

Technical Support/ Research to the NJDOT

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Rutgers University Asphalt/Pavement
Laboratory
(RAPL)

Tech Support/Research

- ▶ Rutgers Asphalt/Pavement Laboratory (RAPL) implemented to support the NJDOT, as well as others
- ▶ Field and laboratory characterization for soils, aggregates, and pavement materials
- ▶ Number of completed and on-going research projects related to the performance characterization of pavement related materials

Laboratory Geotechnical Capabilities

- ▶ Can perform a range tests from basic characterization to seismic site response
 - Flex-wall permeability devices
 - Constant and Falling Head Permeability
 - Consolidation Testing (Incremental Load and Constant-Rate-of-Strain)
 - California Bearing Ratio (CBR)
 - Triaxial (up to 12" diameter)
 - Resilient Modulus/Cyclic Triaxial
 - Torsional Shear/Resonant Column (Site Response)

Resilient Modulus (M_R)



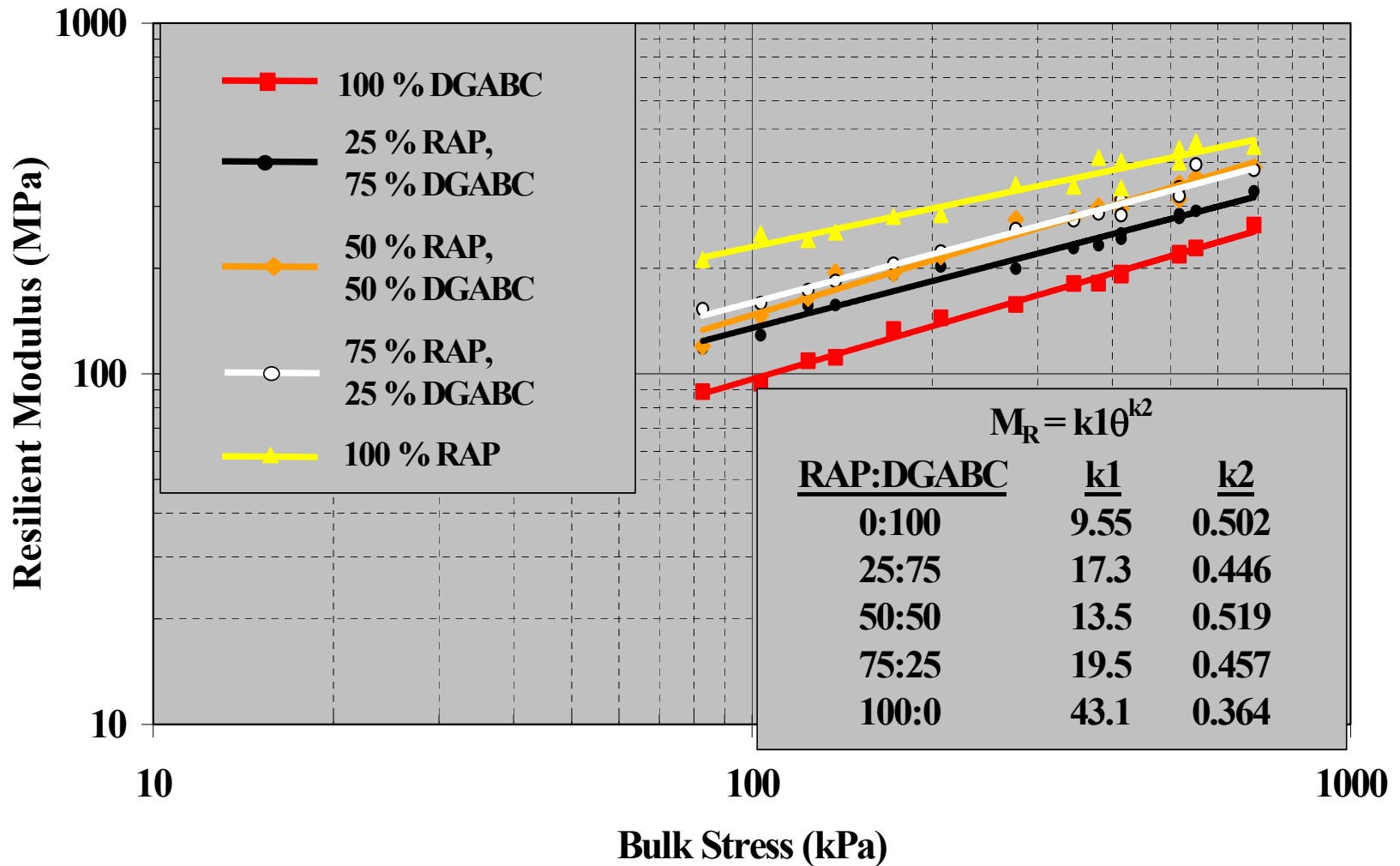
Subgrade Soil



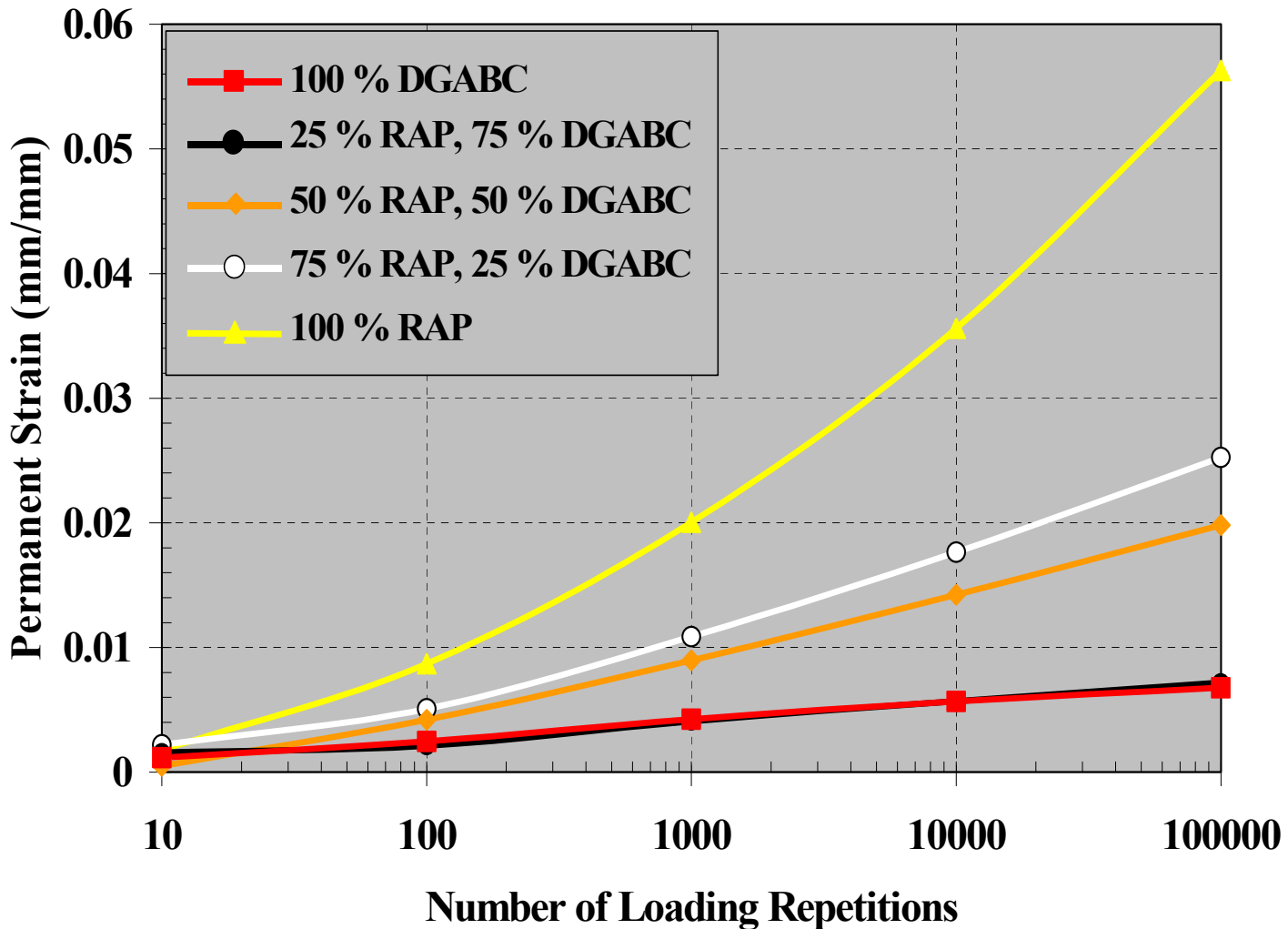
