Growth in Warm Mix Asphalt Technology

CALTRANS Open House

Morro Bay, California

May 7, 2008

EVOTHERM

WARM MIX ASPHALT TECHNOLOGY

MeadWestvaco

OUTLINE

- What are indicators & measures of growth?

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- What are the reasons for growth?

Indicators & measures of growth 1-4

Reasons for growth 1-3

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- What are typical performance results?
- What’s next?

INDICATORS & MEASURES OF GROWTH

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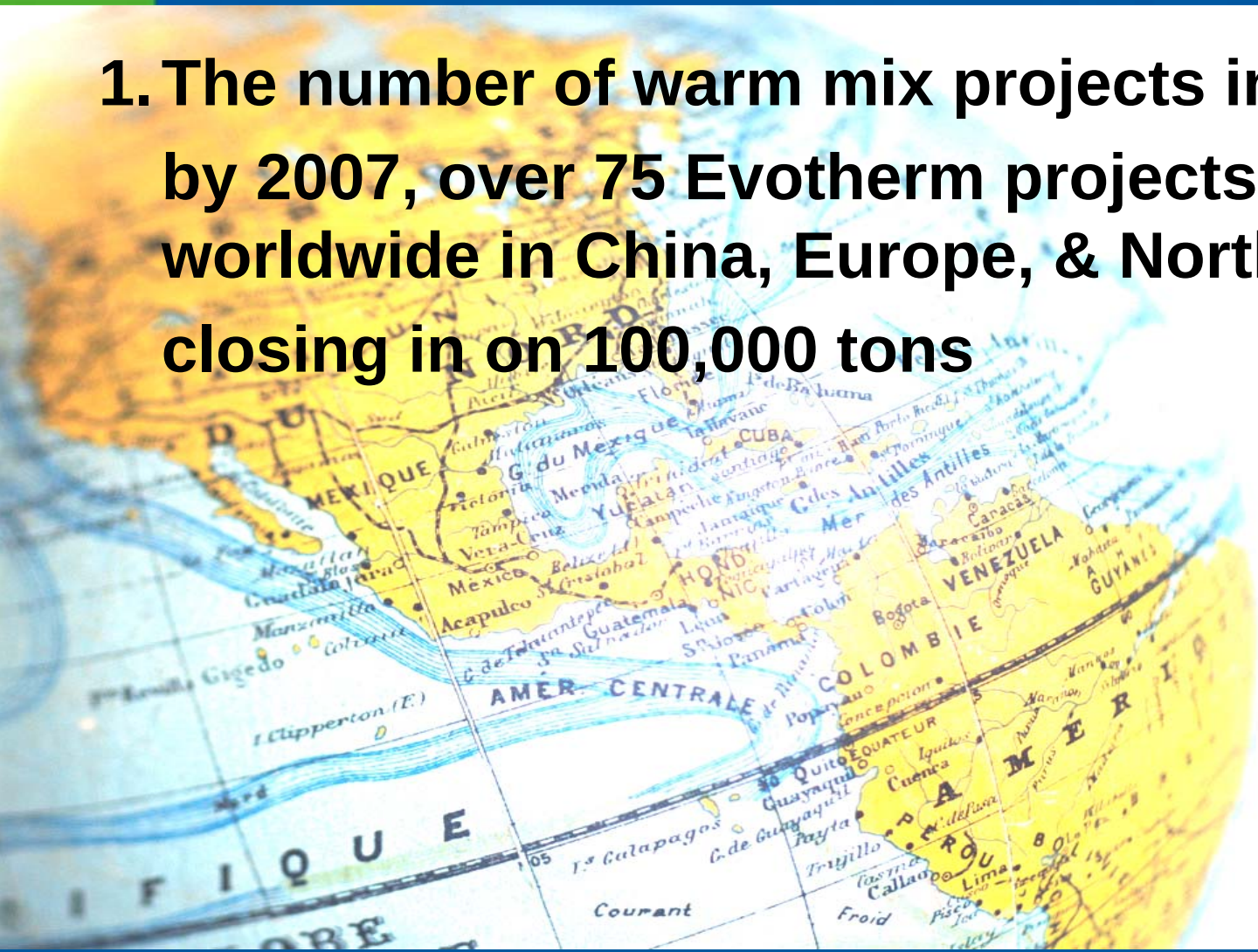
Indianapolis, IN	PG 64-22	12.5 Dolomite, 10%RAP	680
Toronto (Aurora), Canada	PG 58-28	19.0 LS base & 9.5 LS surface	510
Kansas City, MO	PG 64-22	12.5 LS surface	330
Beijing, China	AC 20	13.2 LS surface	220
Calgary, Canada	120/150 pen	12.5 Silicate surface	750
Greenich, NY	AC 20	12.5 Dolomite surface	500
Toronto (Remara), Canada	PG 58-28	16.0 LS surface	1100
NCAT Test Track, AL	PG 67-22 & PG 76-22*	9.5 G**/LS surface & 12.5 G/LS base	270
San Antonio, TX	PG 64-22 & PG 84-22*	9.5 LS surface	740

