What Causes Stripping Under Chip Seals
What to Do About It

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Stripping Under Chip Seals

The Issues

- Some streets develop potholes 2 to 3 years after chip seals are applied
- Starts as small blisters
- Grows to ½” to 1” deep potholes the size of pie pans or larger

The Issues

- The wearing course seems to be destroyed
- Seems mainly to happen on curb and gutter streets

Hypotheses

- Observed high variabilty in density of cores taken from streets with issues
- Then developed theory that high air voids makes mix more prone to stripping then mix with proper density

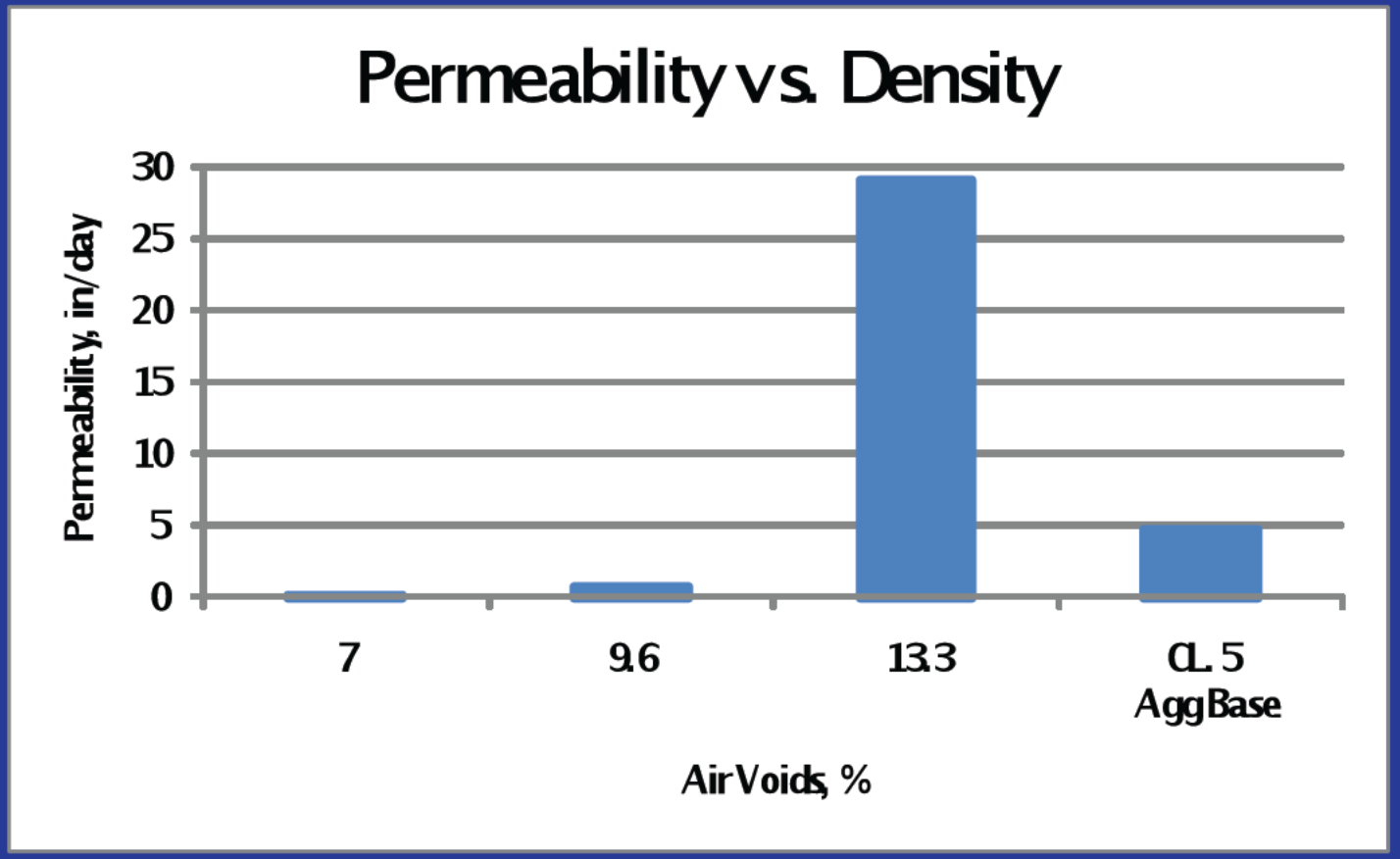
Task 1
Survey local agencies

- Over 60% reported stripping
- Seems to appear 2 to 4 years after first chip seal is placed
- Seems to happen more often on pavements that are older when they received first chip seal
  - 8+ years old or older

