Research Pays Off Series
Safer, Smarter, Sustainable Pavements through Innovative Research

Chip Seal – Use and Benefit to Minnesota
Asphalt Research Group (A Team)
Agenda

• History
• What was done
• Results
• Benefits of doing it correctly
• Accolades
• Where are we going next
History

- 1990’s Chip Sealing Was Dying
- Great variability in performance
- No guarantee of success
- Locals believed in value of chip seal at PMT
What was done

• LRRB fund position to study chip sealing
• Worked on developing design method
• Wrote the Seal Coat Handbook
• Worked on implementation
  – Training
  – Support
  – On going research
What was done

• Updated specifications
  – Changed pay items
    • Gallons / Square Yard
  – Improve materials
    • CRS-2p
    • Flakiness Index
    • Gradation
What was done

• Made Contractor responsible for vehicle damage
• Developed and implemented fog sealing of chip seal
• Developed methods for dealing with pavement markings
Dealing with Pavement Markings

• Removal by grinding
  – $1.00 + linear foot
• Pre treatment them with emulsion
  – $0.05 linear foot
Results

• Less vehicle damage
• Less flushing
• Almost no snow plow damage
• Increased life of chip seal
  – From 5 to 7 years
  – 10 to 15 years
• Cost has not increased above inflation rate
Chip sealing higher ADT roadways
Benefits of doing it correctly
DC(T) Results: TH-56

TH56: DC(t) Data @ -24°C

Higher fracture energy is better
Ride Data

TH 56 IRI Average

- Control Section Paved 1999
- Chip Sealed 2004
- Expon. (Control Section Paved 1999)
- Expon. (Chip Sealed 2004)

R^2 = 0.9609
R^2 = 0.9131

Crack Repair Done

5 Years
Control Section Never Chip Sealed
Last Section Chip Sealed 2004
Accolades

• Article in FP² Pavement Preservation Journal
  – “Penetrating Emulsion, Double Chip Seal Saves Unpaved Road”

• TRB Journal
  – “Research Pays Off, Effective Use of Chip Seals in Minnesota”
Accolades

• New AASHTO Specification on Chip Sealing is modeled after MnDOT’s Specifications
• Other State and FHWA reference MnDOT Seal Coat Handbook and Specifications
• Requests from all over USA to talk about Chip Seals
Where Are We Going Next
Where Are We Going Next

• Using micro milling to improve ride before chip sealing

• Using chip seals to reduce cracking in HMA overlays
  – Texas under seal (Bituminous under seal treatment)

• Developing chip seals at method to lightly surface low volume roadways, and shoulders
Where Are We Going Next

- Studying new methods, material, and equipment
- Continuing education and training
- Starting another long term aging study in partnership with State Aid Office
Where Are We Going Next

- Working with NCAT and member states for North region PM study
- Working on faster curing asphalt emulsions for fog sealing
Developing Faster Setting Emulsion
CFS-1h
What is it

• Same base asphalt as CSS-1h
• Uses Rapid Set emulsifiers
• Designation CFS – 1H
  – Minimum 30% residual asphalt
  – Not diluted in field
  – Pen range 40 to 90 pen
  – Sieve 0.1% max
• Cost similar to diluted CSS-1h
Value of Fog Sealing
Why Fog Sealing Shoulders (Picture taken in 2009)

Fog Seal applied 2001
Fog Sealing still working after 4 years
Thank You