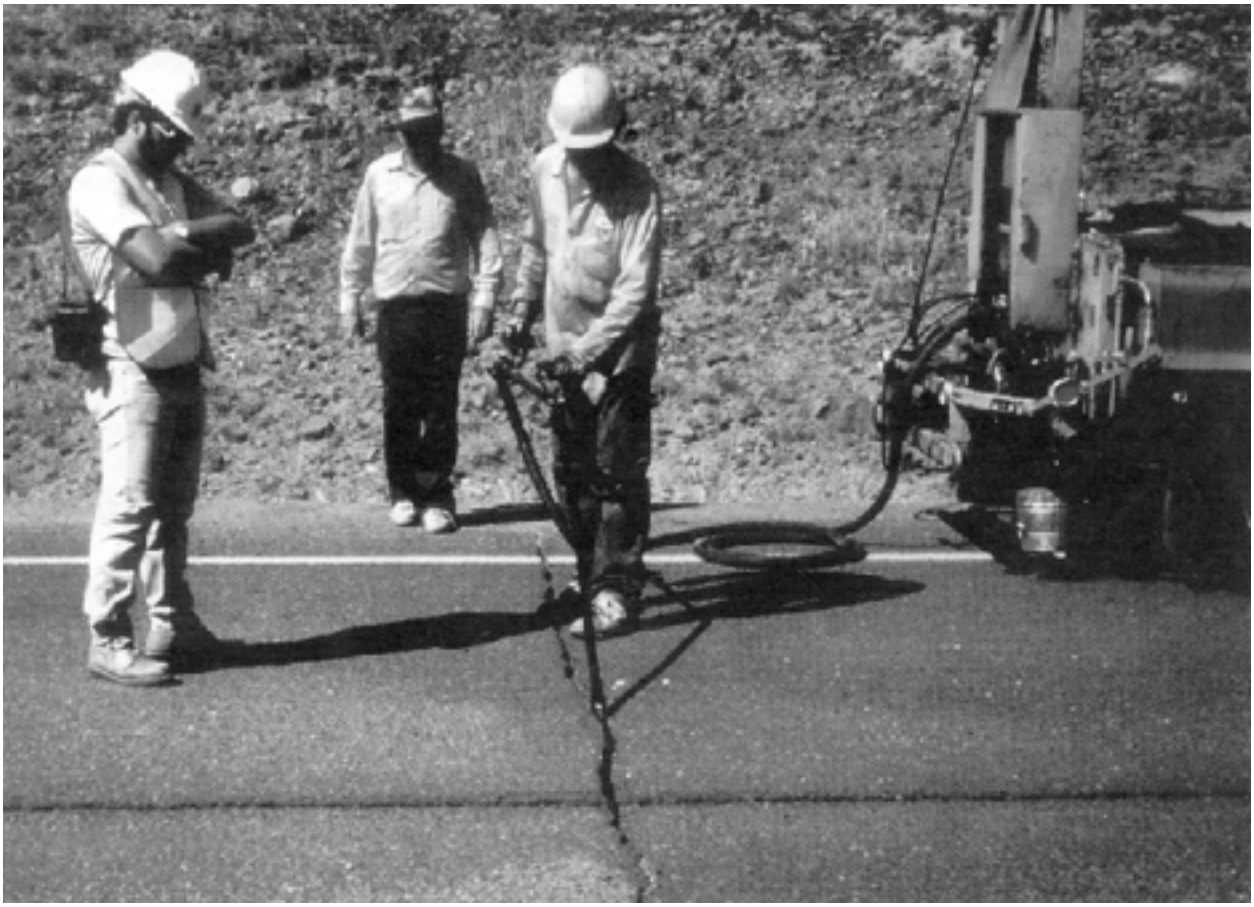

Figure 8-4 Filling a Crack With Asphalt Emulsion

8.4 Prime Coat

Prime coats typically have been spray applications of low viscosity asphalt on granular base in preparation for placing an asphalt mixture. A prime coat performs several important functions:

- Coats and bonds loose mineral particles on the surface of the base
- Hardens or toughens the surface of the base
- Waterproofs the surface of the base by plugging capillary or interconnected voids
- Provides adhesion or bond between the base and the asphalt mixture

In order for the prime coat to satisfy these functions, some asphalt must penetrate into the base. Prime coats generally are being used less frequently, particularly when the total asphalt thickness is 100 mm (4 in.) or greater. With increased asphalt thickness, there is less possibility of surface water penetration into and pavement slippage on the base. A prime coat should be considered, however, when a granular base is to be carried through an extended period, such as the winter months, or when to be exposed

to abrasion damage by traffic. Even though some engineers question the benefits of priming, it should be considered when any doubts exist about the results if it were eliminated.

