


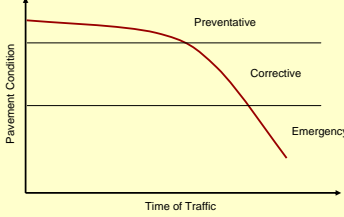
### Perpetual Pavement Preservation: 4.75 mm Maintenance Mixes



Allen Cooley, Ph.D.  
Burns Cooley Dennis, Inc.

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### Perpetual Pavement Preservation?????????



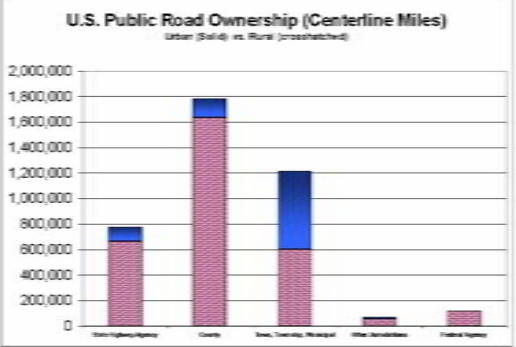
"Selecting a Preventive Maintenance Treatment for Flexible Pavements"  
Dr. R. Gary Hicks, P.E., Stephen B. Seeks, P.E., David G. Postwin, P.E., March 2000

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### What are We Talking About?

#### U.S. Public Road Ownership (Centerline Miles)

Urban (Solid) vs. Rural (crosshatched)



Stephen R. Mueller, P.E.  
FHWA Pavement and Materials Engineer

### What are We Talking About?

#### Pavement Preservation Guidelines

| Type of Activity                                       | Increase Capacity | Increase Strength | Reduce Aging | Restore Serviceability |
|--|-------------------|-------------------|--------------|------------------------|
|  | New Construction  | X                 | X            | X                      |
| Reconstruction   | X                 | X                 | X            | X                      |
| Major (Heavy) Rehabilitation                           |                   | X                 | X            | X                      |
| Structural Overlay                                     |                   | X                 | X            | X                      |
| Minor (Light) Rehabilitation                           |                   |                   | X            | X                      |
| <b>Pavement Preservation</b><br>Preventive Maintenance |                   |                   | X            | X                      |
| Routine Maintenance                                    |                   |                   |              | X                      |
| Corrective (Reactive) Maintenance                      |                   |                   |              | X                      |
| Catastrophic Maintenance                               |                   |                   |              | X                      |

Table 1- Pavement Preservation Guidelines FHWA Memo from Director, Office of Asset Management "Pavement Preservation Definitions"

### What are We Talking About?

- Thin Lift Hot Mix Asphalt
  - **Thin Overlay** – A HMA overlay with one lift of surface course generally with a thickness of 38 mm (1.5 in) or less.
    - PAVEMENT PRESERVATION GLOSSARY OF TERMS November 2, 2001–Foundation of Pavement Preservation
- What are We Really Talking About?
  - 4.75 mm NMAS – Probably ¾" to 1"
  - Specifically for Lower Volume Roadways

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### Outline

- Discuss Several Research Studies
  - 4.75 mm NMAS Superpave Mixes
  - Screenings Mixes
- Show Some Slides from ALDOT's first 4.75 mm NMAS Project (2003)
- Show Some Slides from First Thin Lift Project from Overland Park, KS (2008)

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### Research

- Research Results from Two Studies
  - Develop 4.75 mm NMAS Superpave Mixes
  - Screening Mixes
- Tie it all together

**Both Conducted at NCAT**

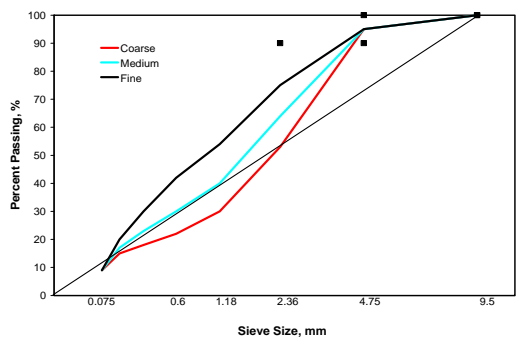
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### 4.75 mm NMAS Matrix

