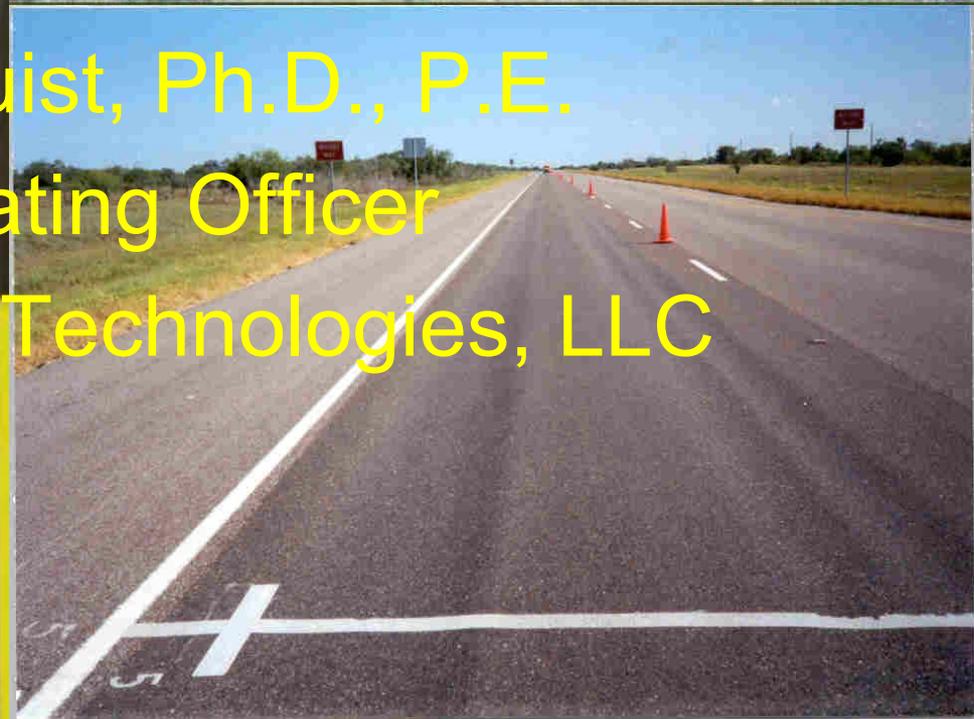




**First Article Simple
Performance Test Equipment
NCHRP Project 9-29**

**Ramon Bonaquist, Ph.D., P.E.
Chief Operating Officer
Advanced Asphalt Technologies, LLC**



Outline

- Background
- Process of Test Development
- Overview of Project 9-29
- Features of First Article Simple Performance Test Equipment
- Summary and Future Work