Base/Subbase Aggregate



M_R of RAP, RCA, and DGABC



Permanent Deformation



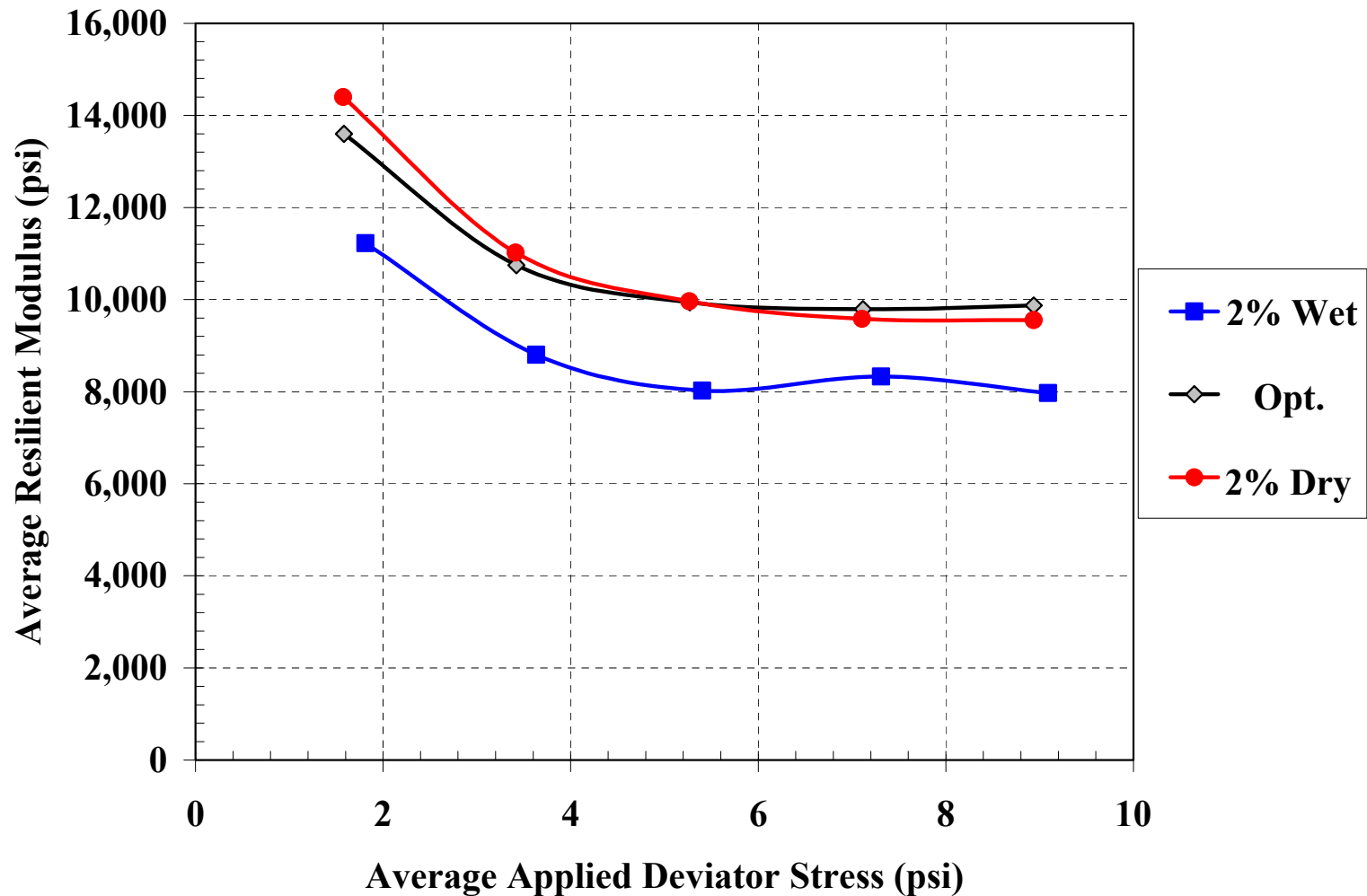
M_R of NJ Subgrade Soils

| Soil Location | Percent Passing 2.00 mm | Percent Passing 75 μm | Liquid Limit (%) | Plastic Limit (%) | Plastic Index (%) | AASHTO TP 46-92 Classification | AASHTO M 145 Classification |
|-------------------|-------------------------|-----------------------|------------------|-------------------|-------------------|--------------------------------|-----------------------------|
| Rt. 23 | 66.6 | 7.6 | 0 | N.P. | N.P. | Type 1 | A-1-b |
| Rt. 46 | 81.5 | 30.1 | 15 | N.P. | N.P. | Type 2 | A-2-4 |
| Rt. 80a | 86.8 | 33.3 | 0 | N.P. | N.P. | Type 2 | A-2-4 |
| Rt. 295 | 99.8 | 9.9 | 0 | N.P. | N.P. | Type 2 | A-3 |
| Rt. 80b | 78.4 | 36.6 | 20.5 | 19 | 1.5 | Type 2 | A-4 |
| Rt. 206 | 82.8 | 43 | 21 | 17 | 4 | Type 2 | A-4 |
| Cumberland County | 100 | 97.5 | 39.1 | 20.2 | 18.9 | Type 2 | A-6 |
| Cumberland County | 100 | 97.7 | 52.5 | 25.1 | 27.4 | Type 2 | A-7 |

