

Pavement Preservation Solutions: Asphalt Overlays

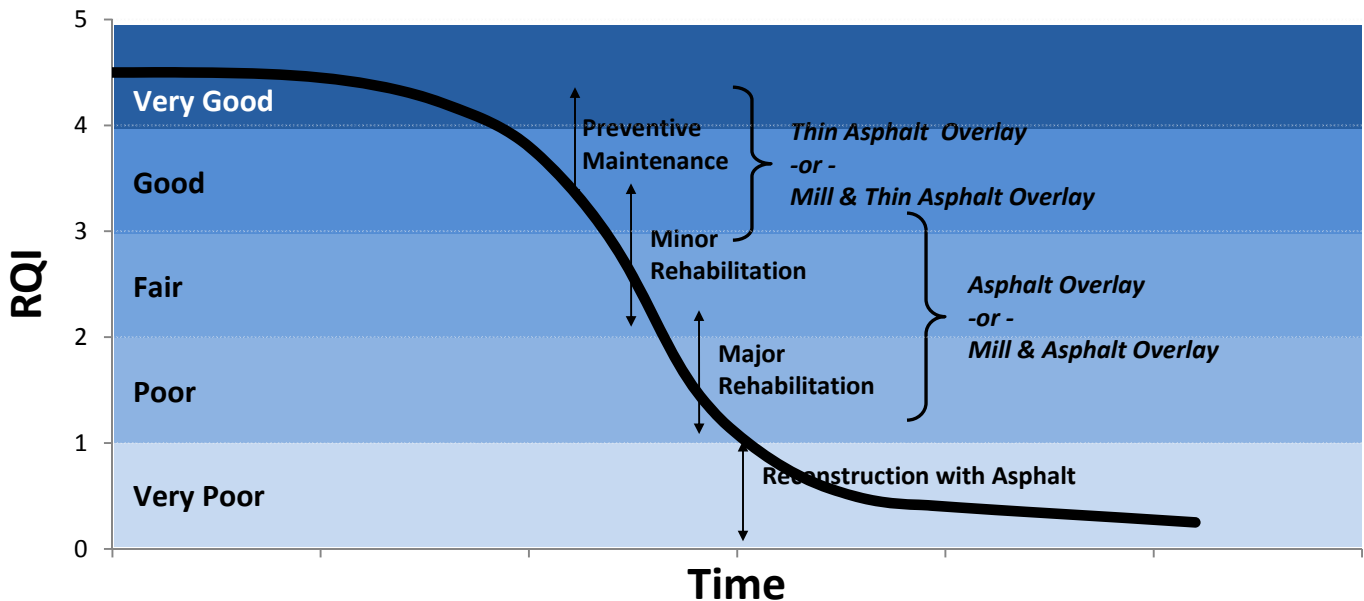
By Richard O. Wolters, P.E., MAPA Executive Director and Jill M. Thomas, P.E., MAPA Associate Director

As our pavement network ages, agencies and owners are looking for solutions to preserve pavements that result in the best value, and asphalt overlays have proven to be an excellent solution.

Asphalt overlays are one of the most cost-efficient and versatile pavement preservation options available. They can consist of thick or thin asphalt overlays, warm mix asphalt, coarse or fine-graded stone matrix asphalt, and coarse or fine-graded hot mix asphalt. An asphalt overlay can improve drainage characteristics and the cross-slope of the pavement structure to correct safety issues. Since overlays can be placed in thicknesses varying from ¾" to several inches, the engineer has flexibility to design according to the needs of the roadway, i.e. add structural capacity to a pavement structure when traffic exceeds the predicted growth. The Minnesota Department of Transportation's (Mn/DOT's) quality management (QM) program in the production and placement of asphalt ensures quality in the overlay. The new surface can improve ride, reduce noise levels, improve skid resistance, seal the pavement against elements, extend the service life, and enhance the appearance. Pavements with curb and gutter, elevation and/or cross-slope issues may require milling the surface prior to placing the asphalt overlay.

The pavement ride quality index (RQI) can be used to determine whether a thin (typically less than 2") or thicker asphalt overlay is needed for your pavement (see Figure 1). This information is available through Mn/DOT's Pavement Management Unit which is responsible for the collection and analysis of pavement condition data on the State's Trunk Highway system as well as the County State Aid Highway (CSAH) system through an agreement with the Division of State Aid for Local Government.

