



**2008 LTRC Peer Exchange
Regional Cooperation**

Review of LTRC Capabilities





LTRC University Employees

**Engineering Materials Characterization
Dr. Louay Mohammad, LSU**

**Geosynthetic Laboratory,
Dr. Murad Abu-Farsakh, LSU**

**Accelerated Research Facility;
Dr. Zhong Wu, LSU**



Laboratory Materials Characterization



Superpave Asphalt Binder Testing Equipment



Geosynthetics Research Laboratory (GERL)

Blue Boxes

- Larger Samples
- Less boundary issues.
- Heavy Reaction Frame
- Geotextile Testing
- Strain & Pressure Gauges
- Direct Shear
- Pluviator
- Fabrics & Geotextile Storage
- Large Quantity Soil Storage



Repeated Loading Cyclic Plate Test Lab Tests



Louisiana Pavement Research Facility (PRF)



- PRF - Located in Port Allen, LA
 - Six-acre land with space for construction of 10 full-scale test sections
- Accelerated Loading Facility (ALF)
 - Approximately 100-ft long and 55-ton
 - One half of a single axle
 - Load adjustable from
 - » 9,750 lbs ~ 18,950 lbs
 - » Simulate traffic wander
 - Speed - 10.5 mile per hour
- ALF is one of only three of its kind in the nation

