

**Development of a Simple Test to
Determine the Low Temperature
Creep Compliance of Asphalt Mixtures
NCHRP-IDEA 133**

Idea Behind this Research Effort

- Can a simpler test device and method be developed to “replace” IDT?
- The Bending Beam Rheometer (BBR) used to test asphalt binders appeared to be the “ideal” candidate
 - Relatively cheap: ~\$20k
 - No need of expensive strain gauges
 - Excellent repeatability
 - Use of small specimens
 - **Most laboratories have BBR equipment and trained personnel to use it**

IDT vs. BBR

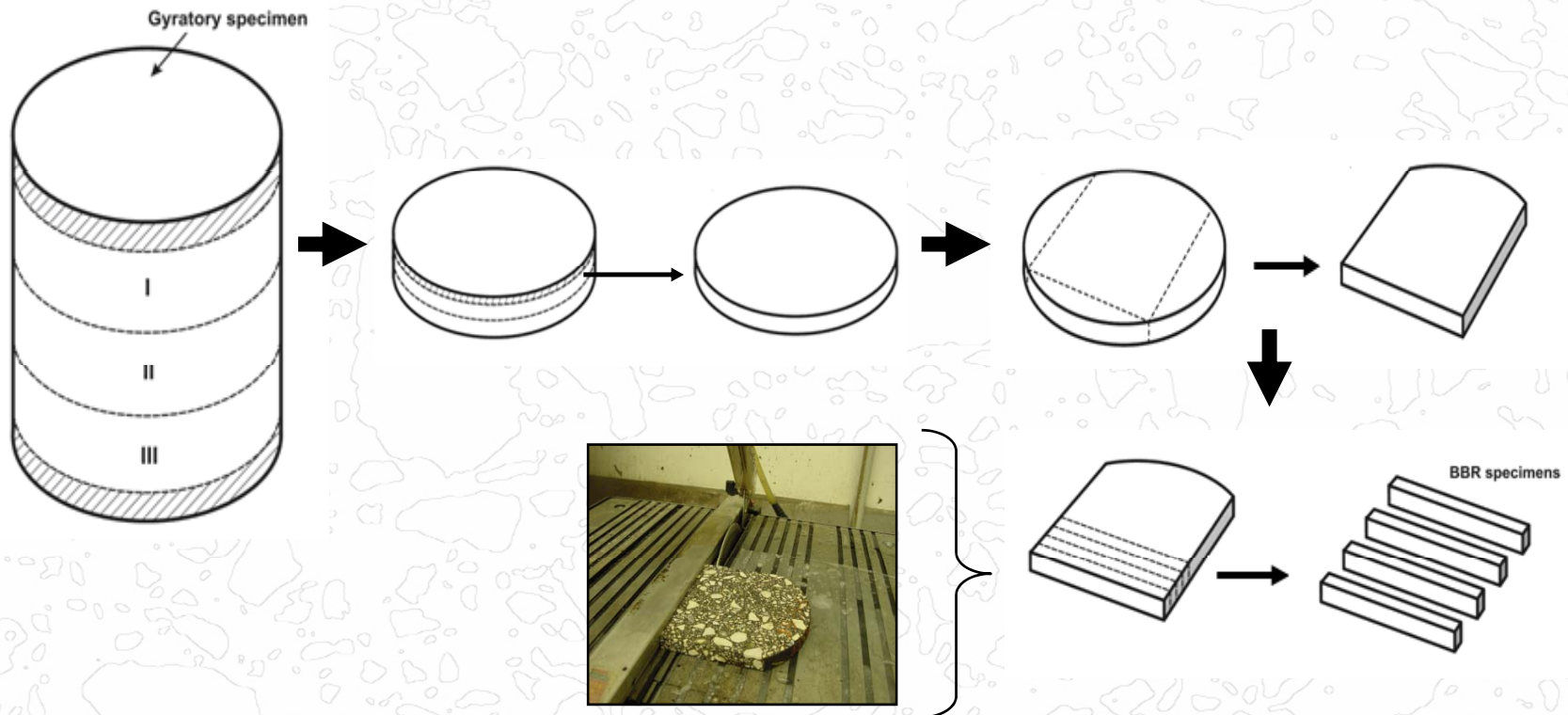


Main Reasons for "Why it Works"

1. Unlike other distresses, low temperature cracking is mainly an environmental distress
 - Restrained pavement contracts as temperature drops
 - Critical stress is **tensile stress**
 - Tensile stress controlled by asphalt mastic (binder)
 - ✓ Very little contribution from larger aggregates
2. At low temperatures, mismatch between mastic (binder) properties and aggregate properties significantly reduced
 - Not true for intermediate and high service temperatures

Sample Preparation

- **Developed detailed sample preparation procedure for tall and normal gyratory compacted cylinders and field cores**

