

MnPAVE Training

Presentation 4

Laboratory Testing

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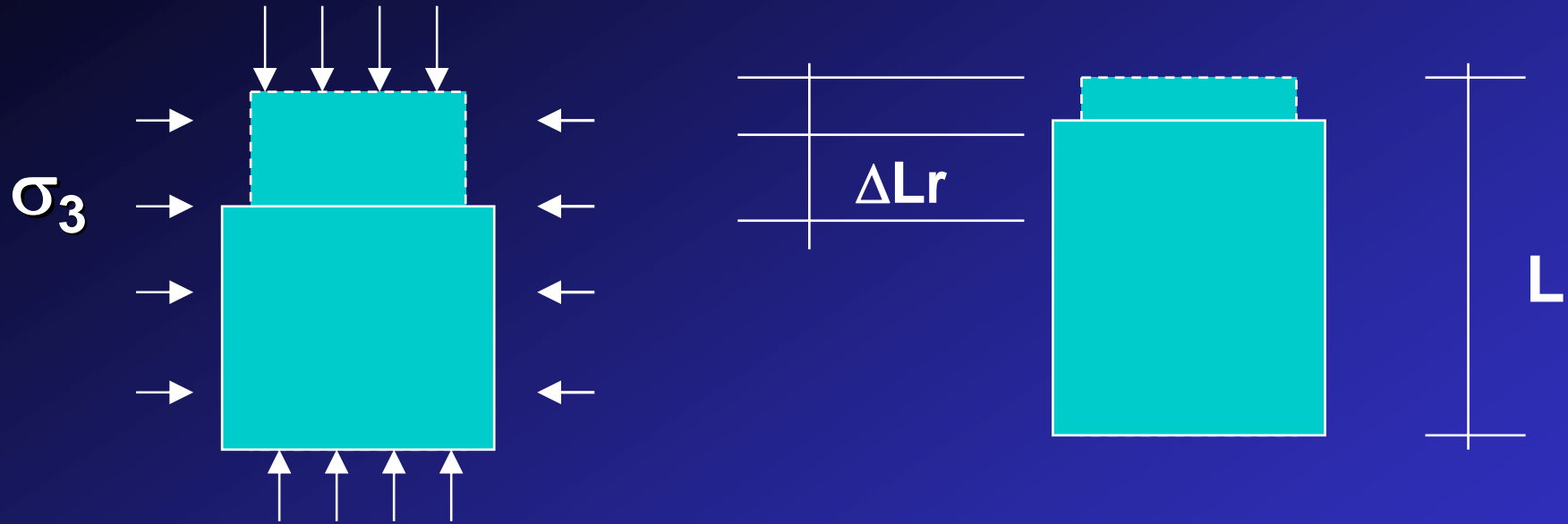
Outline

- Resilient modulus of aggregate base and subgrade soils
- Triaxial strength testing
 - ◆ Allowable stress failure criteria for Class 5 aggregate base

Definition of Resilient Modulus

- Resilient modulus (M_r) is defined as the ratio of the repeated axial deviator stress (σ_d) to the recoverable axial strain (ϵ_a)