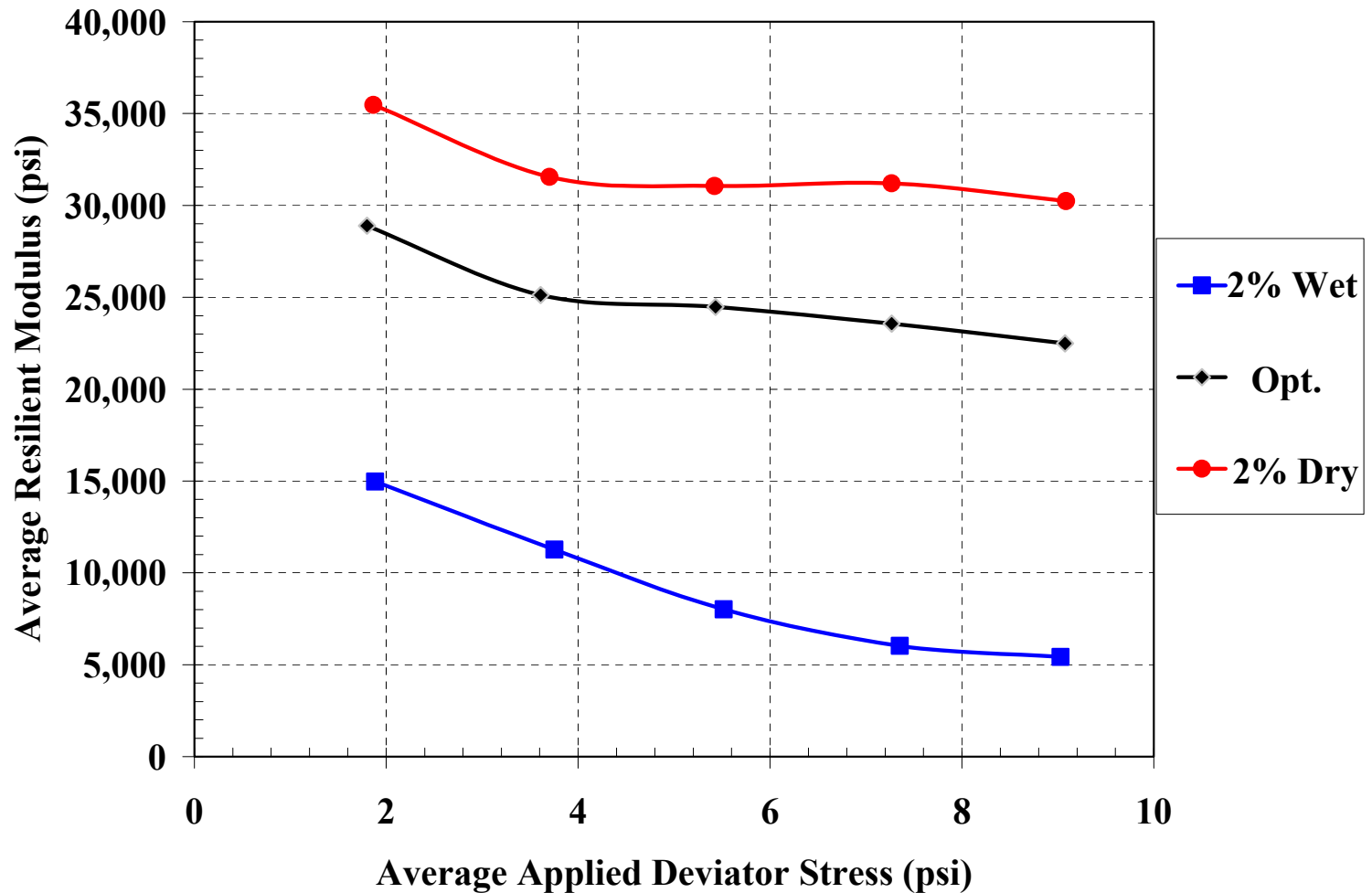
For use with the Rutgers Soil Maps and the NJDOT AASHTO Companion Design Guide

| Soil Location | AASHTO Classification | Moisture Content Type | Soil Parameter (k_1) | Soil Parameter (k_2) | Soil Parameter (k_3) | Coefficient of Determination (r^2) |
|-------------------|-----------------------|-----------------------|--------------------------|--------------------------|--------------------------|--|
| Rt. 23 | A-1-b | 2% Wet | 521.62 | 0.93 | -0.2068 | 0.99 |
| | | OMC | 834.48 | 0.6803 | -0.0792 | 0.95 |
| | | 2% Dry | 1032.07 | 0.7713 | -0.2774 | 0.94 |
| Rt. 46 | A-2-4 | 2% Wet | 314.54 | 0.7532 | -0.4614 | 0.94 |
| | | OMC | 410.71 | 0.7026 | -0.4046 | 0.91 |
| | | 2% Dry | 410.56 | 0.8072 | -0.4166 | 0.96 |
| Rt. 80a | A-2-4 | 2% Wet | 340.97 | 0.7675 | -0.4948 | 0.96 |
| | | OMC | 440.57 | 0.5085 | -0.3913 | 0.89 |
| | | 2% Dry | 599.39 | 0.6571 | -0.2769 | 0.91 |
| Rt. 295 | A-3 | 2% Wet | 344.81 | 0.6029 | -0.3921 | 0.91 |
| | | OMC | 399.77 | 0.7107 | -0.3973 | 0.93 |
| | | 2% Dry | 413.94 | 0.5674 | -0.3986 | 0.96 |
| Rt. 80b | A-4 | 2% Wet | 346.48 | 0.7448 | -0.5927 | 0.97 |
| | | OMC | 433.4 | 0.6982 | -0.3497 | 0.91 |
| | | 2% Dry | 585.62 | 0.7453 | -0.275 | 0.97 |
| Rt. 206 | A-4 | 2% Wet | 273.71 | 0.6025 | -0.5177 | 0.92 |
| | | OMC | 389.67 | 0.6515 | -0.4161 | 0.94 |
| | | 2% Dry | 539.87 | 0.7211 | -0.3934 | 0.93 |
| Cumberland County | A-6 | 2% Wet | 202.6 | 0.4735 | -0.8388 | 0.95 |
| | | OMC | 1278.9 | 0.2636 | -0.2343 | 0.94 |
| | | 2% Dry | 1699.32 | 0.231 | -0.1707 | 0.92 |
| Cumberland County | A-7 | 2% Wet | 284.32 | 0.3307 | -0.7753 | 0.89 |
| | | OMC | 1290.4 | 0.2262 | -0.1864 | 0.89 |
| | | 2% Dry | 1430.67 | 0.2748 | -0.1173 | 0.88 |

AASHTO A-3 (Fine Sand)



