

# **Evaluation of Conventional, Infra-red, and Vacuum Sealing methods for Specific Gravity measurements**

# Presentation outline

- Background.
- Current methods for testing Specific Gravity.
- Problem Statement.
- Objective.
- Scope.
- Newly proposed methods.
- Results.
- Summary and Conclusion.
- Questions.

# Significance

- Mass/volume relation is key
- 0.01 change in gravity = .6 lb/cubic ft change in density
- 0.6 lb / cubic ft change = 0.5% change in voids
- Fine aggregates normally account for 35 to 50% of the mix.

# Specific Gravity

- Provides a relationship between mass and volume .
- It is the ratio of the weight of the aggregate to the volume of the aggregate.

$$G = \frac{\text{Mass}}{\text{Volume } \gamma_w}$$

- Specific Gravity is an indicator of how heavy a material is.

# Specific Gravity (Aggregates)

- Dimensional measurements is difficult, since aggregates have irregular shapes.

$$V_{\text{bulk}} = (W_{\text{ssd}} - W_{\text{submerged}}) \gamma_{\text{water}}$$

$$V_{\text{App}} = (W_{\text{OD}} - W_{\text{submerged}}) \gamma_{\text{water}}$$



- Volume is determined by the volume of water it displaces .

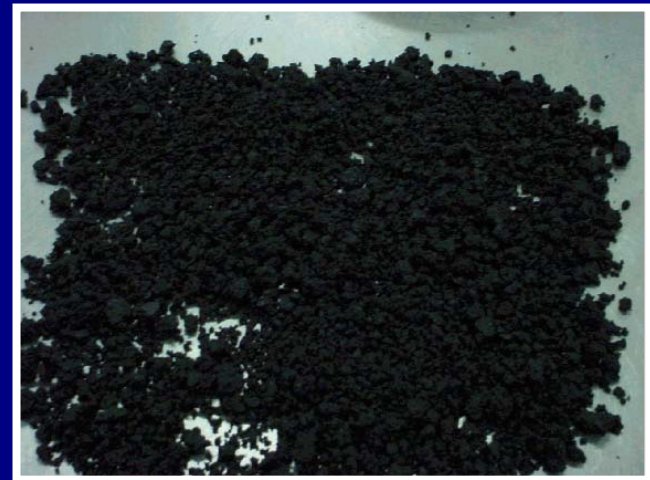
# Specific Gravity

*(Mixture Maximum Specific Gravity)*

## Maximum Theoretical Specific Gravity

( $G_{mm}$ ): mass per volume of material containing no air voids, compared to unit volume of water

$$G_{mm} = \frac{\text{Mass}}{\text{Volume } \gamma_w}$$



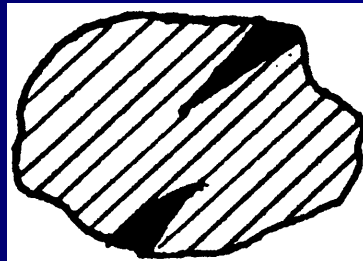
# Current methods for measuring Gravity

## Aggregates

- Fine aggregate - AASHTO T 84

# Saturated Surface Dry (SSD)

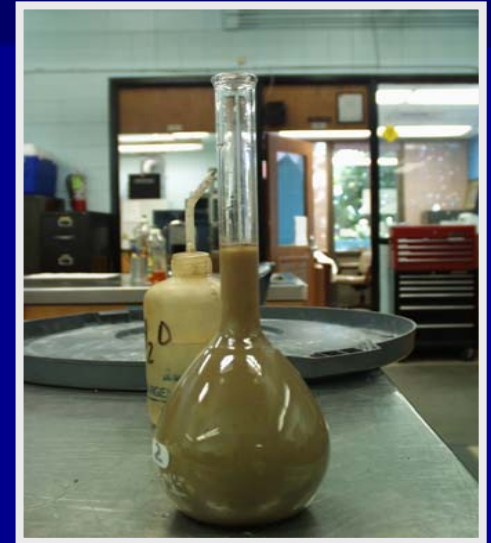
- Aggregate is well soaked.
- Capillary pores saturated with water.
- Surface is dry.



