



Unified **P**erformance **T**esting based on
incremental & **m*** Methodology

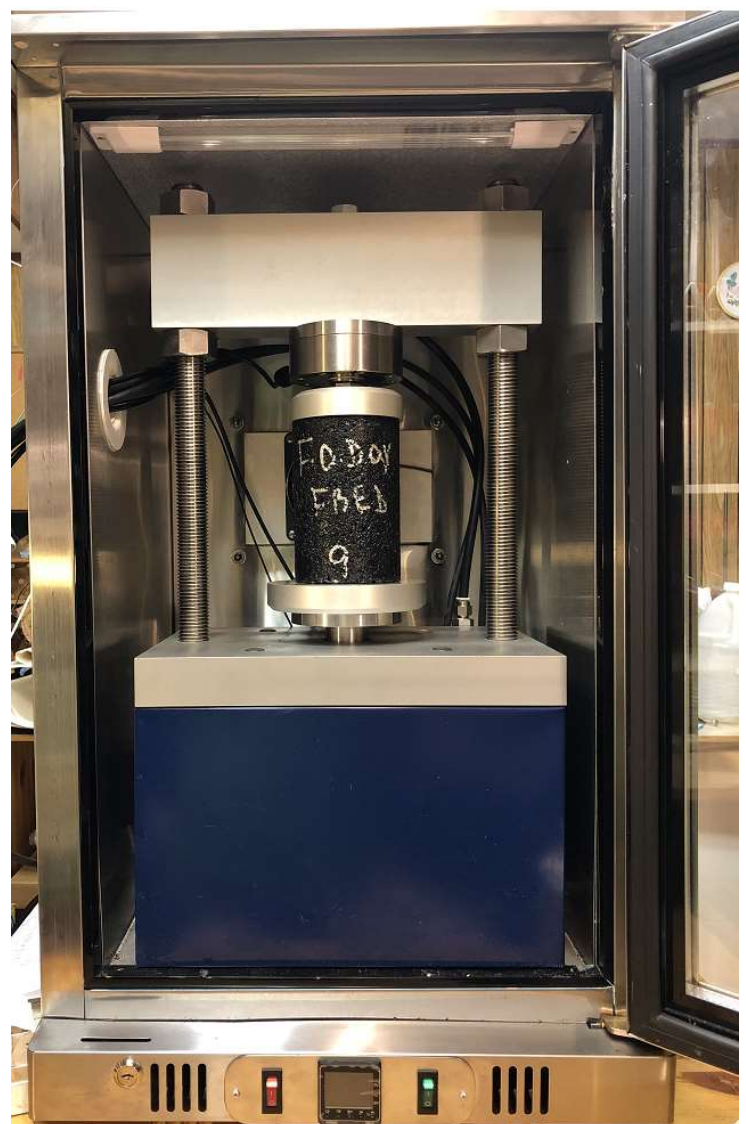
UPTiM™ Asphalt Test Methods

Mixture (iRLPD Rutting, Fatigue and Moisture Damage)

Binder LT, HT and Fatigue (iCCL, HT and FIT-B)

Composite Binder (LT, HT, FIT-C)

Practical Tests for Practitioners



UPTiM software is an one touch operation:

- 1) Measure asphalt binder/Composite by weight
- 2) Place material on the lower plate
- 3) Enter sample info in software
- 4) Close the DSR hood
- 5) Click "Start Test"

