INTERFACE SHEAR STRENGTH CHARACTERISTICS OF EMULSIFIED TACK COATS

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Presentation Outline

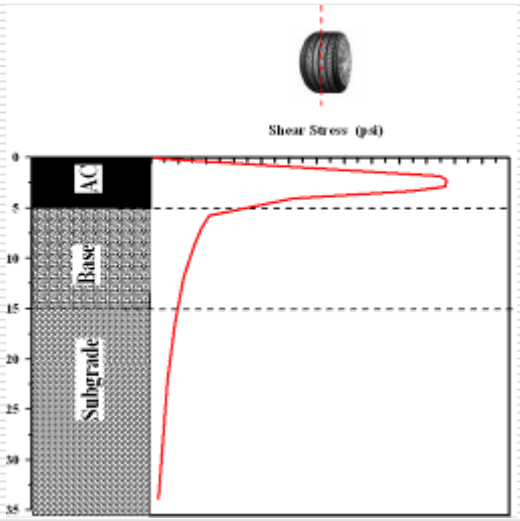
- Introduction
- Purpose of Applying Tack Coats
- Background
- Objectives
- Scope
- Methodology
- Discussion of Results
- Summary and Conclusion

What is a Tack Coat?

- A light application of asphalt on an existing non absorptive surface
- Three Types
  - Asphalt emulsion
  - Cutback asphalt
  - Asphalt cement
- Ensures bond between surface being paved and the overlying course

Why Tack Coat is used?

- Monolithic structure
  - withstand/transfer shear stresses from traffic loading



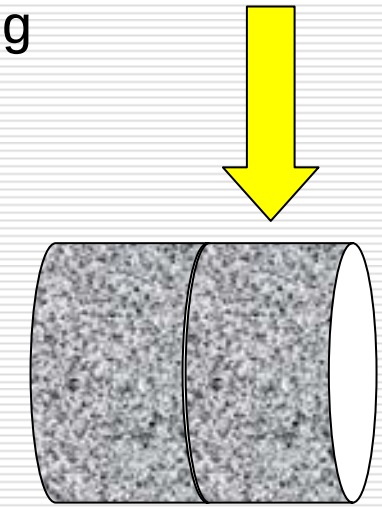
- Lack of bond between the wearing and binding layers
  - Cause slippage
  - activate distress mechanisms and rapidly lead to total failure

Background

- Experience and empirical judgment
  - Selection of tack coat material type, application rate, and placement
- Quality control and quality assurance testing
  - rarely conducted
  - resulting in the possibility of unacceptable performance at the interface,
  - premature failure.

Background

- National Co-operative Highway Research Program Project 9-40
  - Optimization of Tack Coat for HMA Placement
    - Study the influence of tack coat type and application rate on the bond strength
    - Bonding characteristics testing
    - Direct Shear Test



Objectives

- Evaluate the interface shear strength of emulsified tack coats under a wide range of testing conditions commonly encountered in field applications
  - effect of emulsified tack coat type;
  - effect of application rate;
  - effect of dust;
  - effect of wetness (rain).

Scope

- Pavement surface types:
  - existing HMA, new HMA, milled HMA, and PCC
- Surface Condition:
  - clean and dirty
  - wet and dry
- Tack coat material types
  - Hot AC
    - PG 64-22
  - Emulsion
    - CRS-1, Trackless, SS-1h, SS-1
- Application rates (residual):
  - High (0.155 gsy), Medium (0.062 gsy), and Low (0.031 gsy)
- Surface coverages by tack coat:
  - 100% and 50%
- Confining Pressure
  - 0 psi and 20 psi

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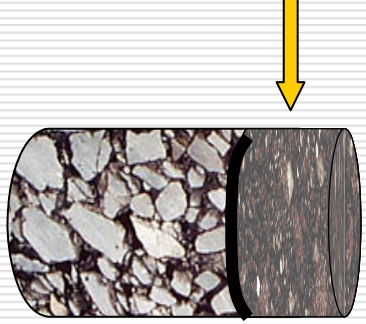
The Test Factorial

Variable	Content	Number
Emulsified Tack Coat Type	SS-1h, CRS-1, Trackless	3
Coverage, %	100	1
Residual Application Rate, gsy	0.031, 0.062, 0.155	3
Rainy Condition	Dry, Wet	2
Dusty Condition	Clean, Dirty	2
Testing Temperature, ^{0}C	25	1
Confinement Pressure, psi	0	1
Number of Replicates	3	3

Methodology



- Laboratory Mixed/Compacted

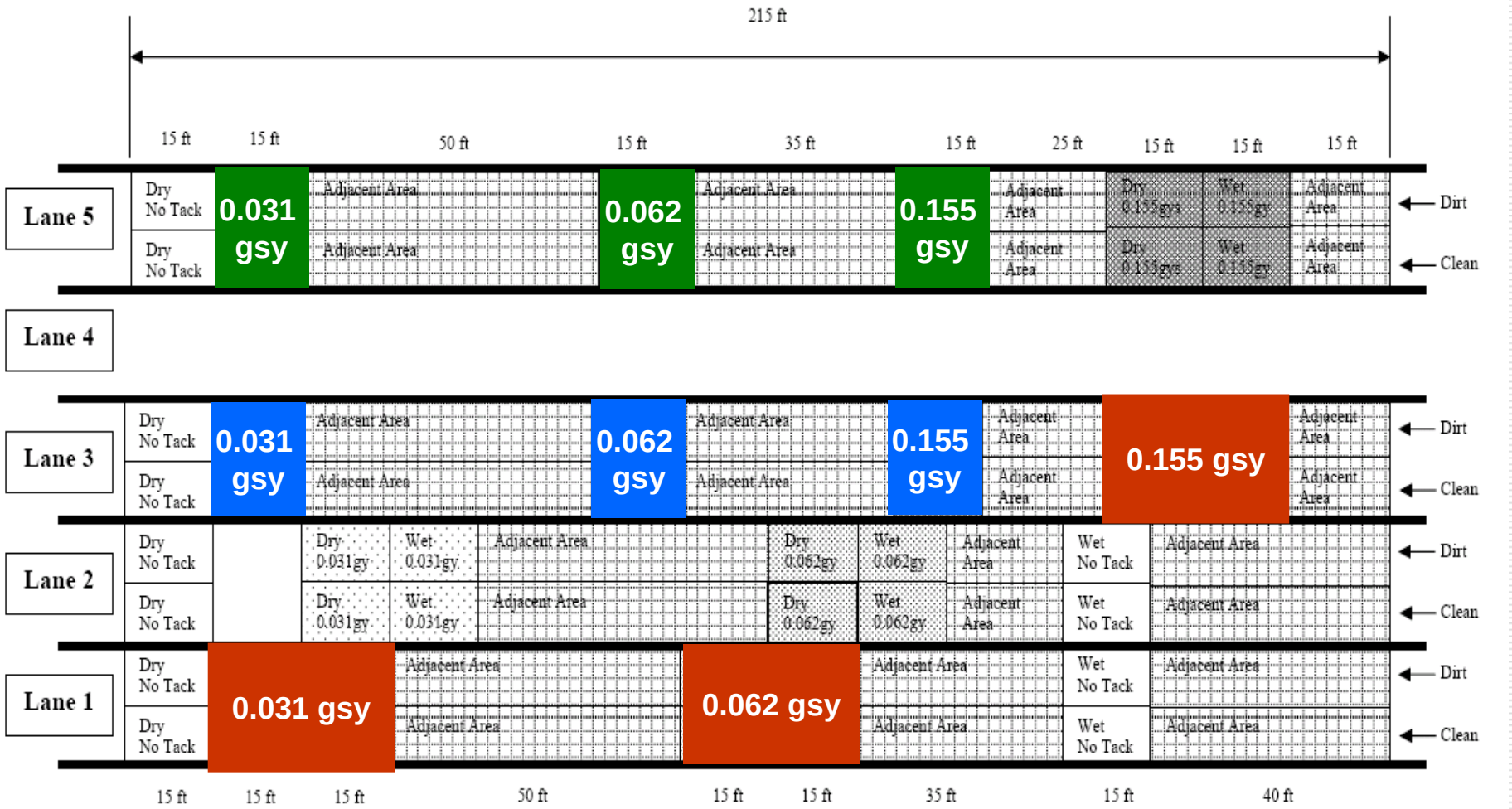
- Field Mixed/Compacted
  - Field test sections
  - LTRC Pavement Research Facility
  - computerized tack coat distributor truck
  - conventional paving equipment