INDICATORS & MEASURES OF GROWTH

1. **The number of warm mix projects increases:**
   by 2007, over 75 Evotherm projects worldwide in China, Europe, & North America closing in on 100,000 tons



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   2008 forecast: 500,000 – 1,000,000 tons

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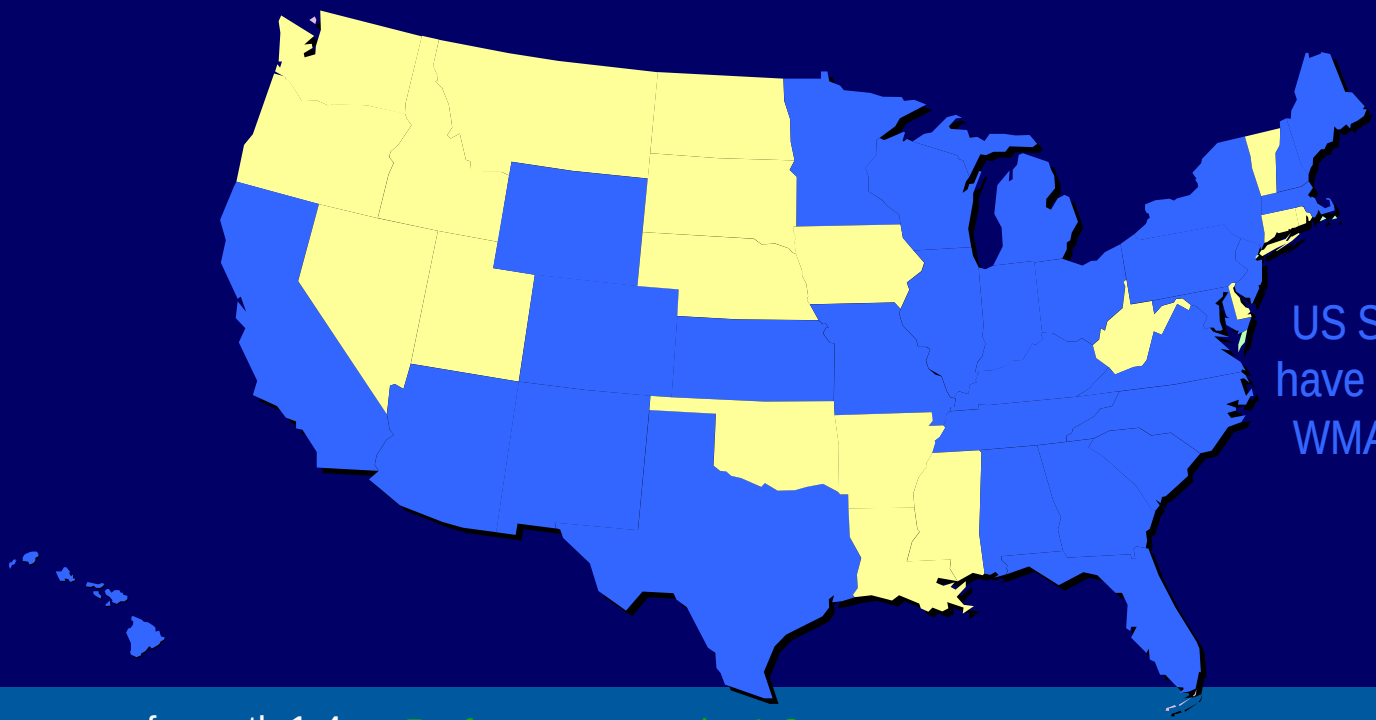
1. The number of states with projects increases: in the US alone, the majority of states have had WMA projects



