WARM ASPHALT PLANT #91 COLUMBUS OHIO

FLEXIBLE PAVEMENTS
ANNUAL MEETING
MARCH 29, 2006

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The Shelly Company

WHAT IS WARM ASPHALT?

- PROCESS BY HMA:

  CAN BE PRODUCED AND PLACED AT LOWER TEMPERATURES

- SOME ROAD FOREMEN SAY THE INDUSTRY HAS BEEN PRODUCING THIS TYPE OF MIX FOR YEARS!!

Why Warm Asphalt?

- 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

Why Warm Asphalt?

Research by Stroup-Gardiner and Lange at AU
Indicates increased emissions with increased temp.

Comparison of Visible Emissions

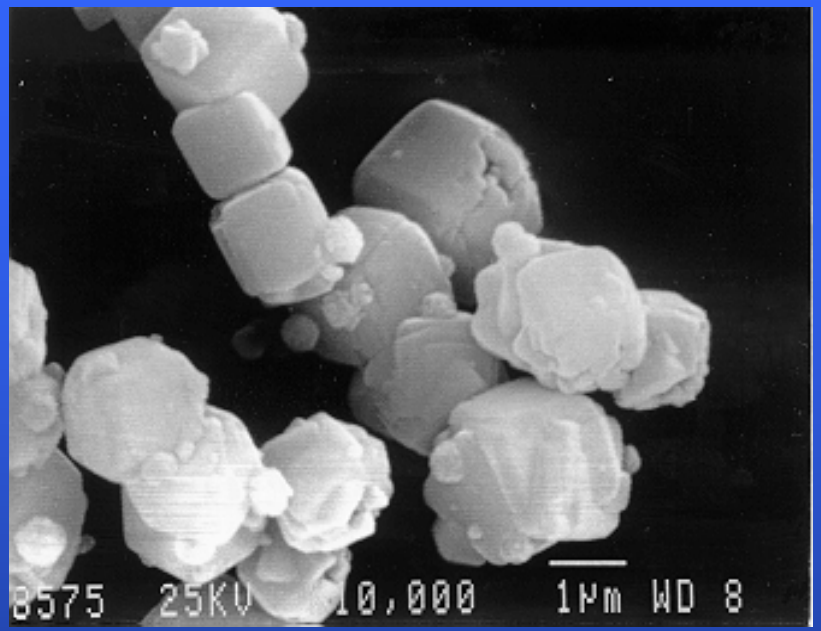
What are Warm Asphalt Mixes?

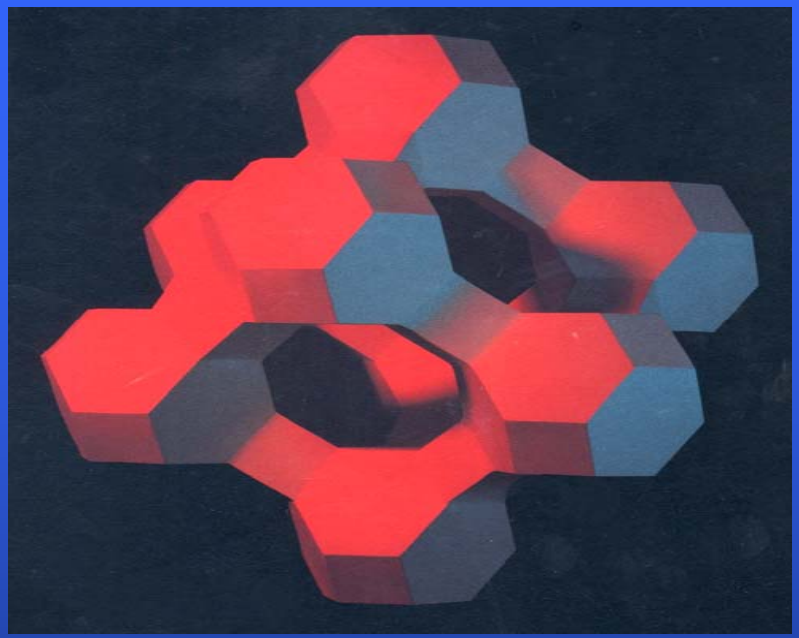
Several process have been developed to improve mixture workability allowing lower production and laydown temperatures

- WAM Foam – Shell/Kolo Veidekke
- Zeolite – Eurovia/Hubbard Construction
- Sasobit – Sasol Int./Moore and Munger
- New processes
  - MeadWetvaco

Zeolite

- Zeolites are crystalline hydrated aluminum silicates
- Aspha-min®, is a special Zeolite added to the hot mix asphalt in the temperature range of 100 to 200 °C (212 to 392 °F)
- When the Zeolite is heated; it gives up it's internal moisture, approximately 21% by weight, microscopically foaming the asphalt

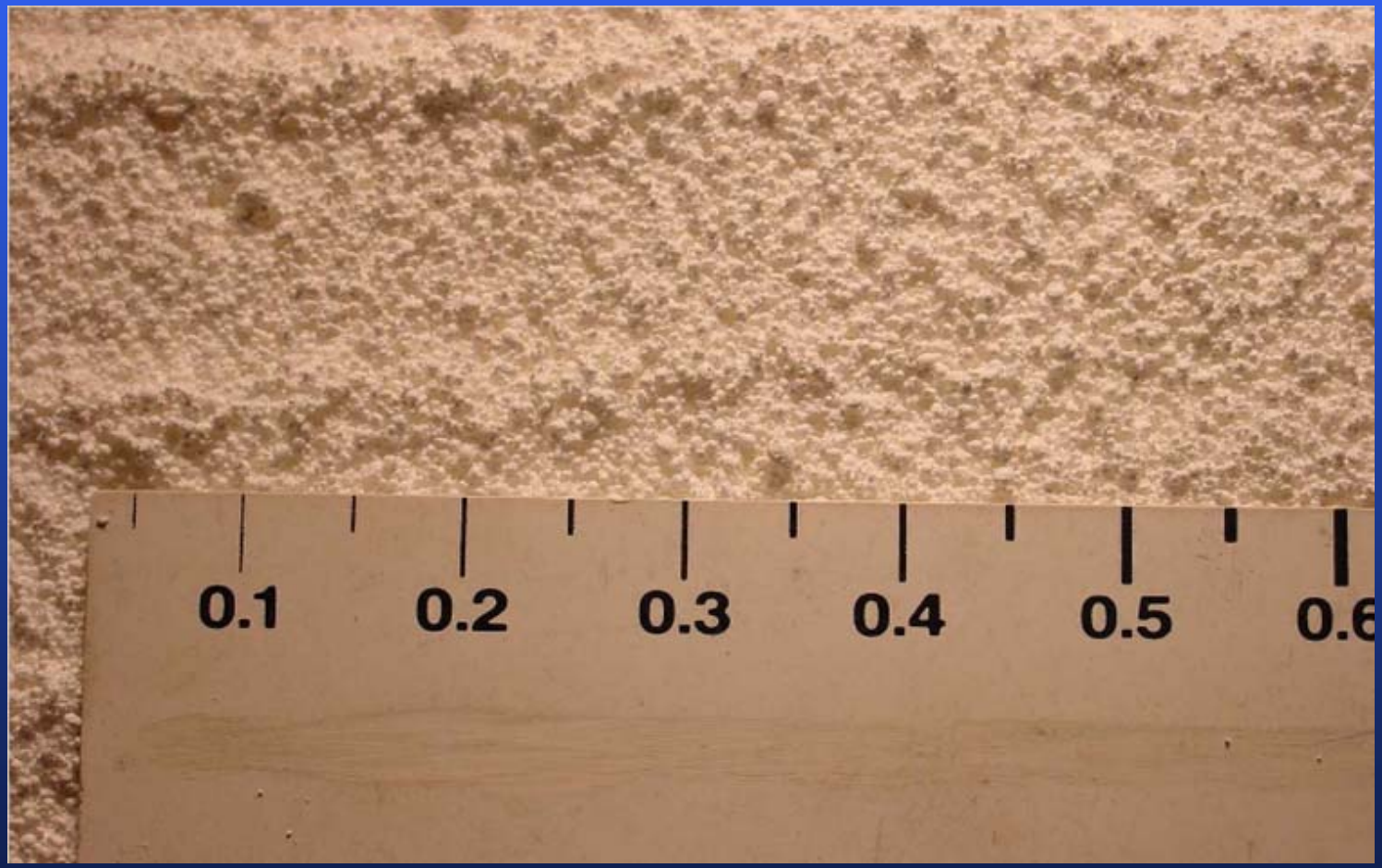




Above 100°C the water is slowly released providing a workable mix at a lower temperature.

