2018 NWPMA Conference

WSDOT Preventive Maintenance Study and HMA Class 3/8

Jim Weston, Pavement Implementation

October 25, 2018

Preventive Maintenance Outline

- Categories
- WSDOT Research
- Treatment Types

Maintenance/preservation is the single most cost-effective treatment we can do to extend pavement service life

Preventive Maintenance (PM)

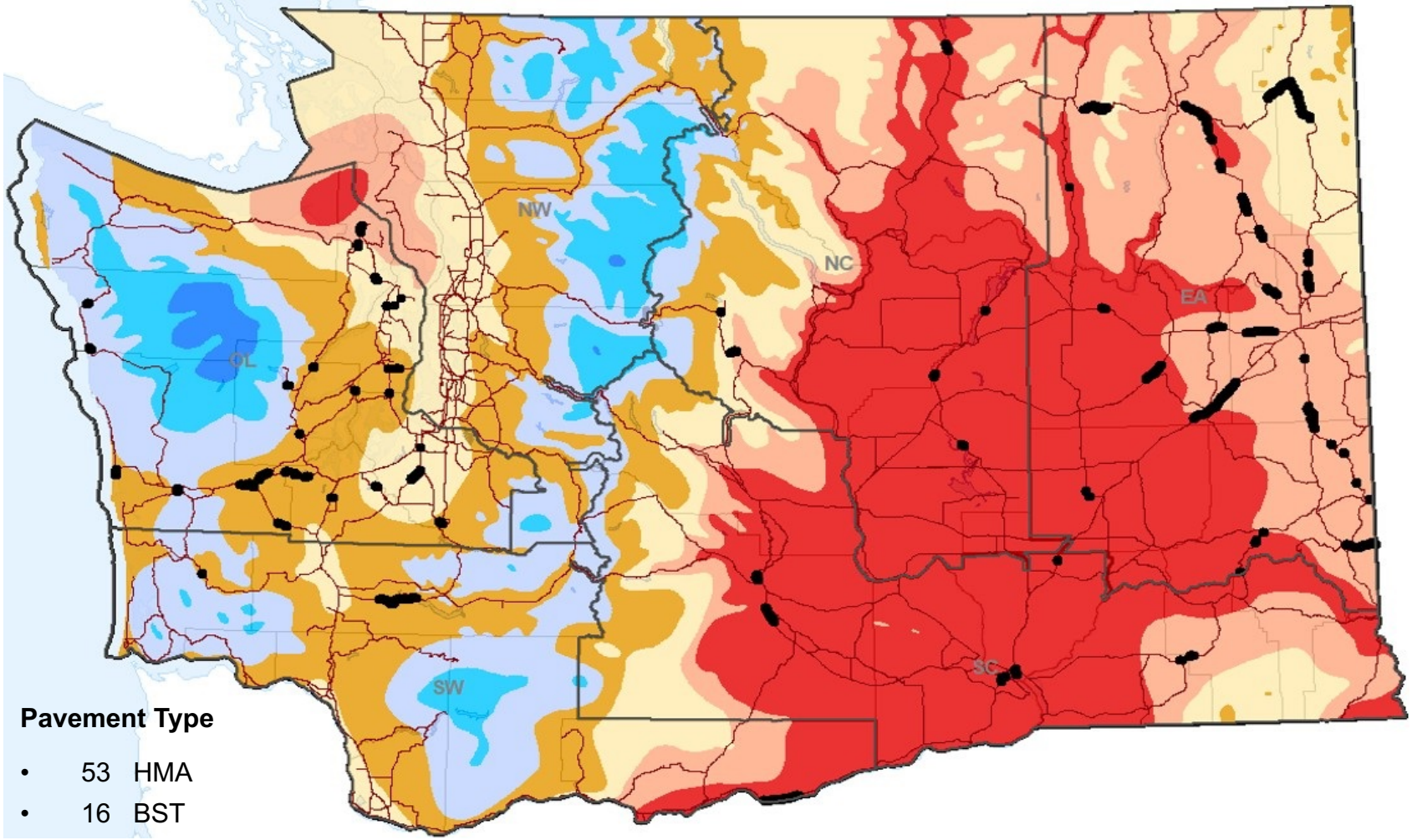
- Nonstructural surface treatments used for pavement restoration
- Prolong pavement life by reduced cost expenditure within a pavement life-cycle
  - Preservation can save 6-10 times in future rehabilitation costs
- Allows for pavements to remain at a reasonable performance level
- Defers costly rehabilitation
- Anticipated, planned work intended to extend pavement service life 1 to 6 years

