

Rubblizing the Interstate System

Rubblization Projects around the U.S.A.

no projects
 1-4 projects
 5+ projects
 10+ projects

Rubblizing. Ten years ago it was a strange word to many DOTs.

It's not anymore. In some states, the use of rubblizing has become almost routine.

Since 1994, states in the northeast, south and midwest have rubblized over 20,000,000 square yards of portland cement concrete (pcc) and overlaid them with asphalt. New York State scheduled six rubblizing projects for 1998 and in 1999 will let 15 to 20 projects using slab-fragmentation technology, which includes rubblizing and Crack & Seat. The Pennsylvania DOT let six major rubblizing projects in 1998.

Previously unused in the south, Alabama, Arkansas and Louisiana are rubblizing several of their major rehabilitation projects. A 10-mile section of I-64 in West Virginia was rehabilitated

this past summer using the multiple-head

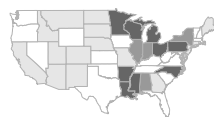
Rubblizing I-65 north of Birmingham during Alabama Superpave Showcase.



rubblizer. And a 17-mile stretch of I-65, north of Fayette, Indiana, was rubblized this past summer by Resonant Machines Inc. (RMI) and overlaid with 13.5 inches of hot mix asphalt (HMA).

Other states, after learning of slab-fragmentation successes, are jumping on the bandwagon. Minnesota DOT will soon let a six-mile project on U.S. 53 near Eveleth, Minnesota, and Colorado DOT will do its first rubblizing project in the spring of 1999.

Slab Destruction



Rubblizing completely destroys the concrete slab and all concrete

slab action by pulverizing the slab into 1-to-3-inch chunks at the top and into 3-to-6-inch chunks toward the bottom.

The rubblizing action completely breaks the bond between the reinforcing steel and the surrounding concrete, causing the broken concrete above the reinforcing steel mesh to have a finer gradation than the concrete below it.

Rubblizing effectively reduces the existing slab to a

crushed aggregate base. This rubblized base prevents reflective cracking and provides a sound base for the asphalt overlay, which extends the service life of the pavement.

The 17-mile stretch of I-65 in Indiana was in dire need of improvement. Concrete pavement for this section was placed in the late 1960s and early 1970s, and was resurfaced about ten years ago. The contractor milled an average of 5.5 inches and 72,000 tons of HMA off the existing mainline asphalt, right down to the concrete. Existing shoulders weren't milled, but received 8 inches of new asphalt.

Rubblizing on the I-65 job was accomplished with two low-

Rubblizing on I-65, north of Lafayette, Indiana.

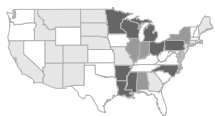


amplitude, high-frequency resonant breakers by RMI of Tulsa, Oklahoma. RMI has done more than 16 million square yards or nearly 80 percent of the rubblizing projects in the U.S. to date.

Before rubblizing, Fox Contractors installed underdrains on either side of the mainline, which is bordered by a 10-foot-wide outside shoulder and a 4-foot-wide inside shoulder.

Concrete pavement was also recycled on the I-65 project, according to Wes Shaw, project engineer for the Indiana DOT's Crawfordsville District. "We crushed concrete pavement from the full-depth removal areas and made compacted aggregate subbase out of it," says Shaw.

New York and Pennsylvania

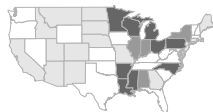


The New York State DOT has had increasingly good success with rubblizing over the last several years.

NYS DOT uses a minimum 6-inch-thick HMA overlay on the rubblized pavement. A current project on I-81 in the Syracuse area was recently used to evaluate two different rubblizing machines—RMI and the Multiple-Head Breaker. All NYS DOT's HMA overlays on the rubblized pavement are Superpave designs.

Pennsylvania DOT's (PaDOT) six major rubblizing projects in 1998 included Route 422 east of Indiana, Pennsylvania. Route 422 is a four-lane, divided concrete pavement merging to two lanes of asphalt. The project consisted of rubblizing and seating approximately 35,000 square meters of concrete pavement in both eastbound and westbound lanes. The rubblized pavement was overlaid with 7.5 inches of HMA.