Aspha-min

Granulated aspha-min®



Addition of aspha-min®

- Aspha-min is added at an addition rate of 0.3% by weight of mix
- 6 pounds of Aspha-min per ton

Aspha-Min

Creates a controlled microscopic foaming effect

Creates an increased volume of the binder in the mix

Creates micro pores in the mix making a higher workability of the mix along with obtaining a higher compactability

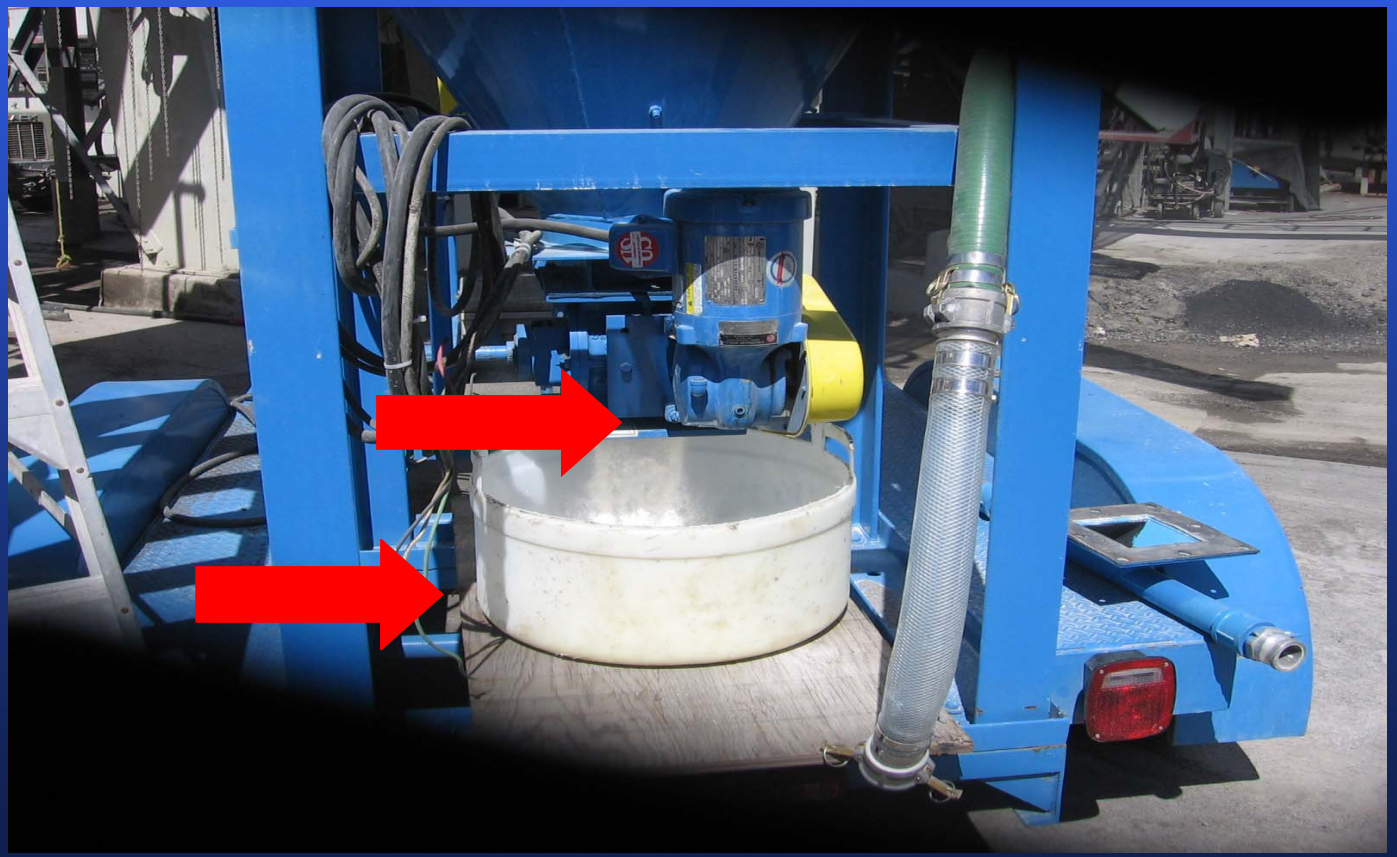
Previously only possible at higher temperatures