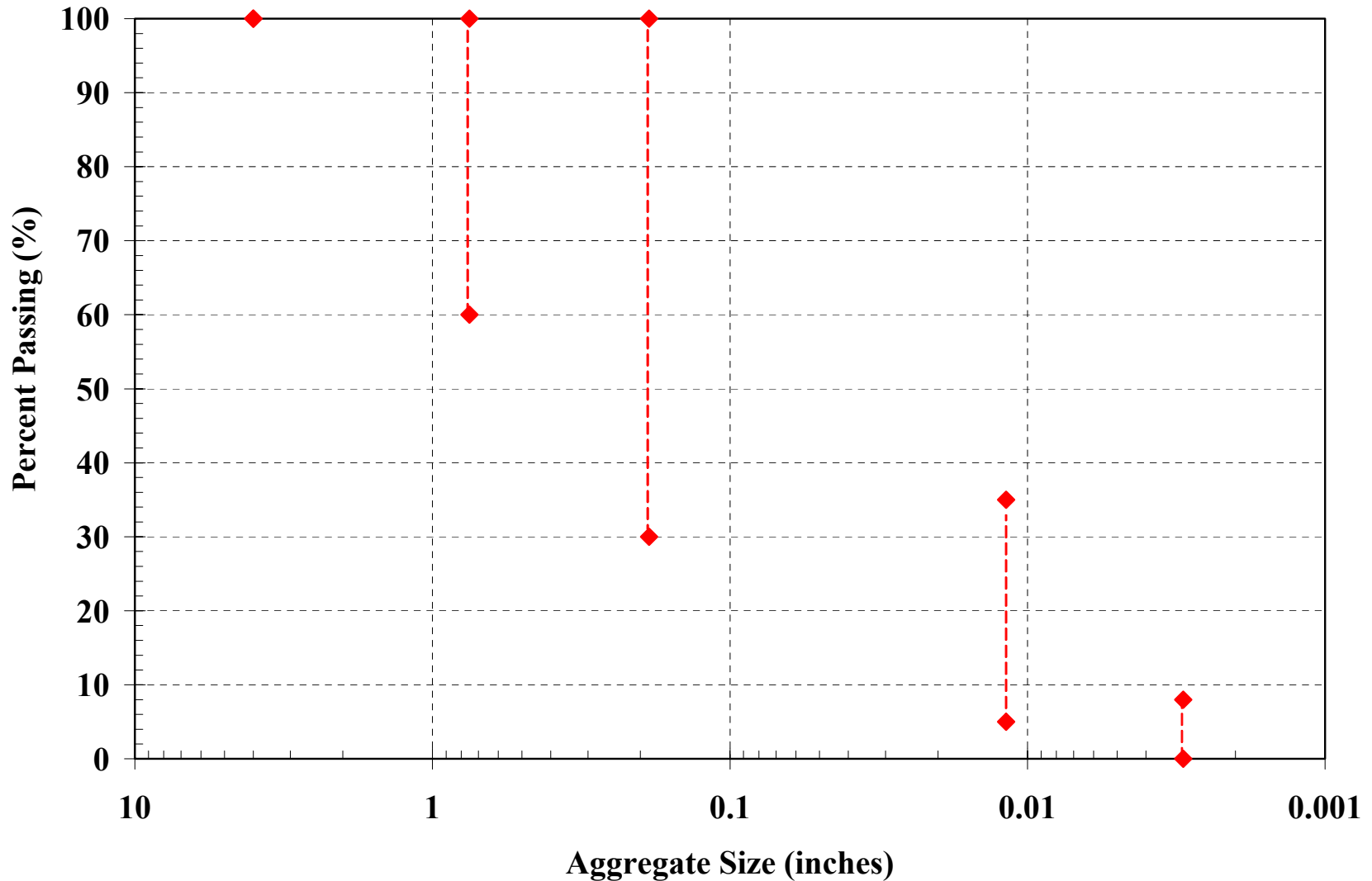
AASHTO A-6 (Stiff Clay)



On-Going Projects

- ▶ Development of Performance Specifications to Accompany Gradations for I-3 and DGABC (Base/Subbase Aggregates)
 1. Moisture-Density
 2. Permeability
 3. Shear Strength
 4. Resilient Modulus
 5. Permanent Deformation (Cyclic Triaxial)

I-3 Gradation Bands (Subbase)