$$M_r = \sigma_d / \epsilon_r$$



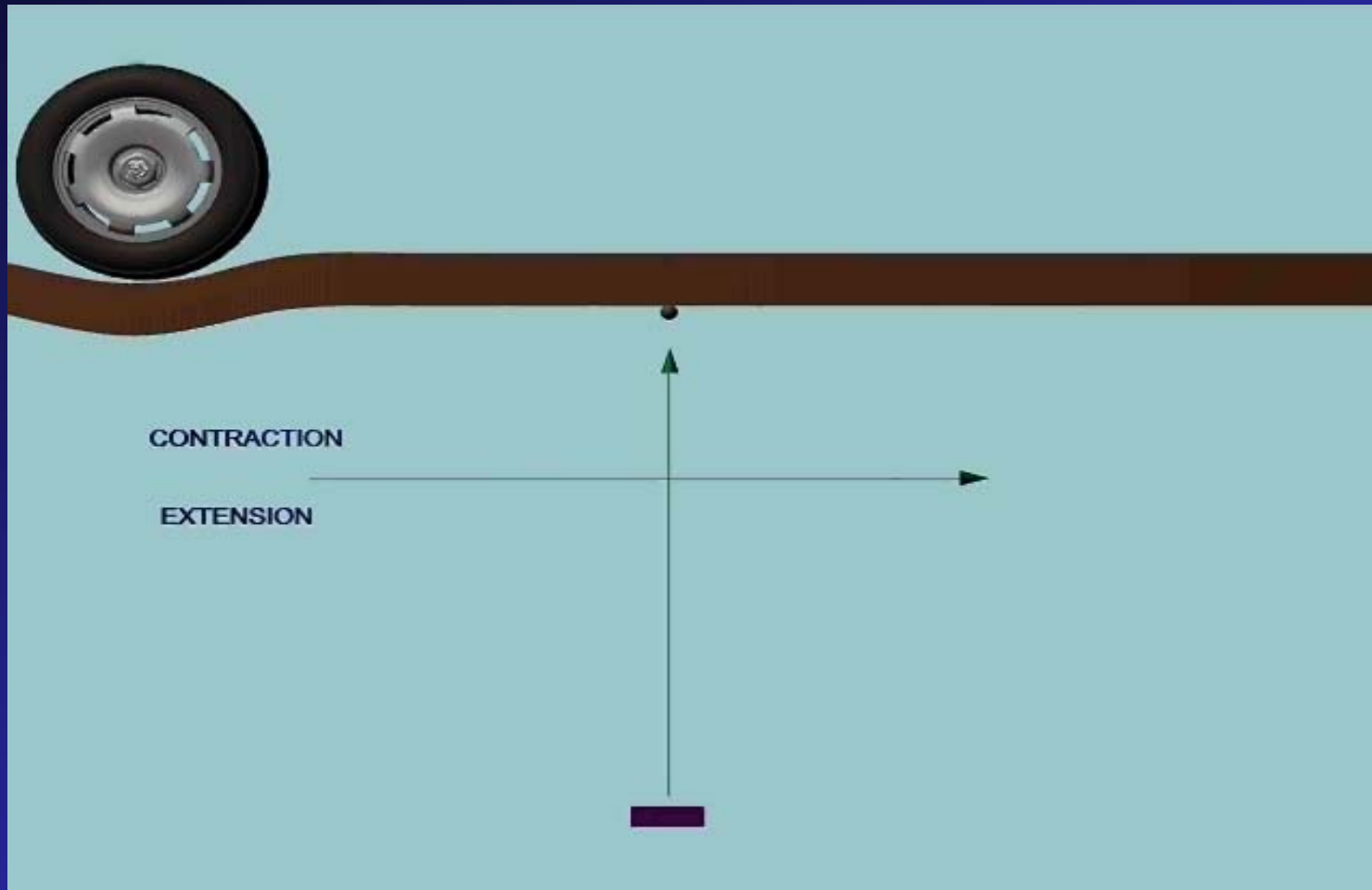
Deviator stress

$$\sigma_d = \sigma_1 - \sigma_3$$

Recoverable strain

$$\epsilon_r = \Delta L_r / L$$

- Mr test is a dynamic test



Laboratory Setup

■ Specimen

◆ For aggregate base

☞ Diameter: 6"; Height: 12"

☞ Stress hardening for granular materials

◆ For subgrade soils

☞ Diameter: 2.8"; Height: 6"