Type of Mineral Filler Bin used

Calibrating the Feeder

The outlet is removed

A container is placed under the hopper and the unit started

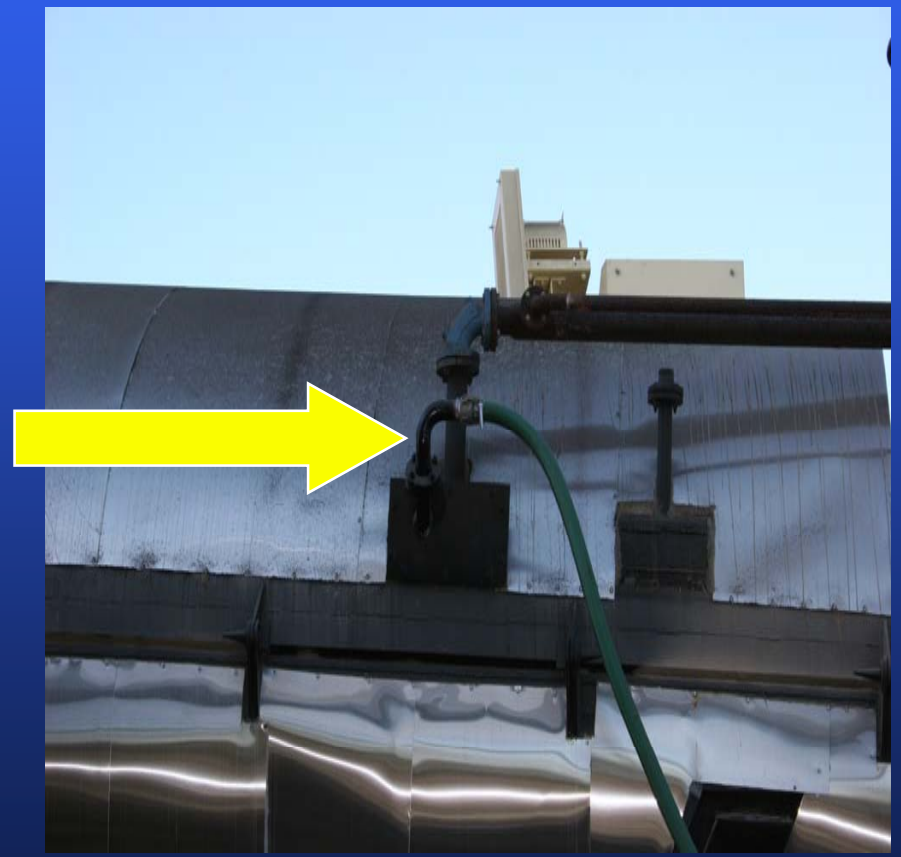


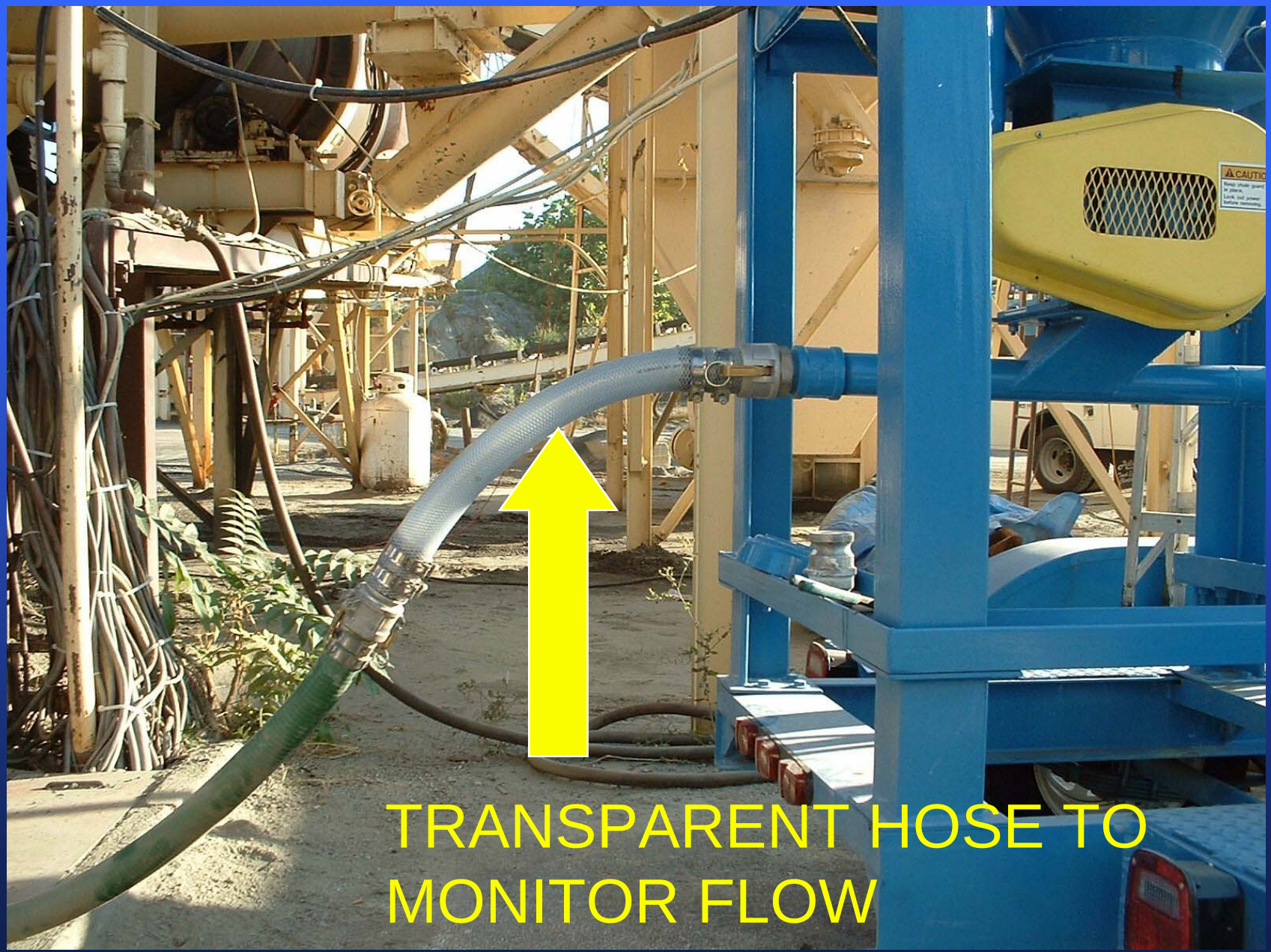
Bags of Aspha-min

HAD SOME PROBLEMS WITH FEED SYSTEM

Drum mix plant

Aspha-min blown into drum close to binder delivery point.




TRANSPARENT HOSE TO
MONITOR FLOW

MAIN ENTRANCE TO PLANT SITE

MAIN ENTRANCE TO PLANT SITE

PAVEMENT DESIGN

Not drawn to scale

Mixes were designed using Marshall Mix Design Procedures per ODOT specifications
75 blows

