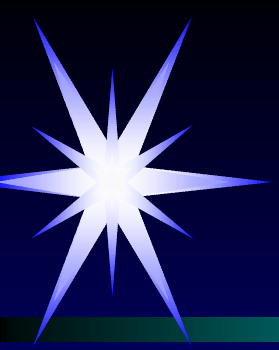


# **“Best Management Practices To Minimize Emissions During HMA Construction”**

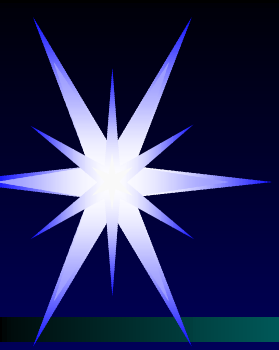
**AMAP 5th Annual Meeting  
Nashville, TN  
February 10, 2004**





# Why Did We Need This Document?





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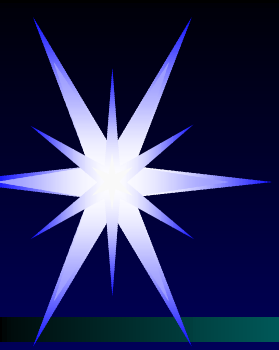


- **Superpave – new technology indirectly led to problems**
- **Emission episodes around the country**
- **Asphalt fumes are an irritant – worker complaints**

# Document Origin



- **Asphalt Paving Environmental Council (APEC)**
- **National Asphalt Pavement Association**
- **Asphalt Institute**
- **State Asphalt Pavement Associations**

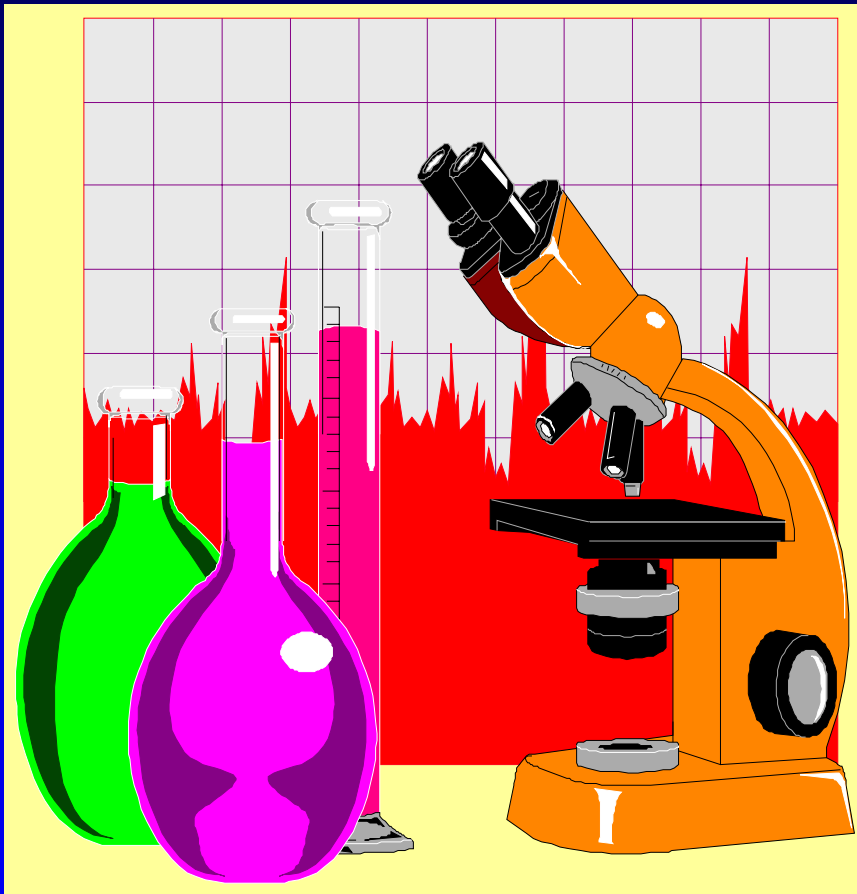


# Existing Guide Documents

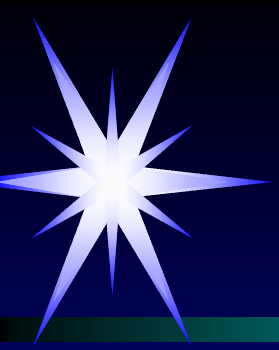


- **Australian APA  
Environmental Guide**
  - **Specs for PMA**
- **OHMPA  
Environmental  
Practices Guide**
  - **Written to help HMA  
plants be good  
neighbors and deal with  
environmental  
problems**