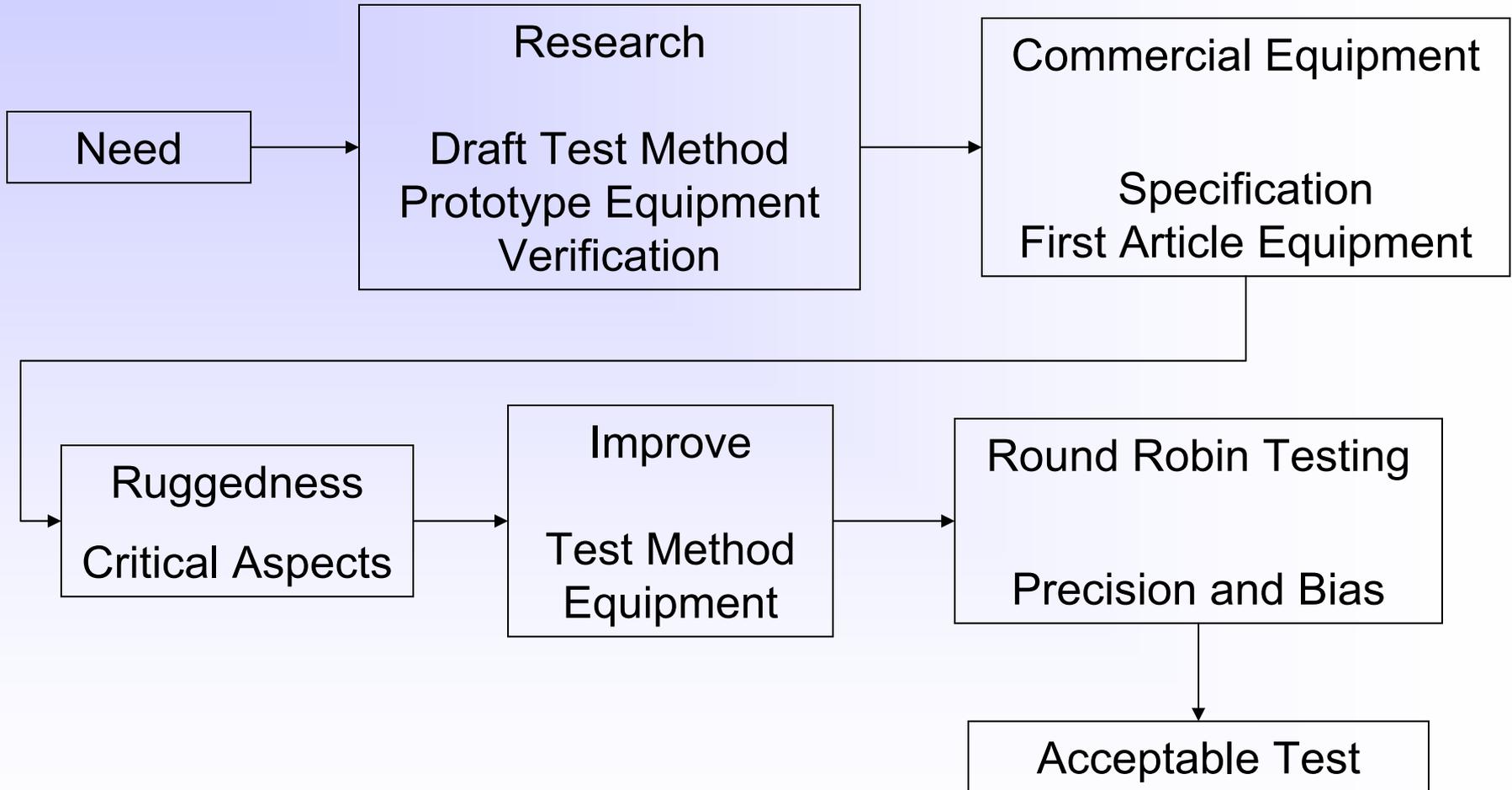


Background

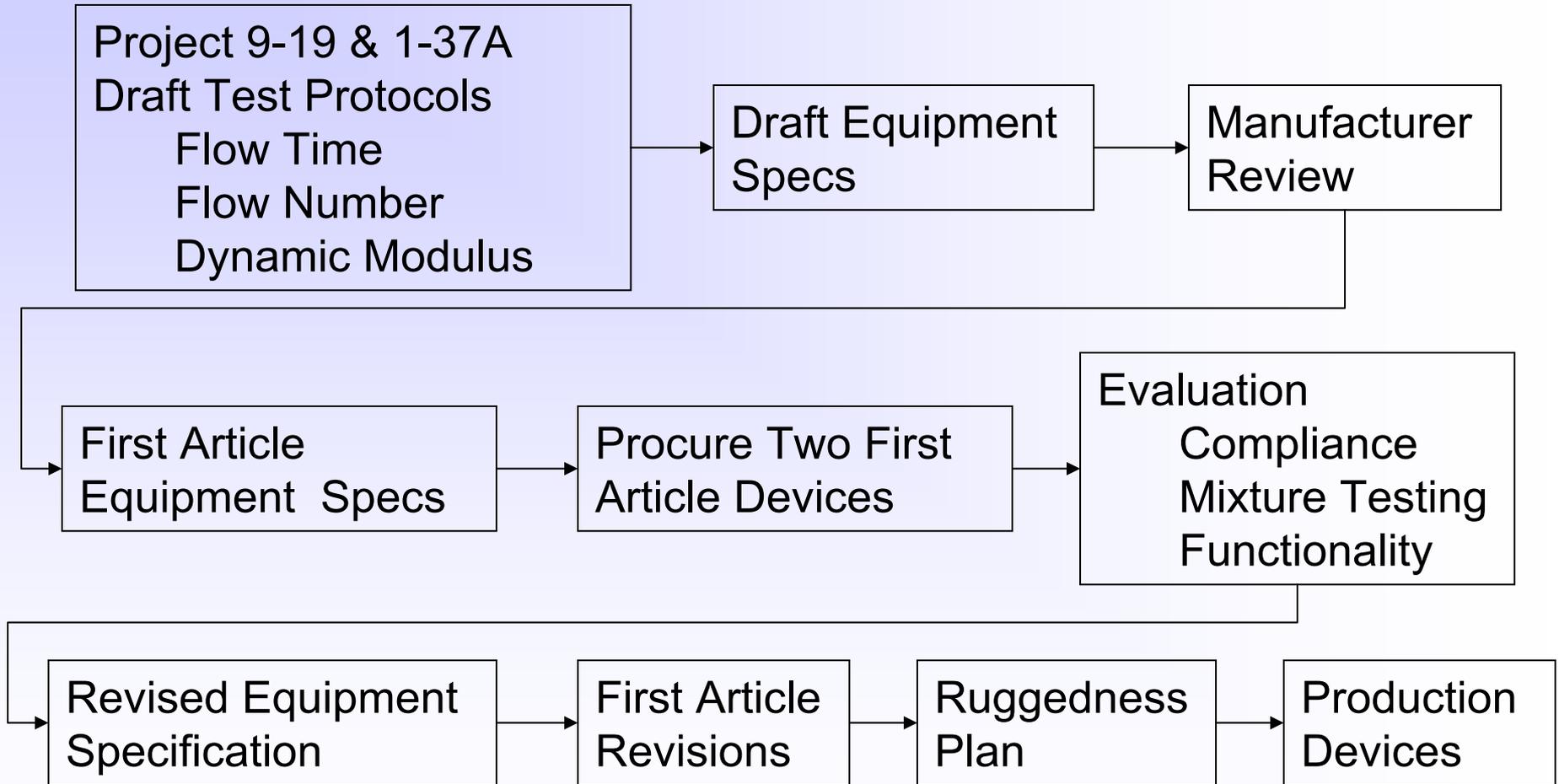
- NCHRP 1-37A Structural Design
 - Adopt Mechanistic-Empirical Design
 - Dynamic Modulus Test
- NCHRP 9-19 HMA Mixture Analysis
 - Simple Performance Test to Compliment AASHTO MP2
 - Dynamic Modulus
 - Flow Number
 - Flow Time
- NCHRP 9-29 Commercial Equipment



So You Want a New Test!



Project 9-29 Overview



Simple Performance Test Equipment Features

DYNAMIC MODULUS STANDARD REPORT

Sample ID: 531 Cond
 Project: NG-FFP-9-34
 Test Frequency (Hz): 10.04
 Gauge Length (in.): 3.94
 Specimen Dia. (in.): 3.94
 Specimen Cross-Sec. Area (in.*2): 12.17
 Test Temperature C: 25.0

Data generated on: 0-Jan-00
 Data exported on: 0-Jan-00

System Configuration:
 Number Of Movers: 2
 Number Of Channels: 11

Points Acquired: 300
 Scan Time: 0
 Time Between Scans: 0

Dynamic Modulus, ksi: 687.6

Phase Angle, Deg.: 23.9

Average Strain, microstrain: 35.7

Data Quality Indicators:

