Fine-Graded Mixes

Illinois Asphalt Pavement Association
Annual Meeting

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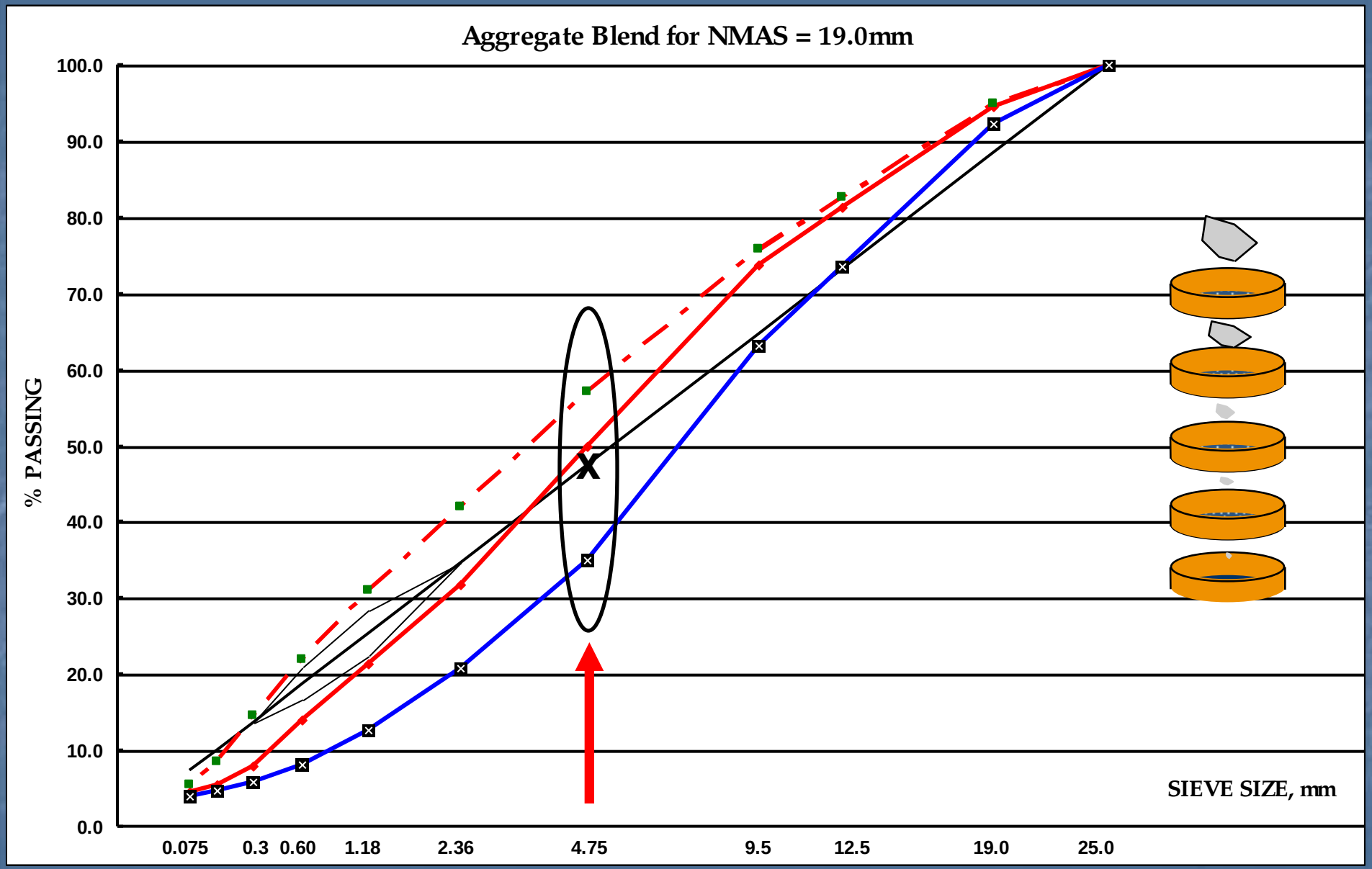
What is a *Fine-Graded* Mix?