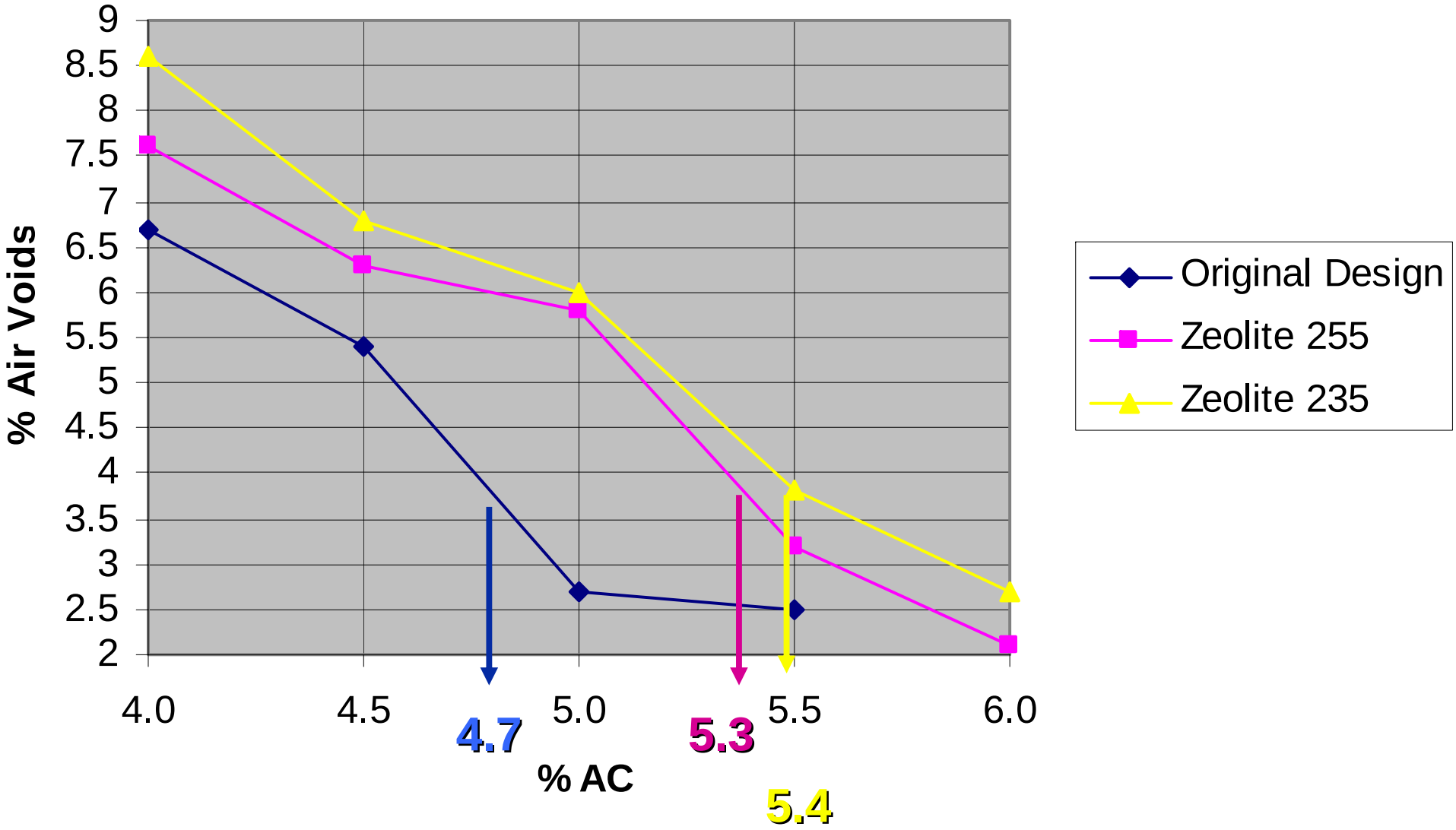
Production Temperatures

- EACH OF THE TWO MIXES WERE PRODUCED AT:
- 300 °F
- 240-255 °F
- 230-235 °F

Mix Design Issues

- What temperature should specimens be compacted?
- TSR
- Volumetrics at plant
- Superpave vs. Marshall

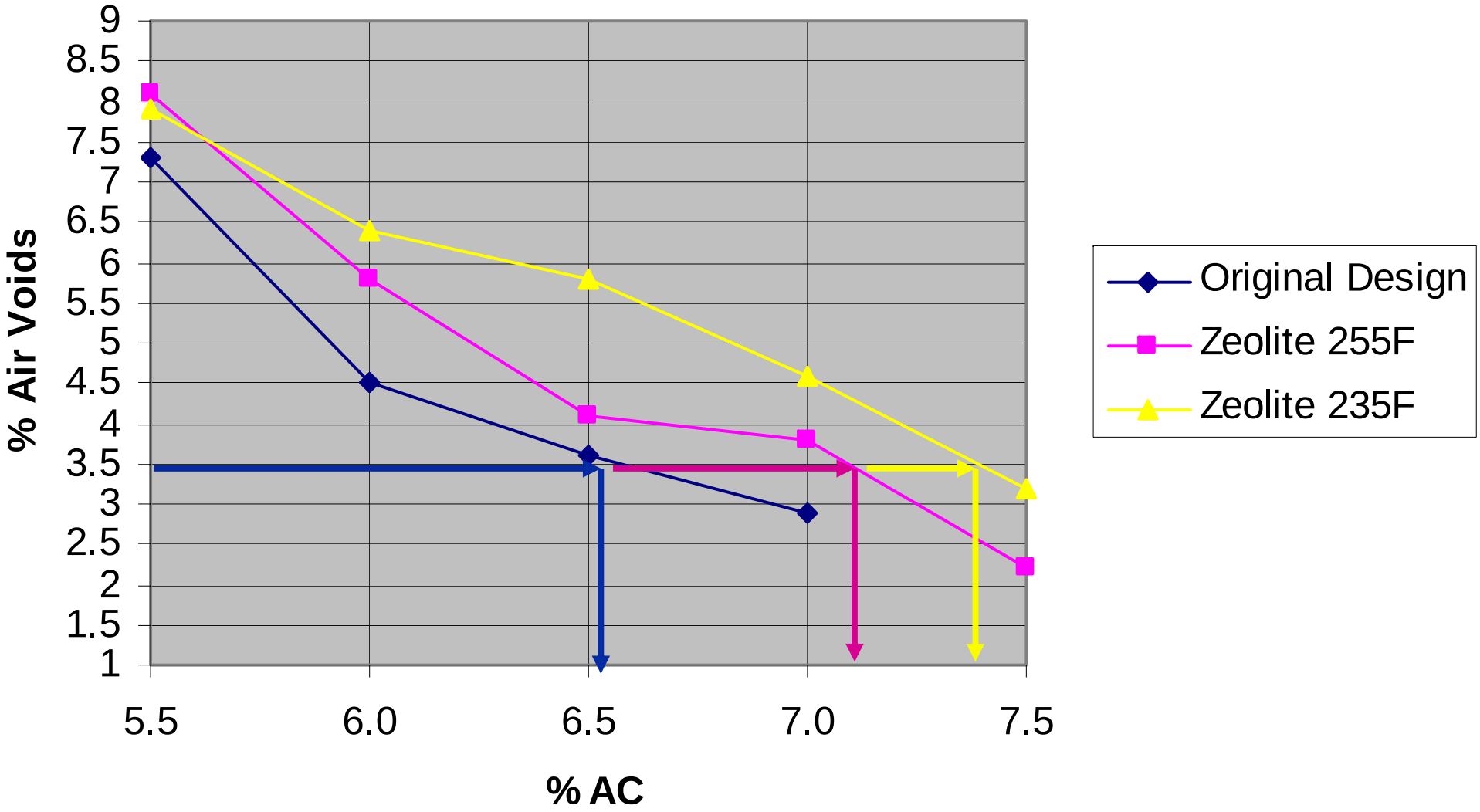
Type 2 Zeolite Mix % Air Voids



WHAT BINDER CONTENT SHOULD WE USE?

- DECIDED TO USE THE ORGINAL DESIGN BINDER CONTENT
- WILL COMPACT SPECIMENS AT THE DESIGN TEMPERATURE NOT THE PLACEMENT TEMPERATURES

