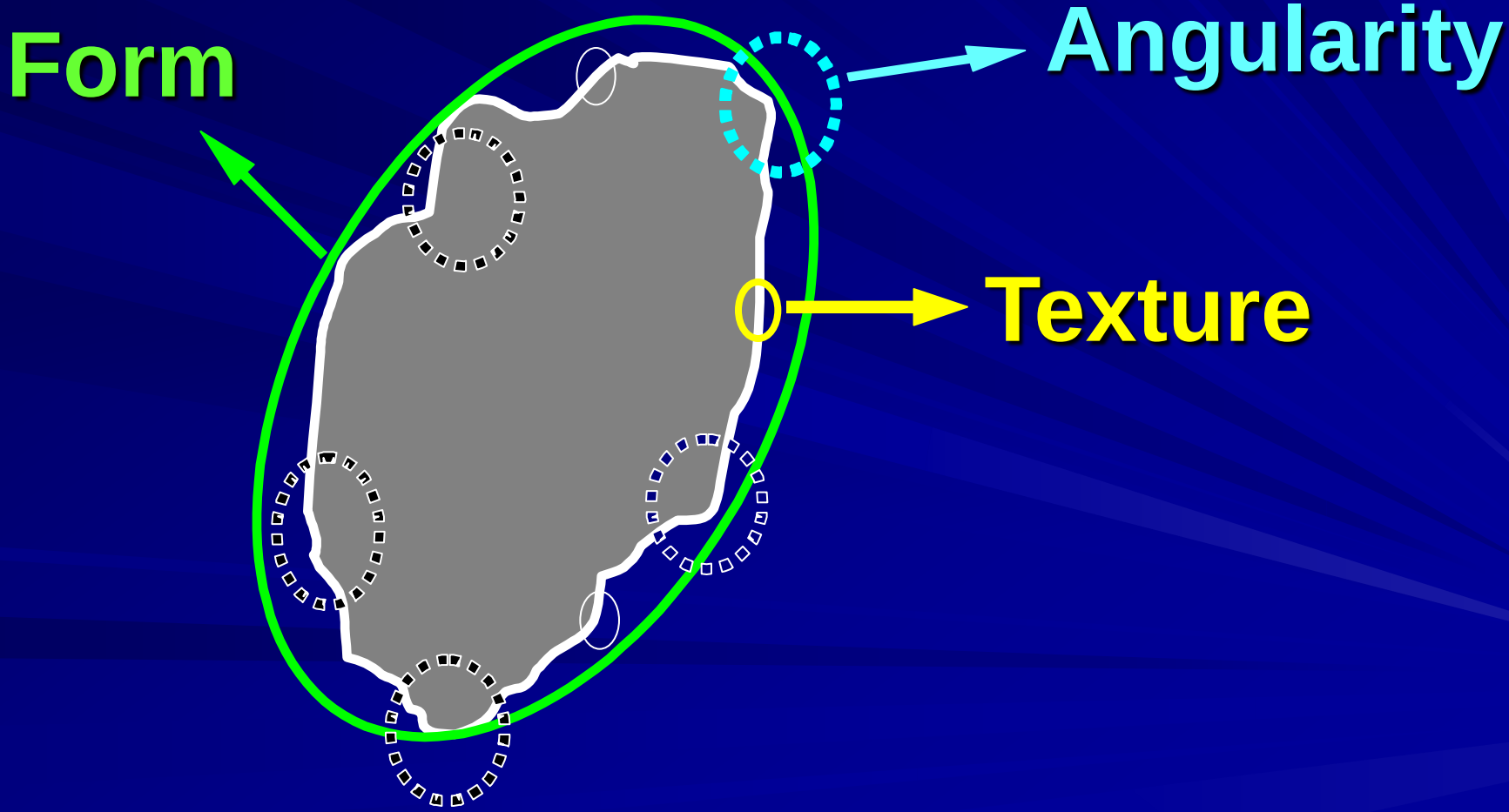
Aggregate Image Measurement System (AIMS)

HIGHWAYS FOR LIFE
Accelerating Innovation for the American Driving Experience.

