

# RAP & RAS Mix Design and QC Issues

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Buda, Texas

January 8, 2013



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# RAP/RAS Utilization

- RAP/RAS is currently used as an economical tool to extend the aggregate and asphalt supply
- In hot climates such as Texas, the true benefit of RAP/RAS usage may be its ability to stiffen the binder to resist rutting
- Technical advances have been made to allow this beneficial use of RAP/RAS
- How do all of the above figure in the mix design?

# Mix Design Issues:

- Volumetric Properties:
  - Density & VMA: Current Design Method Tex-204-F takes care of this
- Mixture Quality and Performance:
  - Current design procedure does not adequately account for this, i.e., there is no definition of good RAP vs Bad RAP and long-term performance is not addressed

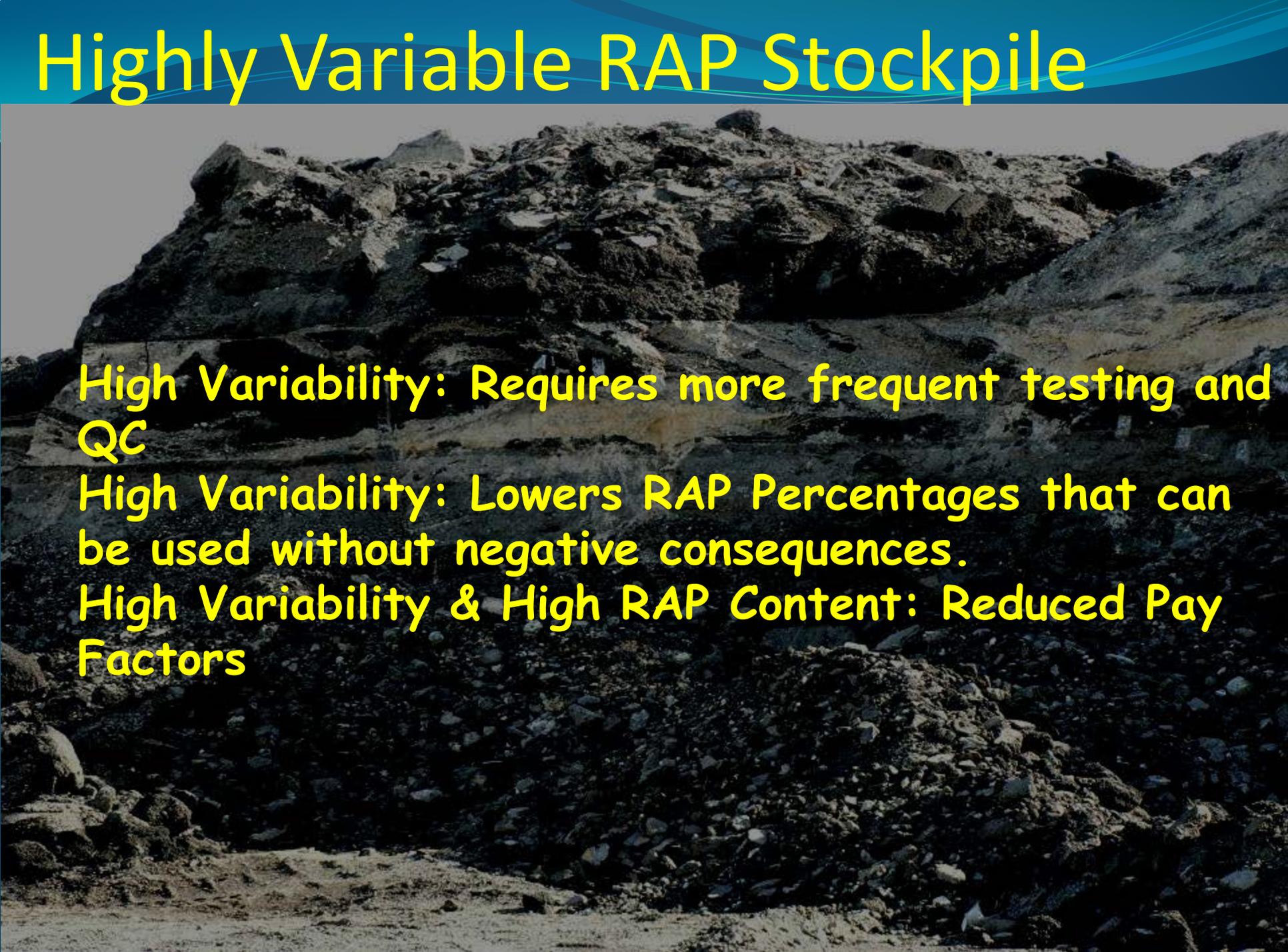
# RAP/RAS Mix Design Topics

- RAP/RAS Gradation & AC %
- Binder Properties
- Mix Performance Indicators

# RAP Characterization

- Gradation and AC Content: Needed for Mix Design
  - Ignition Oven: What to do about Corrections? Wing It?
  - Solvent Extraction : What's That?
  - One test per 500 tons of RAP
- RAP Moisture Content : Not needed for mix design, but critical for QC
- RAP Binder Properties
  - Recovery of Binder from RAP
    - Abson Recovery Tex-211-F

