Illinois Tollway

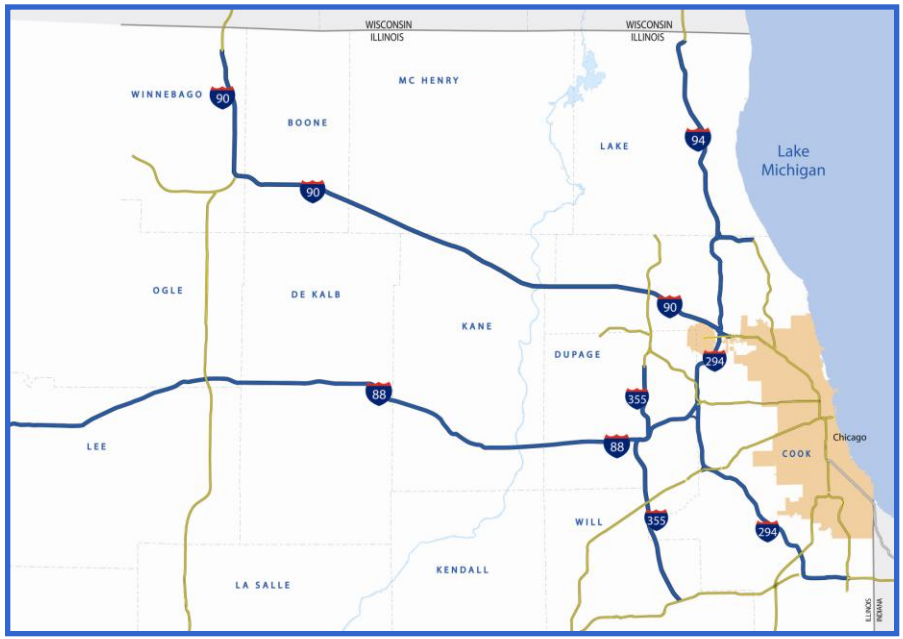
Open Roads for a Faster Future

Green Successes Rebuilding Expressways

NCAUPG Annual Meeting
February 5, 2009

Illinois Tollway – Key Statistics

- **286-mile system comprised of four tollways**
  - Tri-State (I-94/I-294/I-80)
  - Jane Addams Memorial (I-90)
  - Reagan Memorial (I-88)
  - Veterans Memorial (I-355)
- **Opened in 1958 as a bypass around Chicago to connect Indiana and Wisconsin**
- **Carries more than 1.4 M vehicles per day**
- **User-fee system – no state or federal gas tax dollars used for maintenance and operations**



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Congestion-Relief Programs

$6.3 Billion Congestion-Relief Program (CRP) Phase One in progress to:

- **Rebuilding/Restoring** nearly the entire 286-mile system – 50% Complete
- **Widening** many miles of major roads – 50% Complete
- ✓ Converting 20 barrier toll plazas to **Open Road Tolling**
- ✓ Building the 12.5-mile **extension of I-355** to serve fast-growing Will County

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Congestion-Relief Programs

$1.8 Billion Congestion-Relief Program (CRP) Phase Two proposed to:

- Construct the I-294/I-57 Interchange
- Reconstruct the I-90/I-290-IL Route 53 Interchange
- Create “Green” or High Occupancy Toll (HOT) lanes

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Asphalt Research Initiatives

- 2006 – GTR Modification
  - SMA
  - OGFC
  - Dense-Graded
- 2007 – Higher RAP with FRAP
  - Can it work?
  - How soft for the AC?
- 2008 – Additional AC Research
  - 64-22 vs. 58-22 vs. 58-28 for high RAP
  - WMA SMA's vs. HMA SMA's

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GTR Modification

- Terminal Blended GTR
- Test Pavements ~ 2,100 Tons each
  - SMA
  - OGFC
  - N105 Dense Graded
- Fatigue and Dynamic Modulus Analysis
- Noise, Texture, and Friction Testing

2007 – High RAP Research

- FRAP Process Analysis
- Mixture Quality Control
- 9 Mixtures Tested (SMAs, Dense-Graded Binders and Surface)
- Fatigue and Strength analysis
  - Are mix properties compromised with higher RAP?
  - How soft for the PG with the increased RAP?

    (64-22 vs. 58-22 vs. 58-28)
  - How will the use of FRAP and GTR Modifiers effect the strength and durability of SMA mixes.

