



Research Pays Off Series

Safer, Smarter, Sustainable Pavements through Innovative Research



Whitetopping Assessment Project - Preliminary Findings

August 18th, 2015

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We all have a stake in **A  B**



Agenda

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



Acknowledgements

- Chago Heurta – Student worker
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- MnDOT, Q3, and County Traffic Control Forces
- MnDOT Concrete Office
- Tim Andersen - Technical Liaison



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

PCC

OLD HMA

- 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**
 - **1998-2003: Whitetopping performance reports**
 - 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



Literature Search Results

- **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)



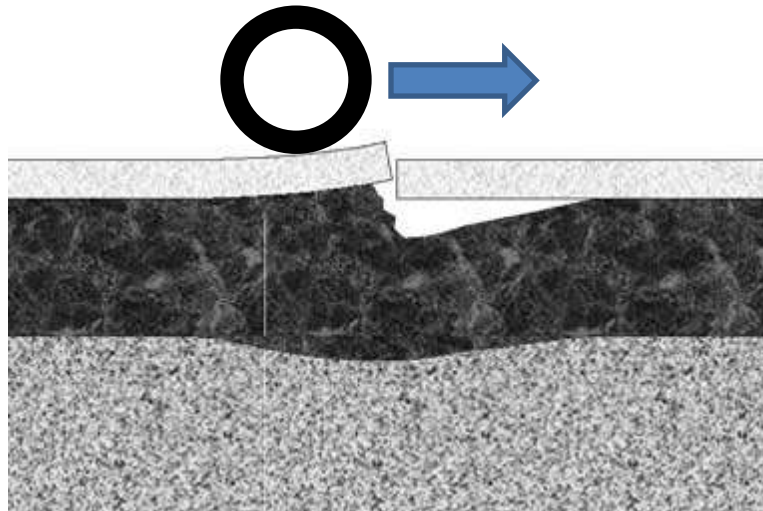
MnROAD Observations

- **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

