PennDOT Longitudinal Joint Density Efforts

February 5, 2014

Garth D. Bridenbaugh, P.E.
Pennsylvania Department of Transportation

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PennDOT's History at Joints

- In 2006, PennDOT specs required joints to be constructed according to a QC plan
- Many QC plans silent about joints
- No measurement of joint density
- Joint quality usually judged by smoothness across the joint
- Some performance issues

But, even visually good joints can bite!!!

Joint Issues in Past

Very costly solutions

How much longer would the road have lasted with a good joint?

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History of PA Joint Density Effort

- Pennsylvania began an effort to improve joint density in 2006-07 with study
- Began measuring joint density in 2007 directly on the joint
- Adopted a best practices (method spec) approach for 2008 construction

History of PA Joint Density Effort

- >1% increase in density in 1st year alone
- More was hoped for 2009 once everyone was comfortable with the new process

Longitudinal Joint Data Summary			
Year	Density Lots	Avg. Joint Density	Avg. Roadway Density
2007	18	87.8%	93.9%
2008	43	88.9%	94.1%

History of PA Joint Density Effort

- Slight increase in 2009 less than hoped
- By end of 2009 looking for higher density

Longitudinal Joint Data Summary			
Year	Density Lots	Avg. Joint Density	Avg. Roadway Density
2007	18	87.8%	93.9%
2008	43	88.9%	94.1%
2009	29	89.2%	94.1%

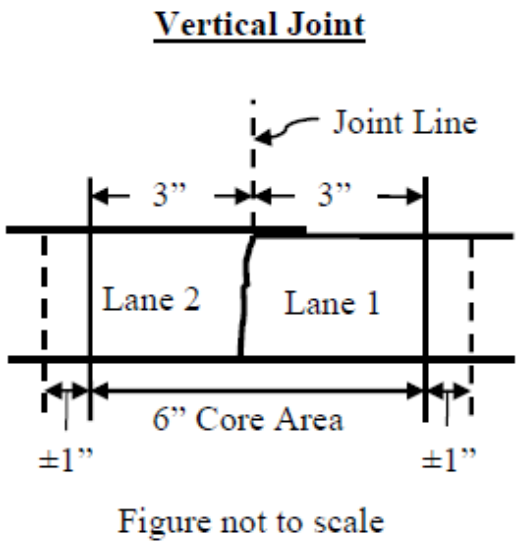
Keeping water out of our joints

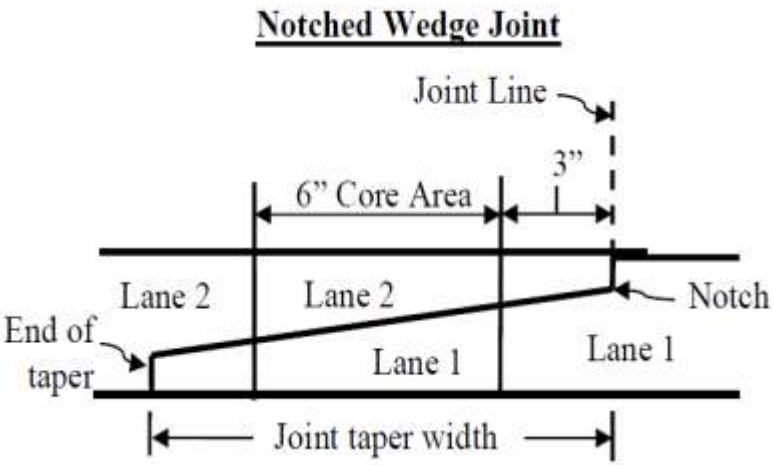
- Most research suggested that
  - densities should be about 92% to minimize permeability
  - Joint densities below 89 to 90% had an exponential increase in permeability
- Bottom line, we needed better joint density that we were achieving on many of the projects

Joint Density Incentive/Disincentive

- For 2010 PennDOT began looking to an end result joint density specification
  - Financial incentive for high density
  - Financial disincentive for low density
  - Contractor innovation to provide optimal joint densities (contractor chooses construction method)

