

Modified Asphalt Research
Activities at FHWA's
Turner-Fairbank Highway Research Center
(TFHRC)

Nelson Gibson

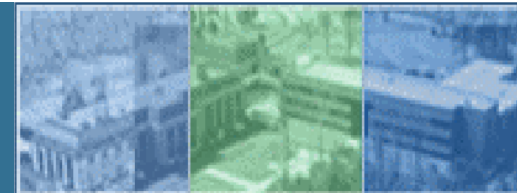
Pavement Materials and Construction Team

AMAP Conference

February 2005

Orlando, Florida

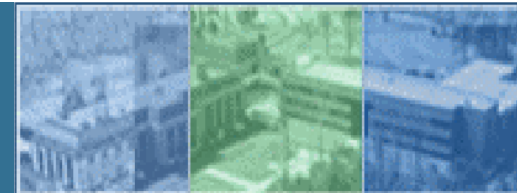




Objective

- To brief AMAP on the binder research activities taking place through the TFHRC
 - Chemistry laboratory
 - Binder & mixture laboratories
 - Accelerated Load Facility (ALF)
 - Associated projects with other organizations

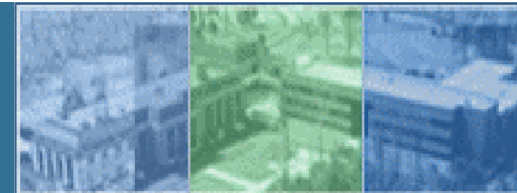




Overview

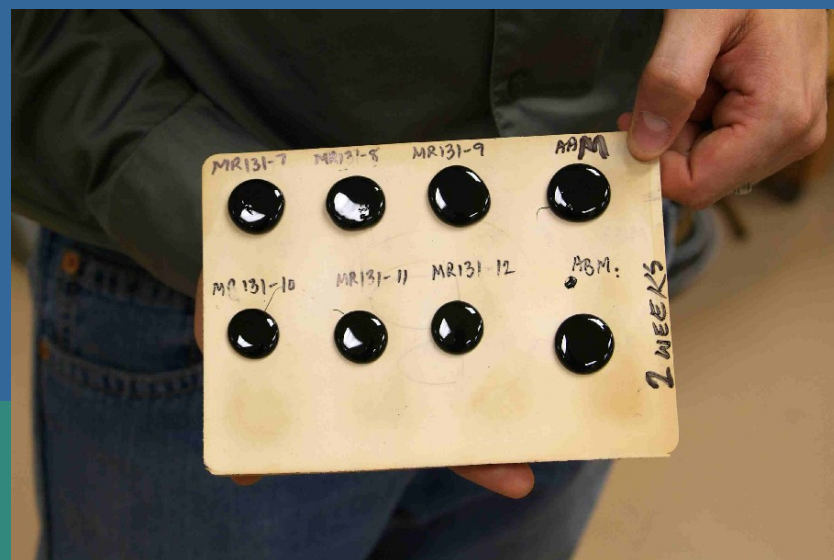
- Polyphosphoric Acid Modification
- Warm Mix Asphalt
- Low Temperature - ABCD & Pooled Fund
- Aging - SAFT
- FHWA Accelerated Load Facility – Pooled Fund
- CAPT

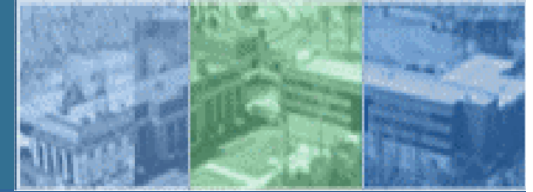




Polyphosphoric Acid Modification

- Develop a fundamental knowledge base of the modification mechanisms to avoid “knee-jerk” bans and inappropriate usage
- What are the appropriate modification rates to obtain the desired effect?
- To do so, we must understand the molecular mechanisms.

