HOT MIX ASPHALT IS THE BEST BUY ALL OF THE TIME

TAKE THE RAP:

It Saves Money and the Environment

Total recyclability is just one more reason that Hot Mix Asphalt (HMA) is the best buy all of the time in pavements.

The motoring public wants its roads to be smooth, safe, durable, and quiet. Taxpayers also want their public officials to use resources (both their tax dollars and our precious natural resources) in the most efficient manner possible. Recycling the road is one way to give the citizens what they want.

Time-tested techniques

Long before environmental issues, resource conservation, and recycling went mainstream, asphalt pavements were being recycled for road base, as embankment fill, and in pavement driving and base courses.

Today's asphalt recycling techniques date to the mid-1970s. Highway contractors in 40 states performed and documented Reclaimed Asphalt Pavement (RAP) demonstration projects between 1976 and 1982. Their findings: HMA from every type of pavement, roads, streets, highways, parking lots, and airport runways, can be recycled.

Now professionals in the Hot Mix Asphalt Industry can tell you that properly engineered recycled pavements make sense both environmentally and economically.

Why is RAP so valuable?

RAP constitutes a "treasure trove" of pre-processed road-building materials. The agency and highway user benefit because the lower cost of RAP stretches tax dollars, allowing money to go farther and permitting more roads to be kept in better condition than if only virgin materials were used.

This supply of construction aggregate already has undergone the hurdles that all virgin aggregates are subject to, such as lease acquisition, permitting, blasting, crushing, washing, screening, and testing. So not only are they less expensive, but their utilization takes the pressure off limited quarry reserves.

Until the advent of large-scale asphalt recycling in the 1970s, RAP generally was disposed of in landfills. Not only did this waste a valuable road construction material, it put pressure on the capacity of waste facilities. The savings to our governments on this basis alone are in excess of hundreds of millions of dollars each year. And many jurisdictions, recognizing the value of RAP, now have laws banning the dumping of this construction material.

"Recycling HMA is a win-win scenario," said Dale S. Decker, P.E., Vice President, Research & Technology, National Asphalt Pavement Association. "The consumer wins with lower construction and rehabilitation costs without compromising quality."

Double recycling

In the Research Triangle area of North Carolina, the rehabilitation of a major urban interstate provided an opportunity for two cities to show the power of road recycling. Contractor C.C. Mangum Inc. of Raleigh went to neighboring Durham to obtain materials for its reconstruction of 3.6 miles of the Raleigh Beltline (Interstate 440).

The contractor reclaimed the pavement from the old parking lot of the Durham Bulls baseball stadium, which had recently been taken up, and incorporated it into the mix for the new Hot Mix Asphalt overlay. The mix included 75 percent virgin materials and 25 percent RAP. The recycling reduced the amount of stone that had to be quarried for the overlay by 66,000 cubic yards.

Even before putting down the asphalt overlay, the contractor had already recycled by rubblizing the worn-out Portland Cement Concrete (PCC) roadbed and leaving it in place as a base for the new riding surface. Rubblizing produced 24,000 cubic yards of PCC — enough to cover four football fields — which would have had to be trucked away if it had not been recycled into base.

By not discarding the old PCC, the contractor saved 2,800 trips by triaxle trucks which would have gone to a landfill five miles away, and that saved about 14,000 gallons of diesel fuel. Not having to truck in new aggregate for the roadbed saved another 2,800 triaxle truckloads of stone that didn't have to be quarried and 14,000 more gallons of diesel fuel. And, by not having all those trucks coming and going, the contractor reduced congestion at the construction site — a welcome relief for the drivers of the 110,000 vehicles a day using the route while it was under construction.

The recycling techniques saved the taxpayers more than $280,000. They also added a full year to the life of the Wake County landfill. And the construction method had the lowest 30-year life cycle cost of four methods studied during the design phase.

But this was not a "cheap fix": The quality of the finished product has been nationally recognized twice. The National Asphalt Pavement Association gave it the most prestigious award in the asphalt pavement industry, the Sheldon G. Hayes Award, for technical excellence. And it won the very first NQI Achievement Award ever bestowed by the National Quality Initiative, a public-private partnership that promotes quality in highways.

RAP use is well accepted

"Of the 500 million tons of HMA produced annually in the U.S.A., fully one-fourth of these tons contain RAP," said Robert M. Nady, P.E., at the 1997 annual meeting of the Association of Asphalt Paving Technologists (AAPT).

