MnDOT'S EXPERIENCE

Micro Milling with Surface Treatments

Introduction

The Minnesota Department of Transportation (MnDOT) began investigating the performance of micro milling with a surface treatment in 2013. Pavement Interactive defines micro milling as follows:

Figure 1 – Finished Micro Mill Texture of TH 89

An investigation of the combination of Micro Milling and surface treatments was performed in 2015 by MnDOT staff. Since then, MnDOT has been observing these projects and their performance over time. The goal of this investigation is to use the additional data gathered by MnDOT personnel to determine the effectiveness of Micro Milling with surface treatments at improving ride quality. For the purposes of this investigation, the ride quality data is an average of the left and right wheel paths. This is to keep the data concise due to multiple projects being investigated for each treatment type.

The surface treatments placed in conjunction with a micro mill include Chip Seal, Micro Surface, and Ultra-Thin Bonded Wear Course (UTBWC). There have been several projects that have incorporated each different surface treatment with a Micro Mill. This investigation will combine the findings of these projects.

DEPARTMENT OF TRANSPORTATION

Treatment #1: Micro Mill with Chip Seal

Figure 2 - TH 89 after Placement of Chip Seal

IRI (International Roughness Index) data has been collected on two different Micro Mill and Chip Seal projects for this investigation. The data is outlined in the table and chart below. From the data, it appears there is a significant improvement to IRI over the first several years. By the third or fourth year following treatment, the IRI appears to return to approximately the same value as before the treatment. This means that, for a relatively small cost, the ride quality of a pavement can be improved for several years by Micro-Milling and Chip Sealing, thus extending the service life of that pavement.

Performance of Micro Milling with Chip Seal													
	Before Micro Mill	After Micro Mill		After Chip Seal		After 1 Year		After 2 Years		After 3 Years		After 4 Years	
	Avg. IRI (in/mi)	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved
TH89 Nothbound (2013)	80.7	64.3	20%	67.3	17%	74.7	7%	71.7	11%	76.1	6%	86.8	-8%
TH89 Southbound (2013)	85.0	69.1	19%	69.9	18%	71.6	16%	76.0	11%	80.2	6%	90.9	-7%
TH9 Northbound (2014)	93.3	73.4	21%	79.1	15%	82.5	12%	86.9	7%	95.0	-2%	-	-
TH9 Southbound (2014)	106.3	79.3	25%	84.2	21%	92.4	13%	99.7	6%	111.5	-5%	-	-
Averages	91.3	71.5	21.4%	75.1	17.6%	80.3	12.0%	83.6	8.7%	90.7	1.2%	88.85	-7.3%

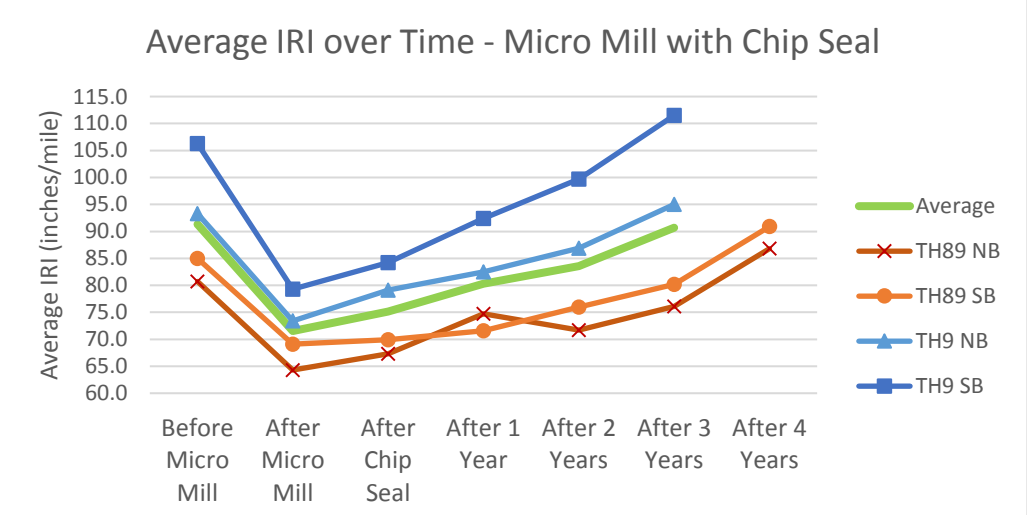

Figure 3 – Micro Mill with Chip Seal Chart

It should be noted that one of the Chip Seal projects included a control section, which was Chip Sealed without Micro-Milling. Without the smoothing benefits of Micro-Milling, this section showed a continued degradation in ride quality over time. This data is displayed below.

