

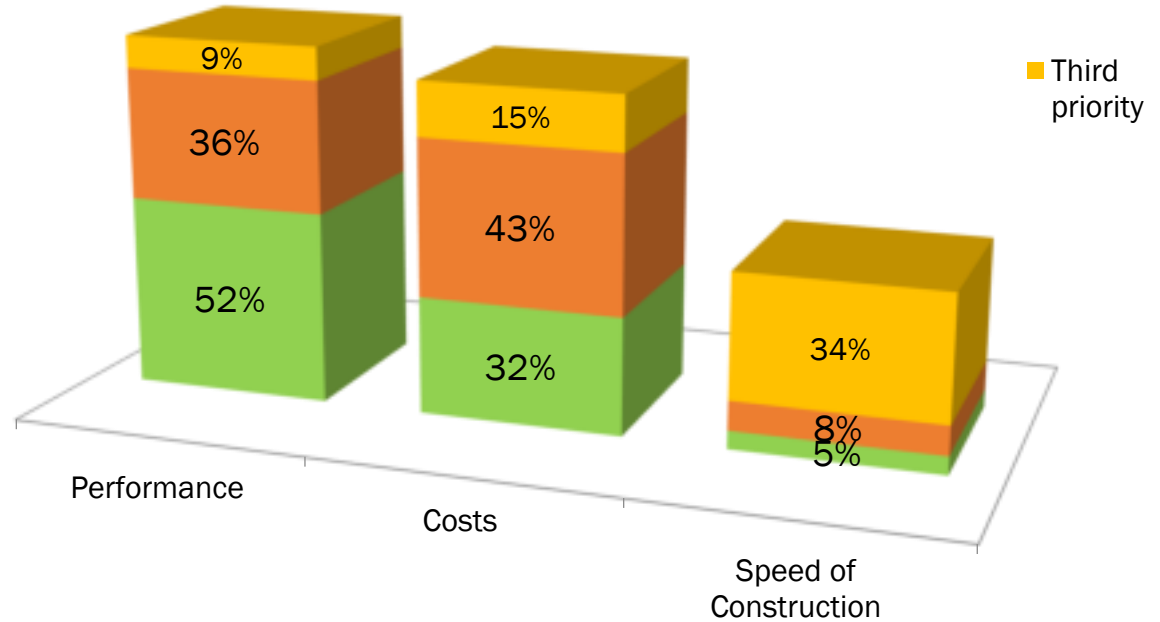


RAS IN ASPHALT MIXTURES: OPPORTUNITIES AND CHALLENGES

**RICHARD WILLIS, PhD
ARMA MEETING
SEPTEMBER 10, 2019**

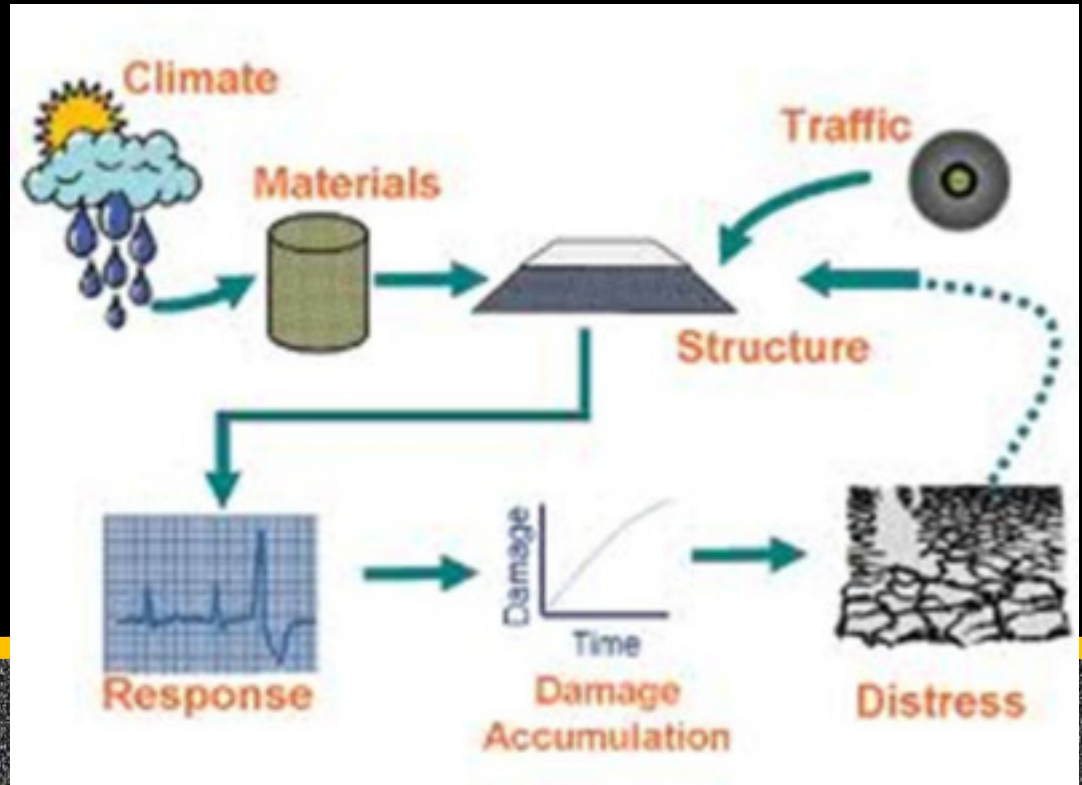


Top Three Priorities in Pavement-Type Selection Decisions





M-E Design





- Critical Location: Top of Subgrade