After 1 hour

Get LT PG

HT PG

Pavement Systems, LLC

**Innovations in Pavement
Materials Testing**

Benefits of UPTiM Tests

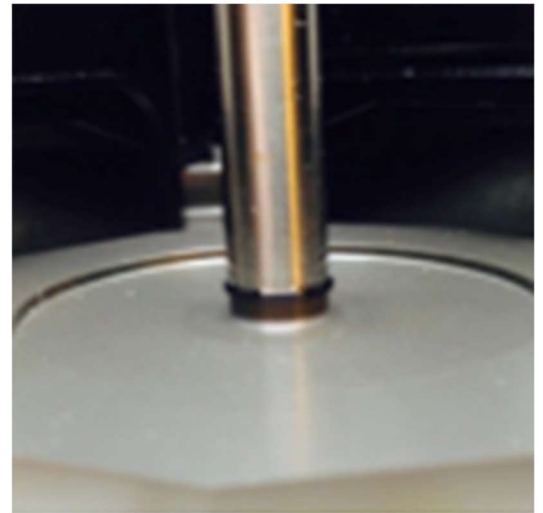
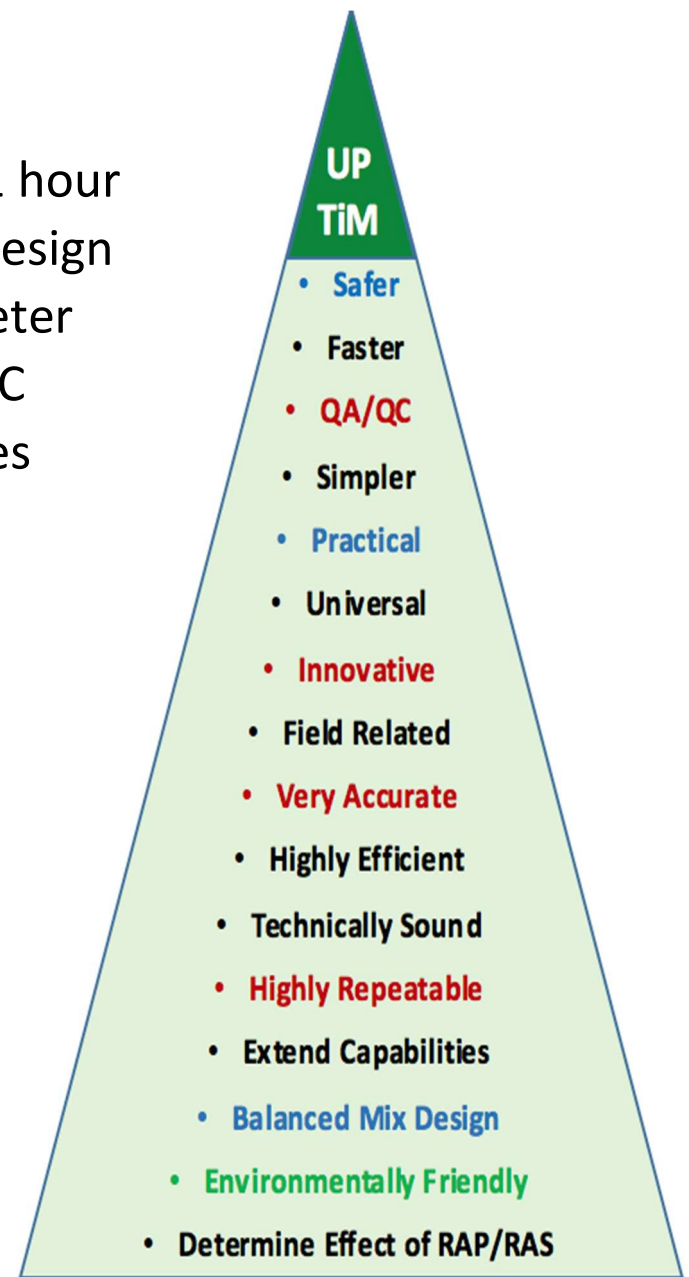
- Complete grading of material in 1 hour
- Effective tools for balanced mix design
- Unified methodology and parameter
- Quick and reliable tests for QA/QC
- Reliable/affordable testing devices
- Fatigue results are field verified
- Binder correlates with mixture
- Automated testing procedures
- Significant reduced training
- Low-Temp. PG same as BBR
- Increased productivity
- Improved accuracy

It's a Green Technology!

- Mess-free sample preparation
- Eliminates use of chemicals
- Use volumetric samples
- Easy cleaning
- Encourages use of recycled materials
- Reduced testing time
- Efficient sample sizes

AutoTrim Technology

UPTiM software uses a patented technology called AutoTrim to automatically mount composite binder samples without the need for manual trimming.