☞ Stress softening for fine grained materials

■ Test protocol: LTPP P-46



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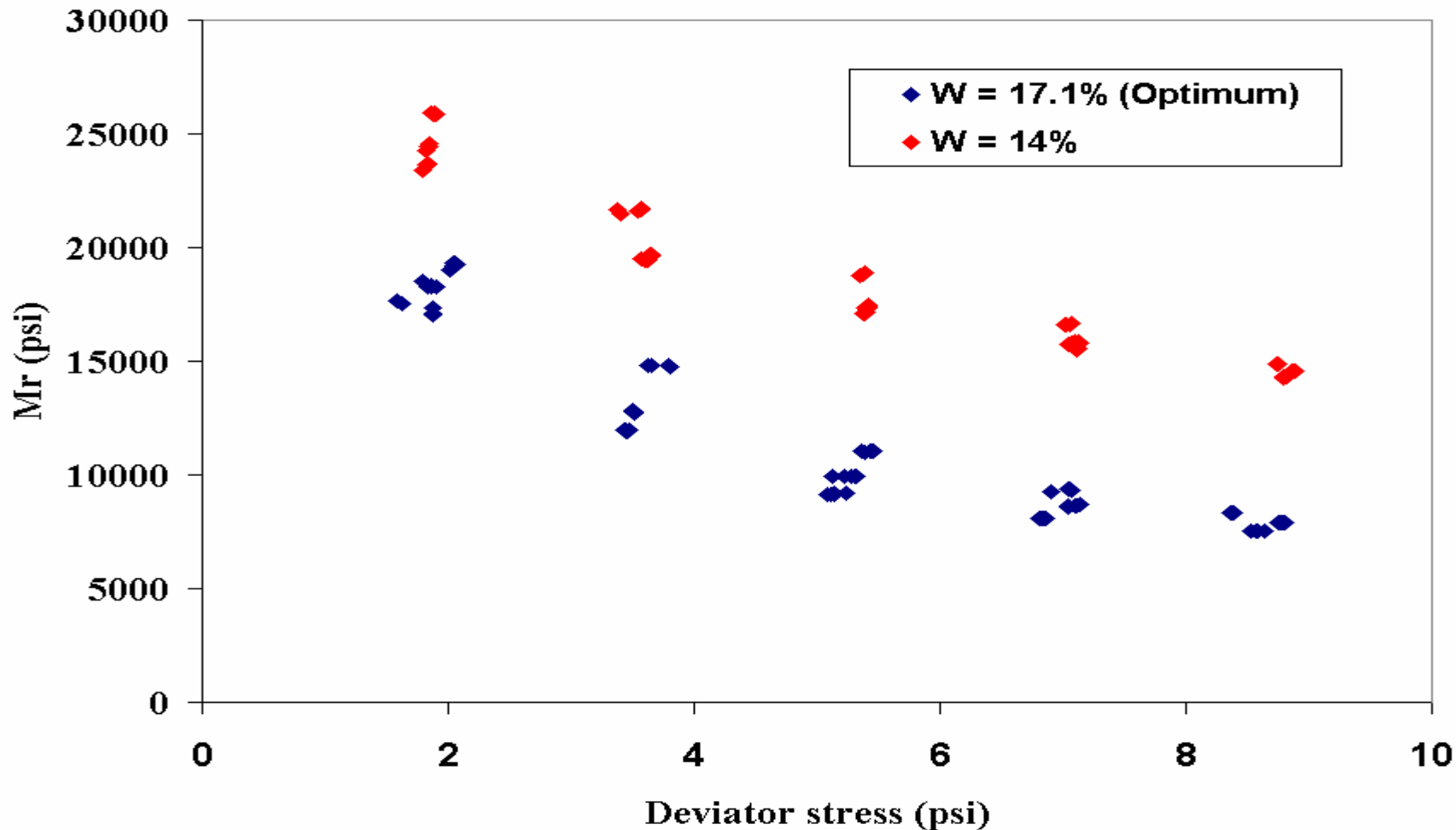