- Distress: Subgrade or structural rutting
- Thicker or stiffer pavements disperse stress



- Critical Location: Bottom of Asphalt Pavement
- Distress: Fatigue Cracking
- Pulling pavement apart



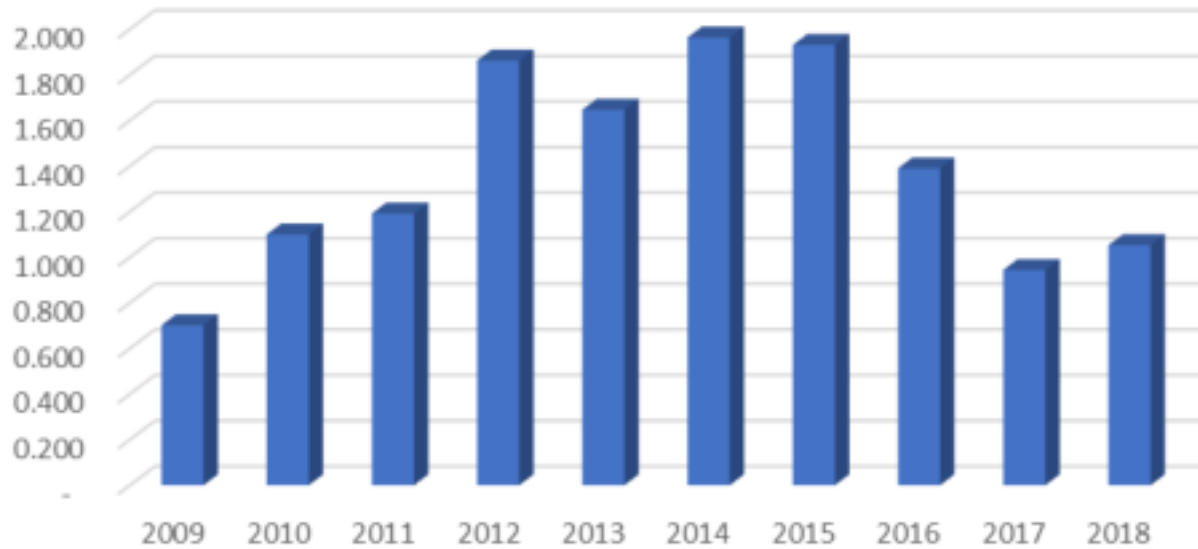
Can We Build Better, Thinner Pavements?





Are both trucks?

