

# Warm Mix Asphalt

2008 ODOT Field Trials

Ohio Department of Transportation

62<sup>nd</sup> Annual Ohio Transportation Engineering Conference



# Warm Mix Asphalt

## 2008 ODOT Field Trials

### What is it?



# Warm Mix Asphalt

## 2008 ODOT Field Trials

### Why?

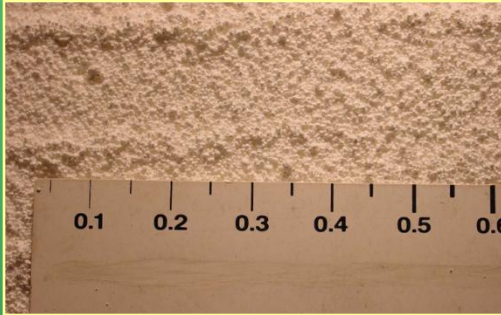
- Reduce production and laydown temperatures
- Reduce emissions
- Reduce energy costs
- Reduce aging of binder
- Other Possible Benefits:
  - Cool weather paving (extend season)
  - Compaction aid for stiff mixes



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## WMA Technologies



- WAM Foam
- Zeolite
- Sasobit
- Evotharm
- Low Energy Asphalt
- FOAMING



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### Why Foaming?

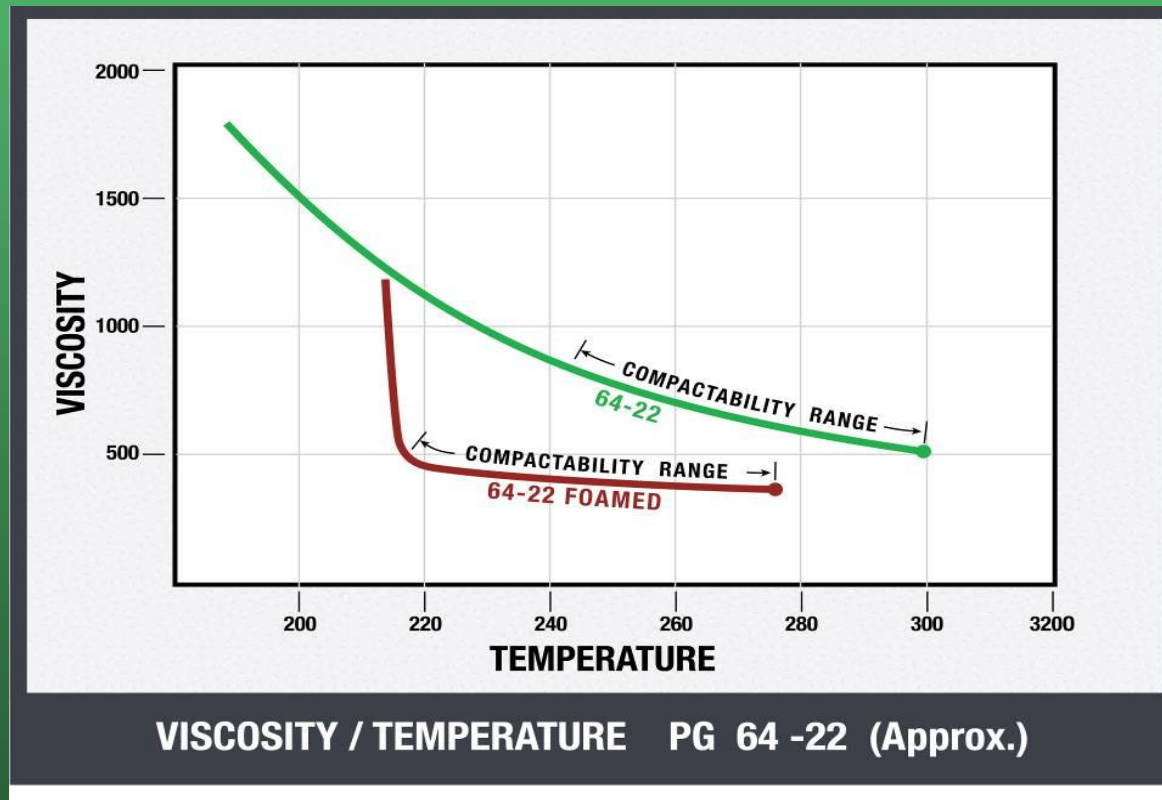
- Improved Workability / coating
- No Smoke , less Smell
- Longer Life Pavement
- 11% Less Plant Fuel
- 11% Higher Production
- Some decrease in cost



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### Why Foaming?