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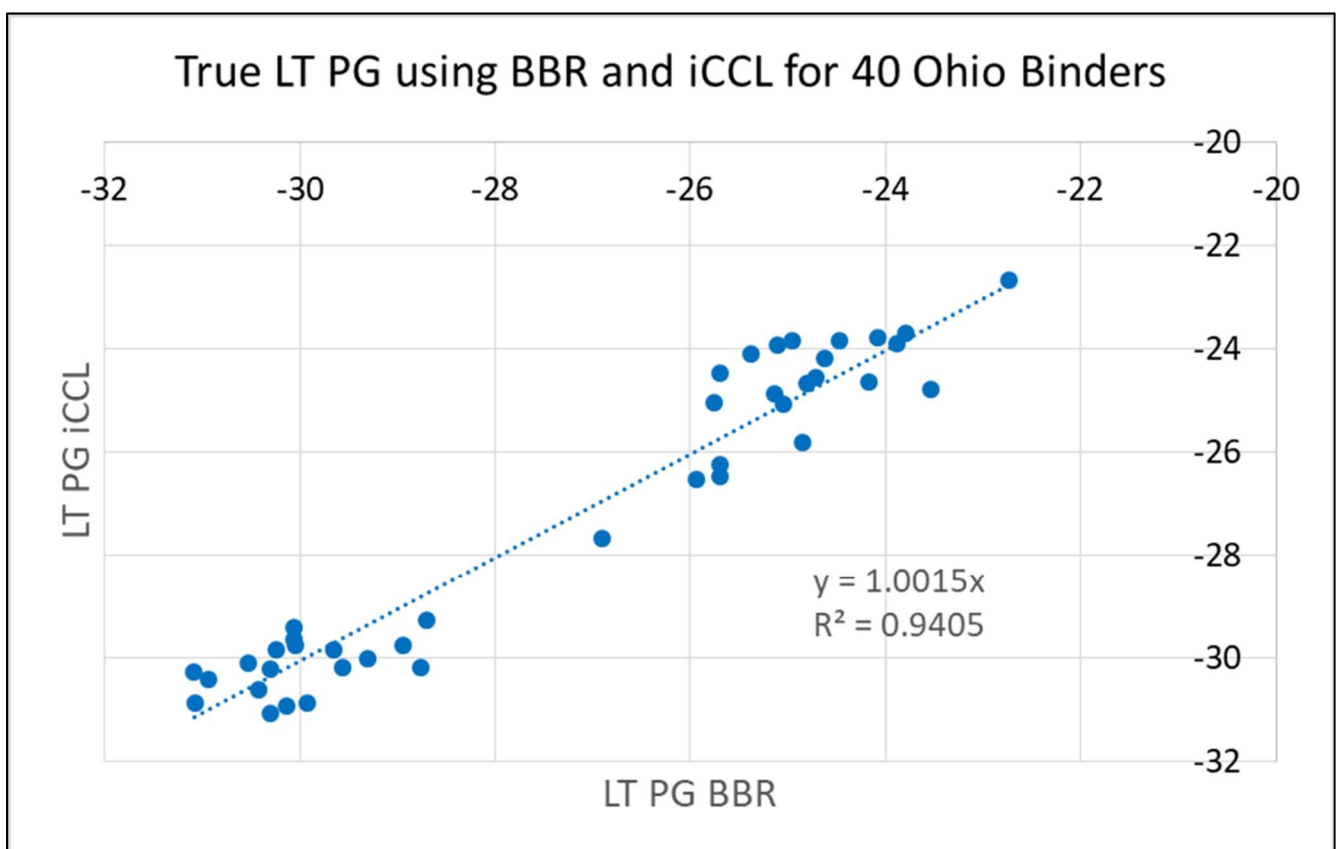
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iCCL: Binder Low-Temp. PG

(*incremental Creep for Cracking at Low Temperature*)

- Provides the same Low-Temperature (LT) PG as BBR
- Performs a full creep test at subzero temperature
- Performed on RTFO/PAV or Original binder
- Needs 30 mg of binder that is easily mounted
- Ideal for small quantity of extracted binder
- No need for molding and de-molding
- A quick screening tool for QA/QC