In the past, the asphalt for prime coating was usually a low viscosity, medium or rapid curing (MC or RC) cutback asphalt. The use of asphalt emulsions is increasing and new emulsion grades have been developed for priming. SS-1, SS-1h, CSS-1 and CSS-1h can be used if they are mix-in-place with the top 50 - 75 mm (2 - 3 in.) of the aggregate base “penetrating emulsion prime” (PEP) and “asphalt emulsion prime” (AEP) grades are also now available.

The emulsion grade and/or technique selected to replace cutback asphalt for a penetrating prime will depend upon a number of factors. The amount and size of voids in the base material will influence emulsion penetration and determine the emulsion grade, application rate, dilution, and if multiple applications and mixing are required.

When the base surface consists of fine grained materials, those passing the 75-µm (No. 200) sieve, the surface will act as a filter and not let the emulsion asphalt particles penetrate. Dampening the surface and/or the adding surfactants cannot overcome the filtering action. Being a mechanical problem, it requires a mechanical solution. Therefore, the surface may need to be loosened by scarifying and the emulsion mixed to a specific depth for an acceptable prime.

Emulsions for priming almost always require dilution with water. The dilution rates normally have ranged from 1:1 to 10:1 (water to emulsion) dependent upon the base material characteristics and method of treatment. The application rates can vary for a 1:1 diluted emulsion from as low as 2.3 l/m^2 (0.5 gal/yd^2) for high fines and tight bases and up to 6.8 l/m^2 (1.5 gal/yd^2) for loose sands and very porous surfaces. In very dense material, it may be necessary to use a higher dilution and make multiple applications at lower rates. This is done to improve penetration and prevent runoff and puddling of the emulsion.

8.5 Dust Palliative

On a road without an asphalt surface, one vehicle per day can create a large quantity of dust. Also, accident rates are much higher on unsurfaced roads. A lack of funding and very low traffic volume may not allow for placing an asphalt mixture or surface treatment, so another method is required for dust control.

Asphalt emulsion can be a practical and low cost solution to controlling dust problems. A diluted emulsion is sprayed directly on the unsurfaced road as a dust control agent or palliative. SS-1, SS-1h, CSS-1 and CSS-1h diluted with five or more parts of water by volume are used. The diluted material is sprayed with an asphalt distributor in repeated light applications as required. The application rates normally are from 0.45 - 2.3 l/m^2 (0.1 - 0.5 gal/yd^2). The total quantity applied depends on the condition of the existing surface.

Some penetration of the emulsion is expected and with higher voids, more emulsion can be applied. As with other spray treatments without cover material, small test sec-

tions are recommended to determine the best application rate for the existing road conditions.