9,750 lbs

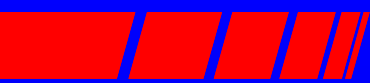


In-Situ Test Devices



Mobile Asphalt Laboratory





Engineering Materials Characterization Research Facility

- **Experimental Capability**
- **Modeling and Numerical Simulation**

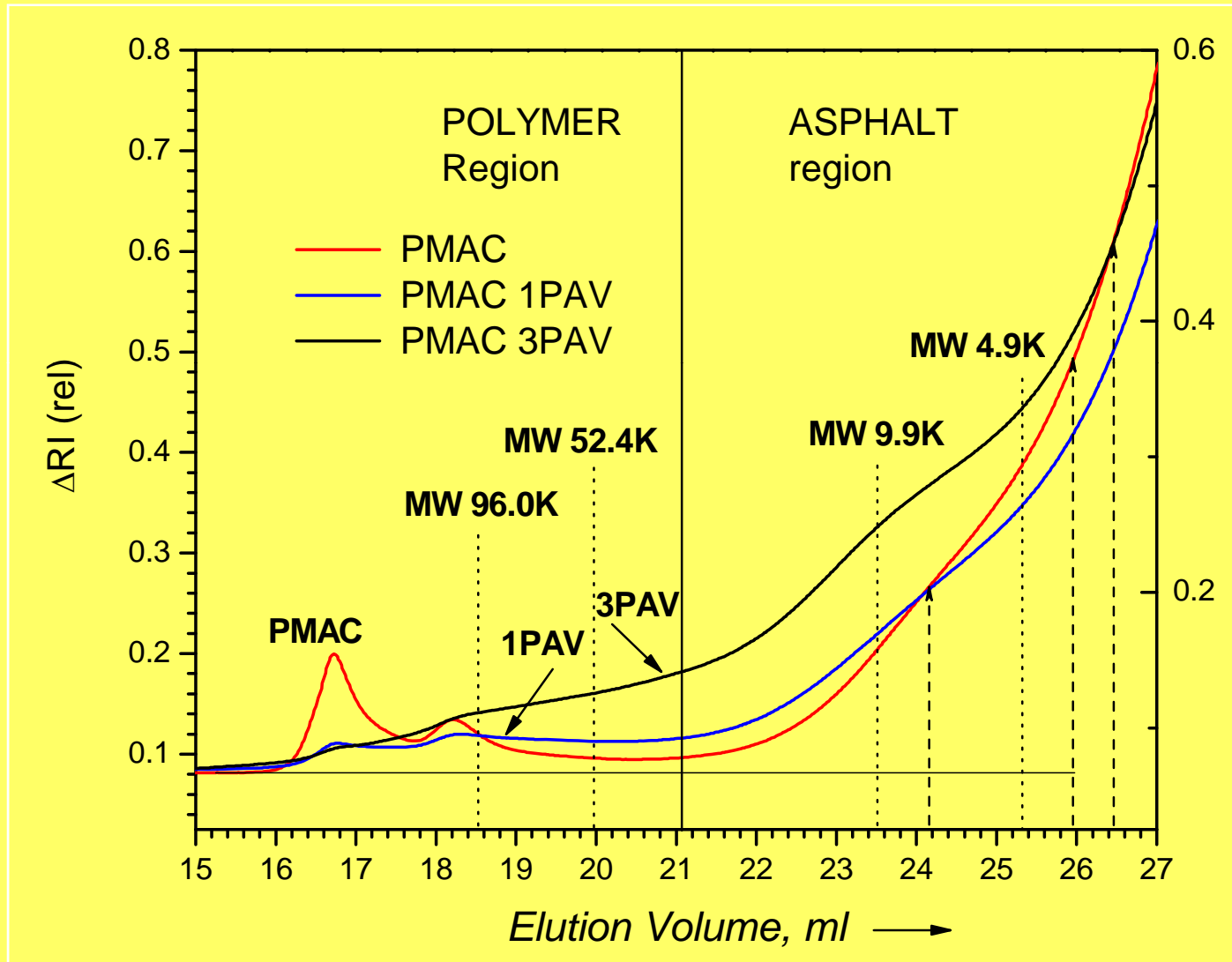




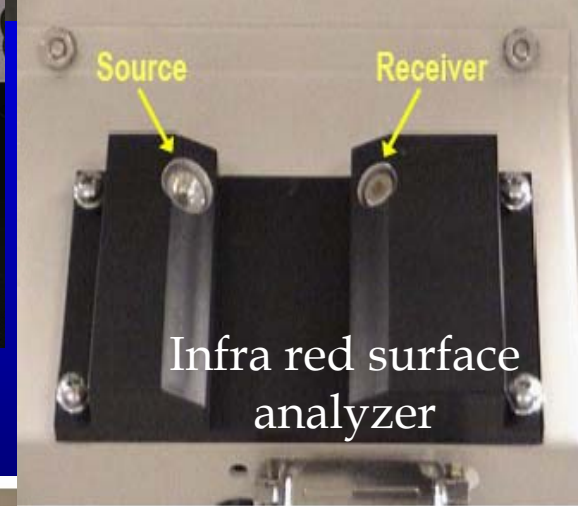
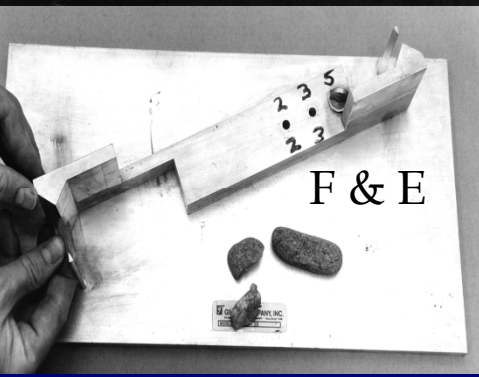
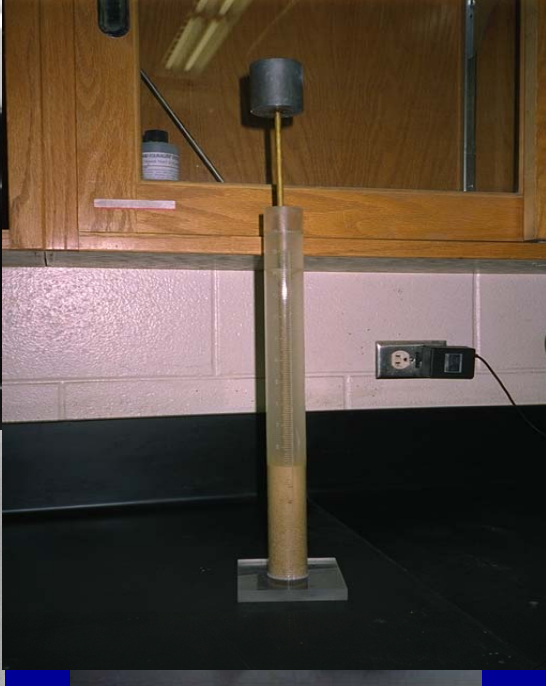
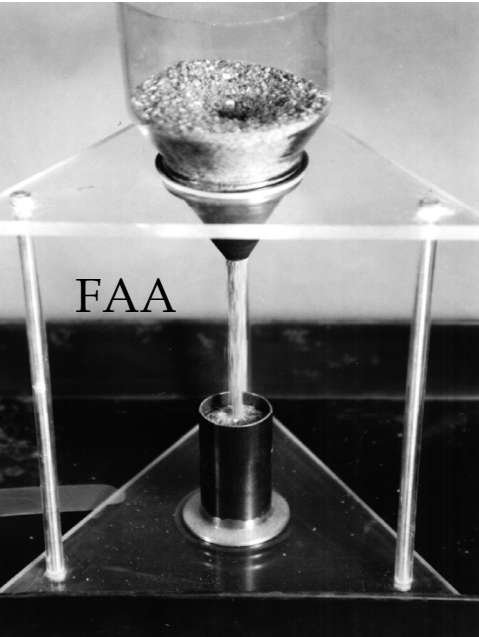
***Asphalt Laboratory is AMRL
Certified***



