



CASE STUDY

March 2023

ULTRA-THIN BONDED WEARING COURSE MINNESOTA DEPARTMENT OF TRANSPORTATION

This is one of five case studies highlighting FHWA's Every Day Counts initiative known as [Targeted Overlay Pavement Solutions \(TOPS\)](#). TOPS integrates innovative overlay procedures into practices to improve performance, lessen traffic impacts, and reduce the cost of pavement ownership.

Overview

An ultra-thin bonded wearing course (UTBWC) is a thin asphalt overlay where a relatively thick polymer-modified emulsion membrane is sprayed onto the existing pavement surface, which is immediately covered with a thin open/gap-graded hot mix asphalt (HMA) placed with a spray paver.

UTBWC is a high-performance surface treatment and preservation tool that addresses mild to moderate distresses and surface deficiencies. The general design thickness guideline is 1.5 to 2.0 times thicker than the nominal maximum aggregate size. Minnesota Department of Transportation's (MnDOT's) typical lift thickness ranges from 0.40 to 0.80 inches. UTBWC is used to restore ride quality while sealing and protecting the underlying pavement.

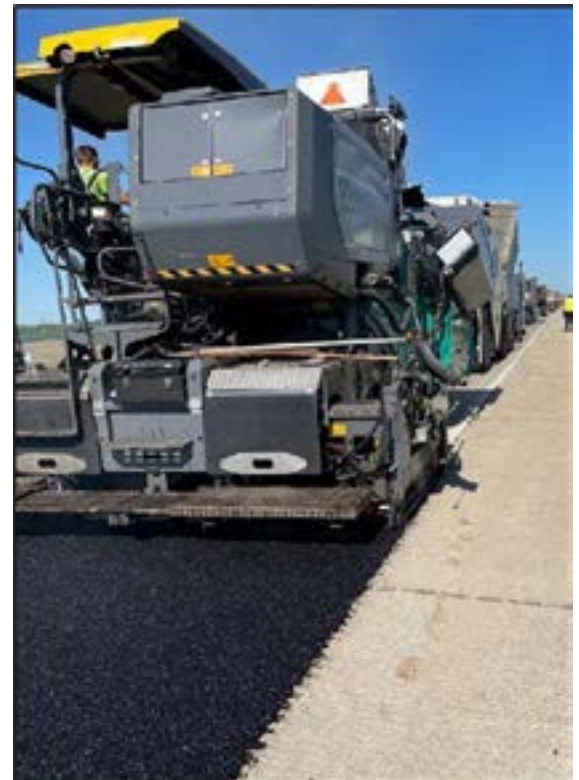
Construction Considerations

Two key construction considerations include:

- A paver designed and built for the purpose of applying UTBWC must be used.
- Mixture must be produced by a MnDOT-certified plant. While placing the mixture, the UTBWC should be at a temperature between 290 and 330 degrees Fahrenheit, as measured in front of the screed.

Cost

UTBWC cost is typically based on square yards. According to MnDOT, UTBWC is one of the most expensive applications per square yard compared to other non-HMA treatments. However, the overall performance is expected to last from 7 to 12 years, an average of one-third more life than other treatments listed in the MnDOT Pavement Preservation Manual. UTBWC has also performed well for up to 10 years when combined with micro milling. Based on a 2020 review of two MnDOT projects, the total cost for UTBWC construction was \$4.55 per square yard for a ¾-inch depth of pavement.



Newly placed UTBWC. (Source: Asphalt Surface Technologies Corporation)

Current data suggests that the average gain in pavement life using UTBWC exceeds the additional cost needed to apply other similar treatments, according to MnDOT.

Potential Benefits

According to MnDOT and other State transportation departments, UTBWC offers many benefits:

- Allows for rapid application and can be quickly opened to traffic. This can create higher customer satisfaction due to fewer construction delays and smoother pavements.
- Can be placed over HMA and portland cement concrete surfaces to delay cracking by sealing existing low-severity cracking.
- Resists rutting with stone-on-stone contact between aggregates in HMA.
- Reduces splash and spray as it allows water to flow through the surface laterally
- Reduces overall life cycle cost because it is relatively cheaper than mill and overlays. The 7- to 12-year UTBWC performance period is similar to the service life of MnDOT pavement markings, which helps the agency be more efficient when scheduling maintenance activities.

Minnesota Case Study

Built in 1991, Interstate 394 is 9.8 miles and runs east to west from downtown Minneapolis to Interstate 494 in the Minneapolis suburb of Minnetonka. The existing pavement structure included 9.75 inches of HMA with a BAB in most of the highway. A small section of highway from RP 7.9 to RP 7.6 has an underlying concrete base. There are three lanes in each direction for most of the highway.

In 2004, 13 years after initial construction, a thin, 1.5-inch mill and overlay was completed. In 2016, 12 years after the thin mill and overlay, micro milling and UTBWC were applied. The Ride Quality Index jumped from 3.0, fair condition to 3.7, good condition. Initially, I-394 was designed with a 20-year service life. Without this pavement preservation treatment, the RQI could have dipped to 2.5, making this section of interstate a candidate for major rehabilitation. I-394 has now exceeded its design life, and according to MnDOT, the pavement has stayed in good condition. At 30 years, the average RQI in both directions was approximately 3.9.

“UTBWCs are an economical solution. The thin overlays offer 8 to 10 years of service life, which is similar to the life of our durable pavement markings. By coordinating the surface treatment and pavement marking applications, we start on a cost-effective maintenance cycle.”

—MnDOT State Engineer

Contact information:

To learn more about TOPS asphalt products contact [Tim Aschenbrener](#), 720-963-3247.
For concrete TOPS products, contact [Robert Conway](#), 202-906-0536.

The contents of this document do not have the force and effect of law and are not meant to bind the public in any way. This document is intended only to provide clarity regarding existing requirements under the law or agency policies. The use of UTBWC is not required by Federal law.

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