PM Categories

- Strategic
  - Work performed early in the pavement life cycle
- Emerging
  - Work focuses on areas that are predicted to fail within the next year
- Reactive
  - Un-planned pavement repairs

PM Research

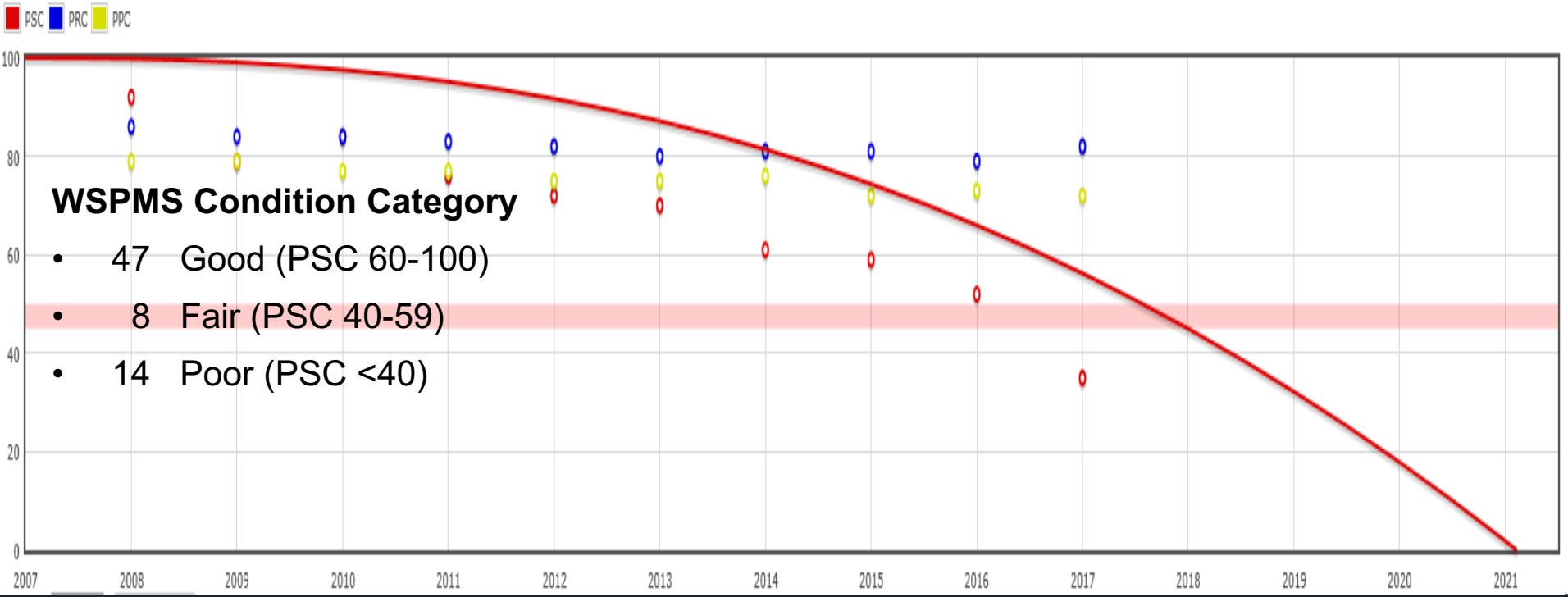
- Began in 2012, Completed 2017
- Various techniques
- Differing roadway distress, traffic volumes, climates
- Sites were “due” roadway segments selected (RME, Maintenance & Pavements)
- Maintenance applied the appropriate treatment
- HQ Pavements Section reviewed each test site (Fall and Spring)
- Performance of both the treatment and the surrounding pavement were summarized for each test site



