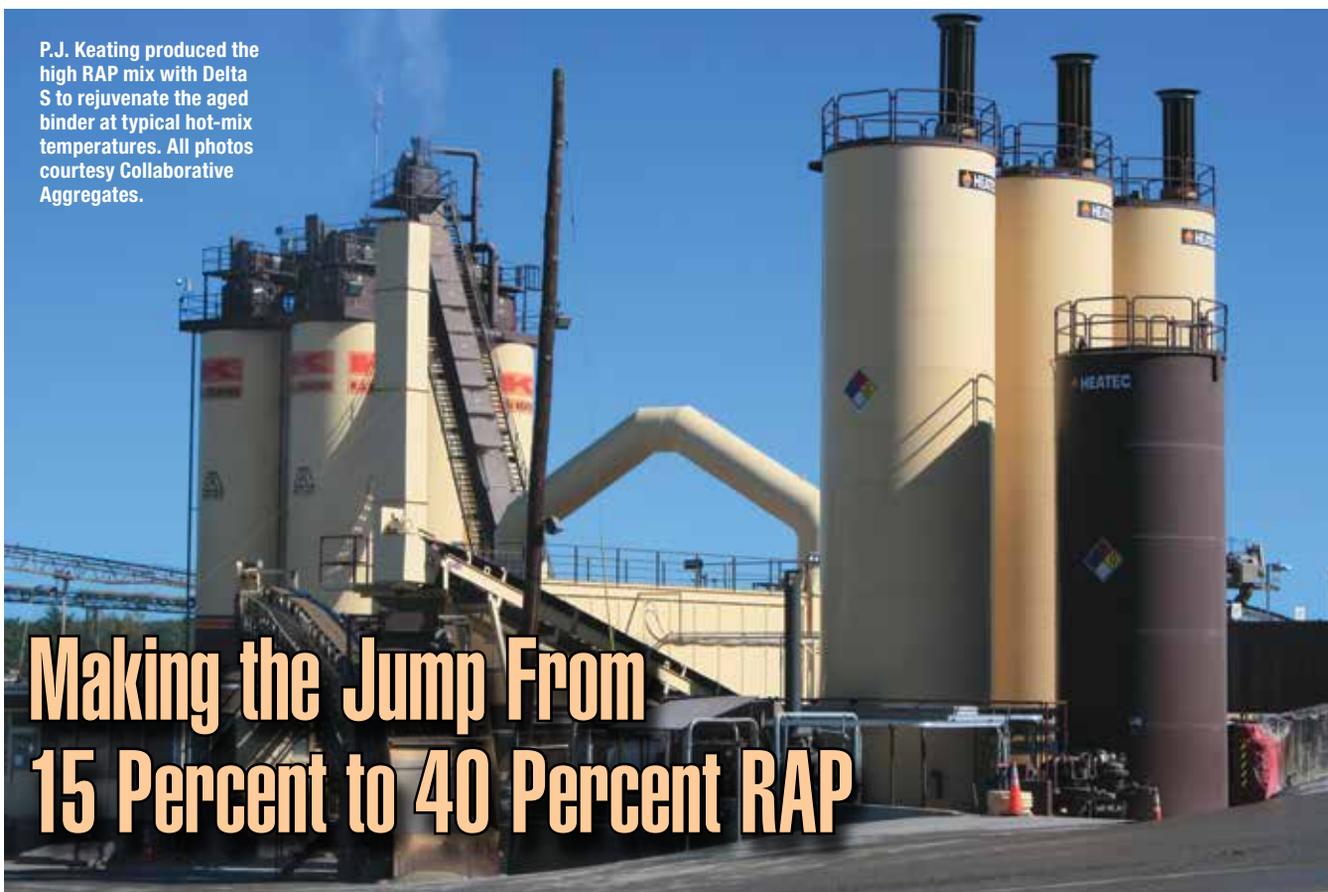


P.J. Keating produced the high RAP mix with Delta S to rejuvenate the aged binder at typical hot-mix temperatures. All photos courtesy Collaborative Aggregates.



Making the Jump From 15 Percent to 40 Percent RAP

P.J. Keating teams with MassDOT for high RAP Thinlay

By *Sandy Lender*

Under the umbrella of its GreenDOT program, the Massachusetts Department of Transportation (MassDOT) has given its six districts leeway to employ innovative techniques to use more sustainable practices in pavement maintenance and preservation. The contractor of record for District 3 district-wide paving, P.J. Keating Co. of Lunenburg, Mass., is on board to assist.

In May 2016, Gregg Berkley, senior project manager for P.J. Keating, was pleased to sit down with a MassDOT District 3 construction engineer to plan for specific sustainable action. They met at the lab of Walaa Mogawer, Ph.D., a civil engineering professor at University of Massachusetts Dartmouth Highway Sustainability Research Center (HSRC)

along with Peter Montenegro, construction marketing consultant for Collaborative Aggregates LLC (CollAgg).