Long-Life Asphalt Pavement for the 21st Century

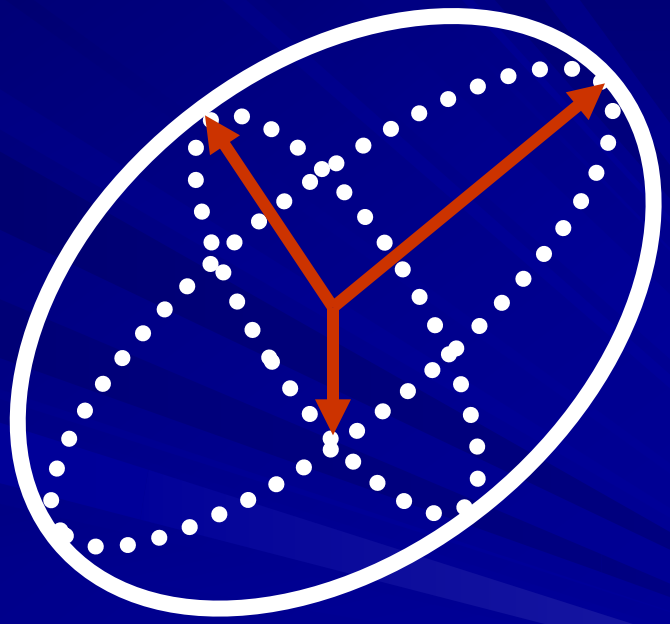
Prototype AIMS Equipment

Objective characterization of aggregate shape properties



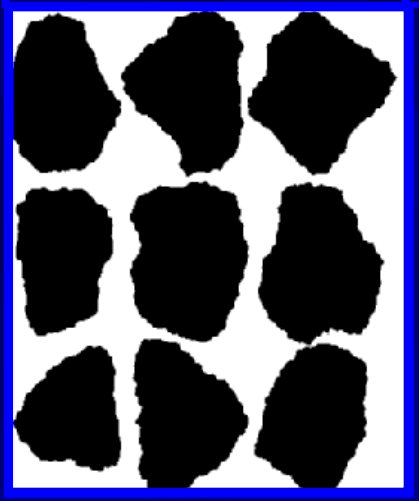
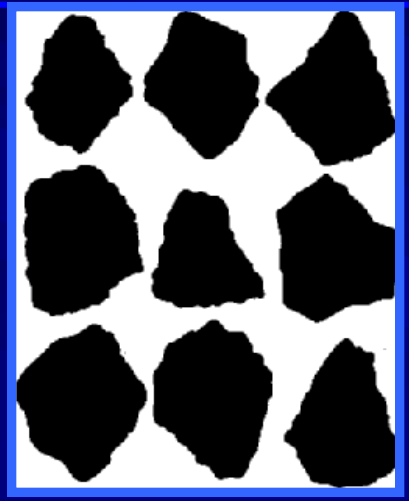
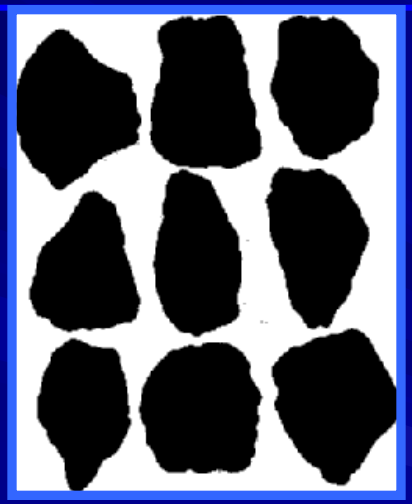
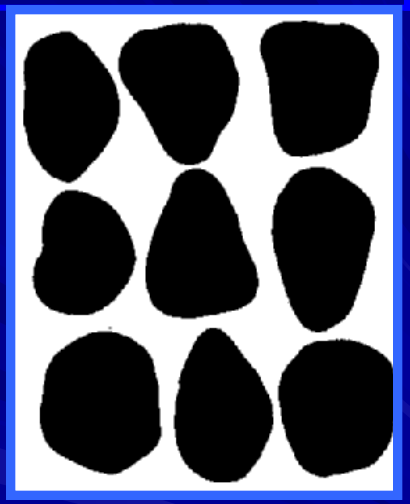
Form – Coarse Aggregate

3-D Aggregate Measurements



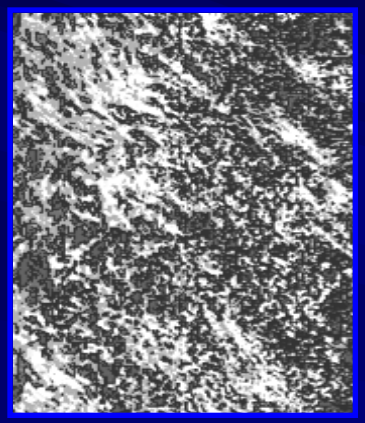
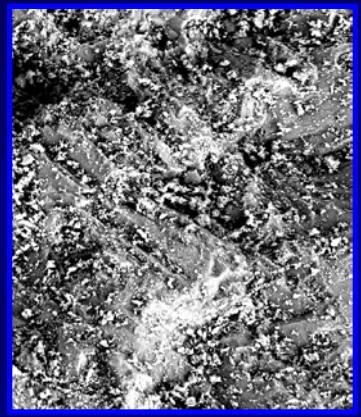
Angularity – Coarse Aggregate