How we sample joints





- The maximum theoretical specific gravity (Gmm) for each core is the average of Lane 1 and Lane 2

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Project Selection Criteria

Density Specification for:

- Surface courses
- RPS pavements (PA's highest level of projects)
- National Highway System
- 12,500 feet of testable joint
- Pavement on both sides of joint must be cored

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Joint Density Incentive/Disincentive

- Cores cut directly on finished joints every 2500 ft.
- 1 Lot = five joint cores (12,500 ft)
- Maximum Dollar Amounts
  - Incentive = $5,000/lot
  - Disincentive = $10,000/lot

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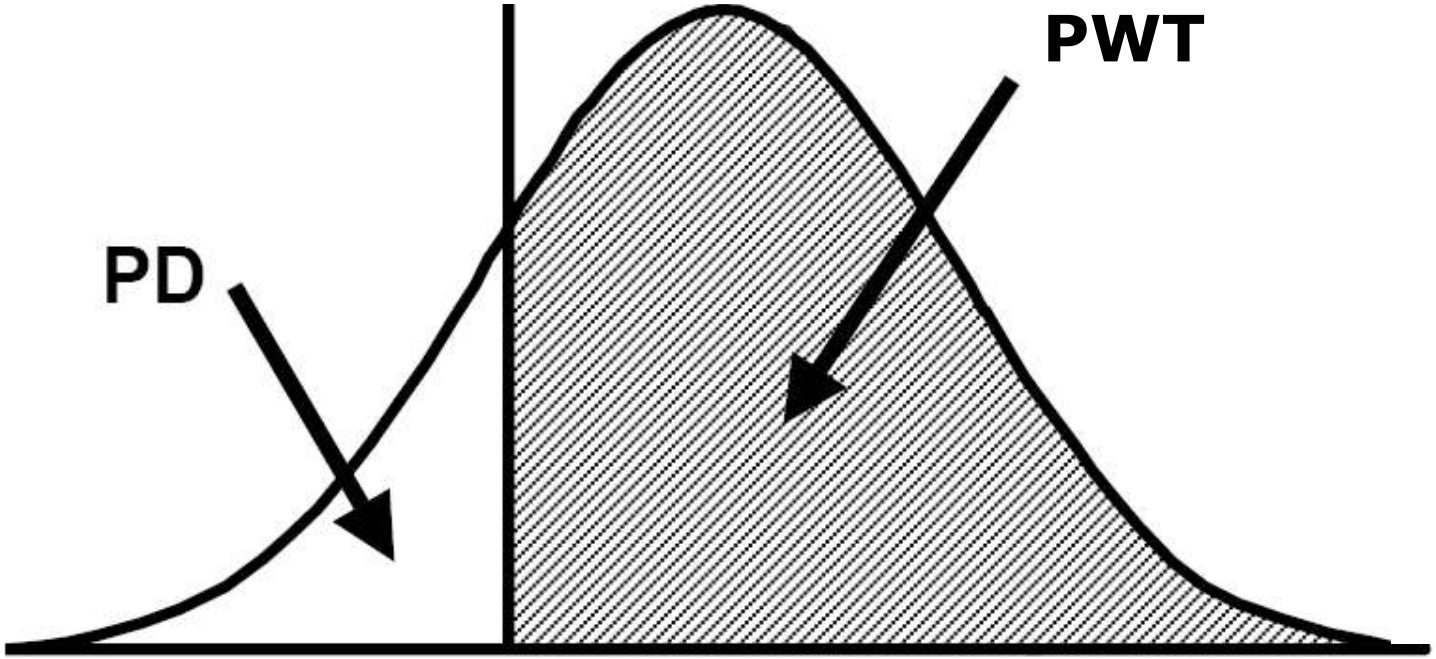
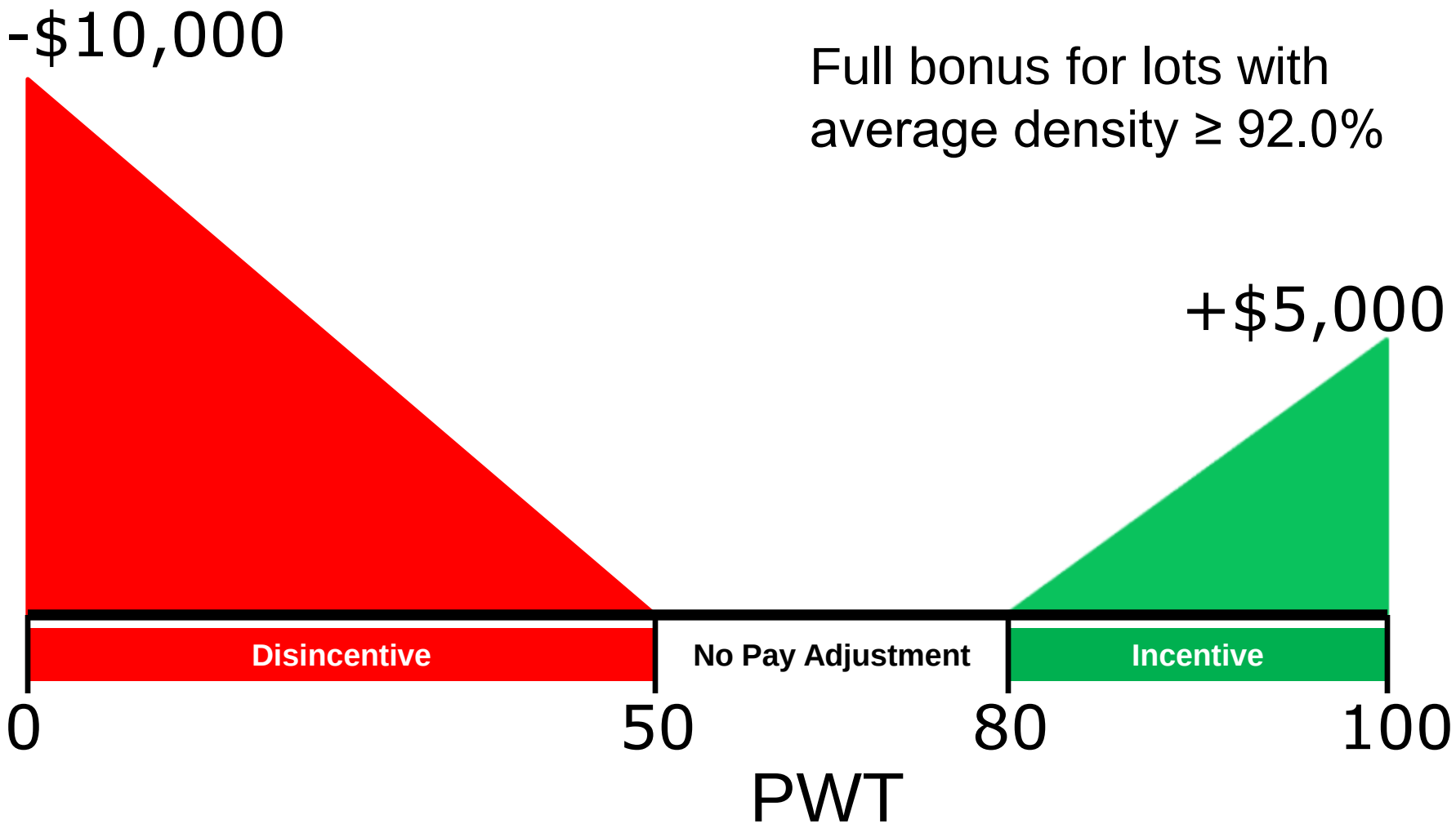
Graphic Illustration of PWT

