

# The Rebirth of Chip Sealing in Minnesota

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# The Issues

- In the early 1990's chip seal performance was very unpredictable.
  - Large amount of aggregate loss
  - Bleeding
  - Vehicle damage
  - Cost overruns
  - Average chip seal life was 5 to 7 years

# LRRB funded a study of Chip Seals.

Mn/DOT adopted a modified McLeod design

- Determined amount of aggregate needed to cover 1 sq/y one stone deep
- Increased aggregate embedment depth from 50% to 60% - 65%

# Seal Coat Design Summary

- Design for FA-3 (3/8") Chip
  - Previous Average (No Design):
    - 30 lbs/yd<sup>2</sup> Aggregate
    - 0.30 gal/yd<sup>2</sup> Binder
  - Current Average (With Design):
    - 17 lbs/yd<sup>2</sup> Aggregate
    - 0.42 gal/yd<sup>2</sup> Binder

*“One state that adopted Mn/DOT’s design method reported a \$1 million savings in aggregate costs the first year”*

# Mn/DOT's Design Method

[http://www.mrr.dot.state.mn.us/research/MnROAD\\_Project/restools/sealcoatprogram.asp](http://www.mrr.dot.state.mn.us/research/MnROAD_Project/restools/sealcoatprogram.asp)

Press F1 for Program Usage Note  
Minnesota Seal Coat Handbook

### SEAL COAT DESIGN

ID	12	Sample	Project	Location	Sampled	Tested	Test ID	Agg ID
		BA06-124	City of Hazel	Hastings M		5/19/2005	BA06-0124	
PERCENT					Agg Type	Dresser T	Binder ID	
Passing 1/2		100			Agg Size	PA 2.5	Binder Type	
Passing 3/8		100						
Passing 1/4		79		Retained 1-3/4		0	Passing 1-3/4	
Passing No 4		30		Retained 3/4-1/2		0	Passing 3/4-1/2	
Passing No 8		1		Retained 1/2-3/8		0	Passing 1/2-3/8	
Passing No 16		1		Retained 3/8-1/4		81	Passing 3/8-1/4	
Passing No 50		1		Retained 1/4-No 4		0	Passing 1/4-No 4	
Passing No 200		0.5						
WASTE		0.21	Waste		1.05	Residual Asphalt		0.67
FLAVINGS		0.18	Traffic		0.7	COVER		21.60736
ALD		0.18	Surface		0.99	FLAT		0.2708157
Bulk SG		2.342	Aggregate Absorption		0	NDT FLAT		0.3033661
Loose LW		103.4	Absorption Correction		0	GRAPH VALUES Below (Gal/Y)		
		0.437334						