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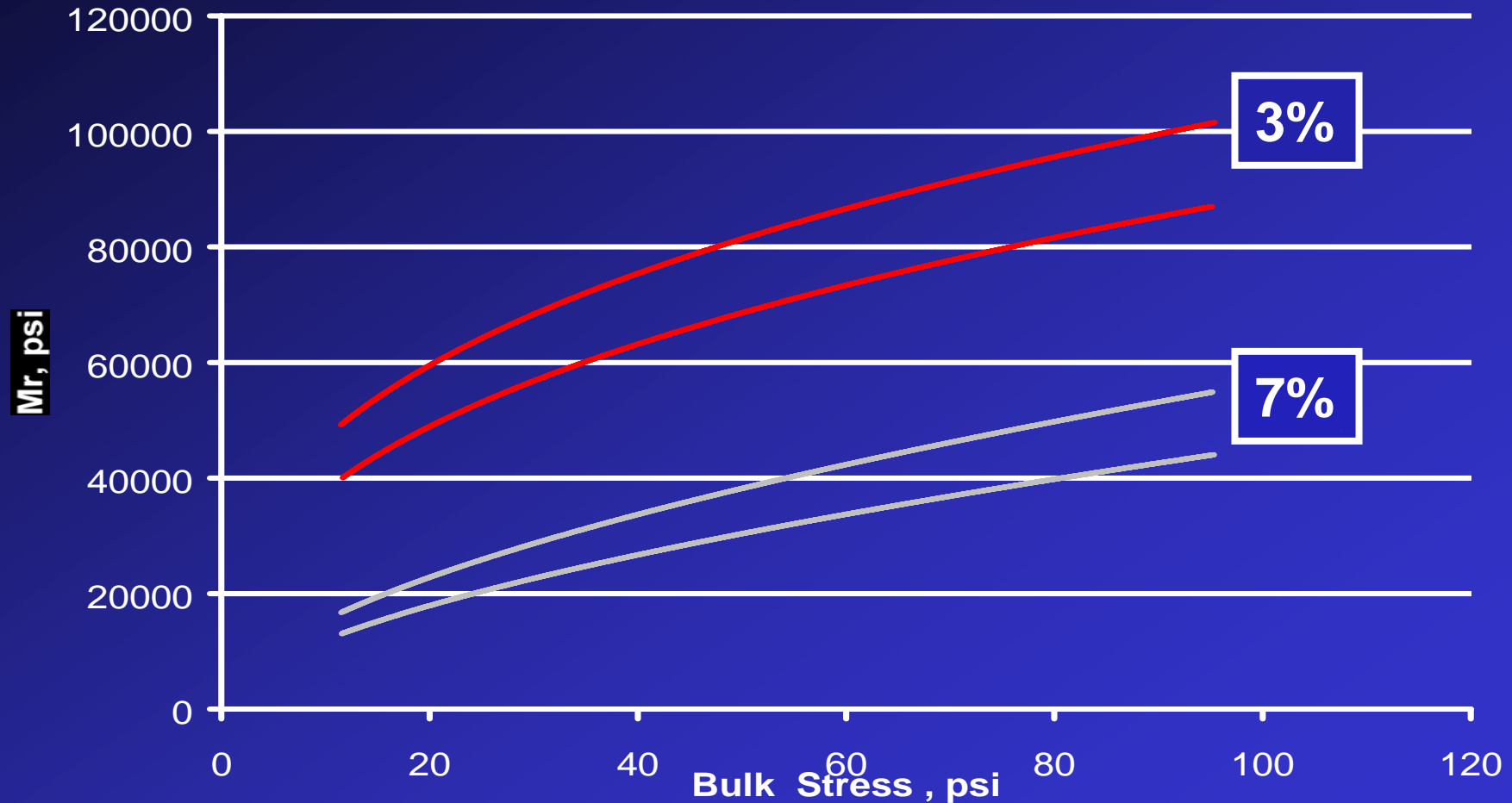
Typical Results

■ Subgrade soils (Clay Loam)