Layout – Existing HMA Surface

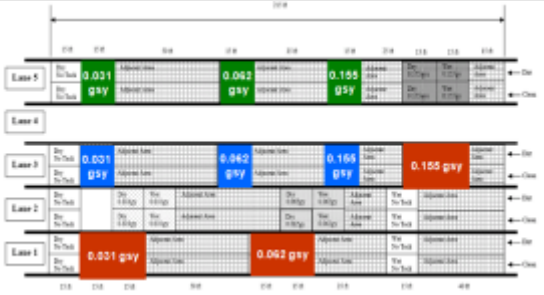
SS-1h 100% Coverage

Trackless 100% Coverage

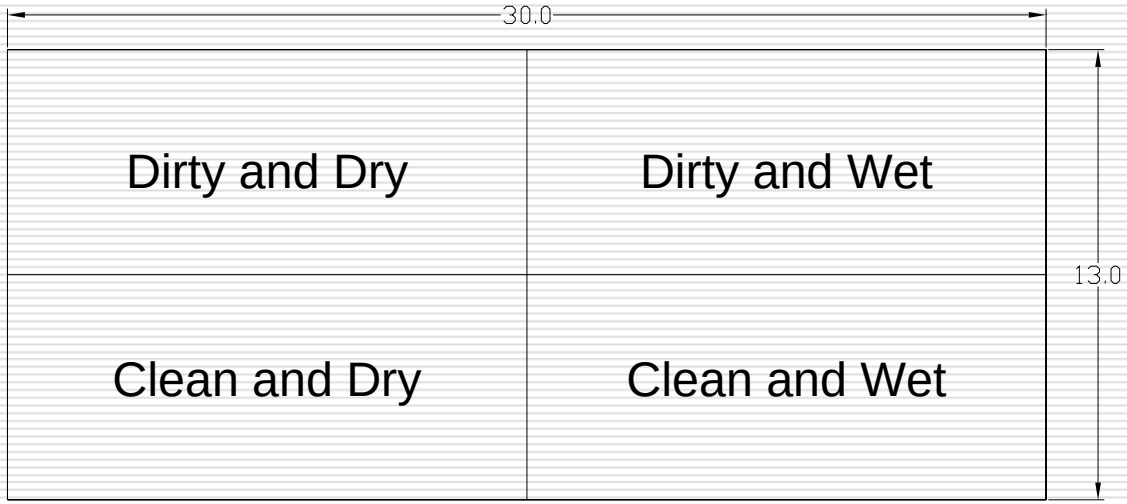
CRS-1 100% Coverage



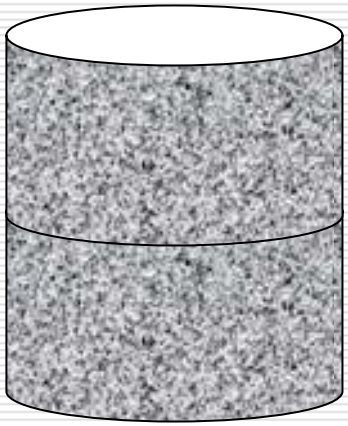
A Typical Section



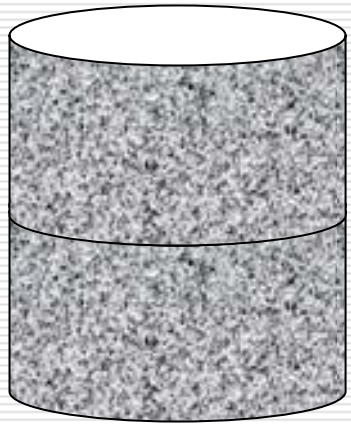
Direction of
Distributor Truck



Clean Sections – Dry vs. Wet

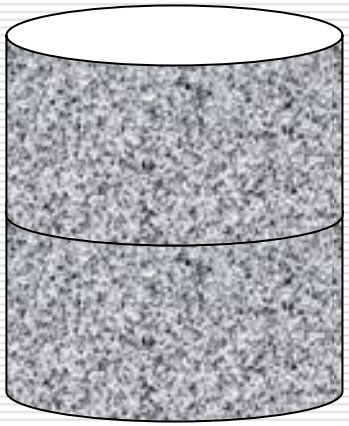


Clean and Dry

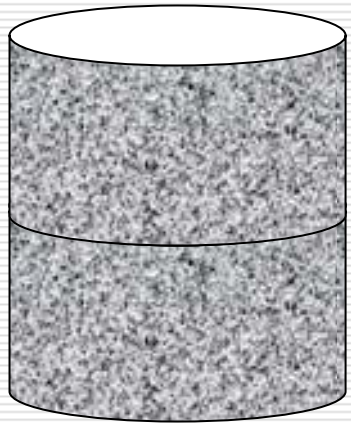


