



**Contractor Actions on This Project
Impact the Industry**

**Asphalt Paving Association of Indiana
2013 Annual Summer Meeting**

July 21, 2013



William R. Vavrik, Ph.D., P.E.
Vice President & Principal Engineer

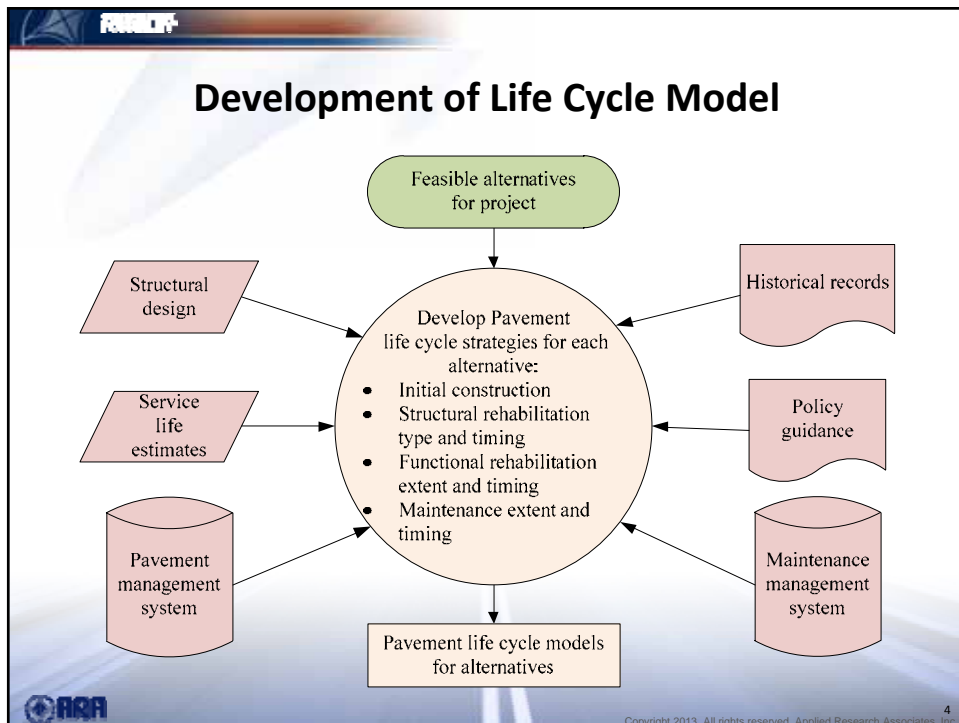
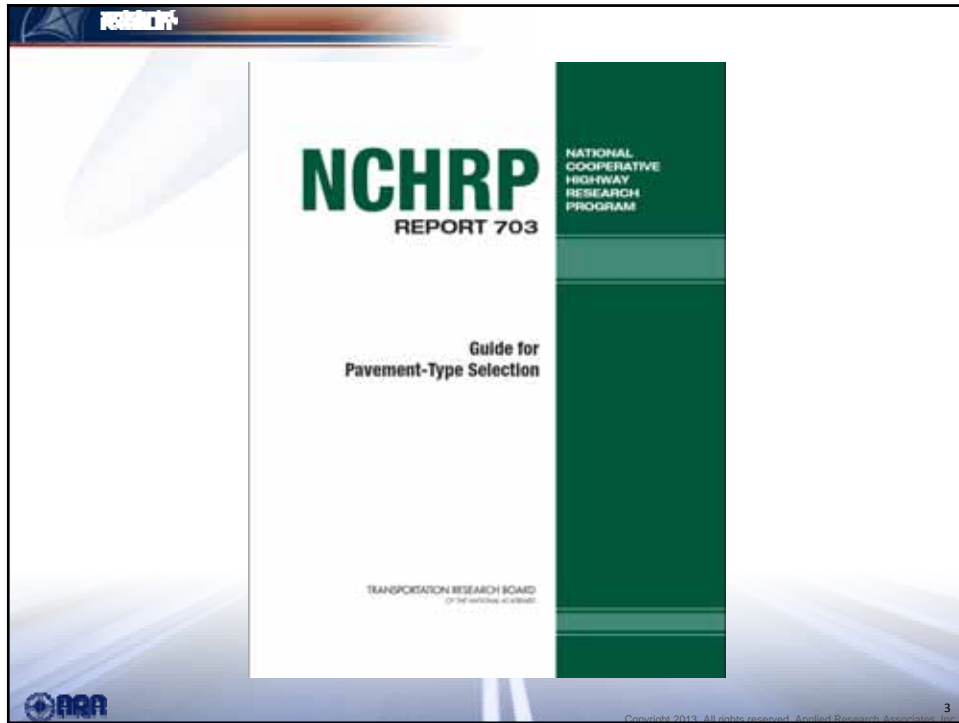


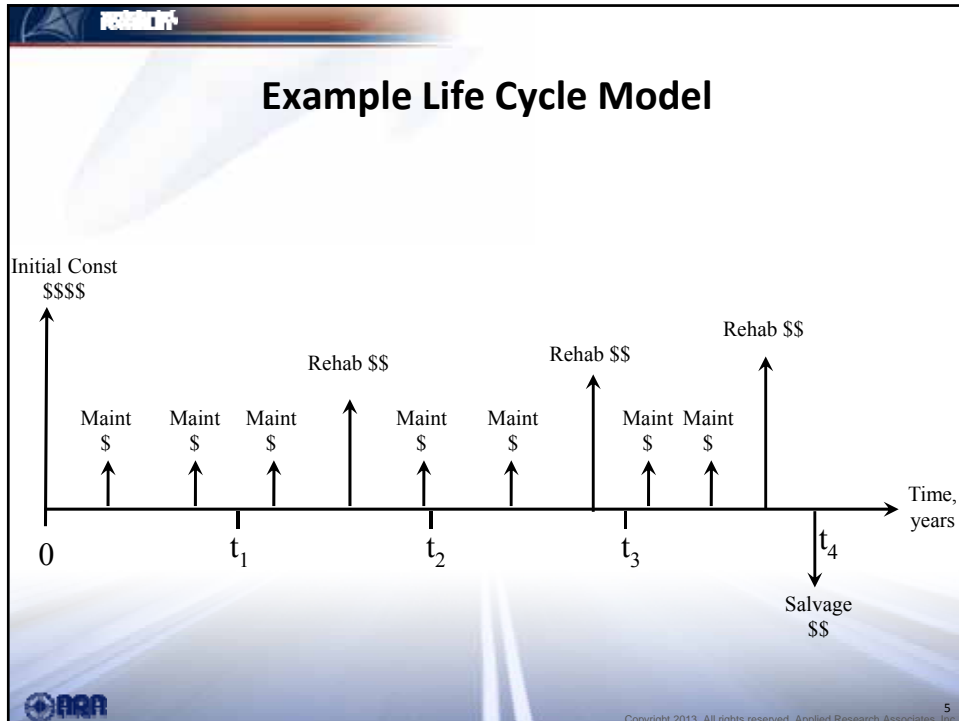
What we will cover

- ⊕ Pavement Type Selection / Alternate Bid
- ⊕ Pavement Design/Analysis Tools
- ⊕ Asphalt Paving Field Actions and Impacts



Copyright 2013. All rights reserved. Asphalt Paving Association of Indiana





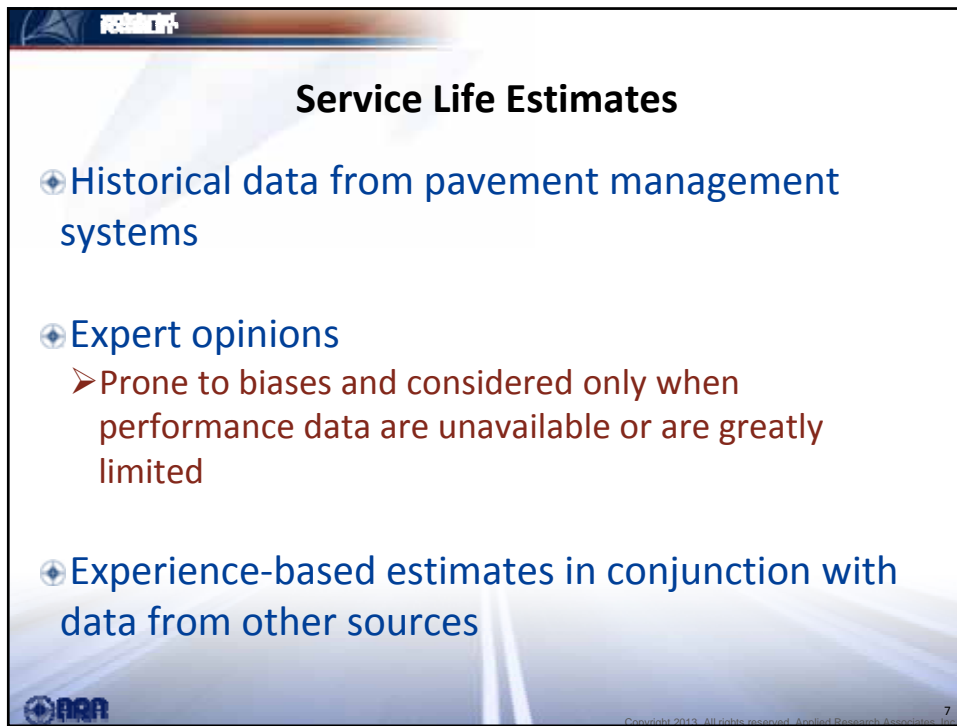
Service Life of Initial Pavement & Rehab

- Service life is estimated for each alternative
- Service life depends on various factors
 - Material Durability
 - Climatic Condition
 - Construction Quality
 - Traffic Loading

ARRA


Copyright 2013. All rights reserved. Applied Research Associates, Inc.

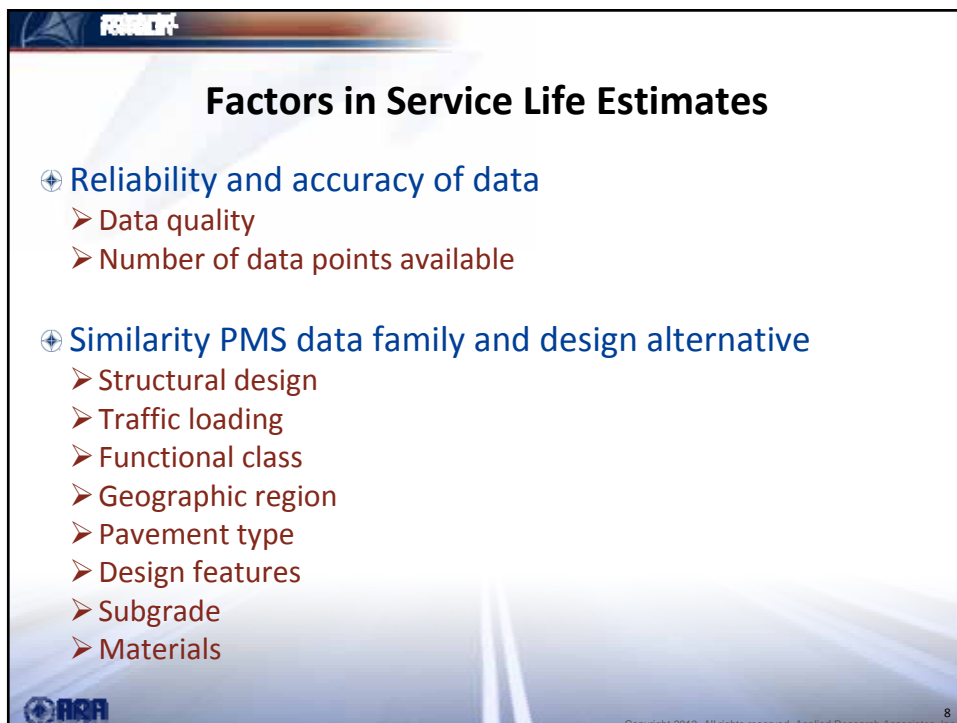
6



Service Life Estimates


- ⊕ Historical data from pavement management systems
- ⊕ Expert opinions
 - Prone to biases and considered only when performance data are unavailable or are greatly limited
- ⊕ Experience-based estimates in conjunction with data from other sources