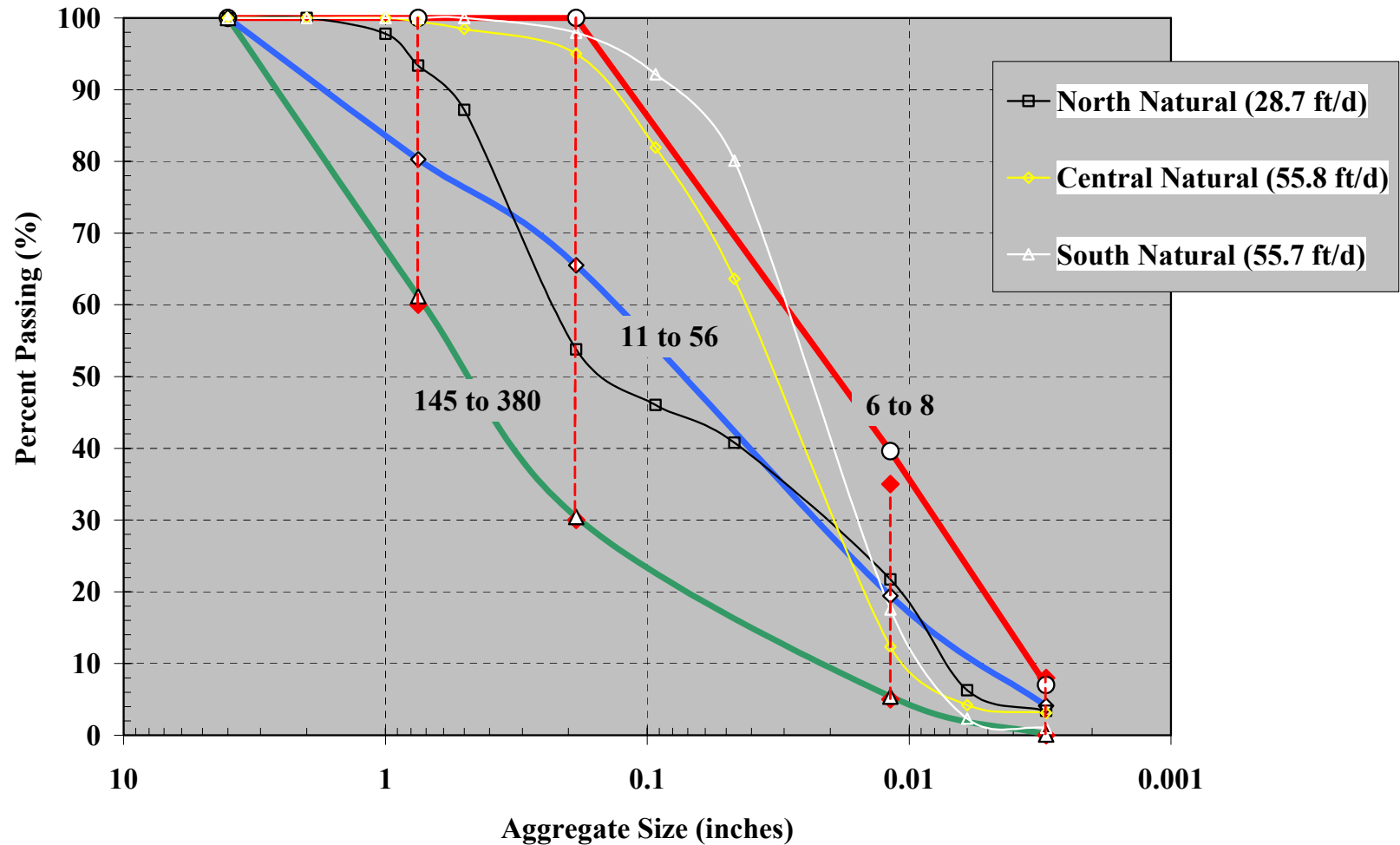


- Rigid Compaction Mold for both Constant Head and Falling Head Permeability Testing