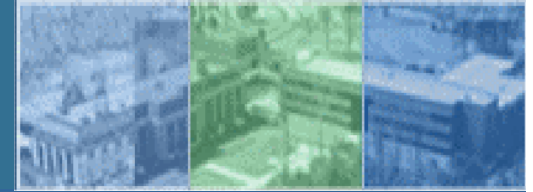




Polyphosphoric Acid Modification

- How do molecular reaction points influence modification with other polymers?
 - Mycelle formation vs. network bonding can produce different results.....which is it?
 - Strategic combinations of polymers & PPA
- How does PPA influence oxidative aging?
 - Further understanding of the apparent initial oxidation occupying reactions sites that reduces long term aging





Warm Mix Asphalt

- Binder selection, mix design, SPT characterization
 - Some modifications stiffen while others may soften
 - How transient is the stiffness and moisture content?
 - Quantify the reduced aging in mixing-storage-laydown
 - Adjust the LTPPBind PG selection?
 - Mixing and compaction temperatures
 - Research to develop mechanistic determination of low temp range
 - Demonstration project with IC Intelligent Compaction

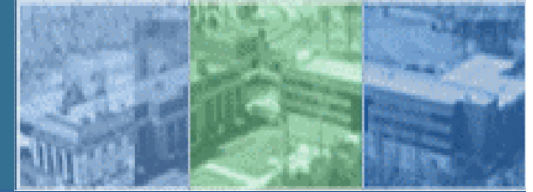




Warm Mix Asphalt

- Binder selection, mix design, SPT characterization
 - Gyratory compactors are fairly insensitive to PG Grade.
 - Include or not to include in mix design
 - Appropriate short term mix aging for SPT
- Long term behavior
 - Ultimate fate of moisture from foaming or emulsion agents
 - Thermal cycling, phase separation and embrittlement washing
- Cost benefit analysis
 - Comprehensive performance tests.....does it hurt us?
 - Coupled with accurate burner fuel saving calculation – trade offs?
- Inclusion into Next ALF experiment?

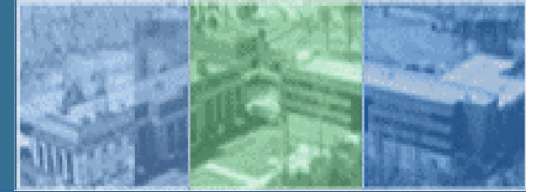




Low Temperature Behavior

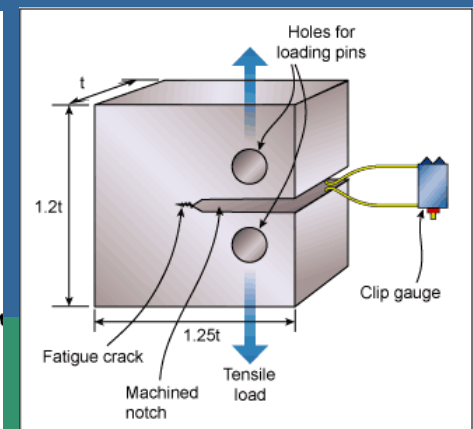
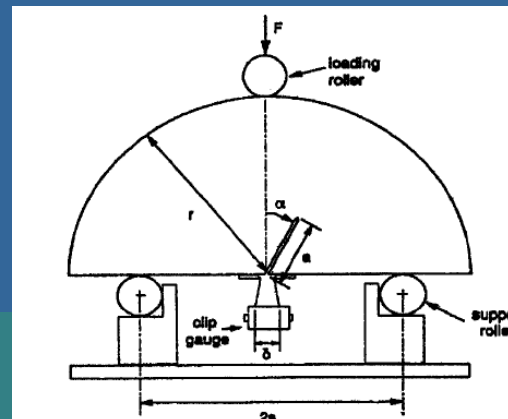
- Continued support for the further development of the Asphalt Binder Cracking Device (ABCD)
- Product of NCHRP I.D.E.A. – Sang-Soo Kim at Ohio University
- What is the role of fine aggregates and mastics in fracture ?

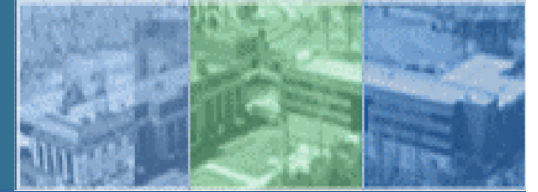




Low Temperature Behavior

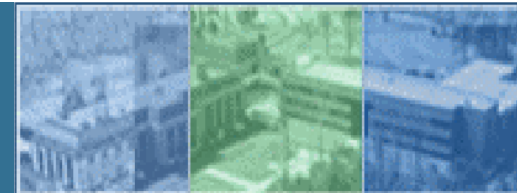
- Pooled Fund Study TPF 5(080), Improvement of Low Temperature Superpave spec for elimination of low temperature cracking
- 12 states and 4 universities
- Materials from 12 northern field sites collected
- Variety of state-of-the-art mix and binder characterization
 - ABCD + BBR
 - SCB w/ AE
 - Compact tension
 - TSRST and IDT