Jane Addams Memorial Tollway (I-90) Reconstruction & Widen Project

- 2007 – FRAP test mixtures on widening and crossovers
- 2008 – EB reconstruction
- 2009 – WB reconstruction
- Contractor willingness to participate - vital

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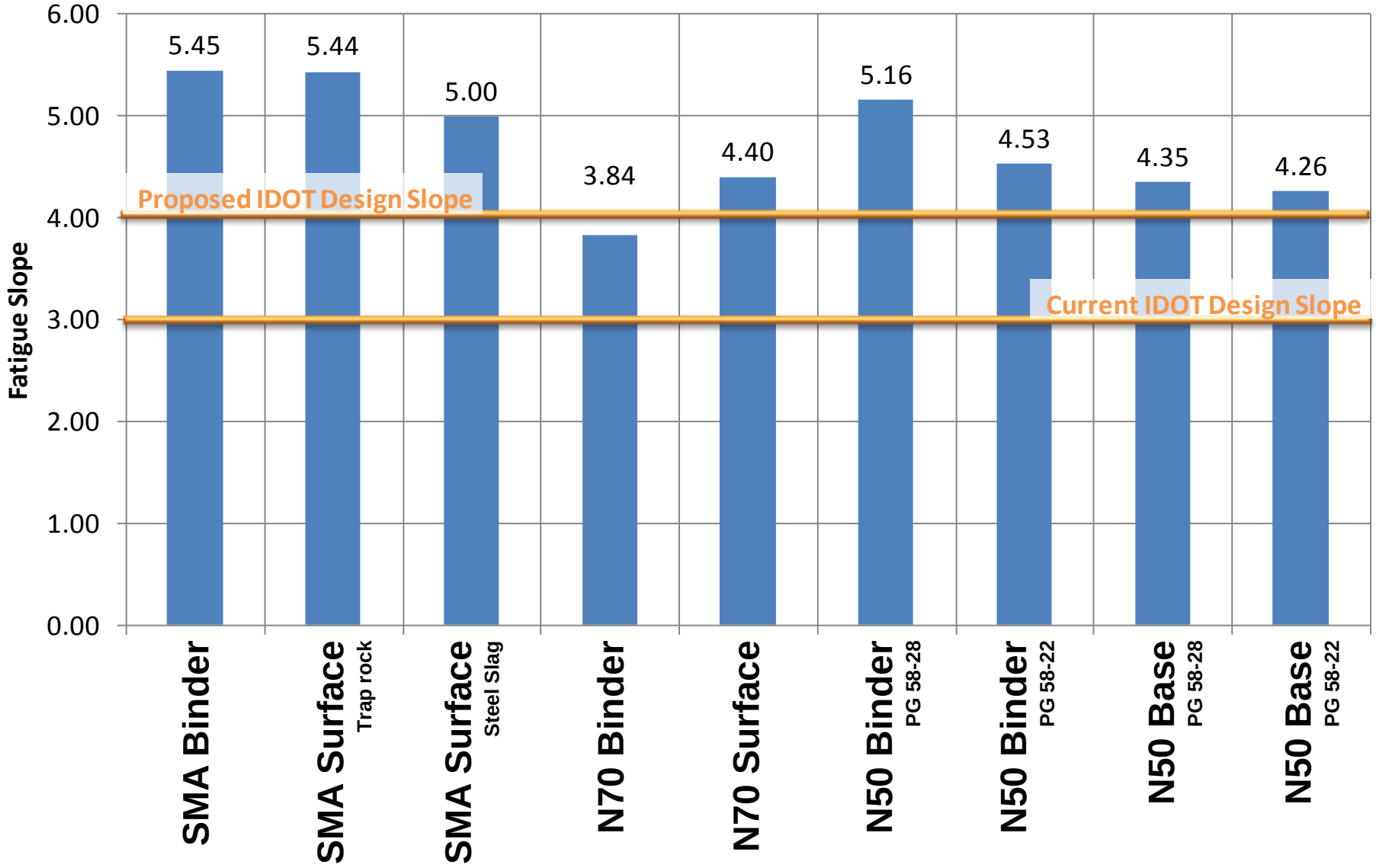
Collaborative Effort