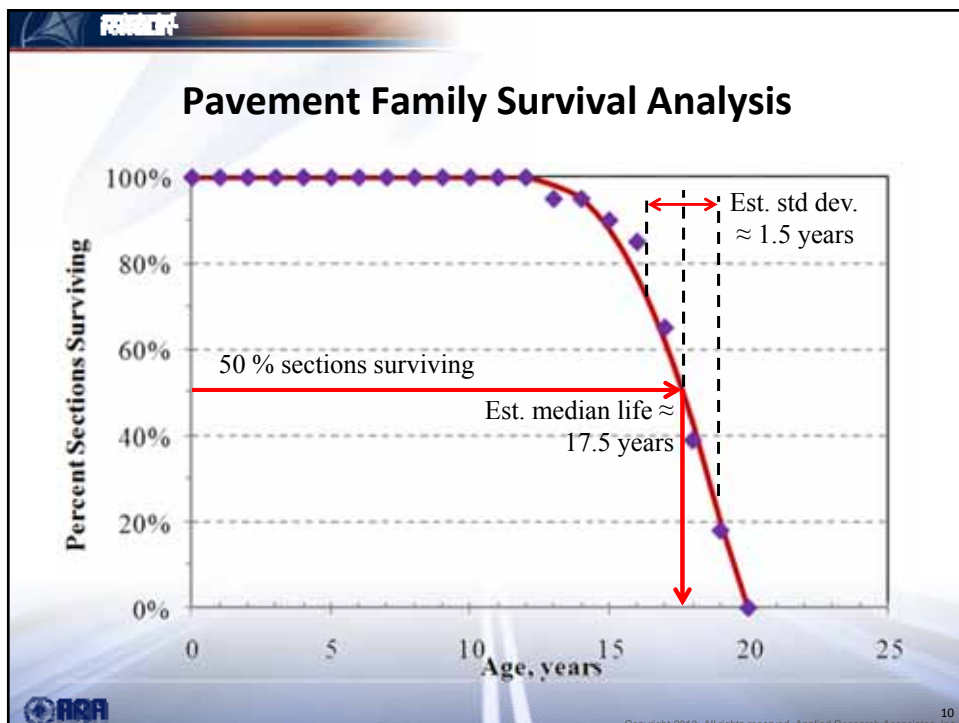
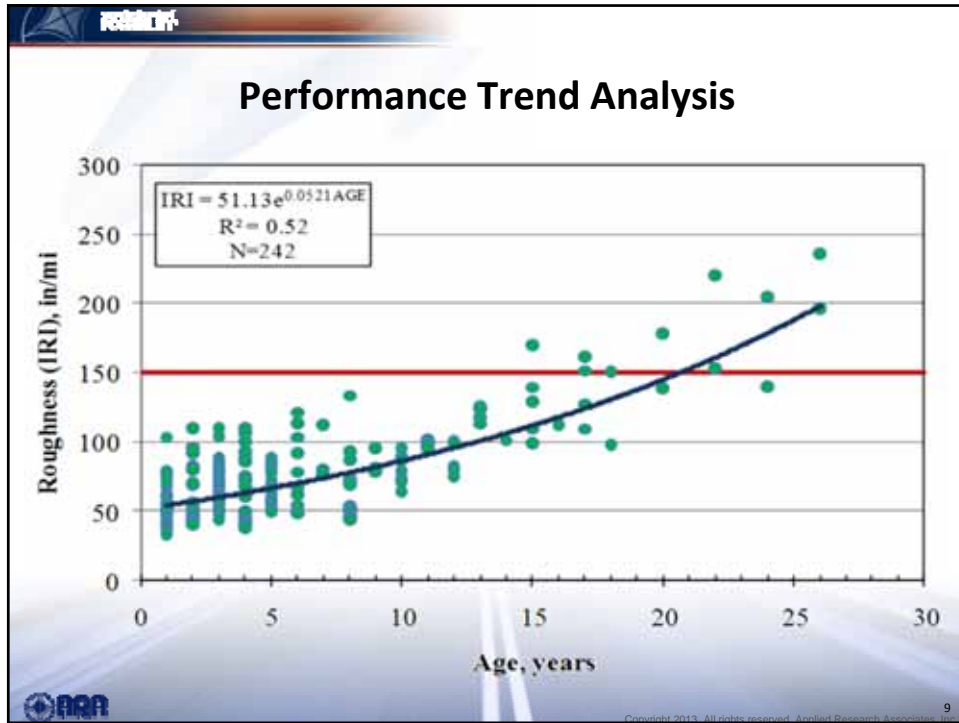
 Copyright 2013. All rights reserved. Applied Research Associates 7




Factors in Service Life Estimates

- ⊕ Reliability and accuracy of data
 - Data quality
 - Number of data points available
- ⊕ Similarity PMS data family and design alternative
 - Structural design
 - Traffic loading
 - Functional class
 - Geographic region
 - Pavement type
 - Design features
 - Subgrade
 - Materials


 Copyright 2013. All rights reserved. Applied Research Associates 8







Factors for LCCA


Economic Factors	Non-economic Factors
<ul style="list-style-type: none"> Initial costs Rehabilitation costs Maintenance costs User costs (delay) Life cycle costs 	<ul style="list-style-type: none"> Roadway/lane geometrics Continuity of adjacent pavement Continuity of adjacent lanes Traffic during construction Availability of local materials Conservation of materials Local preference Stimulation of competition Noise Safety Soil concerns Experimental features Sustainability Maintenance capability



Copyright 2013. All rights reserved. Applied Research Association

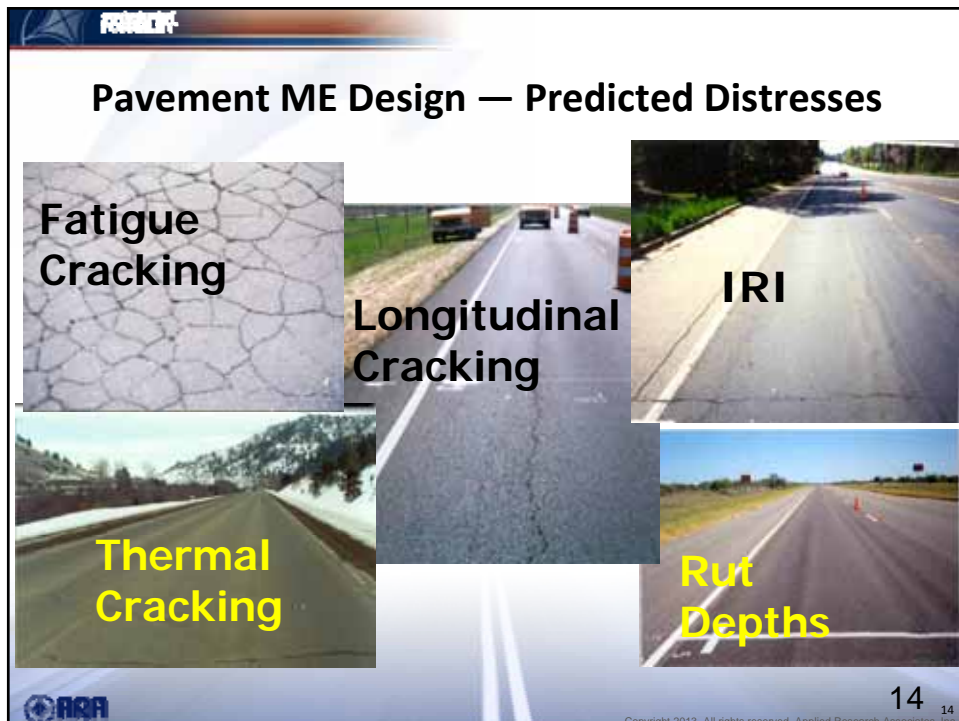
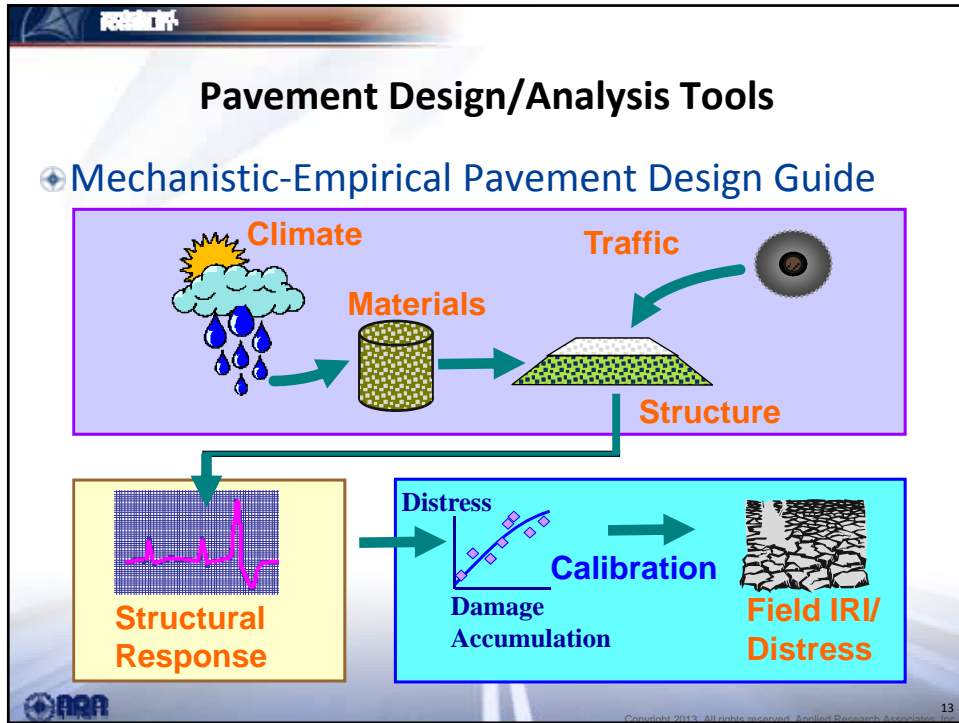


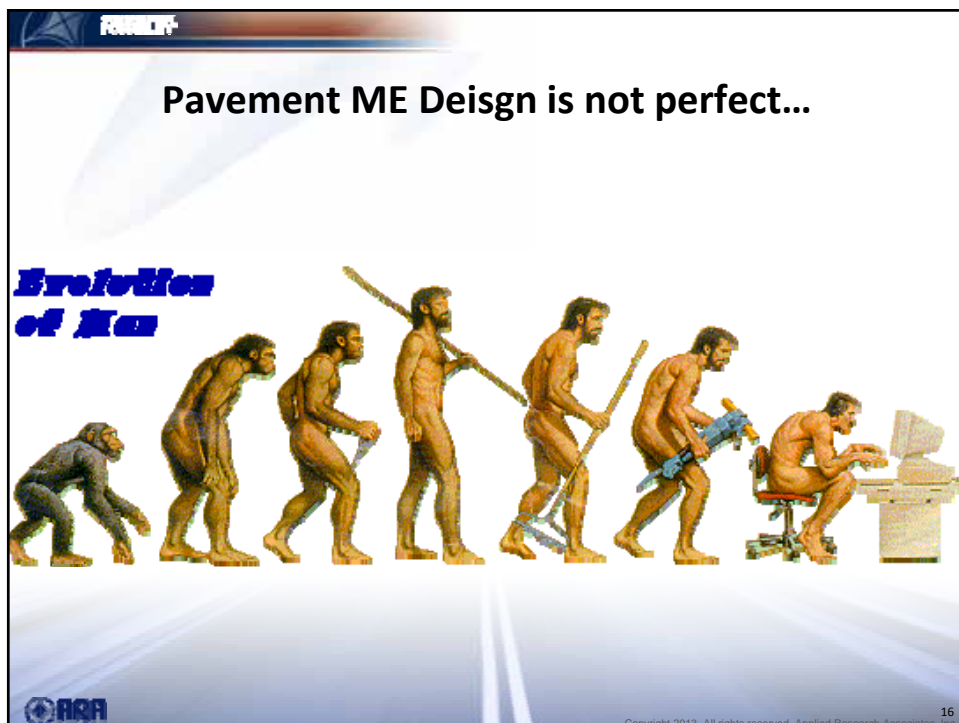
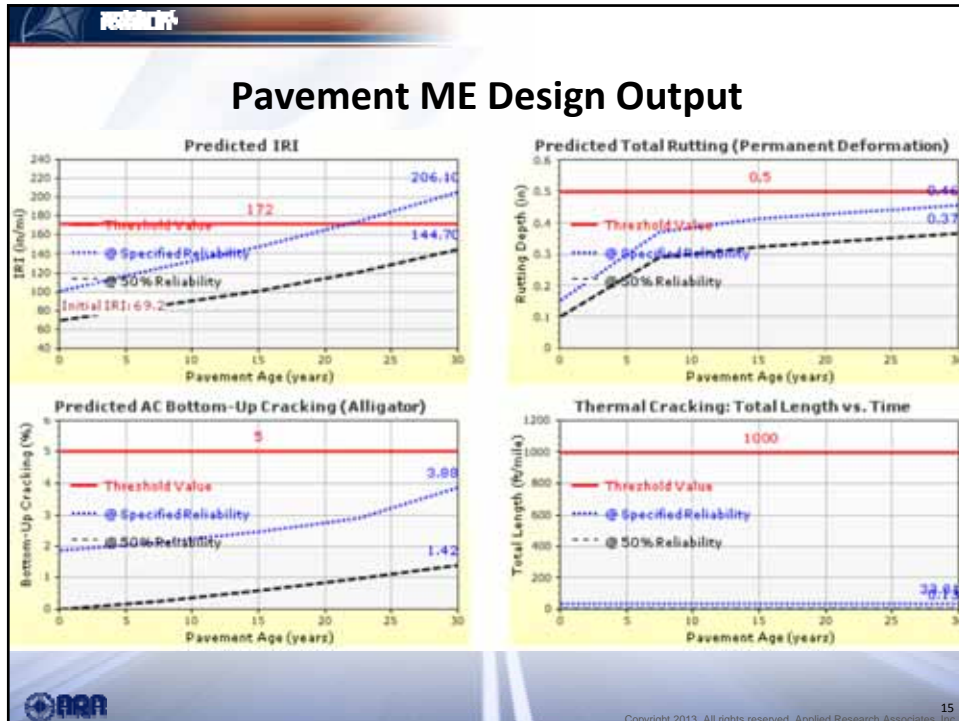
PAVEMENT DESIGN & PERFORMANCE MODELING







Copyright 2013. All rights reserved. Applied Research Association









Field Actions and Impacts

- ⊕ Some “short cuts” are taken in field
- ⊕ Successful completion of this project
- ⊕ Impacts reach way beyond this project




