

Testing Recycled Asphalt Pavement (RAP) in Seal Coats

by Tim Horner, TLN Director and Dale C. Heglund, NDLTAP Director



The North Dakota Department of Transportation (NDDOT) is trying to reduce seal coat costs for North Dakota roadways. Their tests may prove the viability of reclaimed asphalt pavement (RAP) in seal coats while also identifying many other uses for the numerous RAP stockpiles across North Dakota and the rest of the country.

Recycling asphalt pavements became popular in the 1970s because of the high cost of crude oil during the Arab oil embargo. The use of asphalt cement has risen and fallen with the price of oil over the last 30 years. Early uses of RAP centered primarily around reducing the amount of virgin aggregate and asphalt cement in hot mix paving mixes. Some early mix failures and the era of Superpave reduced the use of RAP in mix designs and, over the years, RAP stockpiles have sprung up around the country. Practitioners understand that valuable asphalt cement and aggregate exists in those stockpiles, but utilizing these RAP reserves takes innovation and research.

NDDOT is making the attempt to replicate techniques used in mountainous areas of California where the use of RAP is becoming more common in asphalt seal coats.

NDDOT Field Engineer Tyler Wollmuth is leading up testing of the concept on ND 3 from Napoleon to I-94. Tyler was introduced to the concept while serving on the NDDOT Transportation Innovation Program (TRIP) in 2017. Stephanie Weigel of NDDOT proposed the concept to the NDDOT



Figure 1. Project Limits

TRIP committee after seeing a presentation at the 2017 North Dakota Asphalt Conference. The 2017 TRIP submittal pointed out that typical seal coat aggregate gradations could be met by processing materials out of existing RAP stockpiles. For various reasons, the concept wasn't advanced in 2017, but Tyler and Stephanie continued to collaborate to find the right project near an existing RAP stockpile where test sections could be tried.

NDDOT bid and awarded the ND 3 project to Asphalt Surface Technologies Corporation (ASTECH) of St. Cloud Minnesota. The project began in early June of 2019. NDDOT directed ASTECH to process a RAP stockpile located in the NDDOT Napoleon maintenance yard. The

stockpile had been in place for several years and was significantly compacted and consolidated. Material had to be extracted via a large backhoe.



Figure 2. RAP Stockpile

The resulting stockpile production was approximately 40% coarse aggregate, 20% seal coat aggregate and 40% fine aggregate.



Figure 5. Coarse Aggregate



Figure 3. Backhoe for Removing RAP



Figure 6. Fine Aggregate

The material was screened without crushing and resulted in three piles: coarse, fine and seal coat aggregate.



Figure 4. AP Screening



Figure 7. Seal Coat Aggregate

Tyler and Dale Heglund of NDLTAP speculated that the fine aggregate might be a good additive to gravel surfacing to improve permeability and cohesion. The contractor said they were considering using the resulting fine and possibly the coarse material in a slurry seal coat.

Tyler had the fine material lab-tested with the following gradation results:

ND 3 RAP Fines Material

	Gradation 1	Gradation 2	Gradation 3
Sieve #	% Passing	% Passing	% Passing
1/2"	100	100	100
3/8"	100	100	100
No. 4	91	93	96
No. 8	60	62	80
No. 16	37	36	62
No. 30	18	16	43
No. 50	6	4	26
No. 100	1.5	1	17
No. 200	0.4	0.4	14

Gradation 1 – not extracted & not washed

Gradation 2 – not extracted & washed

Gradation 3 – extracted & washed

NDDOT directed the contractor to install the control (conventional) chip seal coat on 16 miles of the project with CL 41-M chips at a rate of 23 LB/SY and CRS-2P oil at a rate of 0.40 Gal/SY. Then NDDOT had the contractor install 4 test sections with of the RAP aggregate at the following application rates:

Section 1 – 0.34 Gal/SY oil and 21.5 LB/SY RAP chips

Section 2 – 0.30 Gal/SY oil and 16.5 LB/SY RAP chips

Section 3 – 0.28 Gal/SY oil and 14.5 LB/SY RAP chips

Section 4 – 0.30 Gal/SY oil and 13.5 LB/SY RAP chips

Ultimately the section 1 test section application rate was selected which shows an oil reduction of 0.06 gallons per square yard. Tyler said the application at first looked a bit darker than conventional chip seals but the darker appearance faded a bit over time. At the time of this article, it was still darker than a conventional seal coat, but many recent conventional seal coats are receiving a final fog coat which also results in a darker surface. NDDOT will monitor the test sections against the control sections over the next several months and years. It is hoped that bleeding will not be a problem in the short term. Aggregate retention during the snowplowing season will also be reviewed.



Figure 8. Test Section 1 – Right Lane



Figure 9. Application of RAP Chip Seal



Figure 10. Application of RAP Chip Seal



Figure 11. RAP Chip Seal after Application

FOR MORE INFORMATION:

NDLTAP
515 ½ E. Broadway, Suite 101
Bismarck, ND 58501

(701) 328-9855

ndltap@ugpti.org

www.ndltap.org