The Federal Highway Administration (FHWA) estimates that, of the 90 million tons of HMA removed each year, 90 percent is reused in highway applications in one form or another, including pavements, subbase and fill. About one-third of the 90 million tons, or 30 million tons, is recycled into Hot Mix Asphalt pavements.

RAP now is routinely accepted in asphalt paving mixtures as an aggregate substitute and as a portion of the binder for both base courses and surface courses in nearly all 50 states. States vary in their acceptance of RAP in pavements. Florida, for example, recycles 75 percent of its RAP into HMA pavements. Substitution rates of 10 to 50 percent or more, depending on state specifications, are normally intro-

duced in pavements, and recently developed technology has even made it possible to recycle 90 percent to 100 percent RAP in Hot Mix.

Asphalt recycling has a long history and record of performance. But what's new is how modern techniques are optimizing the use of RAP in today's high-performance HMA mixes.

How is asphalt pavement recycled?

Reclaiming and recycling of asphalt pavements is a relatively uncomplicated process.

Hot Mix Asphalt is a mixture of fine and coarse aggregate (particles of stone) with asphalt cement as a binding agent. These elements are carefully heated and mixed according to specifications at a plant, trucked to the job site, and placed and compacted on the roadway while still hot and plastic.

Aggregates make up approximately 95 percent of the mix. The remainder of the HMA mix is asphalt binder, which coats and binds aggregate.

Nothing lasts forever, and after long periods of service asphalt pavements become old and may need repair. In these instances, asphalt pavement can be reclaimed by cold milling machines which use powerful rotating drums with teeth to carve up the old asphalt and deposit it via conveyor into trucks, which ferry the RAP to stockpiles at the mixing plant or adjacent to the job site. These milling machines can remove up to 2 inches of pavement thickness in a single pass.

Different from cold milling, full-depth removal involves a bulldozer-mounted "ripper" or "rhino horn" to cut pavement all the way down to the subbase. Pneumatic pavement breakers also may be used. Front-end or skid-steer loaders then pick up the large pieces and put them in trucks on which they are transported to stockpiles. At the plant, conveyors, crushers, screens, and stacking units work together.

In making HMA, the RAP then may be further crushed, proportioned, heated, and blended with new materials, then mixed to meet pavement specifications. RAP can be incorporated into HMA in both drum mix and batch plants.

"All current available testing methods, devices, and techniques have shown that properly designed recycled mixtures can meet conventional design criteria, including requiring the recycled binder to meet specification properties after production," the FHWA reported in 1996.

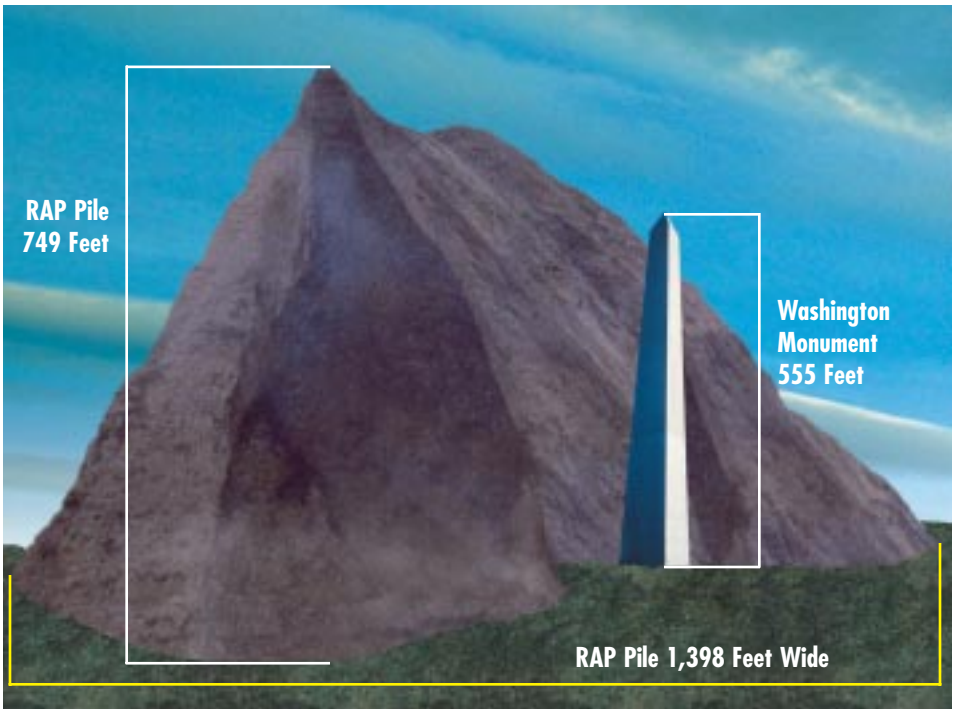
By properly blending RAP with suitable granular materials, the load-bearing capabilities of RAP may be boosted for use in road and highway subbases. It also can be used as embankment fill. "The use of RAP as an embankment base may be a practical alternative for material that has been stockpiled for a considerable time period, or may be commingled from several different project sources," the FHWA said.