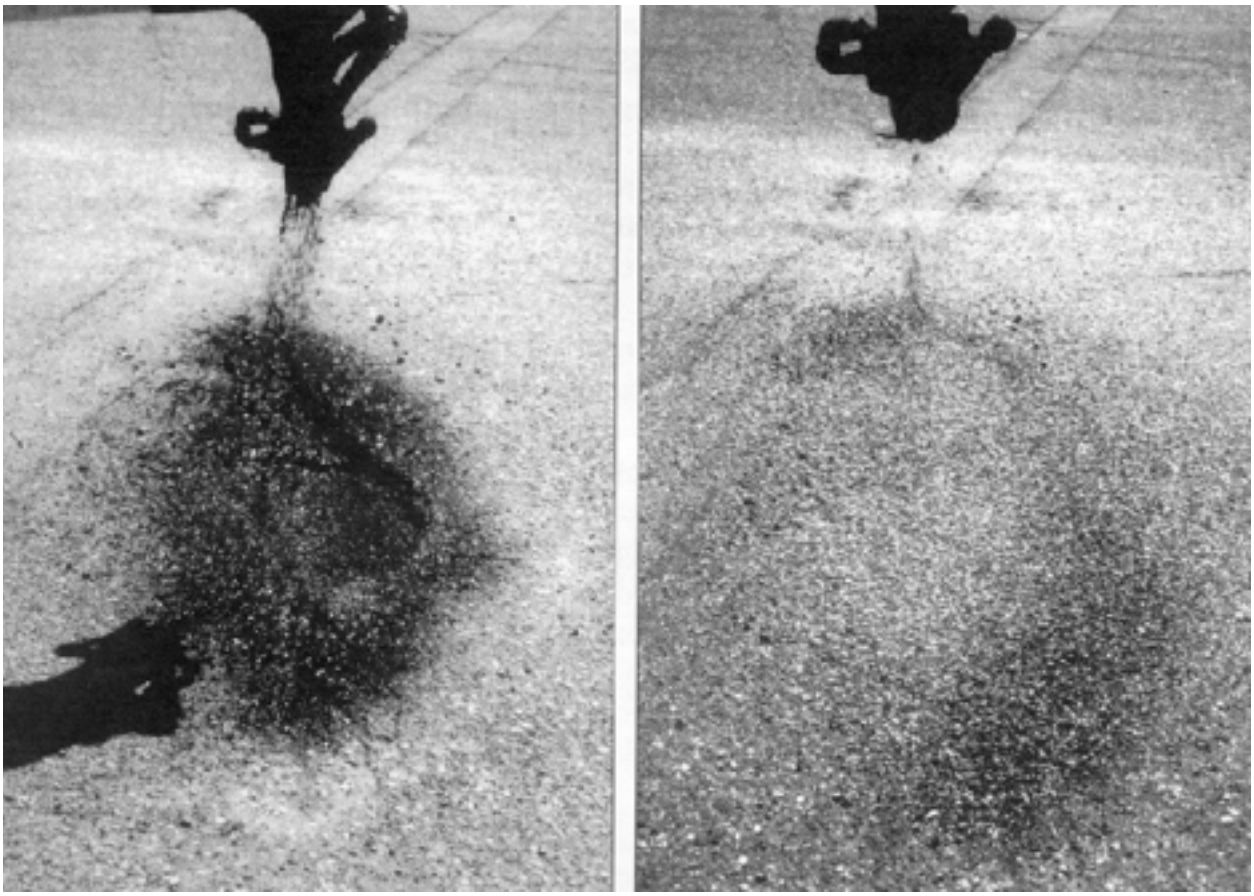

Figure 8-5 Spray-Injection Process — Tack Coat (L), Completed Patch (R)

8.6 Repair of Potholes

The methods typically used for the repair of potholes using asphalt emulsions are throw-and-roll, semipermanent and full-depth removal and replacement. All of these methods involve placing cold mix in the pothole with a shovel and compacting with a truck tire, vibratory plate compactor or steel-wheeled roller. Maintenance mixes for these repair methods and other patching are covered in **SECTION 9 ASPHALT PAVEMENT RECYCLING**. For information on pavement repair procedures, refer to Asphalt in Pavement Maintenance, Manual Series No. 16 (MS-16), Asphalt Institute.

Another method for repairing potholes is by spray-injection. A special piece of equipment, either trailer or truck-mounted, combines together and blows asphalt emulsion and coarse crushed aggregate into the pothole (see **Figure 8-5 Spray-Injection Process — Tack Coat (L), Completed Patch (R)**). The spray-injection procedure consists of these steps:

- Blowing of water and debris from the pothole.

- Spraying a tack coat of asphalt emulsion on the sides and bottom of the pothole.
- Blowing of emulsion and aggregate into the pothole.
- Covering the repaired area with a thin layer of aggregate.
- Opening the repair to traffic as soon as workers and equipment are clear. (This method of repair requires no compacting after the cover aggregate has been placed.)

Experience has shown that the asphalt emulsion to use for spray injection varies between summer and winter application. Summer application, for temperatures above 10°C (50°F), works best with CRS-2, RS-2 or HFRS-2 grades. Limiting the penetration of the residue to a maximum of 135 within the range allowed in the emulsion specification has also shown beneficial in the performance of spray-injected patches placed in warm weather.

Winter applications [colder than 10°C (50°F)] call for a CMS-2, MS-2 or HFMS-2 emulsion. Requiring the penetration of the residue to be a minimum of 135 within the range allowed in the emulsion specification has also shown beneficial in the performance of spray-injected patches placed in cool weather.

For good aggregate coating under either temperature condition, experience has shown the emulsion temperature should be about 65°C (150°F), and the emulsion's Saybolt Furol viscosity at 50°C (122°F) should be limited to 250 seconds.

Aggregate sizes that work best for spray injection are AASHTO or ASTM size No. 9 [4.75 - 1. 18 mm (No. 4 - No. 16)] with no more than 3 percent passing the 75-µm (No. 200) sieve. Crushed aggregate material is recommended for spray injection. Using the emulsions described above, an asphalt emulsion content of approximately seven percent by weight of aggregate works best for warm weather conditions, while spray injection patched placed in winter conditions perform well at an asphalt emulsion content of about five percent by weight of aggregate.