Performance of TH89 Chip Seal Without Micro Mill											
	Before Chip Seal	After Chip Seal		After 1 Year		After 2 Years		After 3 Years		After 4 Years	
	Avg. IRI (in/mi)	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved
TH89 Nothbound (2013)	95.7	95.9	0%	110	-15%	101.2	-6%	104.7	-9%	115.3	-20%
TH89 Southbound (2013)	80.1	85.5	-7%	79.7	0%	85.8	-7%	89.6	-12%	104.2	-30%
Averages	87.9	90.7	-3.5%	94.9	-7.2%	93.5	-6.4%	97.2	-10.6%	109.75	-25.3%

At approximately $17,000 per lane mile, Micro Milling with Chip Sealing can improve the ride and extend the life of a pavement for several years, provided projects are properly selected.*

Treatment #2: Micro Milling with Micro Surfacing

Three Micro Mill with Micro Surfacing projects and their respective IRI data have been analyzed for this investigation. From this data, there appears to be a significant improvement to ride quality when compared to the original surface. Even 3 years after treatment, there is an average 31% improvement in ride quality from the original surface. More data on these projects will need to be collected to determine the longevity of the improvements in ride quality.

Figure 4 - TH 64 After 1 Year

Performance of Micro Milling with Micro Surfacing											
	Before Micro Mill	After Micro Mill		After Micro Surfacing		After 1 Year		After 2 Years		After 3 Years	
	Avg. IRI (in/mi)	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved
TH64 Northbound (2014)	166.3	99.6	40%	-	-	61.4	63%	77.3	54%	92.5	44%
TH64 Southbound (2014)	175.4	103.5	41%	-	-	59.6	66%	75.8	57%	95.5	46%
TH12 Eastbound (2014)	77.7	76.2	2%	58.2	25%	57.2	26%	62.9	19%	65.6	16%
TH12 Westbound (2014)	79.7	79.5	0%	58.2	27%	56.6	29%	59.7	25%	63.9	20%
TH10 Eastbound (2015)	118.2	-	-	58.3	51%	63.4	46%	-	-	-	-
Averages	123.5	89.7	21%	58.2	34%	59.6	46%	68.9	39%	79.4	31%

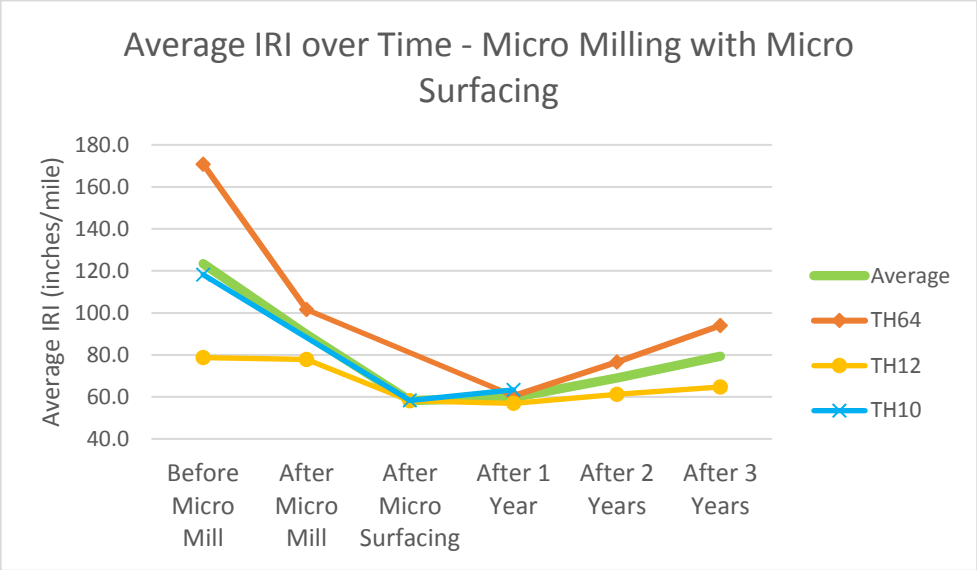

Figure 5 – Micro Milling with Micro Surfacing Chart

At approximately $30,000 per lane mile, Micro Milling with Micro Surfacing can greatly improve the ride and service life of a pavement, provided projects are selected properly.*

Treatment #3: Micro Mill with UTBWC

This investigation analyzed the ride data on two different Micro Mill with UTBWC projects. The data shows that ride quality can be significantly improved compared to the original surface. After 3 years, an average improvement of 40% is shown. As with Micro Surfacing, more ride data will need to be collected in subsequent years since the sections in question have not yet returned to their pre-treatment IRI values. Additional ride quality data will provide further insight into the effectiveness of Micro Surfacing with UTBWC at improving ride and preserving pavement condition.