Stirred Air Flow Test (SAFT)

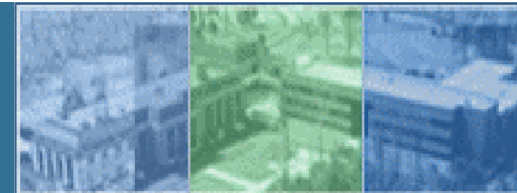




SAFT

- NCHRP Project 9-26 is coming to a close
 - Some recommended mechanical modifications
 - RTFO and PAV Protocols available
- TFHRC has a SAFT on loan from TxDOT
- TxDOT has results from initial round robin - 8 labs
- Finding use in Warm Mix Research to monitor moisture loss using condenser
- Working w/ KsDOT for comparisons to Microwave Aging

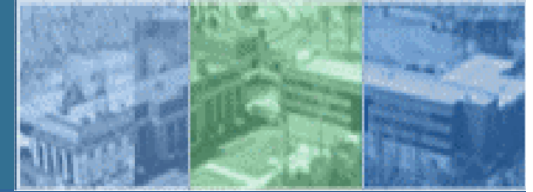




FHWA Accelerated Load Facility

- State Pooled Fund Project 5(019)
- Industry support as well
- Rutting experiments completed
- Fatigue testing to end by 2007

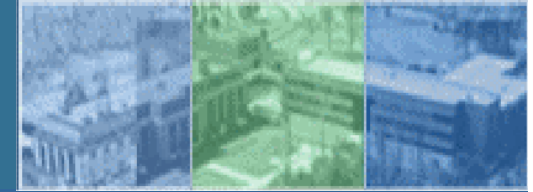




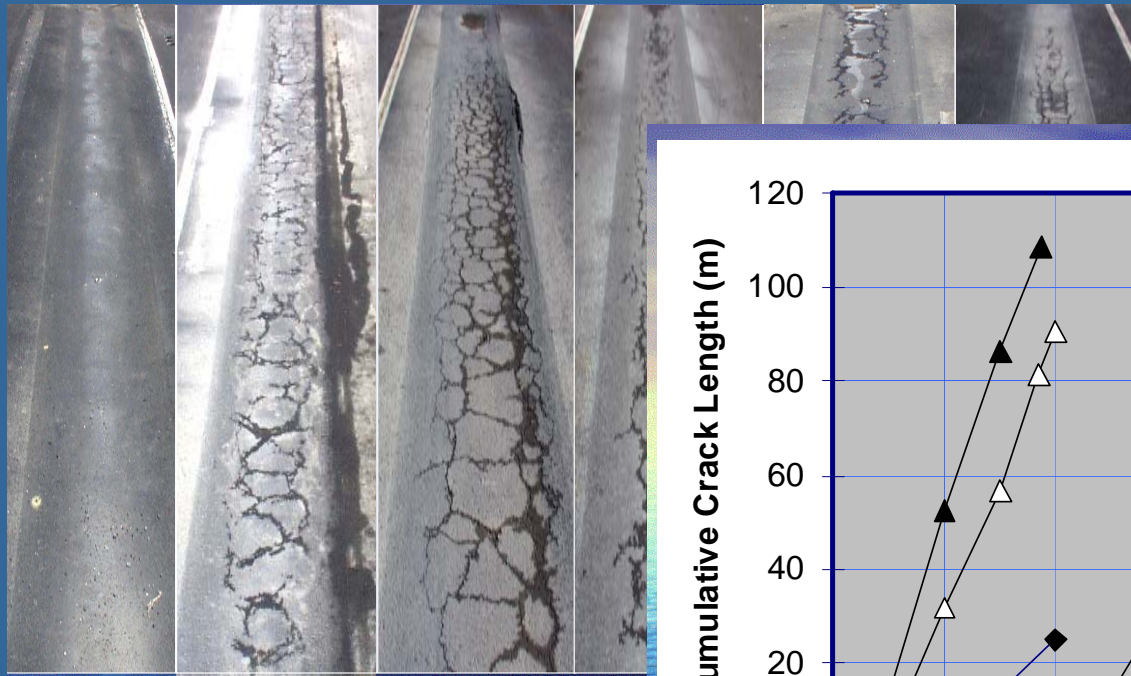
FHWA Accelerated Load Facility

- Technical Working Group meeting this summer
- State of the art characterization
 - TFHRC
 - Texas A&M with Overlay Tester for fracture properties
- State of the art constitutive modeling
 - North Carolina State University
 - Viscoplasticity – Rutting
 - Viscoelastic Continuum Damage - Fatigue