Copyright 2013. All rights reserved. Applied Research Association 17

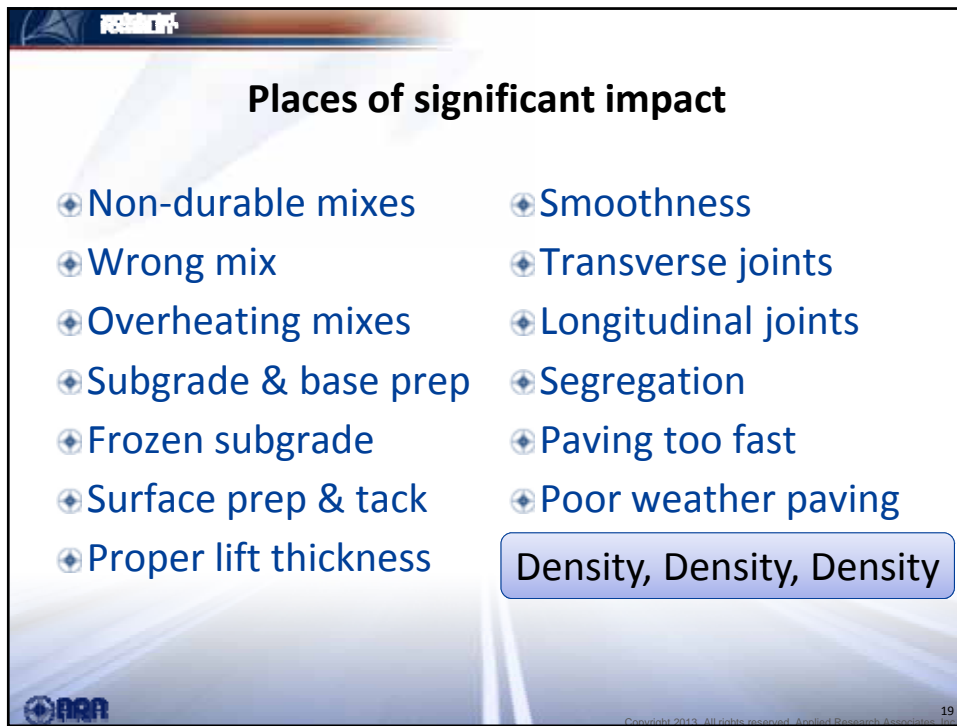


Notes

- ⊕ Joint Construction
 - Density (rolling techniques)
 - Proper application of joint adhesive or tack (sealed interface)
 - Proper application of surface seal when required
 - Straight joints
 - Consider use of echelon paving when possible
- ⊕ Proper milling and cleaning of surface to be paved - delamination
- ⊕ Tacking procedures and materials (application – too thick or thin, over-dilution, etc.)
- ⊕ Sub-base and sub-grade prep (subsidence under compaction of asphalt layers, positive impact of chemical soil treatment, etc.)
- ⊕ How to deal with sensitive existing sub-base and/or structure (pipe, building foundations, etc.)
- ⊕ Enough thickness to achieve compaction (3-4x max nominal)
- ⊕ As built smoothness impact on pavement design/performance
- ⊕ Segregation impact on performance (end load, thermal, starting/stopping impact, paver segregation, plant – mixing, truck loading, silo, etc.)
- ⊕ Non-Durable mixes
 - Under-asphalted (many reasons – all asphalt from recycled products considered effective asphalt, running borderline on VMA, etc.)
 - Poor performing aggregate
 - Improper Binder Grade selection when using recycled products
 - Improper Binder Grade selection for traffic and climate (non-conforming binders)
 - Volumetrics/AMPT impact on performance (low/high voids, low/high vma/vfa, etc.). How these poor volumetric came to be and why they impact performance.
- ⊕ Wrong mix for the application (12.5mm mixes used because they are less expensive but don't fit the application)
- ⊕ Overheating of mixtures
- ⊕ Paver running away from the roller train (not enough rollers for the speed of paving)
- ⊕ Compaction (many options here)
- ⊕ Frozen grade
- ⊕ Weather conditions – cold, rain, snow, etc.
- ⊕ Right fix for the situation or pavement condition




Copyright 2013. All rights reserved. Applied Research Association 18



Places of significant impact


- ⬦ Non-durable mixes
- ⬦ Wrong mix
- ⬦ Overheating mixes
- ⬦ Subgrade & base prep
- ⬦ Frozen subgrade
- ⬦ Surface prep & tack
- ⬦ Proper lift thickness
- ⬦ Smoothness
- ⬦ Transverse joints
- ⬦ Longitudinal joints
- ⬦ Segregation
- ⬦ Paving too fast
- ⬦ Poor weather paving

Density, Density, Density

 Copyright 2013. All rights reserved. Applied Research Associates 19





NON-DURABLE MIXES


 Copyright 2013. All rights reserved. Applied Research Associates 20

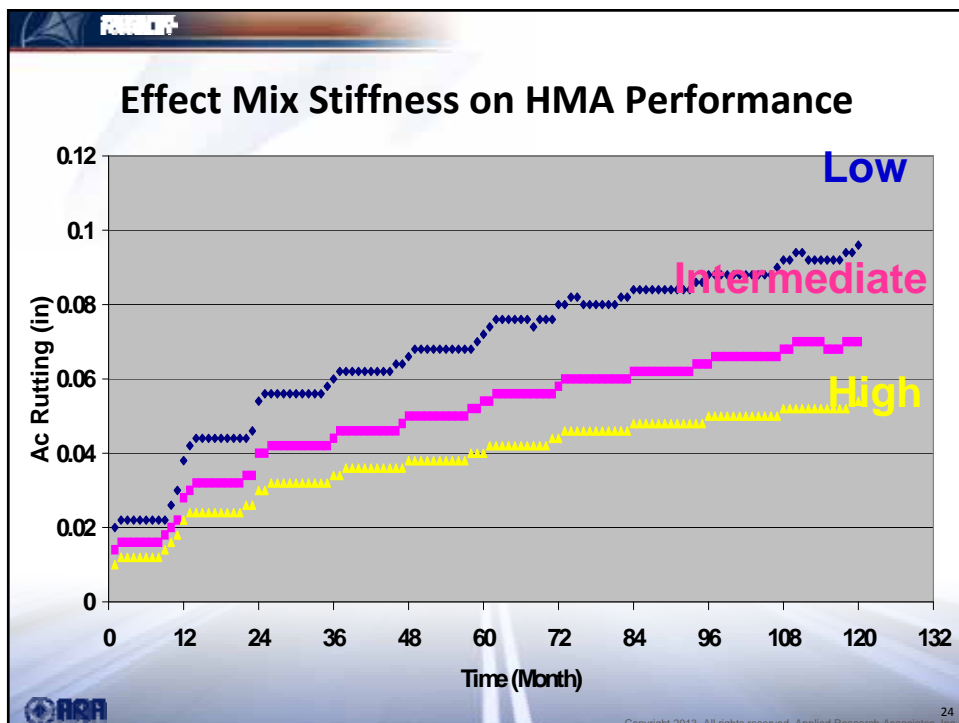
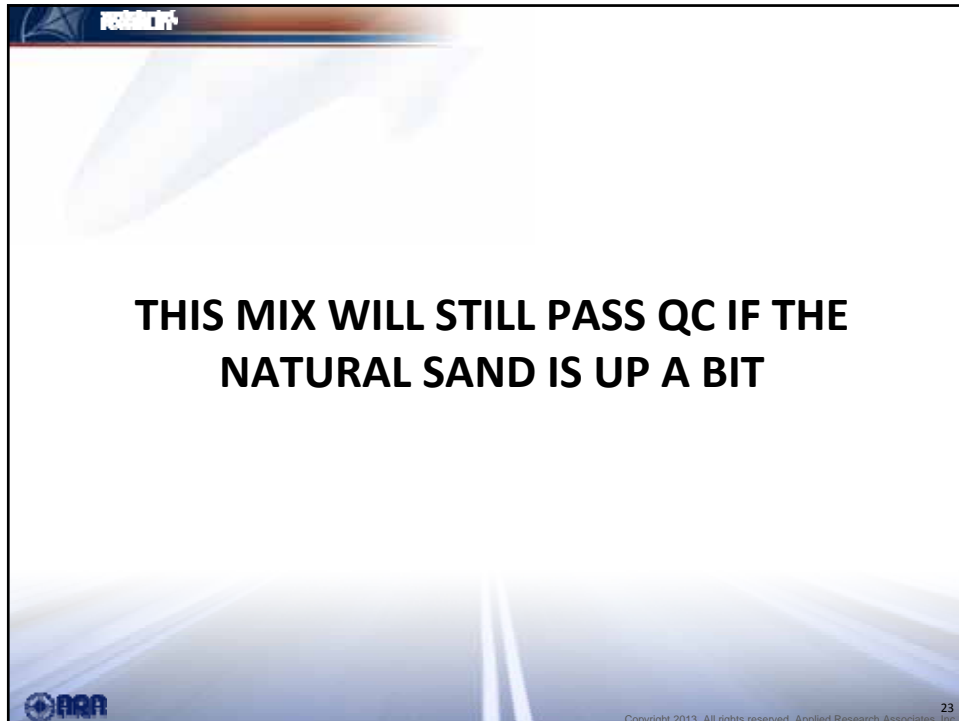
A number of key mix selection items

- ◆ Under-asphalted mixes
 - all asphalt from recycled products considered effective asphalt, running borderline on VMA, etc.
- ◆ Poor performing aggregate
- ◆ Improper Binder Grade with recycled products
- ◆ Improper Binder Grade selection for traffic and climate (non-conforming binders)
- ◆ Volumetrics/AMPT impact on performance (low/high voids, low/high vma/vfa, etc.)

 Copyright 2013. All rights reserved. Applied Research Association 21



 Copyright 2013. All rights reserved. Applied Research Association 22



WRONG MIX FOR THE APPLICATION

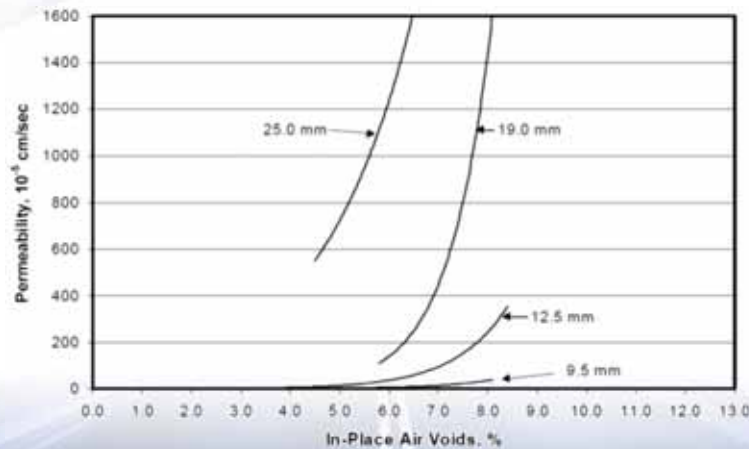


Copyright 2013. All rights reserved. Applied Research Associates, Inc.

25

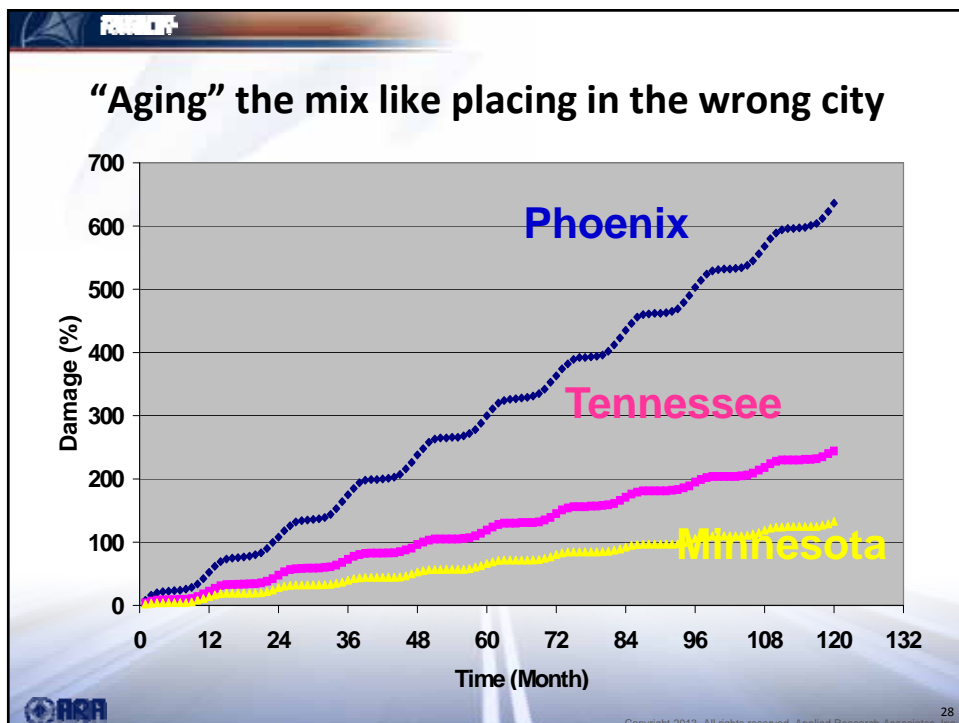
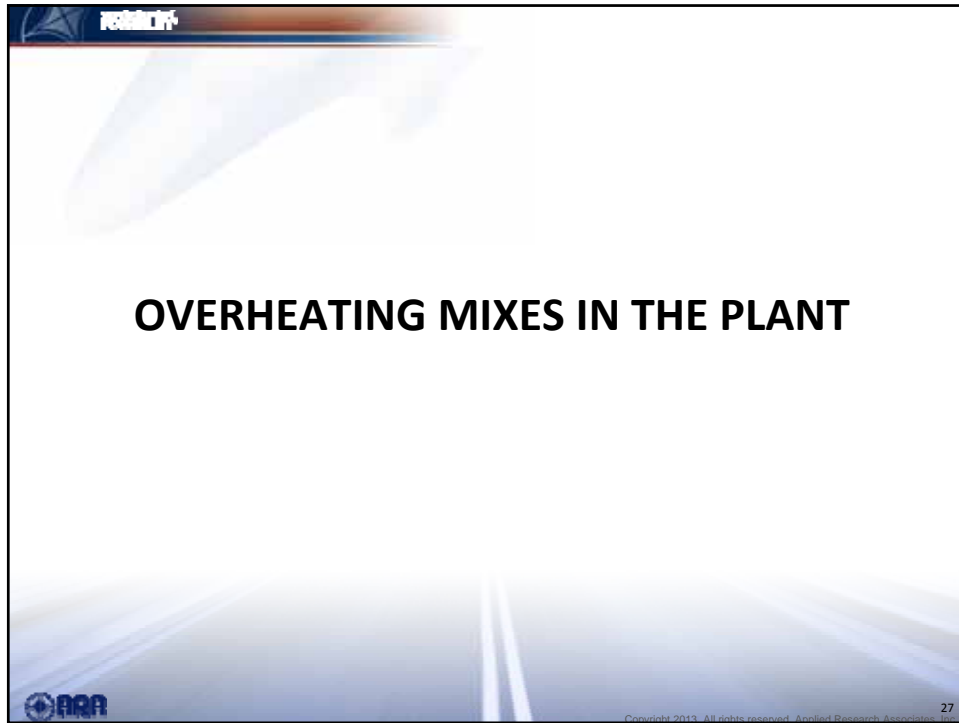
Make sure that the mix fits the application