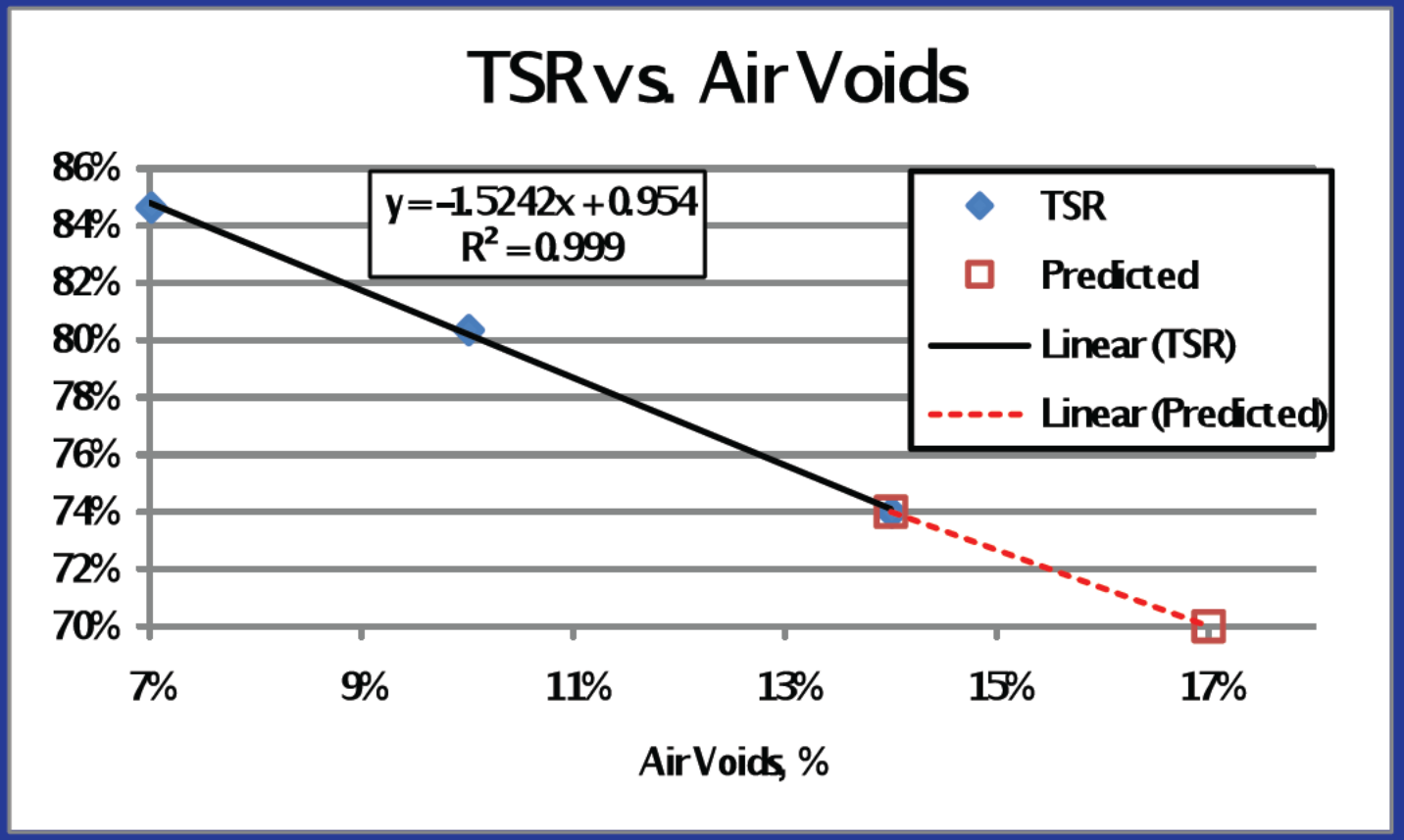
Task 2
Study testing methods

- Lottman Test
- Asphalt Pavement Analyzer
- Modified Iowa Boiling Test
- Lab permeability tester
- Made pucks up at 3 voids level, 7, 10, & 14%
- All testing methods showed that as inplace air voids increase the susceptibility to water damage also increases