Superpave Overlays



The Superpave design for the Route 422 overlay

was based on 800,000 ESALs using a gyratory compactor in accordance with the Asphalt Institute's Superpave (SP-2) manual. Three Superpave mixes were used—a 37.5 mm base course with a PG 58-28 binder and two different surface courses. One was a PG 58-28 19 mm wearing course. The other was a PG 64-22 19 mm wearing course. PaDOT used the two different wearing courses for the purpose of future comparison.

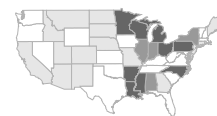


Overlaying the rubblized mainline on I-65 in Indiana with 13.5 inches of Superpave mix.

Indiana has been one of the most receptive states to covering rubblized concrete with Superpave overlays. On the I-65 rubblizing project, Indiana DOT placed more than 280,000 tons of Superpave HMA on the mainline and shoulders in 1998. Due to the increased permeability of some Superpave mixes, InDOT installed a drainage system on both sides of the rubblized pavement.

"InDOT has confidence in Superpave," says Dave Andrews, Materials Engineer for InDOT's

Division of Materials & Tests. InDOT built a total of 62 Superpave projects during 1996 and 1997, and has made the Superpave system its standard for all but the smallest paving projects.



Arkansas and Louisiana

Arkansas and Louisiana are using rubblization on several of their major rehabilitation projects. In Arkansas, two rubblizing projects were completed this year in Pulaski County requiring HMA overlays totaling approximately 380,000 tons. More than 370,000 tons of HMA overlay was placed on a Clark County rubblizing project. Another Clark County rubblizing project, requiring 300,000 tons of HMA, will be let by the first of the year.

Louisiana DOT (LaDOT) recently rubblized a 10-mile continuously reinforced concrete pavement (crp) section of I-20 west of Shreveport, Louisiana. Traffic on this 10-mile stretch was high-volume with a large percentage of heavy trucks. The original crp was in poor condition. LaDOT had done numerous isolated full-depth HMA patches and overlaid the original concrete pavement with a 4-inch HMA overlay. For the sake of cost-effectiveness and pavement performance, LaDOT decided to mill off the overlay, rubblize the original crp, install edge drains, and overlay the entire project with a thick HMA overlay.

Two RMI rubblizing machines worked on the I-20

Rubblizing continuously reinforced concrete on I-20 west of Shreveport, Louisiana.



project, each working in separate half-mile areas. Multiple passes were made with the RMI 12-inch-wide resonant breaker. The two rubblizers traveled at approximately 8 mph and broke approximately 6,000 to 10,000 square yards of concrete per day, depending on the type of aggregate, concrete strength and pavement thickness.

The high-frequency, low-amplitude, rubblizers left relatively uniform rubble behind. The rubblized pavement was relatively level and contained a maximum particle size of approximately 3 inches.

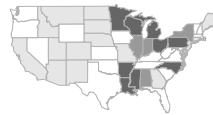
A significant part of the rubblizing operation was done in lanes adjacent to heavy traffic and there was no problem operating the rubblizers in traffic lanes next to the lane with the new HMA overlay. Traffic control barrels were used to keep adjacent-lane traffic approximately 10 feet from the con-



Rubblizing close to traffic on I-65 in Alabama.

struction operation. After rubblizing, the fractured surface was seated with a 10-ton twin vibratory steel drum roller.

I-64 in West Virginia

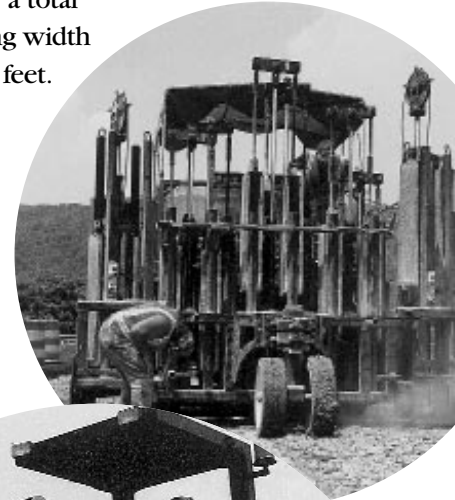


In June 1998, over 90 highway people from 15 states attended a rubblizing demonstration

on the West Virginia Turnpike north of Beckley, West Virginia, on I-77 and I-64. The Multiple-Head Breaker (MHB) rubblized a 16-year-old section of pcc pavement prior to placing a 10-inch large-stone HMA overlay.

