

MnPAVE Training

Presentation 1

Introduction

Dave Van Deusen

Spring 2002



***MnPAVE – Mechanistic-Empirical
Thickness Design Procedure for
Flexible Pavements***

Local Road Research Board

University of Minnesota

Minnesota Department of Transportation



Mn/DOT

Office of Materials and Road Research



Instructors

- **Bruce Tanquist**
- **Dr. Shongtao Dai**
- **Tom Nelson**
- **John Siekmeier**
- **Dr. Gene Skok**
 - ◆ U of Mn, Professor
- **Dave Van Deusen**



Outline of Presentation

■ Brief Demo	Dave	10 min
■ Intro	Dave	15 min
■ Background	Dai	15 min
■ Climate and HMA Inputs	Bruce	30 min
■ Break		30 min
■ Materials and Testing	John	30 min
■ Traffic	Tom	30 min
■ Best Practices for Pavement Design and Construction	Gene	30 min
■ Lunch		60 min
■ MnPAVE Demo	All	60 min
■ Workshop	All	60 min



Course Format

- Let's keep it informal
- Ask questions



Acknowledgements



Purpose of Pavement Design –

- To provide a structure that protects the subgrade and supports both traffic and environmental loads for a given period at a specified level of serviceability
- Design considerations
 - ◆ Structural
 - ◆ Serviceability
 - ◆ Frost protection



A Different Process

■ Current procedure

◆ Considers

☞ subgrade soil R-value, traffic, rule-of-thumb materials properties

◆ Relates to ride

■ M-E procedure

◆ Considers

☞ Modulus of all layers, base strength, repeated load damage in HMA and base/subgrade

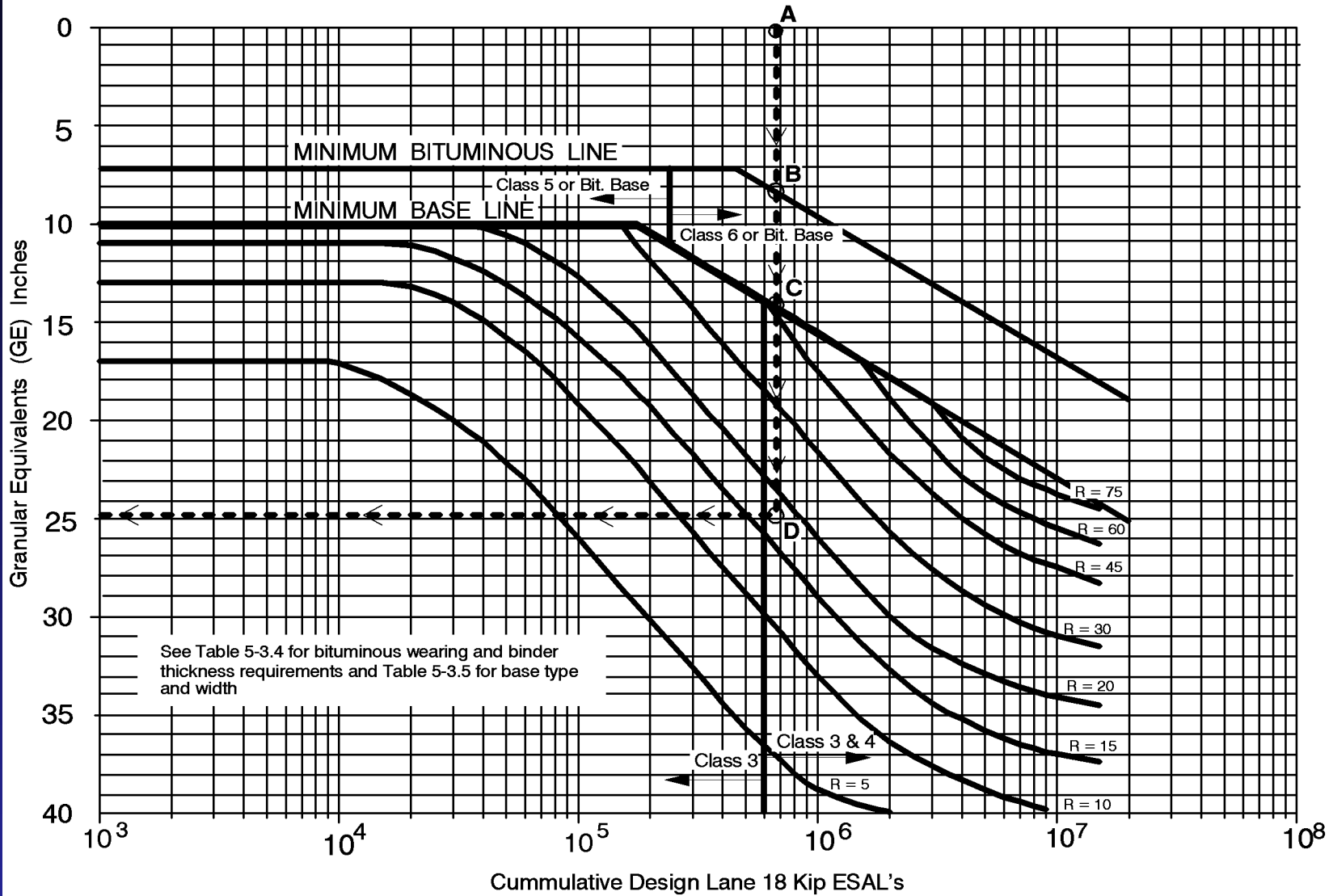
◆ Relates to structural distresses – cracking, rutting