Permeability vs. Density



TSR vs. Air Voids



Task 3
Field testing

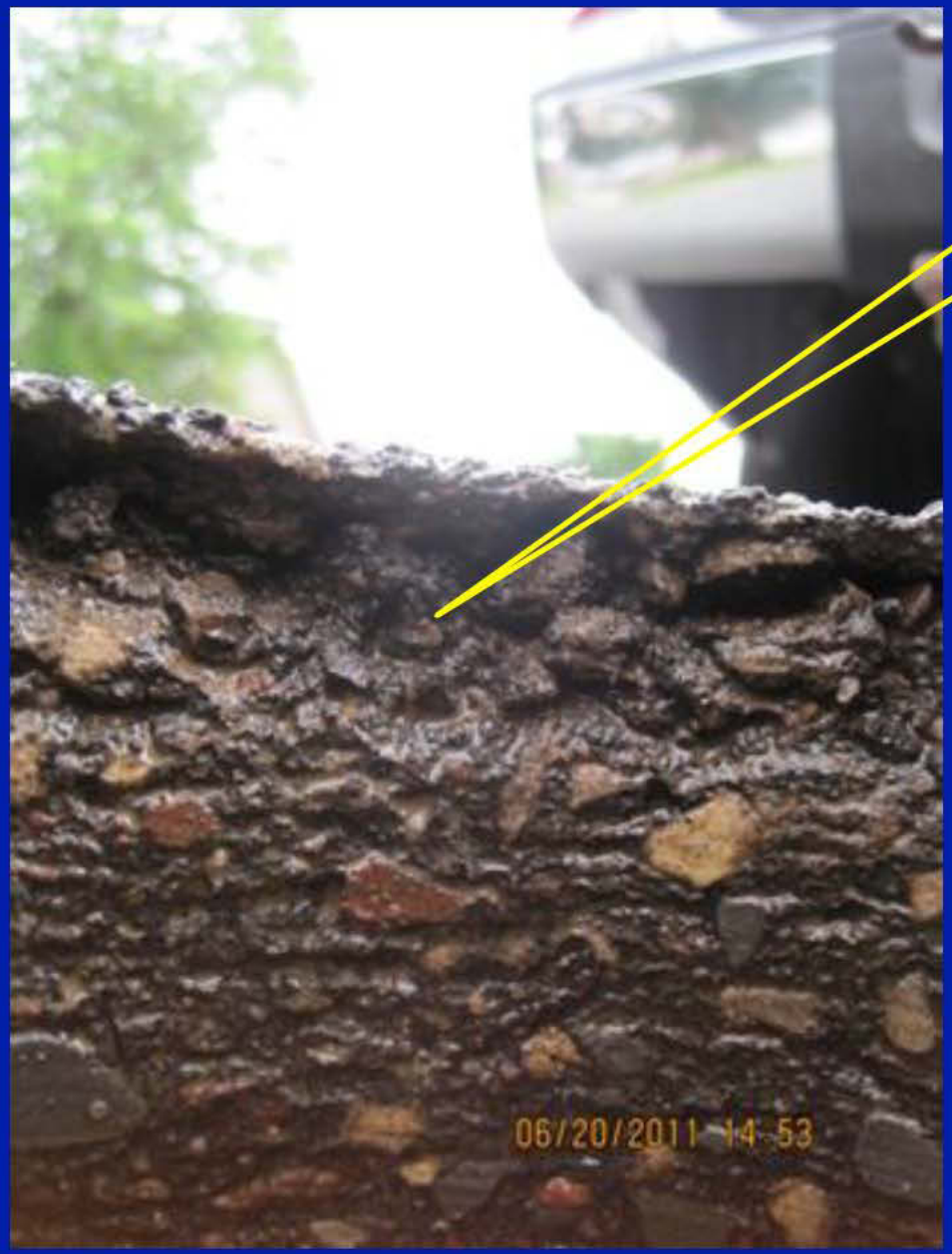
- Valid lab finding
- Develop method to determine if street should be chip sealed
  - Needs to be user friendly
  - Non-destructive