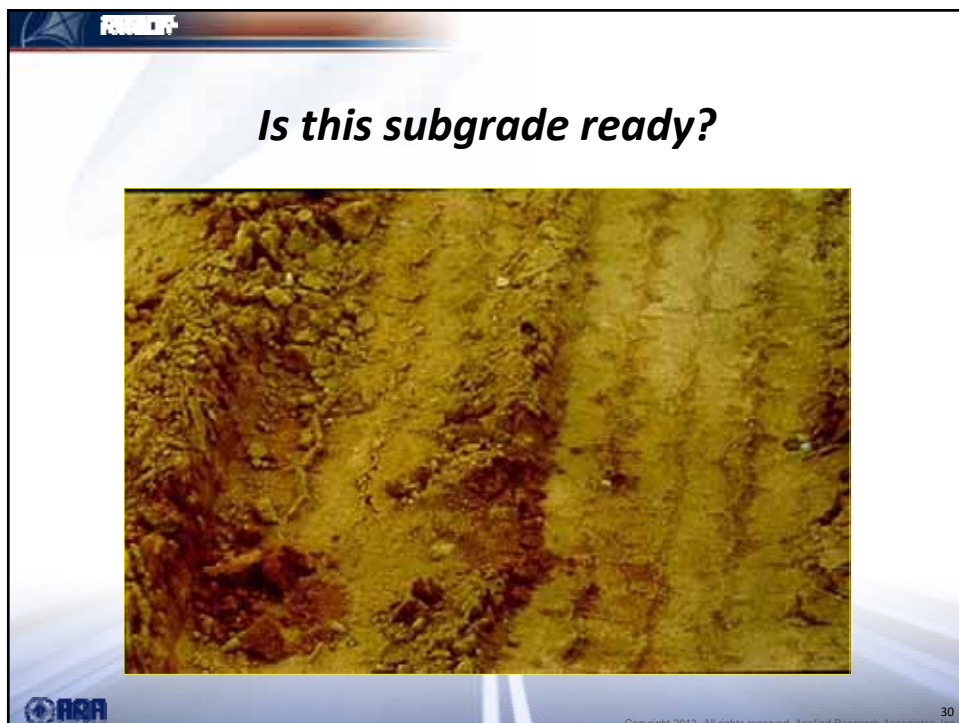
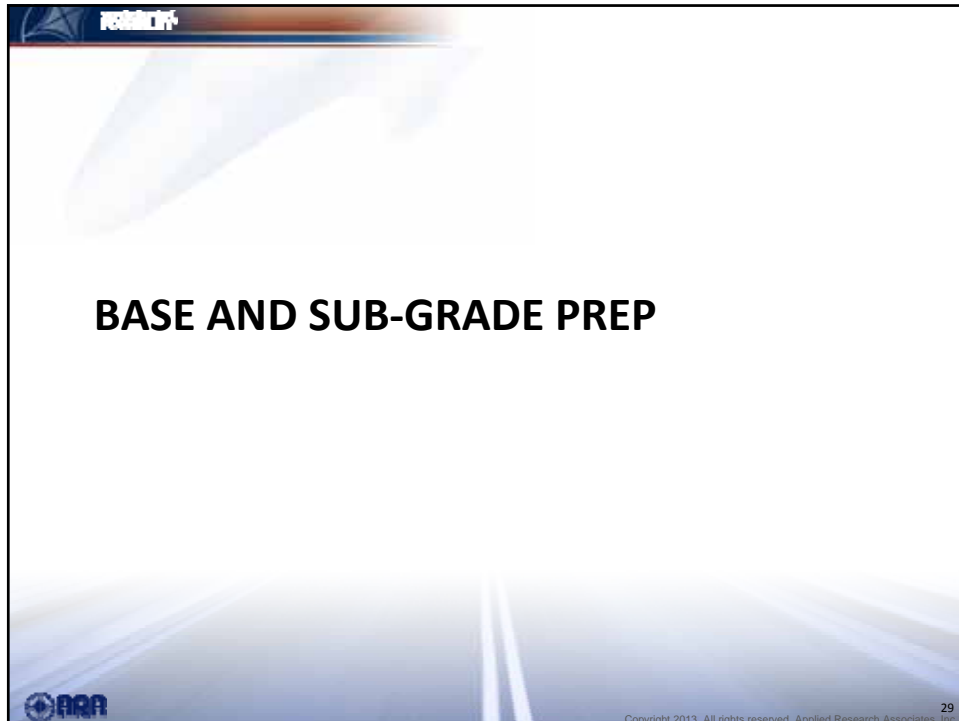
- ◆ Use larger NMAS because they are less expensive



Copyright 2013. All rights reserved. Applied Research Associates, Inc.

26





FOUNDER

What's wrong with these?

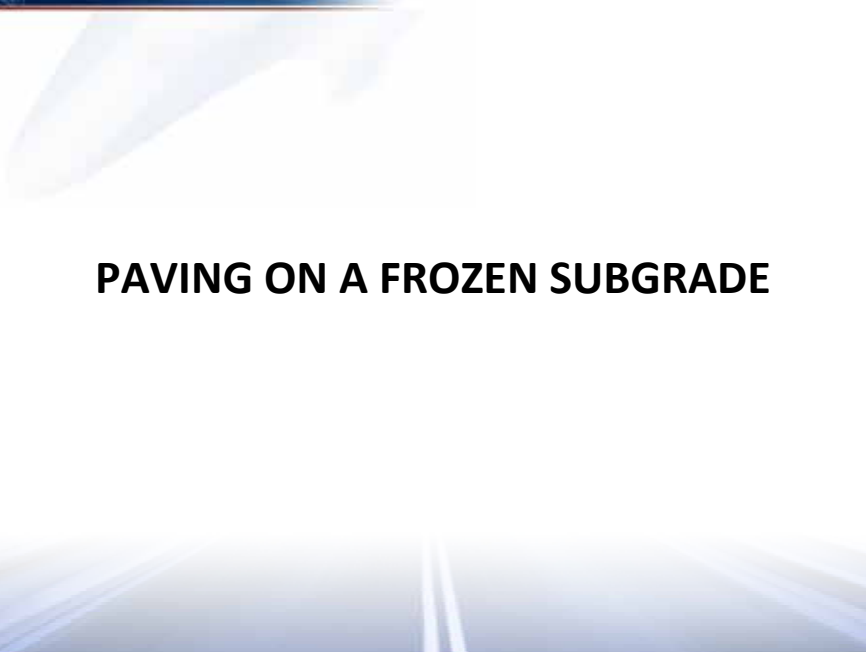


ARRA

Copyright 2013. All rights reserved. Applied Research Associates 31

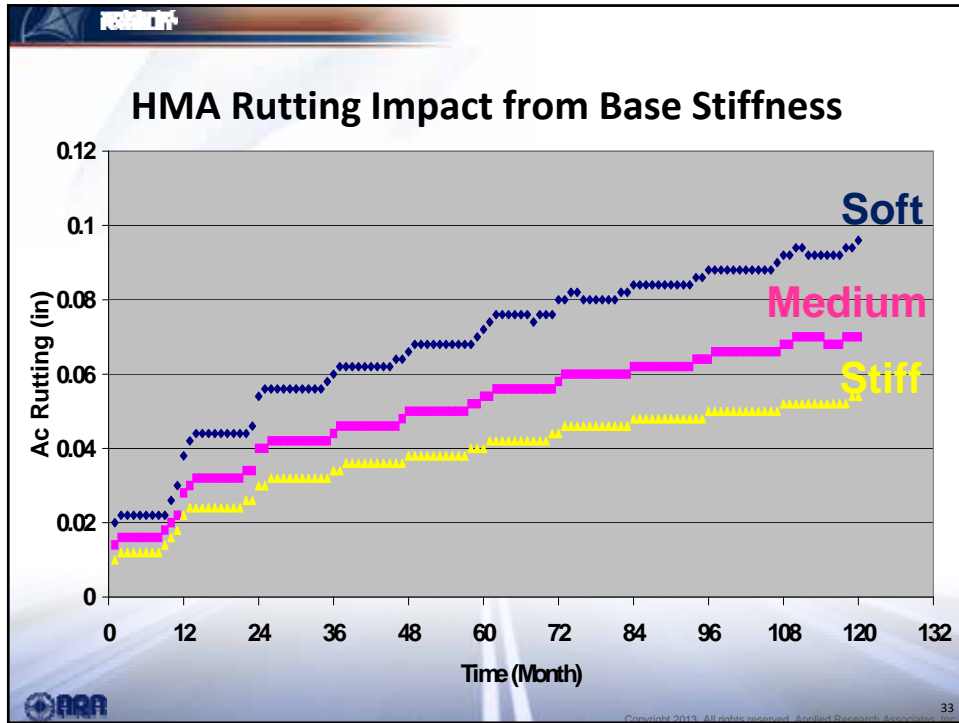
FOUNDER

PAVING ON A FROZEN SUBGRADE



ARRA

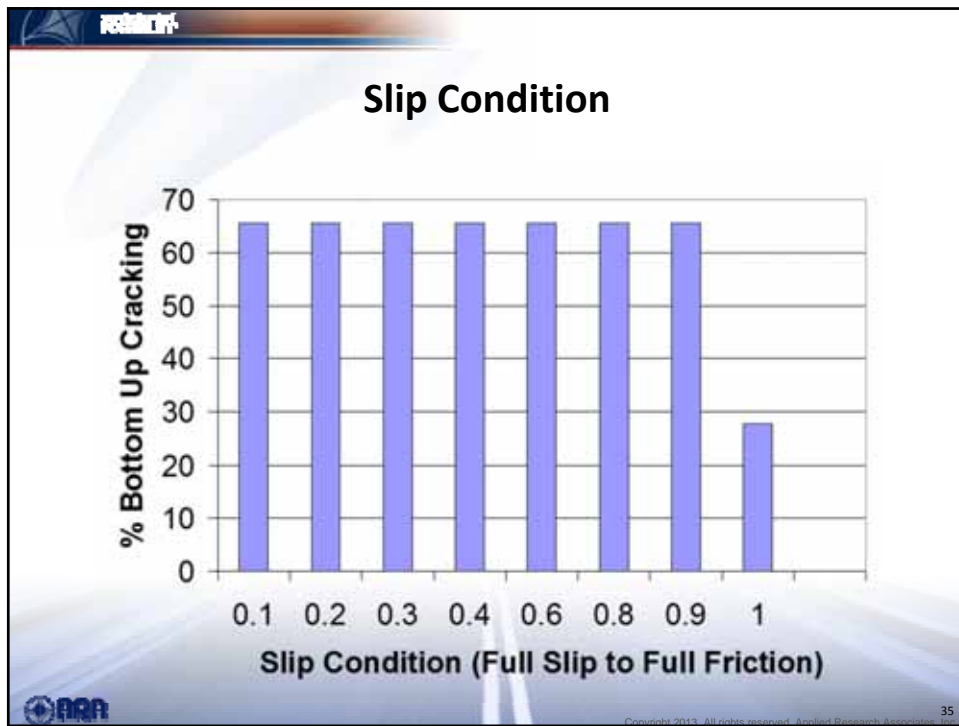
Copyright 2013. All rights reserved. Applied Research Associates 32