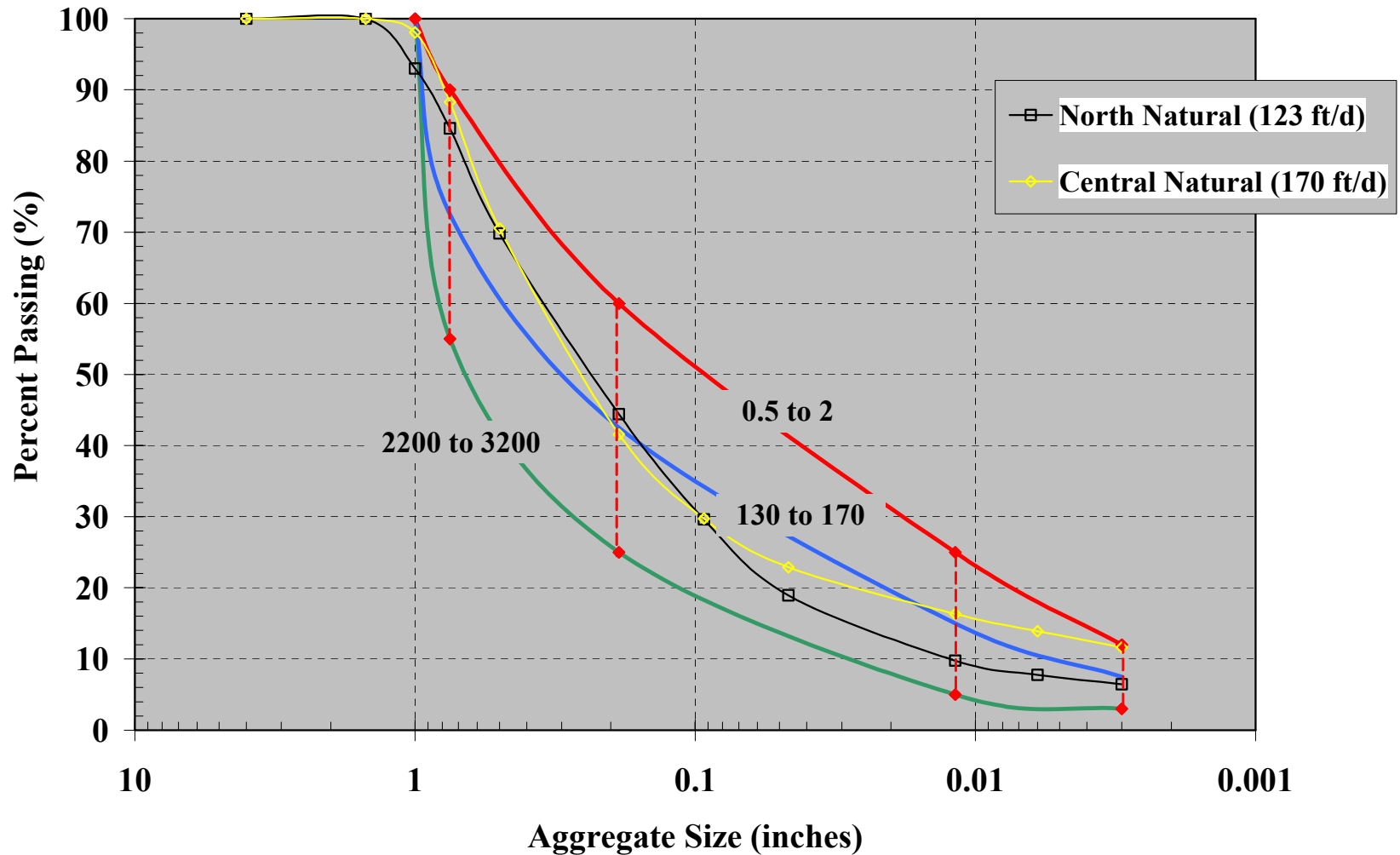
Permeability for I-3 Gradations

Sieve Analysis - I-3 Gradation Designation



Permeability for DGABC Gradations

Sieve Analysis - DGABC Gradation Designation



Current Projects for NJDOT (for 2002 Mechanistic Design Guide)

- ▶ **Evaluation of Poisson's Ratio**
 - Factors affecting value for asphalt and soil/aggregates
- ▶ **Falling Weight Deflectometer vs Laboratory Resilient Modulus**
 - Looking at developing a procedure or shifting method to relate the FWD backcalculated modulus to the lab