- Two Aggregates ~ Granite & Limestone
- 3 Gradations ~ Coarse, Medium & Fine
- 3 Dust Contents ~ 6, 9, & 12 percent
- 2 Design Air Void Contents ~ 4 & 8 percent
- $N_{des} = 75$  gyrations
- PG 64-22

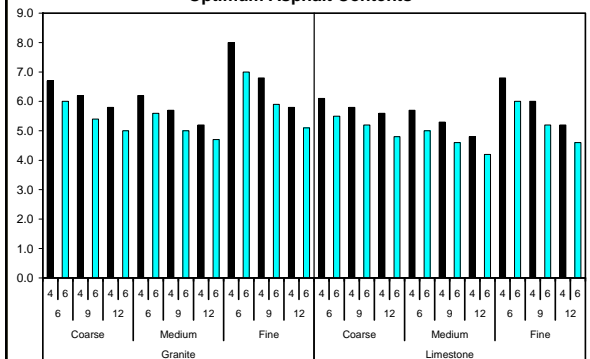
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### General Gradation Shapes



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### Optimum Asphalt Contents



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### Performance Testing

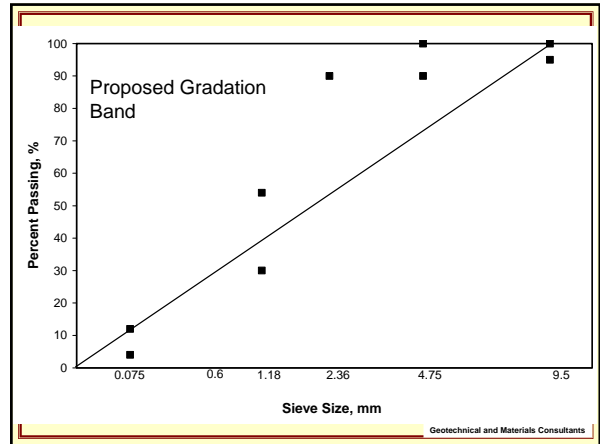
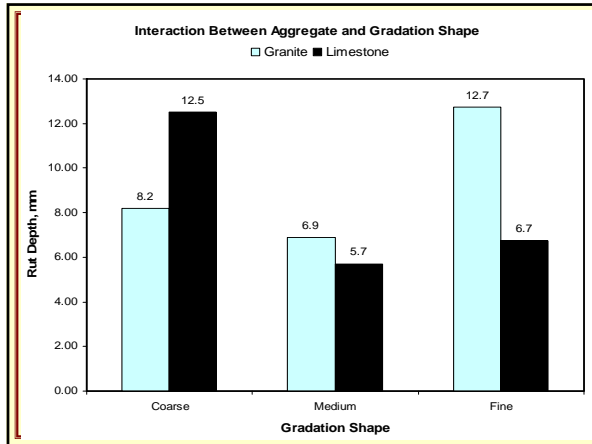
- Rut Testing Only
  - Asphalt Pavement Analyzer
  - 64°C
  - Design Air Void Content
  - 120 lb/120 psi

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### Analysis of Rut Depth Data

- All Main Factors Significant
  - Aggregate Type
  - Design Air Voids
  - Gradation Shape
  - Dust Content

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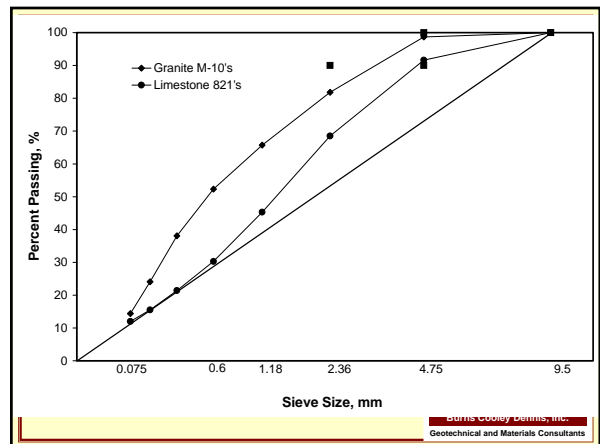


- ### 4.75 mm Volumetric Criteria
- Design Air Void Content
    - All Design Levels 4%
  - VMA Criteria
    - Ndes = 50 16% min.
    - Ndes = 75, 100, 125 16 – 18 %
  - VFA
    - Ndes = 50 75 – 80%
    - Ndes = 75, 100, 125 75 – 78 %
  - D/A Ratio
    - All Design Levels 0.9 – 2.2
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### Use of Screenings to Produce HMA Mixtures