Tons RAS Used (Millions)





PG 76-22



Shingle Asphalt



U.S. Department
of Transportation
Federal Highway
Administration

Memorandum

Subject: **ACTION:** Recycled Materials in
Asphalt Pavements

Date: October 20, 2014

How We Got Here...

- Protect our pavements
- Performance is king!
- We used to assume 100% of the asphalt binder ...
- We used to assume somewhere between 70 and 85% of the binder...
- New low temperature properties



Where We Are Today

- How do I make sure our pavements are going to perform?
 - Cracking test - Ideally!
 - Volumetrics properties - Hasn't worked so far!
 - Some kind of binder test - Let's give it a shot!



Where We Are Today





Roadway Owners

- I now have a surrogate cracking measure
- But how will I choose to implement this?
- Change in policy/testing capabilities?
 - Many states were moving away from doing chemical extractions
 - Do I put this on the contractors?



What Does This Change Mean to Me?

What Does This Change Mean to Me?

- Contractors
 - **MORE TESTING!!!**
 - **Change the way business is done and mixtures are created**





What Do I Have to Do?

Asphalt Content



Asphalt Binder Properties





Aging





The Same,
But Different

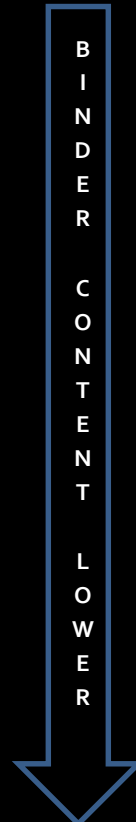
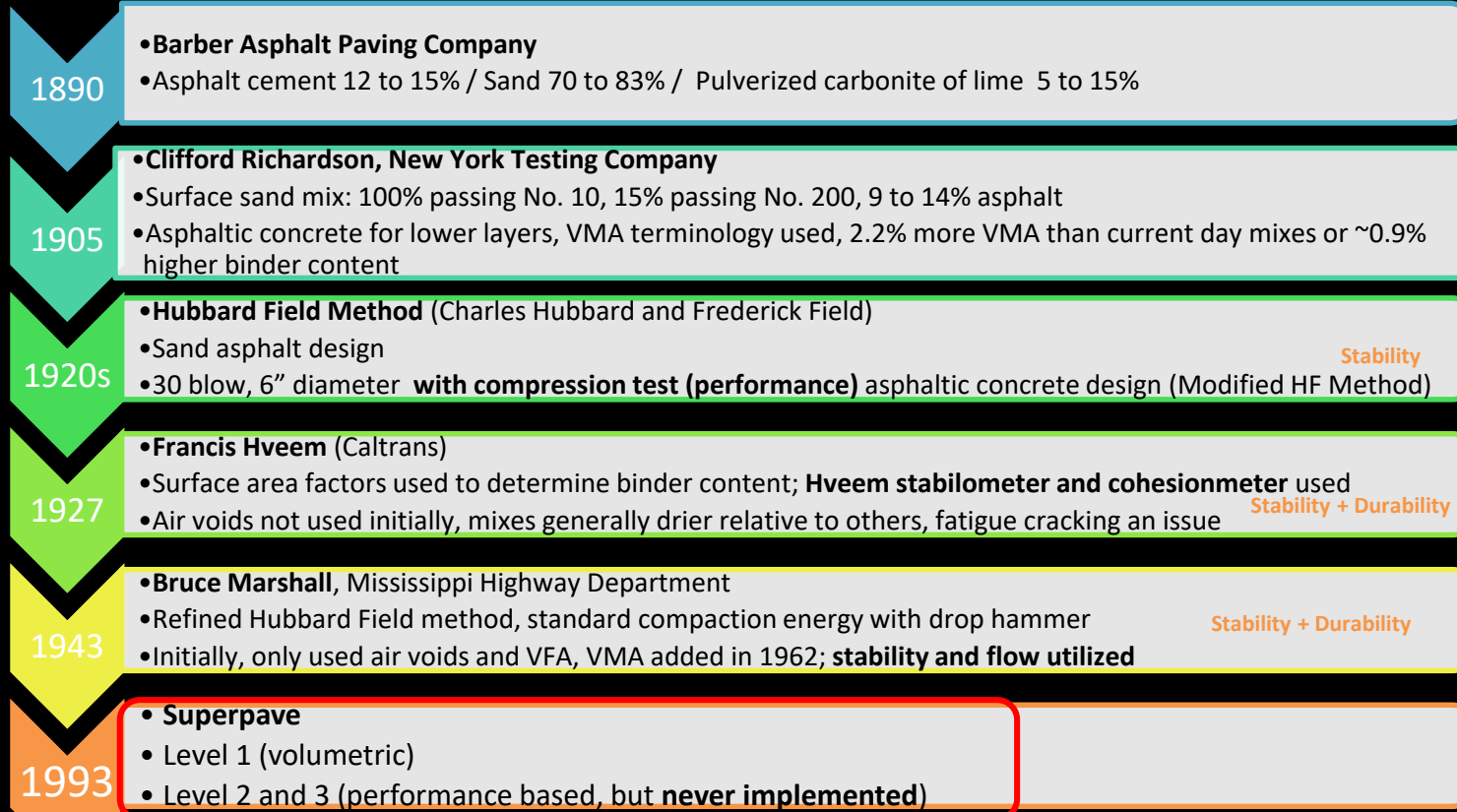
- Could we use a softer binder?
- Recycling agents
- Do I add more binder?
- What do I do?



