The New Mexico State Highway and Transportation Department has been using an innovative process for recycling asphalt pavements. Work has proven that where the roadway deterioration is advanced and the options are few, short of complete reconstruction, this process provides an economical method for pavement rehabilitation.

**THE PROCESS** - The process consists of using a recycling train consisting of a large milling machine which tow two trailers carrying a crushing and screening plant and the other a pugmill mixer. The milling machine removes a 12½ foot width of asphalt pavement 3 to 4 inches thick and reduces about 80% of the material to 1½” maximum size. The first trailer contains the crushing and screening plant where any material larger than 1½” is routed through to reduce it to specification size.

The second trailer contains a belt scale, the additive proportioning system and a pugmill for mixing aggregate with high float emulsion. This trailer also contains an internal 500 gallon tank which is fed by a tanker nurse truck. Application rate of the emulsion is controlled by a weigh bridge on the conveyer system which is interlocked to the additive pump.

Production rates with the system have been over 350 tons per hour. The mixed material is placed in a windrow behind the train. Laydown of the mix is accomplished with a standard paving machine equipped with a paddle type pick device to load the windrow into the paving hopper. The best laydown results have been achieved with by keeping the paver immediately behind the recycling train.

Compaction of the material is accomplished by using a heavy pneumatic roller (35 to 45 ton) for breakdown rolling. Once the pneumatic roller has "walked out" of the mat, a steel wheel roller follows to smooth the surface and to achieve final density. Normally 95% to 98% of 50-blow Marshall is being achieved.

**MIX DESIGN** - A mix design is done using modified Marshall mix design procedures prior to start of construction. The design is done on laboratory crushed samples. The modification consists of doing the mixing and compaction of 140 degrees F and then compacting the sample with a 50 blow Marshall procedure. Using this testing, an initial asphalt application rate is established with optimum density, compressive strength and coating being used as guidelines. However, due to differences in the gradation that is developed by the milling/crushing process, it is usually necessary to make field adjustments in the emulsion rate. These adjustments are made on the basis of the appearance and handling characteristics in the field.

**COLD ASPHALT BINDER** - In-Situ Cold Recycling in the conventional manner, we are trying to attain a thin film of binder on the (similar to a tack coat) individual milled particles.

A high float emulsion (HFE), both with and without polymer is the binder that has been used exclusively on all the projects built in New Mexico. The high floats are designed to work with aggregates with a high fines content. We believe that the use of the high float emulsion in this process has been a major key to our success. It is a very forgiving material. It has been rained on and reworked, frozen and reworked, and rolled several days later to solve a density problem with no ill effects.

Starting with the 1987 construction season, a change was made to require polymer modified emulsions. This change was made because it has been found that they provide a tougher mix and increased resistance to weather problems during construction (rain).

**CASE HISTORY** - The first project built was on US 64/87 in the northeast corner of the state. This was an eleven mile, two lane section, originally built in 1960, consisting of three inches of asphalt concrete over an aggregate base. In 1984, the west end of this 14 mile project was extremely cracked and extensive maintenance had been performed over the years in order to maintain traffic. The east end of the project had transverse cracking, probably temperature related. But, was otherwise in good condition. It was thus decided to cold recycle the west end of the project and place a fabric and overlay the east end of the project. The entire old asphalt mat (3 inches) was cold recycled and a four inch overlay was placed over the entire length of the project (both west and east ends). The
A project was built on I-40 near the eastern border of New Mexico. The ADT is 8,000 vpd with approximately 40% heavy commercial. The original pavement built in 1956 consisted of 4 inches asphalt concrete 11 inches of untreated base. It was overlaid in 1961 with 2 inches of asphalt concrete due to a stripping problem with the original pavement. In the summer of 1985, this section of I-40 was in extremely poor condition. Medium severity, small and large block cracking occurred throughout the project with severe rutting (two to three inch) occurring throughout 70% of the project. The design used was recycle 4 inches and place a 3 inch overlay plus a 5/8 inch open graded friction course. The cost of the project as designed was $7.12 per sq. yd. If we had used a standard design, the cost would have been $10.70 per sq.yd. Thus, the Department saved about 1.2 million dollars on this project.

In the summer of 1986, a rutting problem developed on the I-40 project. Thus, we cut a trench across the most severe rut. It was determined that the rutting was in the overlay and not in the cold recycle layer. During construction, the cold recycle layer carried I-40 traffic during the hottest months (August and September) of the year without any rutting or raveling. Thus providing that the process can be used in areas of high traffic volumes.

CONCLUSION - Based on the construction of almost 600 lane miles of cold in-situ recycled pavements, it is believed that we have an economical process that can be used to rehabilitate aged, rutted and/or badly cracked asphalt pavements. The process does not lead itself to cookbook instruction requirements, but must be applied based on individual project conditions.

We believe the economics, both monetary and in resources, realized using this process should be sufficient motivation for any agency to explore its use in their rehabilitation program.