Lower Spec Limit = 90% Gmm



Started at 89% lower spec limit, raised to 90% current

Impact on Lot Payment Summary



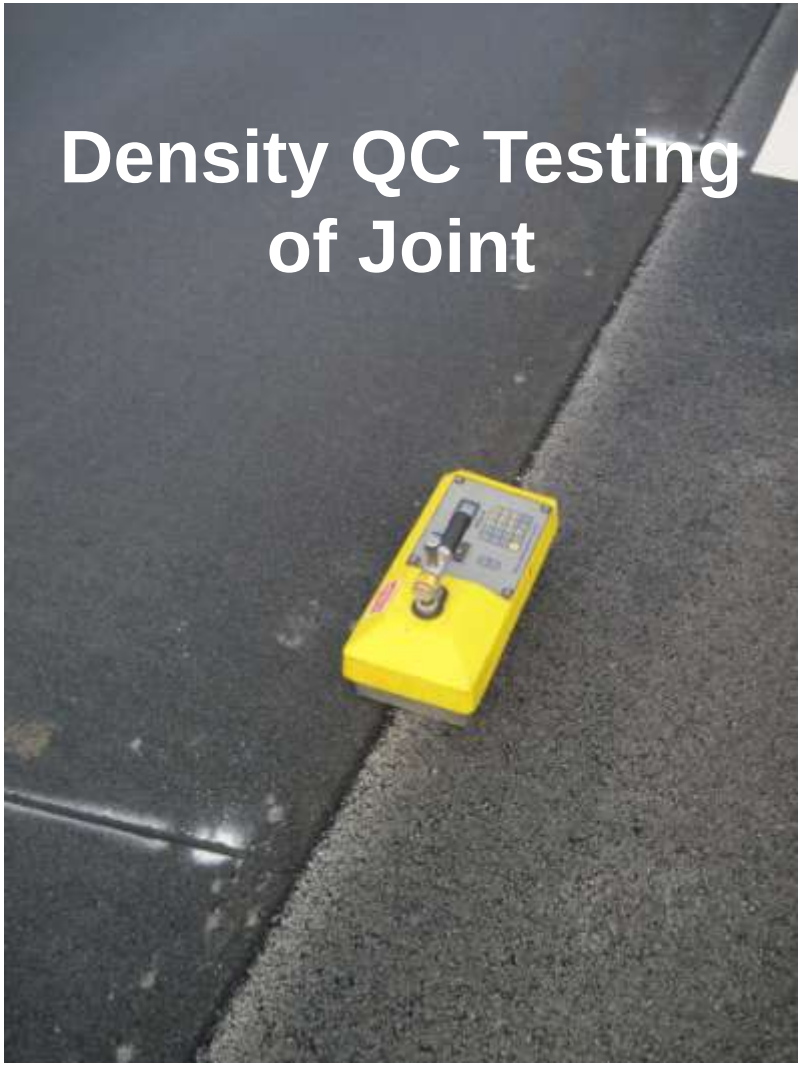
Corrective Action

- Lots with avg. density < 88% Gmm require corrective action
- Contractor must seal the joint with PG 64-22 at no cost
- Very few lots require corrective action

Contractor Innovation

Tandem pavers for a hot joint

Contractor Innovation



How Far Have We Come?

Longitudinal Joint Data Summary			
Year	Density Lots	Avg. Joint Density	Avg. Roadway Density
2007	18	87.8%	93.9%
2008	43	88.9%	94.1%
2009	29	89.2%	94.1%
2010	No data, transition to PWL spec.		
2011	137	91.1%	94.1%
2012	162	91.6%	94.0%
2013	168	91.4%	93.9%