It Takes More Work ...

History of Mix Design

(Courtesy of Shane Buchanan)



Balanced Mix Design is NOT

- A mix design as we define it today
- The silver bullet
 - Vulnerability current exists
 - Find the chinks in the armor & put research there



Balanced Mix Design Definition

- *“Asphalt mix design using performance tests on appropriately conditioned specimens that address multiple modes of distress taking into consideration mix aging, traffic, climate and location within the pavement structure.”*
- Use the right mix for the job!



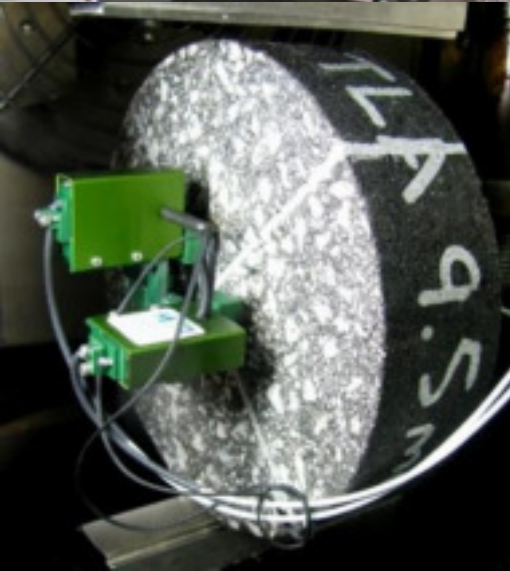
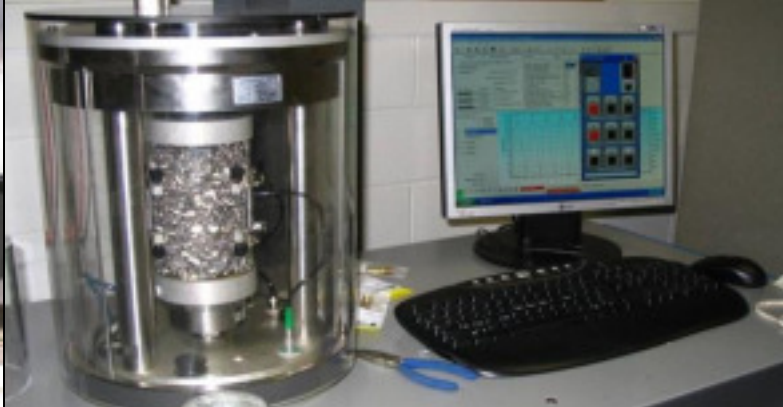
Finding the Balance



Durability (Cracking)