Type 1 Zeolite Mix % Air Voids

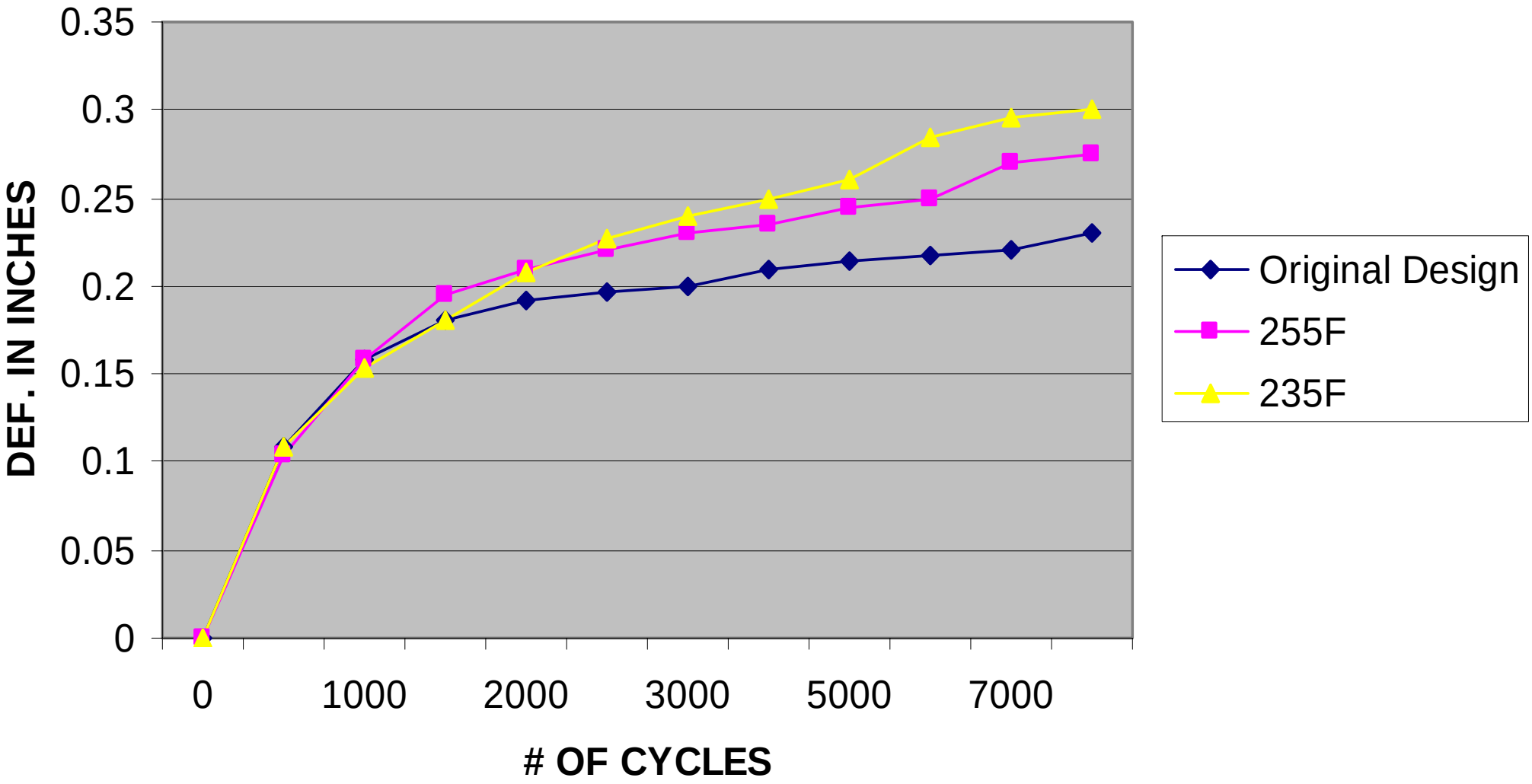


SAME ISSUE WITH TYPE 1

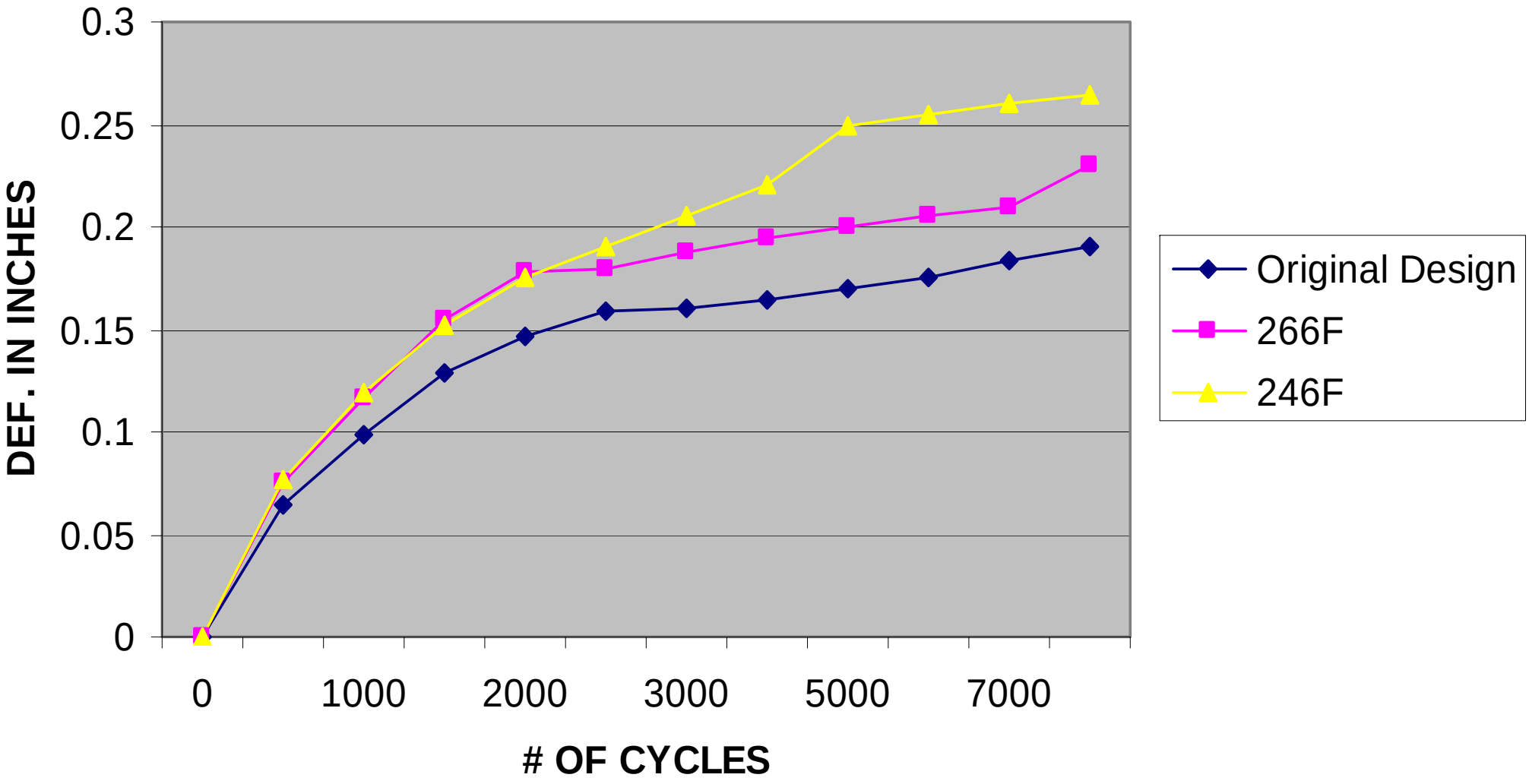
- DECIDED TO STAY WITH ORIGINAL DESIGN TEMPERATURES
- WILL USE ORIGINAL MARSHALL MIX DESIGN