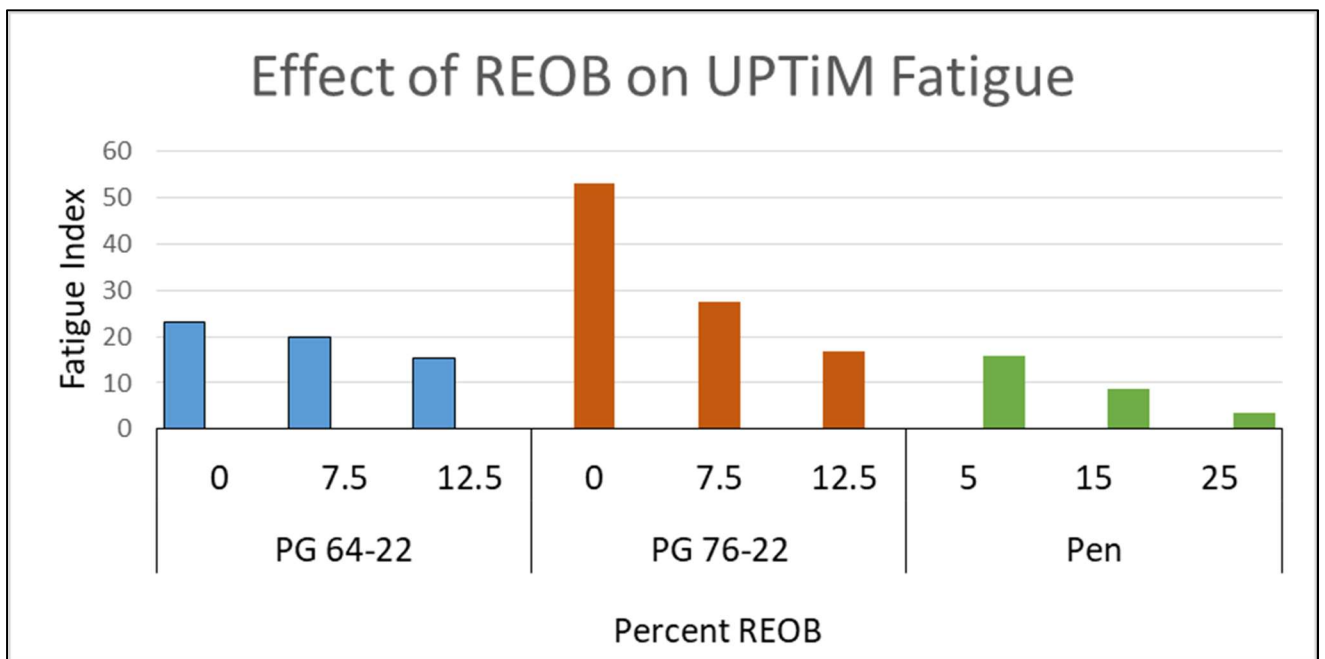
Comparisons of BBR and iCCL

Test Variables	BBR	iCCL
Testing Time/Sample	>2 hours	30 min.
Sample Preparations	Molding	None
Sample Storage Limit	< 2 hours	None
Technician Time	2 hours	2 min.
Calibration/Verification	Every Test	3 months
Liquid Anti-Freeze	Yes	None
Air Pressure	Yes	None
Test Variability	7%	2.5%
De-Gassing	Yes	None
Testing Original Binder	No	Yes
Extracted Binder Needed	> 10 grams	30 mg