Pavement Type

- 53 HMA
- 16 BST

Condition Categories



WSPMS Condition Category

- 47 Good (PSC 60-100)
- 8 Fair (PSC 40-59)
- 14 Poor (PSC <40)

Treatment Types

- 12 - Crack Sealing
- 4 - Chip Sealing
- 2 - Wheel Path Chip Seal Patching
- 5 - Wheel Path Chip Seal Rut Filling
- 2 - Crack Seal Plus Chip Seal
- 22 - Dig Outs
- 4 - Dig Outs Plus Crack Seal
- 6 - Dig Outs Plus Chip Seal
- 8 - Blade Patch
- 4 - Control (no treatment)

Crack Sealing

Full Lane Chip Seal

Wheel Path Chip Seal Patching

Wheel Path Chip Seal Rut Filling

Crack Sealing Plus Chip Sealing

Dig Outs

Dig Outs

Dig Outs Plus Chip Sealing

Preservation Treatment Life

Treatment	Expected Service Life Extension in years (max study)	Cost (1' length of pavement – 12' wide lane)
Crack Seal	3-4+ (5)	$1.14
Chip Seal (WP-rut fill)	2-5+ (4)	$2.76
Chip Seal (WP-patch)	4-6+ (4)	$4.44
Chip Seal (full lane)	4-6+ (5)	$7.08
Blade Patch	2-3+ (3)	$10.00
Patching (dig out)	4-6+ (5)	$12.49

Discussion of Results

- The preventive maintenance treatments of crack sealing, chip sealing and dig outs are capable of extending pavement life for five years or more
- We believe that wheel path chip seal patching and rut filling can last as long as a full lane chip seal
- Multiple treatments on a site is expensive and often not warranted to extend the life of the pavement
- It is best to apply preventive maintenance treatments when cracking first begins to exceed 1/4 inch in width
- Full lane chip seal or wheel path chip seal is also a good choice when the cracking extends over the entire lane or for alligator (fatigue) cracked wheel paths

Recommendations

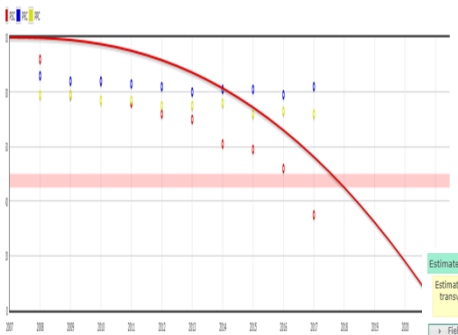
- Primary recommendation is that preventive maintenance techniques are best applied when distress is first observed
- When distress is confined to the wheel paths, the least expensive techniques of crack sealing and wheel path chip sealing are very effective treatments
- Full lane chip sealing can mitigate a number of pavement distress conditions, but must be constructed correctly
- Dig outs are recommended when the distress is severe but generally confined to small areas

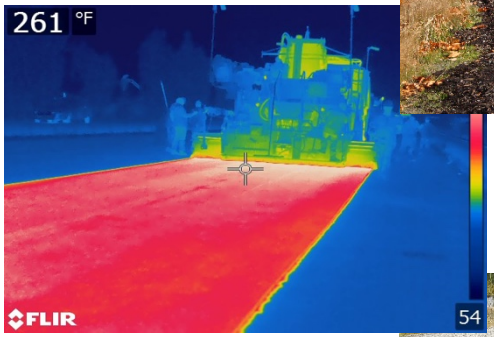
Cost-Effectiveness

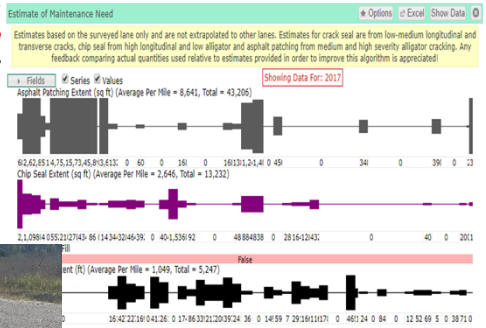
Maintenance/preservation is the single most cost-effective treatment we can do

- Costs for strategic preservation treatments performed by maintenance personnel run about $5,000-$20,000 per day.
- Pavement life extension is 2-6 years.