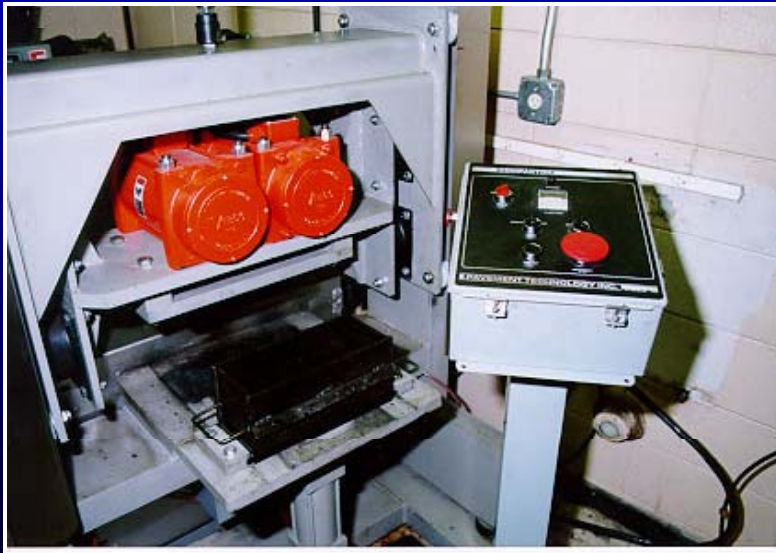
GPC Data for PAV Aged Samples



Aggregate Testing



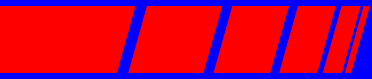
Asphalt Laboratory Compactors



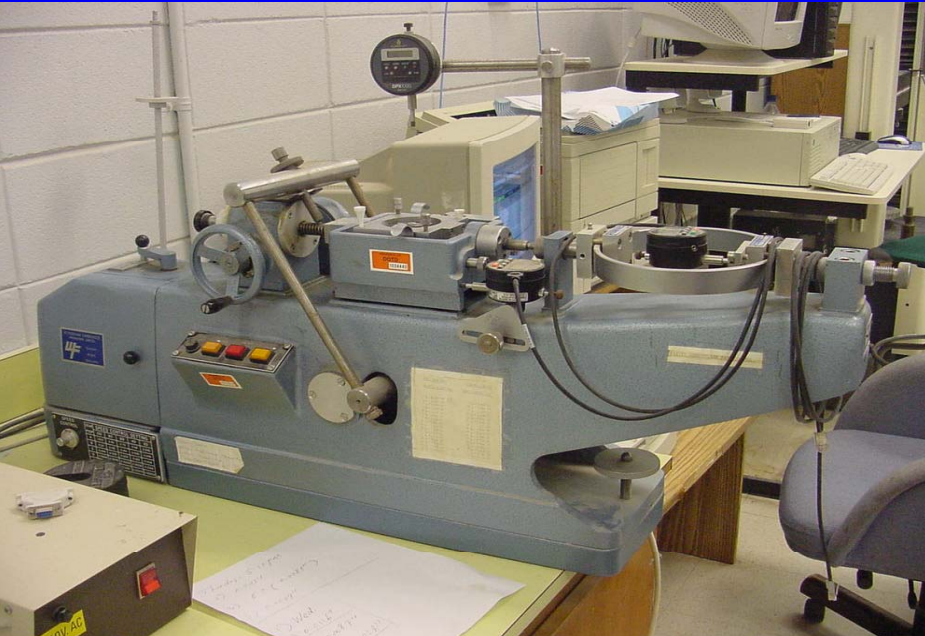
Concrete Testing Laboratory



10,000 psi = f'_c



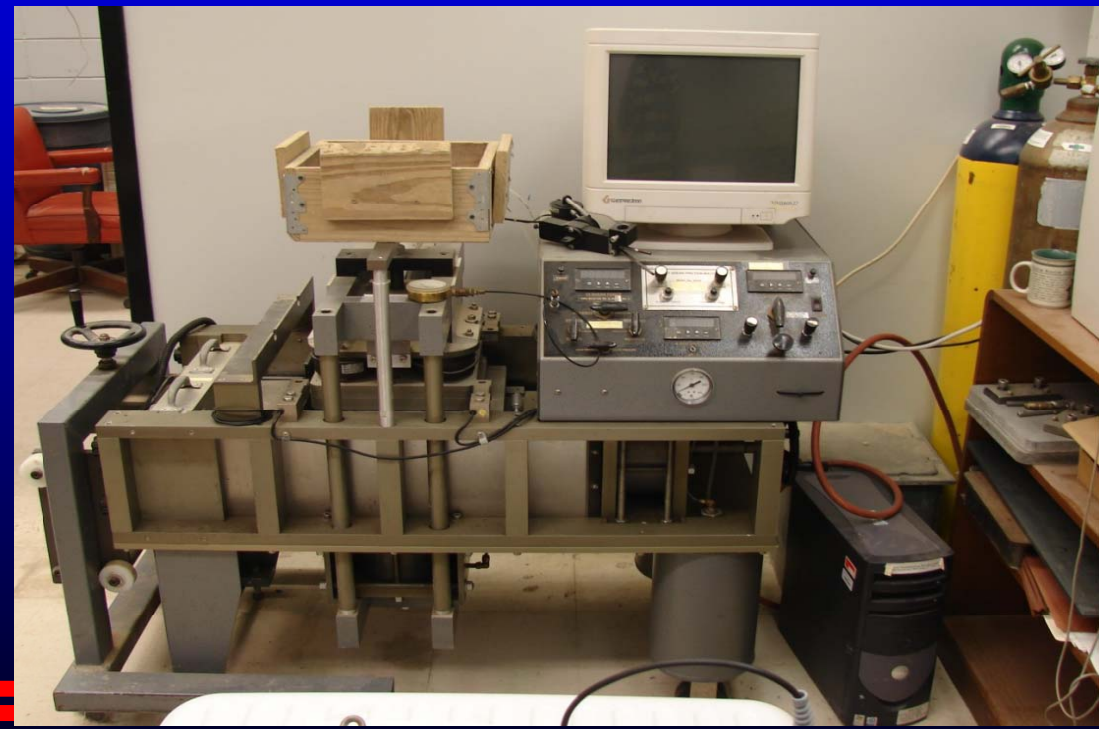
Geotechnical Lab;



2.75 inch diameter
Smaller Grain Sizes

Direct Shear

12 inch square box
Aggregates, Tire Chips, etc



Performance Lab Mixture Characterization Tests

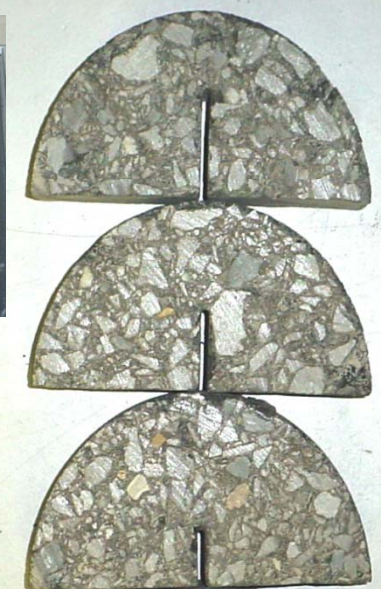
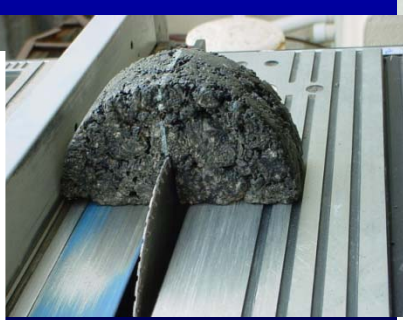
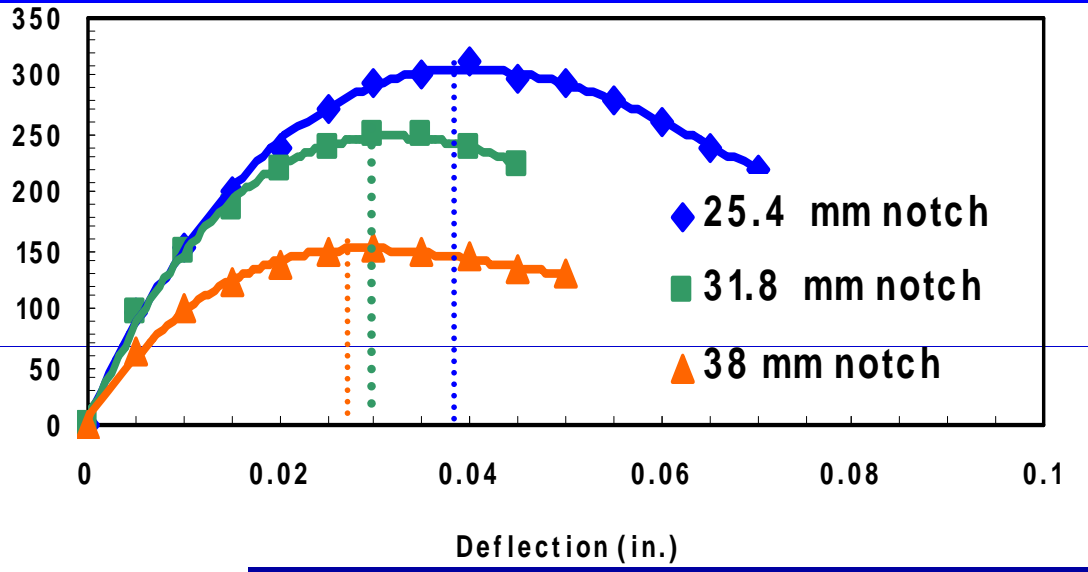
- *Indirect Tensile Strength Test, 25C*
- *Indirect Tensile Resilient Modulus Test, 5-, 25-, 40C*
- *Indirect Tensile Creep Test, 40C*
- *Axial Creep Test, 40C*
- *Frequency Sweep at Constant Height Test, 60C*
- *Repeated Shear at Constant Height Test, 60C*