APA RUT TESTING

T-2 WARM ASPHALT STUDY LOADED WHEEL TEST COMPARISON



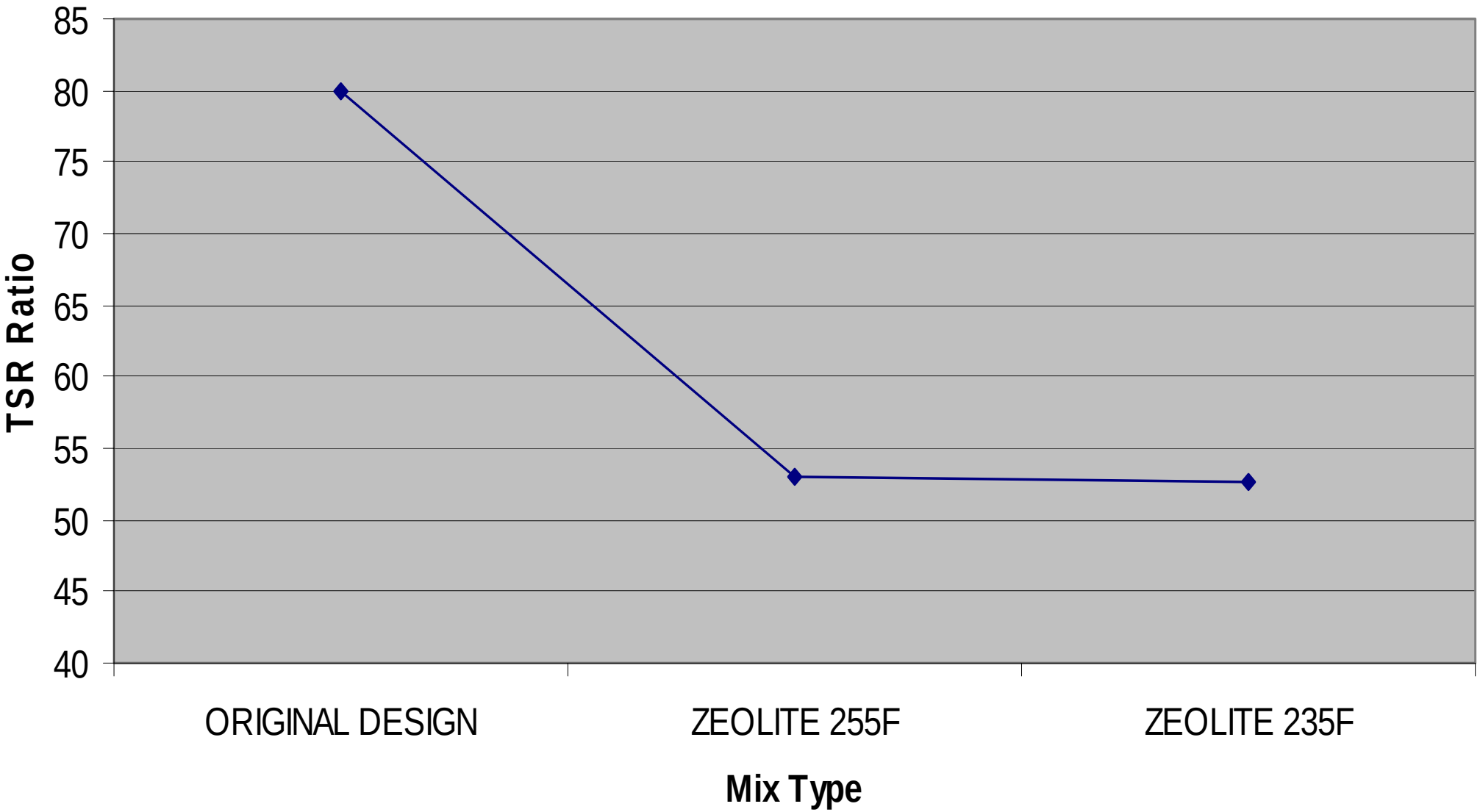
T-1 WARM ASPHALT STUDY LOADED WHEEL TEST COMPARISON



TSR

- EXAMINED THE TSR VALUES IN THE LABORATORY AS RELATED TO ORIGINAL DESIGN AND EACH TEMPERATURE

TYPE 2 Zeolite Tensile Strength Ratio



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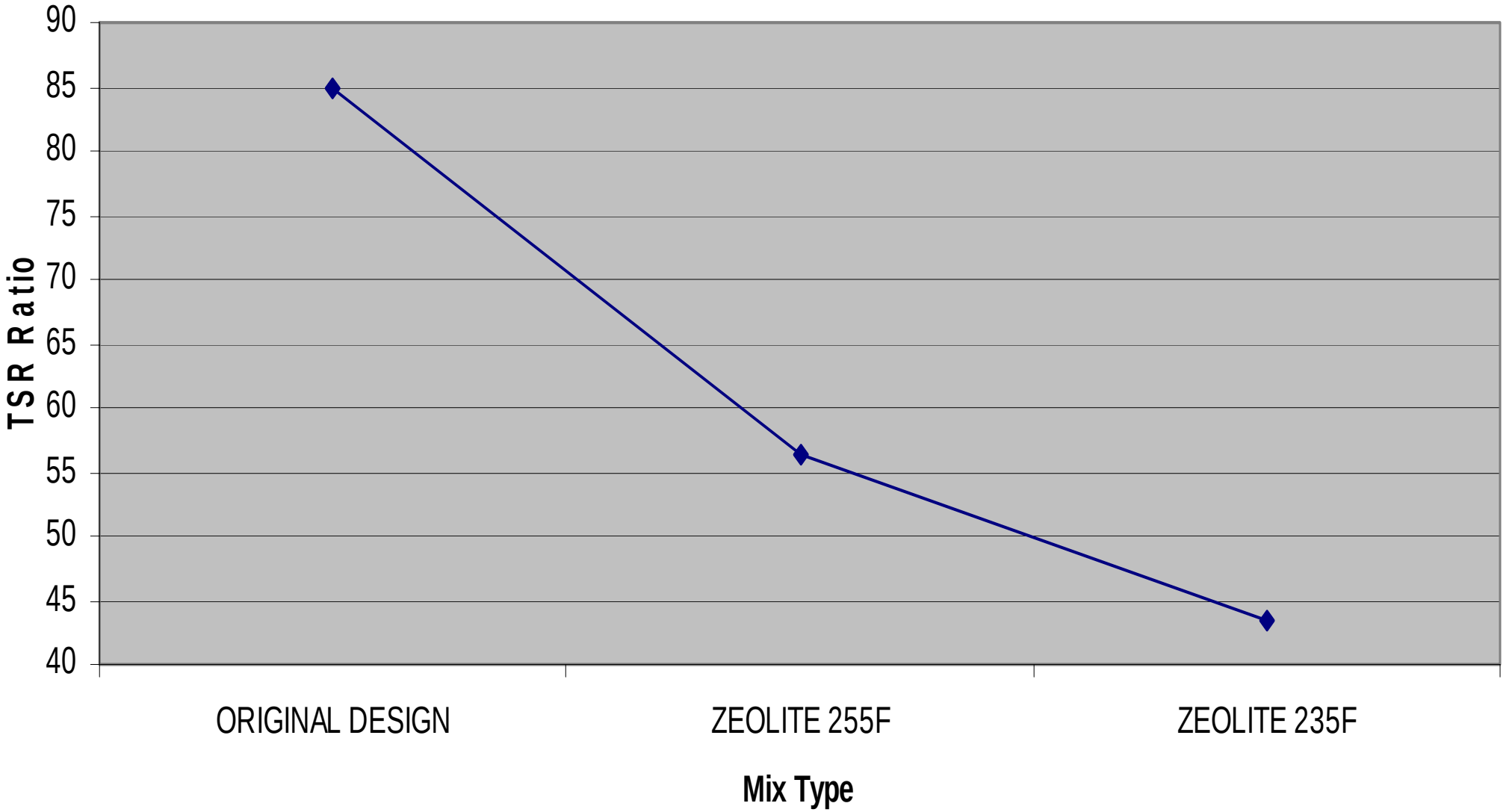
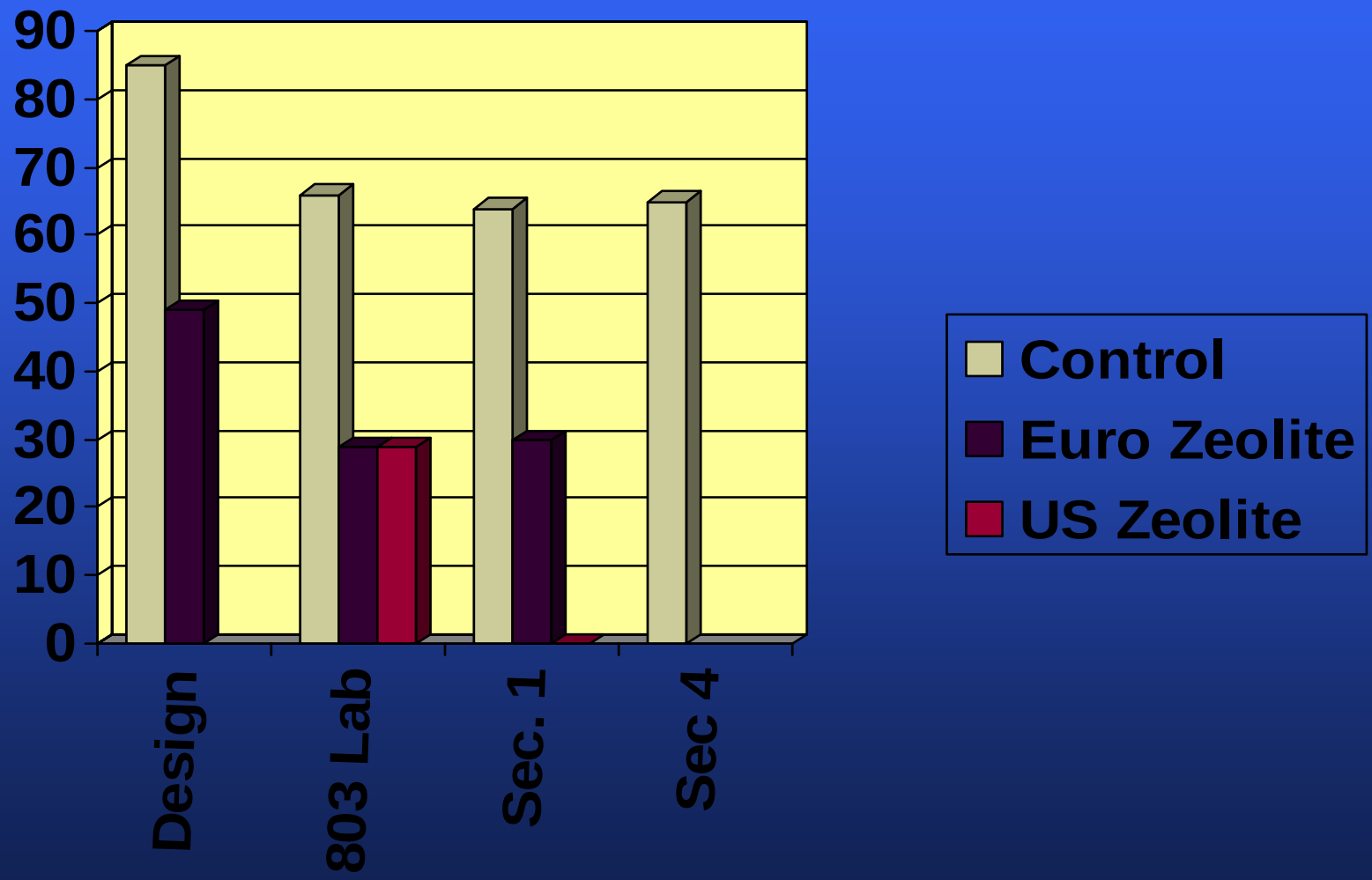