- In the past…it was called a "sand" mix
- Today…most use the % passing the **P**rimary **C**ontrol **S**ieve relative to the Maximum Density Line
- With the *Bailey Method*…it's a function of **CA** and **FA** **Volume**


Aggregate Blend for NMAS = 19.0mm
% PASSING
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.075
0.3
0.60
1.18
2.36
4.75
9.5
12.5
19.0
25.0
SIEVE SIZE, mm
X

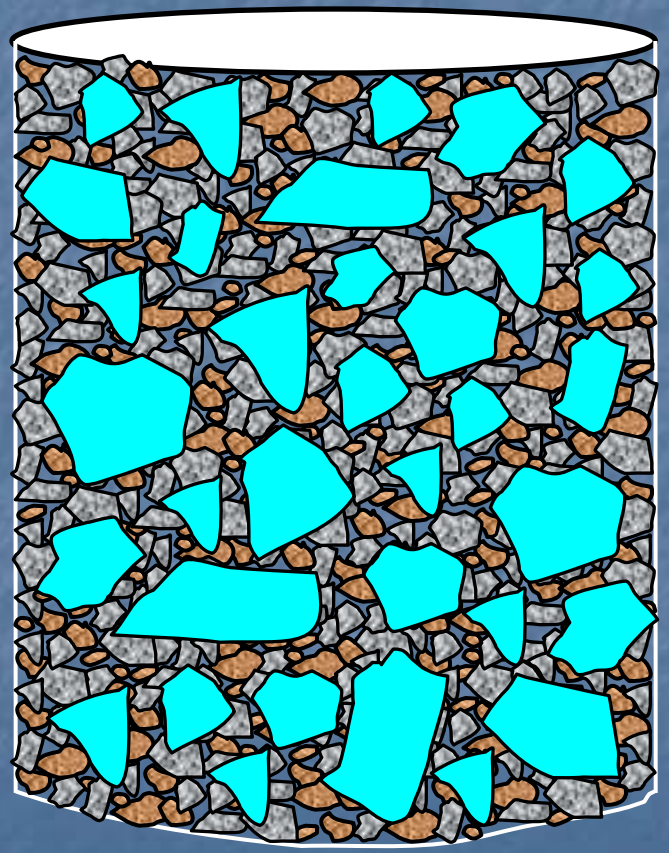
Typical *Fine-Graded* Designation

Nominal Maximum Aggregate Size	Primary Control Sieve Above is Fine-Graded Below is Coarse-Graded	IDOT Max % Passing N90 & N105 Mixes
1" (25mm)	40% Passing 4.75mm	40%
3/4" (19mm)	47% Passing 4.75mm	40%
1/2" (12.5mm)	39% Passing 2.36mm	40%
3/8" (9.5mm)	47% Passing 2.36mm	40%

Info from Fine-Graded Literature Review Performed by Murphy Pavement Technology

With the *Bailey Method* A *Fine-Graded* Mix…

- CA Volume < CA LUW
- Little to No particle-to-particle contact of CA
- Fine fraction carries most of the load
- Increased amount of FA support needed