**Permanent Deformation
Fatigue Cracking**

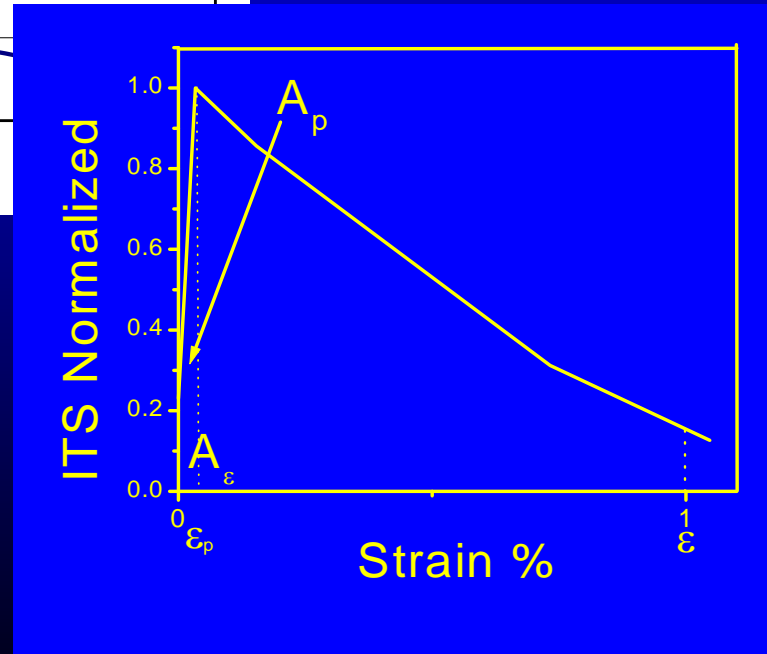
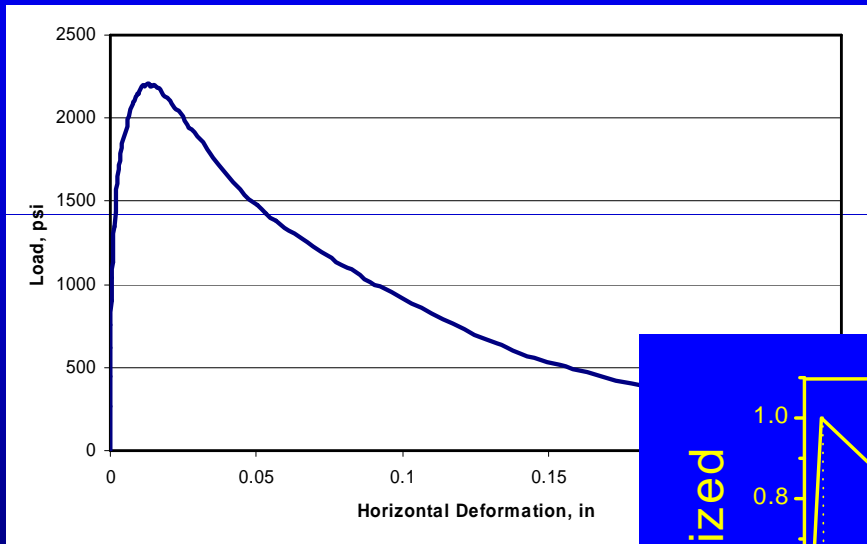


Semi Circular Bend Test Fracture Resistance, J_c

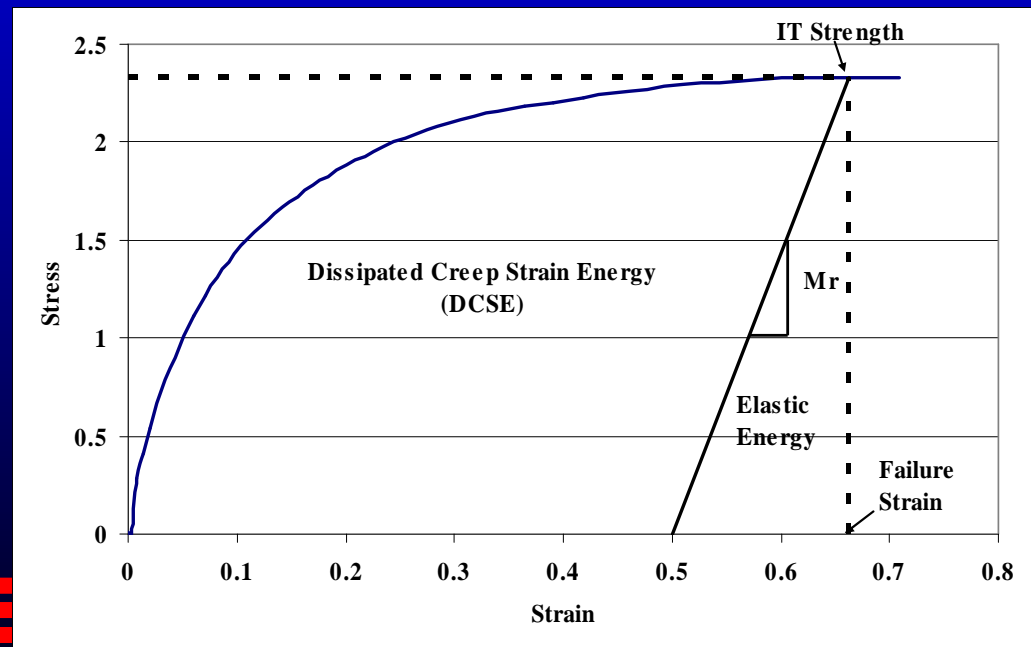
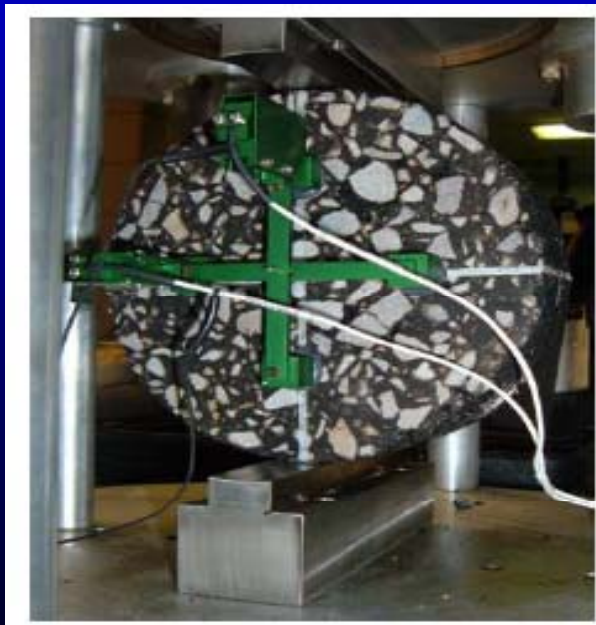