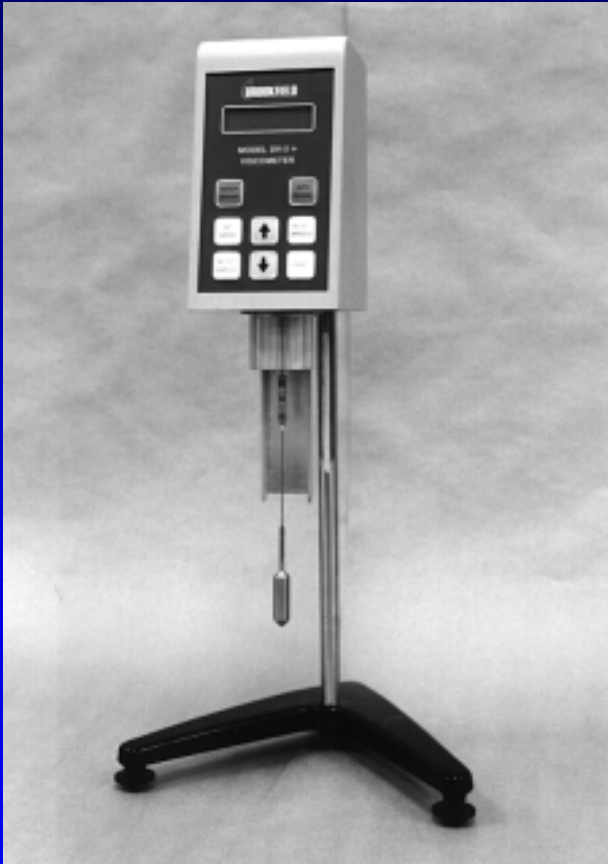
# SUPERPAVE System



- **Performance Graded Asphalts**
  - **Grades for specific climatic and traffic conditions**
  - **New grades for both suppliers and users**