Mogawer's lab had won a \$249,000 grant from the New England Transportation Consortium in 2014 to study new ways of using reclaimed asphalt shingles (RAS) from roofs. CollAgg had formally launched a liquid, plant-based, restorative additive in May 2015 to facilitate the use of higher percentages of reclaimed asphalt pavement (RAP) and RAS in mix designs. That blend of green thinking is what MassDOT was looking for.

In its GreenDOT Implementation Plan, released December 2012, MassDOT's Secretary and CEO Richard A. Davey shared that the plan is designed to move the department forward in achieving sustainability goals

as a framework. Davey wrote: "Like sustainability and livability, the GreenDOT Implementation Plan is not static; it is a 'living document' that will respond to innovations in technology and proven best practices."

Pick and Choose

At the UMass Dartmouth HSRC, Mogawer introduced MassDOT and Berkley to the concept of using a rejuvenator to address oxidized binder concerns in mixes with high RAP percentages in a thin asphalt overlay. While Mogawer's researchers tested the proposed mix design extensively in the lab, MassDOT identified a pavement section in Worcester where the mix design could be put to real-world use in a mill and Thinlay™ application. This gave MassDOT District 3 an opportunity to explore the GreenDOT sustainability

mandate by increasing RAP use from 15 percent in a surface course to 40 percent.

For a mill and Thinlay project using 40 percent RAP, MassDOT selected an older asphalt pavement that they stated was in fair condition, merely in need of resurfacing. The approximately 3,000 linear feet of the North Service Road and westbound ramp onto I-290 in Worcester had seen no preservation treatments in the past.

“It showed no signs of deterioration,” Berkley agreed. “There was some oxidation and some surface cracking... The purpose of this project is a pavement preservation instead of a rebuild.”

A Thinlay’s purpose is not to fix structural problems, but to extend an existing pavement’s life, thus the minor cracking and oxidation could be resolved with the simple 1-inch mill and well-designed Thinlay.

Originally, the test section was going to be included in a MassDOT district-wide resurfacing contract. When the budget was expended prior to completing the work in mid-2016, the North Service Road project had to be pushed to a later date. October 2016 saw the project come to fruition.

Design and Produce

Mogawer prepared a Superpave 9.5 mm Sustainable Thin Overlay (SP9.5 STO) mix design, which can be considered for lift thicknesses ranging from 0.75 to 1.5 inches (19.0 to 37.5 mm). The mixture comprises coarse aggregate, fine aggregate, mineral filler as needed, and a PG64-28 asphalt binder. A maximum of 40 percent RAP incorporates a rejuvenator at a dosage of 6 percent by weight of recycled binder. The draft specification allows MassDOT District 3 to increase the amount of RAP it would typically include in a surface layer.

Montenegro explains: “When mixes include a higher percentage of RAP than 25 percent, the



pavement may experience an early onset of premature cracking due to the stiffness of the aged binder. Industry can offset that brittleness by using a softer binder grade or rejuvenators. Mogawer was using the Delta S rejuvenator in the lab; now it needed to be put to test in the field. MassDOT District 3 and P.J. Keating opted to use it for a pavement in Worcester.”

The specification used for the North Service Road mill and Thinlay project is a provisional one. Once enough projects use and prove the efficacy of the specification, Mogawer can assist in developing a spec that allows for the use of whatever rejuvenator is in a producer’s arsenal. In this case, P.J. Keating added Delta S in-line with the liquid asphalt cement. The plant-based oil penetrates the asphalt binder and carries the Delta S into the recycled material to reverse the oxidation of the aged binder, restoring and softening it, according to Montenegro.

Mill and Thin Fill

P.J. Keating began milling the night of Oct. 19, removing pavement at a depth of 1 inch, and completed paving the night of Oct. 23. Rain delays affected the crew’s schedule, but all work took place between the hours of 8 p.m. and 5 a.m., which Berkley said allowed them to shut down lanes and detour traffic for completely closed night work zones.

“We did everything from soup to nuts,” Berkley said. “From

estimating and traffic control to milling. We manufactured and placed the hot mix.”

The crew used grade control for precise milling and swept the surface ahead of tacking. They distributed an RS1-H trackless tack coat at a rate of 0.06 gallons per square yard immediately ahead of the paver.

From curb to curb, the paving widths varied from 22 to 40 feet, depending on the section of the project. From start to finish, the P.J. Keating crew gave attention to quality control. “This project was a new mix for us with 40 percent RAP,” Berkley explained. “At only 1 inch, it didn’t leave any room for practice. Roland Couto was the foreman. He dealt with that very well. The mix is difficult to work by hand, because of the amount of RAP, and he and his crew handled it very well, especially for the first go around with it.”

Although P.J. Keating is capable of producing warm-mix asphalt (WMA) mixes, they kept the variables on this project to a minimum. They went with all conventional temperatures and conventional paving practices. The use of a high-RAP percentage took the mill and Thinlay pavement preservation technique to another sustainable level for MassDOT District 3. The use of a plant-based rejuvenator enhanced their “green” even more. **AP**

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