RAP performs like virgin mix

Not all engineers give RAP the respect it deserves. "[An] obstacle to increased RAP use is that many engineers believe that recycled HMA is inferior to conventional HMA," said the FHWA in its 1996 publication, *Pavement Recycling: Executive Summary and Report*.

It is true that testing is required to ascertain the properties — including aggregate gradation and asphalt content — of RAP from a particular project. Without this testing, its performance in new construction can't be reliably predicted.

"Recycled HMA, which is designed and produced in a quality assurance program that verifies mixture design assumptions to reasonable limits, can



If all the asphalt pavement that is reclaimed every year were put in one cone-shaped stockpile, it would be 749 feet high and 1,398 feet wide. By comparison, the Washington Monument is 555 feet tall.

be expected to perform comparably to conventional HMA," the FHWA report concluded.

When properly crushed and screened, RAP will consist of high-quality, well-graded aggregates coated by asphalt cement.

In his research presented at the 1997 AAPT annual meeting, Nady reported that so-called "random RAP" — RAP obtained from a variety of sources and blended at the HMA plant — can be processed to produce a very consistent product.

Pavements incorporating RAP are reliable, and are performing well year after year, research shows. A recent study by the National Center for Asphalt Technology, *Performance of Recycled Hot-Mix Asphalt Mixtures in Georgia*, is an example.

The Georgia Department of Transportation (GaDOT) has constructed pavements using RAP for years. NCAT's research project was undertaken to compare recycled pavement performance to virgin (control) asphalt pavements.

Five projects, each consisting of a recycled section and a control section, were closely evaluated. Mix properties, recovered asphalt binder properties, and laboratory recompacted mix properties were measured.

Statistical analysis indicated no differences between the properties of virgin and recycled mix pavements that had been in service from 1 1/2 to 2 1/4 years. Ten additional virgin mix pavements and 13 additional recycled pavements also were evaluated, and no statistically significant differences were found between the recovered asphalt properties of these virgin and recycled pavements in service.

RAP and Superpave

So long as it is treated as an engineered construction material, RAP will also work in tomorrow's Superpave pavements as well, researchers say.

Superpave, or "Superior Performing Asphalt Pavements," is the new system of performance-related Hot Mix Asphalt (HMA) mix design specifications, now being adopted by state departments of transportation throughout the United States.

Superpave is a mix design system which incorporates data about the location where the pavement will be used — the traffic loads and local climate conditions — into the specifications for the asphalt binder and aggregates.

Superpave is an outgrowth of the Strategic Highway Research Program (SHRP) of the 1980s. During research under SHRP, use of RAP in asphalt pavements was not addressed. "The Superpave system as developed did not provide guidelines to characterize asphalt binders extracted from RAP and recycled Hot Mix Asphalts," said FHWA Pavement Division highway engineer Jason Harrington.

Nonetheless, experience so far shows that RAP can be used in Superpave mixes predictably and reliably, so long as the unique properties of the RAP used are tested and known.

What recycling asphalt pavements means to you

The HMA recycling effort, which was initiated within the HMA Industry before recycling became the fashionable thing to do, has grown with very little recognition by the public. It saves taxpayers more than $300 million annually, frees up landfill space, and provides a continuing source of valuable road construction materials.

Asphalt pavement is 100 percent recyclable. And, a pavement utilizing recycled materials performs equally as well as a pavement using all-new materials. Hot Mix Asphalt pavements utilizing Reclaimed Asphalt Pavements give the same durable, smooth, safe, quiet-riding surface as conventional pavements. That's a *rap* the Hot Mix Asphalt Industry will gladly take.

Want more information? It's available from your NAPA-member Hot Mix Asphalt producer or contractor, or from the National Asphalt Pavement Association.

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