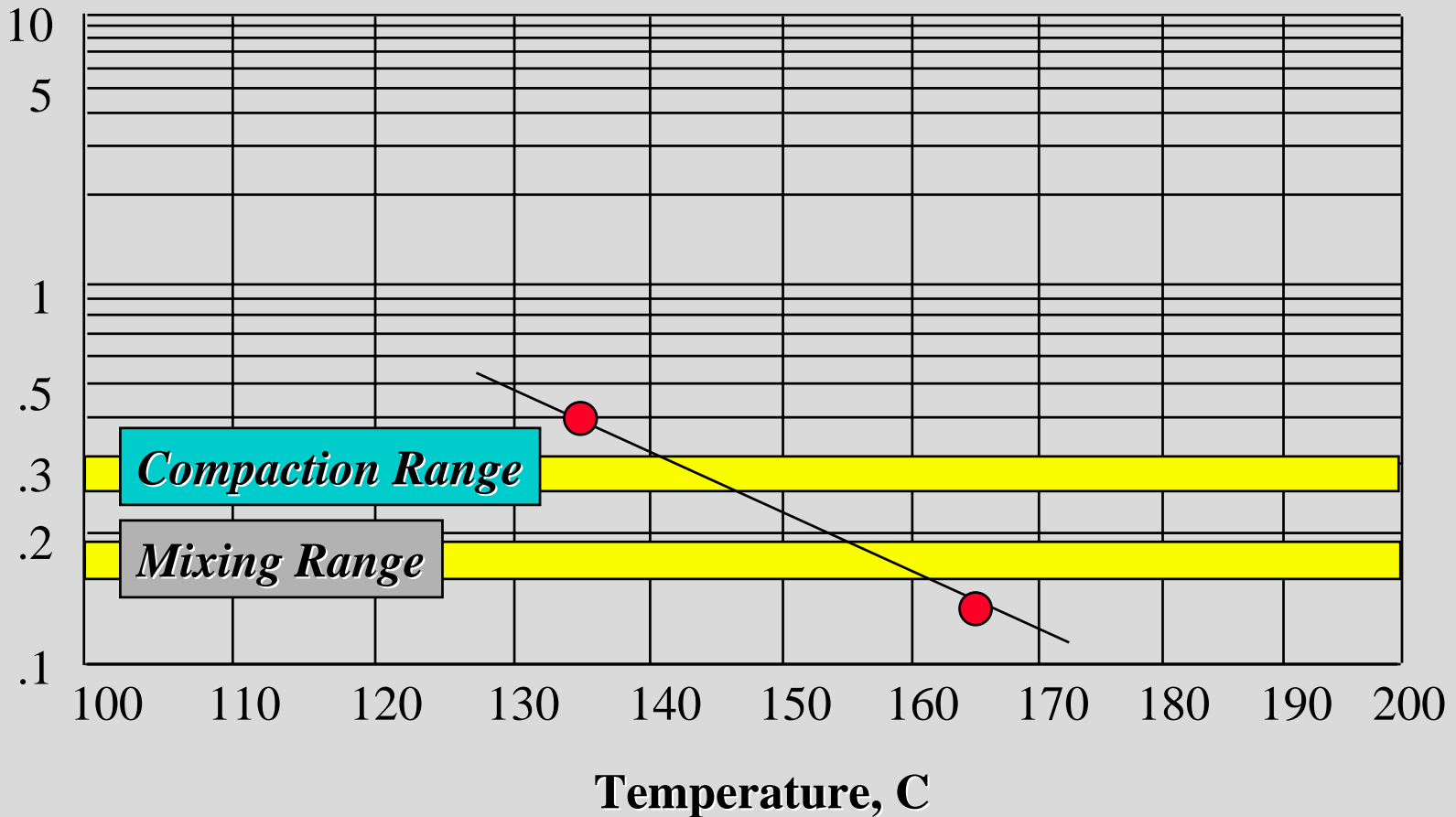
# Laboratory Temperatures



- **Rotational Viscometer (Brookfield)**
  - **Viscosity at 135°C and 165°C**
  - **Viscosity @ 135°C < 3.0 Pa·s**
  - **Equi-viscous Lab Mixing and Compaction Temps**
- **Does not work for PMA - use suppliers' recommendations**
- **Not for field temperatures**

# PG Asphalt Temperatures

Viscosity, Pa s

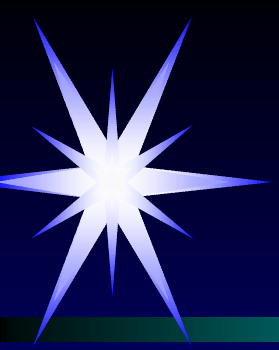




# Laboratory Vs Field Temperatures



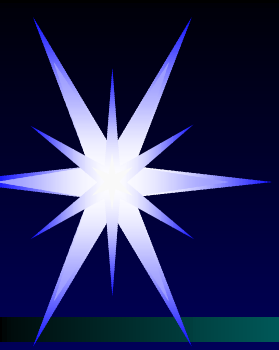
- **EX: PG 70-22**
  - **Lab Mix Temp: 333°F - 343°F**
  - **Lab Comp Temp: 311°F - 320°F**
  - **Best Practices**  
**Recommendation Field Mix Temperature: 280°F - 330°F**
  - **Field Compaction Temp determined by Test Strip**



# SUPERPAVE Compaction



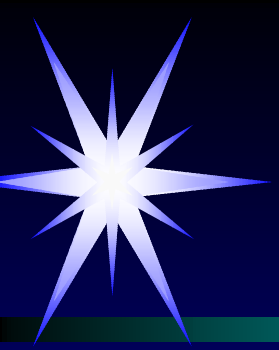
- **SUPERPAVE coarse mixes may be hard to compact**
- **Poor density may mean permeability - FL experience**
- **DOTs are focused on density**
- **Contractors are focused on density**



# SUPERPAVE Compaction



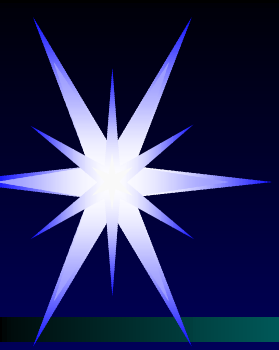
- Pavement designers usually have little SUPERPAVE training
- Maximum Size vs Nominal Maximum Size
- Lift thickness less than 3 X NMAS makes density very hard to achieve
- Poor designs added to density problems