# Highly Variable RAP Stockpile



**High Variability: Requires more frequent testing and QC**

**High Variability: Lowers RAP Percentages that can be used without negative consequences.**

**High Variability & High RAP Content: Reduced Pay Factors**

# Determine RAP Properties

- Extraction and Recovery of RAP Binder and Aggregates



# RAP Binder Properties : Why Do We Care?

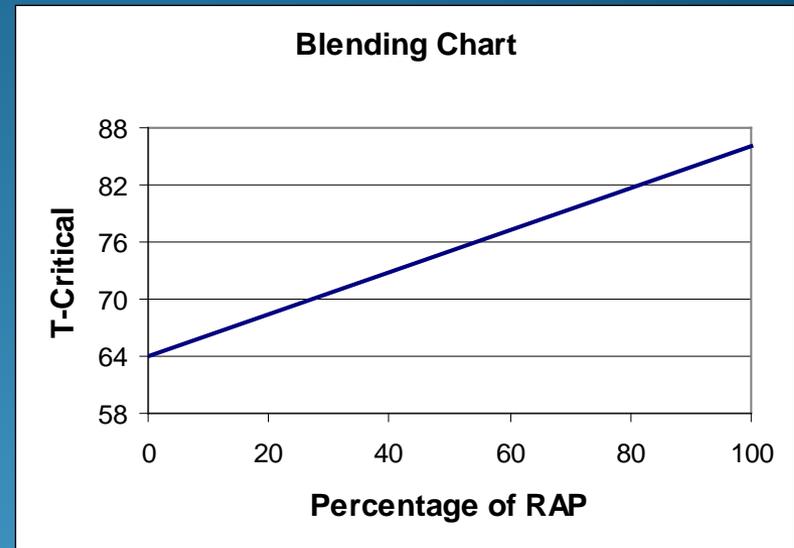
- Liquid Asphalt in RAP can improve high temperature properties of mix (i.e., improve Hamburg)
  - Age of RAP & % RAP both have an effect on this.
- Liquid Asphalt in RAP can increase cracking and raveling potential
- So is RAP Good or Bad???
  - Good tool when used wisely and not overused.

# RAP Binder Properties

- Extraction & Recovery of Binder- Abson Method
- RAP Binder Properties- Pen & DSR
- Binder Grade Selection- What Do Plans Call for?
- Determine RAP Content
  - How much RAP to use ? How much did the boss bid?
    - Some mixes don't tolerate high RAP %. SMA mixes difficult to design and produce with more than 10% RAP.
    - Best place to optimize use of RAP is in base courses.
    - RAP-RAS usage in marginal weather not advisable.

# Binder Blending Chart

- All tests used in this method are well-defined
- Assumption is that Recycled and Virgin AC blend completely? Not So



# Binder Blending- Possibilities

- Black Rock Effect: Asphalt in RAP does not blend with virgin asphalt
  - May be true with low RAP % or very old RAP or RAS
- Total Blending of Old and New Liquid Asphalt: Not very likely
- Partial Blending

# Binder Blending Method

- Most current research support concept of a tiered system
- Blending occurs at higher RAP contents. At low RAP contents blending effects are not significant

# Virgin Binder Grade Selection

- Less than 20% RAP: No change in Binder Grade
- 20-30% RAP: One Grade Lower
- More 30% Binder: Use Blending Chart
  
- This strategy assumes blending occurs only at high RAP percentages: May not be a good assumption

# Alternative to Blending Charts

- When acceptable mixture performance tests are available, RAP usage can be optimized to yield desired mix test results
- Current Potential Tests:
  - Rutting: Hamburg Test
  - Moisture Damage: Hamburg Test
  - Cracking Resistance: Overlay, Tensile Strength, Resilient Modulus, ???
  - Raveling & Flushing: VMA & VFA

# Handling RAP/RAS in the Lab

- Dry and Mix RAP/RAS into a Homogeneous Material
- Do we need to split RAP/RAS sample? Yes, at least + #8 and - # 8. Fine RAP/RAS contains a lot more AC and affects volumetric
- When do we add RAP/RAS: Keep it Simple! Add it to Dry Batch
- Treat RAP/RAS like a black rock

# QC/QA Issues

RAP Moisture- Daily

RAP AC-Daily

RAS Moisture- Daily

Watch out for changes in RAP source