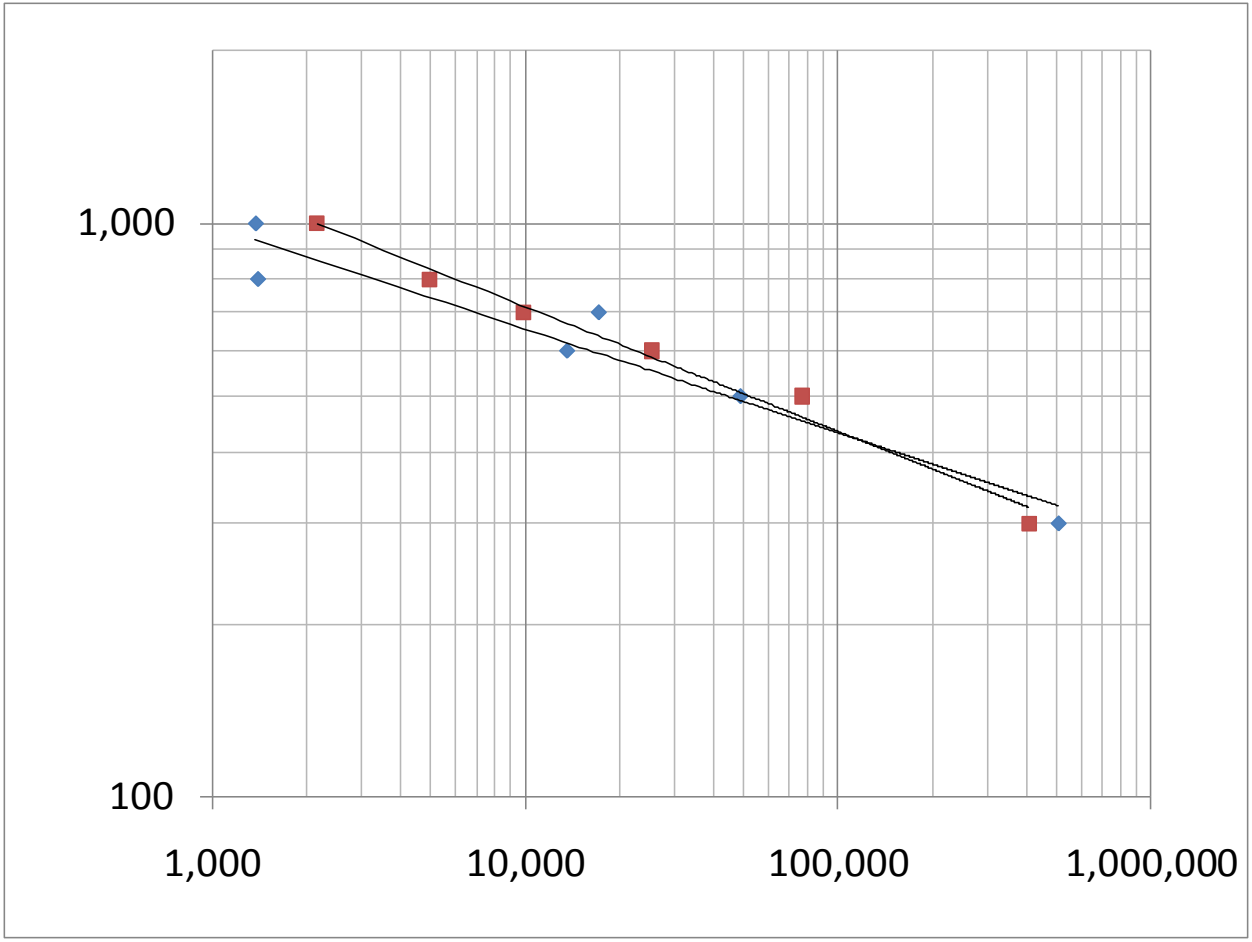
- Illinois Tollway
- IDOT
- Rock Road Companies
- Rockford Blacktop
- Seneca Petroleum
- Heritage/Levy Slag
- Rib Mountain Aggregate
- ARA & STATE Testing
- University of Illinois Center for Transportation