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### Unknowns with Foaming

- Production limitations
- Several different foam technologies
- Emissions
- Mix life
- Cost
- Quality Control
- Placement

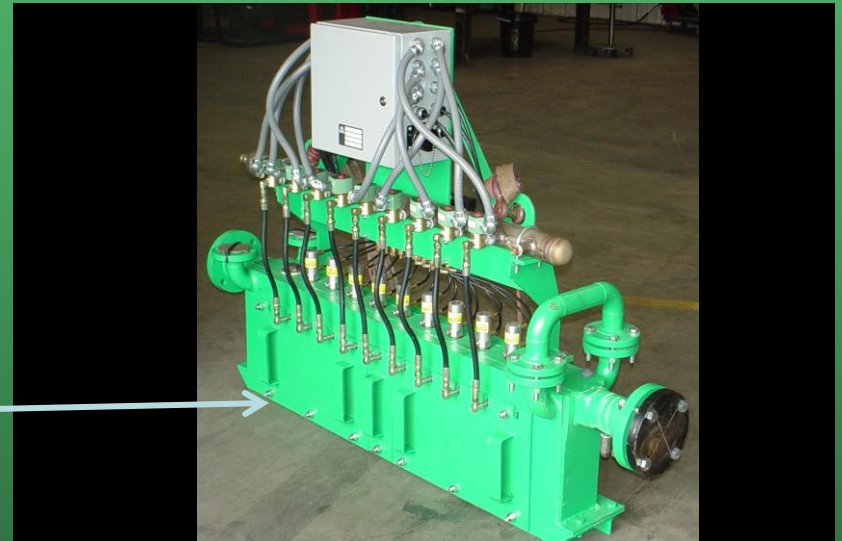


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### Foaming Technologies

Astec



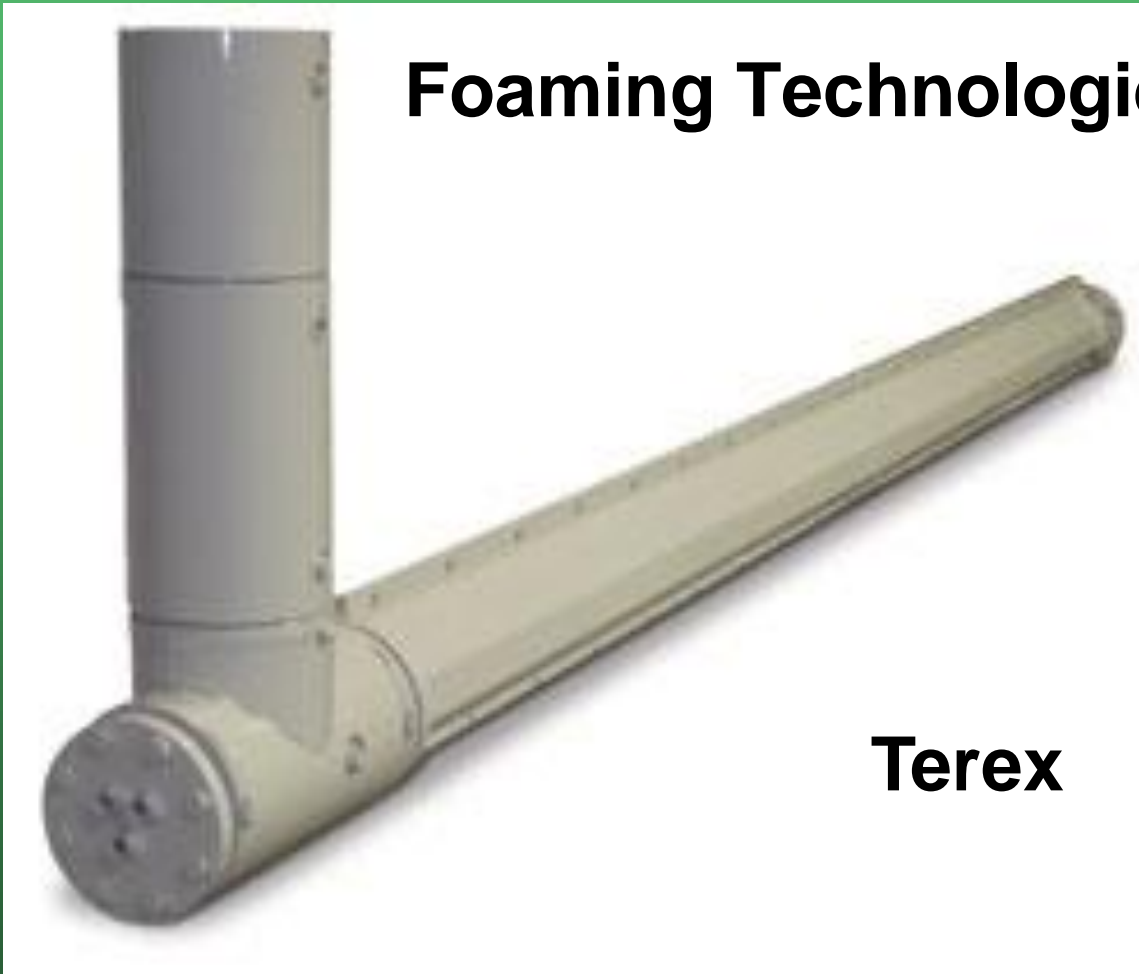
**WATER IS THE ONLY ADDITIVE. WATER IS PUMPED FROM A TANK TO THE FOAM NOZZLES.**