4.75mm

19.0mm

9.5mm

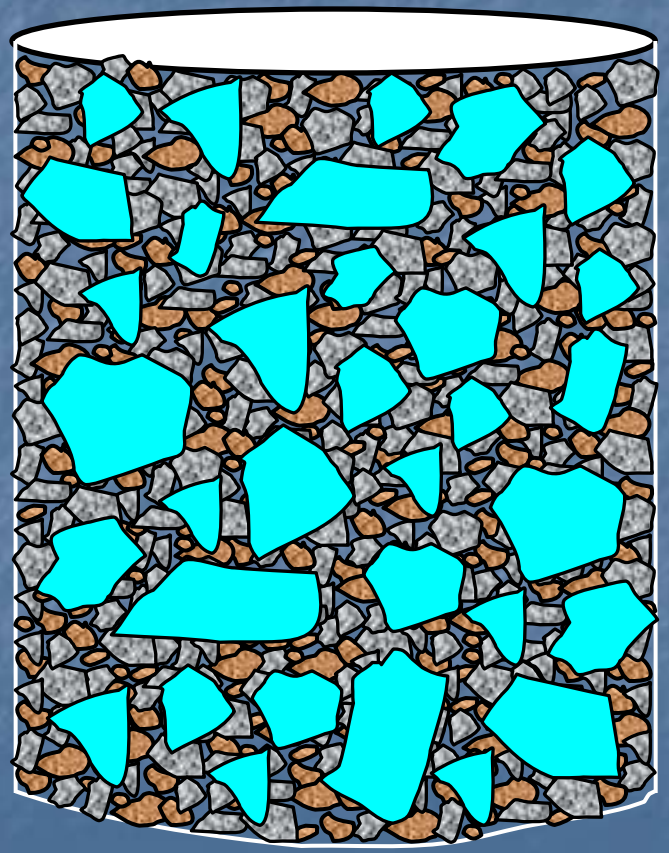
25.0mm

12.5mm

37.5mm

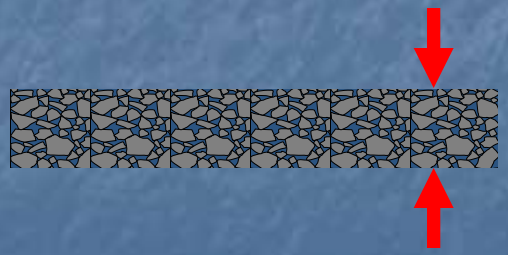
Do Other States Specify *Fine-Graded* Mixes?

- No…
  - Typically gradation bands allow the Contractor to choose **C-G** or **F-G**
- Often…HMA used for Federal Aviation Admin. are *fine-graded*
  - But even their gradation bands typically allow a choice



Should *Fine-Graded* Mixes Be Specified?

- No…
  - *Except…* when lift thickness is too thin to allow a Coarse-Graded mix to be compacted adequately without causing degradation of the aggregate structure
  - *Examples…*
    - 9.5mm (3/8”) Level Binder
    - 19.0mm (3/4”) Binder



Mix **Type** vs. Lift Thickness

HMA Lift Thickness vs. NMAS and Mix Type			
Nominal Maximum Aggregate Size	**NCAT** **Coarse**-Graded **4 x NMAS**	**NCAT** **Fine**-Graded **3 x NMAS**	**IDOT** Specification **3 x NMAS**
9.5mm **(3/8")**	**1-1/2"**	**1-1/8"**	**1-1/4"**
12.5mm **(1/2")**	**2"**	**1-1/2"**	**1-1/2"**
19.0mm **(3/4")**	**3"**	**2-1/4"**	**2-1/4"**
25.0mm **(1")**	**4"**	**3"**	**3"**

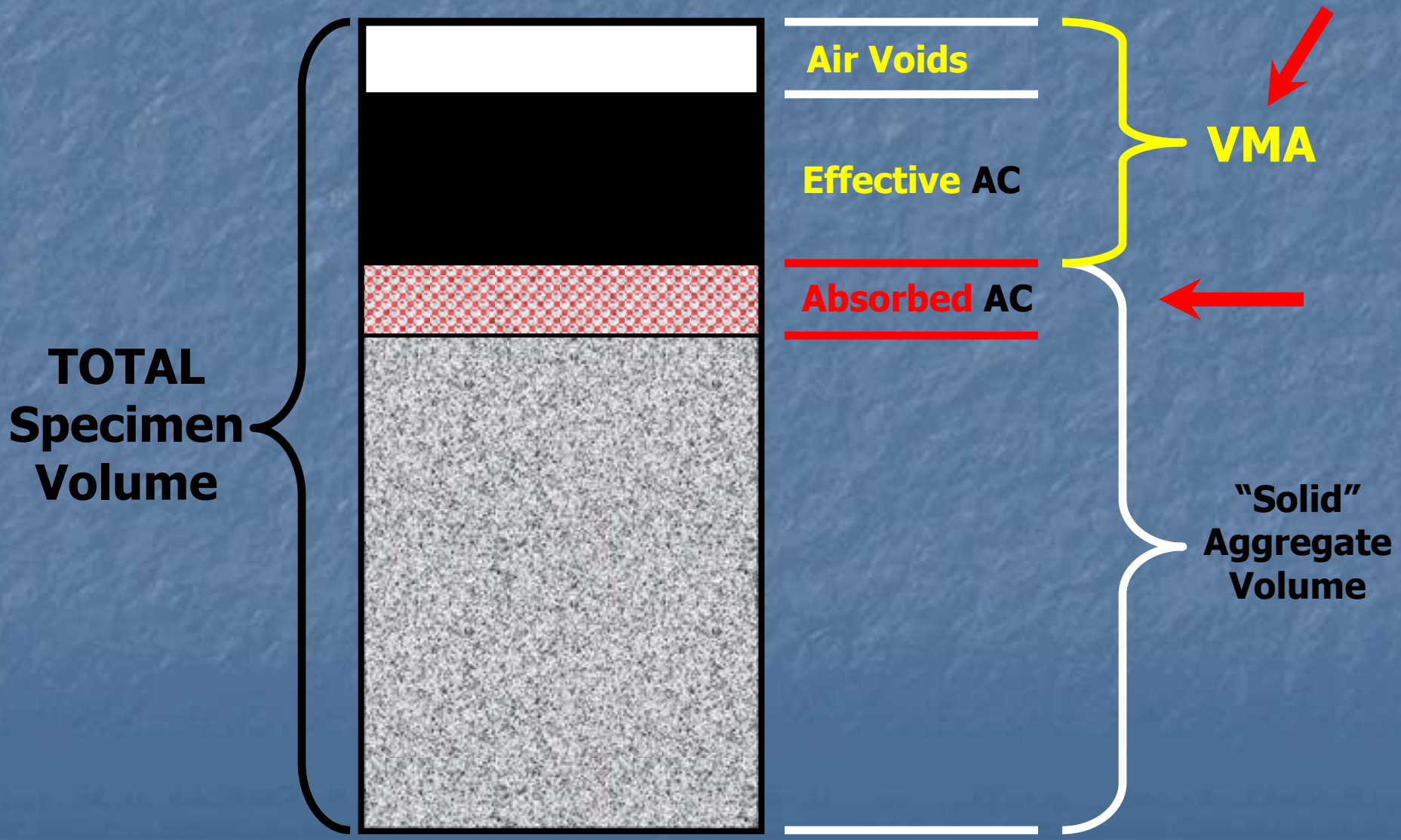
Info from Fine-Graded Literature Review Performed by Murphy Pavement Technology