RMS Cntl. Error, %: 142.1

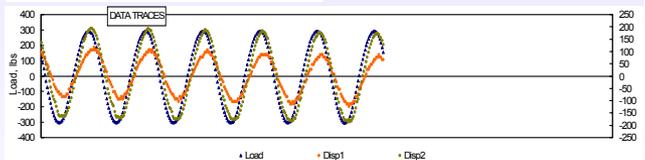
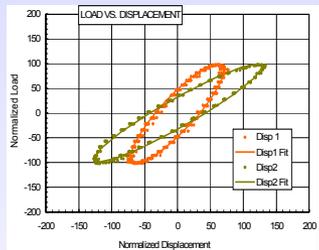
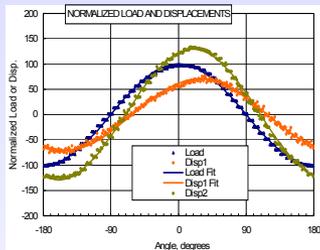
Load Std. Error, %: 3.6

Disp. Avg. Std. Error, %: 4.9

Disp. Uniformity, Deg.: 41.5

Phase Uniformity, Deg.: 6.7

Avg. Total Drift, %: -8.6

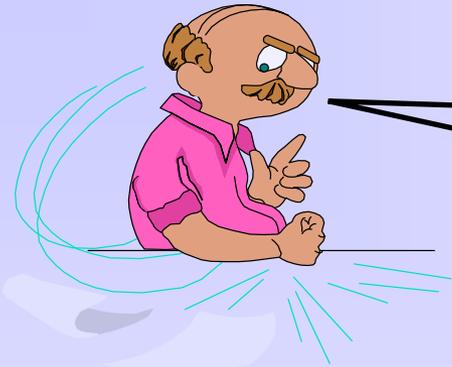


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I remember SHRP! The equipment has to be large and expensive!!!



SHEDWORKS



INTERLAKEN

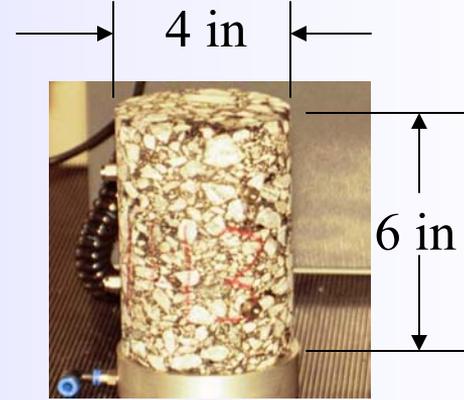
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I can't make the
@#?/ specimen!!



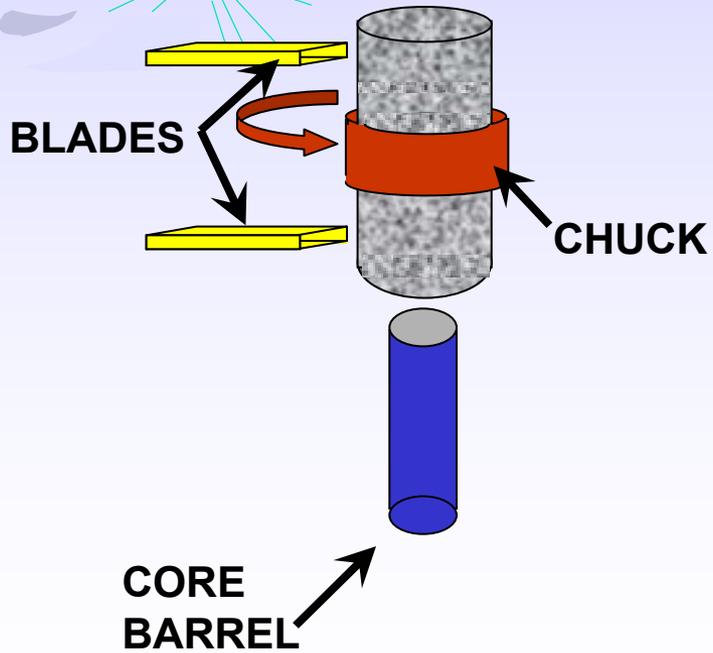
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I need something easier!!!