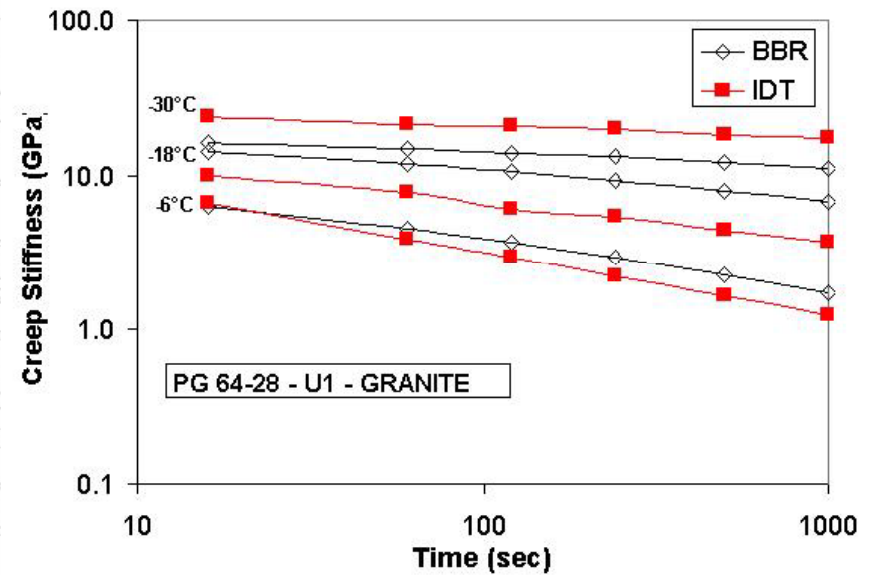
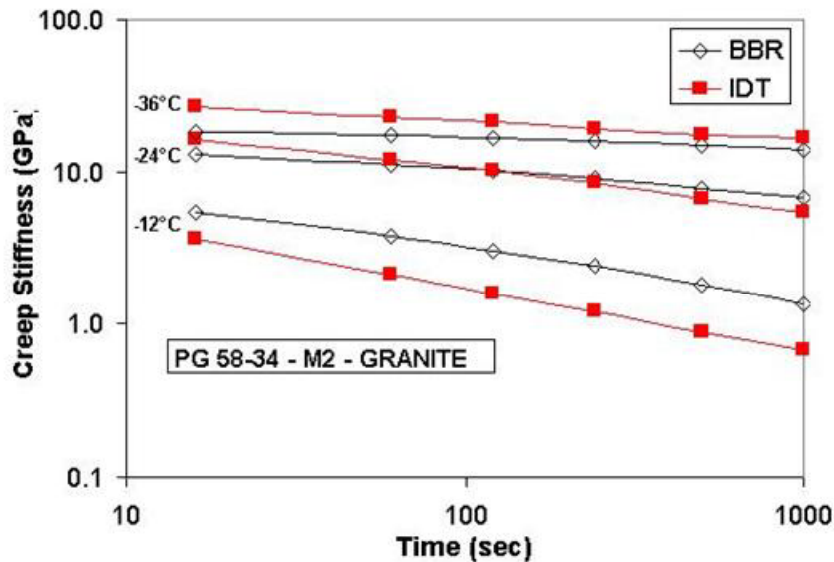


Loading Procedure




- **Developed detailed loading procedure** that allows testing mixture beams with minimal software modifications and no changes to current BBR equipment for testing at temperatures above the PG critical low temperature
 - Below PG critical temperature, predict creep compliance using time-temperature superposition