Stretching Our Comfort Zone…

- Rutting Potential?
- Require More AC?
- Less AC Film Thickness?
- Stripping Potential?
- Less Friction?
- Issues Meeting VMA?
- Crushed FA Availability?
- Use of RAP?

- Superpave…
  - Gradation Control Points
  - ESAL Driven Items:
    - CA Angularity
    - FA Angularity
    - Flat & Elongated
    - Depth in Structure
    - Volumetrics (NMAS)
    - TSR (Stripping)
    - Dust to Effective AC Ratio

VMA = Voids + Effective AC

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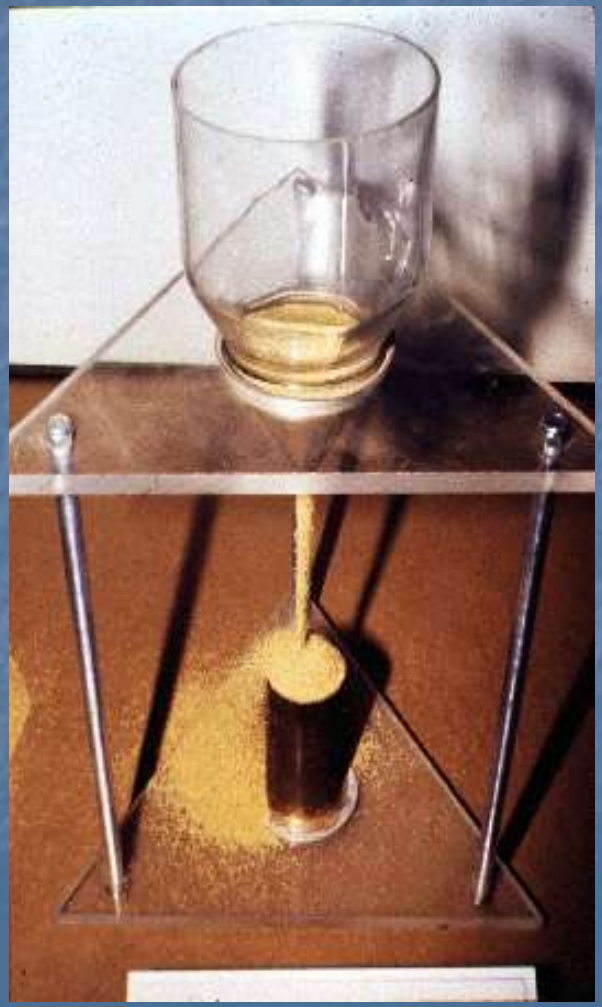
The **Key** to *Fine-Graded* Mixes

- Properties of the **FINE** fraction…
  - Gradation
  - Shape
  - Strength
  - Texture
- IDOT addresses with a minimum 67:33 sand blend requirement for Manufactured vs. Natural

Fine Aggregate Angularity

- **Method A**
  - **Fixed** Gradation
  - Measures **Loose** Voids that are a function of:
    - **Shape and Texture**
- **Natural** 37 – 44%
- **Manufactured** 42 – 52%
- Combined **FAA** requirement a function of Traffic Level



Advantages of Fine-Graded Mixes

- Less permeability at the same density
- Less susceptible to segregation
- Less sensitive to gradation variability on the PCS
- More compactable…
- Improved Aesthetics (Less Macro-texture)

Impact for PFP?