Clean and Wet

Dirty Sections – Dry vs. Wet



Dirty and Dry



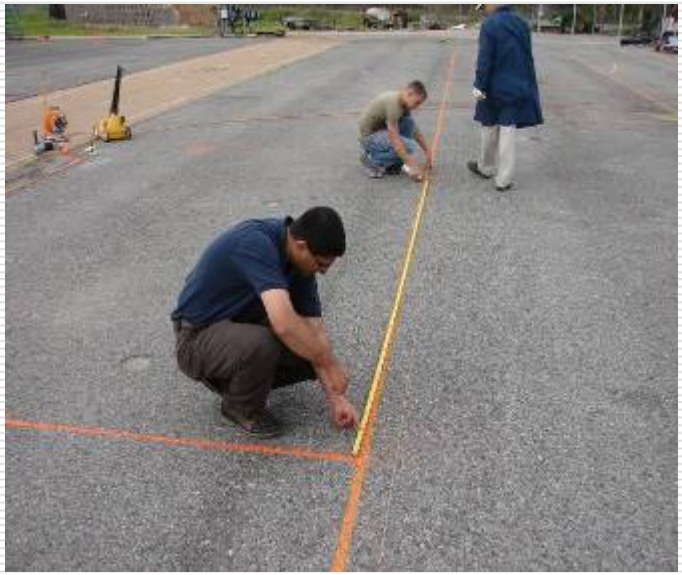
Dirty and Wet

Surface Roughness

- Surface roughness for each lane was measured
- Dynatest 5051 Mark III road surface profiler was used

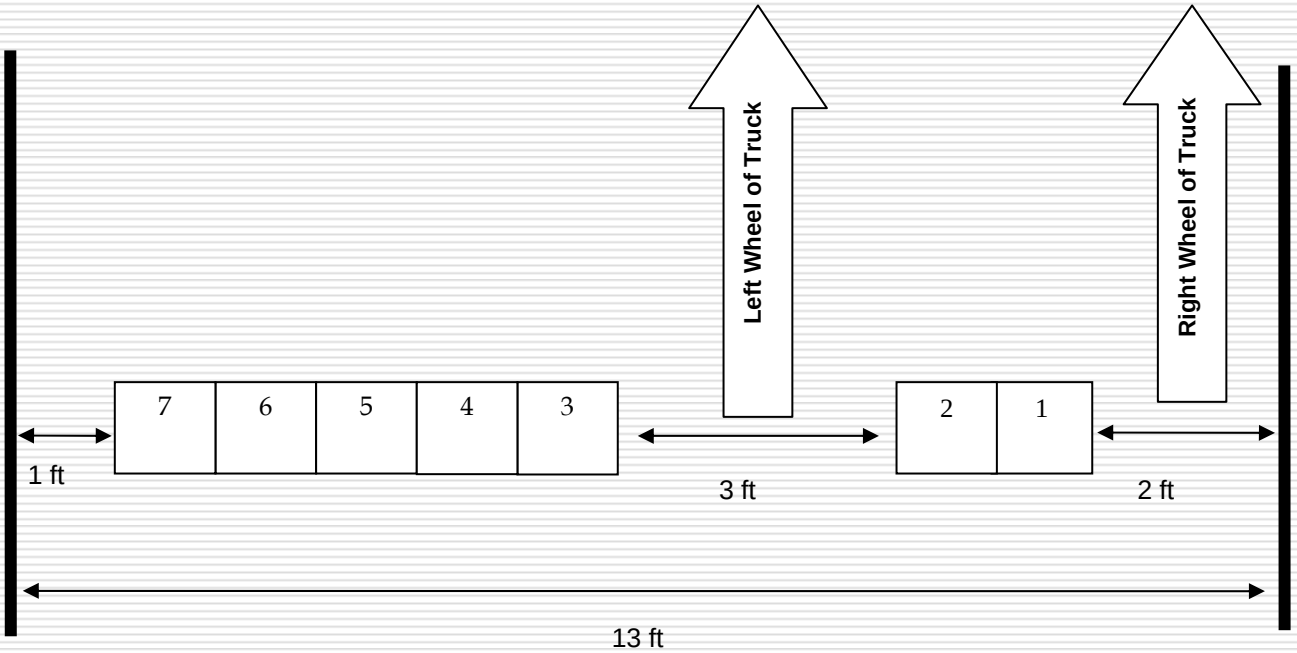
Lane No.	Macro texture Mean Profile Depth, mm
1	1.07
3	1.09
5	1.09

Test Site Preparation



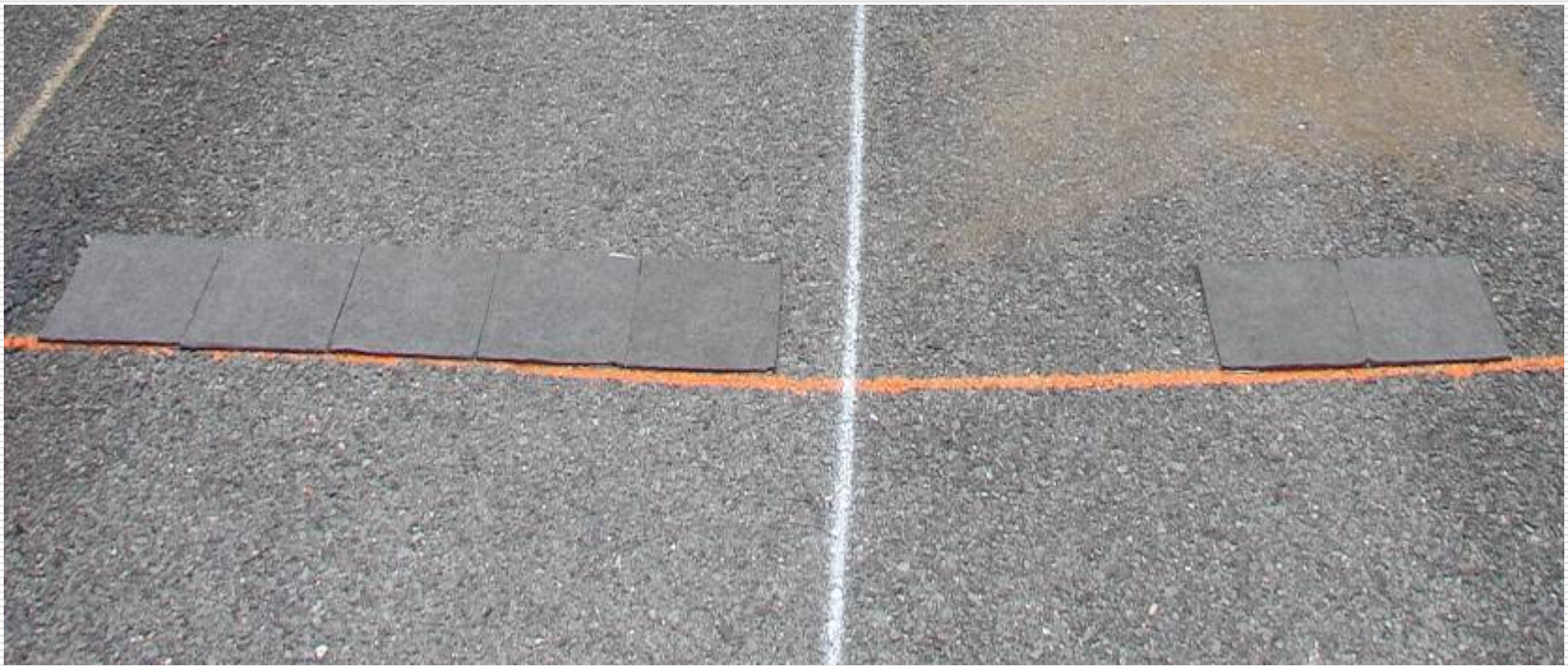
- Section Length and Width are established