TACK COAT

Don't overshoot that tack coat, that stuff is expensive

34











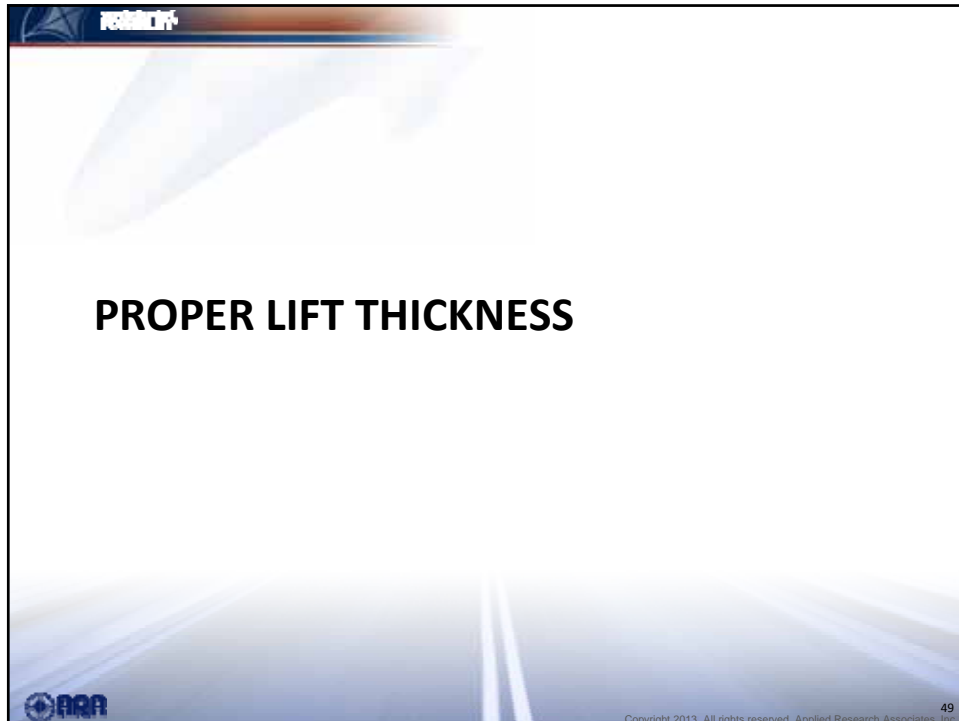


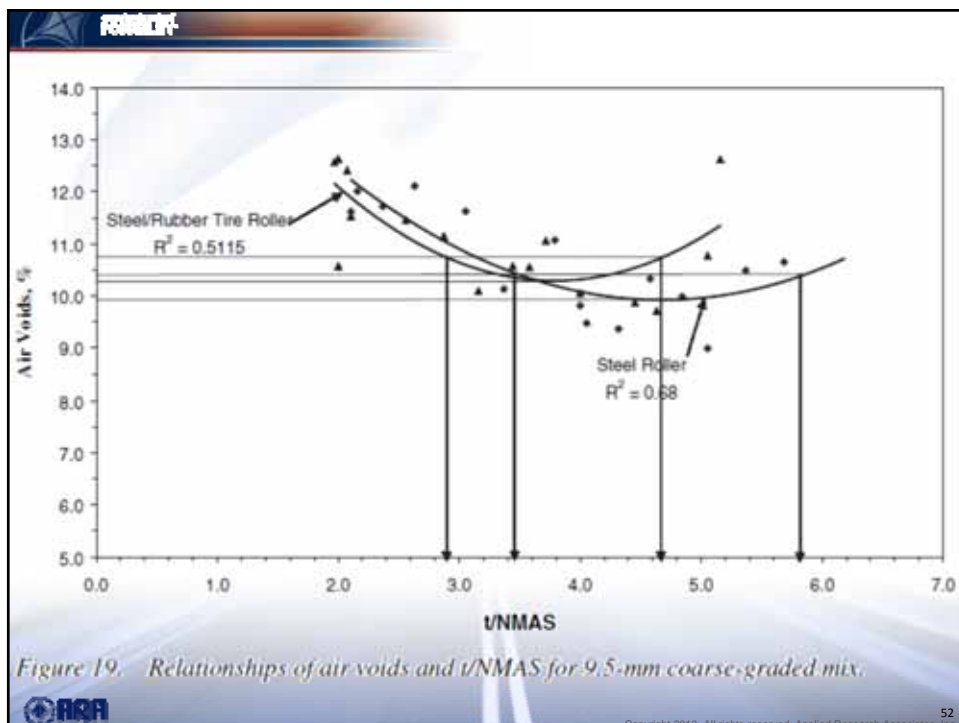
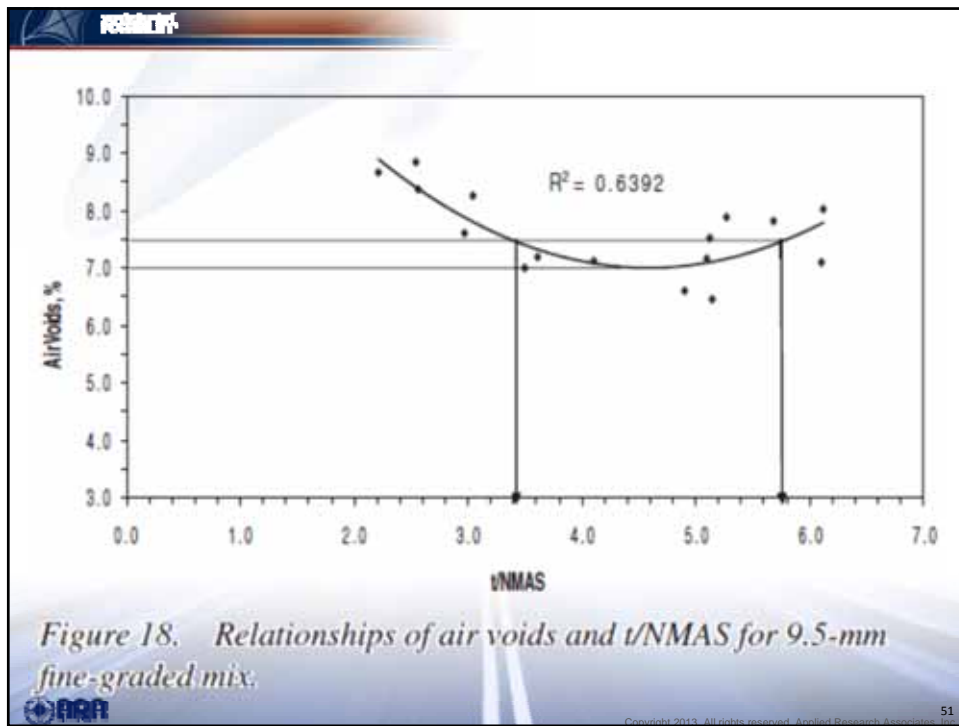


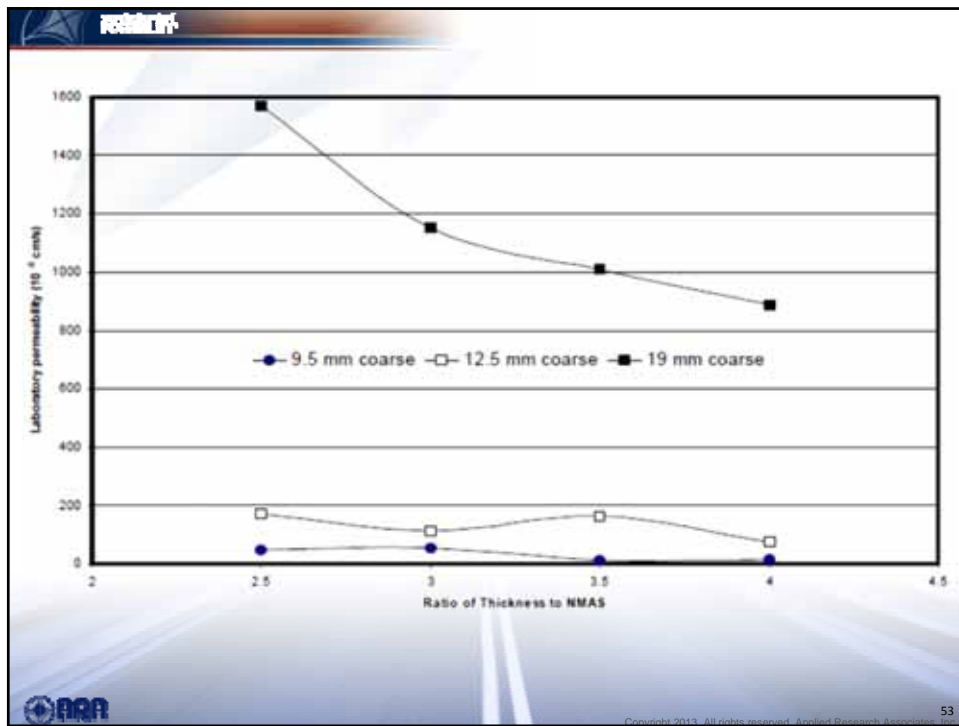
Good Tack Method?

Three workers in safety vests and hard hats are applying a dark material (likely asphalt or sealant) to a road surface using a bucket and a brush. The road has yellow lane markings.

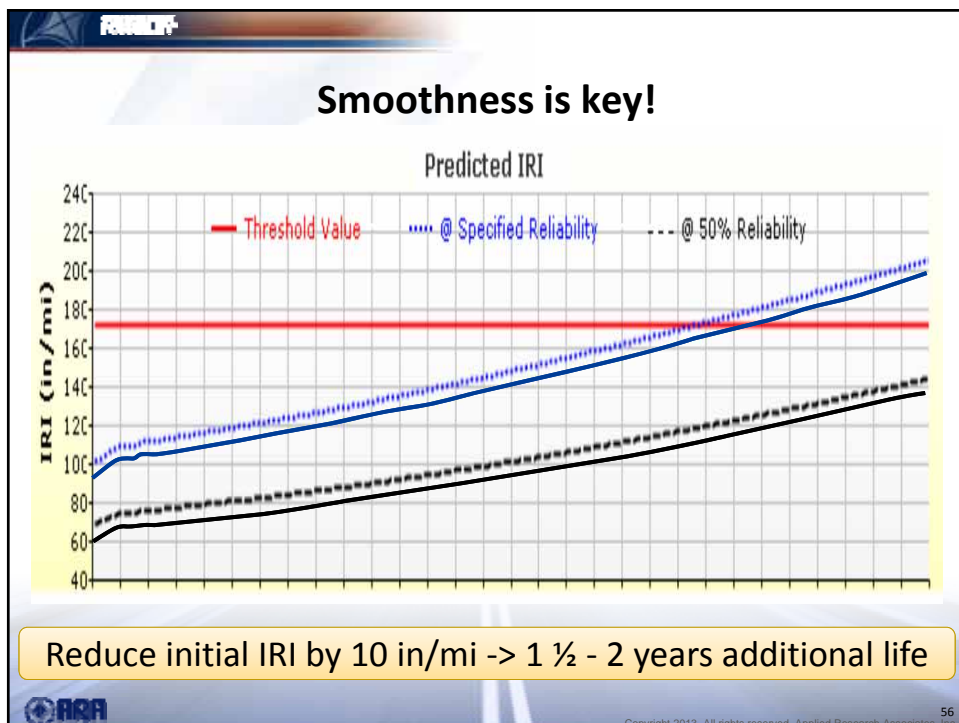
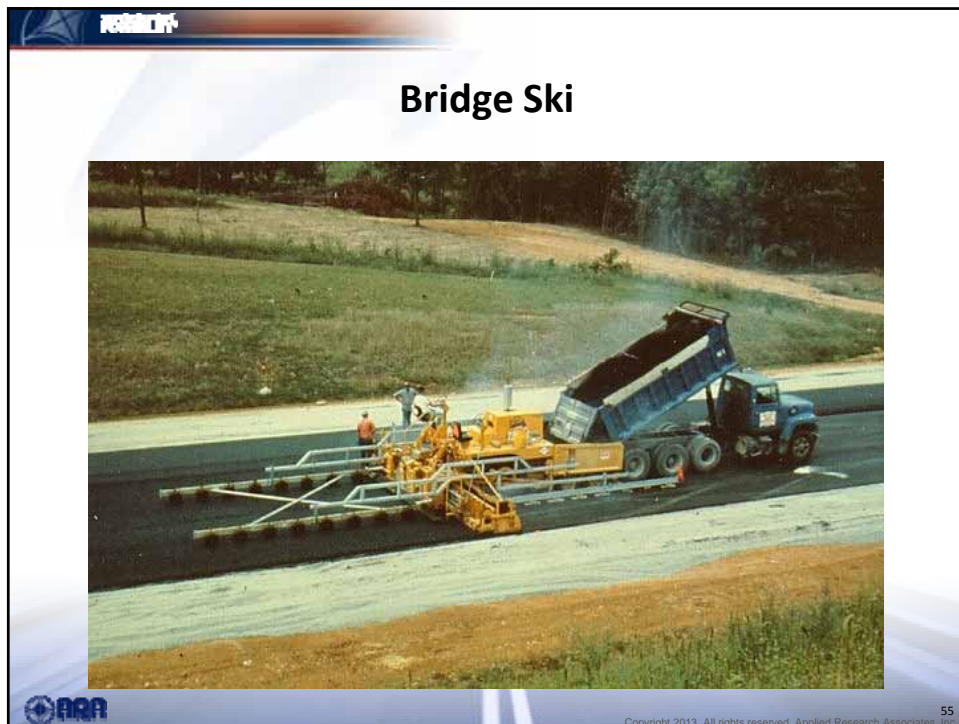
 48
Copyright 2015. All rights reserved. American Road & Transportation Builders Association, Inc.