Mechanistic Tests

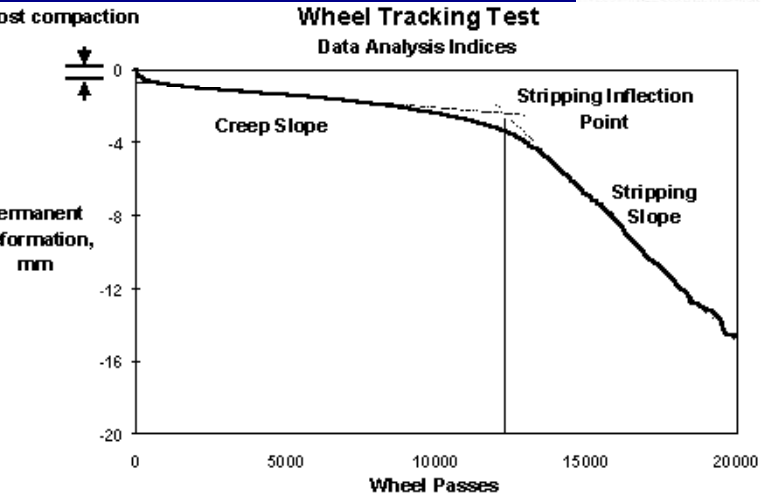
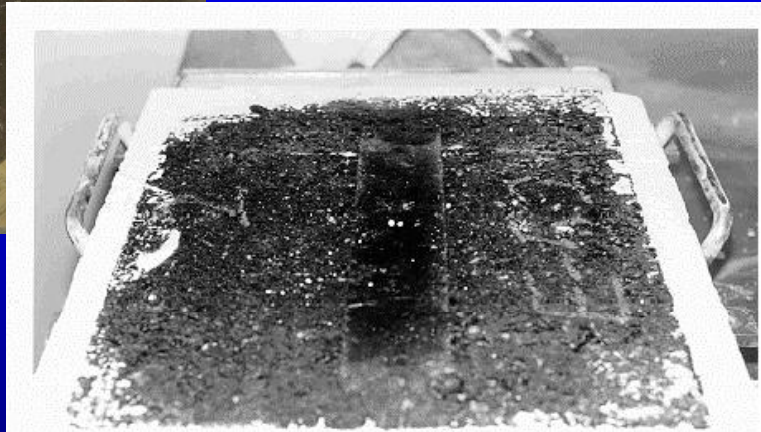
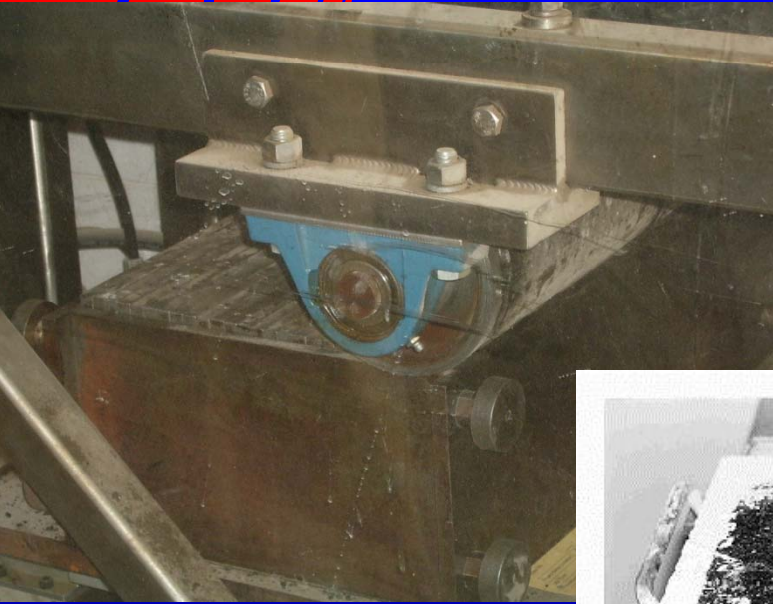
- Material Test System



Dissipated Creep Strain Energy



Loaded Wheel Tracking



JUL 2 2007

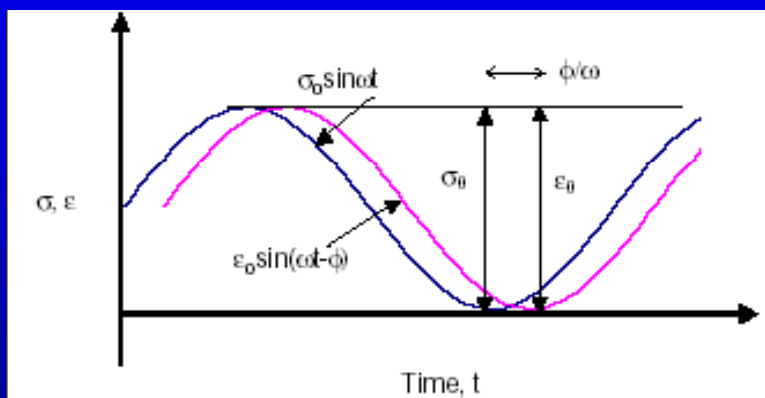
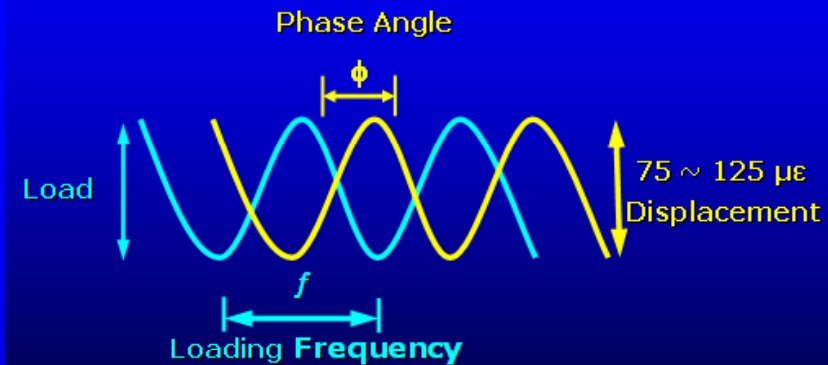
SPT Sample Preparation



Dynamic Modulus $|E^*|$ Test

- IPC UTM-25
- AASHTO TP-62
- Sinusoidal axial compressive stress is applied to a specimen
 - temperature and frequency

$$|E^*| = \frac{\sigma_0}{\epsilon_0} \quad \phi = \omega t_i$$

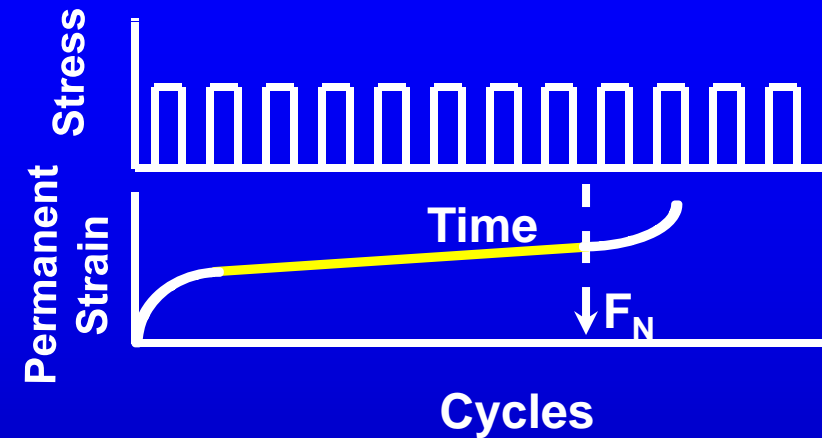


Frequency (HZ)	25, 10, 5, 1, 0.5, 0.1
Temp. ($^{\circ}$ C)	-10, 4.4, 25, 38, 54.4