Pavement Life







3/8 Inch HMA Outline

- WSDOT Use of 3/8 Inch HMA
  - Performance Issues
  - Pavement Design
  - Compaction/Permeability
  - Results

Question

If you could increase pavement performance by paying an additional $0.50 per ton, would you do it?

Quality

- Construction
- Mix Design
- Pavement Design



Rutting

Fatigue Cracking

Fatigue Cracking

Raveling

Oxidation/Premature Aging

Permeability

Permeability

Permeability

Permeability

Permeability

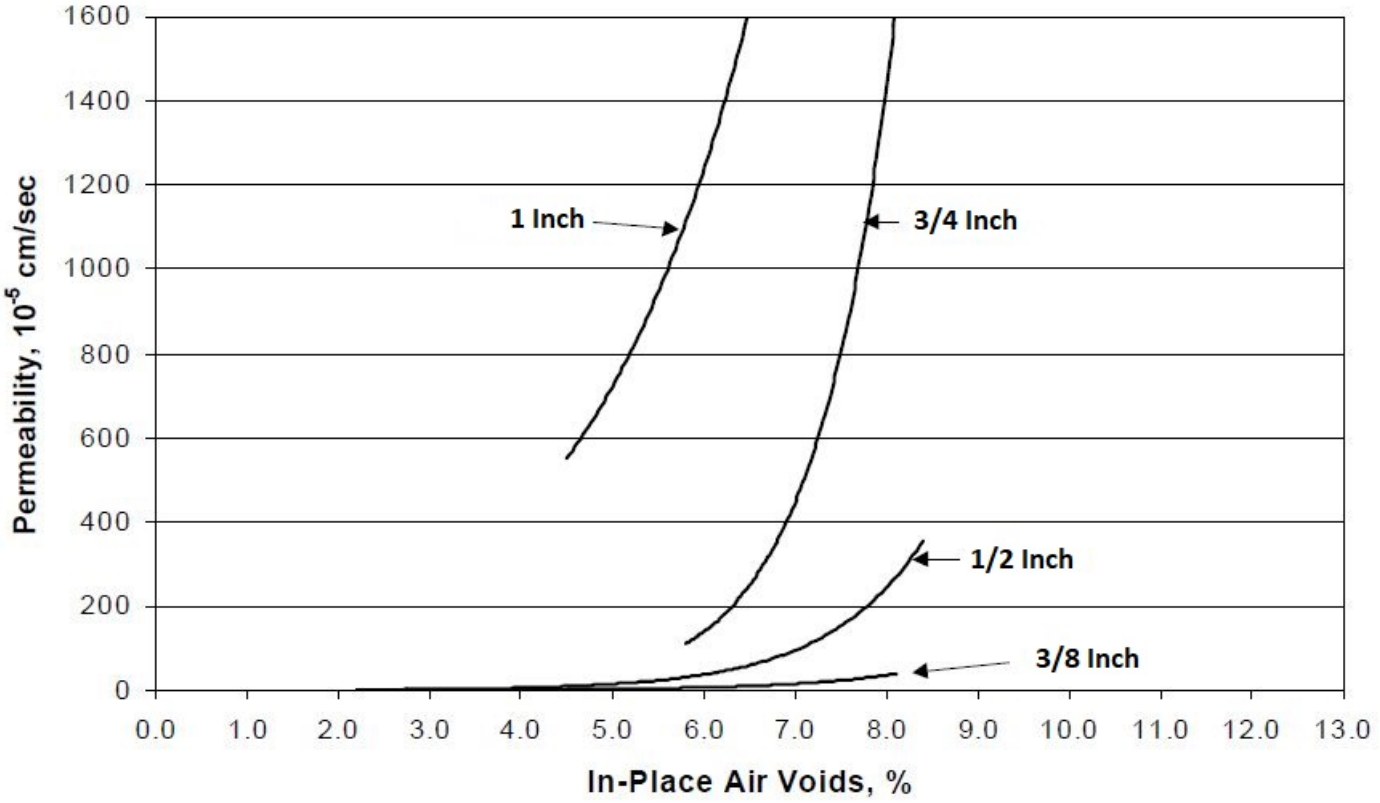
- The single most important factor that affects pavement performance in terms of
  - durability
  - fatigue life
  - resistance to deformation
  - strength
  - moisture damage