FIT-B: Binder Fatigue Test

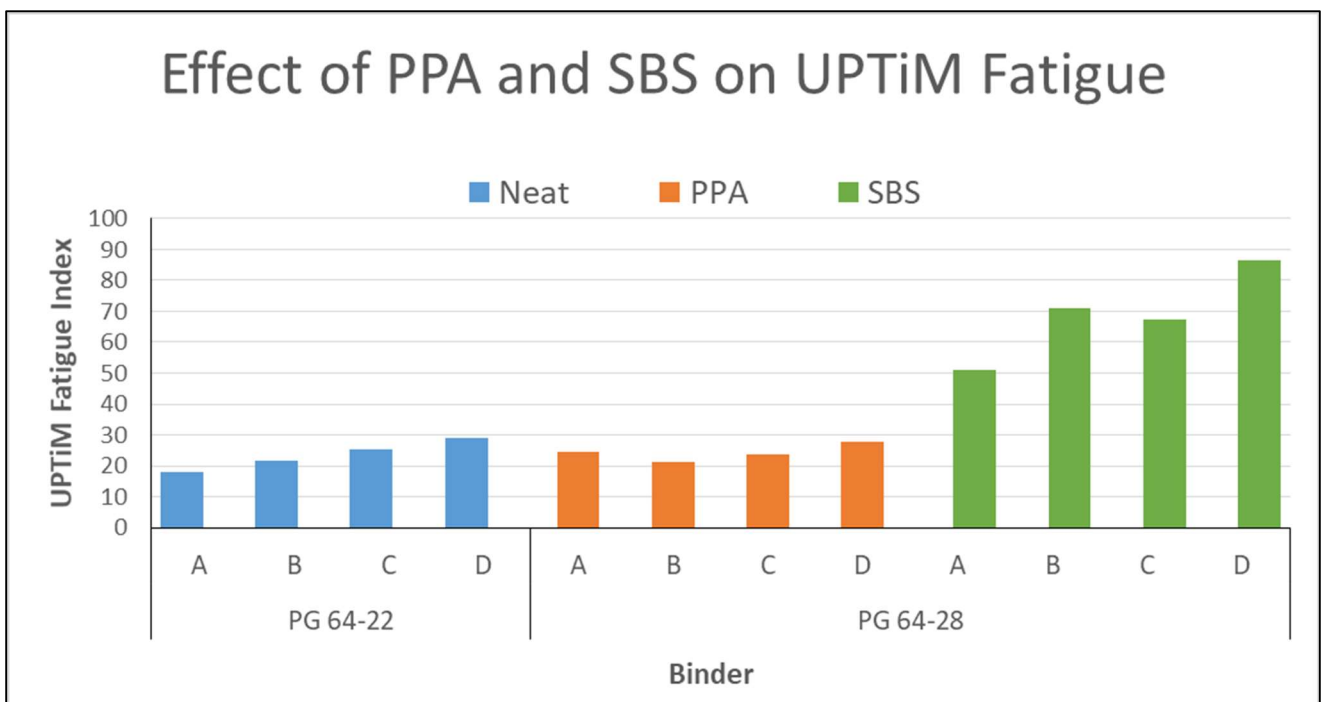
(*Fatigue at intermediate temperature for binder*)

- Determines cracking resistance of asphalt binder
- Conducted using Temperature Sweep and Pulse Load
- Provides two parameters at the same time: Intermediate Temperature (IT) and fatigue index (FI)
- Can determine effects of REOB, PPA, and Polymers
- Provides reliable estimates of Elastic Recovery (ER)
- ALF Extracted binder correlated to Passes to Failure



Applications

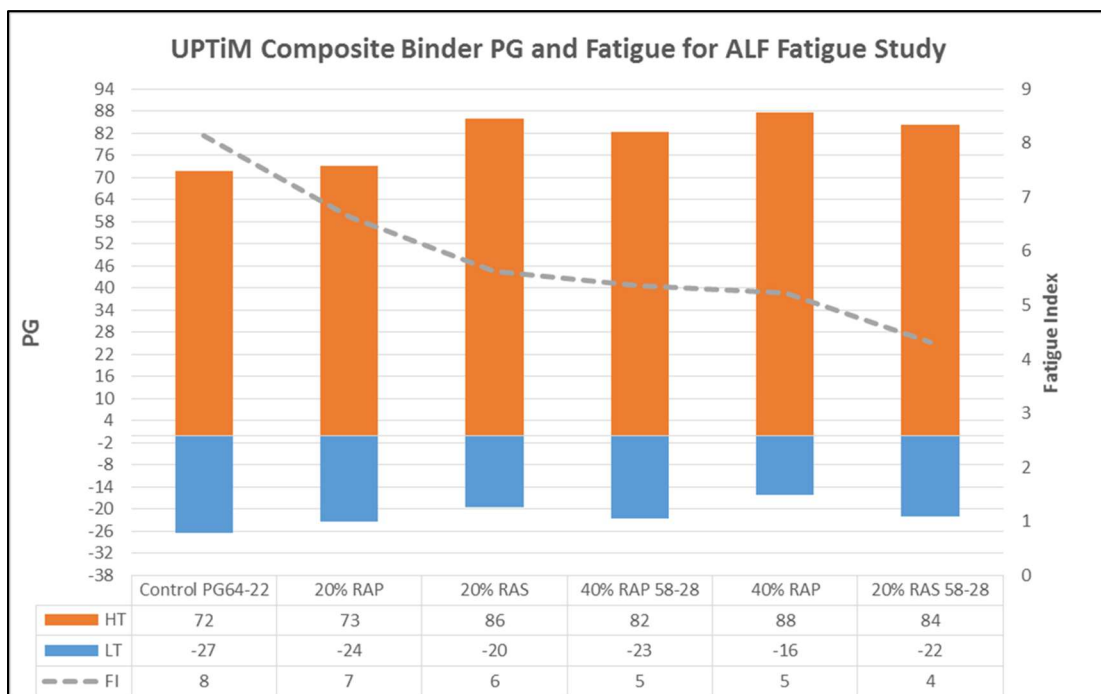
- Determines effect of REOB (see above graph)
- Determines effect of modification on performance
- Differentiates type of modification (SBS vs. PPA)