Saturated-  
Surface-dry



# Conventional method Fine Aggregates



# Problems with Conventional Method

- Achieving proper SSD Condition.
- Long testing time.

# Objective

- **The objective of this study is:**  
*Evaluate alternative test methods to determine the Specific Gravities of fine aggregates*

# Scope

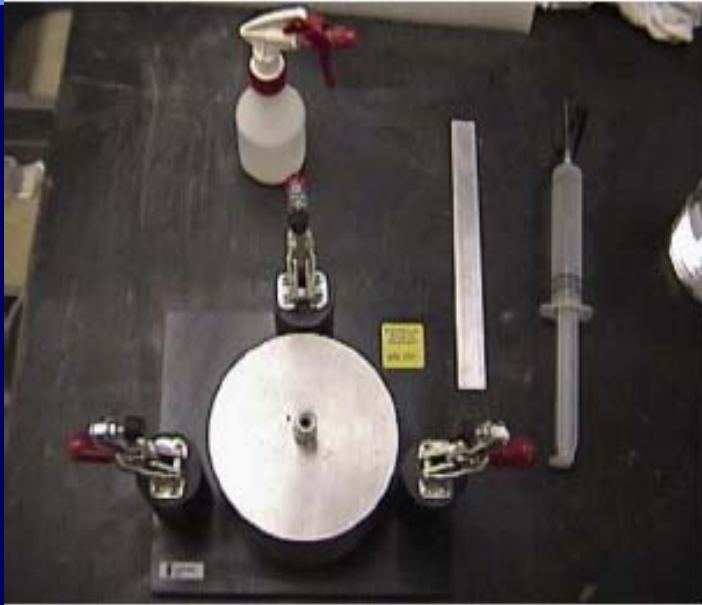
## Materials

- **Fine aggregate:**
  1. *#11 LimeStone.*
  2. *#11 SandStone.*
  3. *Coarse Sand.*