Fatigue Analysis



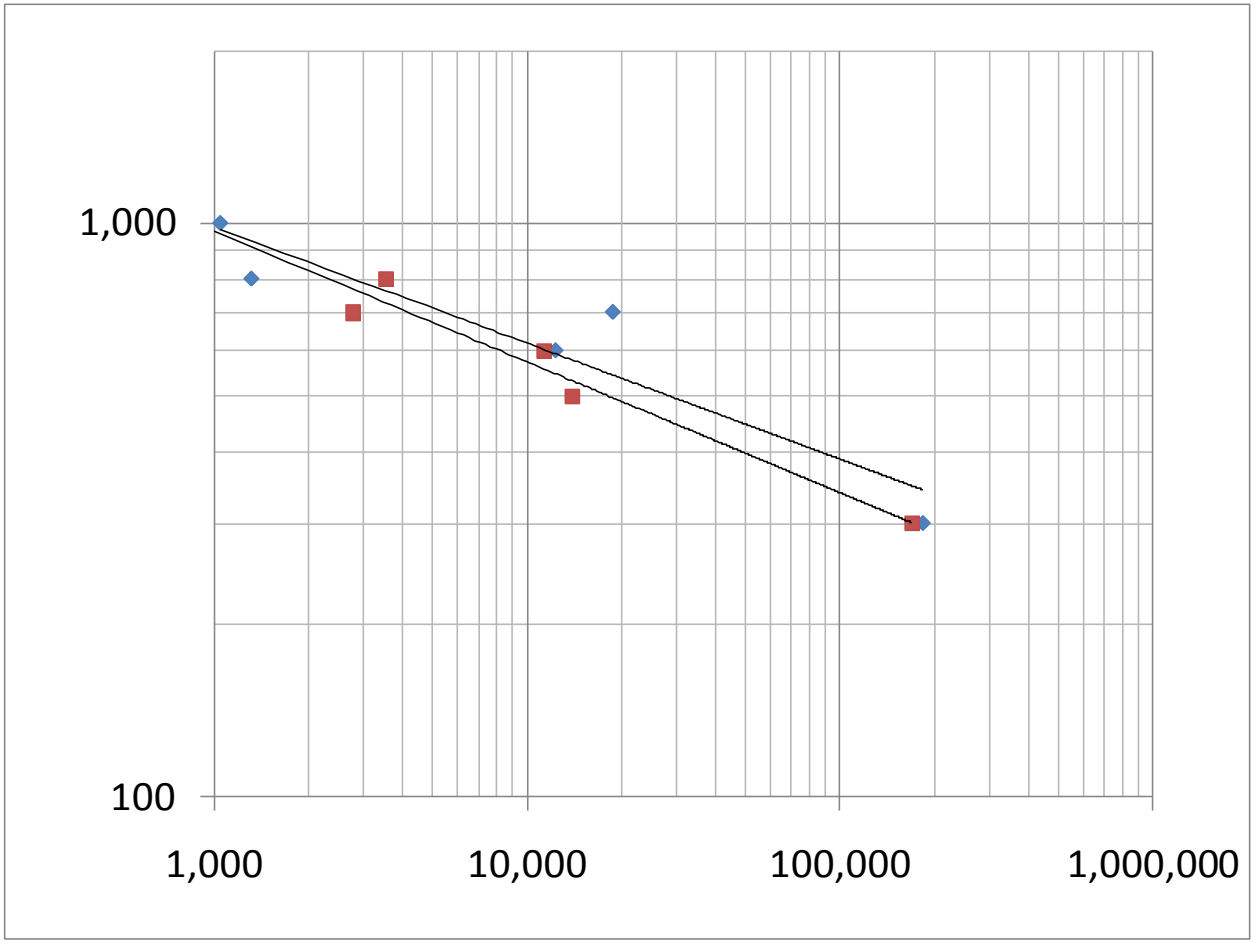
Binder Mix Double Bump

- Fatigue performance of the 2 mixes is nearly identical

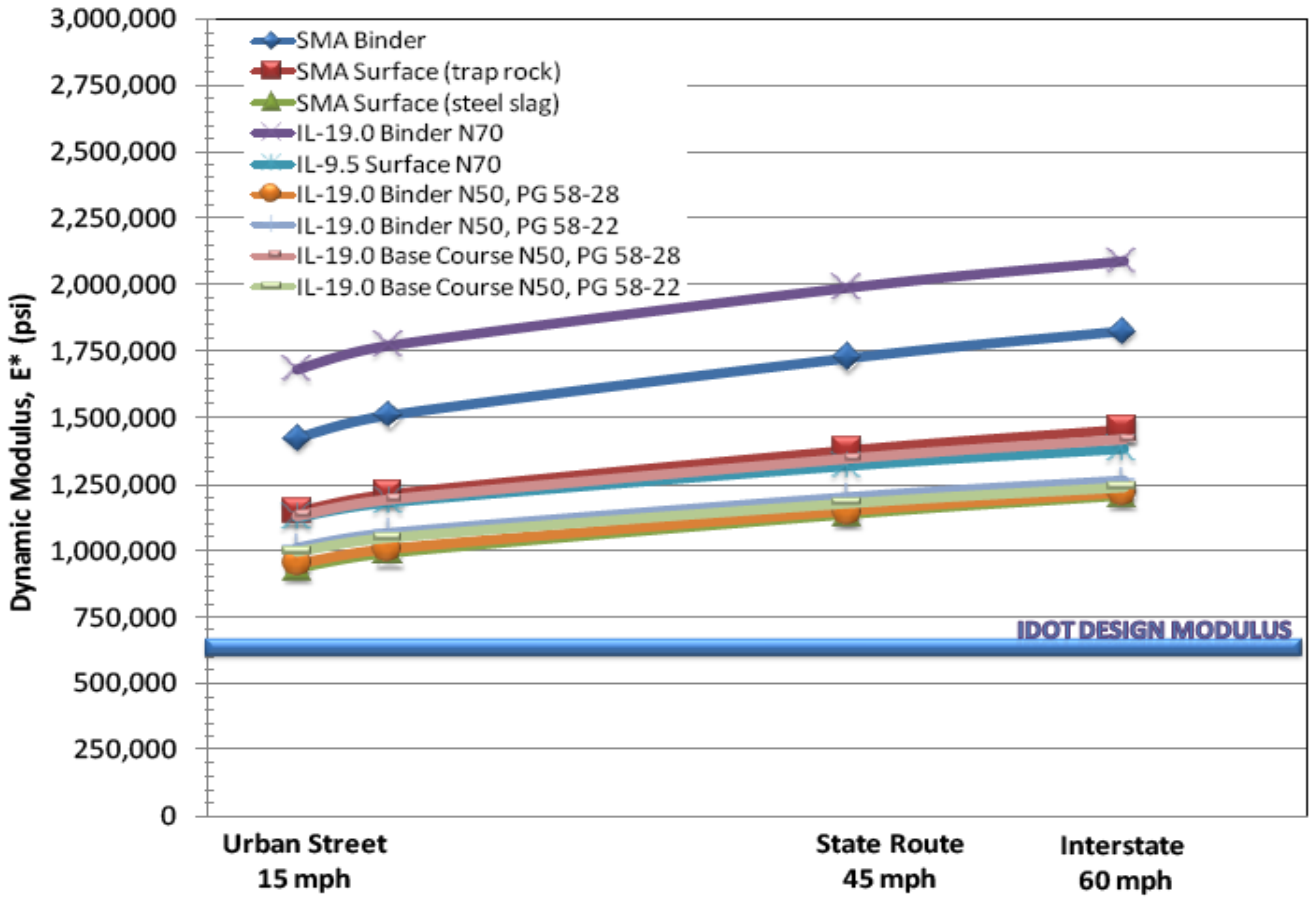


Base Mix Double Bump

- Fatigue performance of the 2 mixes is nearly identical



Dynamic Modulus Results



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Modulus Test Interpretation

- The results are typical of all-virgin-aggregate IDOT mixtures.
- The magnitude of the modulus values are typical of IDOT mixtures,
- No extra hardening of these mixes with the high RAP content.
- Compaction to lower voids increases the modulus slightly, as expected.
- Performance should be the same as a typical IDOT mix with all new materials.

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Reconstruction Stage 1 - Complete

2008 FRAP and Mix Research

- N70 Binder, 4% Air Voids
- 3 asphalt grades (PG 64-22, PG 58-22, & PG 58-28)
- 3 percentages of Lower Quality Category 2 FRAP (10%, 27.5%, & 45%)
- Lab-produced samples; production samples
- Fatigue and Dynamic Modulus Analysis
- Warm Mix Additives with high FRAP SMA's

Cost Savings and Moving Forward

- Estimated $10 million+ HMA savings – I-90
- GTR modified binder – avoided SBS “shortage”
- Tollway specs give FRAP option (with increased RAP allowance) on all contracts
- Results of 2008 research to be shared with industry.