Nuclear Density Tester

Coring and Air Voids Testing

Lab Permeability Testing

Stripping


Area of Stripping
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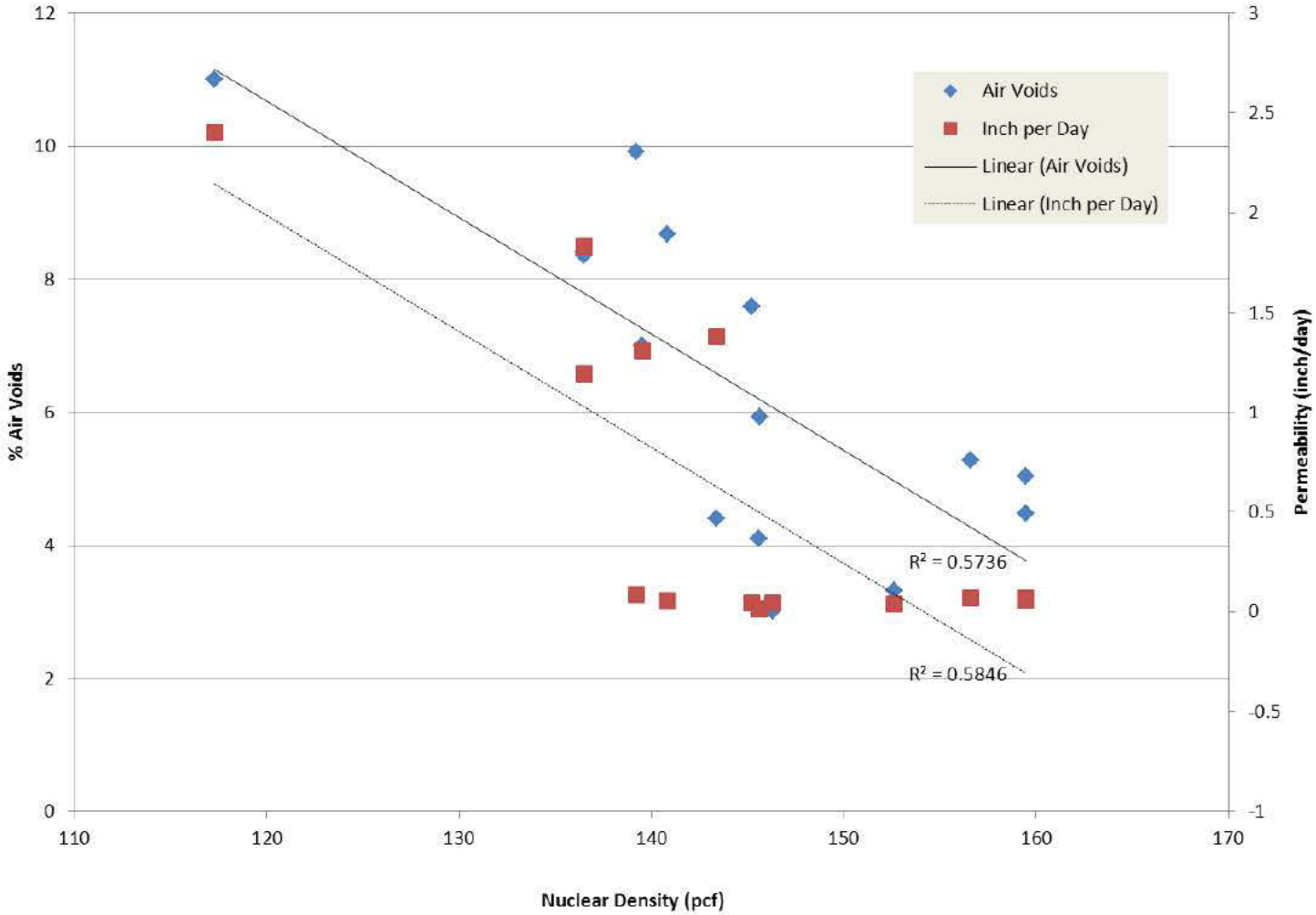
Comparison of Data