- ▶ **Seasonal Variation Study**
 - Evaluating the effect of seasonal environmental changes on the pavement response (FWD, Seismic Pavement Analyzer, laboratory characterization)

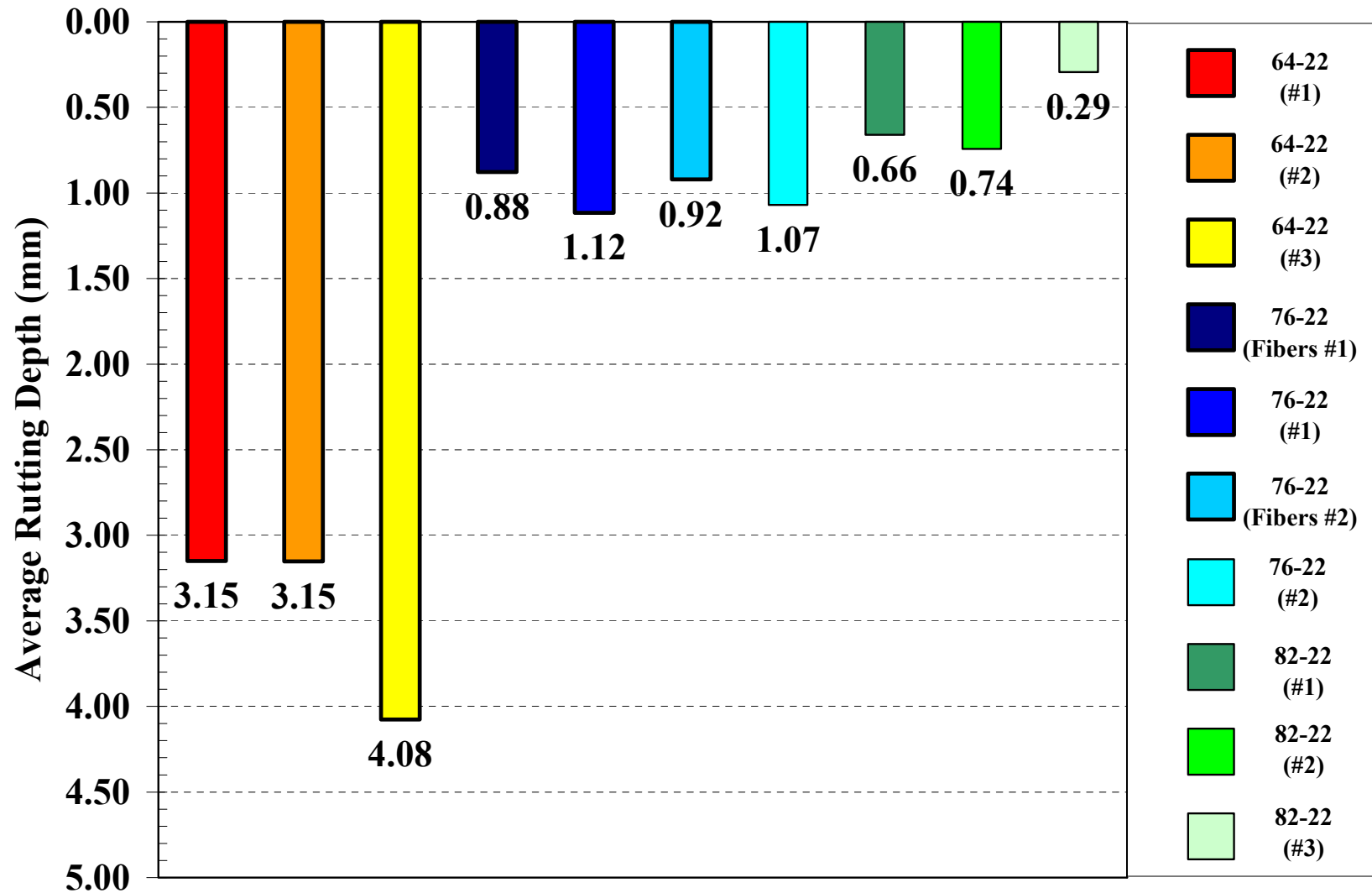
Asphalt Related Support/Research

- ▶ RAPL Facilities include:
 - Superpave Shear Tester (SST)
 - Indirect Tensile Tester (IDT)
 - Asphalt Pavement Analyzer (APA)
 - Superpave Gyratory, Vibratory, and Marshall Impact Compactors
 - Pine Marshall Stability and Flow
 - Falling Head Permeability Device
 - CoreLok Device
 - Ignition Oven