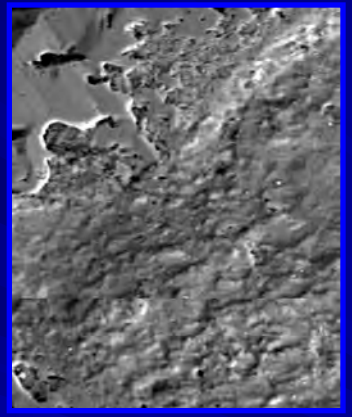
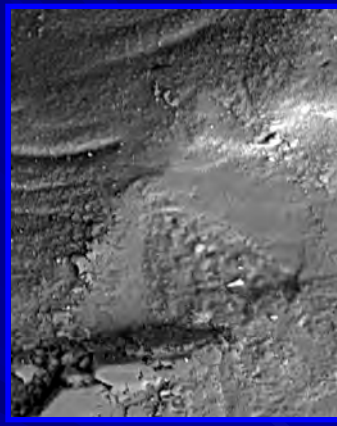
Angular	Sub-Angular	Sub-Rounded	Rounded
> 6000	4000 - 6000	3000 - 4000	< 3000

Texture – Coarse Aggregate

High Roughness	Moderate Roughness	Low Roughness	Smooth	Polished
> 750	550-750	350-550	200–350	< 200

Aggregate Image Measurement System (AIMS)

Objective characterization of aggregate shape properties

Project Team

- **FHWA**
  - Highways for Life Program
  - Office of Pavement Technology
    - Mobile Asphalt Testing Laboratory
- **Pine Instrument**
- **Texas DOT**
- **Texas A&M**

www.fhwa.dot.gov/hfl/partnerships/aims.cfm

FHWA Highways for Life Project Description

Phase I

- Develop implementation ready equipment (Spring 2008)
  - Integrated hardware
  - Streamlined user interface
  - Ease of use
  - Address ambient light issues
  - Target price ~ $30,000

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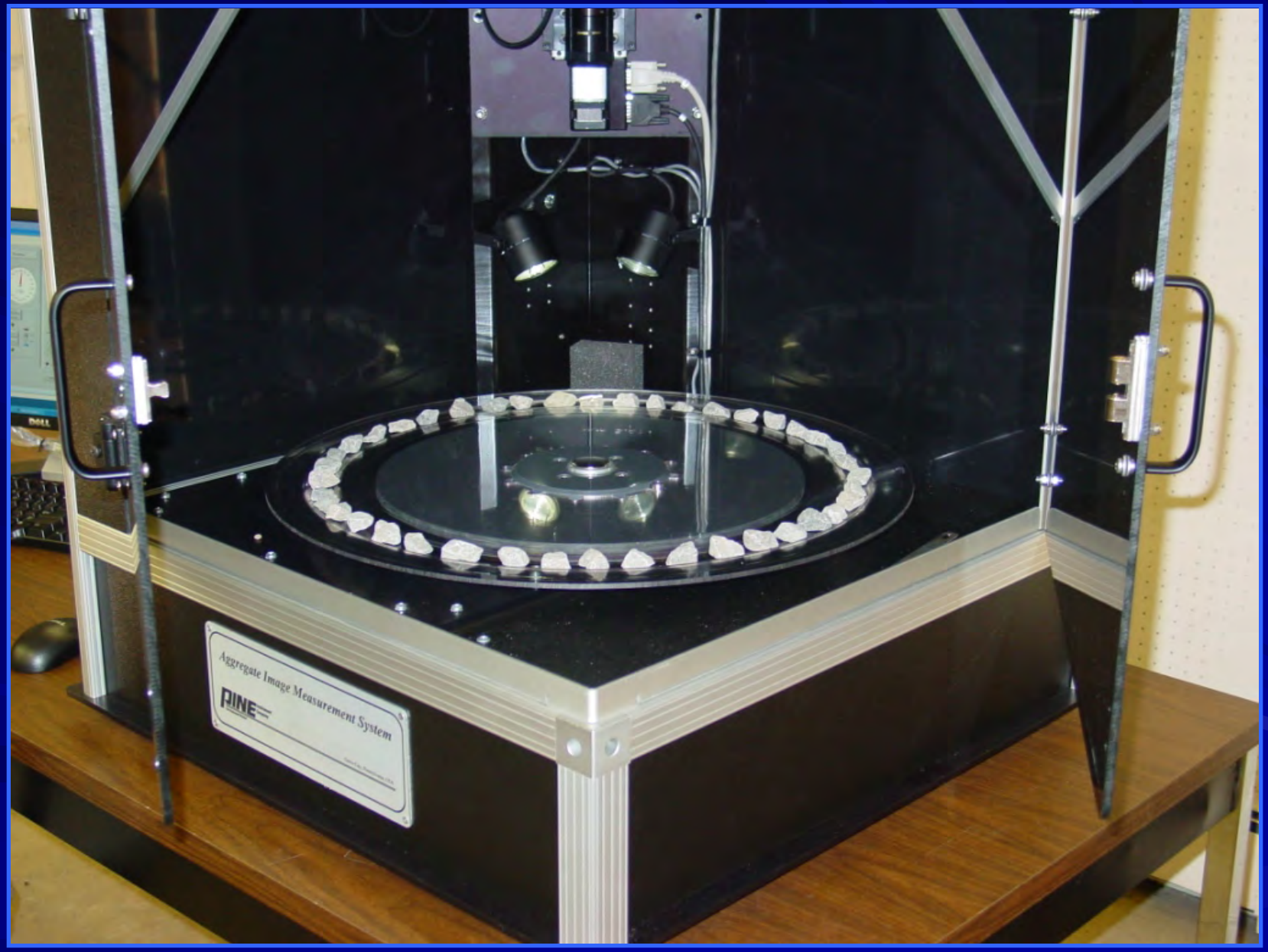
New Production Version of the AIMS System