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I can't instrument the specimen!



INTERLAKEN



SHEDWORKS



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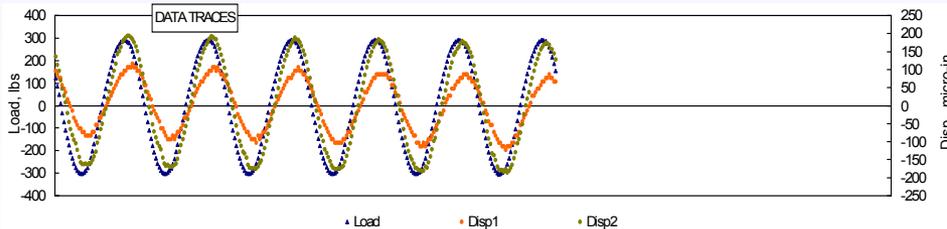
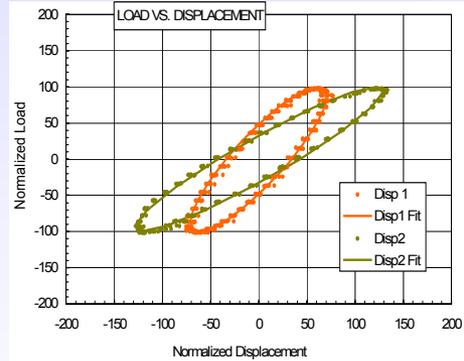
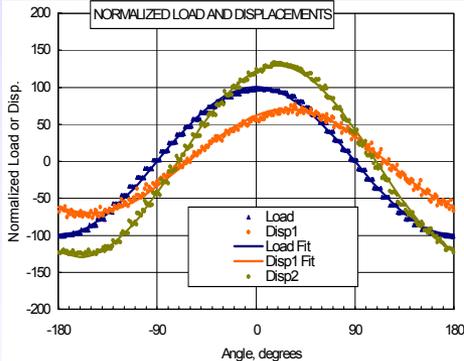


You need a Ph.D.
to run the tests!



DYNAMIC MODULUS STANDARD REPORT

Sample ID: 531 Cond	Data generated on: 0-Jan-00	<u>Dynamic Modulus, ksi:</u> <u>687.6</u>
Project: NCHRP 9-34	Data exported on: 0-Jan-00	<u>Phase Angle, Deg:</u> <u>23.9</u>
Test Frequency (Hz): 10.04	<u>System Configuration:</u>	<u>Average Strain, microstrain</u> <u>36.7</u>
Gauge Length (in.): 3.94	Number Of Movers: 2	RMS Crd. Error, %: 142.1
Specimen Dia. (in.): 3.94	Number Of Channels: 11	Load Std. Error, %: 3.6
Specimen Cross-Sec. Area (in.^2): 12.17	Points Acquired: 300	Disp. Avg. Std. Error, %: 4.9
Test Temperature C: 25.0	Scan Time: 0	Disp. Uniformity, %: 41.5
	Time Between Scans: 0	Phase Uniformity, Deg.: 6.7
		Avg. Total Drift, %: -8.6