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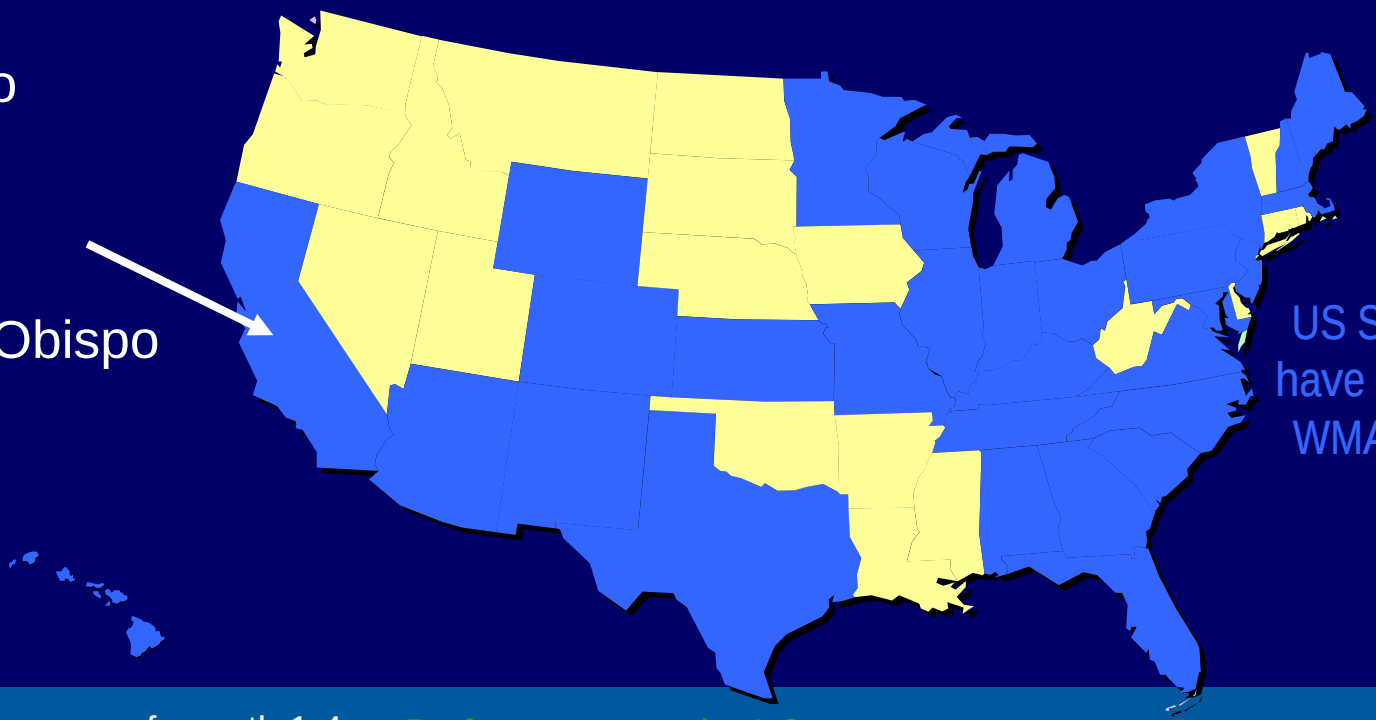
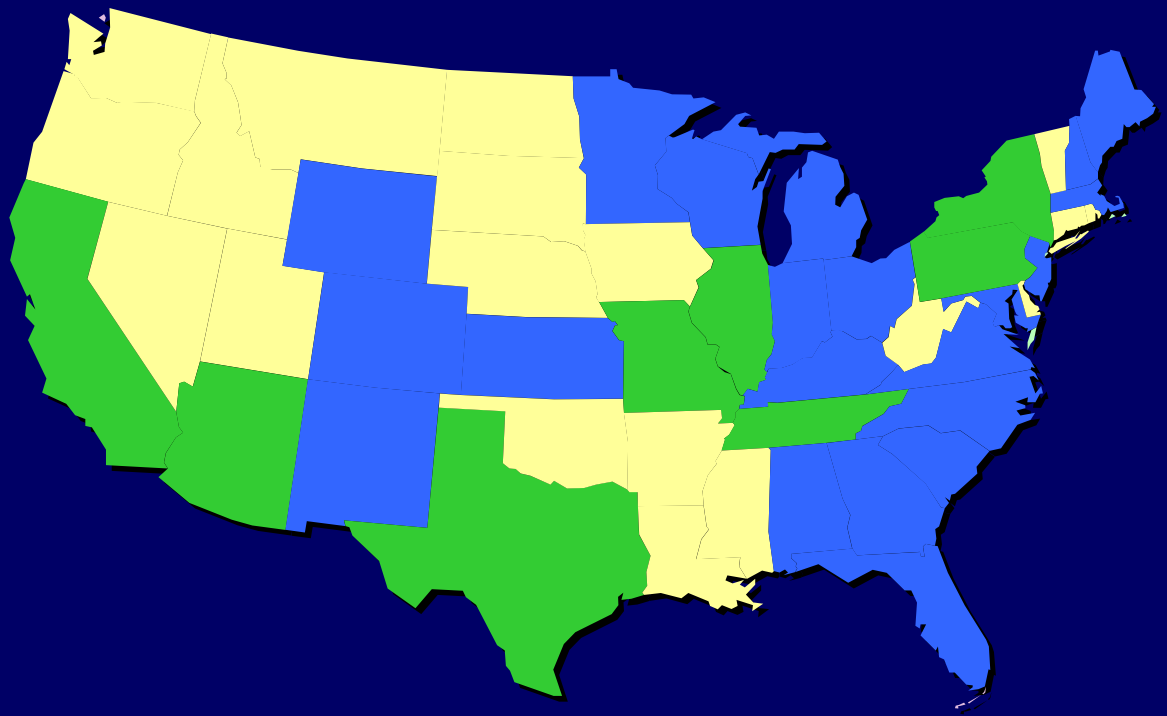
Escondido
Stockton
Aromas
Oreville
San Luis Obispo
…. more