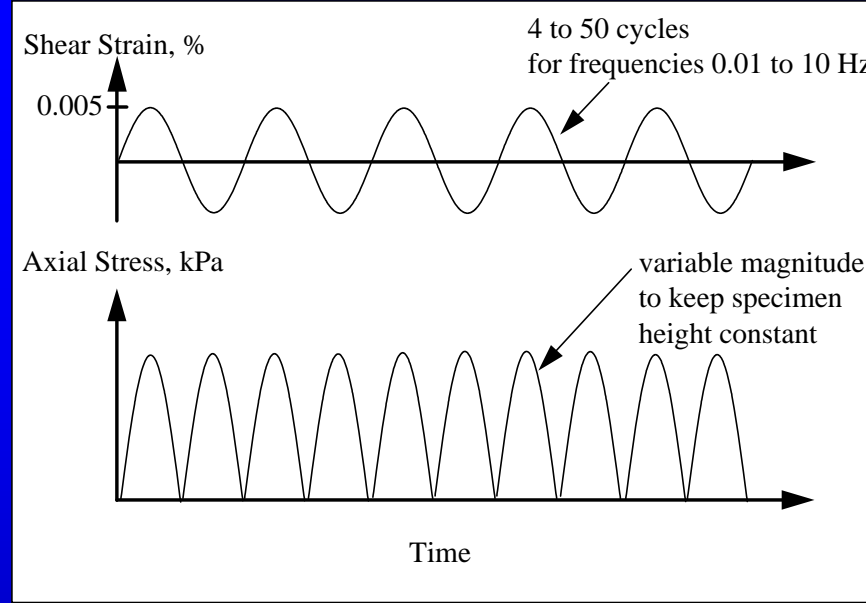
Repeated Load Permanent Deformation Test – F_N

- IPC UTM-25
- A haversine axial compressive stress is applied
 - Loading: 0.1 Second
 - Rest Period: 0.9 Second
 - 54.4°C
- F_N : Number of cycles
 - Tertiary Failure
 - 10,000 cycles
 - Related to Strength

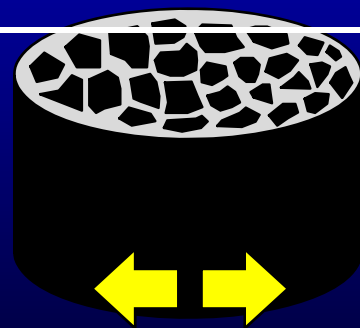


Frequency Sweep Test at Constant Height

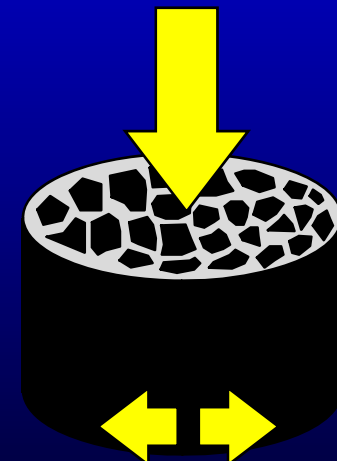
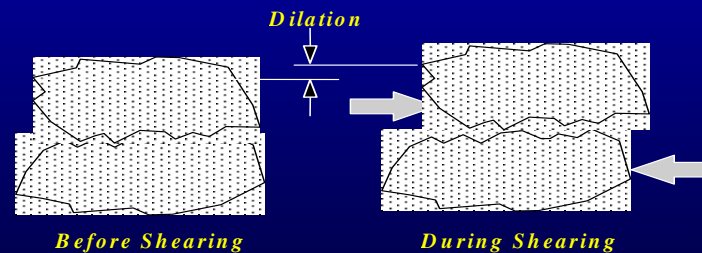
- AASHTO TP-7
- A sinusoidal horizontal shear strain and axial stress are applied
 - temperature and frequency
- G^* and δ



Frequency, HZ	10, 5, 2, 1, 0.5, 0.2, 0.1, 0.05, 0.02, 0.01
Temp. (°C)	48, 60



Apply repeated controlled shearing strain...

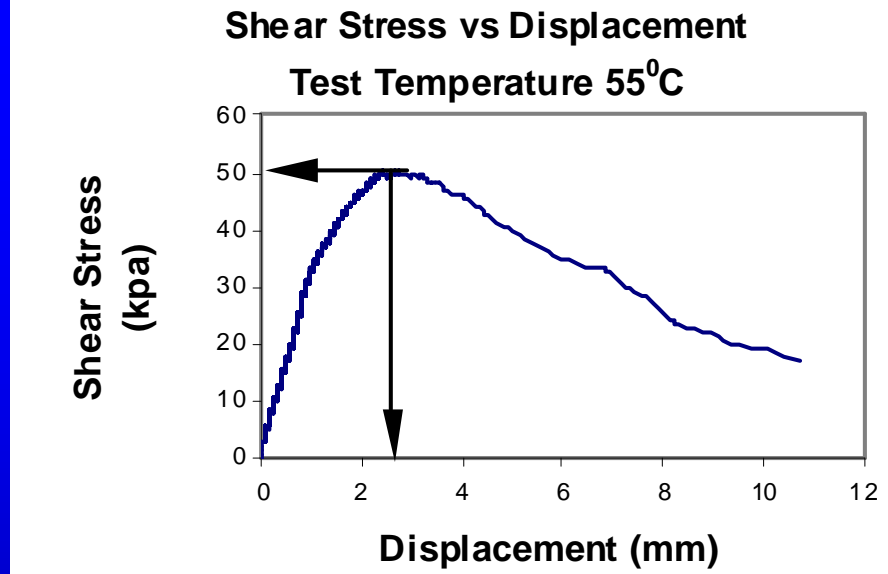
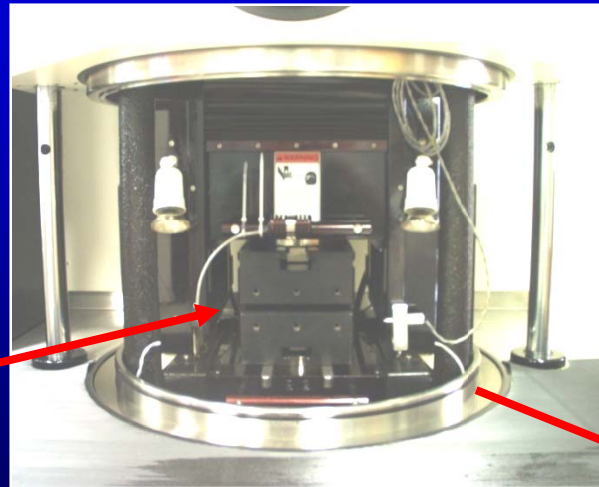
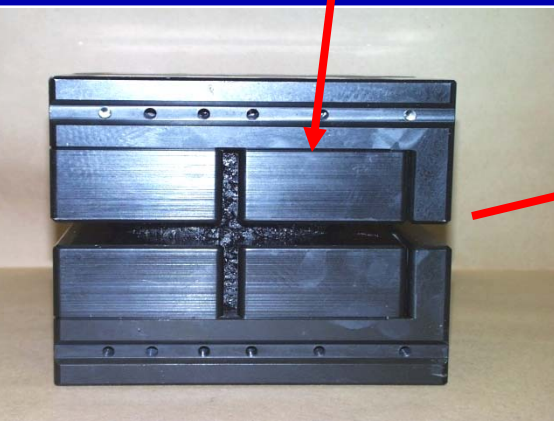