Motivation

- **Why Mechanistic-Empirical Design?**
 - ◆ Our current procedures cannot adequately address issues facing us today

Figure 5-3.6 Bituminous Pavement Design Chart (Aggregate Base)



BITUMINOUS PAVEMENT DESIGN CHART (AGGREGATE BASE)

Our Current Design Procedures

- **Predominantly empirical**
- **Depend on conditions remaining the same**
- **Limited failure modes**
- **Primary focus on structural design**
 - ◆ **Pavement evaluation for rehab is difficult, if not impossible**



Mechanistic-Empirical Design -the potential

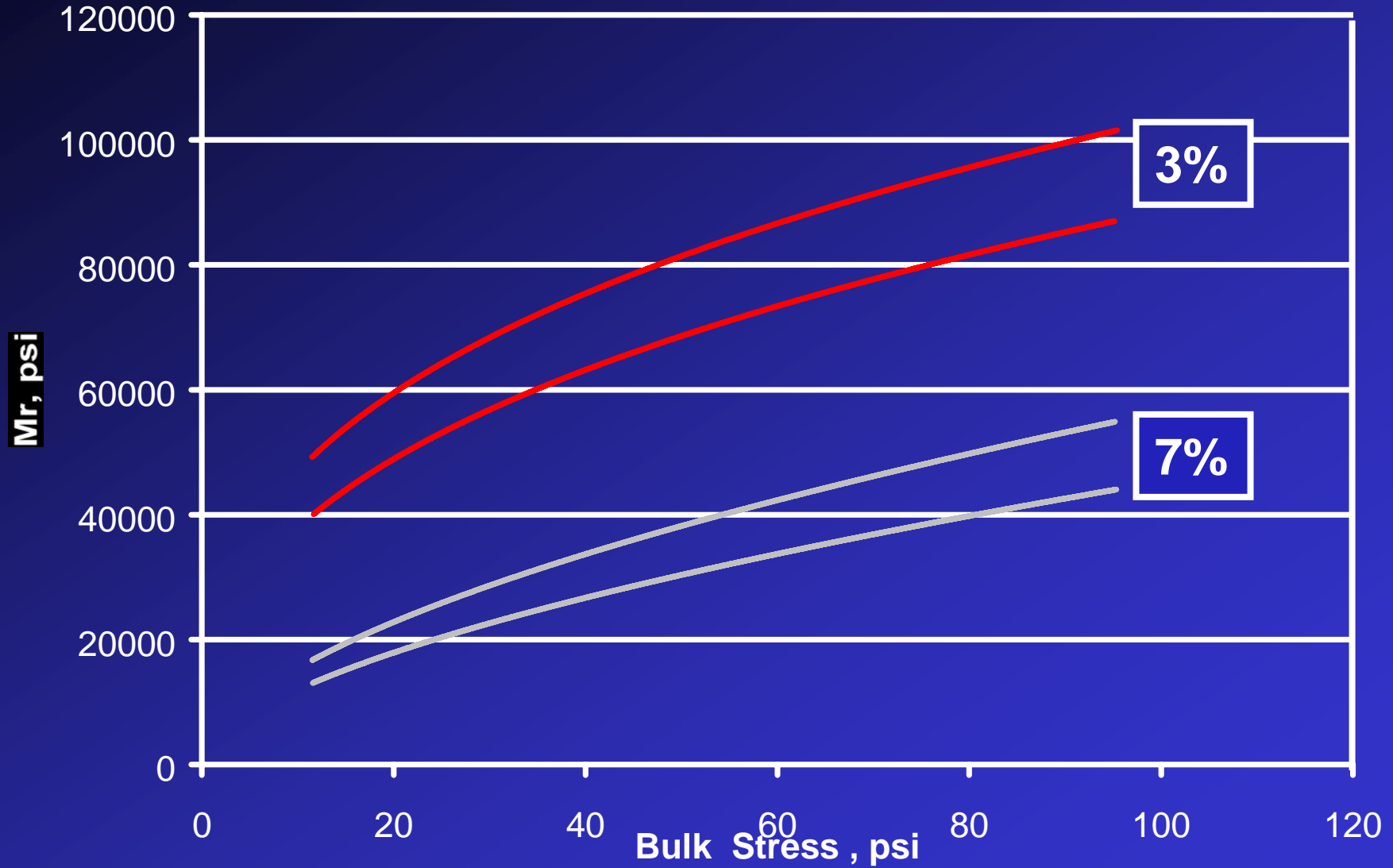
- Ability to adapt to different distress modes
- Allow better materials tests and characterization
 - ◆ Quantify and show benefit of improved materials and specifications
- Adapt to changing load limits and configurations
- Achieve agreement between structural and materials design