US States that have conducted WMA Projects

INDICATORS & MEASURES OF GROWTH

2. Numerous municipalities, states, provinces, & countries are accepting provisional, supplemental specifications for WMA:



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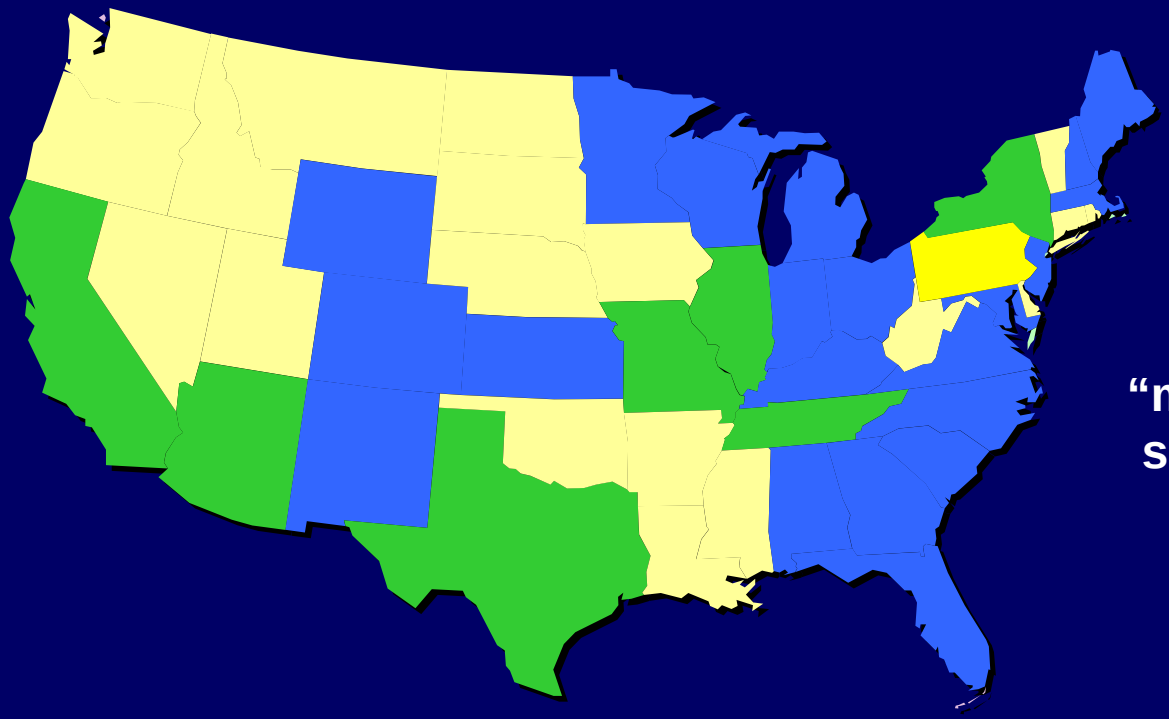