# SUPERPAVE Compaction



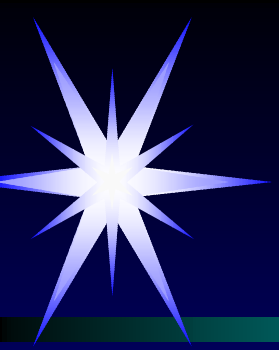
- Contractors want to extend compaction time - Higher Mix Temperatures
- Higher Temperatures should be LAST RESORT
- Use more rollers - three or four
- Keep front roller close to paver
- Watch the Tender Zone
- Use an Infrared Device



# Superpave Caused Higher Mix Temperatures



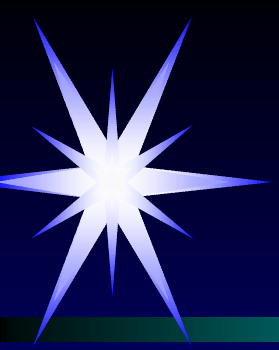




# What's Wrong With Higher Mix Temperatures?



- Each 10°F Increase in Temperature Doubles the Amount of Fumes
- From 310°F to 350°F
- $2 \times 2 \times 2 \times 2 = \underline{16 \text{ Times}}$  the Fume Amount



# High Mix Temperature Consequences



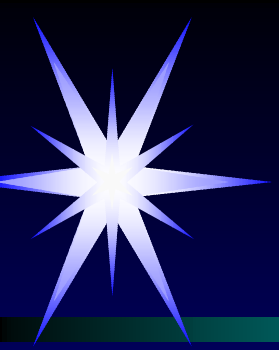
- **Excessive aging during construction**
- **Excessive fumes**
- **Tender mix**
- **Asphalt drain-down - SMA and OGFC mixes**

# Very Small Quantity of Asphalt Causing Fumes



- Normal 8 hour paving day  
– 1500 tons of HMA at proper temperature
- AC 5% = 75 tons AC
- Fumes for that day are caused by 21 grams of asphalt material
- One tablespoon of material from 75 tons of AC creates the fumes





# Lab Temperatures as a Starting Point?

## ➤ **EXAMPLE - PG 70-22**

- **Lab Mix Temp: 333°F - 343°F**
- **DOT allowed contractor to select mix temp**
  - **Target +/- 25°F**
- **Contractor selected Job Mix Range: 345°F - 395°F**
- **Temperature Lowered to 315°F - Improved Density and Ride**