# Alternative methods for testing specific gravity of aggregate

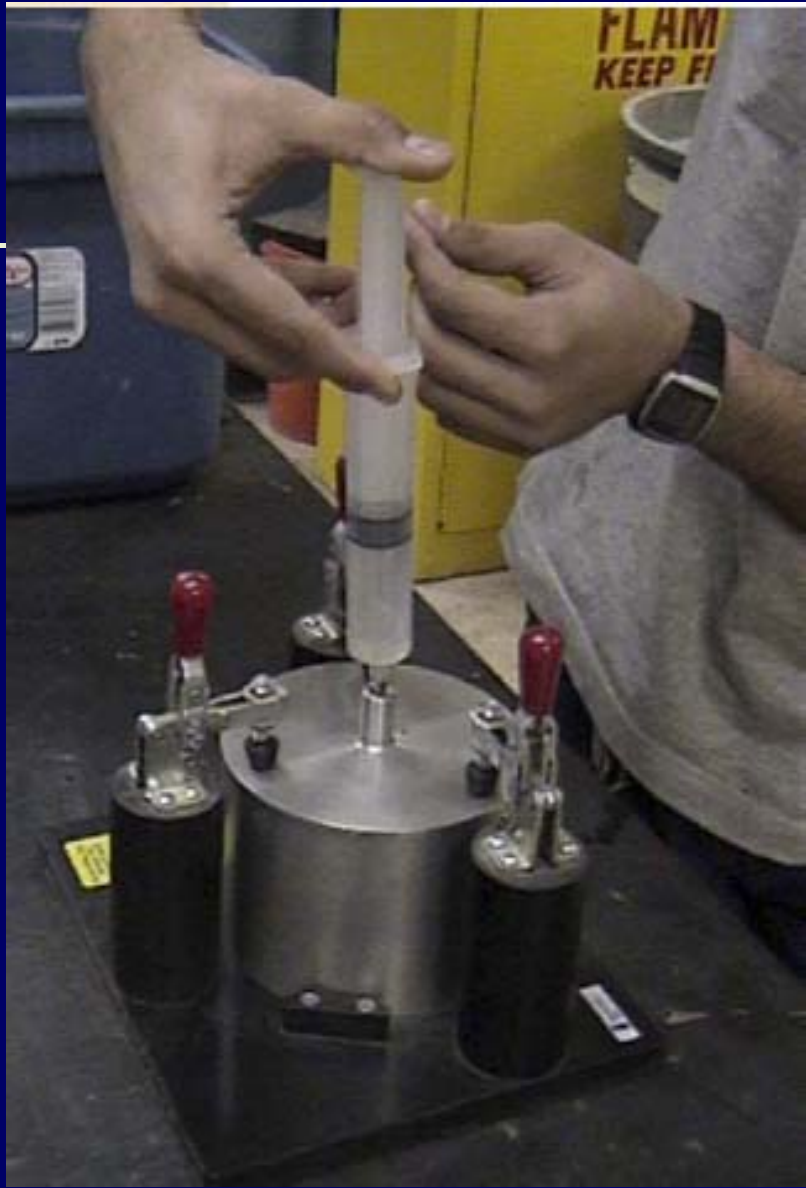
- *Vacuum Sealing.*
- *Infra-red*