Compaction

- Effect of In-Place Air Voids on Service Life
- 1% decrease in air voids
  - Increases service life by a conservative estimate of 10%
  - Improve rutting resistance by 7.3 to 66.3%
  - Improve fatigue performance between 8.2 and 43.8%

Enhanced Compaction to Improve Durability and Extend Pavement Service Life: A Literature Review (2016)

Relationship of Compaction & Permeability

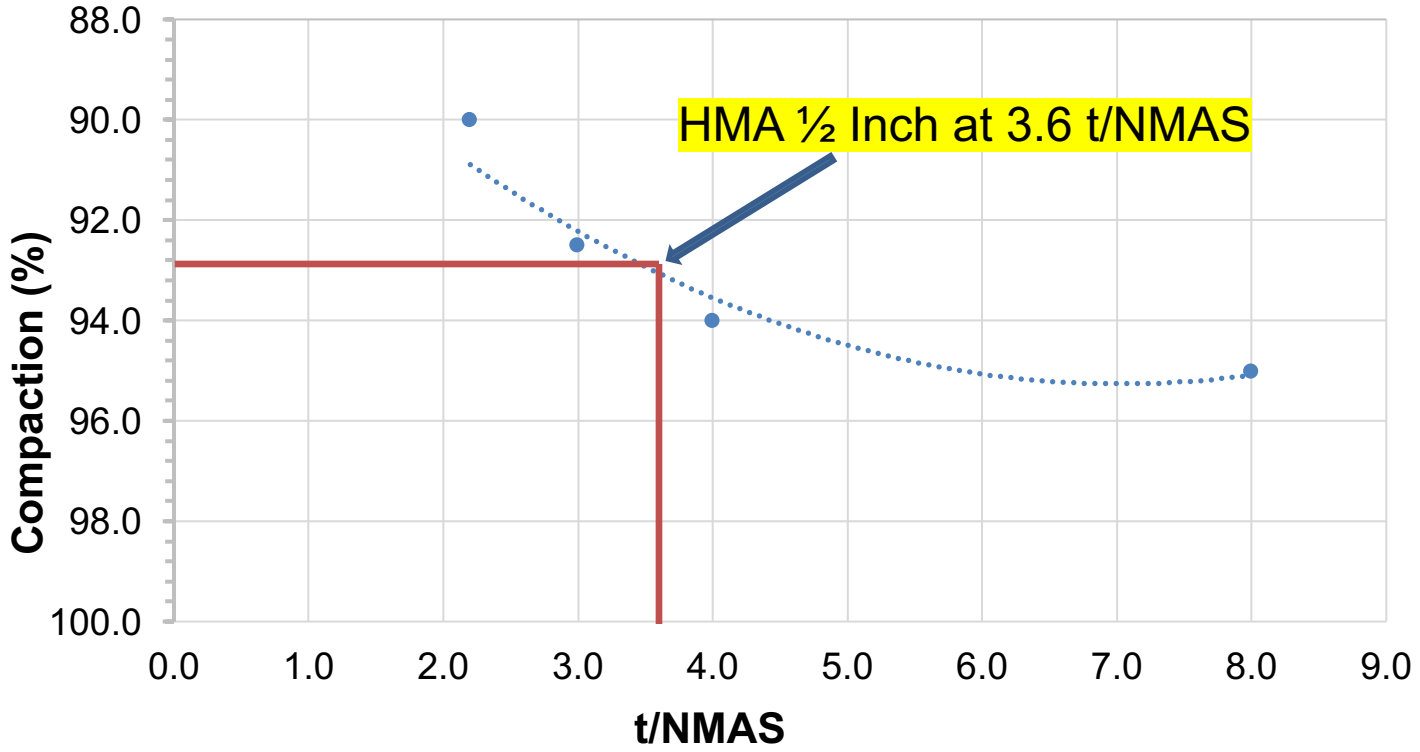


NCAT Report 03-02, *An Evaluation of Factors Affecting Permeability of Superpave Designed Pavements*, 2003