Figure 1. Typical Pavement Ride Quality Index (RQI) Curve.



According to MnDOT's 2008 *Pavement Condition Executive Summary* report, the RQI is Mn/DOT's ride or smoothness index with a rating scale of zero (very poor ride) to five (very good ride). The RQI is intended to represent the rating that a typical road user would give to the pavement's smoothness as felt while driving his/her vehicle. Most new construction projects have an initial RQI slightly over 4.0. Pavements are normally designed for a terminal RQI value of 2.5 (the point where most people feel it is uncomfortable and a major rehabilitation is likely needed). This data can be used by agencies to determine the timing and thickness of an asphalt overlay.

Thin Overlays

A thin asphalt overlay is an excellent option to restore ride quality to structurally sound flexible pavements and is compatible with future maintenance activities. Thin asphalt overlays consist of well-blended aggregates and asphalt cement. The quality of the pavement preservation technique is controlled through the QM process.

Several cities use thin overlay as a preventive maintenance technique. For example, Bemidji's city streets were



rehabilitated with a thin HMA overlay in 2004 after serving for more than 20 years (see photo left). The top 1.5 inches of the 3.5-inch HMA layer was milled and replaced with HMA. Another example is the City of Blaine, which has been using asphalt overlays in their pavement management program for over 15 years. This has proven to be a cost-efficient tool for the city as they have paid for the overlays out of their general fund rather than assessing adjacent property owners. A recent Mn/DOT report¹ and a national survey² has also validated that thin overlays can have a functional life of 16-18 years depending on the condition of the existing pavement. A thin overlay is more effective when compared to chip seal, slurry seal, or microsurfacing in extending pavement life.

The Minnesota Department of Transportation (Mn/DOT) has received seven National Perpetual Pavement Awards over the past seven years (the only state to have accomplished this honor). Each of these award winning pavements has received a thin overlay (ranging from ¾" to 1½" thick) in their lifetime and they are still going strong. A thin overlay is a viable and cost-effective means to prolong the life of low, medium, and high volume HMA pavements. These projects have demonstrated outstanding design, construction, and performance value for more than 35 years of service to the traveling public of Minnesota and continue to do so today.

Life Cycle Cost Analysis

A life cycle cost analysis should be completed to determine the most cost efficient pavement preservation solutions. A new life cycle cost analysis program (LCCAExpress) was developed by Dr. David Timm (Auburn University and National Center for Asphalt Technology (NCAT)). The new, user-friendly software program quickly analyzes the life cycle cost of pavement type alternatives.