PA has created a "model" WMA specification

INDICATORS & MEASURES OF GROWTH

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Aspha-min – foam zeolite

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Evotherm – surfactant

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2008: > 16 WMA Technologies

INDICATORS & MEASURES OF GROWTH

4. Federal, state, & association support increases to formalize tests, specs, & designs for WMA:

NCHRP studies due in ’08 & ’09

9-43 $0.5 MM;

9-47 $1.2 MM (D-18);

D-19 $0.4 MM “Eval. of emission/fumes of WMA” candidate for funding

NAPA “Best Practices Manual”

NAPA formalization of testing for emissions/fumes

INDICATORS & MEASURES OF GROWTH

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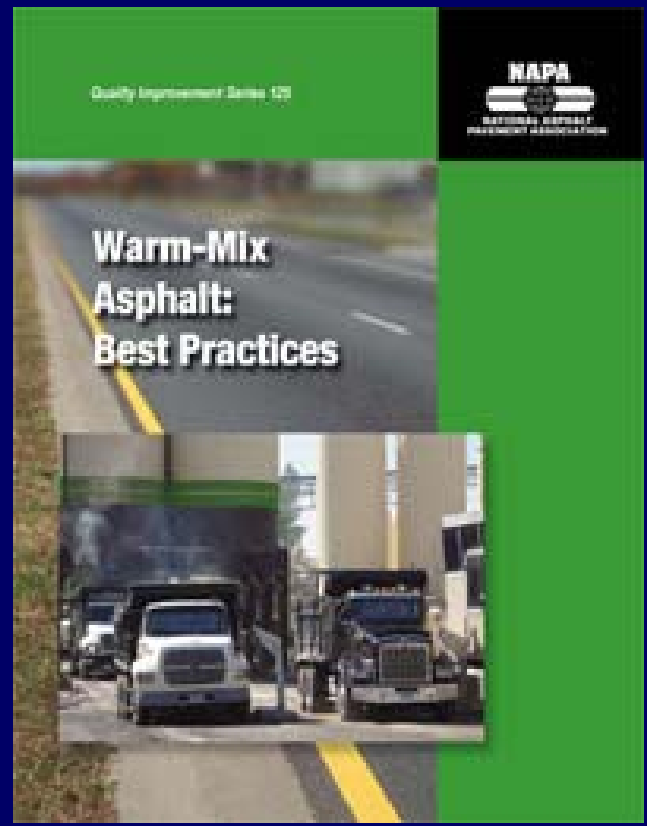
Standardization of WMA use:
"Best Practices Manual"
published by National
Asphalt Paving Assocation

German "Merkblatt" for
WMA est'd by BASt



REASONS FOR GROWTH

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Emissions & fumes studies from several testing labs have substantiated these emissions & fumes reductions.

REASONS FOR GROWTH

2. Improved compactability of WMA technologies has driven interest in high-altitude paving, cold-weather paving, & use with coarse mixes

REASONS FOR GROWTH

3. Good performance in lab & field as regards three main pavement failure modes:
   - Deformation
   - Cracking
   - Moisture damage

PERFORMANCE: NO DEFORMATION

HEAVY VEHICLE SIMULATOR TESTING

Research conducted by David Jones, University of California Pavement Research Center, Davis, California, for California Transportation Dept.