Pavement Design

- Currently 0.15’ (1.8”) grind/inlays
- HMA Class 1/2 Inch
  - Volumetric mix design
  - Increased interconnected void space vs HMA Class 3/8 Inch
  - Provides 3.6 t/NMAS

Lift Thickness – T/NMAS



NCHRP 531, *Relationships of HMA in-Place Air Voids, Lift Thickness, and Permeability Volume Three*, 2004

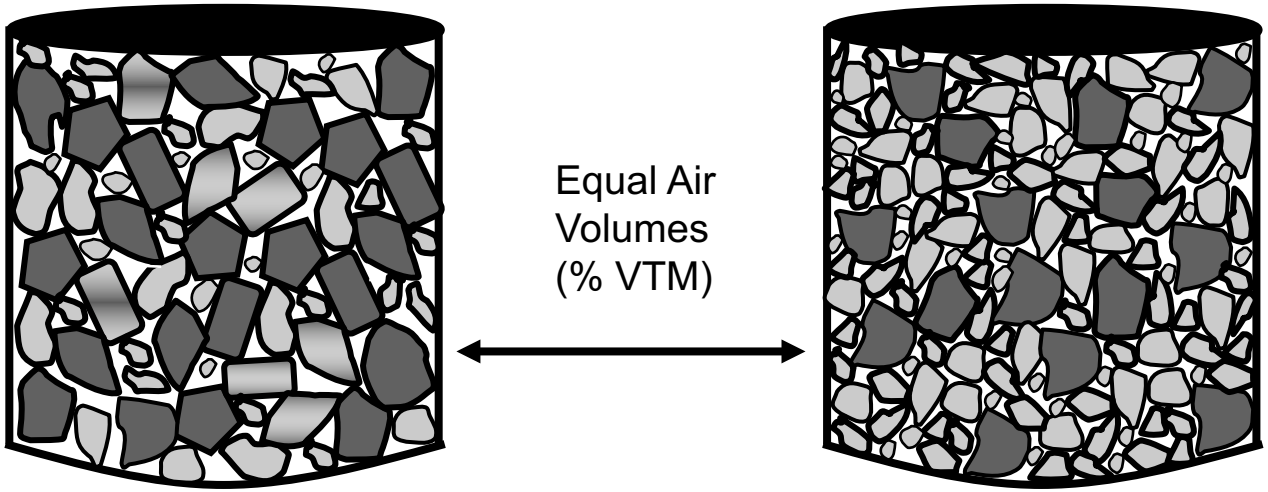
WSDOT Use of 3/8 Inch Mix

- Decrease permeability through pavement design
- Increase t/NMAS to better align with research findings
  - Provides 5 t/NMAS
- Increase surface area (smaller aggregate) resulting in slightly added binder
  - Decrease interconnected void space
  - Increased in-place density