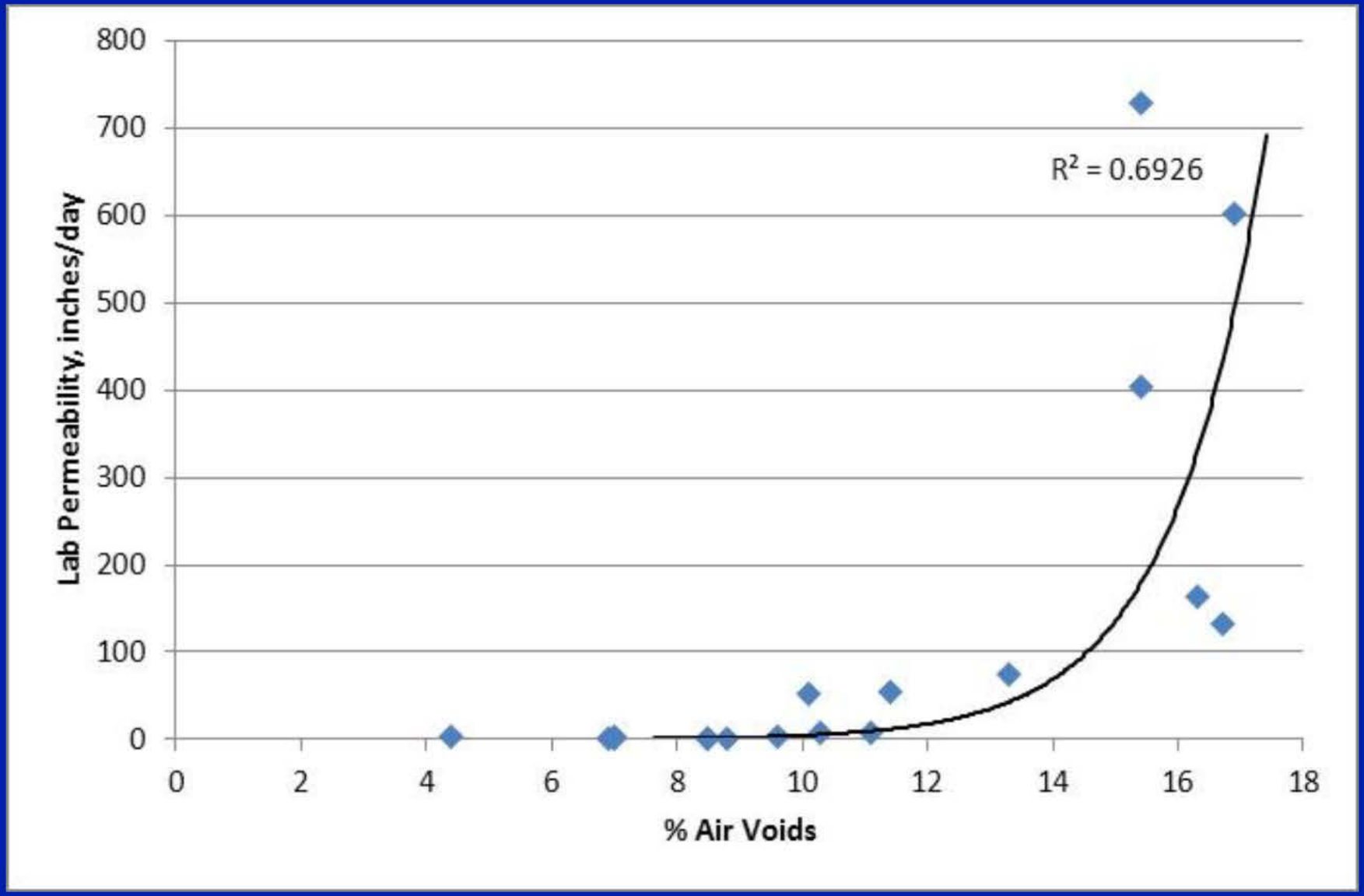
Task 4
Compare Construction Methods

- Ordinary compaction vs. specified density
  - Most Cities use ordinary compaction
- 2340 mixes vs. 2360 super pave

2340 Mixes	2360 Super Pave
Crushing	
Type 31 No crushing requirement	Level 2 30% + 4
Volumetric	
Air Voids	Air Voids
	4%
	VMA*
	AFT **
No TSR***	TSR Required
Compaction	
Ordinary Compaction	Max Density
Modified specified	Higher Requirements