Software Standardizes

- Load Control
- Data Acquisition
- Data Analysis
- Reporting

Data Quality Statistics

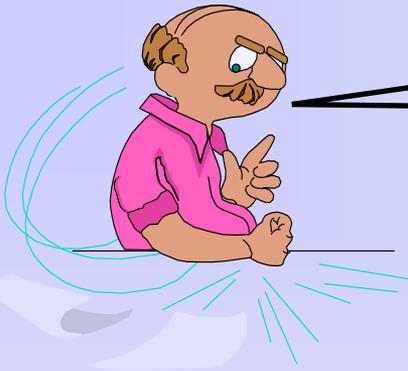
- Reliability of Results

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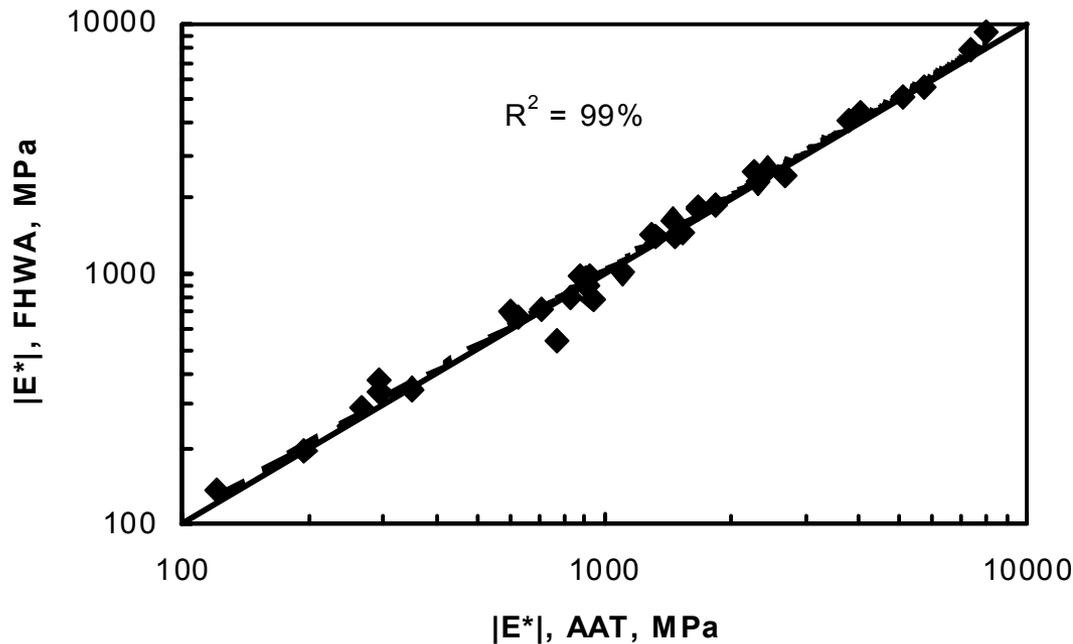


Fundamental tests are too variable!! They are expensive random number generators!

Within Lab

Test	Pooled Coefficient of Variation, %	Number of Tests
Dynamic Modulus	13	288
Flow Number	35	128
Strain at Flow	14	128

Two Labs



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The P.I. is biased! What do others have to say?

- **Weaknesses**

- Size
- Nose Level
- Test Chamber
- Extensometer System
- Hydraulic Control

- **Strengths**

- Safety Features
- Software
- Dynamic Modulus Summary Sheet

INTERLAKEN





The P.I. is biased! What do others have to say?

SHEDWORKS

- **Weaknesses**

- Safety Features
- Hydraulic Control
- Software Complexity

- **Strengths**

- Small and Quiet
- Heating/Cooling Capacity
- Automated Gage Point System
- Hands Clear Buttons



I want to see
it for myself!!



FHWA Mobile Asphalt Pavement Mixture Lab



Leslie Myers
Project Manager
(202) 366-1198

Chuck Paugh
Lab Manager
(202) 366-6640

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Summary of Completed Work

- Specification for Equipment to Perform Simple Performance Tests
 - Dynamic Modulus
 - Flow Number
 - Flow Time
- First Article Simple Performance Test Devices
 - Small
 - User Friendly
 - \$45,000



Summary of Completed Work

- Comparable Data From Two First Article Devices
- Prototype Automated Specimen Fabrication Device



Future Work

- Upgrade First Article Devices
- Develop Ruggedness Testing Plans
- Purchase Three Additional Simple Performance Devices
- Simplify AASHTO TP 62 for Dynamic Modulus Master Curves
- Develop Specification and Purchase First Article Dynamic Modulus Master Curve Device





QUESTIONS?



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