Apply repeated axial stress to keep specimen height constant

MTS System (Repeated Load Triaxial Test) Soil Resilient Modulus & Permanent Deformation

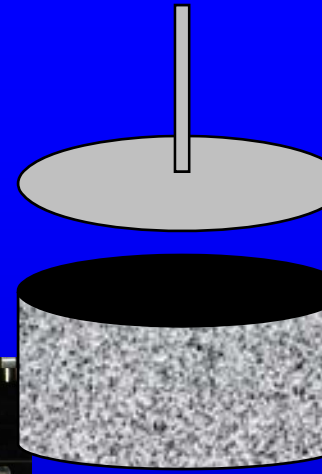
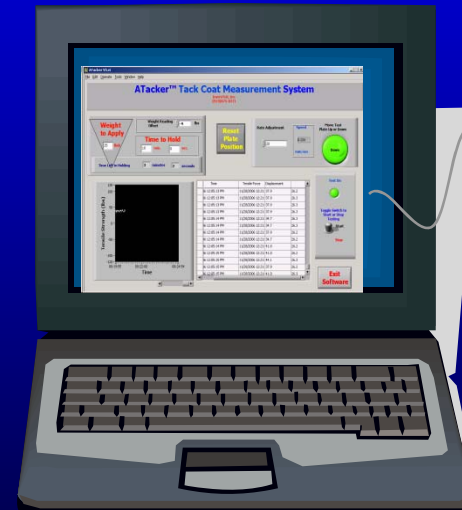
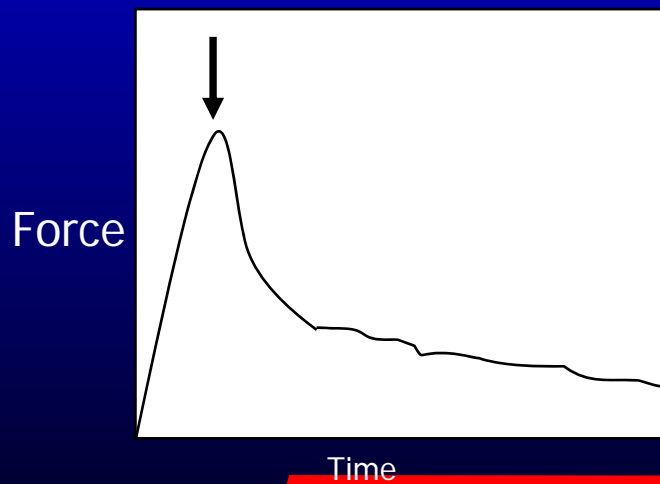


Direct Shear Test



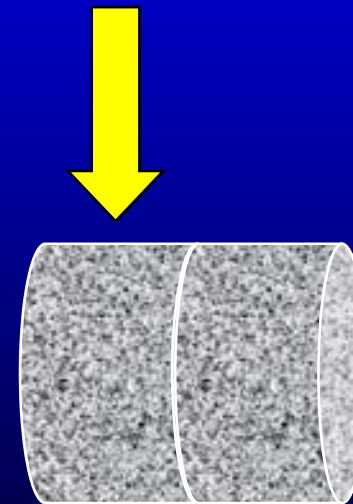
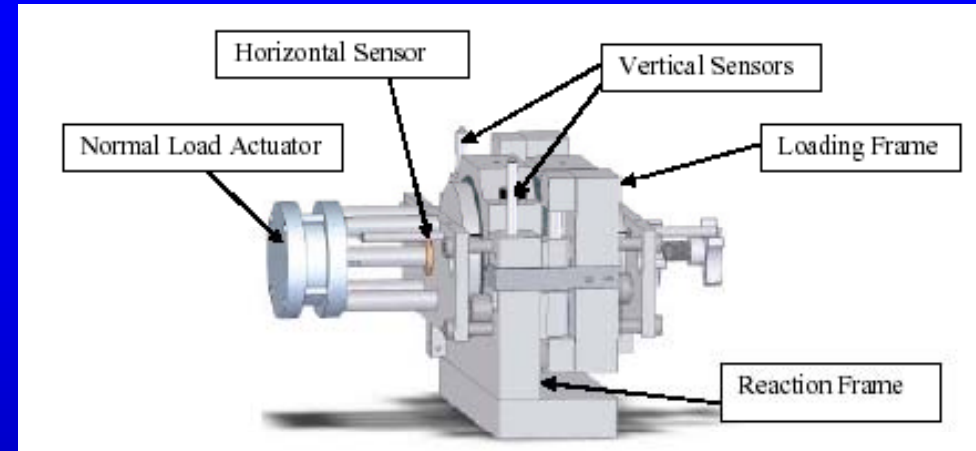
Characterization of Tack Coat Quality

- Developed equipment
 - NCHRP Project 9-40
 - Tack coat quality -- residual
 - Tension
- User friendly
- Easy to use
- Laboratory and field



Interface Bond Strength Test

- **Developed equipment**
 - NCHRP Project 9-40
 - Louisiana Interlayer Shear Strength Tester (LISST)
 - Interface Bond Strength
 - Shear
- **Easy to use**
- **Portable**
- **Adoptable to existing load frames**
- **Reasonable cost**
- **accommodate both 100 and 150-mm sample diameter**



