

Alaska Asphalt Pavement Summit



Dec. 4, 2007

Anchorage, AK

What is Warm Mix Asphalt?



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Why the interest?

- ❖ Lower temperatures for production and lay down
- ❖ Reduce emissions
- ❖ Reduce energy costs
- ❖ Reduce oxidation of binder
- ❖ Other Possible Benefits:
 - ❖ Cool weather paving (extend season)
 - ❖ Compaction aid for stiff mixes

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Construction Advantages

- ❖ Haul material longer distances
 - ❖ Possible increase in plant coverage area
- ❖ Increased workability
 - ❖ Easier to compact and obtain density
- ❖ Decreased oxidation of binders during production
- ❖ Construction in colder weather

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Emission Exposure

Employee	Conventional Asphalt 160-180°C	Low Temperature Asphalt approx. 130°C
Paver Operator	6.5 mg/m ³	0.4-3.1 mg/m ³
Screed Operator	10.4 mg/m ³	0.6-6.9 mg/m ³

BITUMEN discussion group. Practical Solutions:
BITUMEN Forum – Low Temperature Asphalt.
European Agency for Safety and Health at Work.

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Do Emissions Really Matter?

- ❖ Debate about asphalt fumes being carcinogenic since 1977
- ❖ NAPA objected to initial studies based on roofing materials
 - ❖ Roofing materials have a higher temperature than road asphalt
- ❖ 1990 Clean Air Act will significantly restrict air pollutions
- ❖ 2005 Clean Air Interstate Rule cleaner air by 2015

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Do Emissions Really Matter? (cont'd)

- ❖ OSHA is still researching the affects of asphalt fumes on workers
 - ❖ Decision could change how asphalt is produced
 - ❖ WMA seen as possible alternative
- ❖ Pollution reduction acts have created non-attainment areas
 - ❖ Already require very strict air pollution control
 - ❖ WMA being used in some of these areas
 - ❖ Allows for greater haul distances
 - ❖ Plants not in non-attainment areas

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Current Non-Attainment Areas

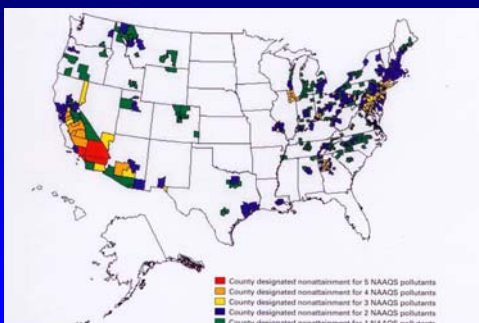


FIGURE 3: Counties not attaining the National Ambient Air Quality Standards (NAAQS) of the Clean Air Act, April 2005.



Brief History

- ❖ 1997 German Bitumen Forum
- ❖ 2000 Second Euroasphalt & Eurobitume Congress (Barcelona)
- ❖ NAPA 2002 European Scan Tour
 - Germany and Norway
- ❖ NAPA 2003 Annual Convention
 - San Diego
- ❖ World of Asphalt 2004
- ❖ 2005-2006 – Numerous U.S. Field Trials
- ❖ 2007 – FHWA/AASHTO Scan Tour

Goals for Warm Mix Asphalt

- Use existing Hot Mix Asphalt plants
- To meet existing standards for Hot Mix Asphalt specifications
- Focus on dense graded mixes for wearing courses
- WMA quality = Hot Mix Asphalt quality

WAM-Foam

- ❖ Two Phase addition of asphalt
 - ❖ Aggregate coated with "soft" asphalt
 - ❖ Hard asphalt foamed to mix with pre-coated aggregate
 - ❖ Soft asphalt controls minimum placement temperature
 - ❖ Material placed as low as 80 C (176 F), 50 – 60 C (90 – 108 F) reduction
 - ❖ Requires plant modification for foaming, estimated at \$50,000 - \$70,000. No additional costs thereafter
 - ❖ Special asphalt feeds may be required

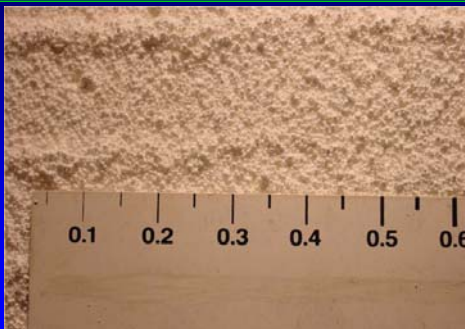
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Zeolite

- ❖ Zeolites are crystalline hydrated aluminum silicates
- ❖ When the Zeolite is heated, it gives up its internal moisture, approximately 21% by weight, microscopically foaming the asphalt
- ❖ Approximately 6 lbs Advera® WMA or Asphamin® per ton
- ❖ Added where fiber would be added