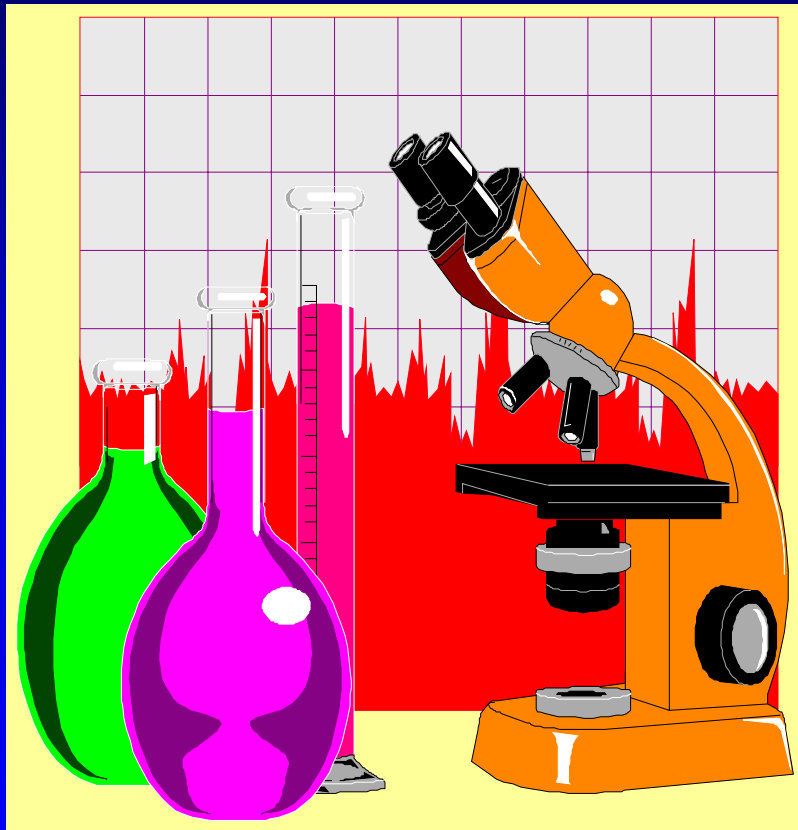


# Research Efforts are Underway

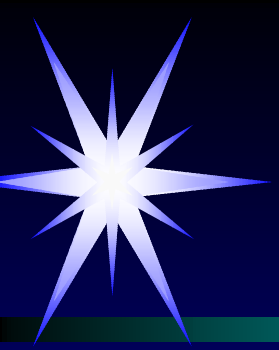


- **NCHRP 9-10 - Bahia Zero Shear Viscosity in Brookfield**
- **Univ. of Texas - Kennedy Shear Rate of Mix in Gyratory Compactor**
- **NCAT - Paddle Mixer Torque**

# Research Efforts are Underway



- **NCAT Smoke Emission Potential (SEP) Test**
  - Oven gradually increases temperature - measures opacity and mass loss vs. time and temperature
  - Possibly may identify safe maximum mixing temperature for a given binder



# Interim Guidelines

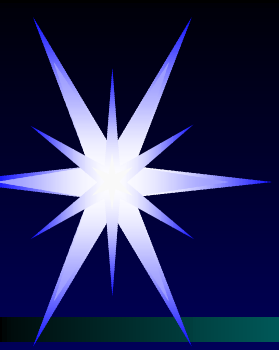


- **Field Mix Temp Chart**
  - **Asphalt Institute Survey**
  - **Listed by Binder Grade**
- **Select starting point in middle of range**
- **Test strip - monitor temperatures & density**

# Interim Guidelines (continued)



- Determine lowest laydown temp to get density
- Estimate heat loss
  - Haul distance
  - Ambient temperature
  - Wind
  - Mat thickness
  - PaveCool
- Test Strip Temp + Heat Loss = Plant Mix Temp



# Other Items That Contribute to Emissions



- **Handling aggregate and RAP**
- **Anti-strip additives**
- **Plant and paving equipment**
- **Plant burner operation**
- **Weather conditions**
  - **Atmospheric inversions**
  - **Night paving**



# Guidance Available

## Best Management Practices To Minimize Emissions During HMA Construction



ASPHALT PAVEMENT  
ENVIRONMENTAL COUNCIL

NATIONAL ASPHALT PAVEMENT ASSOCIATION  
ASPHALT INSTITUTE  
STATE ASPHALT PAVEMENT AGENCIES

### Asphalt Pavement Environmental Council Best Practices

#### Typical Asphalt Binder Temperatures

Binder Grade	HMA Plant Asphalt Tank		HMA Plant Mixing	
	Storage Temperature (°F)		Temperature (°F)	
	Range	Midpoint	Range	Midpoint
PG 46 -28	260 – 290	275	240 – 295	264
PG 46 -34	260 – 290	275	240 – 295	264
PG 46 -40	260 – 290	275	240 – 295	264

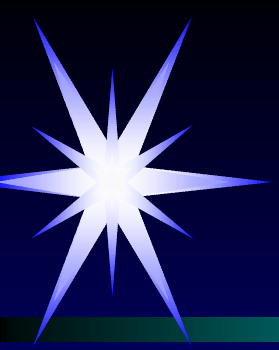
### Asphalt Pavement Environmental Council Best Practices