In-Situ Test Devices



FWD & LFWD

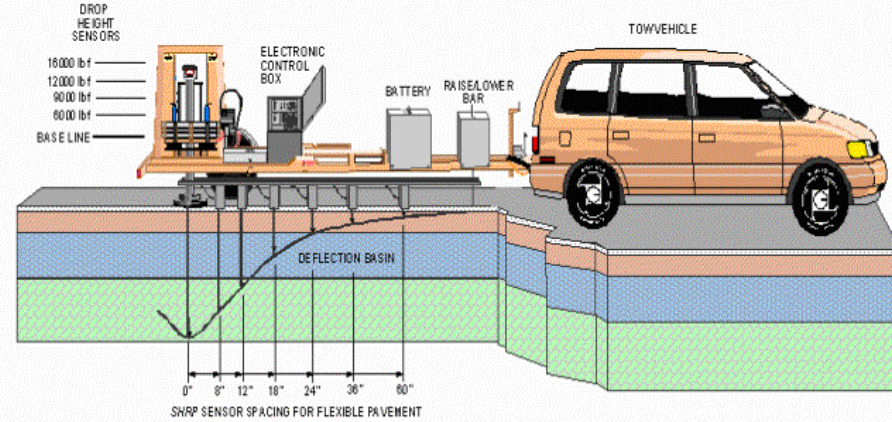


LFWD - PRIMA 100 model
Carl Bro Company, Denmark

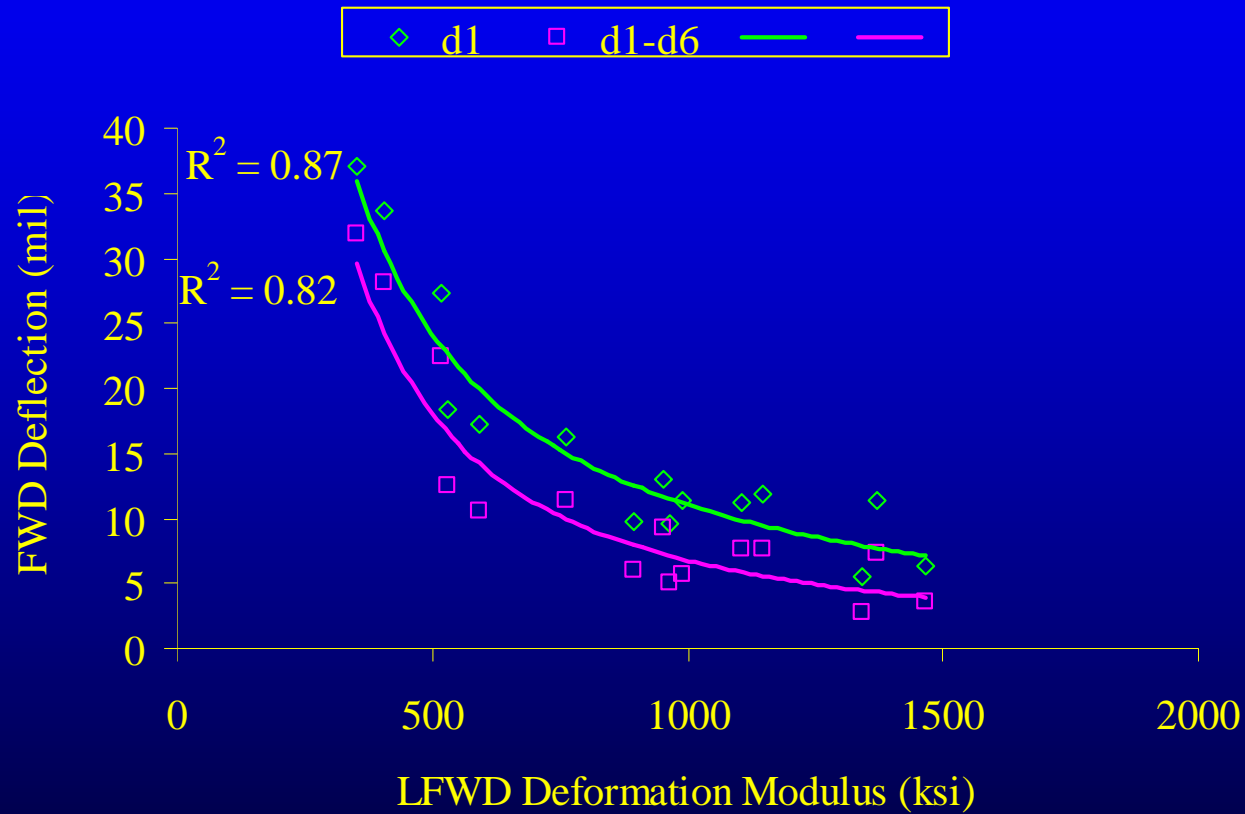
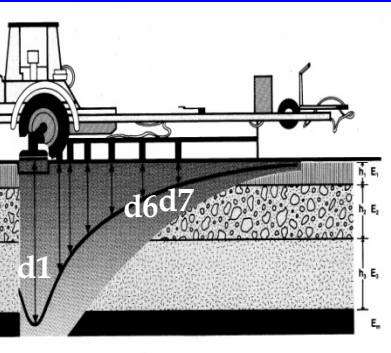


DYNATEST FWD TEST SYSTEM

(NOTE: The right trailer tire has been removed to clarify illustration)



Comparison B/W Tests FWD and LFWD



Performance

Laboratory Mixture
Characterization

Field Accelerated
Loading Evaluation
(ALF)



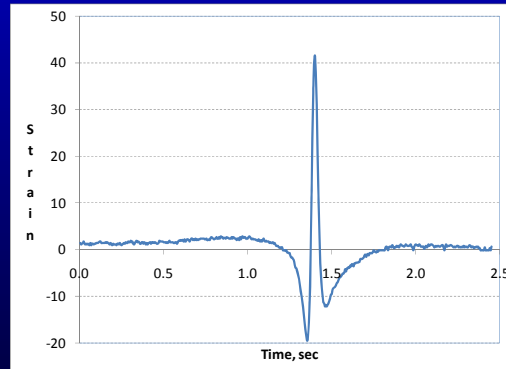
Louisiana Accelerated Loading Facility

Full-scale Accelerated Loading Facility

- Simulates pavement response to real loading at vehicle speed
- Responses of pavement sensors allow advanced pavement modeling of test lanes
- Findings of three experiments were successfully implemented by DOTD
- Cost to Benefit Ratio = 5.3: 1



Model



*Repeated Loading Cyclic Plate Test
Field Tests*



Advanced Imaging



X-ray Computerized Tomography



Optical Imaging



SGI Workstation



PM 675 Infrared Imaging



Cordin M550 Speed Imaging System

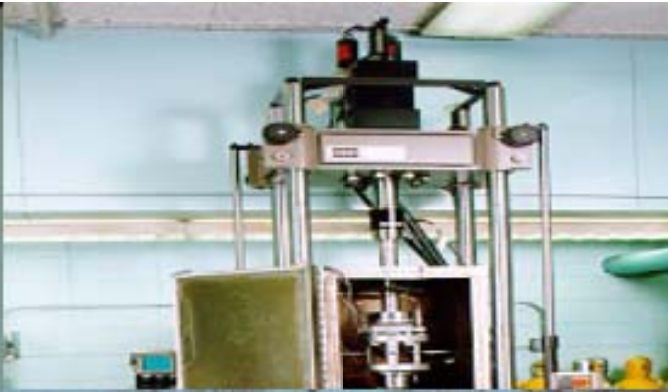
Computational capability

- **Several high end processor based PCs**
- **Two Sun workstation**
 - equipped with ABAQUS
 - commercial finite element program.



Educational Outreach





Thank You!