# Vacuum Sealing







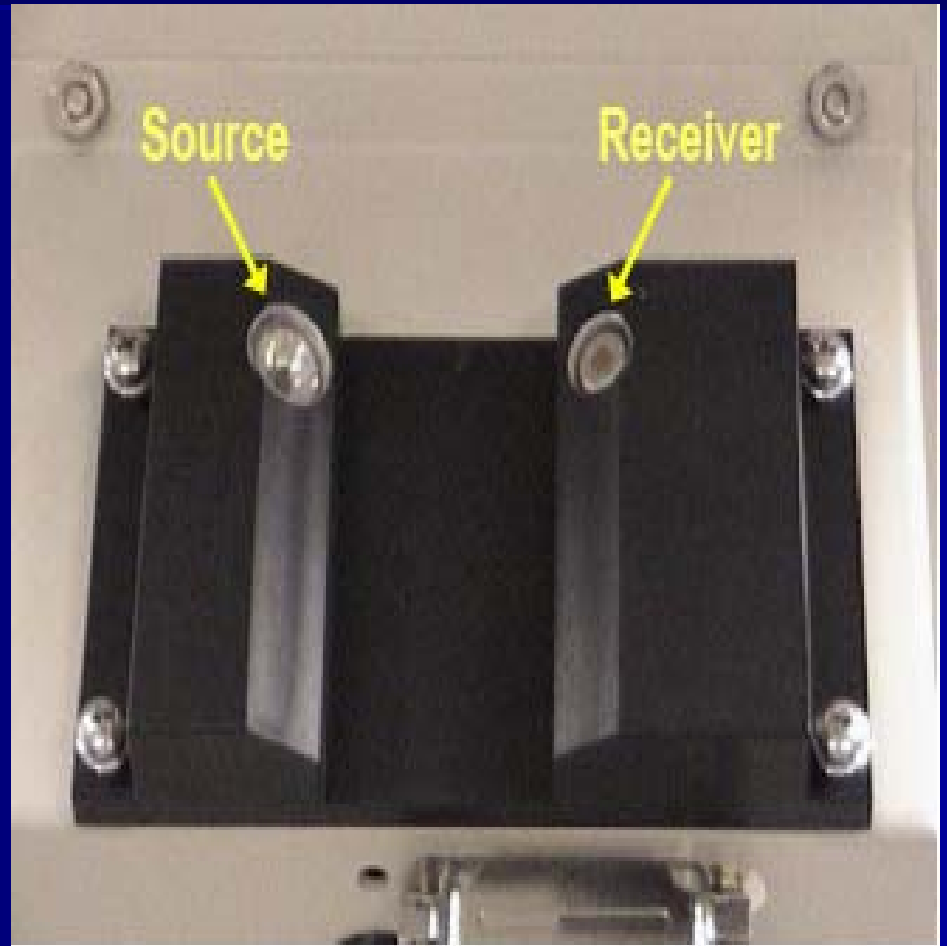


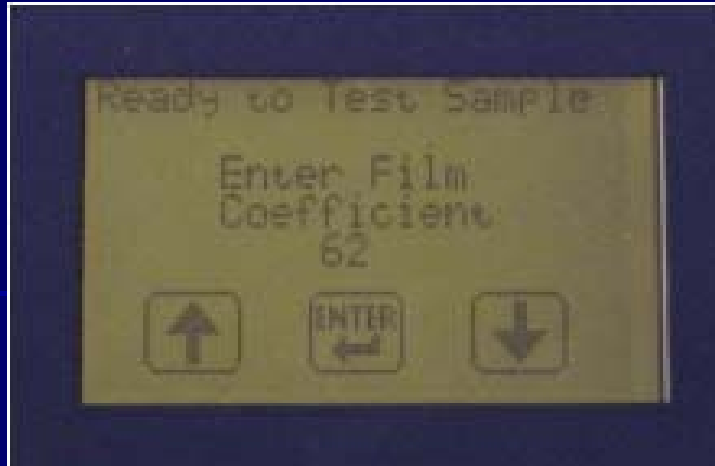
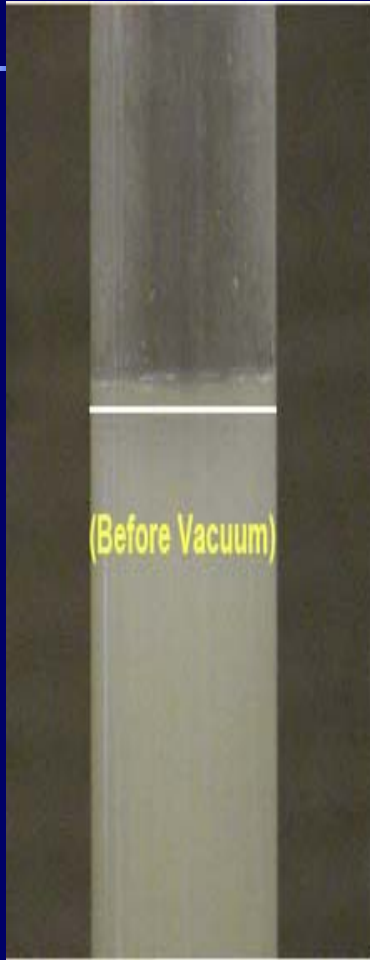