The MHB is a rubber-tired, self-propelled unit that carries twelve 1,000-pound hammers, 8 inches wide, mounted laterally in pairs. Each pair of hammers is attached to a hydraulic lift cylinder that operates an independent unit and cycles at the rate of up to 35 impacts per minute. The 8-foot-wide machine carries 12 hammers that are 8 inches in width. A 2.25-foot-wide carrying two 1,500 hammers, can be added to each side for a total breaking width of 12.5 feet.

Rubblizing I-64/I-77, south of Beckley, West Virginia, with the Multiple-Head Breaker.



Breakdown compaction after rubblizing with the Multiple-Head Breaker was done with "Z" roller.

RMI 1/4 pg ad

Compaction of the rubblized pcc was performed with a "Z" grade roller followed by a rubber-tired roller. A vibratory roller was used to finish the seating process.

West Virginia Turnpike officials gave a number of reasons for choosing rubblizing as the best method of rehabilitation.

▲ A 10-mile section of the West Virginia Turnpike was rubblized in 1989 with an RMI rubblizer and overlaid with HMA. Its performance has been outstanding to date.

▲ Total construction with pcc is out of the question because it is too expensive and time consuming. In addition to expense and time, after a few years it will require additional rehabilitation.

▲ Pcc overlay is also too expensive and time consuming. Delays with heavy traffic flow on the turnpike would be intolerable while doing a pcc overlay.

▲ Pcc slab repair and patching is expensive and time consuming. Traffic flow is a big problem. Pcc patches don't give reliable performance.

▲ Diamond grinding is a band-aid approach. It does not provide an ultimate solution.

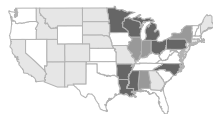
▲ HMA overlays without slab fragmentation will not prevent slab cracking, joint deterioration, faulting, punchouts and D-cracking when the underlying pcc pavement reflects through.

▲ Rubblizing has proven far less costly and far more effective than other methods of pcc rehabilitation.



Professor/Consultant Marshall Thompson emphasizing that the primary goal of rubblizing is to reduce or eliminate reflective cracking in the HMA overlay at a West Virginia Rubblizing Demonstration.

Resonant Breaker or Multiple Breaker?



According to Marshall R. Thompson,

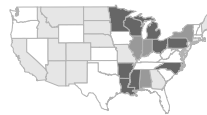
Professor Emeritus of Civil Engineering at the University of Illinois and Rubblizing Consultant, the resonant breaker (RMI) and the multiple-head breaker produce about the same result. "If you don't distort the slab, then it doesn't matter which piece of equipment you use, a resonant breaker or a multiple head breaker," he says. "We don't want distortion after rubblizing, we want to retain the interlock."

Marshall emphasizes that the primary goal of rubblizing is to reduce or eliminate reflective cracking in the hot mix asphalt overlay. "The smaller the chunks, the less chance of reflective cracking," he says. "If you have a weak subgrade, go with smaller chunks. If you have a strong subgrade, go with bigger chunks. A coarse break will provide better, stiffer support. If you don't distort the slab after rubblizing, the pavement should perform well."

The Falling Weight Deflectometer tests on the 1998 West Virginia Turnpike rehabilitation project show that the rubblizing and asphalt overlay

work are providing a strong structural pavement. "The numbers are among the best," says Joe Denault, State Highway Engineer for the West Virginia Division of Highways.

HMA Overlay Thickness



Consultants and state DOT engineers agree that

an increase in the thickness design of the overlay will provide a big increase in pavement life. Thompson says that increased HMA thickness decreases the maximum deflections and increases the "AREA" of Deflection Basin. AREA is a measure of the combined effect of HMA overlay modulus and thickness. It increases when HMA modulus and thickness increases.

Dan Cooperrider, Vice President of West Virginia Paving, Inc., paver for the Turnpike project, says that 4-inch-thick initial lifts are helpful. "We want to avoid distortion of the fractured/rubblized slab," says Cooperrider. "So we usually go with thick, 4-inch initial lifts. Then we use a materials transfer vehicle (MTV) on the second lift. We want to keep the big equipment off of the fractured slab."

The increasing success of rubblized projects around the nation has encouraged more and more state DOTs to consider rubblizing pcc pavements with HMA overlays as a viable and cost-effective rehabilitation option.

Fractured slabs and thick lift overlays are not yet business-as-usual at state highway district headquarters around the nation, but their use is steadily increasing. ▲

"Happy face" signs encourage motorists on I-65 near Lafayette, Indiana.