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HMA Field Demonstrations And Resultant Applications

Jay Behnke, P.E., President

S.T.A.T.E. Testing, LLC

Dundee and Chicago

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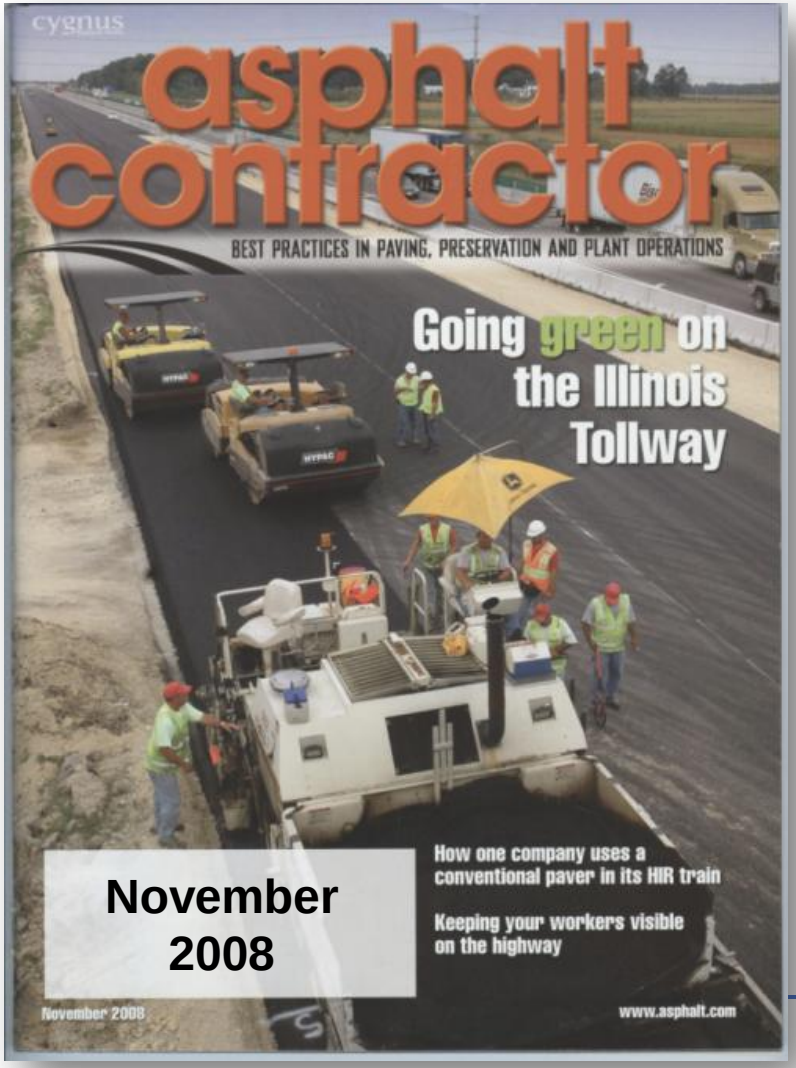
IL Tollway Field Demonstrations



- New Materials
- Useful Mixes
- On-the-Fly Design and Production
- Did it work?

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New Materials

FRAP

GTR

NEW!

Coarse Aggregate

WMA

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Useful Mixes for IL Tollway

- Bituminous Base Course
- 4.75 mm Level Binder
- SMA – Stone Matrix Asphalt
  - Surface
  - Binder

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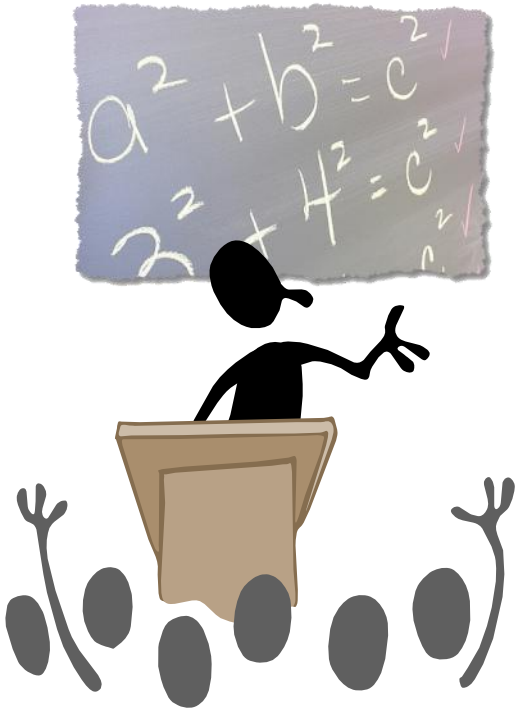
Objective – Look at:

- Alternate Coarse Aggregates for Strength / Friction / Supply
  - Crushed Gravel in SMA Binder Course
  - Trap Rock in SMA Surface Course
- Maximize RAP &/or FRAP
- Grade Bumping for RAP
- GTR - Ground-Tire Rubber
- WMA - Warm Mix Asphalt