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- ### Screenings Materials
- 2 Screenings Stockpiles: Granite Limestone
  - 2 Binders: PG 67-22 and PG 76-22
  - With and Without Fiber
  - 3 Target Air Voids: 4, 5 and 6
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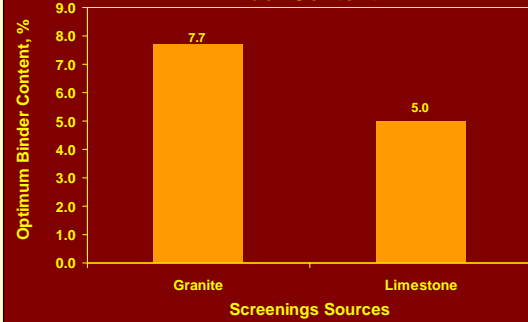
## Optimum Binder Content

### Significant Factors:

- Screenings Material
- Existence of Fiber
- Design Voids Content

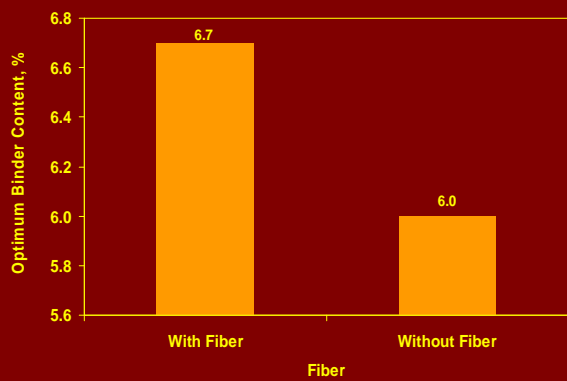
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## Effect of Screenings Source on Optimum Binder Content

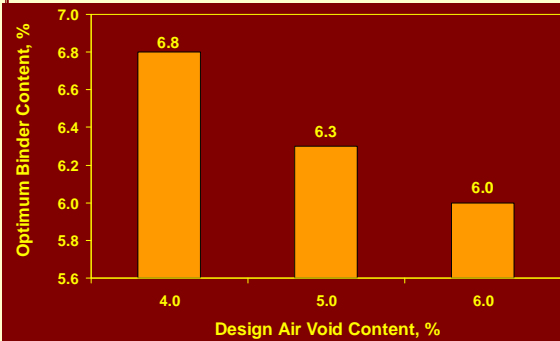


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## Effect of Fiber on Optimum Binder Content



## Effect of Design VTM on Optimum Binder Content



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## Asphalt Pavement Analyzer Rut Testing

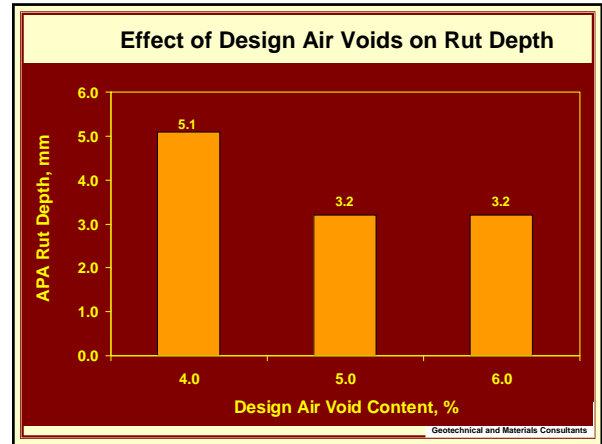
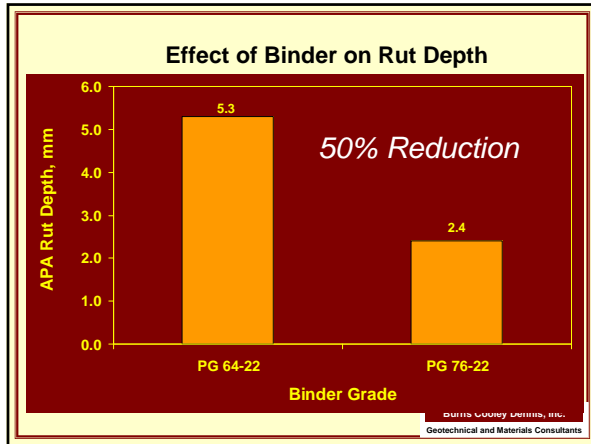
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## Analysis of Rut Depth Data

### Significant Factors:

- Binder Type
- Screenings Material
- Design Void Content

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### Fiber not significant \*\*

Even though mixes with fiber had 0.7% higher OAC

This indicates: for a given screenings and gradation, fiber would allow for an increase in binder content without the loss of stability.