Composite Binder PG

(Composite Binder, Sustainable Alternative to Extraction)

- RAP/ RAS and other additives affect properties of original binder; thus, need performance grading of binder in the mix
- Binder extraction is performed to evaluate the change in PG
- Extraction is a lengthy process involving use of chemicals
- There are also uncertainties with the extraction process
- Composite Binder includes the fine portion of the mixture that is physically separated and includes all the effects of additives



- UPTiM on composite binder are reliable, precise, safe, time saving, and cost effective; while more representative of mixture
- UPTiM recovery method has been verified with extraction

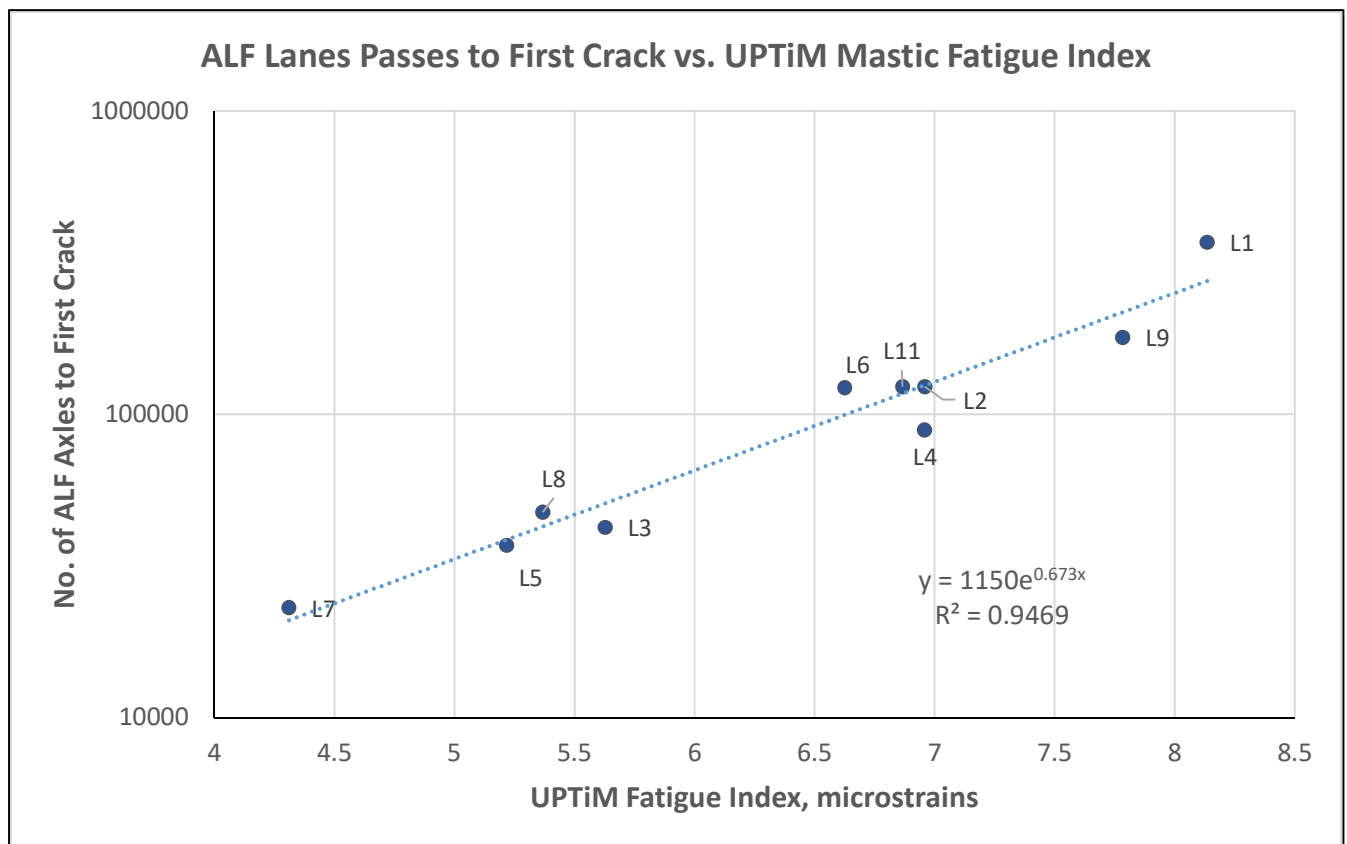
Comparisons of UPTiM Recovery and Extraction