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Nine FRAP Research Mixtures (2007)

- 3 SMA mixtures (Steel slag, trap rock, and crushed gravel coarse aggregates).
  - Used GTR modified PG 76-22 liquid in all.
  - Used 15% fine portion FRAP in all.
  - Used Warm Mix Additive in trap rock surface SMA.
- N70 binder – 40% FRAP
- N70 Surface – 25% FRAP
- N50 Binder – 40% FRAP, PG 58-28 & PG 58-22
- N50 Base – 40% FRAP, PG 58-28 & PG 58-22

Coarse Aggregate

Crushed Gravel

SMA Binder

Diabase Trap Rock

SMA Surface

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FRAP

Fractionated RAP

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Ground-Tire Rubber AC

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Warm mix Asphalt

MWV EVOTHERM
WARM MIX ASPHALT TECHNOLOGY

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Pulling Together

- Temporary / phased / multi-year work
- Cooperative Construction Team
- IL Tollway - flexibility and commitment
- Team included materials, research, and academic specialists

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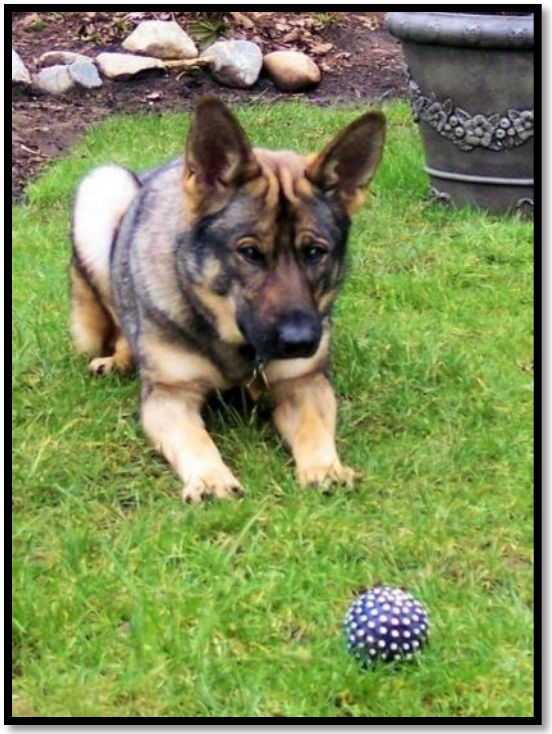
Keep an eye on the ball

- Mix Design
- Start of Production / Test Strips
- Monitor Mix Characteristics
  - Field compaction and density
  - Lab Voids and VMA
  - TSR
- Sample for Performance Testing



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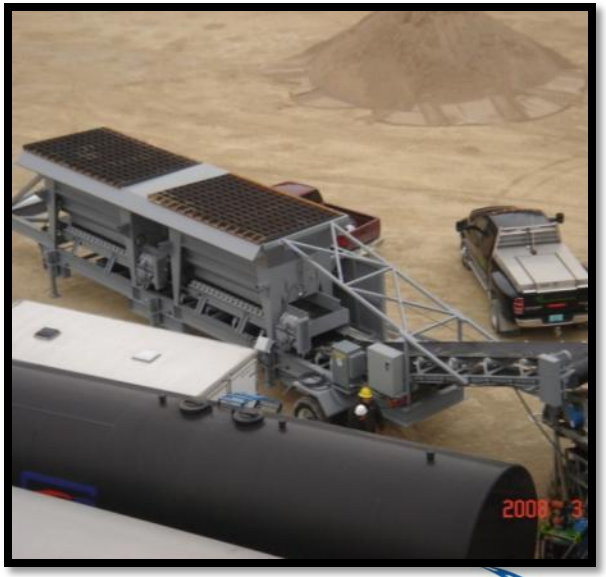
Observations – Coarse Aggregate

- **Trap Rock and Crushed Gravel**
  - ☑ Stability
  - ☑ Friction
  - ☑ Lower Absorption
  - ☑ Less Breakdown
  - ☑ Better Control

Observations - FRAP

- RAP / FRAP
  - High Quality Grindings
  - Higher RAP % did not affect production
  - P#4 Material useful in SMA
    - Angular
    - High AC Content
  - Bids reflect overall savings



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Observations - GTR

- Cost comparable to SBS/SBR modified AC
- Lack of Draindown saved $$ on SMA
- Terminal-Blending Convenient