Verification of Spray Rates



- ASTM 2995
- One Transverse Direction

Geometric Layout of Pads



Application of Dirt

RATE = 0.34 kg/m²

Equipment

- Computerized Tack Coat distributor truck
- Asphalt Products Unlimited., Inc
- Etnyre, Model 2000

Tack Coat Application

Spray Application of Tack Coat
Existing HMA Surface Type
100% Coverage

0.031 gsy

Low

0.062 gsy

Medium

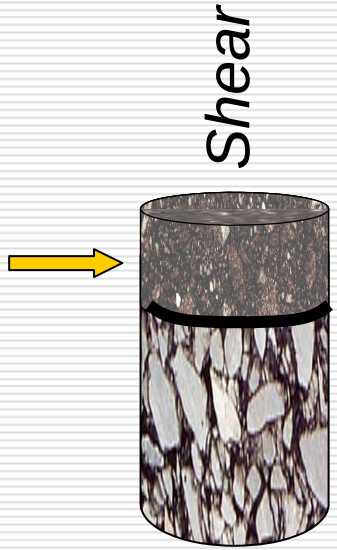
0.155 gsy

High

Application of Water

Rate = 0.27 l/m^2

HMA Overlay Construction



Laying HMA

HMA Overlay Construction

Sections are Re-established