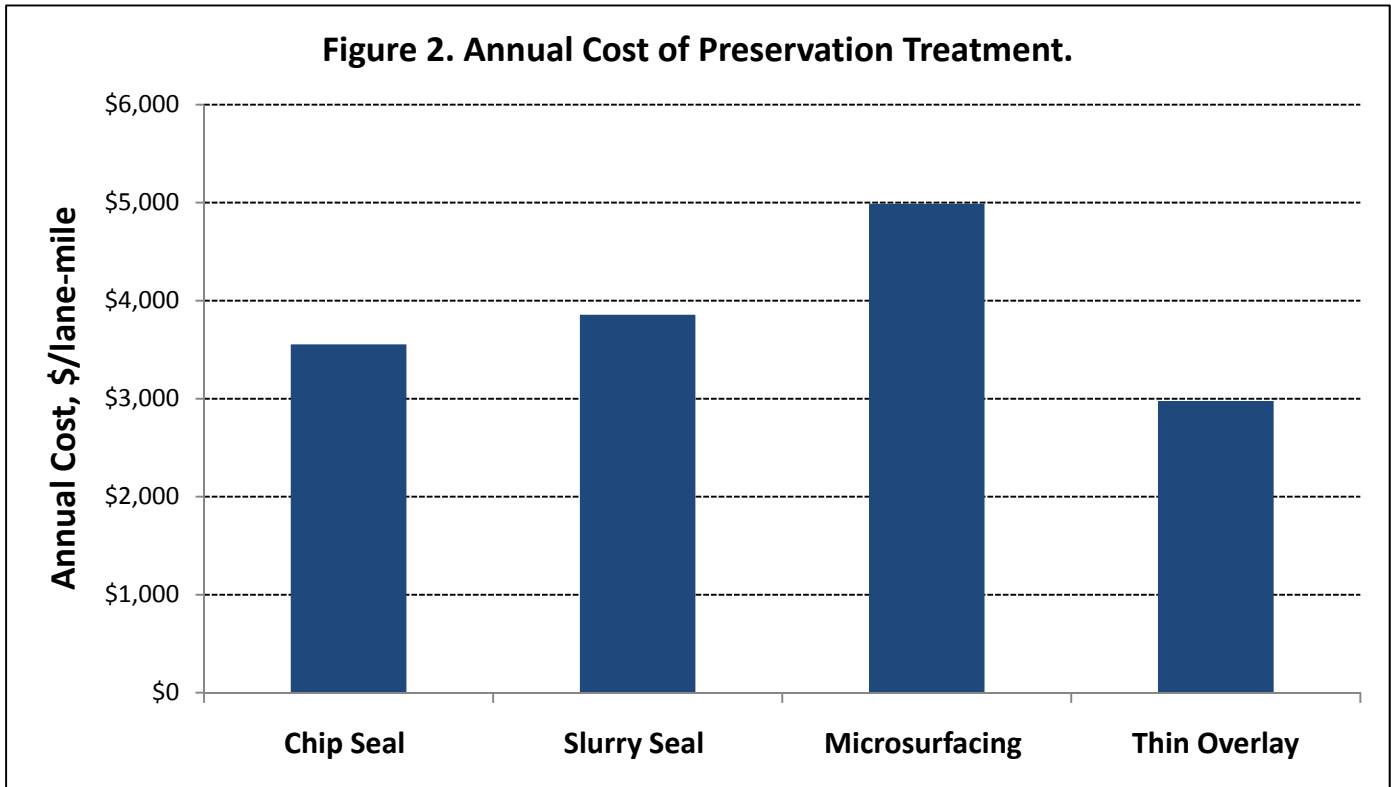


This new software computes the net present value of alternatives for you. There are no hidden inputs and there is no bias in the software for one option over another. The new software is a scaled down version of the "LCCA" software that is based on the FHWA's "Life-Cycle Cost Analysis in Pavement Design" publication. [To download the new LCCAExpress software, click on the link http://www.eng.auburn.edu/users/timmdav/LCCAExpress1_0.msi. Either "Run" or "Save" the file for installation. If you "Save" the file, you will need to open the *.msi file and allow "Run" for installation.]



In 2008, Chou³ and his colleagues found that in almost all cases, a thin asphalt overlay on an asphalt pavement was the most economical solution. He reported that thin overlays on portland cement concrete (pcc) were not as cost effective, possibly due to increased deterioration of the underlying pcc pavement. Therefore, asphalt overlays thicker than 2” would be more beneficial to extend the service life of the pcc pavement.

Also in 2008, the National Asphalt Pavement Association (NAPA) surveyed the state asphalt associations concerning the cost and effectiveness of various pavement preservation treatments. Thin asphalt overlays had a longer expected life than the other treatments. Although the initial cost was higher, when that was divided over the service life, the thin overlay option was the most cost efficient surface treatment (see Figure 2).



In conclusion, asphalt overlays are a proven solution to pavement preservation needs. An asphalt overlay can consist be thick or thin, warm mix asphalt, stone matrix asphalt (coarse or fine-graded), or hot mix asphalt (coarse or fine-graded). Contact the Minnesota Asphalt Pavement Association at (651) 636-4666 or by email at info@mnapa.org with any questions or for further information.

References:

1. Wood, T., R. Olson, E. Lukanen, M. Wendel, and M. Watson, “Preventive Maintenance Best Management Practices of Hot Mix Asphalt Pavements,” Minnesota Department of Transportation Report Number MN/RC 2009-18, May 20009.
2. National Asphalt Pavement Association Information Series 135, “Thin Asphalt Overlays for Pavement Preservation,” and powerpoint presentation, 2009, http://www.hotmix.org/index.php?option=com_content&task=view&id=465&Itemid=1021
3. Chou et. al., “Effectiveness of Thin Hot Mix Overlay on Pavement Ride and Condition Performance,” for the Ohio Department of Transportation, 2008.