Mechanistic-Empirical Design -the challenge

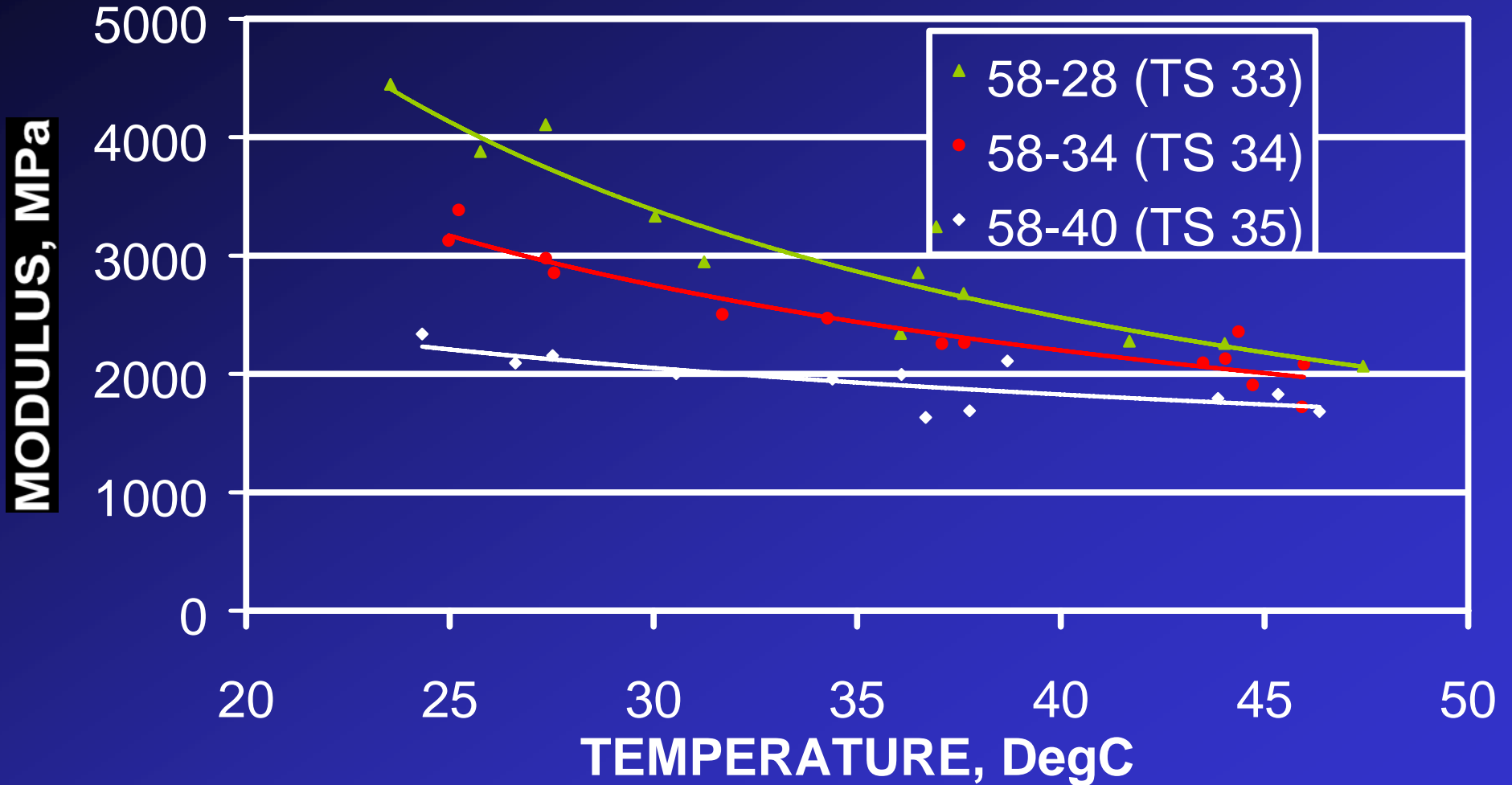
- Increased complexity
- More testing will be required
- Change