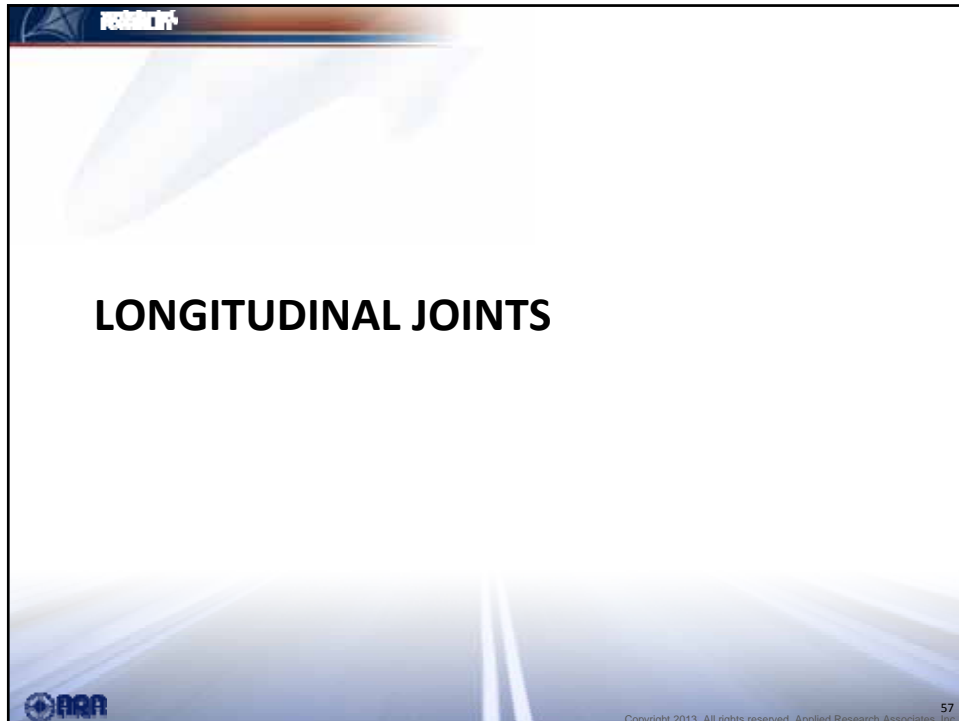






SMOOTHNESS

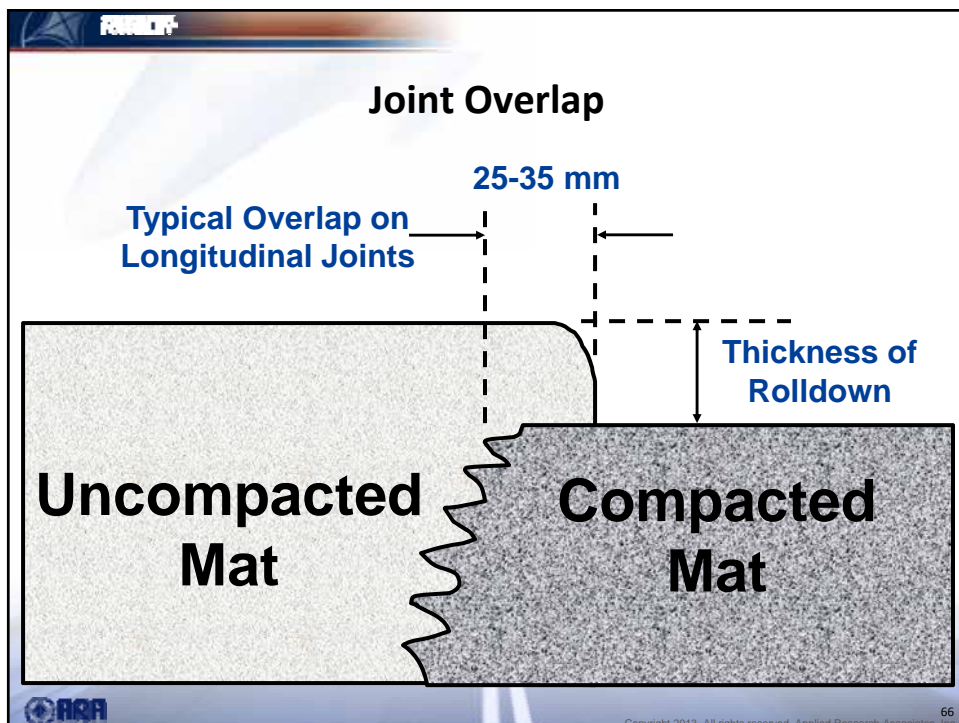
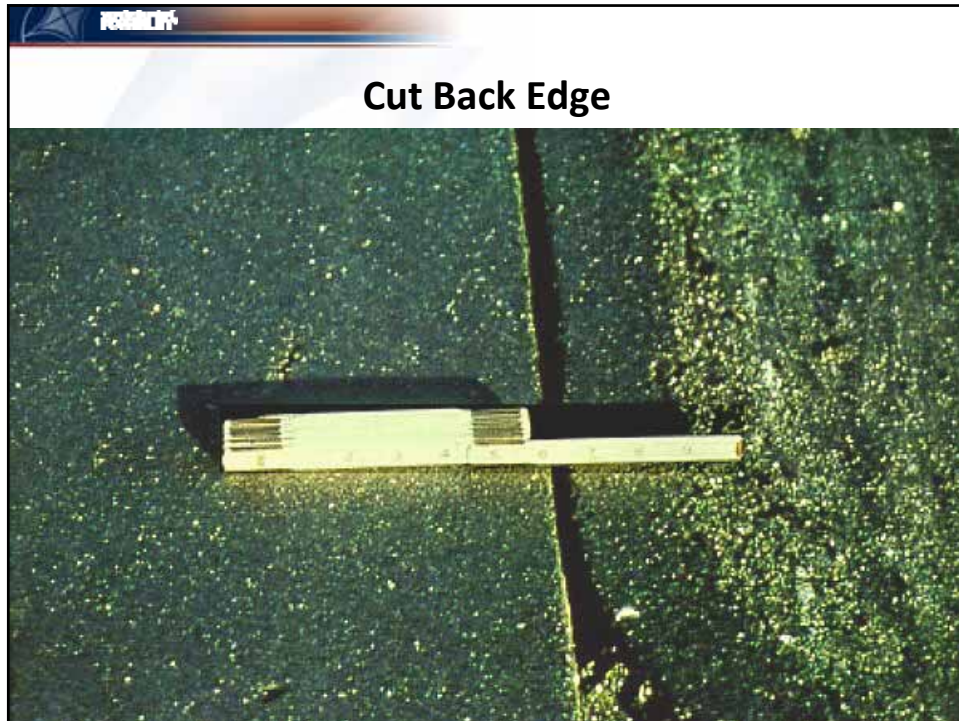


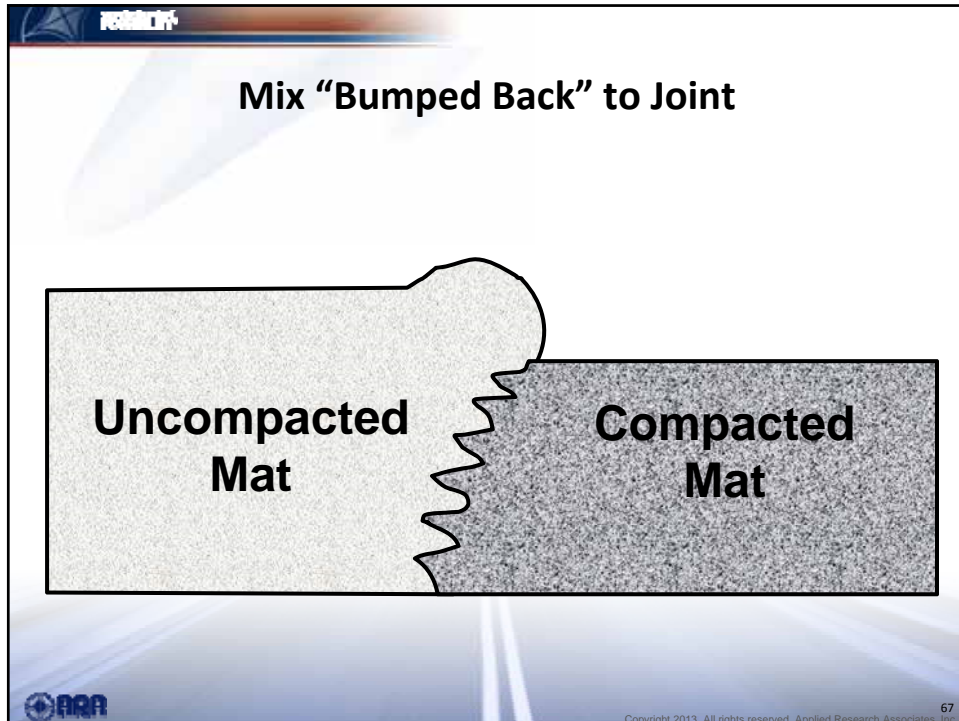






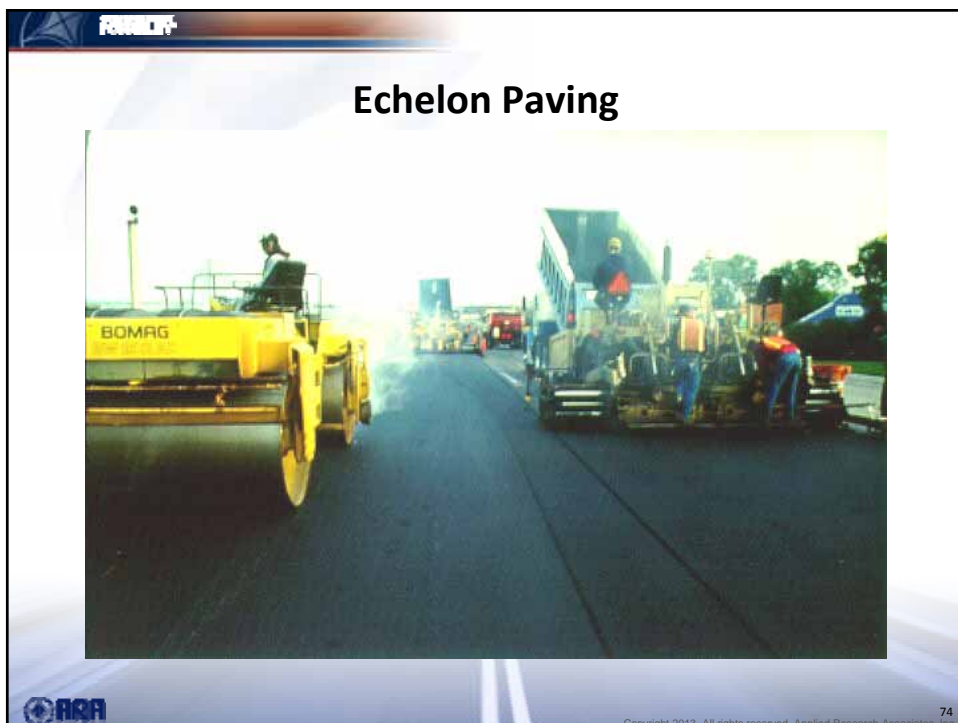




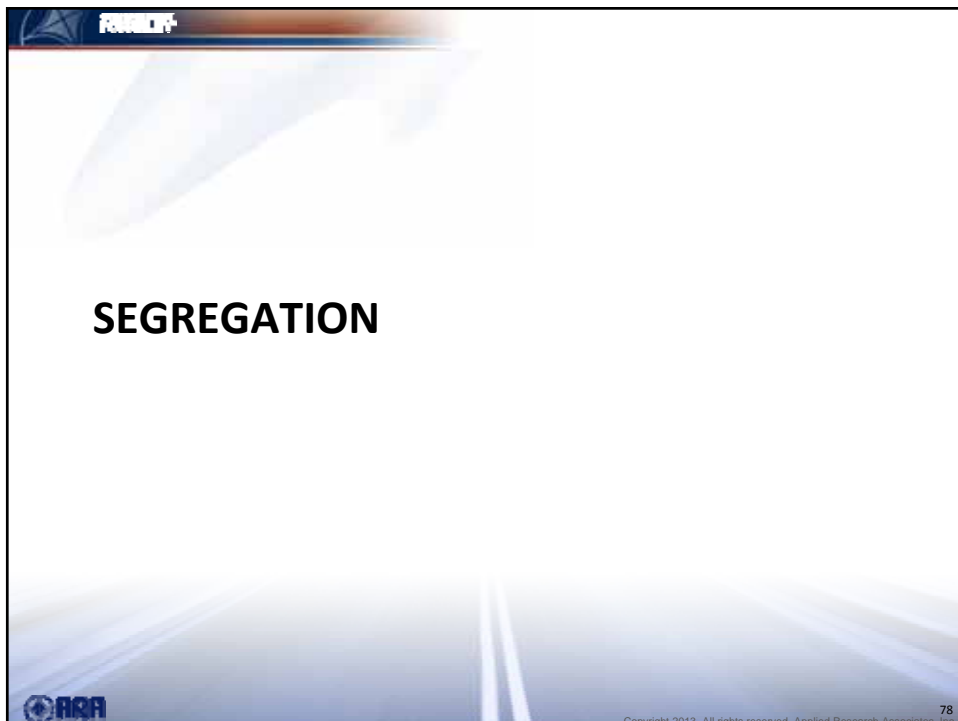






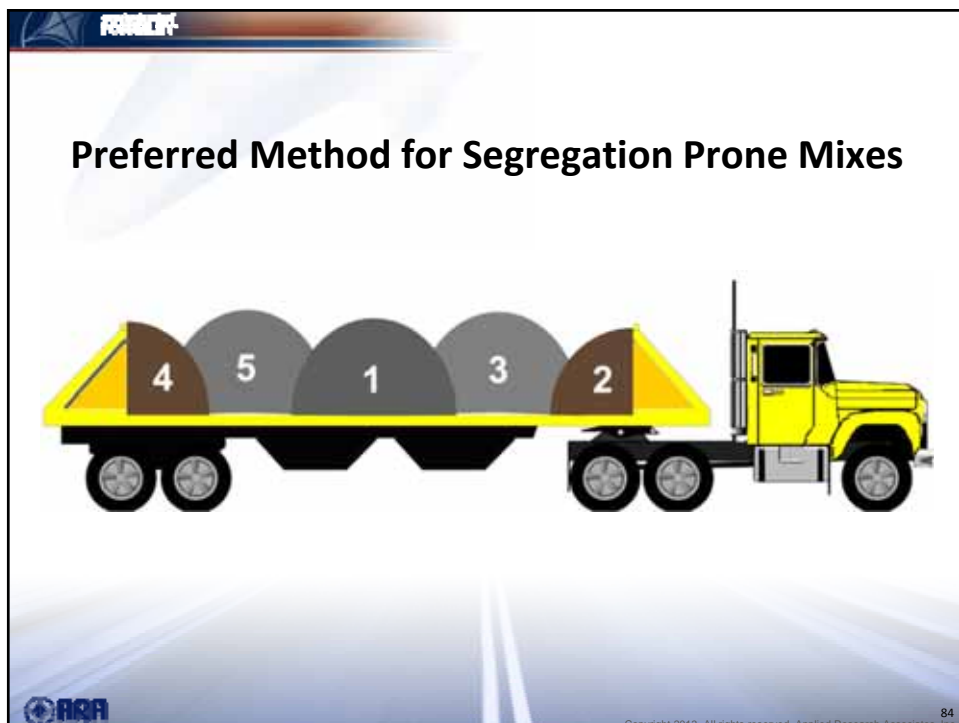
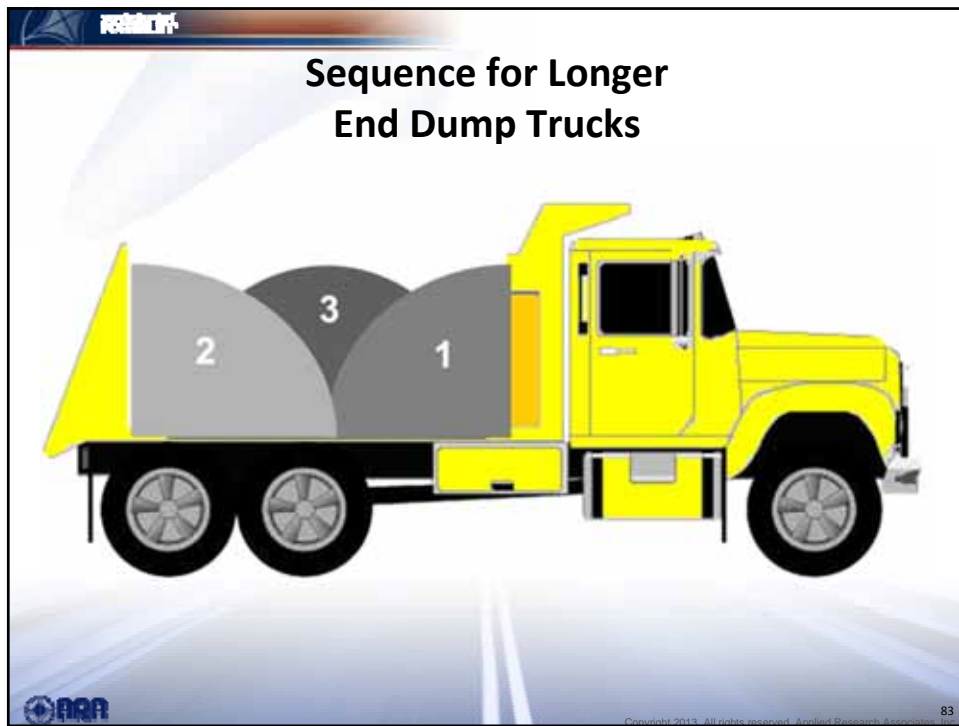













End Dump Truck Operation



Raise bed, but keep tailgate closed until mix slides against it

 Copyright 2013. All rights reserved. Applied Research Association 85

What probably caused this



 Copyright 2013. All rights reserved. Applied Research Association 86

Why can't this be paved over?