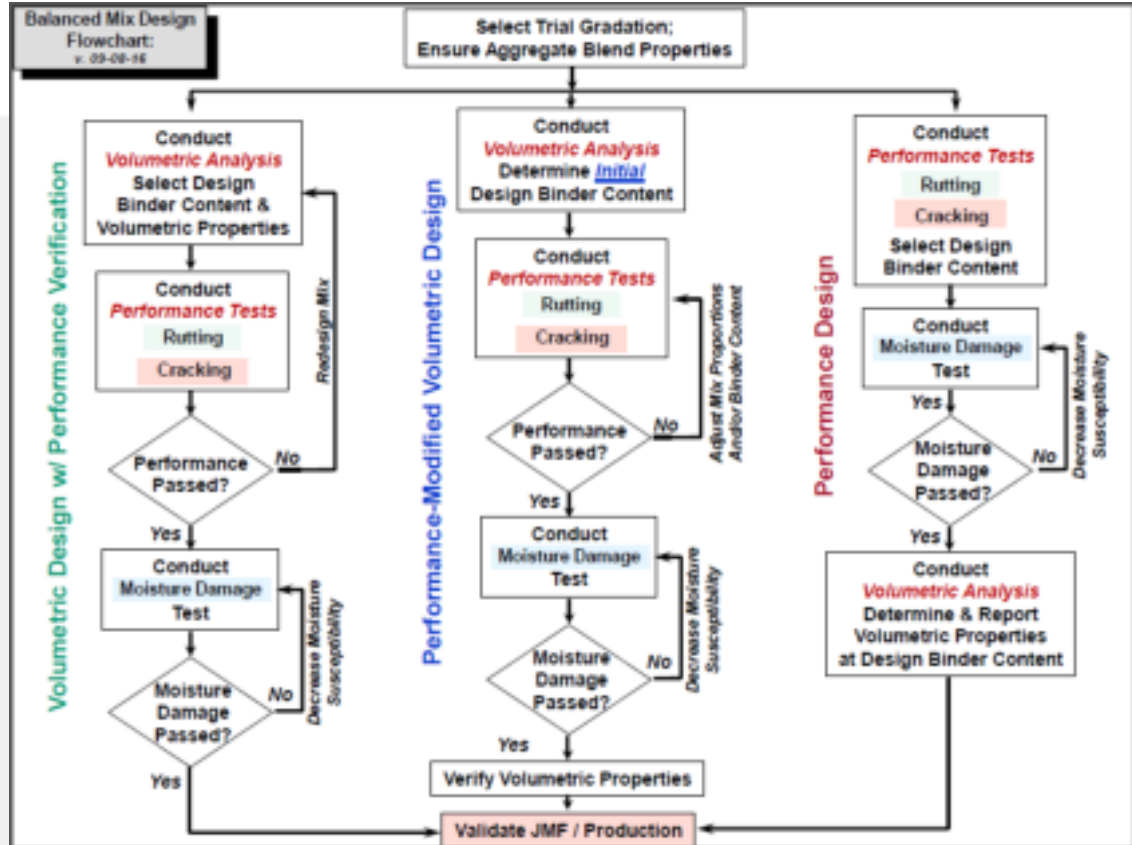


- Cracking is more challenging
- What type of cracking?
 - Thermal
 - Reflective
 - Top-down load related
 - Bottom-up Fatigue



BMD Approaches

- Three general mix design approaches.
- 1. Volumetric Design w/ Performance Verification
- 2. Performance Modified Volumetric Design
- 3. Performance Design



