


# SEAUPG 2003 CONFERENCE

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**Determination of In-place Density**

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Southeastern Asphalt User/  
Producer Group Meeting  
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**Background: In-place Density**

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- ▶ **IMPORTANCE**
- ▶ Difficulty achieving
- ▶ Methods of determination
  - nuclear density gauges
  - non-nuclear density gauges
  - cores


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**Nuclear Density Gauges**

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- ▶ History / Longevity
- ▶ "The Gold Standard"
- ▶ Require specialized training
- ▶ Regulated
- ▶ Expensive operation
- ▶ Heavy



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**Pavement Quality Indicator**

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- ▶ Non-nuclear device
- ▶ easy to use
- ▶ rapid operation
- ▶ discrete and continuous operation
- ▶ lighter than a nuke
- ▶ no specialized training or licensing required
- ▶ lower operating and administrative costs




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**PaveTracker**

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- ▶ Electromagnetic
- ▶ Very lightweight



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**Objectives**

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- ▶ Evaluate performance of non-nuclear PQI device
- ▶ Evaluate performance of a prevalent nuclear device
- ▶ Assess operating characteristics of both PQI and nuclear devices

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## PQI Studies

- ▶ Based upon the results of the research study, it was concluded that poor correlation exists between PQI Model 300 instrument density and core density obtained in the field, as indicated by an average R-squared value of 0.28 for the ten sites evaluated. (Henault, 2001)
- ▶ In its current form, the densities obtained with the device do not correlate with the measured densities to the same degree that the densities measured with existing devices do. (Romero and Kuhnaw, 2003)

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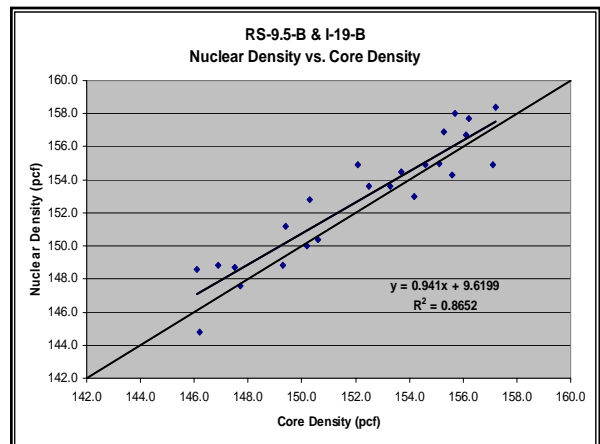
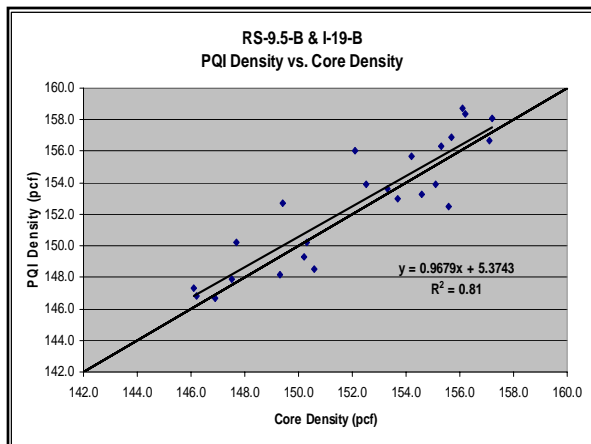
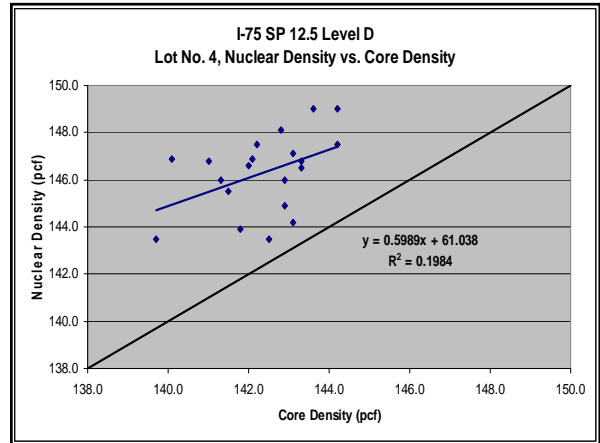
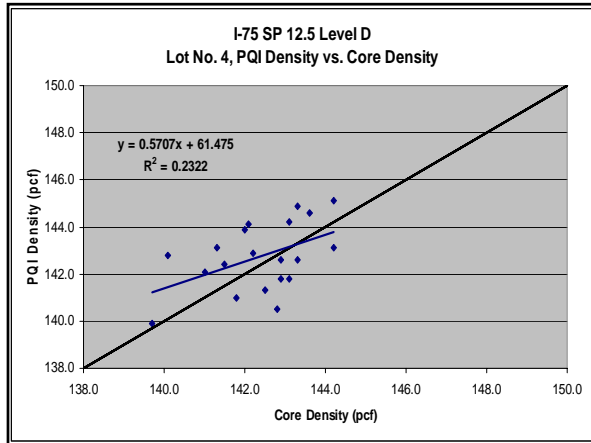
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## Test Plan (III)

- ▶ PQI
  - Use on as many jobs as possible
  - Calibrate gauge per TransTech (offset from cores) - use one entire lot with 5 shots per core location
  - Cut six-inch core
  - Determine Gmb
- ▶ Nuclear
  - Use per manufacturer and DOT guidelines
  - Else, same as above

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## What does all of this mean?

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- ▶ Bad news.
- ▶ Good news.
- ▶ No major revelations really.
  - Background
  - Literature

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## Nuclear Density Gauge Studies

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- ▶ The findings indicated that the five nuclear gauge density units did not always produce similar results and did not consistently correlate with the core densities. In addition, the nuclear density testing variability differed not only from gauge to gauge but also from location to location within each gauge. (Choubane, et.al., 1999)
- ▶ Analysis of the data shows that the accuracy of the nuclear gauge is highly material-dependent: The gauge produced acceptable results with limestone mixtures, but it did not perform satisfactorily with mixtures containing siliceous aggregate. (Kennedy, et.al., 1989)

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## Nuclear Density Gauge Studies

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- ▶ When considered as a group, gauges fail to generate an accurate regression equation. When considered individually, however, the gauges are capable of producing an r-squared of 0.8 or greater. (Stroup-Gardiner and Newcomb, 1988)

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## So, what does all of this mean?

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- ▶ USE EITHER DEVICE WITH CAUTION!!!
- ▶ Each has its place.
- ▶ USE CORES FOR ACCEPTANCE!!!

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## Objectives

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- ▶ Evaluate performance of non-nuclear PQI device
- ▶ Evaluate performance of a prevalent nuclear device
- ▶ Assess operating characteristics of both PQI and nuclear devices
  - ease of operation
  - cost
  - etc.

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## APAC's nukes....

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- ▶ Survey: 14 of 24 divisions responded
- ▶ 101 gauges
- ▶ Average calibration cost = \$300 per gauge (\$30,300)
- ▶ Avg. license fees = \$1700 per division
- ▶ Leak tests = \$4000 annually
- ▶ Repairs = \$500 per instance
- ▶ "Monitoring fee" (FL) = \$2800 annually

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## APAC's nukes....

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- ▶ Estimated total annual cost (based on 101 gauges):

**\$76,600**

(Note: Purchase, administrative and disposal costs NOT included.)

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## Recommendations

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- ▶ USE EITHER DEVICE WITH CAUTION!!!
- ▶ Each has its place.
- ▶ USE CORES FOR ACCEPTANCE!!!

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