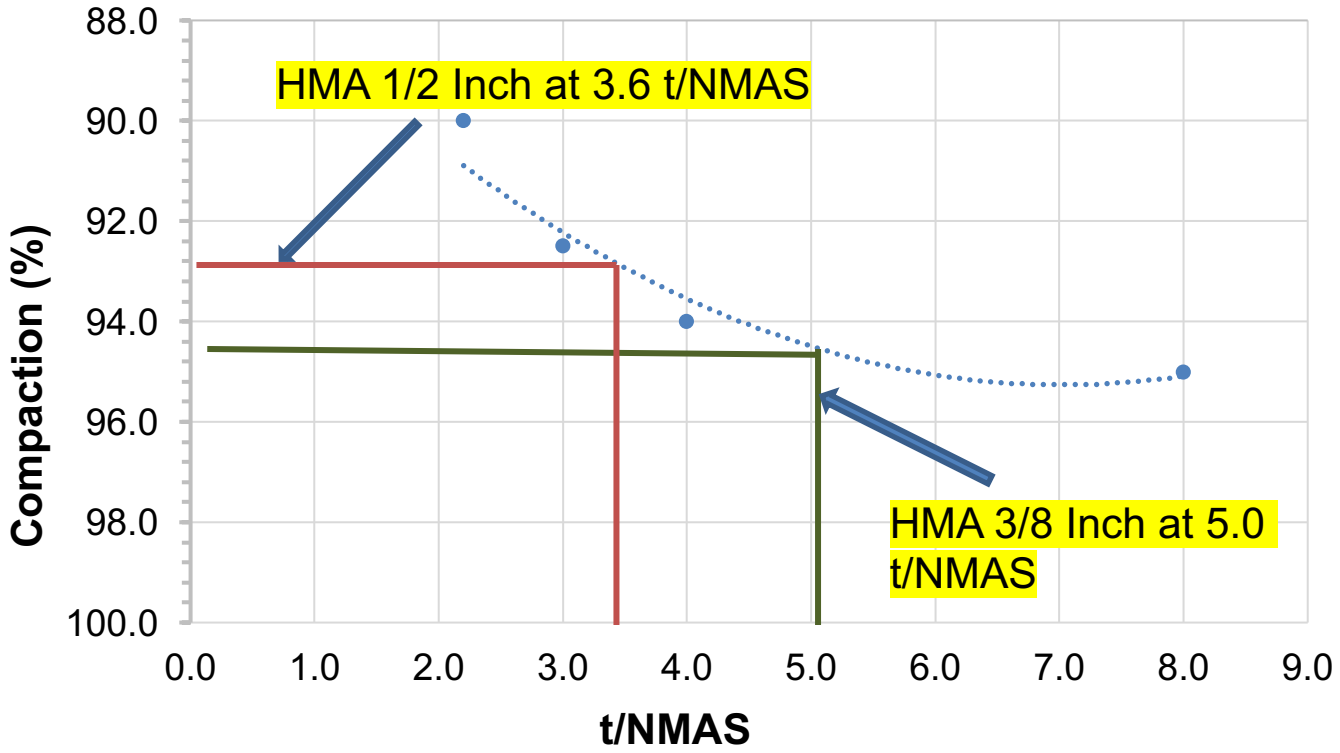
Lift Thickness – T/NMAS

HMA Class 1/2”

HMA Class 3/8”