Data analysis from 2011 - 2013

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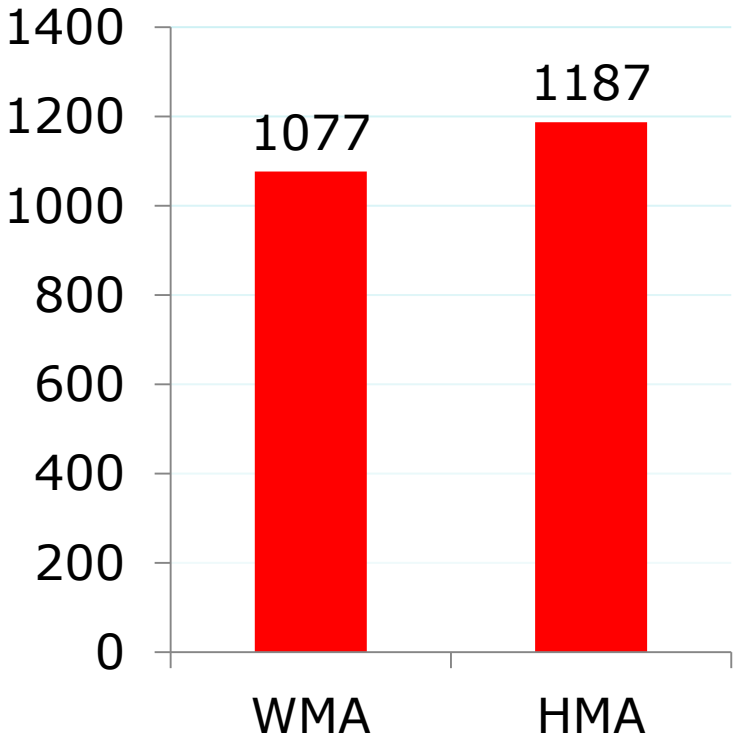
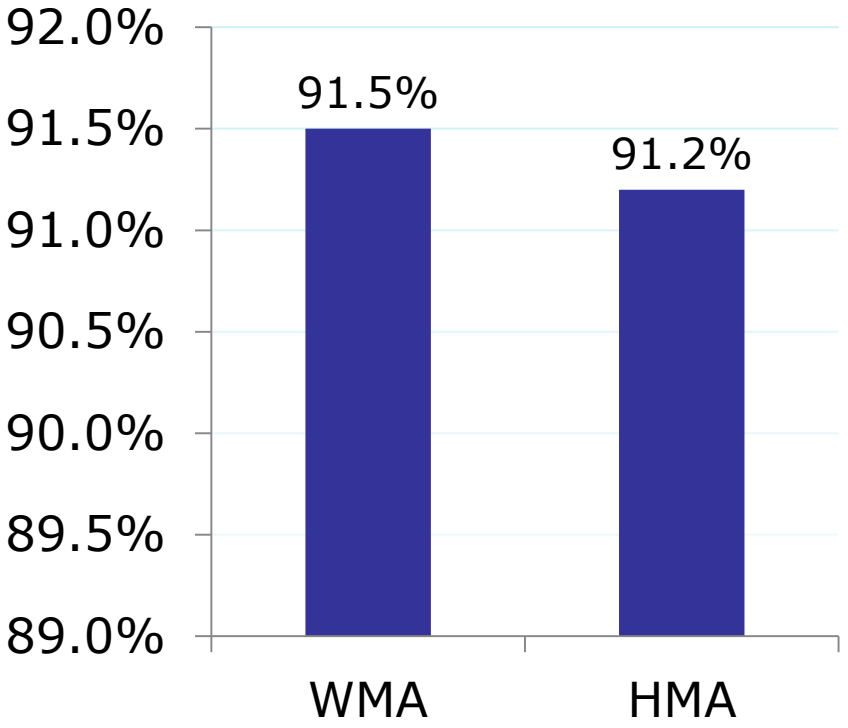
Warm Mix vs Hot Mix