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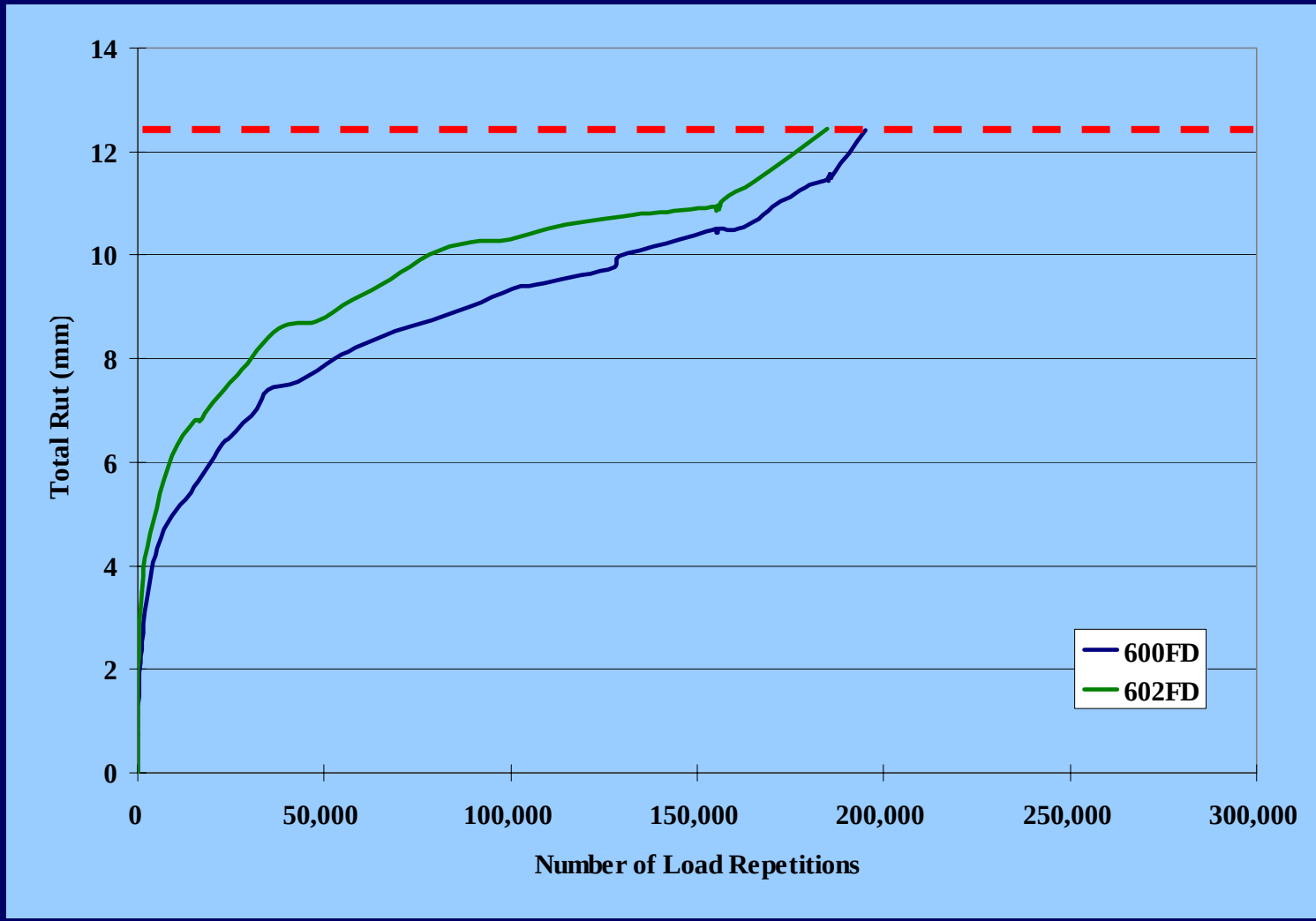