New Production Version of the AIMS System



Phase I

- Develop implementation ready equipment (Spring 2008)

- Develop draft AASHTO test procedure (Fall 2008)

  "Standard Method of Test for Determining Aggregate Shape Properties by Means of Digital Image Analysis"

Phase I

- Ruggedness Testing (Fall 2008)
  - Purpose is to identify important operational and environmental factors which might cause significant variability in the results
  - Establish appropriate ranges of the factors
  - ASTM C1067-00 “Standard Practice for Conducting a Ruggedness or Screening Program for Test Methods for Construction Materials”
  - 7 factor experiment
  - Multiple aggregate sources

Phase I

7 Factor Experiment (ASTM C1067)

Coarse Aggregate Study Factors:

- 1. Ambient light (on, off)
- 2. Image mean intensity (high limit, low limit)
- 3. Back light illumination (high limit, low limit)
- 4. Focus (high limit, low limit)
- 5. Zoom level (high limit, low limit)
- 6. Camera Settings (gamma contrast)
- 7. Tray size (+1, -1)

Phase I

7 Factor Experiment (ASTM C1067)

Fine Aggregate Study factors:

- 1. Ambient light (on, off)
- 2. Particles touching (TPF value)
- 3. Light level (high limit, low limit)
  - Back light (translucent tray)
  - Top Light (opaque tray)
- 4. Focus (high limit, low limit)
- 5. Zoom level (high limit, low limit)
- 6. Camera settings (gamma contrast)
- 7. Tray color for light fine aggregate

Phase I

- Ruggedness Testing (Completed)
  - Limits were recommended for these factors in order to eliminate their influence on the results and produce repeatable and reproducible results
  - AIMS can control normal variations related to the factors without significantly changing the results with a 95% level of confidence

Phase II

- Inter-Laboratory Study (Spring 2009)
  - ASTM C802-96 "Standard Practice for Conducting an Inter-laboratory Test Program to Determine the Precision of Test Methods for Construction Materials"
  - 8 new AIMS Systems
  - Three aggregate types (25 mm - #200)
    - Crushed Gravel (low angularity and texture)
    - Limestone (mid angularity and texture)
    - Granite (high angularity and texture)
  - 30 Laboratories

Phase II ILS – 30 Laboratory Participants

Maine DOT
Vermont DOT
New York DOT
FHWA Mobile Asphalt Testing Laboratory Trailer
FHWA Turner-Fairbank Highway Research Center
Alabama DOT
Mississippi DOT
Florida DOT
NC State University
South Carolina DOT
Michigan DOT
Ohio DOT
Indiana DOT
Illinois DOT
New Mexico DOT
University of Texas
Texas DOT (TTI)
Nebraska DOT
Kansas DOT
Oklahoma DOT
Iowa DOT
Minnesota DOT
FHWA Central Federal Lands
South Dakota DOT
North Dakota DOT
Saskatchewan Ministry of Highways and Infrastructure
Oregon DOT
Washington DOT
Alaska DOT Southeast
Alaska DOT Central
Alaska DOT North

For more information:

Aggregate Image Measurement System

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www.pineinst.com/test/Products/AFA2.html

Mobile Asphalt Testing Laboratory Program

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