Task 5 Analysis Data

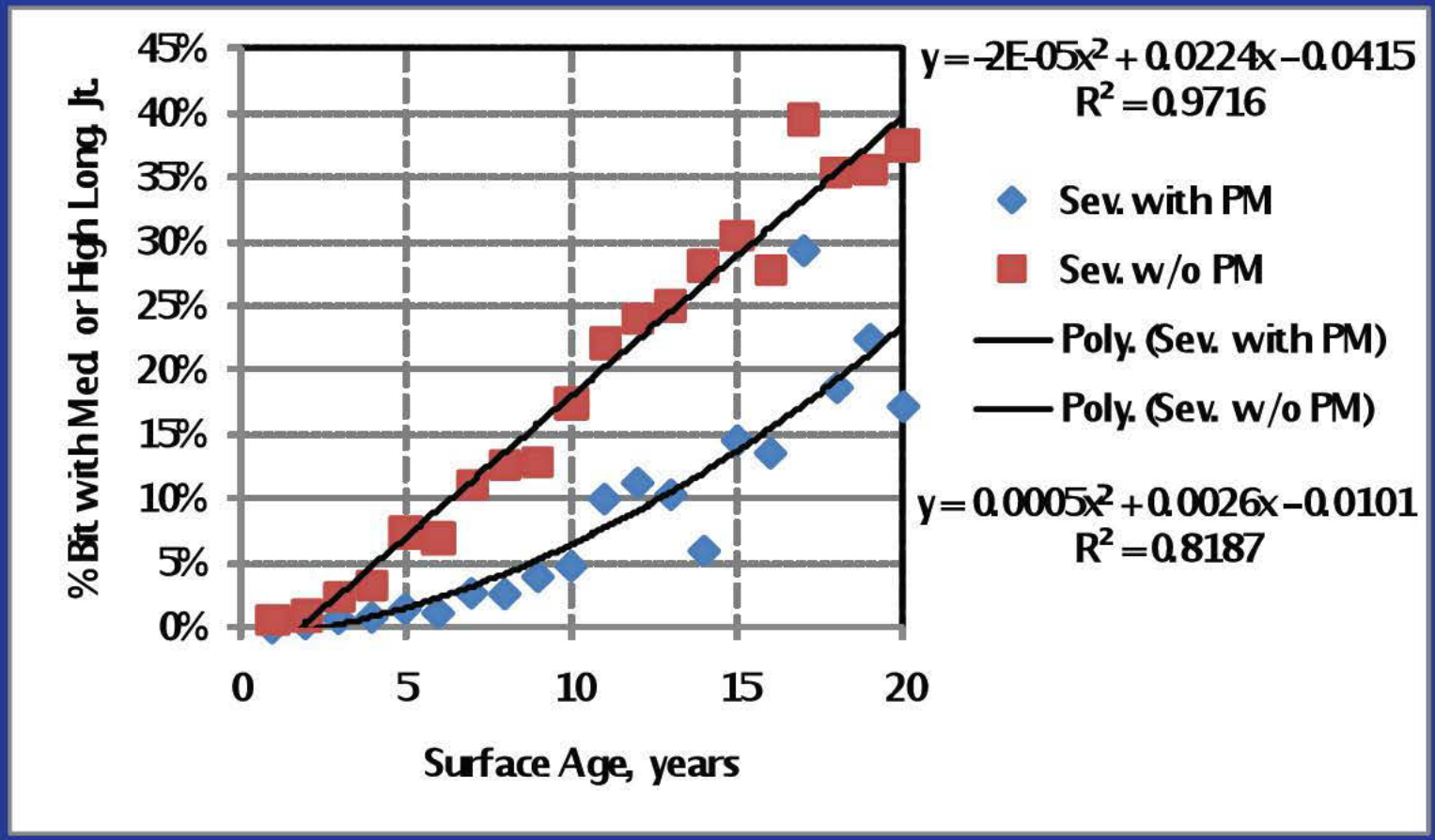
- Good correlation between all test method used
- Permeability increased greatly around 9% air voids
  - This corresponds with finding from other states


800
700
600
500
400
300
200
100
0
Lab Permeability, inches/day
R² = 0.6926
0
2
4
6
8
10
12
14
16
18
% Air Voids

Conclusions & Recommendations

- Stripping is caused by high air voids
- Streets seem to have high degree of variability of density
- MnDOT has similar issues on longitudinal construction joints
  - Air voids from 10 to 16%
  - Chip sealing is not cause of the issues

Effects Chip Seals on Construction Joints



Conclusions & Recommendations

- On new construction or re-paving
- Recommend switching from ordinary compaction to specified density
- Does not appear to increase cost of paving
- May increase cost of inspection
- Reserve right to pick coring locations

Conclusions & Recommendations

- Existing Streets
- Nuclear density tester will determine variability quickly
- Recommend chip sealing streets with less than 6 lbs. variability
- Chip sealing early in streets life seems to help