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Observations - WMA

- Performance as advertised
- Lower Temps / Lower Energy
- Lower Emissions
- Wider Window for Compaction
- Minimal Plant Modification

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WMA Plant Modification

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Adding up the Changes

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SMA Surface Course

N_{80}; Design Voids 3.5%; Design VMA 16%

	Traditional SMA	IL Tollway - Green
Coarse Agg.	Steel Slag	Trap Rock
RAP/FRAP	N/A	15% (P#4)
AC Binder	SBS PG 76-22	GTR PG 76-22
Fibers	YES	NO
WMA	N/A	Evotherm
New AC	6%	4.7%
Production Temp	330 F	270 F
Compact. Temp	280 F	220 F

Bituminous Base Course

Over Rubblized PCC

- **19.0mm – N_{50}**
- **2% Design Air Voids**
- **50% FRAP (2 sizes)**

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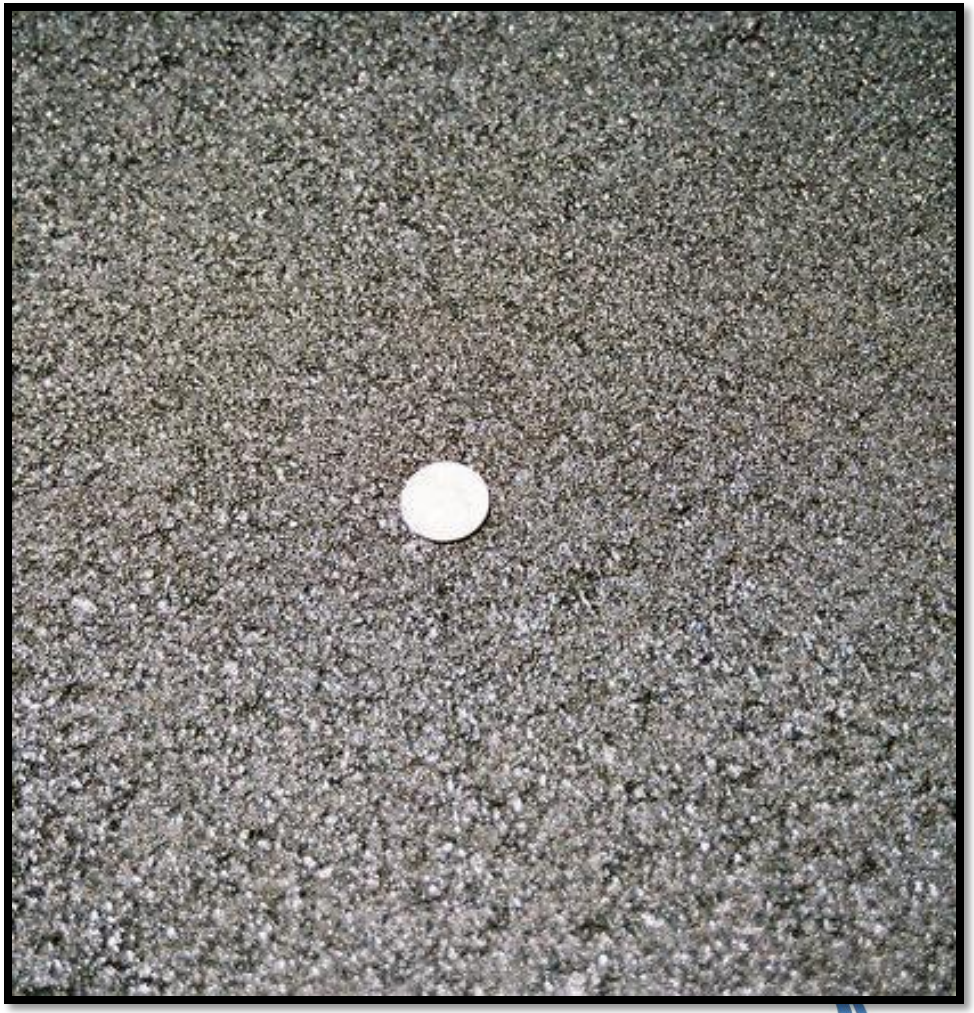
4.75 mm Level Binder

For Overlays

- **N_{50} - 4% Design Air Voids**
- **18.5% VMA**
- **PG SBS 76-22**
- **25% FRAP (P#4)**



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The End and Thanks to:

- IL Tollway
- Rock Road Companies
- Rockford Blacktop
- ARA – Applied Research Associates
- University of IL

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THANK YOU