Graphic Developed by Kevin Hall (FHWA BMD Task Force), 2016

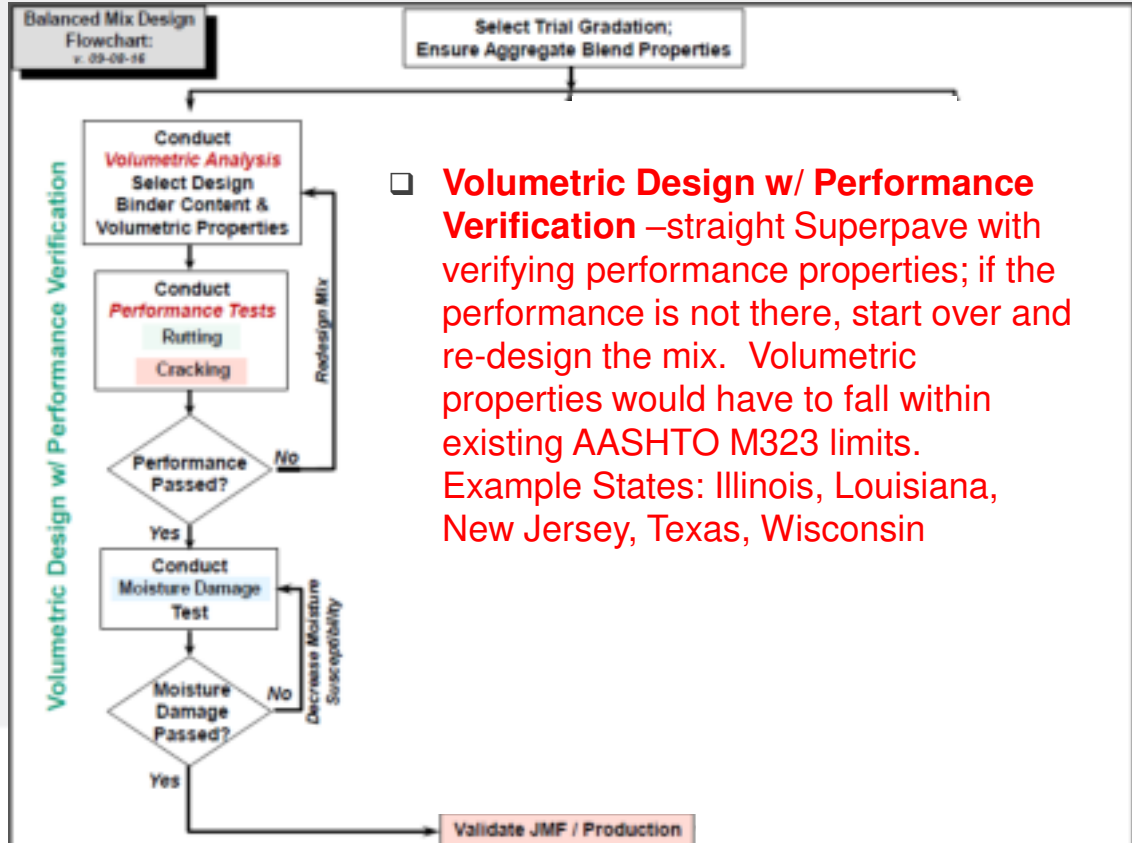
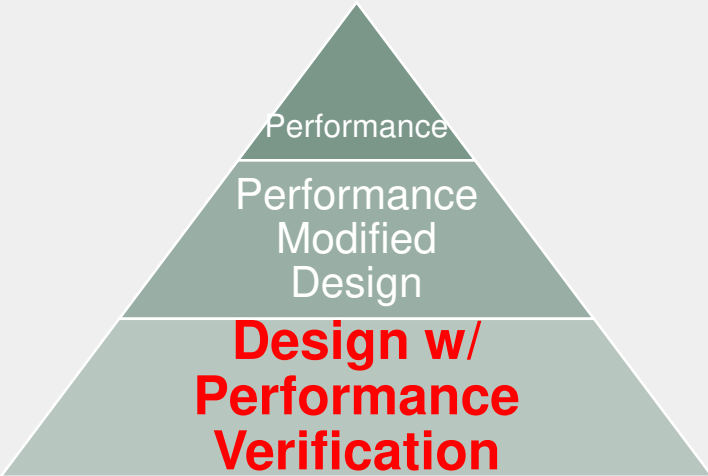
Volumetric Design w/ Performance Evaluation

or

Little Debbie Mix Design



Volumetric Design w/ Performance Verification



- ❑ **Volumetric Design w/ Performance Verification** –straight Superpave with verifying performance properties; if the performance is not there, start over and re-design the mix. Volumetric properties would have to fall within existing AASHTO M323 limits. Example States: Illinois, Louisiana, New Jersey, Texas, Wisconsin

