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Ideas to Meet Volumetric Specifications in the Lab and in the Field

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Southeastern Asphalt User Producer Group
December 14, 2005

Outline

- Understanding volumetrics
- Meeting volumetric criteria in the lab
- Meeting volumetric criteria during production

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Volumetric Principles

- Mix Design is the process by which we proportion the ingredients in the mixture.
- Selection of the optimum asphalt content is primarily based on volume proportions.
- Specific gravities (densities) are used to convert masses to volumes.

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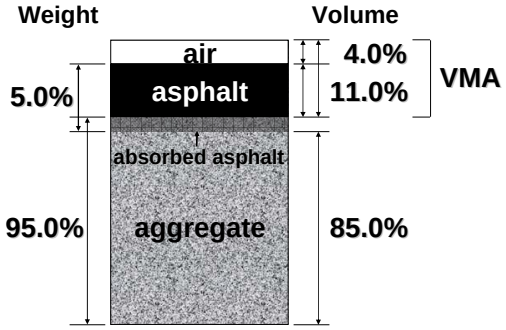
Weight / Volume Relationships



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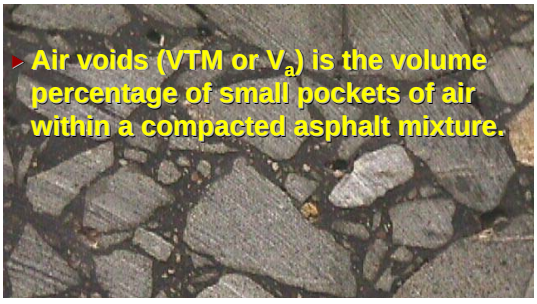
Air Voids



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Air Voids

- Pavements with low air voids (below 2 to 3%) will often be unstable mix and lead to rutting or shoving.
- Pavements with high air voids (above 7 to 8%) tend to be permeable which leads to rapid aging, cracking, raveling, and stripping.
- Optimum asphalt content is usually selected at 4.0% air voids.

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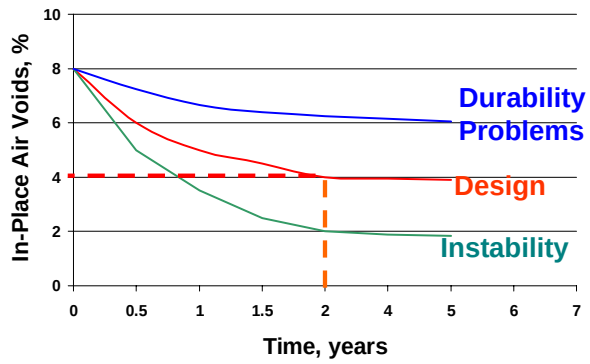
In-Place Air Voids vs. Time



Air Voids

- Air voids is calculated from the mixture's maximum (Rice) specific gravity and the compacted sample's bulk specific gravity.

$$V_a = \frac{G_{mm} - G_{mb}}{G_{mm}} \times 100$$

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Voids in Mineral Aggregate

- VMA is the volume percentage of intergranular space (space between aggregates) in a compacted asphalt mixture.
- VMA includes the air voids and the volume of ***effective*** asphalt.
- Specifications require a minimum VMA to assure that the mixture contains a minimum volume of effective asphalt.

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VMA

- VMA is calculated from the compacted sample's bulk specific gravity, the asphalt content, and the aggregate bulk specific gravity.

$$VMA = \left(1 - \frac{G_{mb} \times (1 - P_b)}{G_{sb}}\right) \times 100$$

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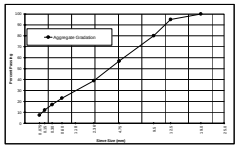
VMA

- The VMA of a mixture depends on the aggregate gradation, particle shapes and textures, the asphalt content, and the level of compaction.



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In the Design Lab….The Bottom Line!

- Assess and account for aggregate breakdown
  - Target 0.5 to 1.0 percent higher VMA
  - Incorporate baghouse fines
- Investigate "fine graded" mixes (if possible)
- Use a "sweetener" (i.e. combination of aggregates)
- Conduct sensitivity analysis…
- Be aware of SGC issues / differences…

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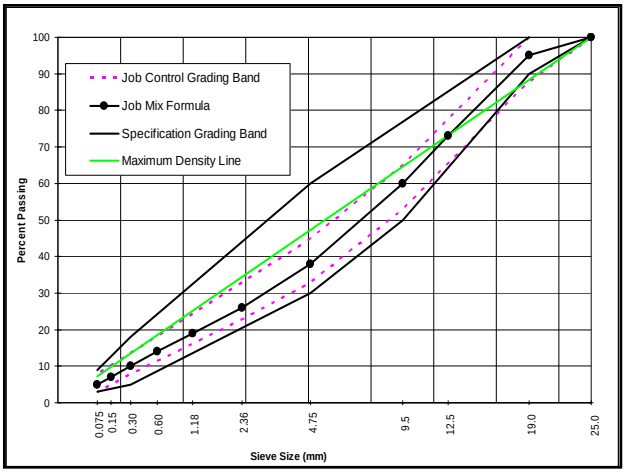

SGC Issues

- Revised compaction levels
- Locking Point Mix Design
- "What do you mean we don't match up?!?!"