SISTER COMPANY PIKE INDUSTRIES FOUND SOME ISSUES WITH TSR

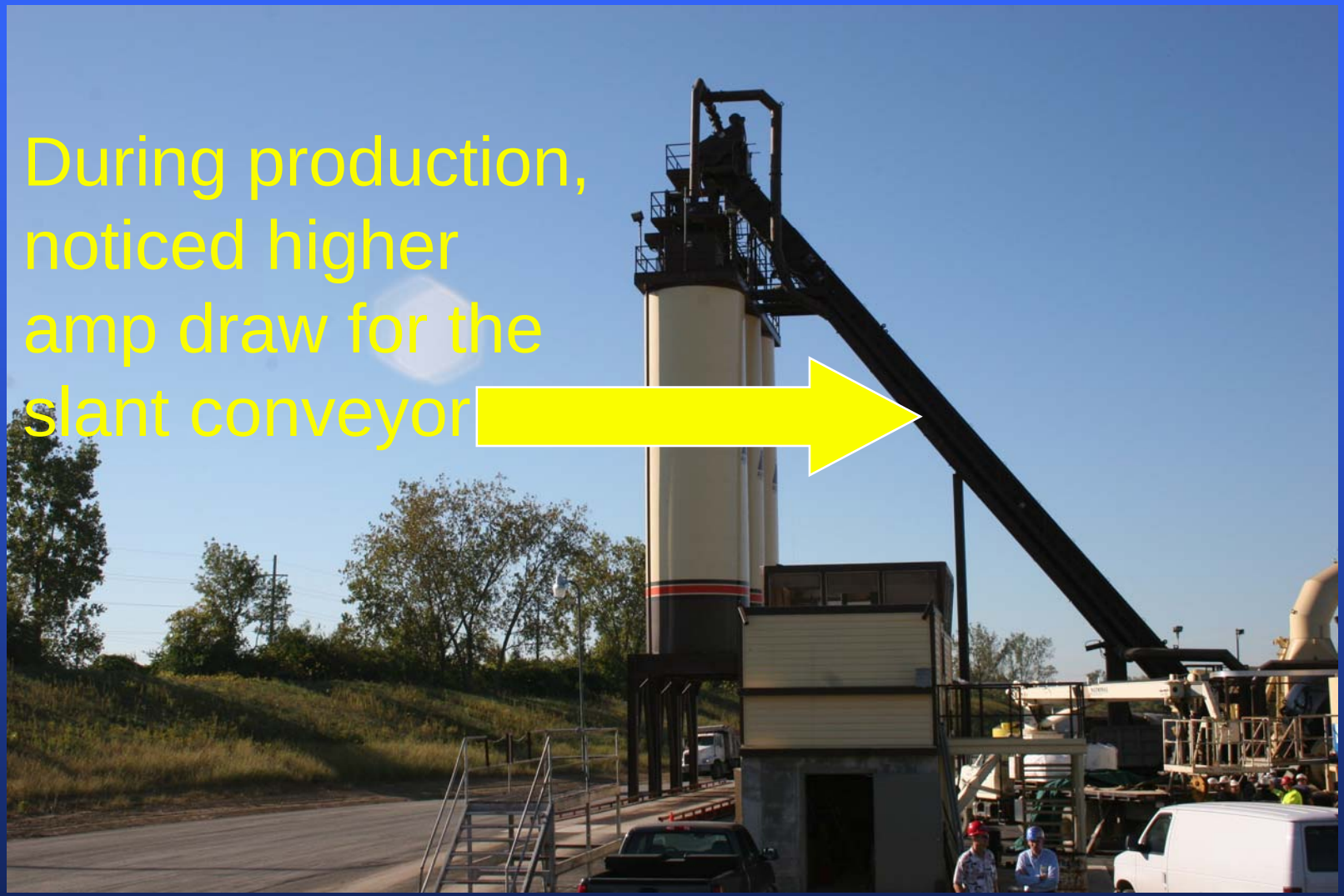


PRODUCTION

- ASTEC DOUBLE BARREL
- CALIBRATED THE ASPHA-MIN TO PLANT'S EXPECTED TONS PER HOUR
- EXPECTED TPH - 200-250 TPH
- SILO STORAGE TIME APPROX 20-30 MINUTES
- WEATHER: COOL LOW MID 40'S HIGH 65

FIRST MATERIAL PRODUCED

- The material coming out of the dryer-drum discharge chute was uncoated
- When the material was loaded into the truck the material was coated!


During production, noticed higher amp draw for the slant conveyor

Production

- Easier to produce than expected
- Some concerns about baghouse temperature
- Did experience decrease in tons per hour

Seeing is Believing!