#### Controlling Fumes, Emissions and Odors from HMA Plant and Paving Operations

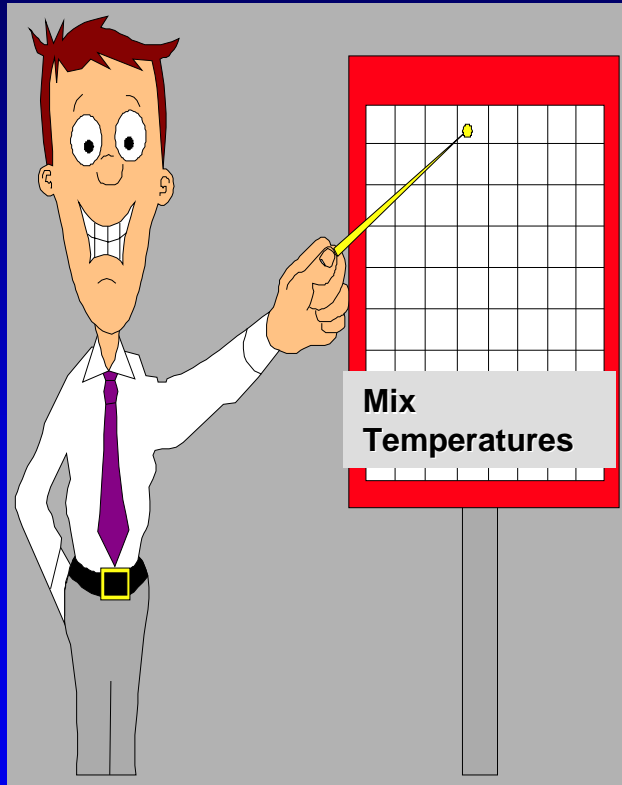
##### NT

... mixing temperature by:  
... ng your asphalt supplier.  
... e chart on the back.  
... laboratory mixing tempera-

- Gather data on aggregate moisture content and fuel usage. If fuel usage goes up for the same or less moisture, find the reason.
- Have stack gases tested to see if they are in limits. If not, contact

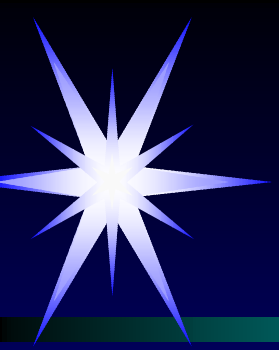


# Conclusions

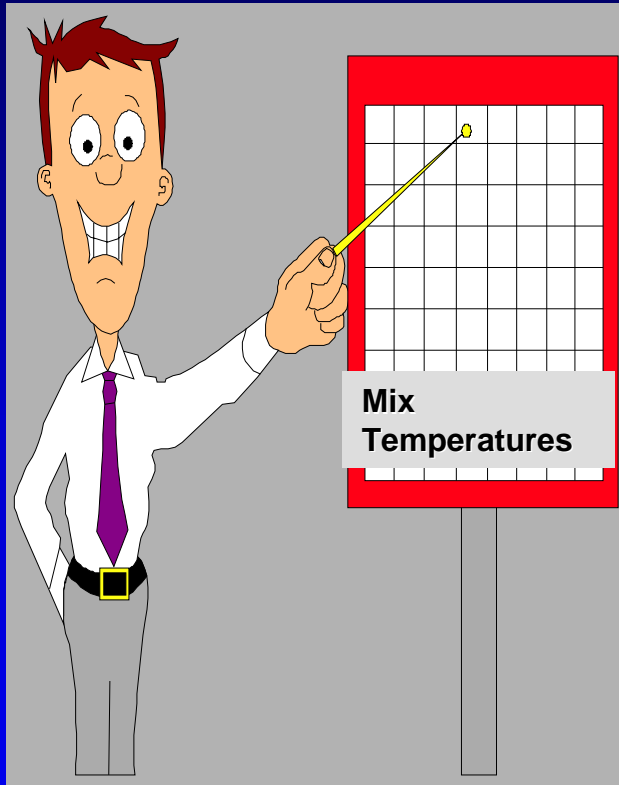


- **New PG grades and density concerns lead to high mix temperatures**
- **Need separate ranges for lab and field**
- **Use common sense until research provides an answer**

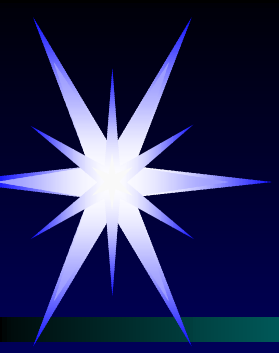




# Conclusions



- **EC 101 available through NAPA & Asphalt Institute**
- **Contact AI at [www.asphaltinstitute.org](http://www.asphaltinstitute.org)**
- **Contact NAPA at [www.hotmix.org](http://www.hotmix.org)**



# THE END

## Questions?