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### Recommendations

Based Upon the Two Studies, the following criteria are recommended

| Property                      | Criteria |
|-------------------------------|----------|
| Design Air Void Content, %    | 4 to 6   |
| Effective Volume of Binder, % | 12 min.  |
| Voids Filled with Asphalt, %  | 67-80    |

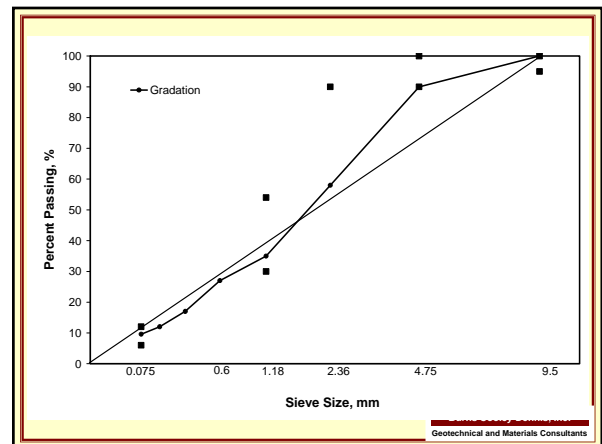
**Other Needs:**  
Proper Ndesign Value  
Aggregate Requirements (FAA)

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### ALDOT's First 4.75 mm Superpave Mix

(Placed in 2003)

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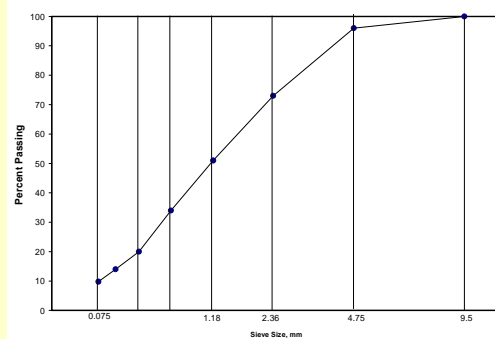
### JMF

- Aggregates
  - Granite Screenings (38%)
  - Limestone Screenings (50%)
  - Sand (10%)
  - Baghouse Fines (2%)
- Binder Content – 6.3% (Ndes=75)
- D/A – 1.66
- VMA – 17.1%

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### Overland Park, KS

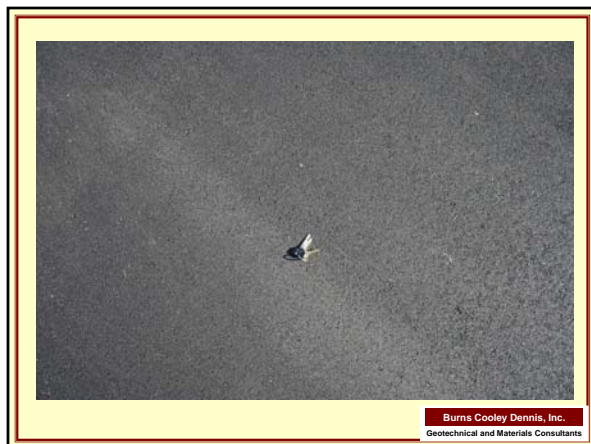


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## Overland Park, KS

- Limestone
- Chat
- Sand
- **35% RAP**

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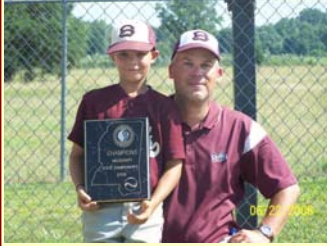


## Conclusions

- 4.75 mm NMAS or 4.75 mm Like Mixes Can Be Designed
- These Type Mixes can be Constructed
- In Some States, These Type Mixes Have Performed for Many Years
- **4.75 mm Mixes Should Be Considered for Preventative Maintenance or Pavement Preservation, Especially in Urban Environments or Low Volume Highways**

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*Thanks!*  
*Questions?*



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