HOT IN-PLACE RECYCLING OF ASPHALT PAVEMENT

Michael T. Vietti
Regional Marketing Director
ANGELO BENEDETTI, INC.

The first asphalt pavement was placed in the United States in 1870. By 1915, reuse of asphalt pavements in road structure was recognized as an important option for pavement rehabilitation. However, use of asphalt cement to stabilize recycled asphalt pavement probably dates back only to the 1930s or 1940s. This time period also saw the developement of the first heater-planer machines. Thus, recycling of asphalt pavements has been practiced in the United States for a long time. However, the total quantity of pavement materials recycled by all methods from 1915 to 1975 is small in comparison to the amount that has been recycled since 1975.

Early recycling efforts were somewhat primitive and equipment wear and tear from pulverizing old asphalt concrete was considered excessive and costly. Equipment and technology have improved, and productivity has increased to a degree that recycling of asphalt concrete by a variety of procedures is increasingly attractive to highway engineers and should be even more attractive to those responsible for selecting construction alternatives. Today, asphalt-pavement recycling is commonly performed on highways and airport runways using several methods, including both hot and cold methods for both central plant and in-place recycling. From these methods, the most sweeping changes and innovations in North America in the last 10 years have been in hot in-place recycling (HIPR).

HIPR is defined as a process of correcting asphalt-pavement surface distress by softening the existing surface with heat, mechanically removing the pavement surface, mixing it with recycling agent, possibly adding virgin asphalt or aggregate, and replacing it on the pavement without removing the recycled material from the original pavement site. HIPR may be performed as either a single-pass operation that recombines the restored pavement with virgin material, or as a two-pass operation, wherein the restored material is recompacted and the application of a new wearing surface then follows a prescribed interim period.

THERE ARE FOUR BASIC HOT IN-PLACE RECYCLING PROCESSES:

1. Heater-Recycling - heating, scarifying, adding rejuventor, mixing, leveling, reprofiling and compacting;

2. Hot-Mill Heater Recycling - heating, milling, adding rejuventor, mixing drum, tacking, leveling, reprofiling and compacting;

3. Repaving - heating, scarifying, rejuvenating, leveling, laying new hot mix, reprofiling and compacting;

4. Remixing - heating, scarifying, rejuvenating, mixing (and/or adding new hot mix), mixing, leveling, reprofiling and compacting.

HEATER-RECYCLING

Heater-recycling has been in fairly common use in the United States since the mid 1960s, but in the 1970s it began transforming to the more versatile processes. Heater-recycling is a rather simple process involving heating of the old pavement surface, scarifying using a bank of non-rotating teeth, adding a liquid rejuvenating additive (recycling agent), mixing and leveling the recycled mix using a standard auger system, then compacting it using conventional equipment. No new aggregate materials are added. A scarification depth of 25 mm (1 in.) is common although 50 mm (2 in.) can be achieved.

The latest technology uses radiant or infrared heating to reduce damage to the asphalt cement and undesirable visible emmissions. Most heaters currently use indirect heating and propane gas as fuel. Heating is performed by one or more machines, providing there are at least two banks of heaters on one machine or two single heaters traveling in tandem, producing a temperature in the scarified material of 230F to 325F. Heater-recycling is often followed by a conventional asphalt-concrete overlay. Heater-recycling, when followed closely by conventional overlay paving is known as a multiple-pass repaving process.

HOT-MILL HEATER RECYCLING

During the past decade, cold milling has been more prominent in dealing with asphalt surface deformity and distress. With the advent of Hot-Mill In-Place Heater Recycling, this process can eliminate trucking, traffic problems and excessive landfill costs.

Hot milling involves heating the old asphalt surface, adding a rejuvenator and milling the surface to a depth of 25 mm (1 in.) or 50 mm (2 in.). The asphalt is then moved into an on-board mixing drum to insure complete blending. Prior to leveling, the non-processed surface is tacked to assure proper bonding of the recycled surface across the full width of payment, then compacted with conventional equipment.

REPAVING

The repaving process consists of the following step: heating, scarifying and/or rotary milling, applying a rejuvenating agent, mixing rejuvenator with scarified material, placing the recycled mixture as a leveling course using primary screed and simultaneously placing a new hot-mix wearing course.

Heating softens the existing payment to a depth of 22 mm to 29 mm (0.9 in. to 1.2 in.). The heated, softened pavement allows rows of carbide-tipped teeth to scarify the pavement in a level plane to a depth of 19 mm to 25 mm (.75 in. to 1 in.)

REMIXING

Remixing is used when repaving alone cannot impart the required properties to the recycled asphalt mixture and additional mineral aggregate is needed to provide adequate strength or stability. The single-pass remixing process was introduced in the United States around 1980.

Although there are variations, the typical remixing process begins, like the other methods, with heating and softening of the damaged pavement by a series of infrared pre-heaters. Scarifiers or milling heads then loosen the softened material, which is augered toward the center of the machine. Then it is carried into a pugmill mixer, where it is combined with an asphalt rejuvenator and a measured quantity of virgin aggregate or hot-mix asphalt.

Sometimes the rejuvenator is applied in advance of the pugmill to provide good dispersion and maximize mixing time in the loosened mix. Emulsions are typically used in all four HIPR processes to provide a higher fluid content and thus ensure adequate dispersion of the recycling agent throughout the RAP. Finally, the resulting mixture is placed by a compacting screed and finished in the normal manner.

REASONS FOR USING HOT IN-PLACE RECYCLING:

Most types of surface distress in an asphalt pavement can be corrected by HIPR provided the pavement has adequate structural integrity. Types of pavement distress that may be addressed include rutting, corrugations, raveling, flushing, loss of surface friction, minor thermal cracking and load-associated cracking.

When a pavement would typically need a minimal overlay to correct rutting, oxidation and/or cracking, all four HIPR processes are viable options. Rutted or cracked asphalt pavements with problems limited to the top 38 mm (1.5 in.) are ideal candidates for HIPR.

HIPR is acceptable to the driving public because of increased awareness of the need to conserve natural resources, and with HIPR, drivers can see the old pavement virtually turn into a new pavement.

The bottom line, of course, is comparative cost. Published information suggests that, when all factors are considered, a savings up to 35 percent can be achieved when a 25 mm (1 in.) HIPR layer is compared with cold milling and placement of a new 25 mm overlay. HIPR eliminates the costs associated with stockpiling, handling, hauling and inventorying reclaimed asphalt pavement (RAP). Additional cost savings can be realized by the reduced interruptions in traffic flow when compared with conventional rehabilitation techniques.