Test Variables	Extraction	UPTiM
Extraction Process Time	>2 hours	<30 min.
Chemical Solvents	Yes	None
Equipment	Costly	None
Cleaning	Extensive	Minimal
Verification	Needed	None
High Temp. PG Test, min.	120	15
BBR Test (Low Temp.), min.	120	30
Intermediate Temp. Test	120	15
Quantity of Extracted Binder Needed	> 15 grams	100 mg

FIT-C: Composite Binder Fatigue

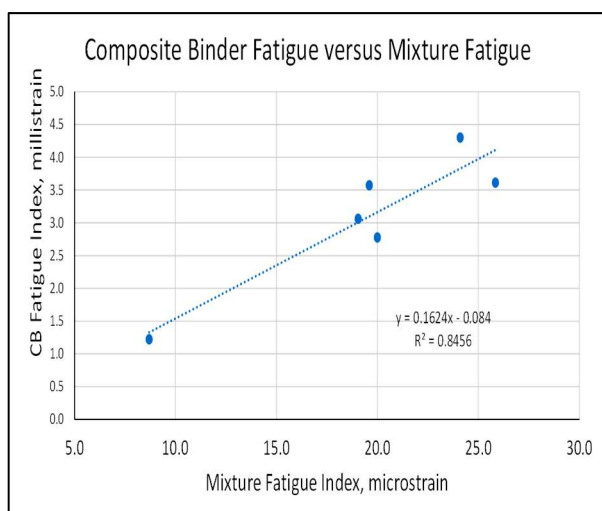
(Fatigue at Intermediate Temperature for Comp. Binder)

- Determines cracking resistance of asphalt mixture
- Conducted using Temperature Sweep and Pulse Load
- Provides two parameters at the same time: Intermediate Temperature (IT) and fatigue index (FI)
- Can determine effects of RAP, RAS, REOB, PPA, and Polymers
- Automated testing process, which takes less than 30 minutes