Hot Mix 314 F

Warm Mix 254 F

Laydown

- Did not tell crew temperatures at first
- Fewer paver fumes
- Private crew did the hand work
- Little to no build up in trucks

Workability of the Mix

Warm Asphalt Mix at lower temperature could be handled in the same way as normal HMA


TYPE 2 PLACEMENT

Compaction

CONDUCTED NUCLEAR GAUGE TESTS

Mix cooled quickly

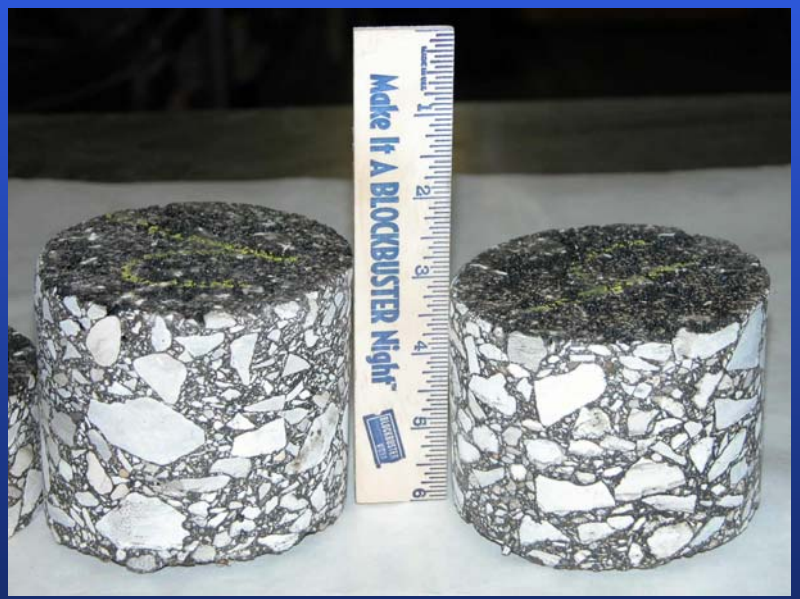
Loadout with Warm Asphalt

Loadout

TEST RESULTS OF PRODUCED MIX

- TSR TYPE 2 ONE HOUR CURE= **87%**
- TSR TYPE 1 ONE HOUR CURE= **80%**
- BETTER THAN MIX DESIGN RESULTS

Cores yielded good density



PAVEMENT DENSITY-AVERAGE

BASED ON FIELD MTD 1 HOUR CURE

TYPE 1 PG 70-22 **94.4% (230F)**

TYPE 2 PG 70-22 **95.3%(230F)**

TYPE 2 PG 70-22 **96.5% (240F)**

AVERAGE DENSITY STANDARD TEMPERATURES 93%

Cure Time – Early Concern

- In some cases, Europeans allow pavement to “cure” before allowing traffic on roadway
- When does Warm Asphalt’s workability end?
- Will pavements rut if traffic allowed on an hour or so after placement?

Conclusions-Pro

- Mix can be produced and placed at lower temperatures
- Density did not seem to be an issue
- Lower emissions from load out and paving spread
- Workability improved
- Fuel savings

Conclusions-Con

- Expense of the additive offsets fuel savings
- Concerned about lower temperatures in Baghouse-corrosion, caking of bags
- Possible lower tph, more load on slant conveyor
- Low TSR values in design stage-did not see stripping in place-may be too soon
- Need larger project to gain experience

A Word About Cost

- Most additives, warm asphalt or other, are expected to increase the price of the HMA
- Some processes or additives may require plant/production modifications
- It is not anticipated that the fuel savings will totally offset these costs

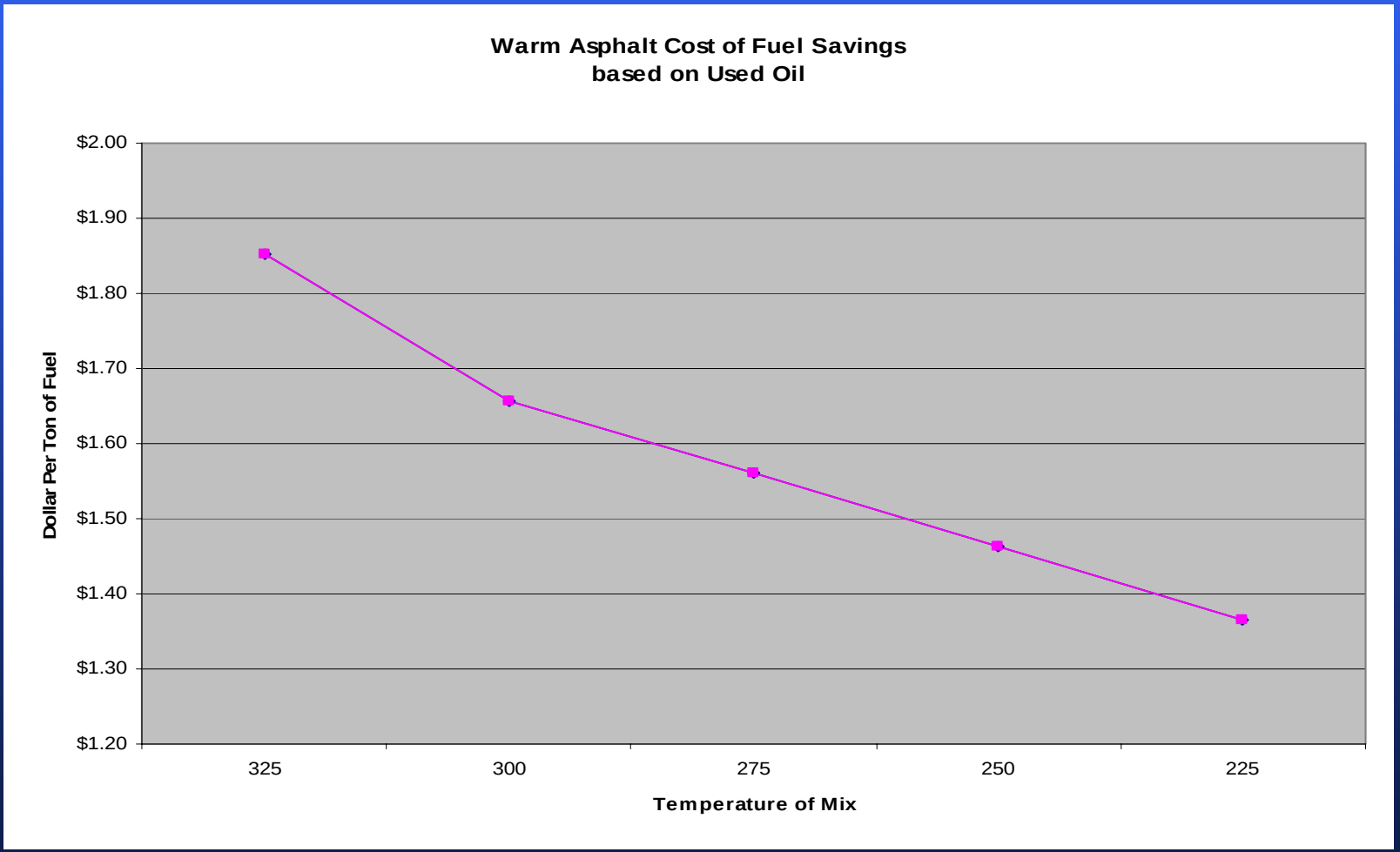
Questions to be answered

- Are there economic benefits?
- How will compaction be affected?
- What temperature should volumetric specimens be compacted?
- Antistrip - Is it needed?
- DOT acceptance?
- EPA possible involvement???

Questions?


A.C. BARRY

Projected cost savings used oil



Economics of warm asphalt

- Zeolite-$0.60 per pound (not including shipping)
- 0.3% per ton of mix
- 6 # per ton
- $3.60 per ton of mix


3