Innovation Potential = Very Low

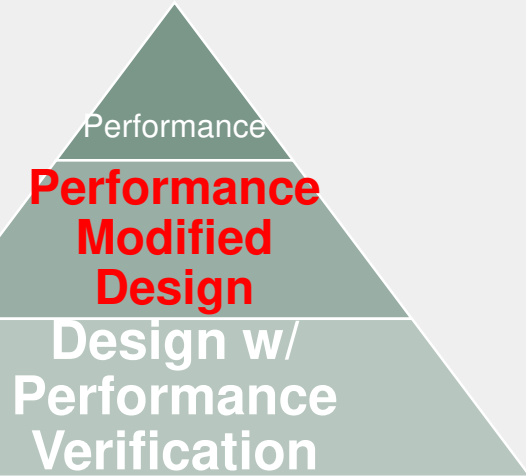
Performance Modified Volumetric Design

or

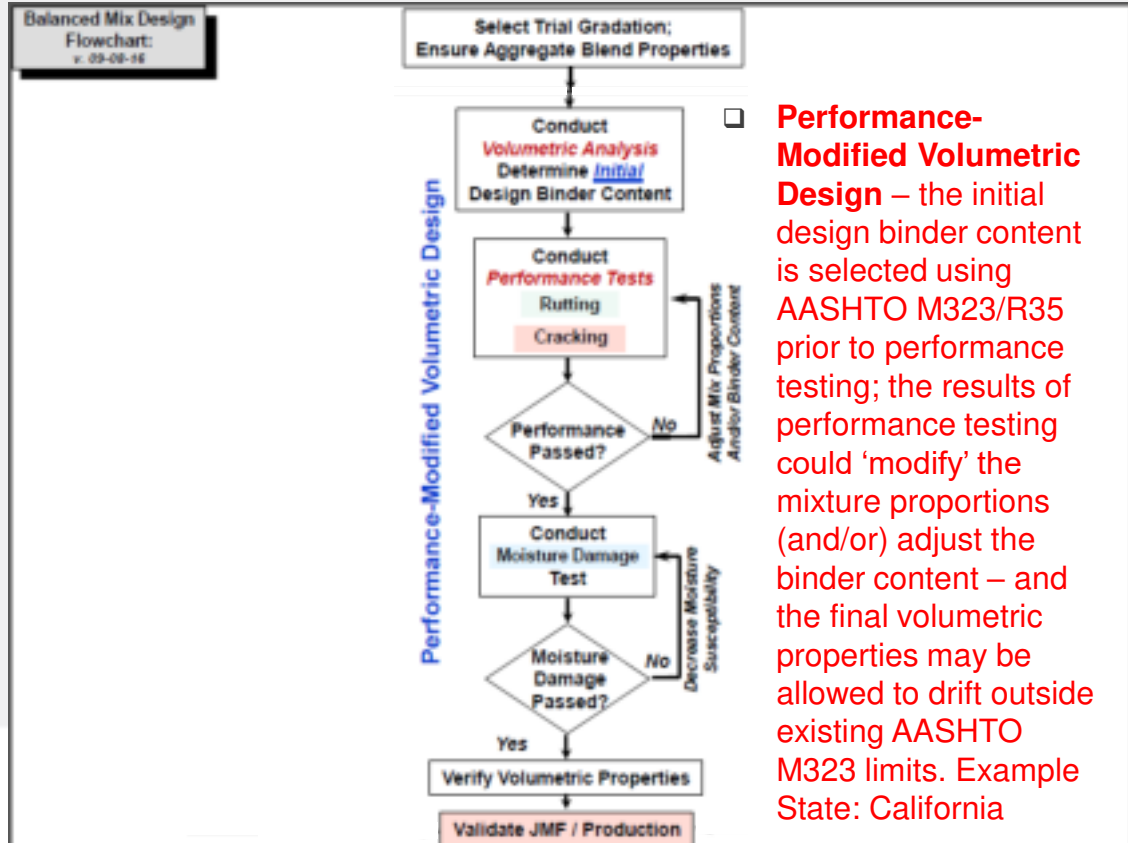
Amy Willis School of Mix Design



Performance Modified Volumetric Design



Innovation Potential = Low



Performance Design

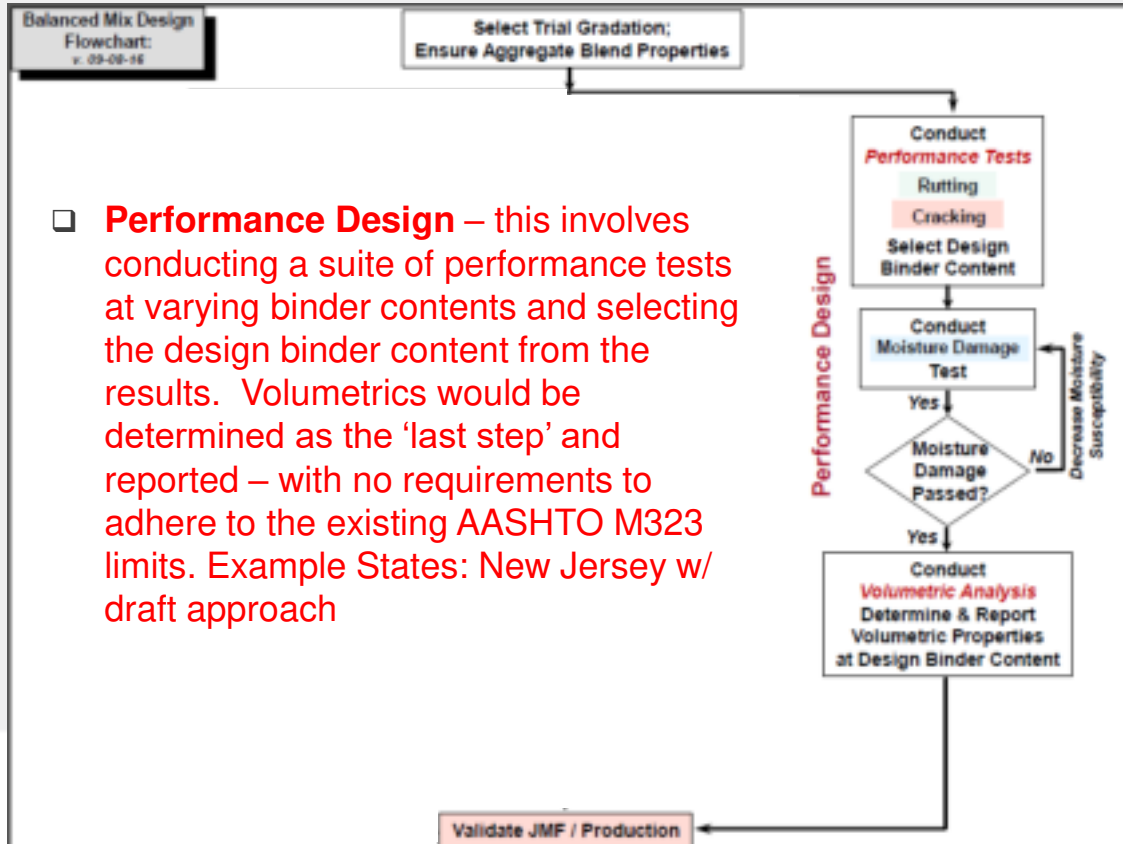
or



Performance Design

Performance
Performance Modified Design
Design w/
Performance Verification

*Innovation Potential =
Medium / High*



Solutions for Today's Problems

1. **Recognize performance issues** related to dry mixes in some areas. (Note: Many performance issues are caused by factors outside the mix design.)
2. **Increase understanding** of the factors which drive mix performance
3. **Design for performance** and not just to “the spec”.
4. **Start thinking** outside of long held “rules and constraints”
5. **Innovate!**



- The freefall of RAS usage has seemingly stopped
- New methods of mix design will be what allow RAS to be used if it is a viable source material
- Ultimately, it is all about performance.
- RAS properties impact performance
 - Consistent and fine grind
 - Clean sources

THANK YOU!

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