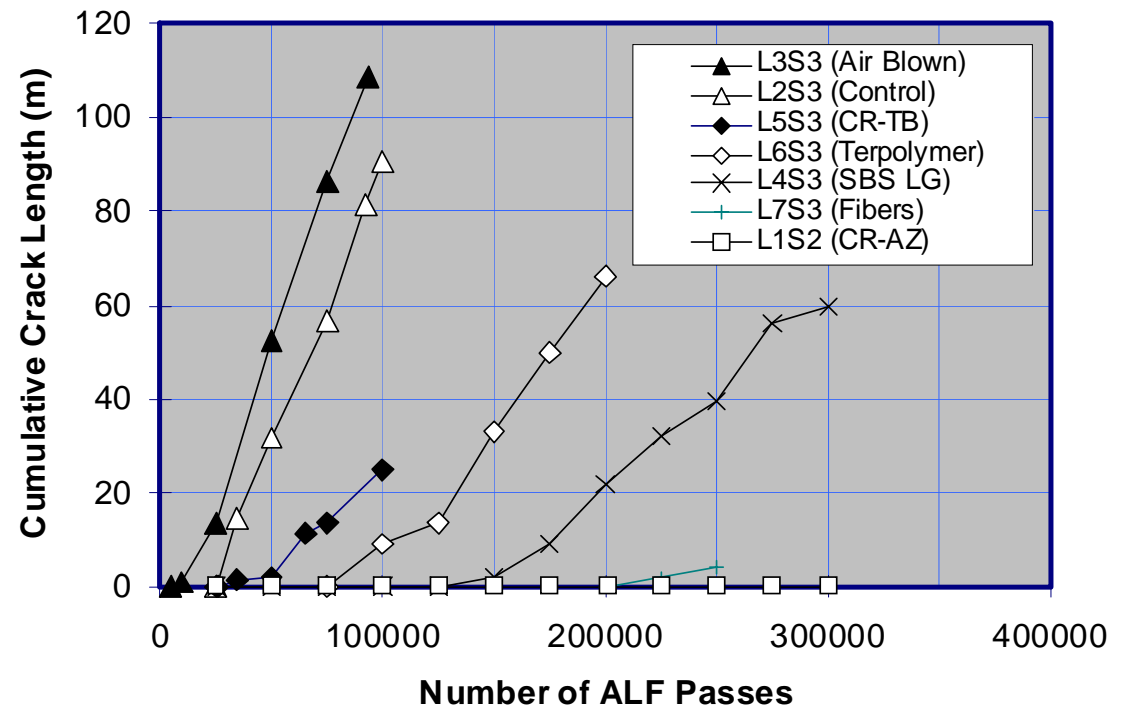




FHWA Accelerated Load Facility

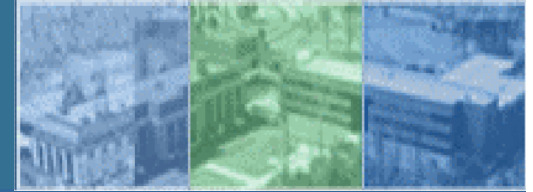


Lane 1	Lane 2	Lane 3	Lane 4
CR-AZ	Control	Air Blown	SE
300,000	100,000	100,000	300,000



Fatigue Cracking Length vs. ALF Wheel Load Passes

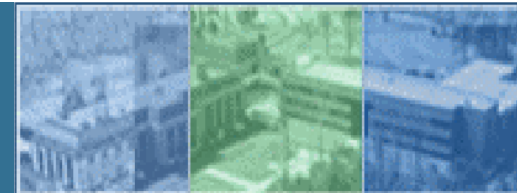




Consortium of Accelerated Performance Testing CAPT

- Objective is a mechanism for owners of U.S. APT facilities to share best practices
- Approved Pooled Fund now exists
 - 13 in all – most DOTs
- Opportunities for research including modified asphalt research
- Next meeting to take place in April 2006