# Infra-red





## Determining Film Coefficient for Infra-red "Eye"





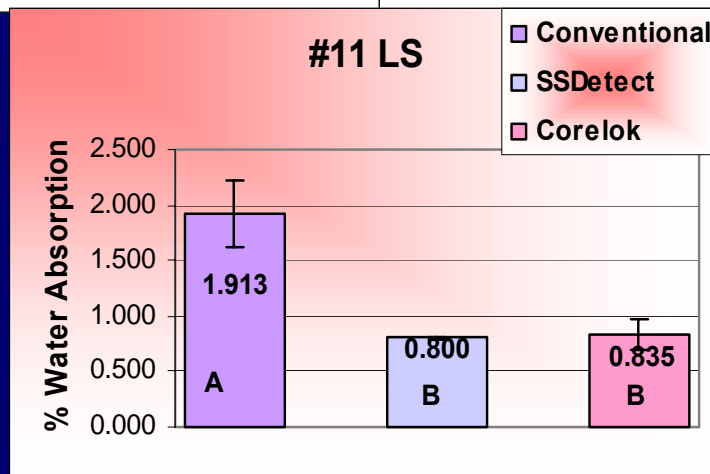
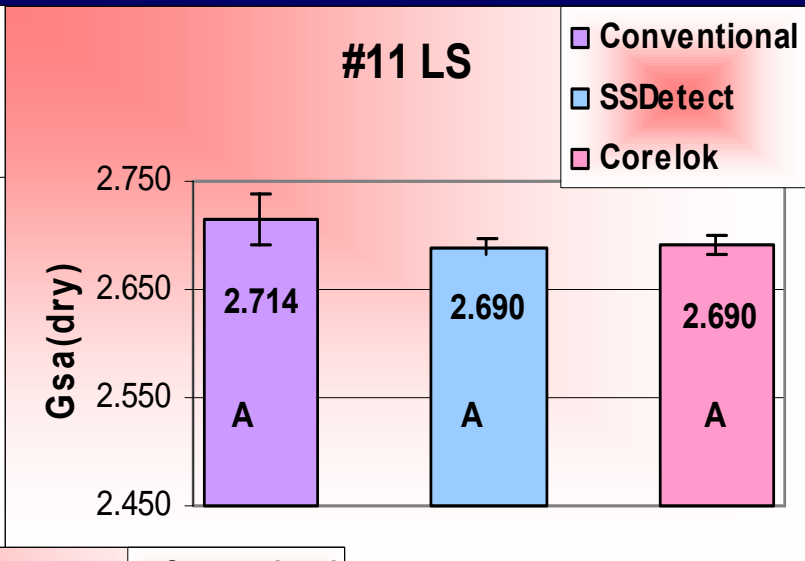
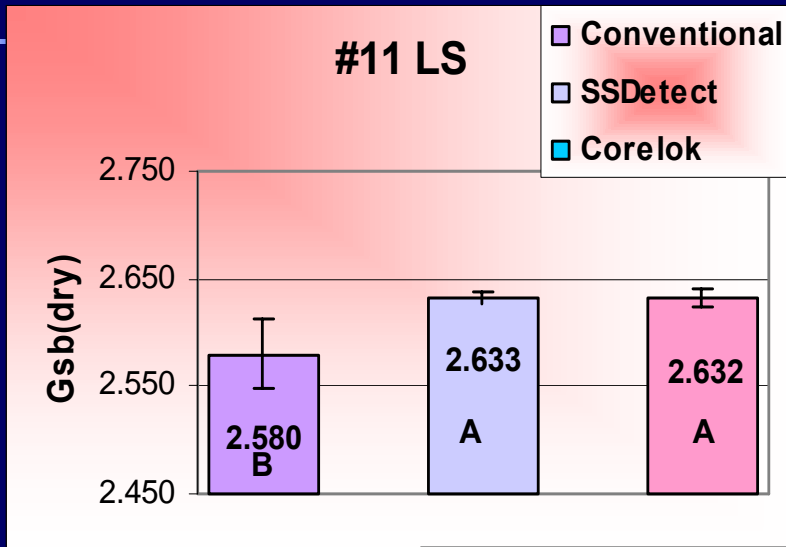