Figure 6 – US 10 After 1 Year

Performance of Micro Milling with UTBWC

	Before Micro Mill	After Micro Mill		After UTBWC		After 1 Year		After 2 Years		After 3 Years	
	Avg. IRI (in/mi)	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved	Avg. IRI (in/mi)	% Improved
TH10 Eastbound Driving Lane (2014)	105.9	-	-	42.0	60%	46.2	56%	57.6	46%	67.1	37%
TH10 Eastbound Passing Lane (2014)	109.0	90.4	17%	41.2	62%	45.1	59%	54.1	50%	64.0	41%
TH10 Westbound Driving Lane (2014)	109.4	-	-	39.4	64%	44.0	60%	54.8	50%	64.9	41%
TH10 Westbound Passing Lane (2014)	110.8	86.5	22%	40.2	64%	45.6	59%	52.2	53%	65.6	41%
I-394 Eastbound Driving Lane (2016)	93.1	-	-	43.9	53%	46.2	50%	-	-	-	-
I-394 Eastbound Passing Lane (2016)	105.8	-	-	41.5	61%	44.6	58%	-	-	-	-
I-394 Westbound Driving Lane (2016)	93.1	99.5	-7%	42.8	54%	45.3	51%	-	-	-	-
I-394 Westbound Passing Lane (2016)	113.3	-	-	43.1	62%	44.9	60%	-	-	-	-
Averages	105.1	92.1	11%	41.8	60%	45.2	57%	54.7	50%	65.4	40%

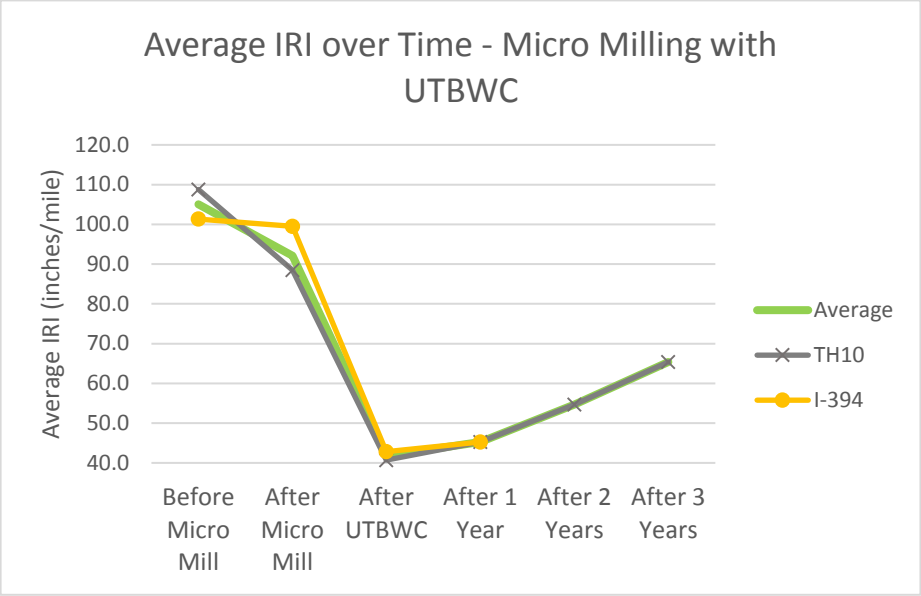

Figure 7 – Micro Mill with UTBWC Chart

At approximately $43,000 per lane mile, Micro Milling with UTBWC has shown the best results at improving ride quality within the scope of this investigation, but has the highest initial cost of the three treatments detailed herein.

Conclusions

As discussed above, since the IRI of the Micro Surface and UTBWC sections have not yet returned to the original values, additional IRI data will need to be collected in subsequent years to provide a true comparison of cost/benefit ratio and longevity of the different treatments. Based on the available data, it is clear that Micro Milling combined with surface treatments has the potential to greatly improve ride quality of a properly selected bituminous pavement.

*Please see the MnDOT Pavement Preservation Manual for more information on project selection guidelines.

For more information on Micro Milling with a surface treatment, please contact:

Elliot Keyes
651-366-5432
elliot.keyes@state.mn.us

Jerry Geib
651-366-5496
jerry.geib@state.mn.us

http://www.pavementinteractive.org/2011/09/20/micro-milling-the-finer-side-of-milling/