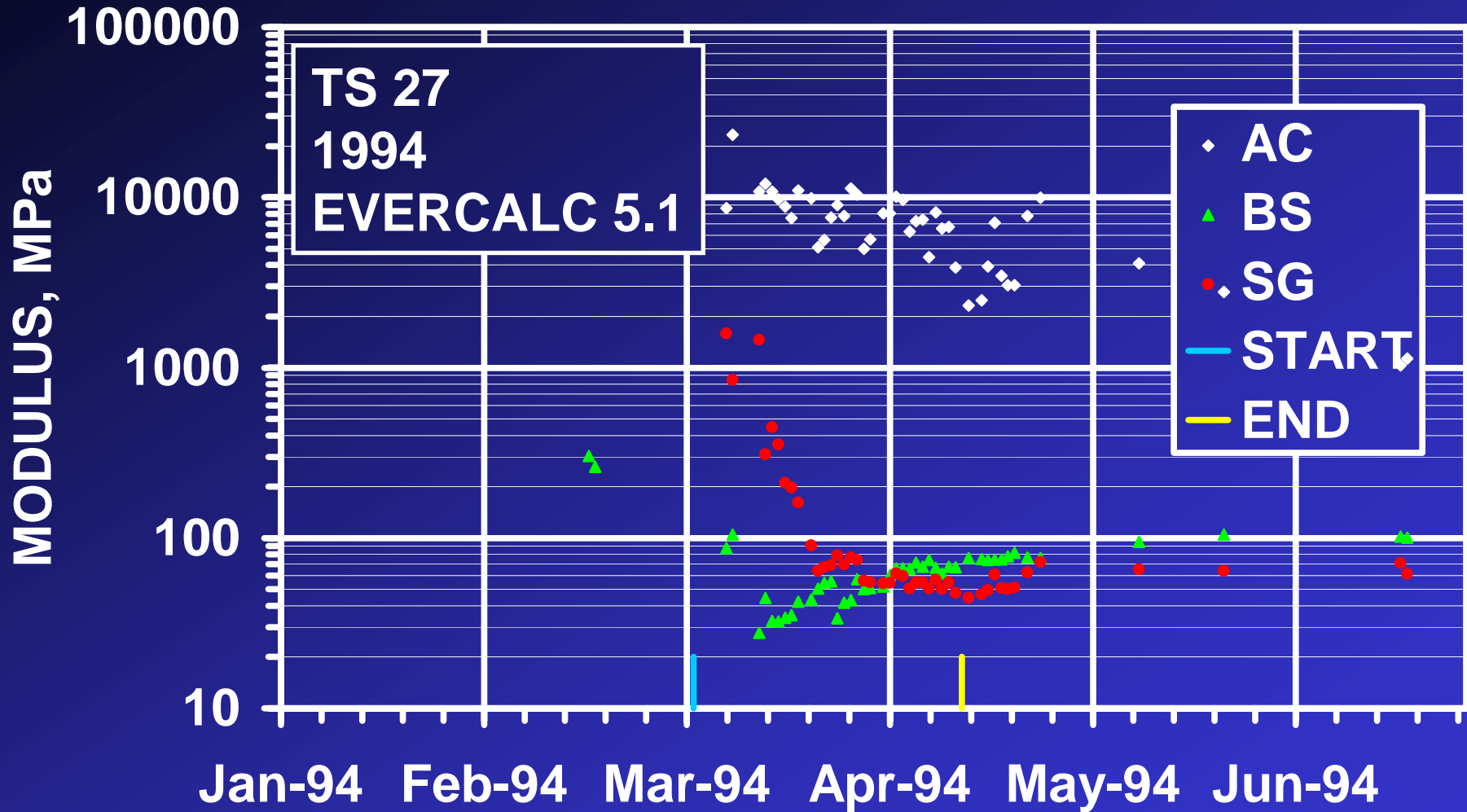
Gradation Effects - Class 5



HMA MODULUS vs. TEMPERATURE



VARIATION IN MODULUS



Previous Work

- **Mn/DOT - Research at Mn/ROAD**
 - ◆ In-place properties, seasonal testing, performance monitoring (1991-present)
 - ◆ SLR work
- **U of Mn -**
 - ◆ ROADENT, Reliability projects (1999)
 - ◆ Seasonal Study (2000)
 - ◆ Low-Volume Road Best Practices (in progress)
- **U of Illinois -**