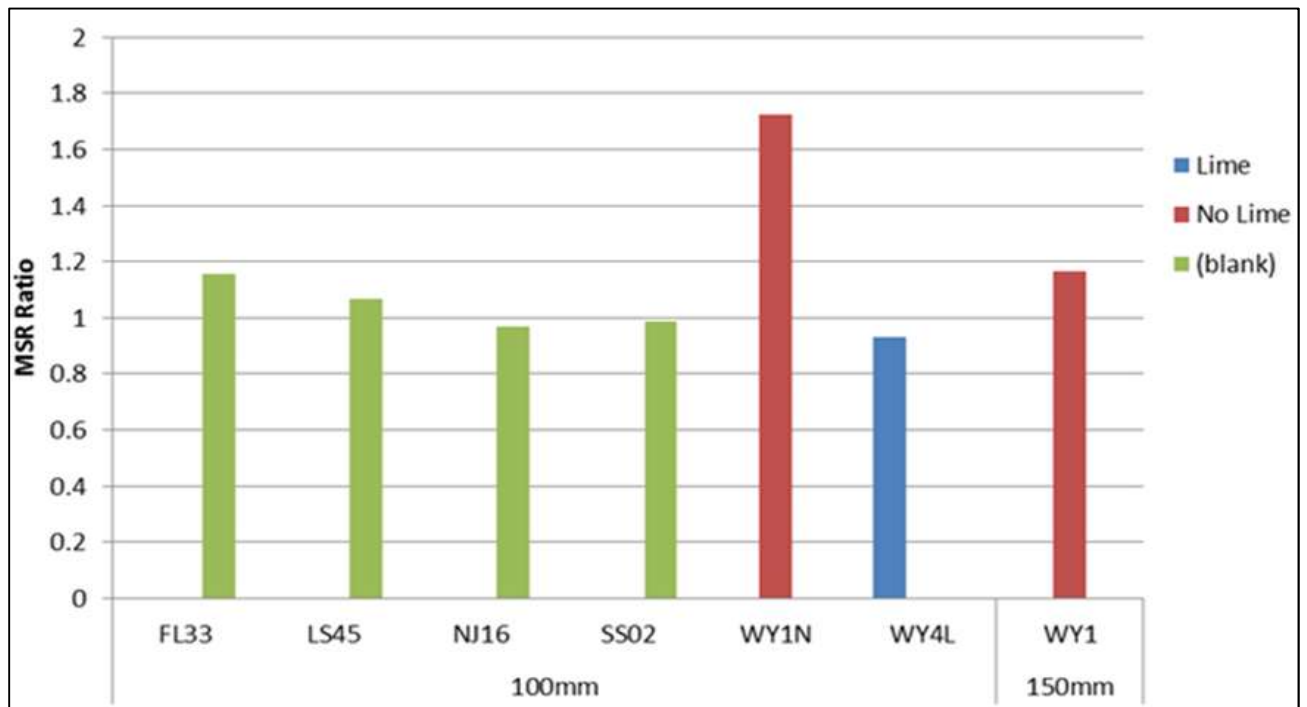
Applications

- correlates with the ALF Passes to Failure (above)
- correlates with Mixture Fatigue (below graph)
- CB could be tested for fatigue in place of testing mixture
- Provides estimate of allowable traffic before cracking



iRLPD Moisture Damage Test

- Sample size: SCB 150-mm x 50-mm
- Applies Incremental repeated load before conditioning, as part of conditioning, and after conditioning
- Test Temperature: 25°C
- Moisture Damage Ratio is the after to before m^* ratio
- m^* ratio >1.5 indicates moisture susceptibility



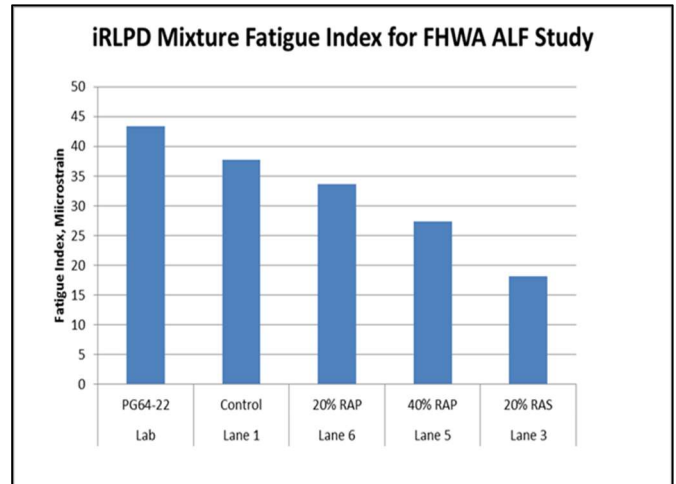
Advantages:

- Damage is caused by Pore pressure, which is related to field
- Higher precision since same specimens used before and after
- Sample preparation and testing time is reduced by 80%
- Total conditioning and testing time is 4 hours
- Better assessment of moisture resistance by using smaller sample size
- Verified with moisture susceptible and moisture resistant mixtures



iRLPD Fatigue for Mixture

- Test provides fatigue index, which is the measure of resistance of the mixture to cracking at intermediate temperature
- Test is performed at sweeps of stresses and temperatures
- The duration of the test is 30 min. /temperature
- Fatigue index of ALF mixtures are well correlated with number of passes to first crack in ALF lanes.



iRLPD Rutting (AASHTO TP 116)

- Test can be performed on field cores or volumetrics
- Takes only 33 min. to create MSR master curve, which determines resistance of a mixture to rutting at any temperature and under any stress
- Determines allowable traffic

Traffic Category	Traffic Level, MESALs	Critical m*
1	1 to <3	16 to <24
2	3 to <10	10 to <16
3	10 to <30	3 to <10
4	≥ 30	<3