Conclusions & Recommendations

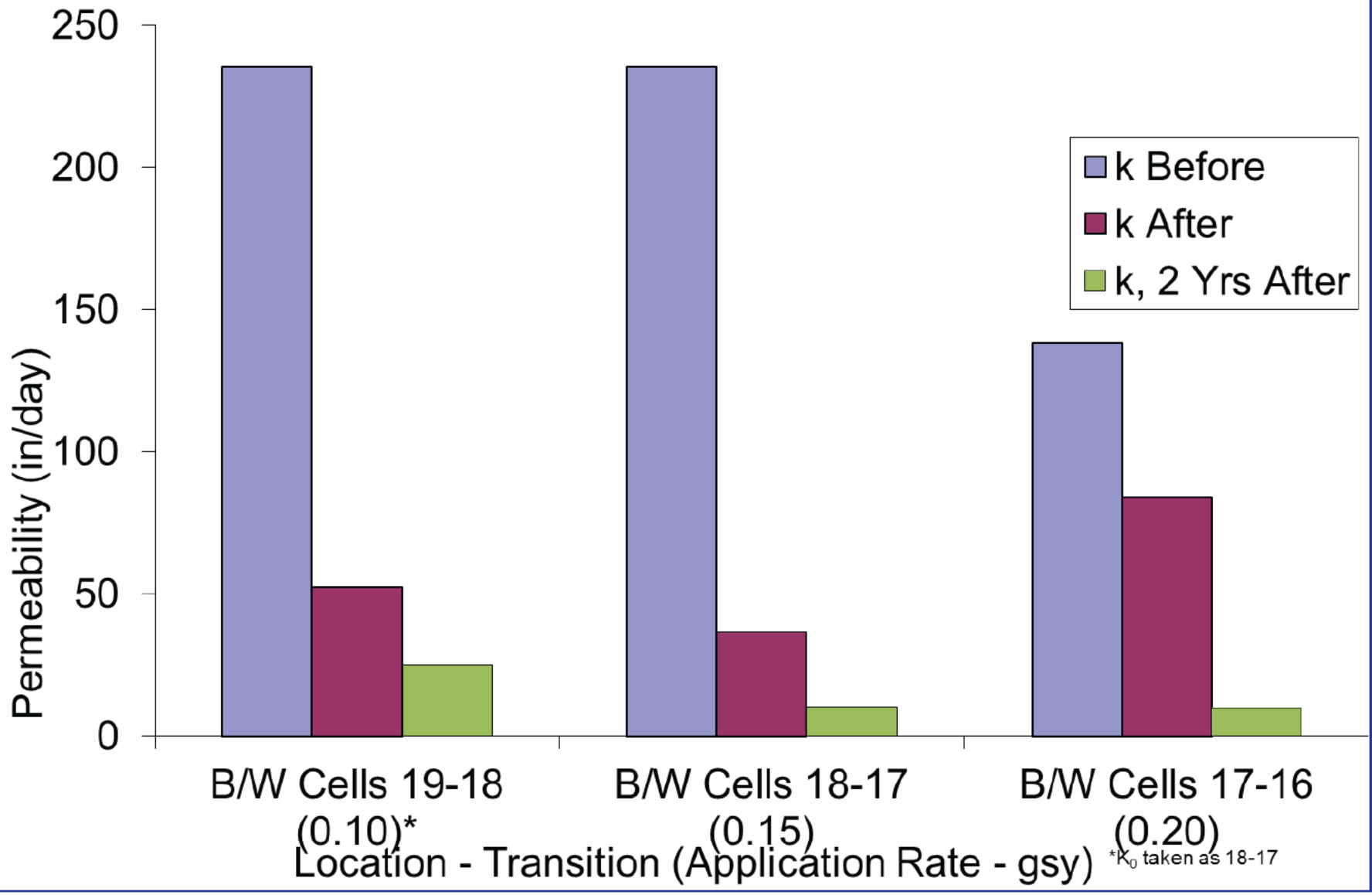
- Fog sealing may be an options
  - Seal water out
  - Allow water vapor to escape


NO
PARKING
OR
WATERING
MON-FRI
7AM - 7PM
08/28/2012 14:27

Next Steps

- Working of faster curing fog seal emulsions
- Emulsions that will stay black longer
  - Polymer modification
- Fog seal are still effective after they have turned gray

Css-1h Fog Seal Performance



Questions?

Thank You!