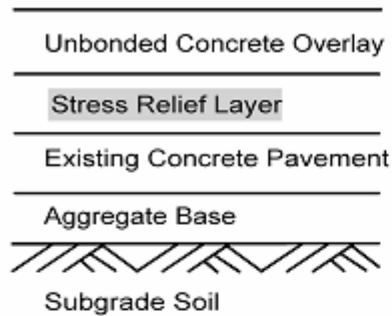
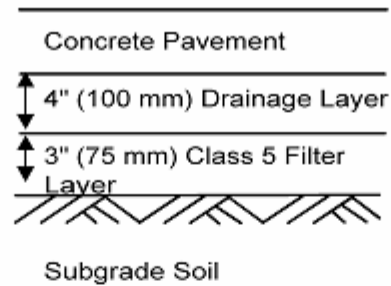
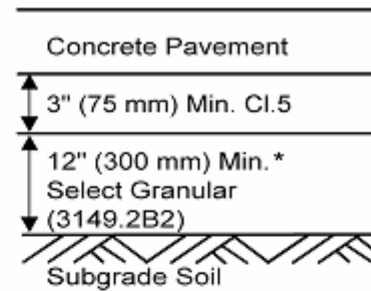
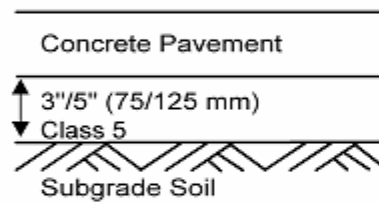
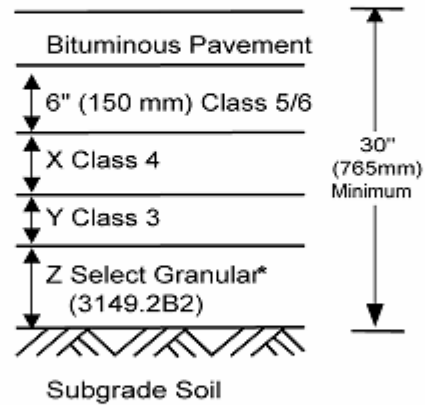
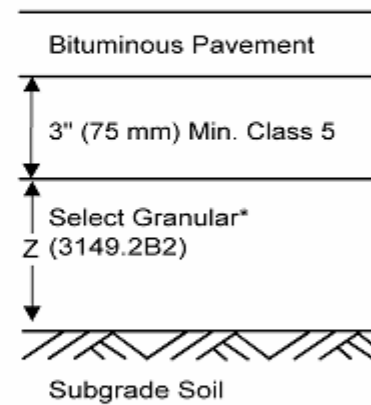
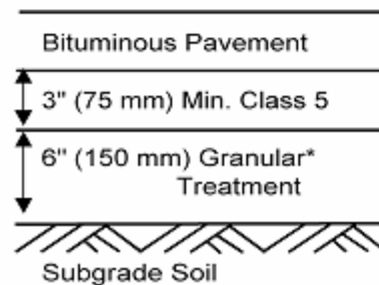


Course Objectives

- **Understand fundamentals of M-E design, its theory, development**
- **Introduce MnPAVE and its components**
 - ◆ Inputs
 - ◆ Evaluate output including stresses and strains
 - ◆ Get hands-on experience
- **Provide enough info for user's to be comfortable using the program**

Scope

- MnPAVE currently applicable for new or re-construction
- Mn/DOT Tech Memo on Pavement Selection
- No full-depth (deep strength) alternative at this point

No. 1 (i)(i)**No. 2** (a)(b)(j)**No. 3** (a)(e)(i)(j)**No. 4** (a)(c)(i)(j)**No. 5** (d)(f)(i) (BAB)**No. 6** (d)(e)(g)(i) (BDS)**No. 7** (d)(e)(h)(i) (BAB/BDS)

* Refer to Select Granular Subgrade Treatments, Figure 2.
(a), (b), (c),..., (j) Refer to Design Option Notes

Reference Materials

■ In the classroom

- ◆ Program
- ◆ Manual
- ◆ Slide show

■ In your office

- ◆ MRR website: www.mrr.dot.state.mn.us
- ◆ MnPAVE help file
- ◆ Contact one of us



The Future

- **NCHRP 1-37a, 2002 Guide**

- ◆ The future of M-E?
- ◆ Serviceability, ride

- **Rehab design options**

- ◆ FDR, CIR
- ◆ Crack/seal, rubblize
- ◆ M/O



We Don't Have all the Answers, So...

- **When you leave please help us further develop the procedure by:**
 - ◆ Using the program for your projects
 - ◆ Provide us with feedback on the results
 - ☞ Design Summary printout
- **Contact us with your questions and comments**



Let's Get Started

■ Recap

- ◆ Ask questions
- ◆ Use the program to obtain experience with it
- ◆ Provide us with feedback
 - ☞ Design Summary output
- ◆ Contact us with your questions

■ Questions before we start?