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### Foaming Technologies



**Terex**



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## Foaming Technologies

Gencor



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### How much water?

About 1% H<sub>2</sub>O of liquid AC by weight.

1 ton mix – 2,000 lb.

5.3% AC liquid – 106 lb.

1 lb H<sub>2</sub>O

Volume of liquid – 1.63 cu. ft.

1 lb. H<sub>2</sub>O when converted to steam = 30 cu. ft.

Expansion =  $30/1.63 = 18$



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### Projects with Water Injection for Foaming

In 2008 6 projects were sold to:

- 1) Determine asphalt plant emissions data
- 2) Create projects with control sections of equivalent HMA mixes to compare performance and laydown.
- 3) On some, sell as alternate to determine if realistic cost savings.



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### Projects with Water Injection for Foaming

One additional project was let as an alternate but was awarded as a hot mix due to the way multiple contractors bid the job for mix placement vs. mix producer.

One existing project not sold as WMA had it's 301 base mix change ordered to WMA at a savings.

Total WMA tonnage – approx. 50,000 tons in 2008



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### Projects with Water Injection for Foaming

Dist	PID	Section	Length	Sale	Contractor	Stack Test
4	77838	POR-224-13.42	4.9 mi	6/4/08	Shelly	Yes
4	25554	SUM-303-8.14	2.4 mi	6/4/08	Karvo	
5	22640	LIC-40-0.58	5.7 Lmi	change order	Shelly	
6	78156	PIC-62-0.00	7.64 mi	5/21/08	Kokosing	Yes
7	77424	DAR/MIA-49-0.00	9.75 mi	5/21/08	Valley/ Walls	Yes
8	25378	CLE-132-0.00	12.43 mi	6/4/08	Barrett	Yes
12	22896	CUY-176-12.76	0.59 mi	7/23/08	Karvo	



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### Projects with Water Injection for Foaming

Dist	Contr.	Section	Project Cost	Item	Cubic Yards
4	Shelly	POR-224-13.42	1,411,473	Mill 1.5, place 1.75 446-2, 64-22	2512 WMA/ 1897 HMA
				Place 1.25 446-1, 70-22M	1539 WMA/ 1840 HMA
4	Karvo	SUM-303-8.14	962,912	Mill 1.5, place 1.5 448-1 70-22M	1835 WMA/ 937 HMA
5	Shelly	LIC-40-0.58	- 3341	301 base only for WMA	6683 WMA
6	Kokosing	PIC-62-0.00	934,073	Mill 1.5, place 1.5 446-1, 64-22	2665 HMA/ 2928 WMA
7	Valley	DAR/MIA-49-0.00	1,662,762	Place 0.5 448-1 64-22	1222 WMA
				Place 1.5 448-1H, 70-22M	3433 HMA/ 3667 WMA
8	Barrett	CLE-132-0.00	2,263,252	Mill 2.0, place 1.75 446-2	3713 total
				Place 1.5 446-1H 70-22M	3283 total
12	Karvo	CUY-176-12.76	255,843	Mill 0.5, place 1.0 424-B	1179 WMA