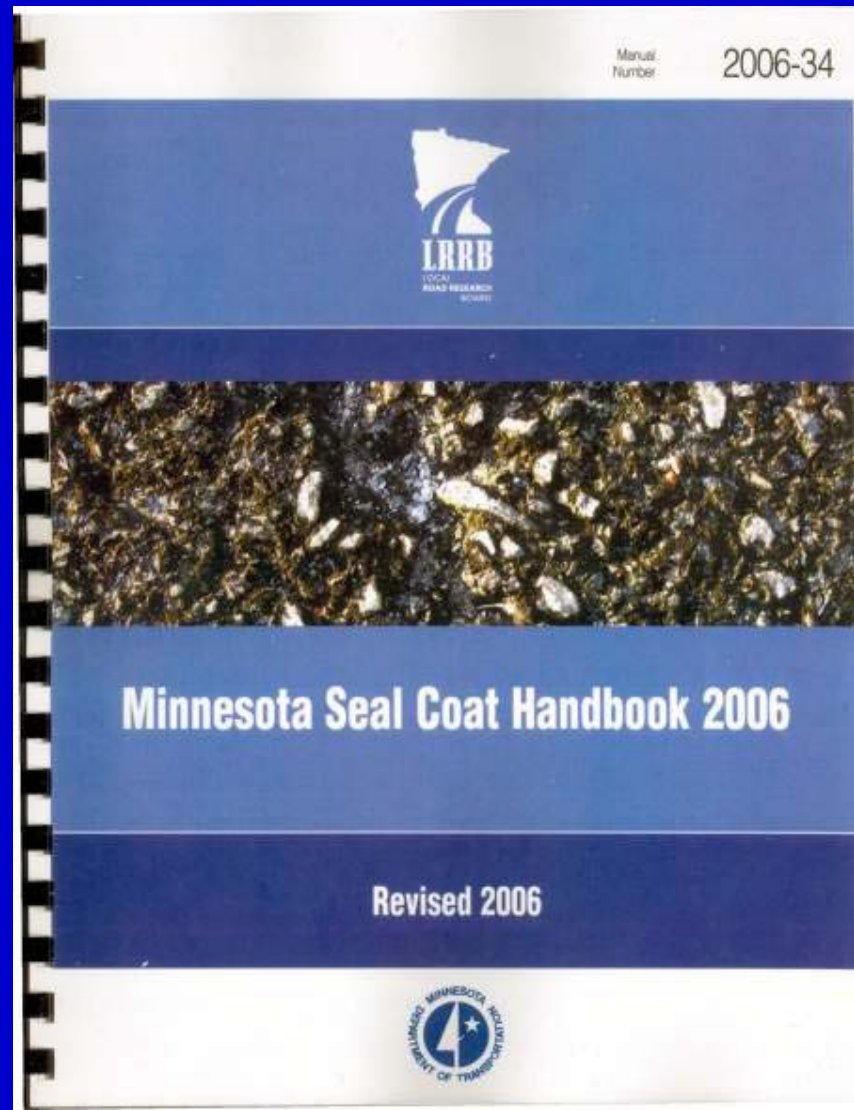
Traffic Factor	Slightly Pocked	Slightly Pocked	Slightly Porous	Vehicles / Day
0.6	0.3796	0.3508	0.2662	Over 2000
0.65	0.3807	0.3509	0.3061	1000 to 2000
0.7	0.4156	0.371	0.3292	500 to 1000
0.75	0.4359	0.3911	0.3483	100 to 500
0.85	0.4767	0.4313	0.3885	Under 100

#### APPLICATION RATE

Traffic Volume	Slightly Pocked (Gallons/Sq Yd)	Slightly Pocked (Gallons/Sq Yd)	Slightly Porous (Gallons/Sq Yd)
Under 100	0.47	0.43	0.39
100 to 500	0.43	0.39	0.35
500 to 1000	0.39	0.35	0.31
1000 to 2000	0.35	0.31	0.27
Over 2000	0.31	0.27	0.23

# Originally Published in 1997

## Revised in 2006



# Current Mn/DOT Special Provisions

- Requires use of CRS-2p emulsion
- Clean aggregate
- Proper methods
  - Minimum time between application of binder and aggregate (< 1 minute)
  - 3 rollers with minimum of 3 passes
- Chips shall be swept day of construction
  - Before traffic control is lifted

# Current Mn/DOT Special Provisions

- Contractor responsible for all vehicle damage.
- All chip seals on State routes shall be fog sealed.
  - No earlier than the next morning.
  - Css-1h diluted 1:1 at place of manufacture is required for fog seal.
  - Shoulders + Rumble Strips too!

# Mn/DOT Special Provisions were re-written in 2001

- Old pay items
  - Tons aggregate
  - Gallons of binder
- New pay item
  - Gallons of binder
  - Square yards of chip seal applied
    - Pay for aggregate, application, sweeping, etc.

# Outcome

- Many Agencies in MN have started to chip seal or increased their use of chip sealing.
- Average age of roadway to receive first chip seal application is 5 years
- The average size of chip used has increased from 1/4" chip to 100 percent passing 3/8".
- Maximum allowable traffic for placing chip seals increased from 500 - 1000 ADT to as high as 15,000+/- ADT.
- Average life of chip seals has increased from 5 – 7 years to 10 - 15 years.

# What the Traveling Public Sees!



2 Years Later



# Minnesota State Animal The Gopher