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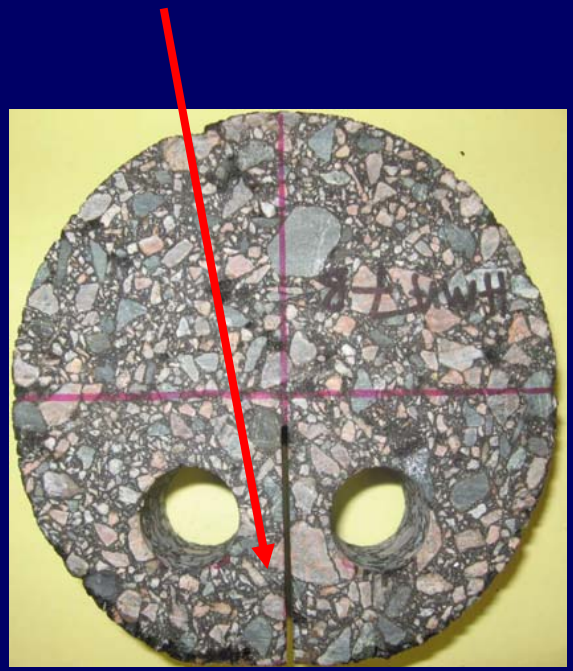
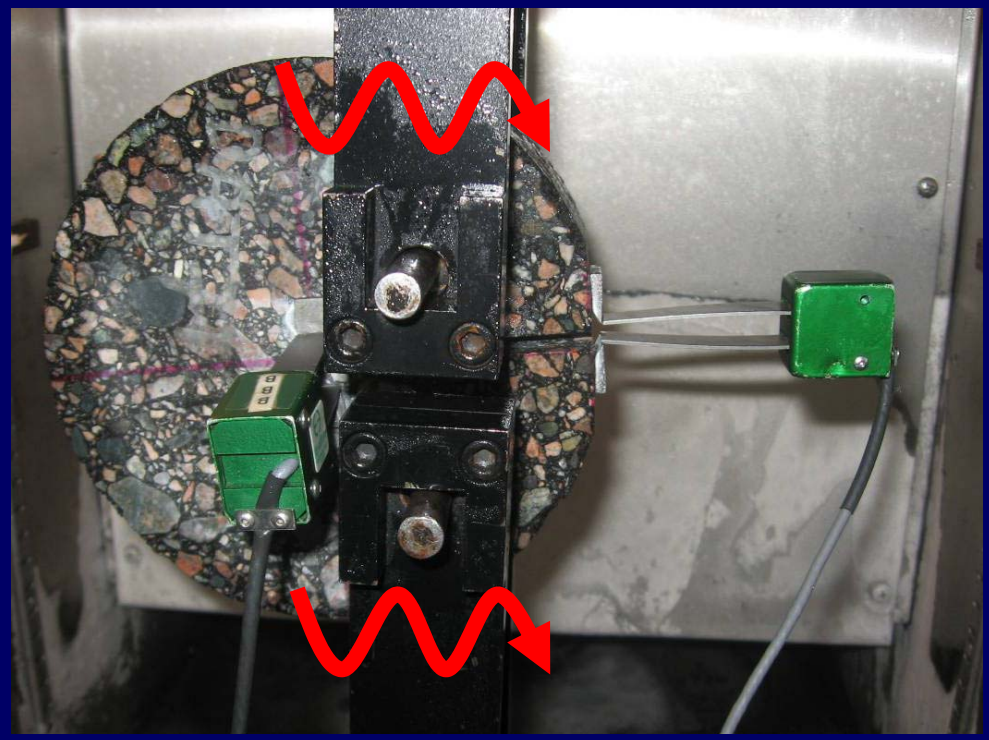
PERFORMANCE: REDUCED CRACKING

Small cut (mouth) made in specimen



Sinusoidal load applied



ASTM 7313-06 is also known as
Disk-Shaped Compact Tension Test or the DC(T) test

Research conducted by Prof. William Buttlar, University of Illinois, & P. Blankenship, Asphalt Institute

PERFORMANCE: REDUCED CRACKING

Mix Type	Test Temperature (°C)	Mean Air Voids (%)	CMOD Fracture Energy (J/m^2)	δ_{25} Fracture Energy (J/m^2)
Warm-Mix	-10	6.9	1042	480
	-20		511	228
Hot-Mix	-10	6.6	697	328
	-20		506	225

49.5%

~ 50% Higher fracture energy (resistance to Crack-Mouth Opening Deformation, CMOD) may be due to the lower heat-induced binder aging in Evotherm mixes compared to HMA controls.

