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Arlington, Massachusetts, Adopts Pavement Preservation Methods Such as Asphalt-Rubber Chip Seal to Boost Rating of Town's Road Network



By Paul Fournier

The Town of Arlington, Massachusetts – a community of 42,000 residents located a few miles from Boston – has significantly improved the health of its road network in just six years using pavement preservation techniques, according to Wayne Chouinard, P.E., the Town Engineer.

“By adding pavement preservation techniques such as crack sealing, chip sealing, and bonded wearing courses to our Road Program, we’ve been able to stretch our road funds and increase the number of roads being treated,” said Chouinard, who heads up the Engineering Division of the Arlington Public Works Department.

“This has improved the overall condition of our 100 miles of paved roads, and raised the town’s PCI from 74 in 2014 to 84 in 2020,” he indicated.

Chouinard was referring to the internationally recognized Pavement Condition Index, a number that rates the surface condition of a pavement. It is based on observations of pavement surface distress. For example, pavement alligator cracking is usually a sign of fatigue stress due to frequent loading, and indicates structural integrity failure and poor surface condition that affects rideability and even safety issues.

PCI values – derived from standards set by ASTM International – range between 0 and

100, with 0 representing the worst possible condition and 100 representing the best.

Highway officials equipped with this kind of road information are better able to justify modifying, when needed, the allocation of road funds for repair, rehabilitation, and preservation.

Rethinking Spending

Changes were absolutely necessary for Arlington due to budgetary constraints, according to Chouinard. He noted that after seeing local roads deteriorating but no budget increases available to fix them, they had to rethink the way they were spending money.

“When I began working in Arlington in 2011 our approach to pavement preservation was to perform crack sealing on a selected group of streets each year to prevent water infiltration and extend the life of the road surface. We spent the remainder of road funds on expensive rehabilitation methods.”

He listed the following examples:

- Milling the road surface followed by applying Hot Mix Asphalt (HMA). This was done most often when there was an existing granite curb in place and they wanted to maintain the reveal.

- Another technique involved placing a leveling course of HMA to give shape to a deformed, but stable, road surface and installing a final HMA wearing course. Typically, this was done when there was no curb.
- Lastly, they employed Full Depth Reclamation (FDR), which is very costly but was used only when a road had reached a severely deteriorated level. FDR usually involves pulverizing all of the asphalt pavement section and a specific amount of underlying materials, introducing an additive to produce a stabilized base course, shaping and compacting the mixed material, and lastly applying a wearing course overlay.

Worthwhile, but Costly

"In addition to this expensive road work we were eventually required to make improvements to Americans with Disabilities Act (ADA) accessibility and increase multimodal travel due to a MassDOT Healthy Transportation Policy Directive, and Complete Streets Program, among other programs," said Chouinard. "This required us to install curbs, sidewalks and curb ramps for ADA as well as additional pavement markings and planning for bicycle accommodations."

While these were worthwhile modifications, he pointed out, they had to be done within the same budget.

"So the value of our budget dollar actually assigned to roads and pavement was being reduced, and the condition of the roadways began to decline. In 2011 the town's PCI was 76, which had fallen from 81 in 2005, and it fell even further to 74 after the 2014 season," Chouinard explained.

Starting Small

Realizing they needed to find more economical ways to maintain their roads, the engineers began researching pavement preservation methods. As part of this effort, they began working with Robert Betsold, Technical Marketing, All States Material Group (ASMG), in experimenting with small preservation projects utilizing chip seal, rubber chip seal, and bonded wearing course (BWC).

"Once we learned the basic planning and construction requirements, we modified our maintenance program to include a significant portion of pavement preservation projects. Now we use asphalt rubber chip seal and bonded wearing course in our road program wherever possible.

ASMG's Betsold provided advice as the town gradually grew its preservation program in 2017 through 2019 before doubling the program for 2020, and it is slated to do so in 2021.

"Chip seals are often thought to be for more rural applications, but many more urban communities have been using them successfully to help build their pavement preservation and road maintenance program," said Betsold. "Arlington is a textbook case study, as they eased their way into the process five years ago, did a few trials, made some modifications to how and where the process is used in town, and have since grown the program as a staple of their overall road maintenance program. This has allowed them to do more miles and improve their overall road network condition."

Neighborhood Focus for Treatments

"Their focus has been on treating roads within the same neighborhood each year

to optimize efficiency and have consistency with road condition across the neighborhood," Betsold said. He pointed out that ASMG has a current contract with the town to apply asphalt-rubber chip seal with same-day sweeping, and also apply bonded wearing course in select areas.

"Our contract includes any necessary preparatory work such as patching, shimming, and levelling, and repairing or replacing any previously low or damaged structures," he added.

In ASMG's asphalt rubber chip seal process, the road surface first receives a thorough cleaning immediately before application, then a distributor hot sprays approximately 0.60 gallons per square yard of crumb rubber modified asphalt over the road. Betsold said the asphalt rubber is made in their terminal where performance grade liquid asphalt binder is blended with 20 percent crumb rubber formed from shredded recycled tires. This modified asphalt rubber is said to provide a flexible, durable seal. The aggregate, or chips, are 7/16-inch single sized stone that is run through a hot mix plant to be heated and lightly coated with asphalt to assure it is clean and dry.

A chip spreader distributes the coated stone over the hot-sprayed asphalt rubber binder at the rate of approximately 35 pounds per square yard, then rollers embed the stone into the asphalt rubber binder. The final step is sweeping away any loose cover aggregate. This is followed by the return to normal traffic.

Betsold said asphalt rubber chip seal not only protects and prolongs the life of a road's pavement, but also consumes about 1,300 recycled tires per mile that otherwise would have ended up in landfills.

The other principal pavement preservation treatment provided by ASMG, the BWC, is being used in selected areas of town. This thin asphalt overlay is employed to restore ride quality while sealing and protecting the underlying pavement. It can also be used to mitigate shallow rutting and can help retard fatigue cracking. BWC is a non-structural layer, typically only 0.75-inches thick, which incorporates a gap-graded aggregate and polymer-modified asphalt.

In this process, an emulsion layer is applied to the existing pavement surface immediately in front of the paving screed using a self-priming paver. The emulsion serves as a tack coat and helps to seal the underlying pavement surface while also immediately bonding it to the new asphalt surface placed by the paver.

Eight-Fold Rise in Pavement Preservation

Betsold pointed out that in 2016, about 95 percent of the town's road maintenance budget was spent on repair and rehabilitation, with only 5 percent used for pavement preservation in the form of crack sealing. Five years later, it allots about 60 percent for repair and rehabilitation, and 40 percent for preservation. That's an eight-fold increase in preservation, consisting of crack sealing, asphalt rubber chip seal, and bonded wearing course.

Chouinard said the shift in focus to pavement preservation techniques has had a welcoming effect on their road program.

"As a result of these changes, we have seen an increase in the number of roads being improved and an overall rise in the town PCI. We expect this trend to continue as we utilize pavement preservation techniques."



A Mack truck with an Etnyre live-bottom body feeds asphalt coated aggregate to Etnyre chip spreader which broadcasts the stone into hot-sprayed asphalt rubber binder on road.



A Vögele Super 1800-3i Tracked Paver is used to place bonded wearing course treatment in selected areas as part of Arlington's successful pavement preservation program.