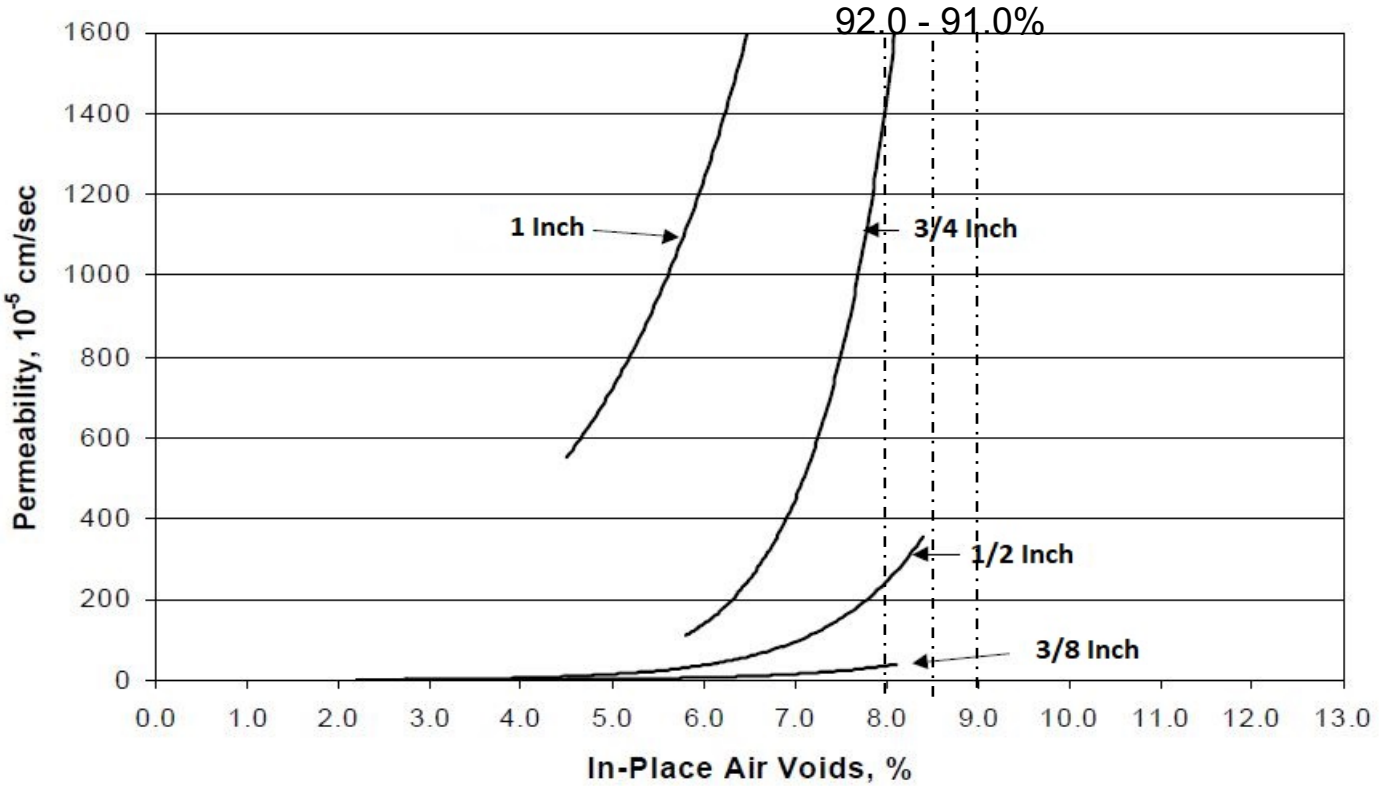


Lift Thickness – T/NMAS



NCHRP 531, *Relationships of HMA in-Place Air Voids, Lift Thickness, and Permeability Volume Three*, 2004

Relationship of Compaction & Permeability



NCAT Report 03-02, *An Evaluation of Factors Affecting Permeability of Superpave Designed Pavements*, 2003

HMA CL 3/8 Inch - Past

- 2008, SR 20
- 2009, SR 2
- 2011, I-90 (Pavement Repairs)
- 2012, SR 21
- 2012, SR 278
- 2012, SR 542
- 2013/2014, I-90 (East and West)
- 2015, **5** projects
- 2016, **9** projects
- 2017-18, **51** projects

Results so far…

- Increased t/NMAS fits well into our current design standard
  - 0.15’ (1.8”) grind/inlay
- No unusual rutting present
- Good density results (93-94%)
- Provides less permeable pavement
- Possibly quieter (long term)
- IRI may be lower (smoother roads)
- No decrease in friction results
- No increase in studded tire wear

Summary

- This method is being employed as a way to increase pavement service life (last longer)
  - Durability, fatigue life, resistance to deformation, strength and moisture damage
- Better align with national research findings related to NMAS
- Pavement design does not replace good standard practices
  - Material Properties (Mix Design)
  - Construction processes
- **Costing about $0.50 per ton**

References

- *Preventive Maintenance Study – Final Report (2018)*
  http://www.wsdot.wa.gov/research/reports/800/preventive-maintenance-study-final-report
- *Enhanced Compaction to Improve Durability and Extend Pavement Service Life: A Literature Review (2016)*
  https://trid.trb.org/view.aspx?id=1404151
- *An Evaluation of Factors Affecting Permeability of Superpave Designed Pavements (2003)*
  http://eng.auburn.edu/research/centers/ncat/files/technical-reports/rep03-02.pdf

Questions?