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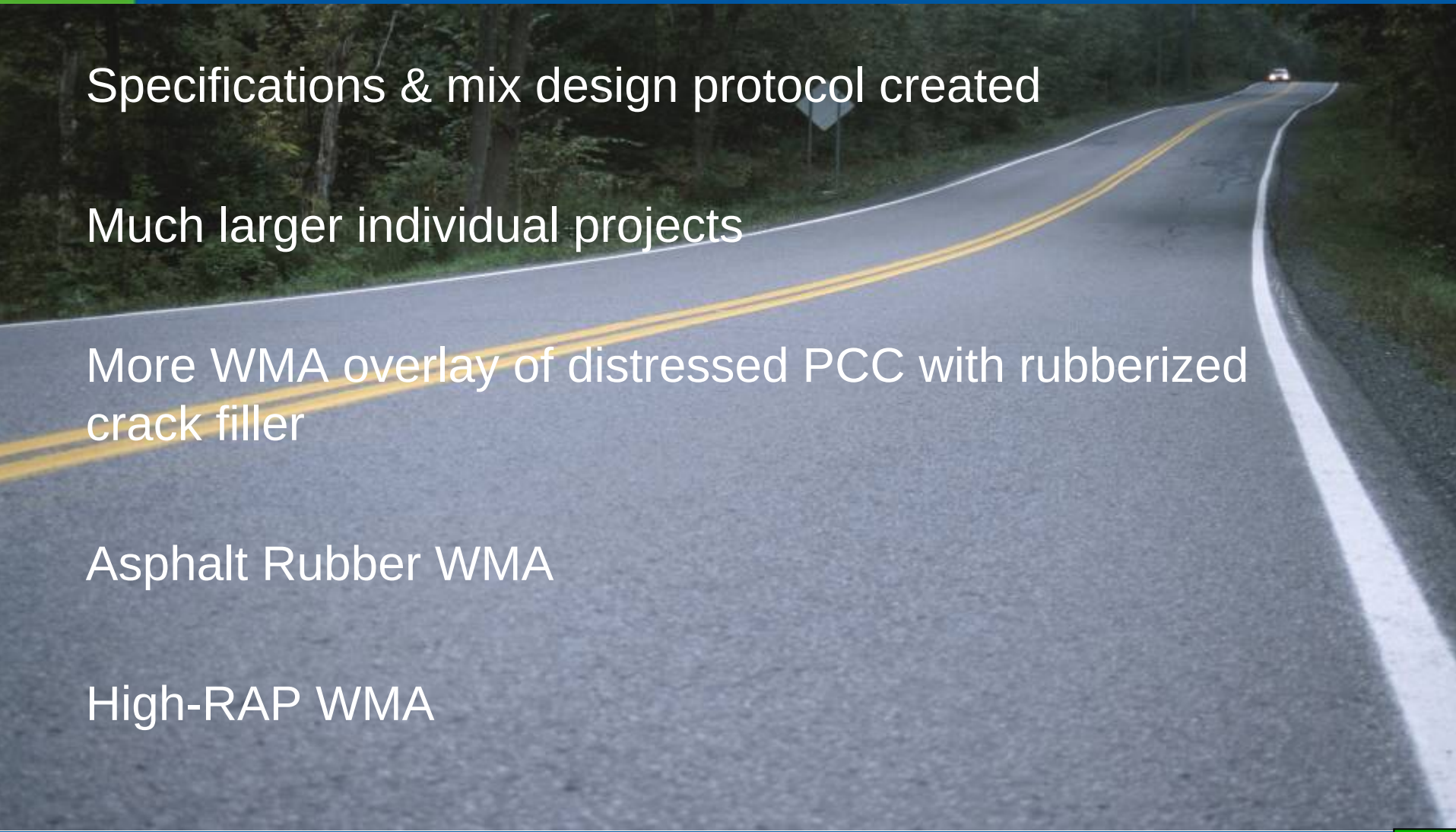
WHAT'S NEXT



Specifications & mix design protocol created

Much larger individual projects

More WMA overlay of distressed PCC with rubberized crack filler

Asphalt Rubber WMA

High-RAP WMA

THANK YOU