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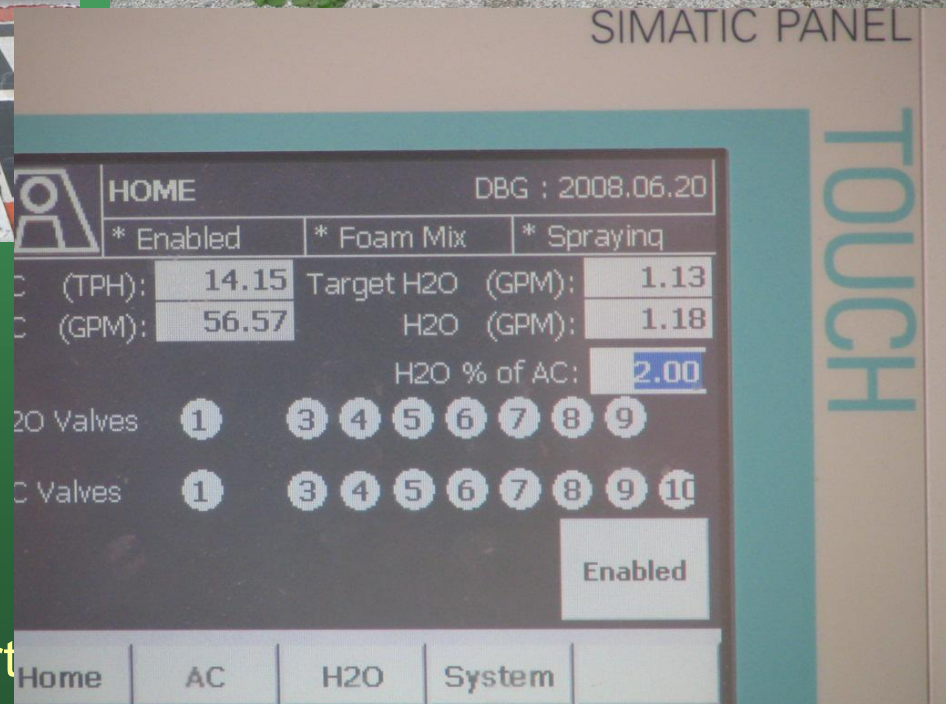
## 2008 ODOT Field Trials

### General Project Requirements:

- Project split HMA/WMA with same JMF
- When stack test required: NO<sub>x</sub>, CO<sub>2</sub> and VOC
- Use Astec multi point water injection
- Perform QC lab compaction at 25 F less than design
- Field compact as needed for density measure
- Perform T 283 moisture damage testing each day
- Collect all QC, stack and fuel data and report to ODOT



# POR-224



POR-224



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SUM-303



**SUM-303**



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# PIC-62



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# DAR/MIA- 49



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**DAR/MIA- 49**



07/29/2008

# DAR/MIA- 49



DAR/MIA- 49



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Temp	% Density	Pay Factor
277	90.0	0.80
280	93.0	1.00
276	92.8	1.00
296	93.7	1.04



**CUY- 176**  
**424 w/ PG76-22M**

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## Fuel and Emissions

### **POR-224 Summary of Fuel and Emissions**

	T 1 HMA	T 1 WMA	Percent Reduction	T 2 HMA	T 2 WMA	Percent Reduction
Production tons/hr	430	330		452	478	
Plant Fuel Usage gal/ton	2.08	1.71	17.8	1.77	1.57	11.3
Temp °F	290	261		298	260	
NOx lb/hr	31.97	19.10	40	30.46	27.33	10
CO <sub>2</sub> lb/hr	16599	11378	31	17258	15253	12
VOC lb/hr	8.7	6.39	27	6.92	6.54	5

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## Fuel and Emissions

### **DAR/MIA-49 Summary of Fuel and Emissions**

	Hot Mix	Warm Mix	Percent Reduction
Production tons/ hr	301.07	297.48	
Plant Fuel Usage gal/ton	1.64	1.40	14.8
Temp °F	330	295	
NOx lb/hr	21.04	17.65	16.1
CO <sub>2</sub> lb/hr	14,830	12,789	13.8
VOC lb/hr	5.9	4.0	31.9

# Thank You!

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