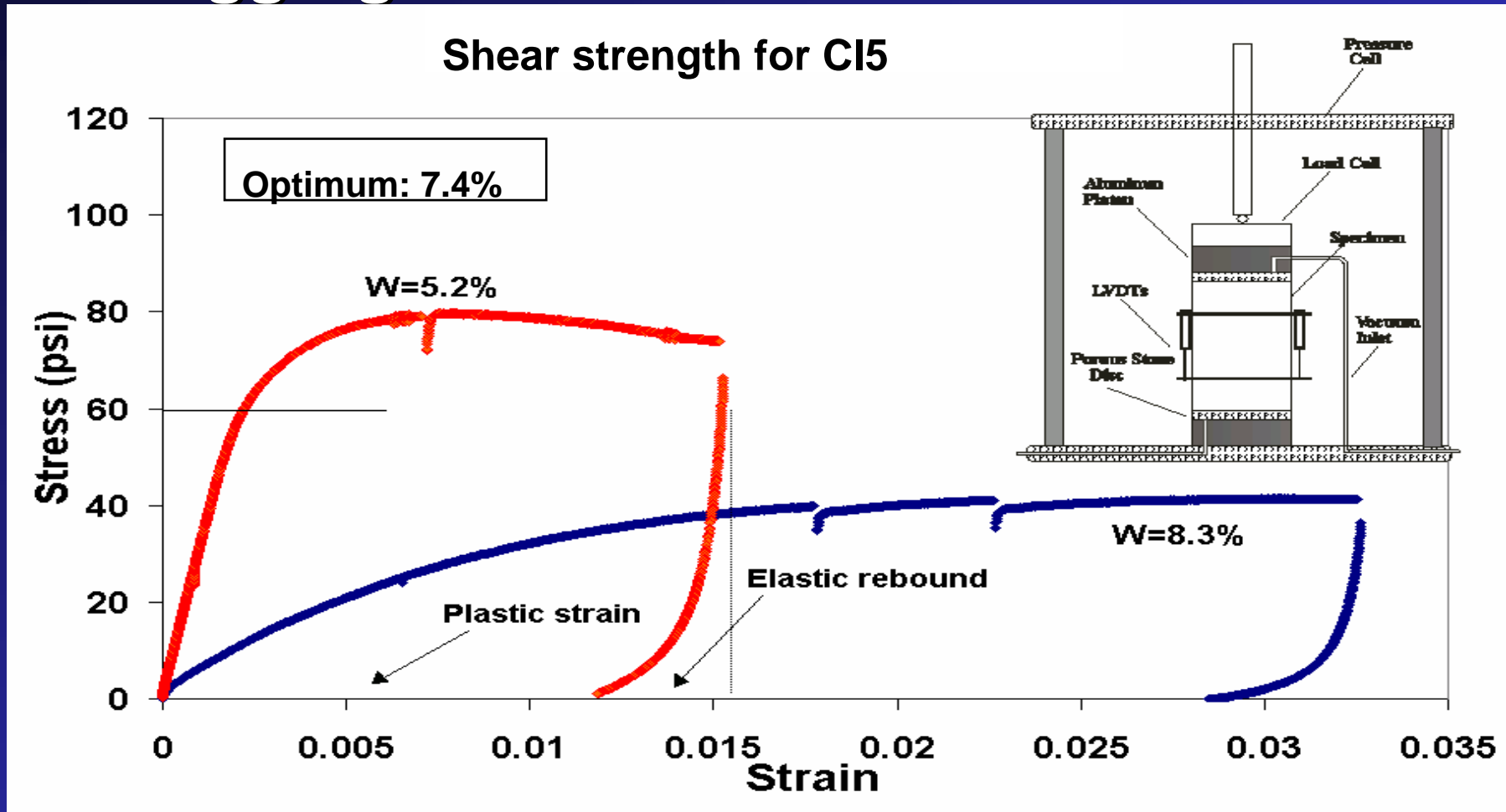
■ Aggregate base

Gradation Effects - Class 5



Triaxial Test

- Obtain allowable stress criteria for aggregate base



■ MnPAVE uses 70% of the failure strength

- ◆ Ensure that the aggregate base does not fail.

- ☞ Currently, Class 5 failure criteria are implemented in MnPAVE. The criteria are based on test results from MnROAD Class 5 Special.

- ☞ Additional criteria for other materials will be added.

■ Minimum HMA thickness

- ◆ The maximum allowable aggregate base stress equals 70% of the failure strength.



Summary

- Resilient modulus is used to characterize aggregate base and subgrade soil in M-E design.
- Moisture content has great effects on material property.
- Gradation has effects on Mr.
- Minimum HMA thickness can be obtained by using allowable stress criteria in aggregate base (Class 5).