Whitetopping Assessment Project
- Preliminary Findings
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Agenda

- Reason for study
- Study tasks and timeline
- Literature search results
- Project database
- Preliminary Findings
- Associated research
Acknowledgements

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• MnDOT Concrete Office
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Reason for Study

December 18, 2014 –
MnDOT Operations Division Managers meeting:
A plan to deploy more whitetopping projects across the state was discussed and approved.

Goal: 20 projects over the next 4 years
Statewide Whitetopping Performance Assessment Study

- Review performance in Minnesota
- Identify best practices for design, construction, and maintenance
- Develop performance curves for MnDOT Pavement Management System

- Associated new study on improved project selection just getting underway
Study Tasks and Timeline

- Task 1 - Literature search and project database (Aug 2015)
- Task 2 - Field condition survey – Part 1 [AET] (Sep 2015)
- Task 3 - Data Analysis – Part 1 (Dec 2015)
- Task 4 - Interim Report (Mar 2016)
- Task 5 - Field condition survey - Part 2 (Sep 2016)
- Task 6 - Data Analysis – Part 2 (Dec 2016)
- Task 7 - Draft final report (Jan 2017)
- Task 8 - Final report (May 2017)
Literature Search Results

• 27 references related to thin or ultrathin whitetopping
    • Tennessee, Georgia, Florida, Iowa, New Jersey, Missouri, Minnesota, Brazil
  – 2004: NCHRP Synthesis 338 (national study)
  – 2005-2014: Whitetopping performance reports
    • CPTech Center - 2014
    • Illinois – 2014
    • Louisiana – 2014
Literature Search Results

• Common observations
  – Difficult to get comprehensive performance information
    • Local projects not routinely measured
    • “Snapshot” survey at time of study
    • Most projects very young
    • Many “experimental” sections (pushing limits)
    • Main metric: % panels cracked
    • Virtually no ride quality data reported

  – Project selection is important
    • Majorities of distresses caused by permanent deformation of underlying asphalt
• Common observations (con’t)
  – Distresses linked more to traffic than environment
    • Longitudinal and transverse joint faulting (magnitude rarely reported)
      – Hypothesized mechanism proposed in NCHRP Synthesis 338
    • Reflective cracking not major issue (winters too mild?)
    • Some reports of “shifting” panels
    • Little mentioned on benefit of sealing joints
    • Illinois likes fiber-reinforced concrete for overlays

  – Limited reports on repairs to whitetoppings
    • Timing and performance not reported
Literature Search Results

• Common observations (con’t)
  – Performance curves
    • Crack development with time
    • Correlation with performance index (PCI) and traffic
    • Louisiana reported on 13 year-old projects
    • MnROAD data available
Literature Search Results

• Conclusions
  – Most performance reports based on young sections
  – Thinner whitetoppings designed for no more than 20 years of service
  – Thicker (5”+) overlays show very good performance after 10 years
    • Based primarily on % cracked panels
    • Ride quality not reported
  – Joint faulting commonly reported for larger panels and heavy truck traffic
  – Overall few negative comments in reports
Literature Search Results

• Conclusions

*Developing performance curves will be challenging due to lack of older projects in Minnesota*

*(MnROAD data will help!)*
Assessment Project Database

• 26 projects identified in Minnesota
  – Does not include MnROAD or other MnDOT test sections

• Logistics
  – 5 MnDOT projects
    • TH30 (1993)
    • TH212 (2009)
    • I-35 (2009)
    • TH56 (2010)
    • TH24 (2014)

  – 21 County projects (oldest built in 2009)
Assessment Project Database

• Logistics (con’t)
  – 19 projects with smaller panel lengths (6’ most common)
  – 3 projects with 10-’12’ panel lengths
  – 4 projects with 15’ panel lengths (all with doweled joints)
  – PCC thickness ranges from 4” to 8”
  – Remaining asphalt thickness from 3” to 14”
  – 9 projects with unsealed joints
  – No major projects with structural fibers(?)
    • MnROAD Cells 160-162 (2013)
Initial Visits and Data Collection (Task 2 Sneak Peek)

- Data collected on 21 projects
  - GPR for thickness variation (AET)
    - TH24 MnDOT GPR in 2014 [Core samples in future]
  - Profiled for IRI (AET)
  - Initial visual distress survey (MnDOT)
  - 3 core samples
    - Assess bond quality
    - GPR thickness calibration
    - HMA assessment (future)
Preliminary Observations

• Most projects are good to very good condition
  – Still “young”
  – Some longitudinal cracking
  – A few buckled panels (McLeod County)

• Little transverse reflective cracking
  – I-35 cracks remain tight
Preliminary Observations

• Faulted transverse joints in projects with heavy truck volumes/loads
  – Attempts to match overlay joints to underlying HMA cracks seems to lead to early faulting
    • Full-depth vertical movement
  – With smaller joint spacings, not all joints appear to deploy
  – Noticeable faulting on TH22 Olmsted County project
    • 4 years old, 12 ‘x12’ panels, undoweled joints
    • Very heavy truck volumes
    • No cracked panels

• Little to no maintenance on most projects
Preliminary Observations

TH22 Olmsted County, Age=4 yrs
Preliminary Observations

TH30 Amboy – 22 years old
Preliminary Observations

CSAH 46 Freeborn County, Age=6 yrs

3 dowels in OWP only
Preliminary Observations

I-35 North Branch, Age= 6 yrs
MnROAD Observations

• Whitetopping (2013)
  – Cell 162, 4” Macro fiber-reinforced
MnROAD Observations

- Whitetopping (1997)
  - Cell 96, No cracked panels, joint deterioration (too many fibers)
MnROAD Observations

- Whitetopping (2008)
  - Cells 114-914, undoweled 6’ x 6’ panels faulting (12’ effective)
Faulting Mechanism

• NCHRP 338 (Rasmussen and Rozycki), 2004
  – Hypothesis for joint faulting = permanent deformation of HMA

• Current TPF 5-269 UBOL design pooled fund
  (Vandenbossche), 2014
  – Observed permanent deformation in HMA interlayers in lab
Associated Research

• New Imetrum Video Gauge Equipment
  – Measures movement of high-resolution camera pixels
  – Will use to *characterize movement of concrete overlay panels*
    • Whitetoppings
    • Unbonded concrete overlays
Associated Research

• Video Gauge “Targets”
Associated Research

- Video Gauge Equipment
Questions and Discussion