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SGC Differences?

- Angle of Gyration
  - External measure
  - Internal measure
- AASHTO T 312
- ETG Guidance Document
- Mold Wear…

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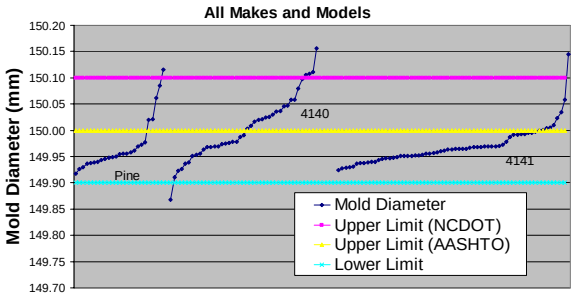
Mold Wear in NC



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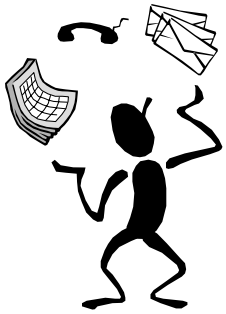
In the Field….Process Control!

- Quality Control is an important subset of Process Control
- Quality Control is an investment not a cost center



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QC Testing

- Establish appropriate testing frequencies
- Maintain an organized filing system for:
  - paperwork
  - computer files
  - database
- Control charts:
  - monitor accuracy and consistency
  - help see the big picture and make adjustments as necessary

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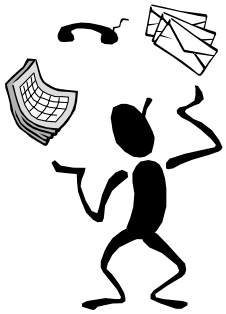
In the Field….Process Control!

- Plant maintenance
- Plant calibration
- Mix design
- Mix verification
- Monitoring inputs
- Monitoring outputs
  - Volumetrics
  - Specimen heights



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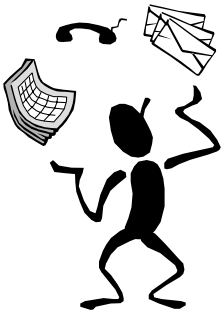

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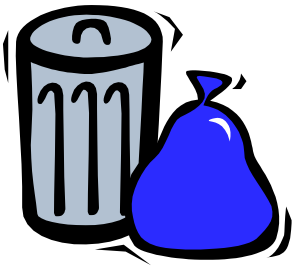
Steps for Verifying Mix Properties

1. Ensure proper plant setup and calibration.
2. Check materials to assure that they match the properties used in the mix design.
3. Run trial at the end of the day.
4. Sample the mix after plant "levels out".
5. Determine critical mix properties.
6. Make necessary adjustments and retest as necessary.

Monitoring Inputs

- "Garbage in, garbage out!"
- Proactive QA Program valuable



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Monitoring Outputs

- Volumetrics
- Binder Content
- Gradation
- SGC Specimen Heights

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In the Field….The Bottom Line!

- Plant Properly Setup and Calibrated
- Verify the Mix Design
- Production "Best Practices"
  - Monitor moisture content
  - Monitor dust level
- Be aware of SGC issues / differences

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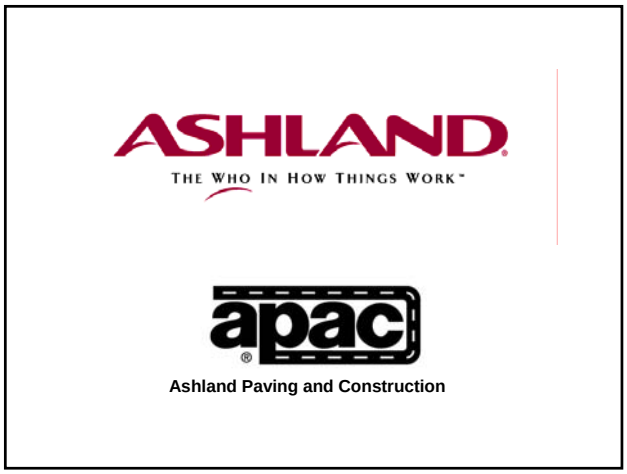
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