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Granulated Zeolite



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Sasobit®/Sasoflex

- ❖ Fischer-Tropsch synthetic waxes – Sasobit
 - ❖ Produced from gasification of coal or natural gas feed stocks
 - ❖ Added to binder or directly into mix
 - ❖ Can incorporate an SBS modifier using special cross-linking agent (Sasoflex)
 - ❖ Does not require high-shear blending
 - ❖ May negatively impact low temperature properties

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Evothem®

- ❖ Emulsion – approximately 70% binder residue
- ❖ Chemical package provides mixing, coating, workability, compaction and adhesion (e.g. anti-stripping agents)
- ❖ Some steam liberated upon mixing

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Evotherm® DAT

- ❖ Liquid added to binder
- ❖ Generally 80% binder 20% liquid
- ❖ Latest WMA technology from MeadWestvaco

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Evotherm® North American Field Trials

- ❖ 2005-2006
 - ❖ San Antonio
 - ❖ Indiana
 - ❖ Ontario
 - ❖ California
 - ❖ NCAT Test Track

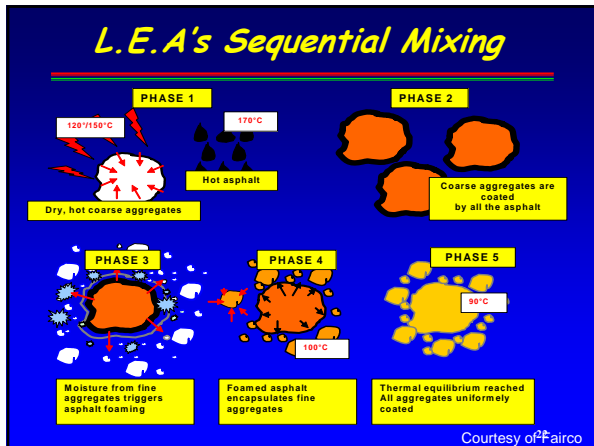
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Low Energy Asphalt (L.E.A)

- ❖ Hot Asphalt: 140 to 180 °C
- ❖ Hot coarse aggregates: 145 °C
- ❖ Cold & wet fine aggregates
- ❖ Final mix temperature < 100 °C

Courtesy of Fairco

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EZ Asphalt

- ❖ Foaming Technology
 - ❖ Asphalt
 - ❖ Cold Water
 - ❖ Air
- ❖ Temp ~ 250 – 270F



Astec® Green Asphalt

- ❖ Foamed asphalt via nozzle head
- ❖ Air and water shot into binder
 - ❖ Moisture added is 0.1% by wt of total mix
- ❖ Mixing temperatures have ranged between 245-275°F

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Other Technologies

- ❖ SuBit (Licomont): Montanwax
 - ❖ Temp drop similar to Sasobit
- ❖ Colas
 - ❖ 2-Phase Process
 - ❖ Polyolefins
- ❖ BAM – Low Energy Asphalt Concrete
 - ❖ Foam Process
 - ❖ 195°F

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Applications

- ❖ Dense-graded mixes
 - ❖ Majority of projects
 - ❖ RAP – Wisconsin and Missouri
- ❖ SMA
 - ❖ Maryland – Washington Beltway
- ❖ Open-graded mixes
 - ❖ Florida
 - ❖ China
- ❖ Asphalt-Rubber
 - ❖ California

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Reduced Emissions

Data provided by suppliers.

- ❖ Aspha-min – North Carolina – 265°F
 - ❖ 17.6% decrease in SO₂
 - ❖ 3.2% decrease in CO₂
 - ❖ 35.3% decrease in total hydrocarbons
 - ❖ 6.1% decrease in NO_x
- ❖ Evotherm – Canada – 140°F
 - ❖ 45.8% decrease in CO₂
 - ❖ 63.1% decrease in CO
 - ❖ 41.2% decrease in SO₂
 - ❖ 58% decrease in NO_x
- ❖ Direct comparisons are discouraged – different plants, different weather, different temperatures

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What Have We Learned?

- ❖ WMA additives improve lab and field compaction.
- ❖ In the lab, rutting increases with lower temperatures – may not translate to the field
- ❖ Moisture, trapped in the aggregates and introduced into the mix, still a concern. Can mitigate effect in lab.
- ❖ **NEED TO ADJUST BURNER FOR LOWER TEMPERATURE!**
- ❖ Need best practices for aggregate moisture.
- ❖ Need best paving practices.

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Things We Need to Go Forward

- ❖ Larger trials – Yellowstone and Texas – 30 k tons
- ❖ A robust product evaluation protocol
- ❖ **WE NEED A PERFORMANCE TEST!**
- ❖ Better understanding of effect on rutting and moisture damage
- ❖ Procedures for mix design and QC/QA (Do they need to be different?)
- ❖ A way for Agencies to specify
 - ❖ Temperature reduction?
 - ❖ Binder grade?

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Discussion



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