Asphalt Pavement Analyzer (APA)



APA Results



Indirect Tensile Tester (IDT)



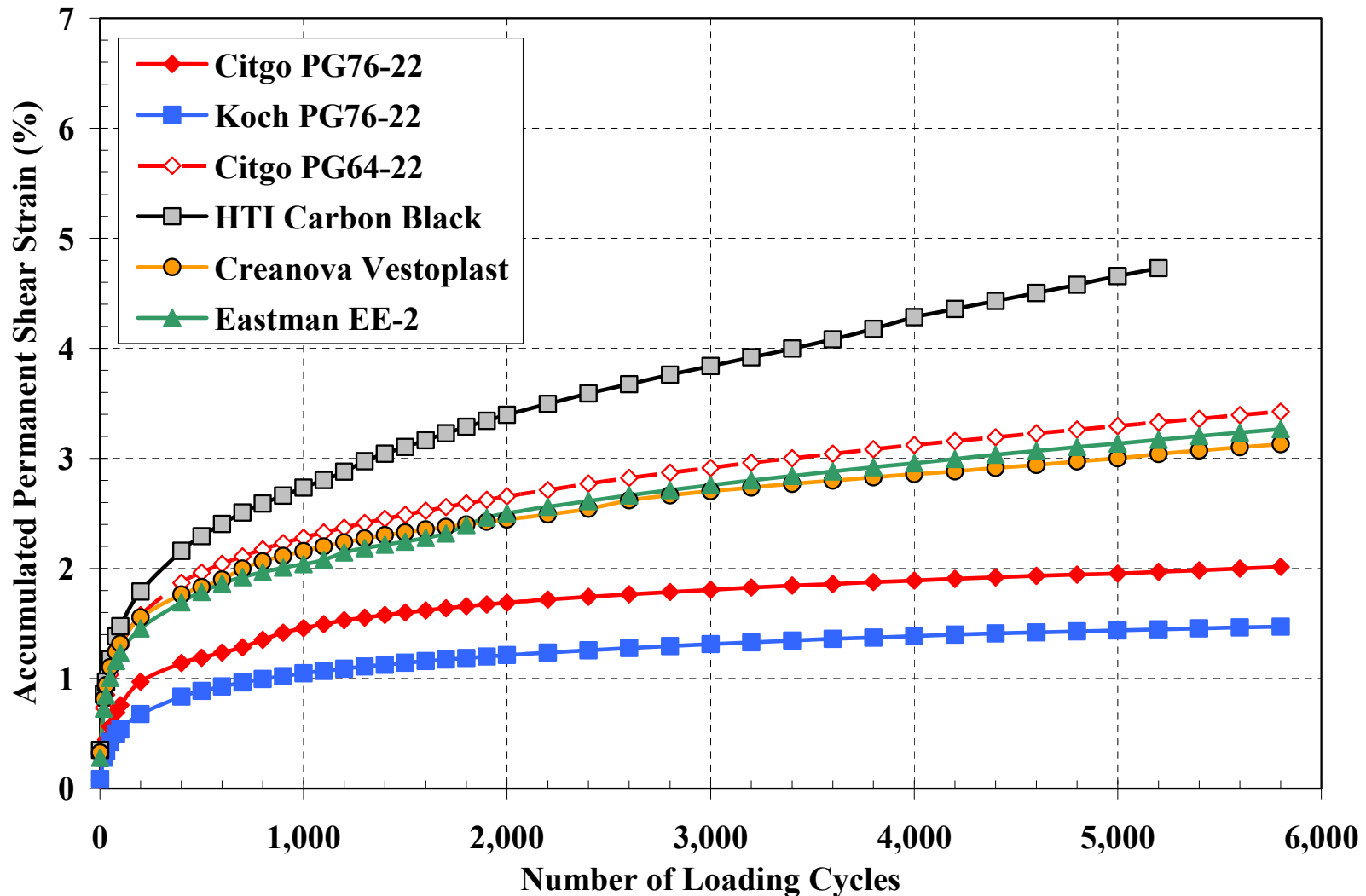
- Indirect Tensile Strength
- Diametric Resilient Modulus
- Creep Compliance

Superpave Shear Tester (SST)



- Repeated Shear (Rutting)
- Frequency Sweep (G^*)
- Simple Shear (Creep)

SST Repeated Shear Tests



Asphalt Permeability Devices



Asphalt Related Support/Research

- ▶ Other on-going projects
 - APA Rutting Criteria to Supplement Volumetric Design
 - Superpave for Low-Volume Roads
 - Evaluation of OGFC Under Superpave Design for NJ
 - Preparing for 2002 Design Guide
 - * HMA Simple Performance Test and Dynamic Modulus (E^*)
 - * SHRP Fatigue Device

For Further Information

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