**(Bowl + Aggregate) weighed  
before and after test is run**

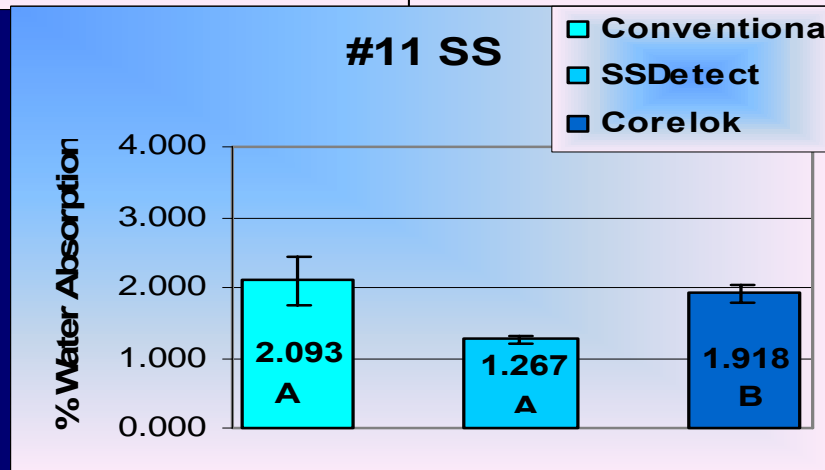
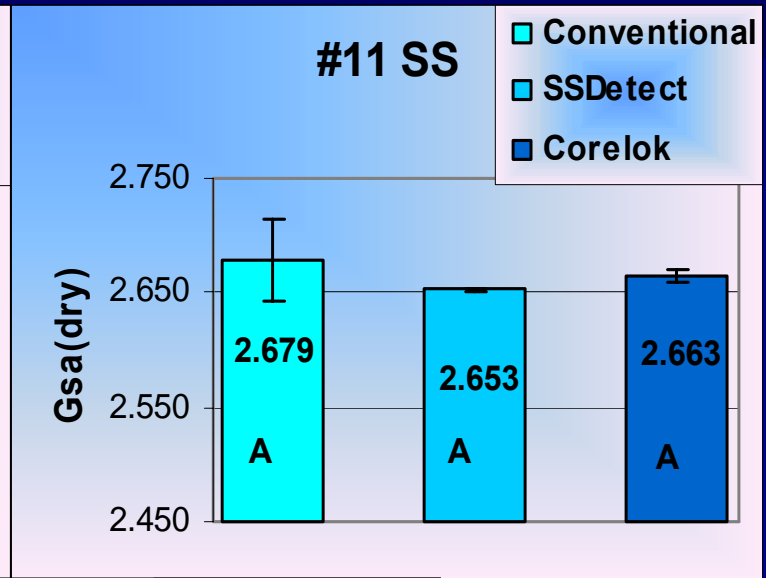
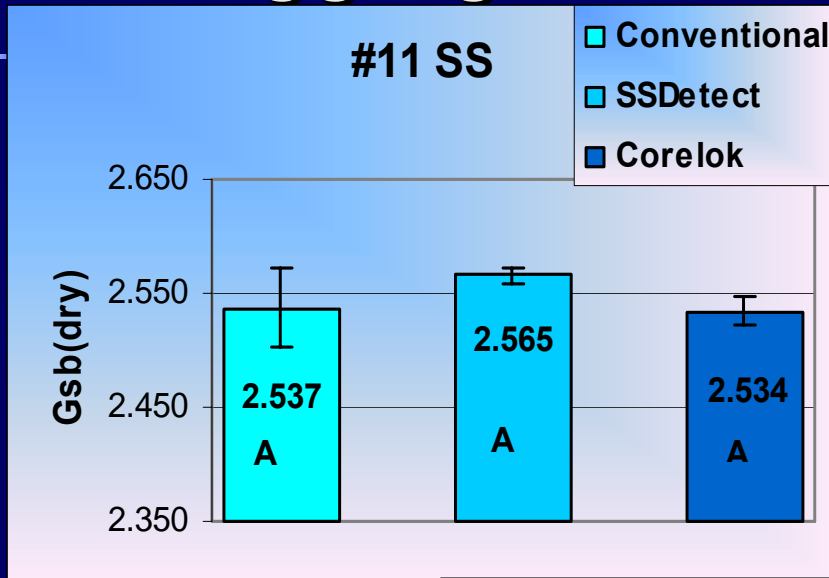


# *RESULTS*

# Comparison of Specific Gravity of fine Aggregates: #11 LS



# Comparison of Specific Gravity of fine Aggregates: #11 SS





# Comparison of Specific Gravity of fine Aggregates: Coarse Sand