Creep Compliance Comparison

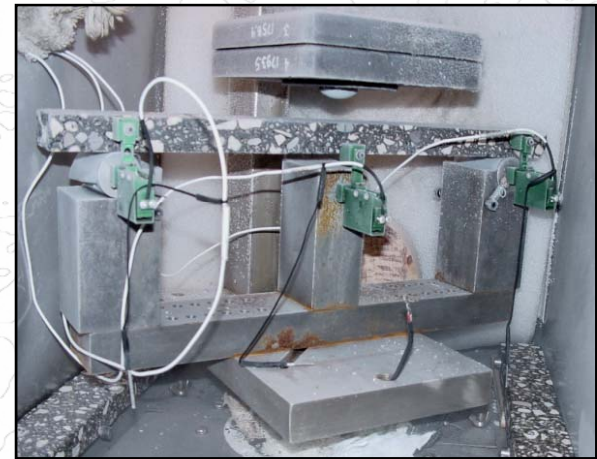
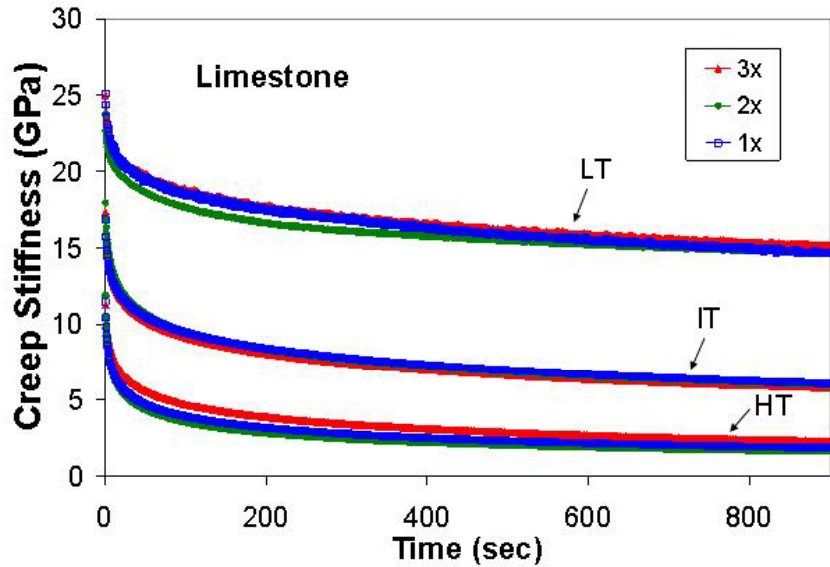
- Compare IDT and BBR creep compliance results
 - Slightly different creep compliance curves
 - Relative ratio between BBR and IDT results varies with time and temperature



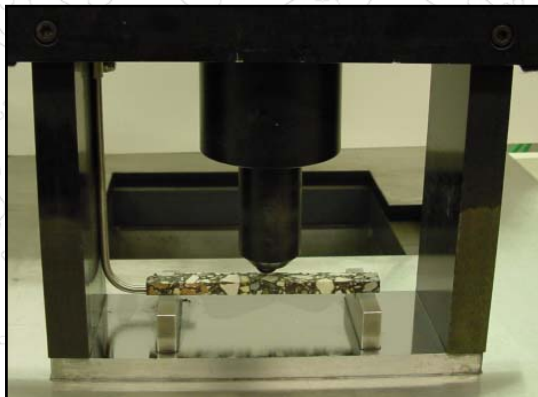
Specimen Geometry Effects

- Low temperature 3-point bending creep tests on specimens with three different sizes:
 - 6.25mm × 12.5mm × 100mm (1x) → 
 - 12.5mm × 25mm × 200mm (2x) → 
 - 18.75mm × 37.5mm × 300mm (3x) → 
- The results show that the 1X, 2X, and 3X beams produce similar creep compliance curves
 - Differences between IDT and BBR most likely due to specimen geometry effects

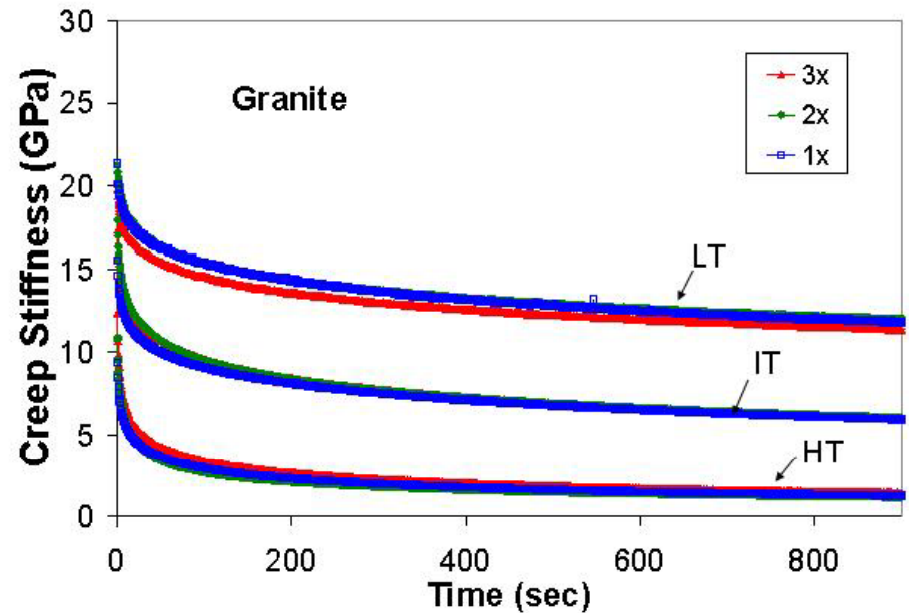
Beam Size Effect



For 2x and 3x



For 1x



AASHTO Test Method

- Part of IDEA project deliverables
 - Draft AASHTO test method for BBR on thin mixture beams
- Based on advice from panel members, it was decided to use the current AASHTO test method for binders (T 313-09) as a template and replace only the sample preparation procedure and loading procedure
- Presented to mix ETG members for input to get draft to final form and submit to AASHTO for approval
- Note: precision and bias has not been evaluated