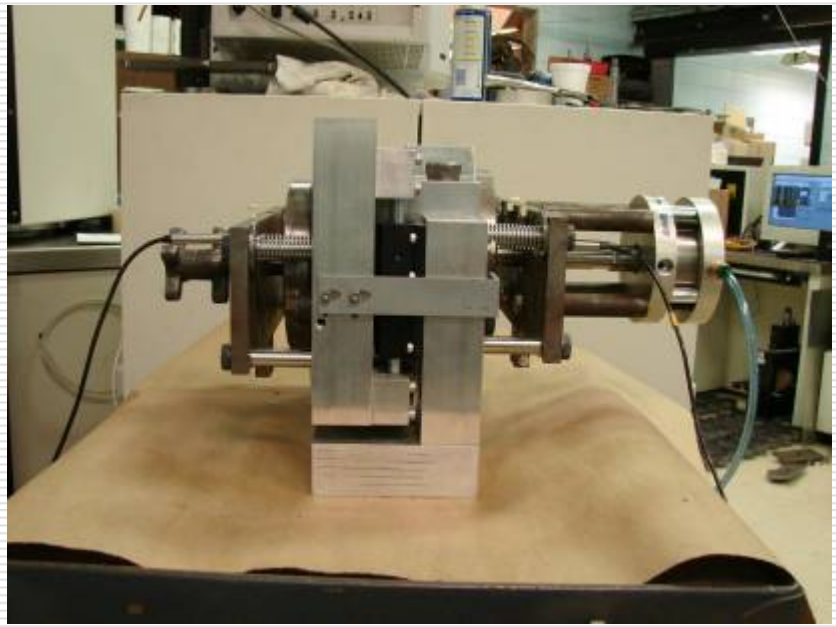
Completion of Overlay Construction

Coring

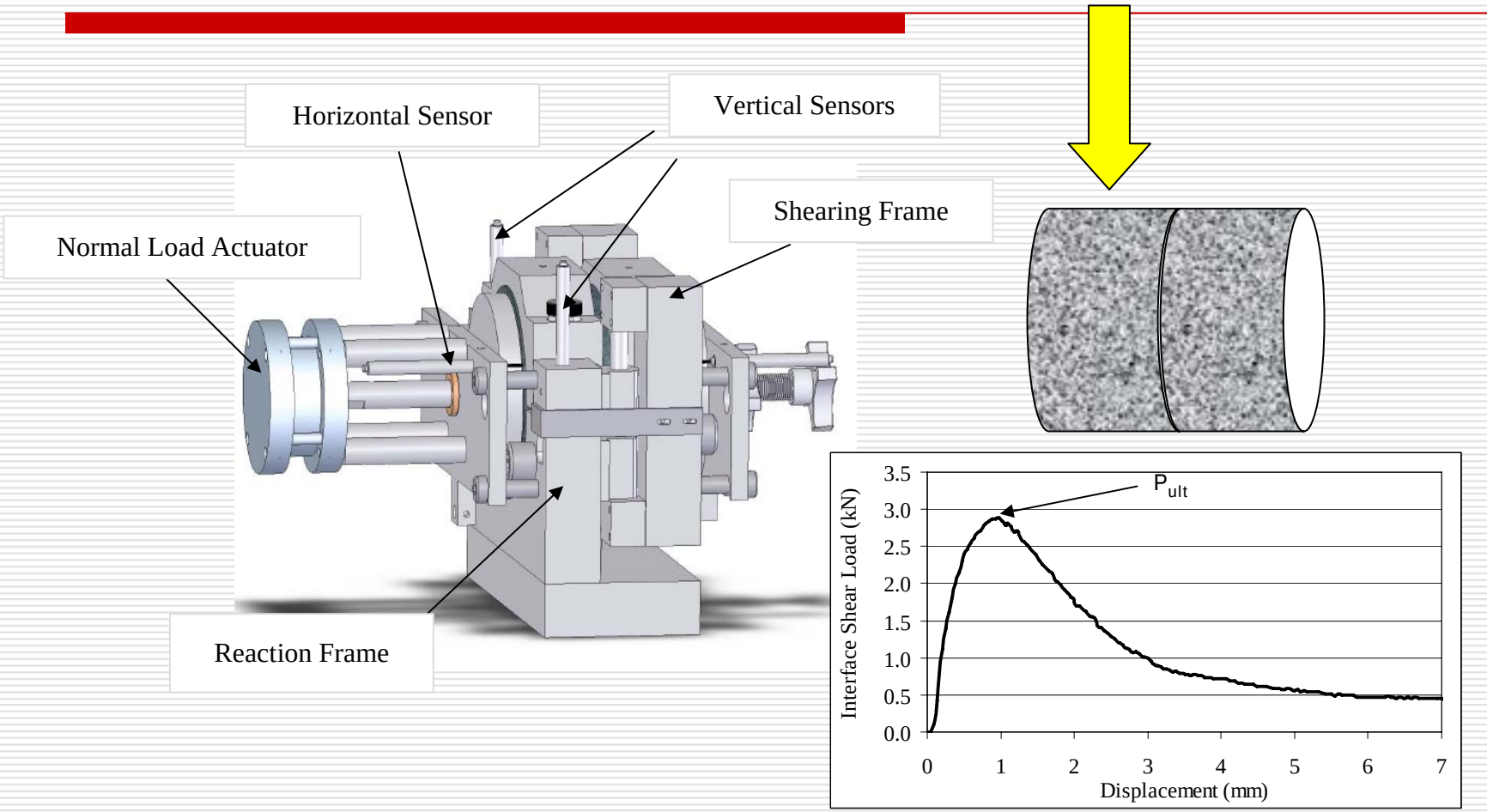
Sample Retrieval and Bagging

Testing Equipment

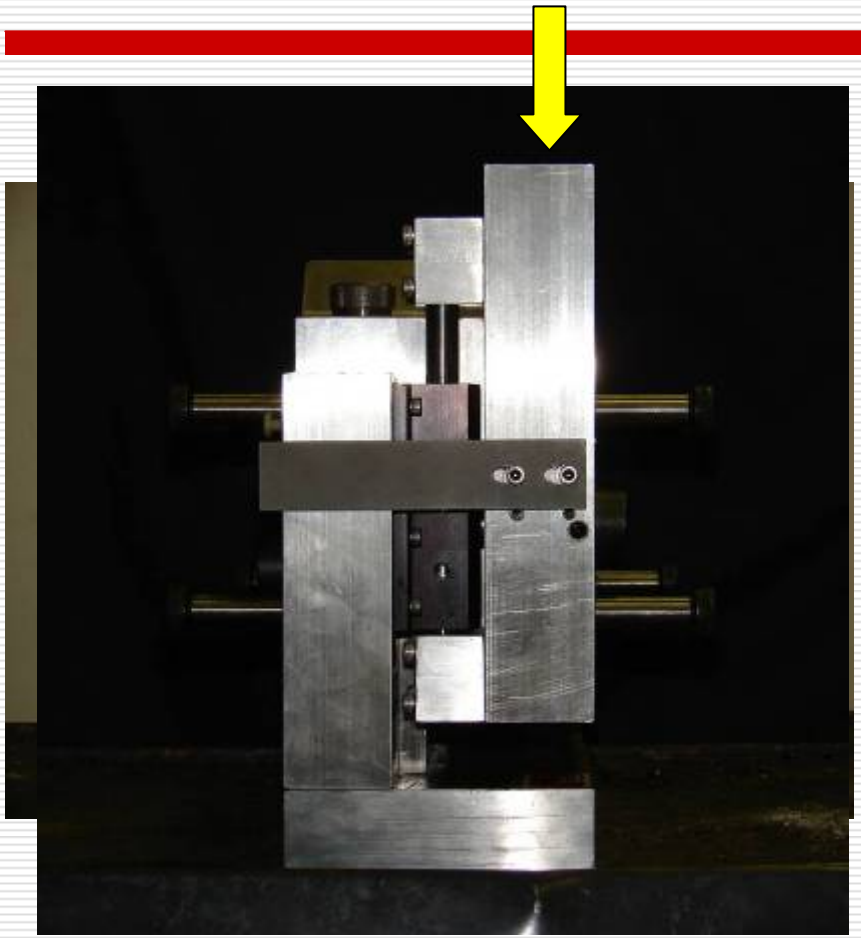
- Developed equipment
  - Louisiana Interlayer Shear Strength Tester (LISST)
  - Interface Bond Strength
  - Shear
- Easy to use
- Portable
- Adoptable to existing load frames
- Reasonable cost
- accommodate both 100 and 150-mm sample diameter

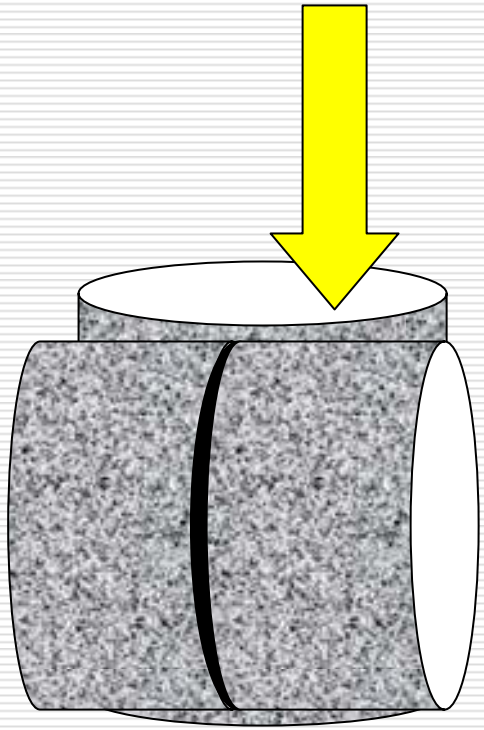


Characterization of Interlayer Bond Strength



Louisiana Interlayer Shear Strength Tester (LISST)