Advantages of *Fine-Graded* Mixes

- Generally easier to compact, primarily due to lift thickness vs. NMAS
  - Min and Max lift thickness for **C-G** and **F-G**
    - **4 to 8** x NMAS for **Coarse-Graded**
    - **3 to 6** x NMAS for **Fine-Graded**
  - Less degradation during field compaction?
  - Improved smoothness because the mix isn't being over-rolled?

Impact on LJT Performance?

Designing, Producing & Constructing Fine-Graded Hot Mix Asphalt on IL Roadways (IHR27-79)

- Phase 1: Literature review
  - Review historical development of IDOT HMA specs
  - Interview various IDOT Personnel
  - Gather info from other states, FAA, and intermodal uses with similar traffic, climate, and aggregate resources
- Phase 2: Mix Designs
  - Development of the various aggregate structures for the Fine-Graded mixes using the Bailey Method
- Phase 3: Lab Performance Testing
  - Hamburg wheel and the AMPT
- Phase 4: Field Testing
  - Mixes placed and tested with ATLAS loading at ICT
  - Potential use on IDOT project

- Jim Trepanier
- Matt Mueller
- Patty Broers
- Steve Hefel
- Steve Robinson
- Laura Shanley
- Hal Wakefield

- Brett Williams
- Frank Mathewson

- Bill Buttlar
- Imad Al-Qadi
- Sam Carpenter
- Tim Murphy
- Bill Pine

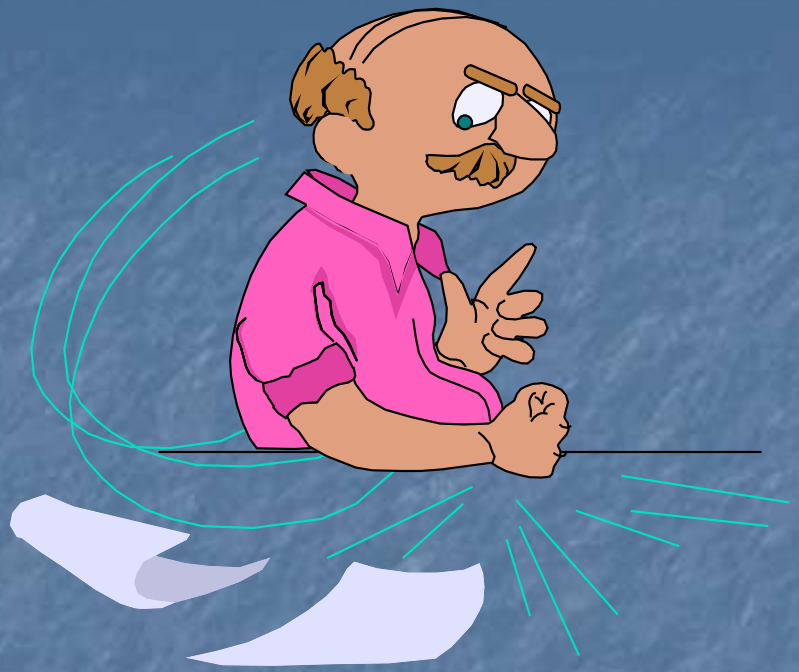
Thin, Quiet, Long Lasting, High Friction, Surface Layer (IHR 27-42)

- Task 1: Literature Review
- Task 2: Field Data Survey and Analysis
  - Collect info on various pavement surfaces
- Task 3: Laboratory Experiment Program
  - Fine-Graded SS/Dolomite with Fibers
  - Fine-Graded Quartzite/Dolomite
  - Fine-Graded Dolomite for use with Sprinkle Treatment
  - SMA 4.75mm NMAS Quartzite with CRM AC
  - Various Lab Performance Tests
- Task 4: Field Testing
  - DRAFT Special Provision in Progress
  - Proposed 2010 District 1 Project
- Task 5: Engineering Benefit Analysis

- Tom Zehr
- Abdul Dahhan
- Patty Broers
- Jim Trepanier
- Dave Lippert
- LaDonna Rowden
- Hal Wakefield

- John Lavalee
- Bill Pine

- Imad Al-Qadi
- Sam Carpenter
- Jeff Kern



Thank You!