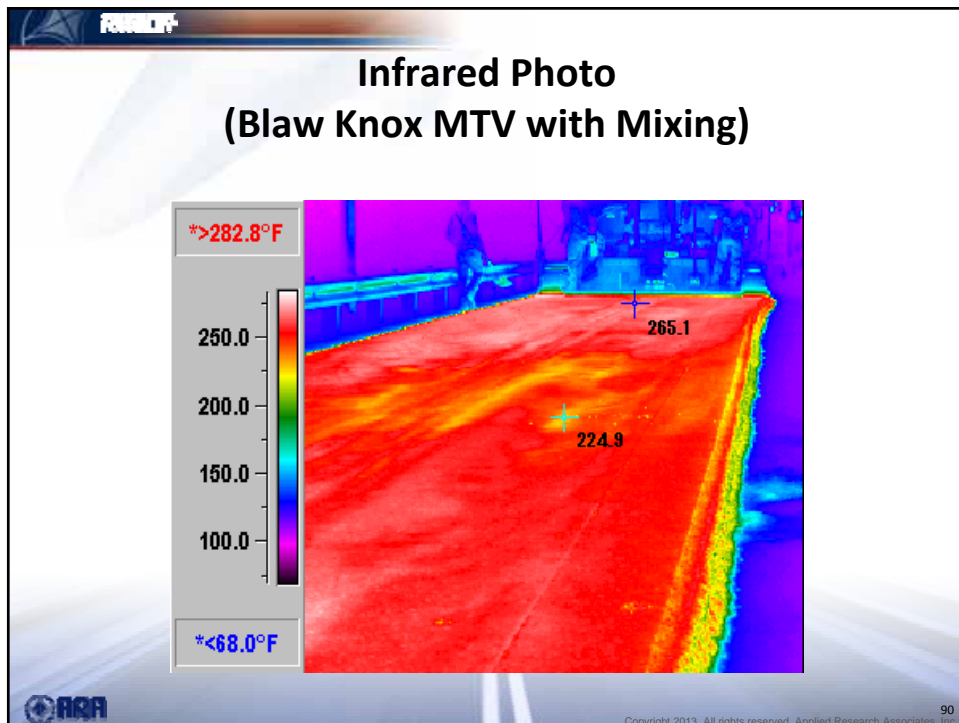
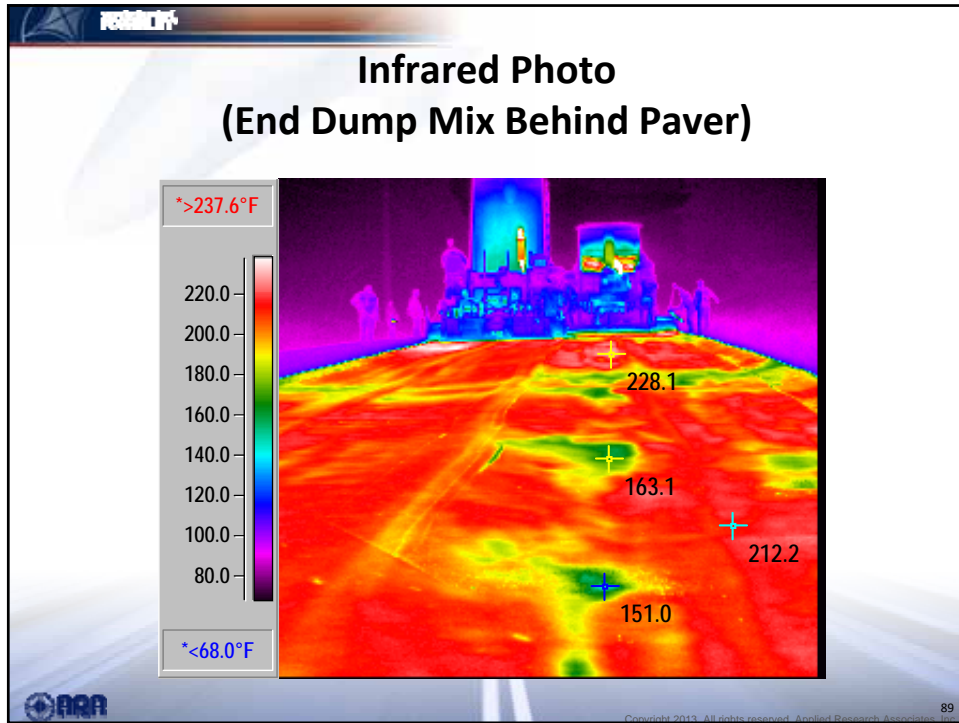
87

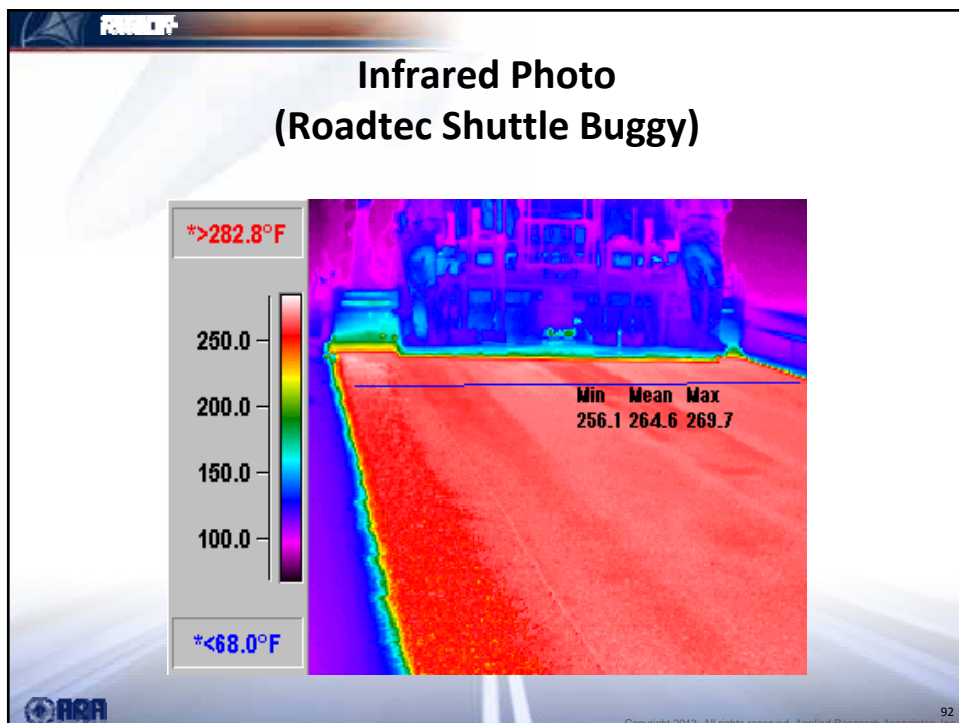
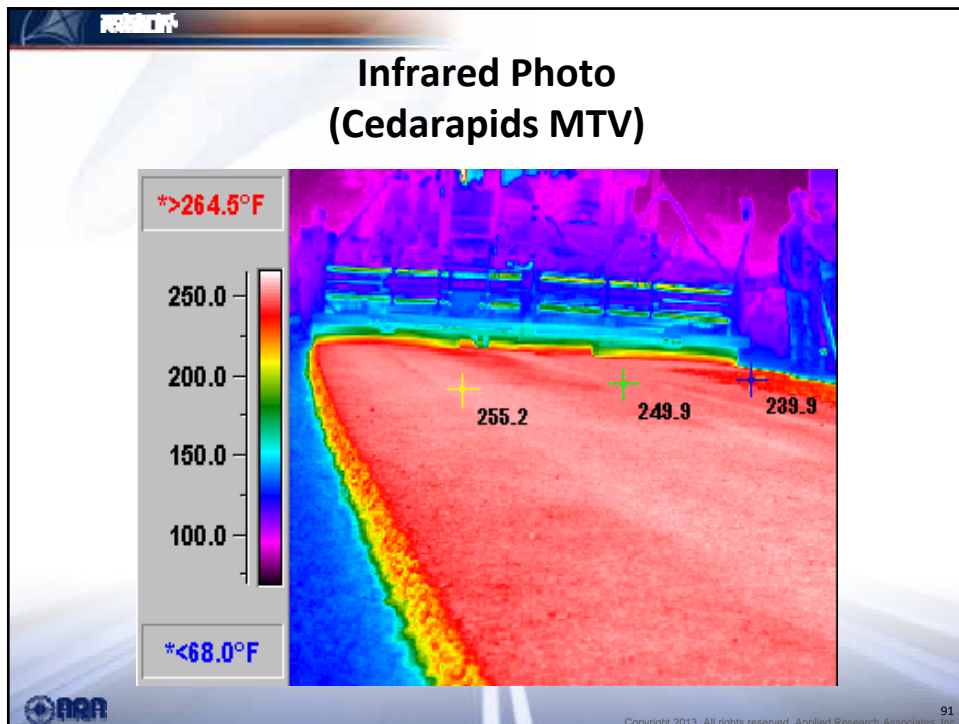
Copyright 2013. All rights reserved. Applied Research Associates, Inc.

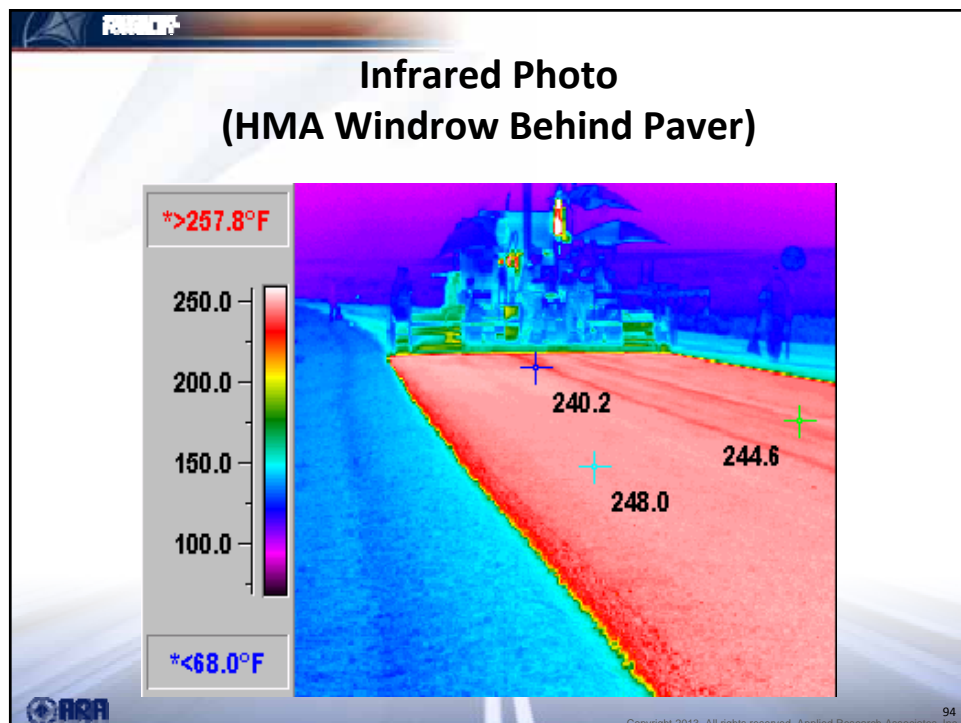
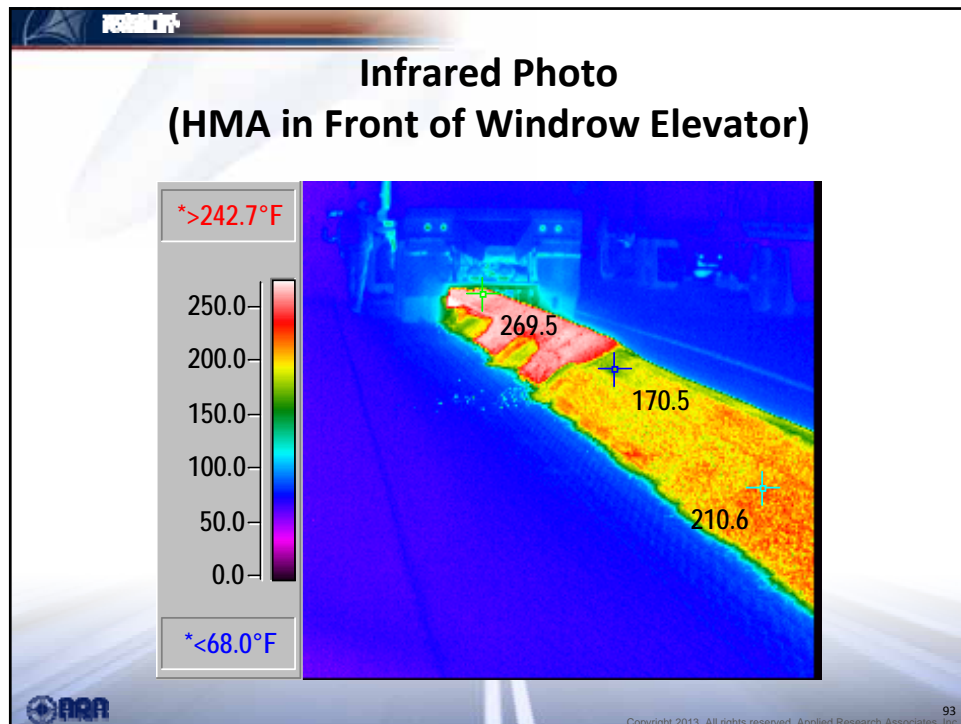
THERMAL SEGREGATION