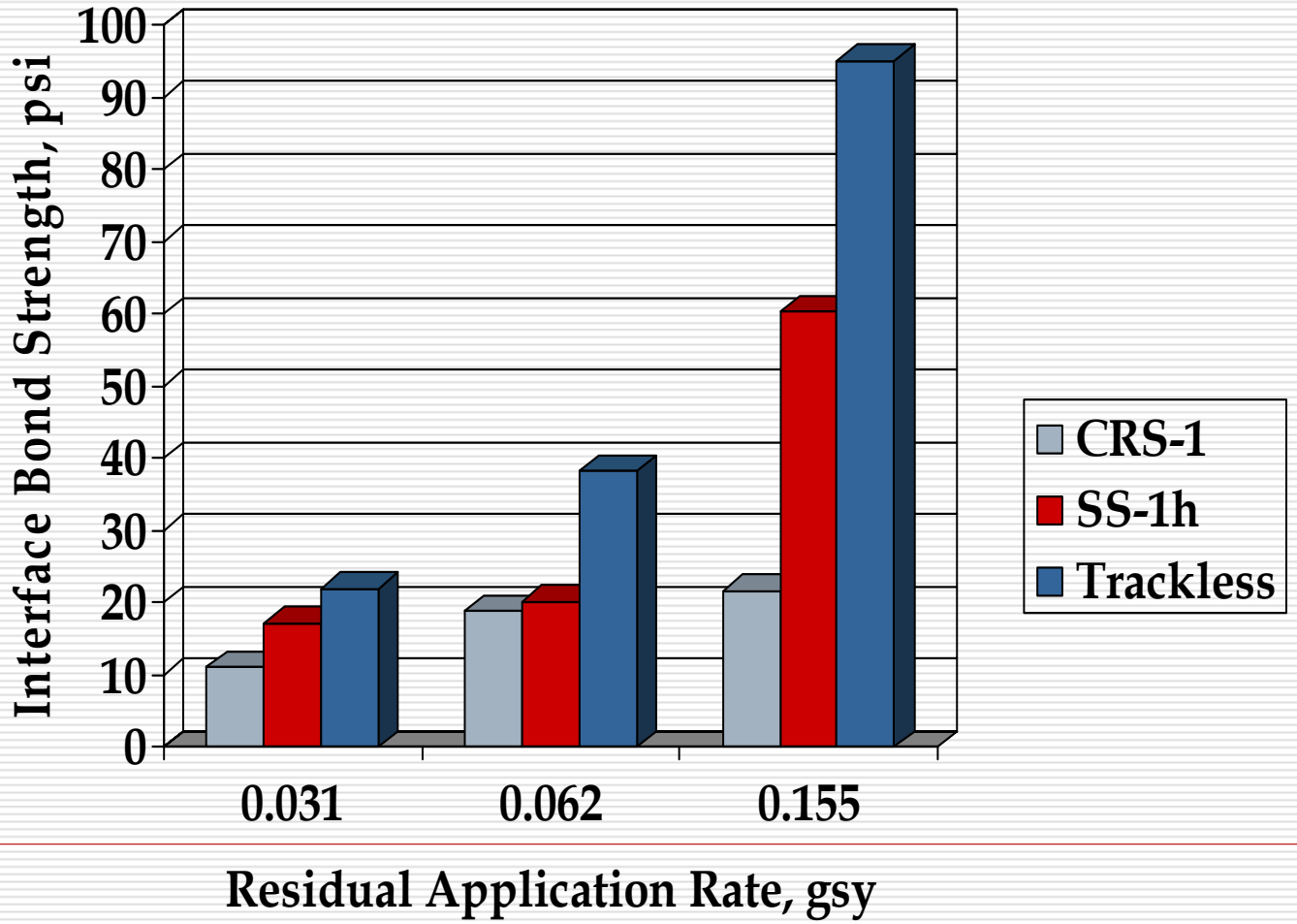




Influence of Material/Application Rate

Surface Condition: Clean/Dry

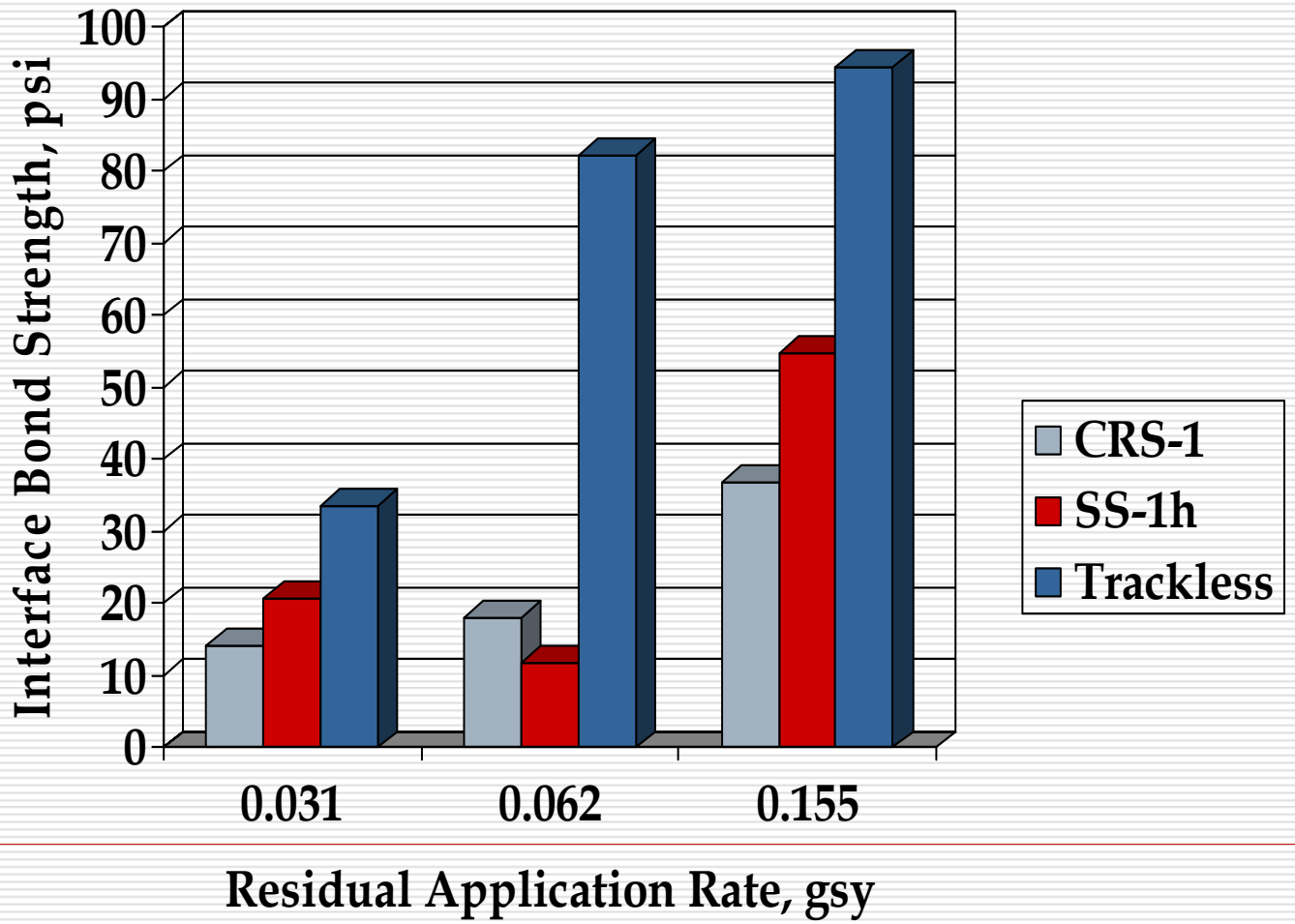
Confinement: 0 psi



Influence of Material/Application Rate

Surface Condition: Dirty/Dry

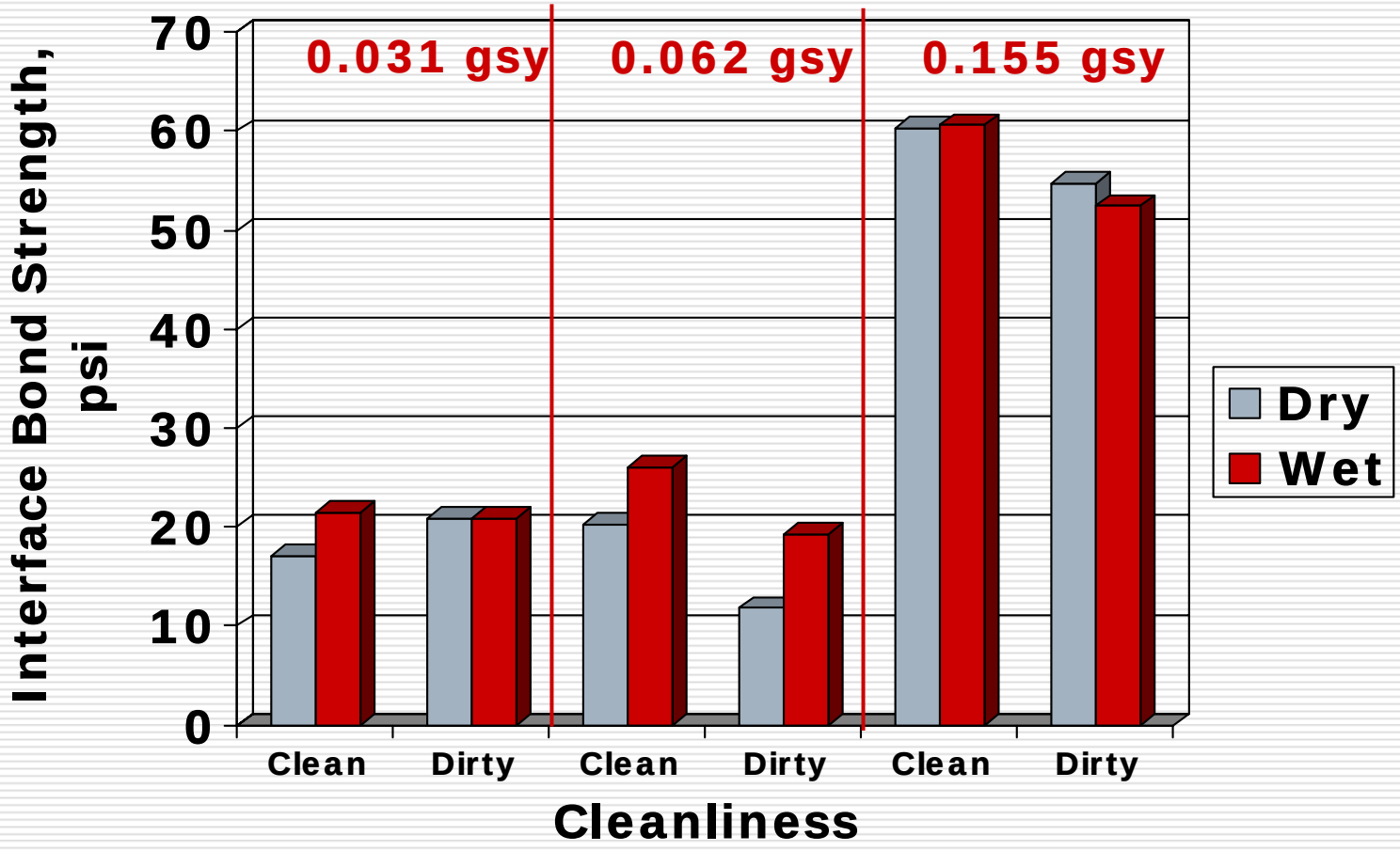
Confining Pressure: 0 psi



Influence of Surface Condition

Tack Coat Material: SS-1h

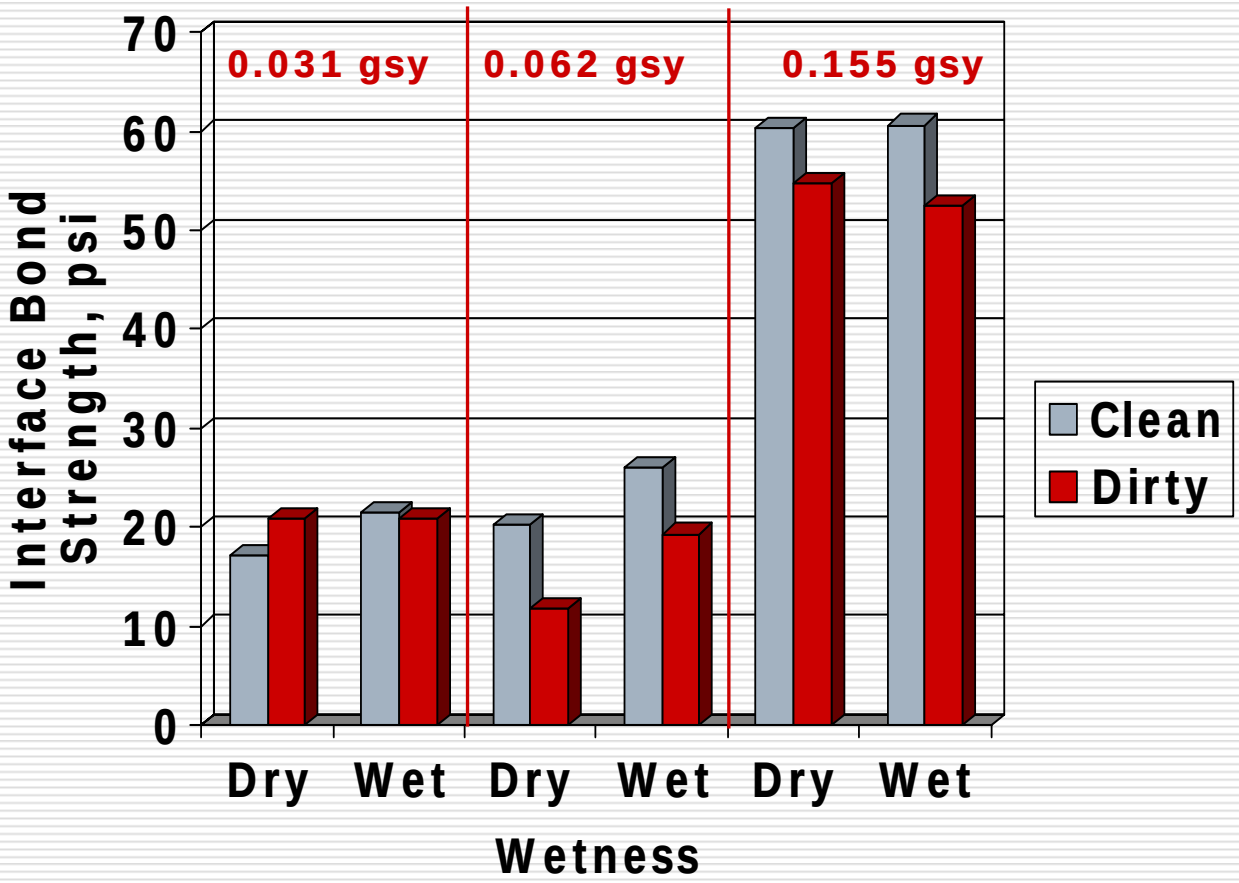
Confinement: 0 psi



Influence of Surface Condition

Tack Coat Material: SS-1h

Confinement: 0 psi

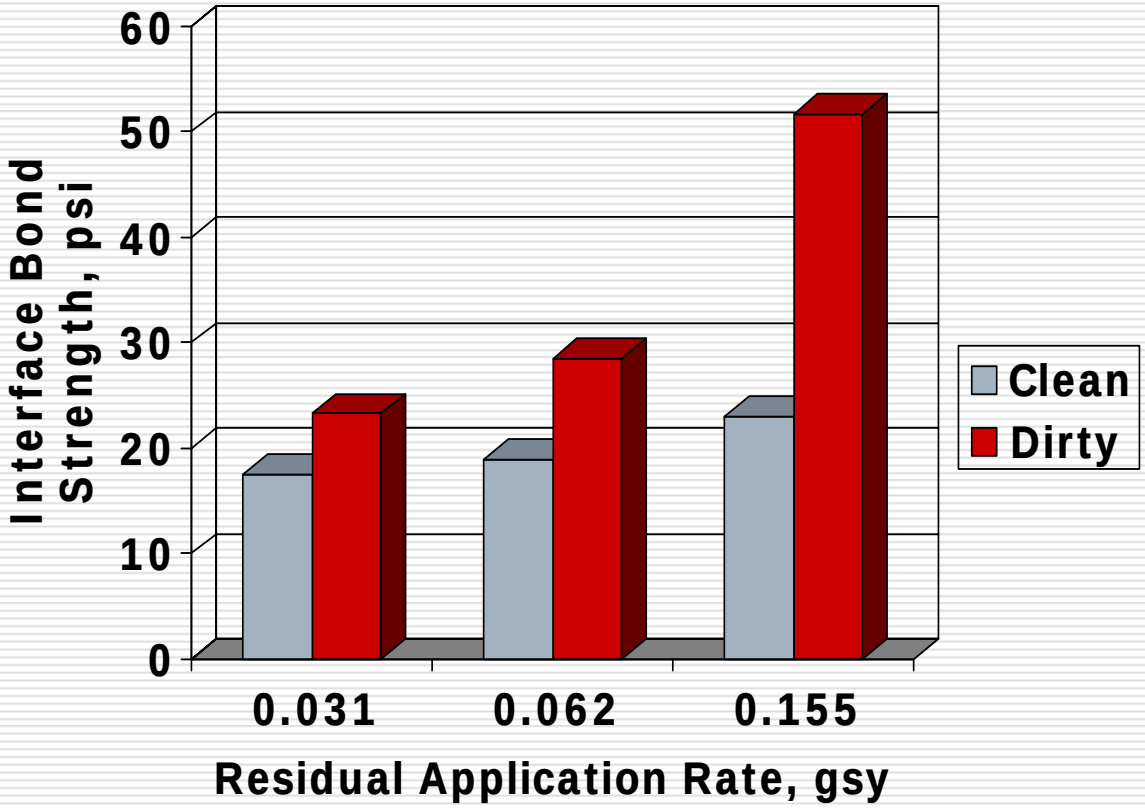


Influence of Surface Condition/Application Rate