2011-Present Cores



Average Joint Density



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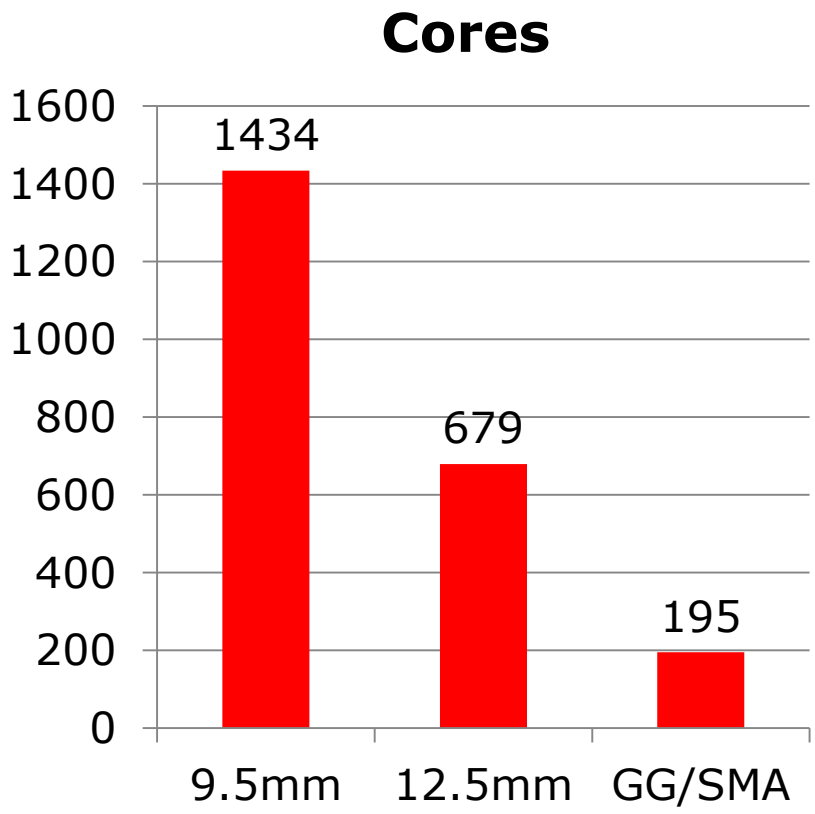
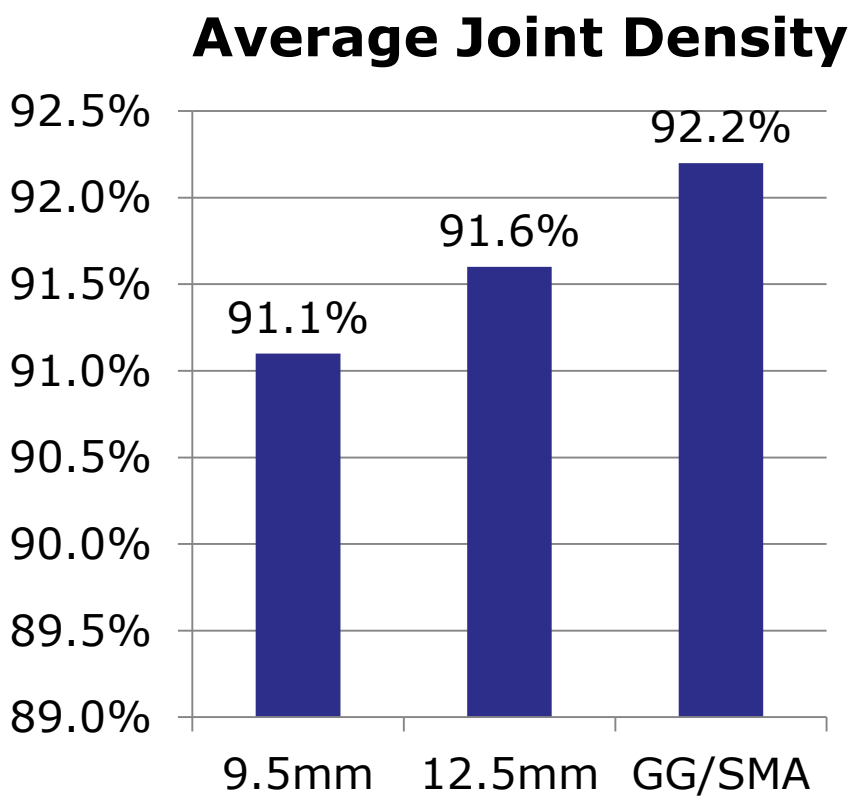
Mix Size and Type





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More 2011-13 Joint Density Info.

- 1,082 linear miles of joint tested
- 2,285 joint core samples
- 161 total projects
- 3.6% increase in joint density from outset
- Approx. $1,000 per mile

Notched Wedge Joint Core Hole

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Why Joint Density?

- Lower permeability reduces chance for moisture damage
- Higher density reduces the permeability of the pavement in place.

Joint Density Spec. Impacts

- Improved density is expected to lead to better long term performance
- Anticipated lower maintenance costs


Questions?
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