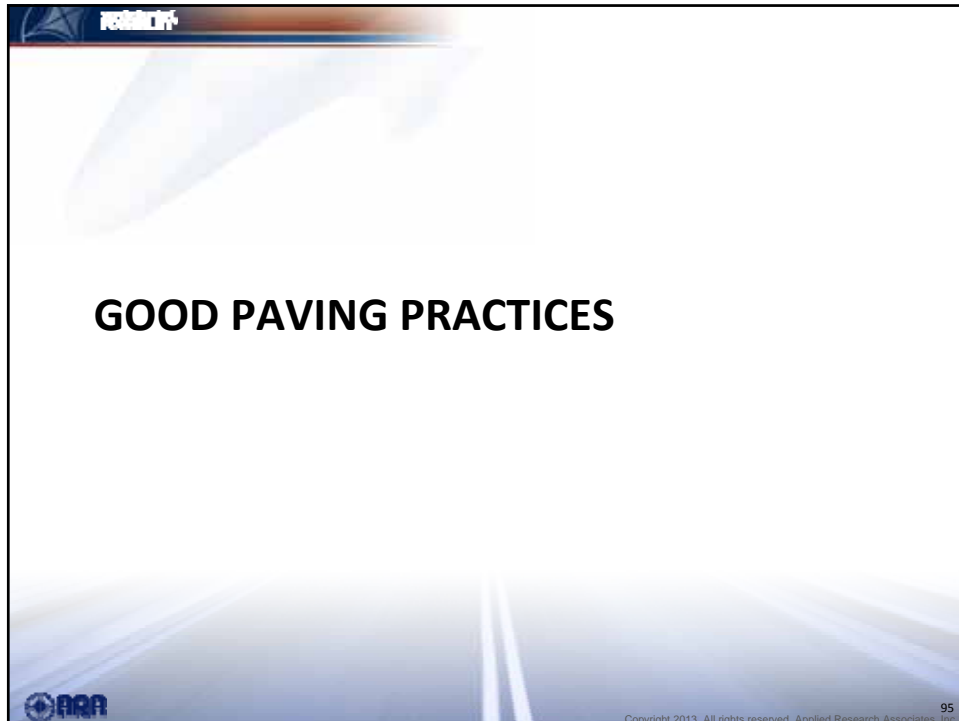
88

Copyright 2013. All rights reserved. Applied Research Associates, Inc.

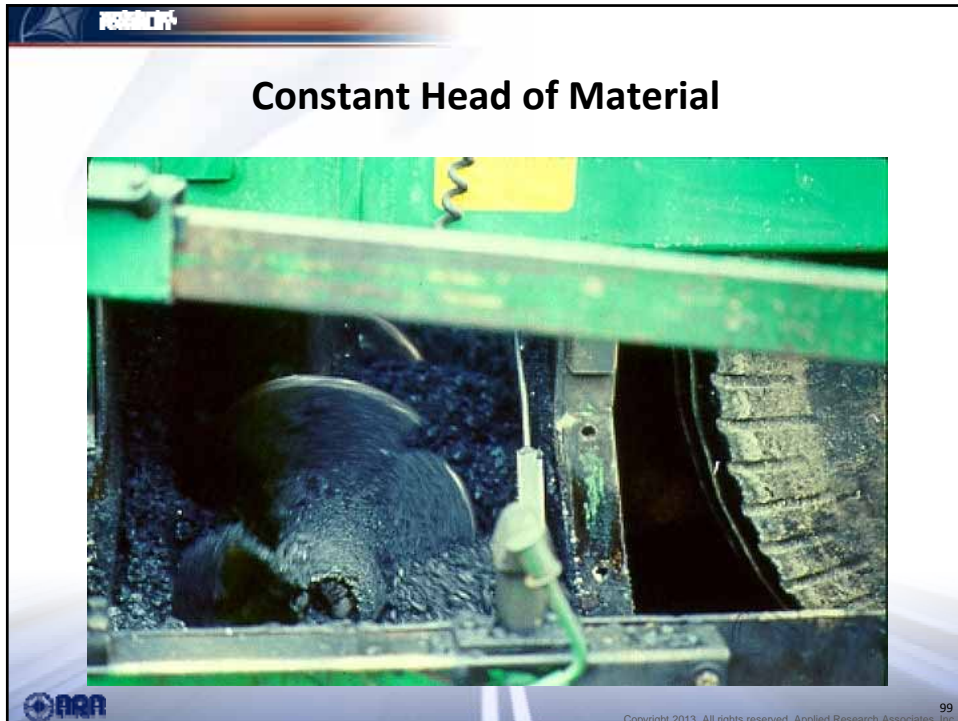












COMPACTION

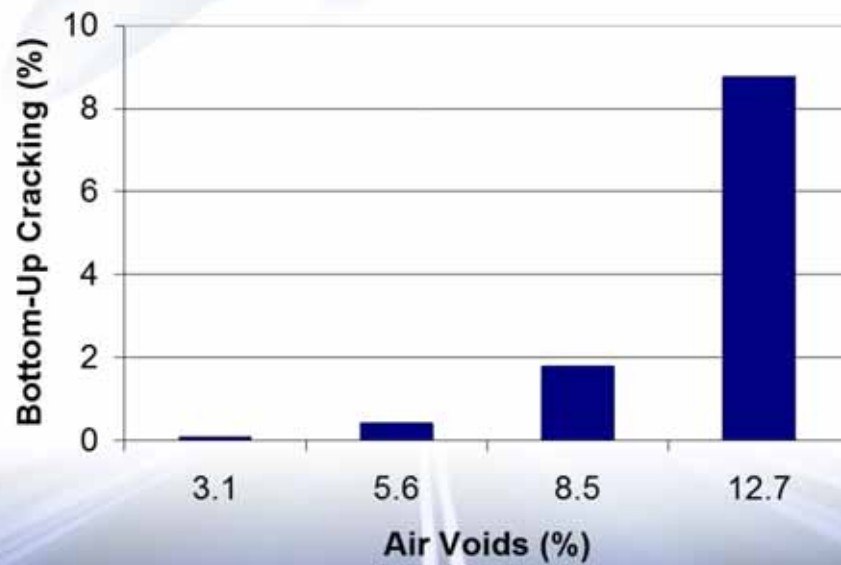
Density, Density, Density



Copyright 2013. All rights reserved. Applied Research Association

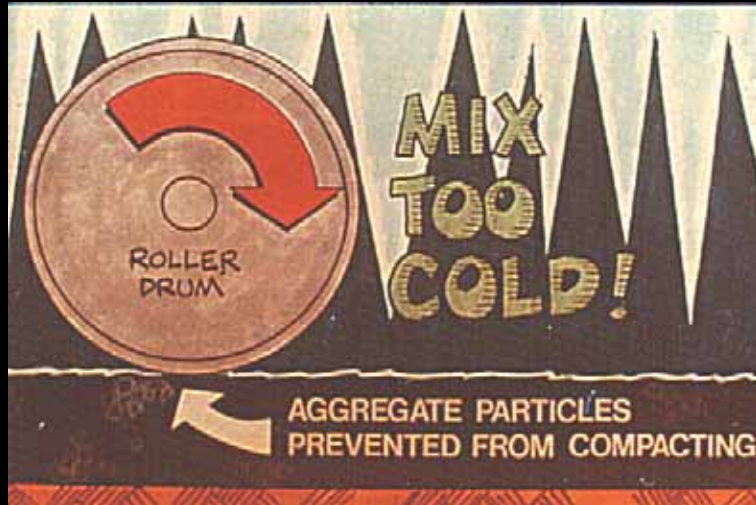
101

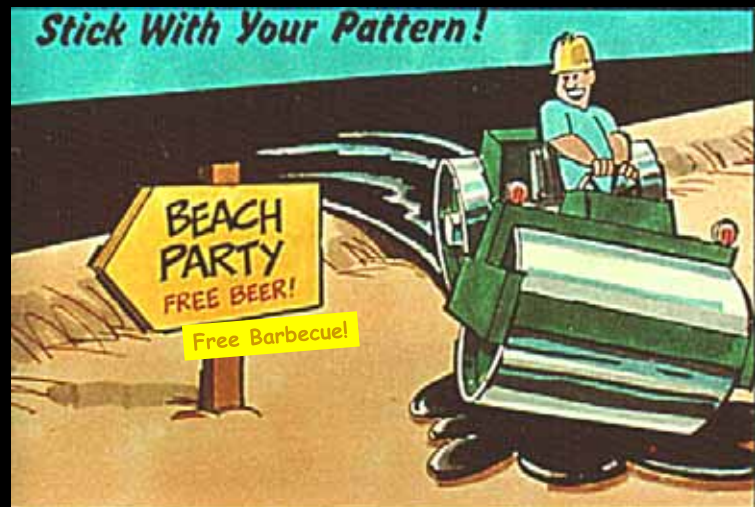
Air Voids Have a Huge Impact on Performance

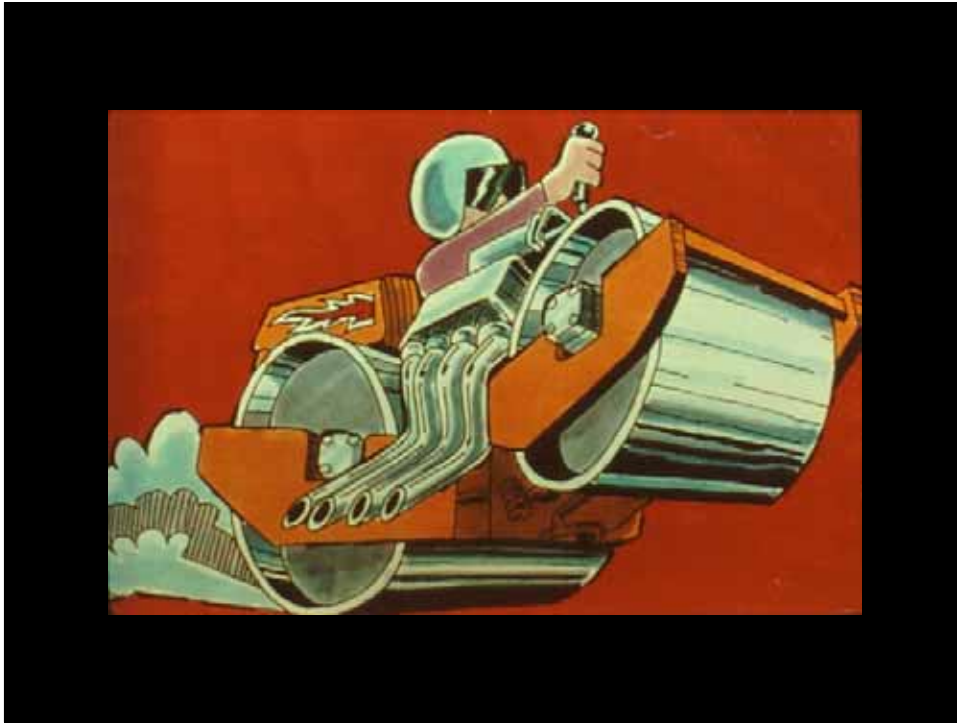


Copyright 2013. All rights reserved. Applied Research Association

102








Closing

- ⦿ The decisions that you make matter
- ⦿ Today's actions predict future pavement performance
- ⦿ Future performance impacts life cycle cost analysis
- ⦿ Life cycle cost analysis determines pavement type selection
- ⦿ Pavement type selection makes/breaks industries

 Copyright 2013. All rights reserved. Applied Research Association 109

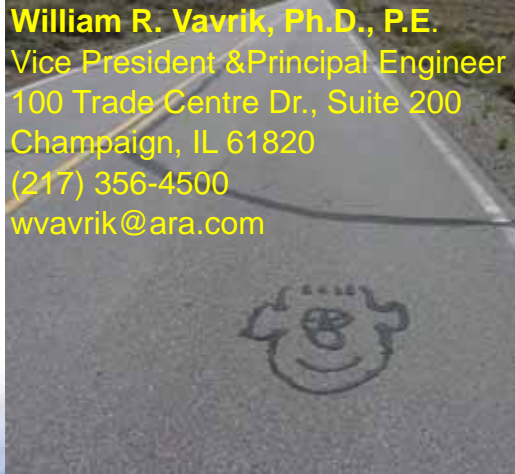


I am responsible for my actions at all times.

 Copyright 2013. All rights reserved. Applied Research Association 110

Thank You!

William R. Vavrik, Ph.D., P.E.
Vice President & Principal Engineer
100 Trade Centre Dr., Suite 200
Champaign, IL 61820
(217) 356-4500
wvavrik@ara.com



Copyright 2013. All rights reserved. Applied Research Association

111