Tack Coat Material: CRS-1

Surface Condition: Dry

Confinement: 0 psi

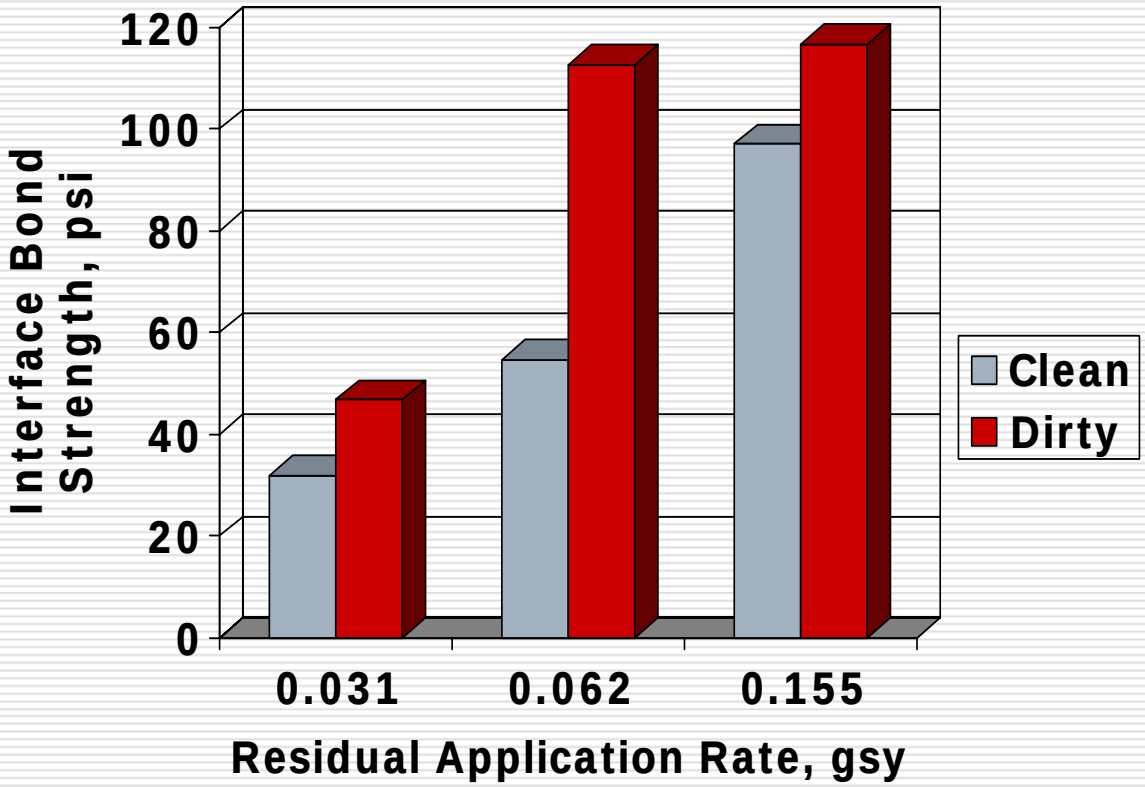


Influence of Surface Condition/Application Rate

Tack Coat Material: Trackless

Surface Condition: Dry

Confinement: 0 psi



Conclusion

- Effect of Tack Coat Material on Interface Shear Strength
  - Trackless is strongest followed by SS-1h and CRS-1
    - All residual application rates
- Effect of Application Rate on Interface Shear Strength
  - Highest strength exhibited at high rate
    - All materials
- Effect of Dirt on Interface Shear Strength
  - Presence of dirt exhibits greater interface strength than clean conditions
  - Some cases, no difference statistically
- Effect of Wetness on Interface Shear Strength
  - No statistical difference between dry and wet conditions
  - Some cases, wetness exhibits higher strength

Acknowledgement

- **NCHRP**
  - **Project 9-40**
    - » **Optimization of Tack Coat for HMA Placement**
  - **Technical Review Panel**
- **LDOTD**
- **Asphalt Products Unlimited**
  - **Distributor Truck**
  - **SS-1h, CRS-1**
- **Coastal Bridge**
  - **HMA**
- **Blacklidge**
  - **Trackless**

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