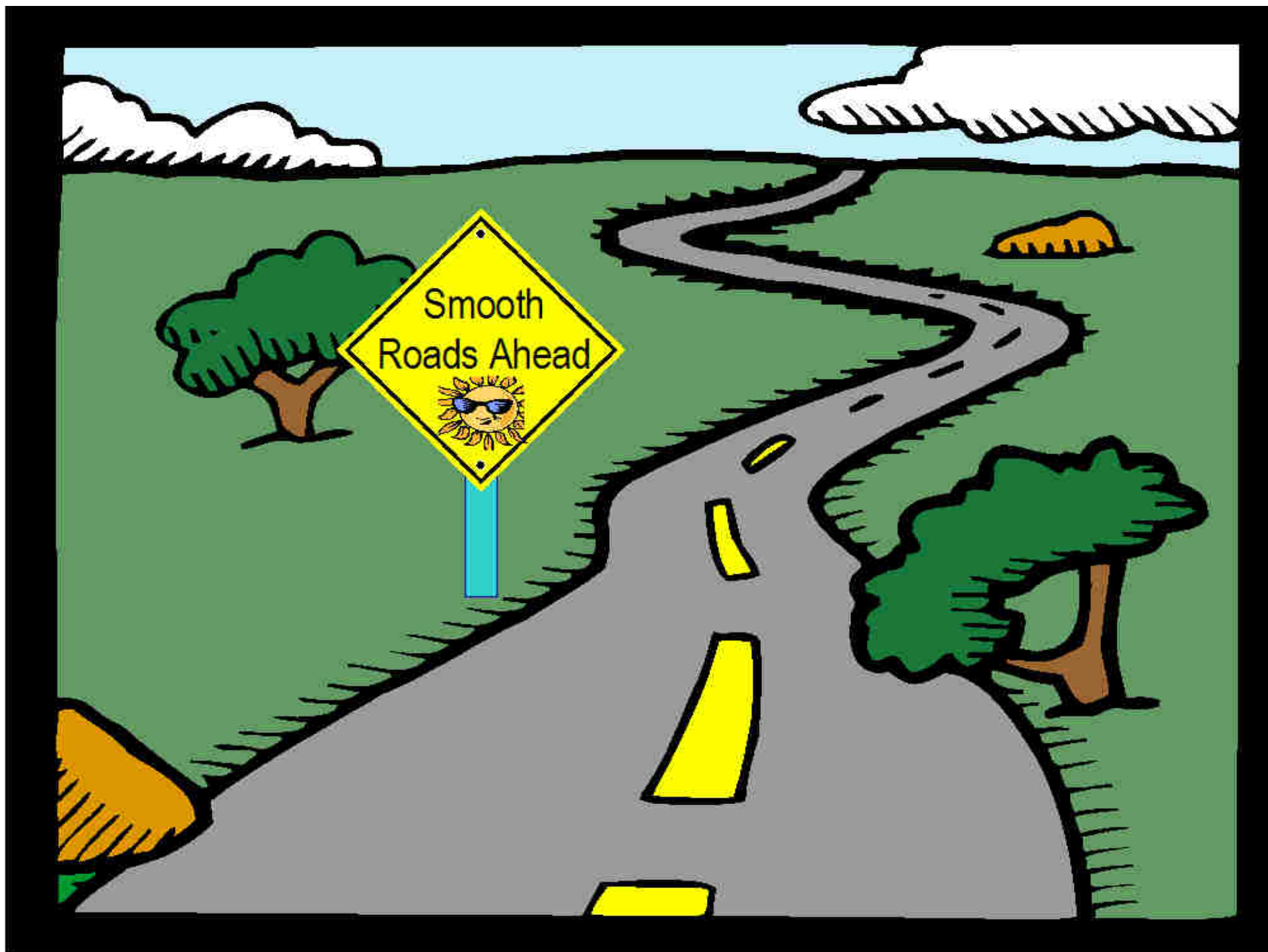




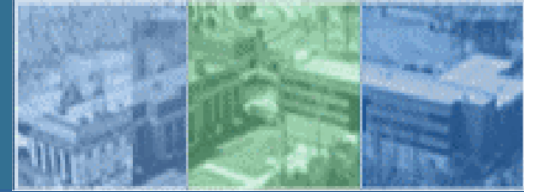
Overview Summary

- A wide variety of activities are taking place
 - Fundamental knowledge base building
 - Full spectrum of distresses
 - Evaluation of new materials and processes
 - Collaborative research





TURNER-FAIRBANK HIGHWAY RESEARCH CENTER



**Thank You
Questions?**



U.S. Department of Transportation
Federal Highway Administration