

Developing Affordable GTR Asphalt Mixes for Local Roadways



Munir D. Nazzal, Ph.D., P.E.
Sang Soo Kim, Ph.D., P.E.
Ala Abbas, Ph.D.



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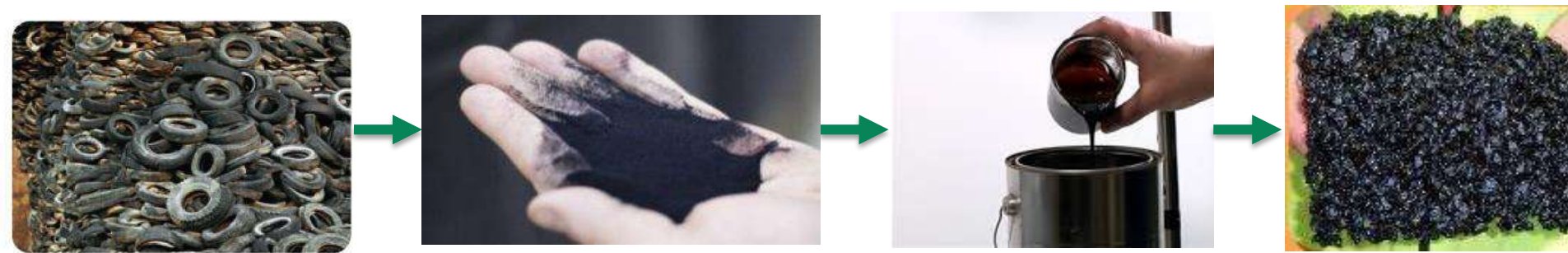
Acknowledgement

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- ❑ Ms. Vicky Fout for her time and assistance.

Background

- ❑ Ground tire rubber (GTR) has been incorporated in asphalt mixtures to:
 - ✓ Enhance the pavement performance
 - ✓ Reduce environmental impact of pavements



GTR Mixtures Produced Using The Wet Process

Background

- ❑ ODOT has Supplement Specification 887 specifications for GTR asphalt binders and mixtures.
- ❑ Although the use of GTR may be beneficial for pavement quality and the environment, the GTR asphalt mixtures were not extensively used In Ohio.
- ❑ GTR has been used on approximately 33 local roads and 3 state highways since 2005.

Objectives

- ❑ Evaluate the long-term field performance of GTR
- ❑ Compare the life-cycle cost of GTR to traditional asphalt mixtures.
- ❑ Examine recent GTR technologies and assess their potential in reducing the initial cost of mixtures.
- ❑ Develop draft GTR mix design specifications to be used for local roads.
- ❑ Provide recommendations regarding QC/QA criteria for testing and acceptance of GTR mixtures.

Collect Information & Analyze Data

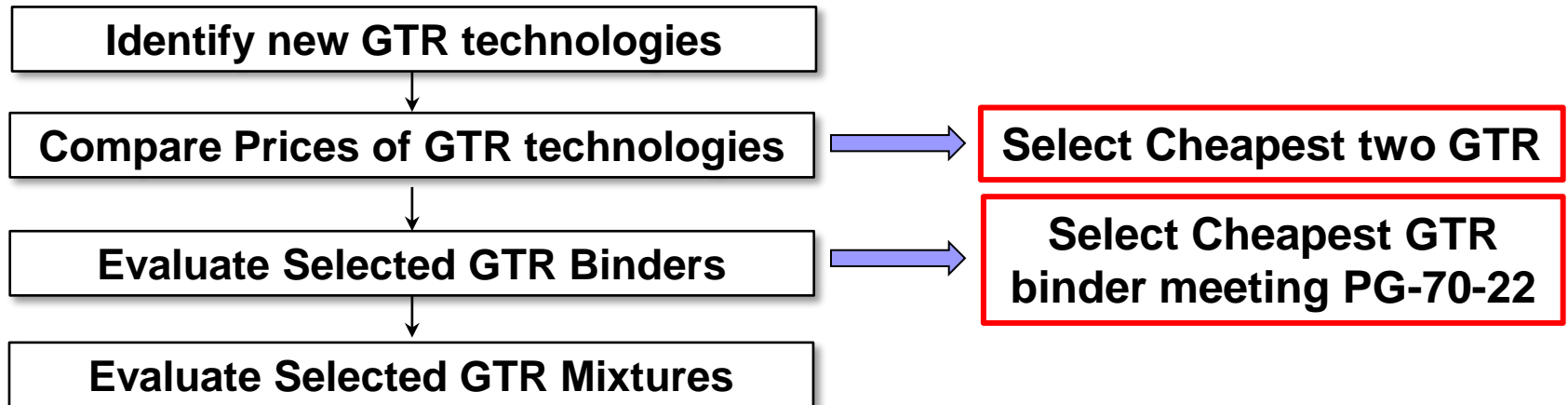
- ❑ All available information for GTR projects constructed in Ohio were collected. The collected information included:
 - ✓ Pavement information (e.g. layers thickness & traffic)
 - ✓ GTR asphalt mixtures information & properties
 - ✓ Problems encountered during construction
 - ✓ Pavement condition data
 - ✓ Dates and costs of maintenance/repair activities
- ❑ The collected data were analyzed.

Previous GTR Sections: Findings

- ❑ All GTR mixtures previously used in Ohio were produced using GTR binder from Seneca.
- ❑ After 10 years of service, GTR modified pavement sections had good performance.
- ❑ The use of GTR binder in place of a polymer modified PG 76-22M binder resulted in increasing the mixtures price by 10-15%:
 - ✓ Additional cost encountered by asphalt contractor when using a binder purchased from an asphalt supplier
 - ✓ Using GTR binders had resulted in increasing the required asphalt binder content by 0.2-0.5%.

GTR Technologies To Reduce Cost

- ❑ A multi-stage procedure was pursued to select the GTR technologies that can reduce the cost and yet can be used to produce a PG 70-22 binder with similar performance to that of a polymer modified binder.



Price Comparison (Per Ton)

Asphalt Product	PG 70-22	PG 76-22
Seneca Petroleum-GTR asphalt	\$660	\$660
Wright-GTR asphalt	\$675.00	\$675.00
Quantum Polymer -GTR	\$628.20	\$642.70
Lehigh -GTR	\$582.05	\$582.05
Liberty –GTR	\$561.6	\$561.6
ODOT Price Index	\$665.00	\$695.80
SBS-Polymer modified Binder (Estimated Contactor cost)	\$629.70	\$652.00

Price were estimated based on ODOT asphalt binder price index for Oct. 2014

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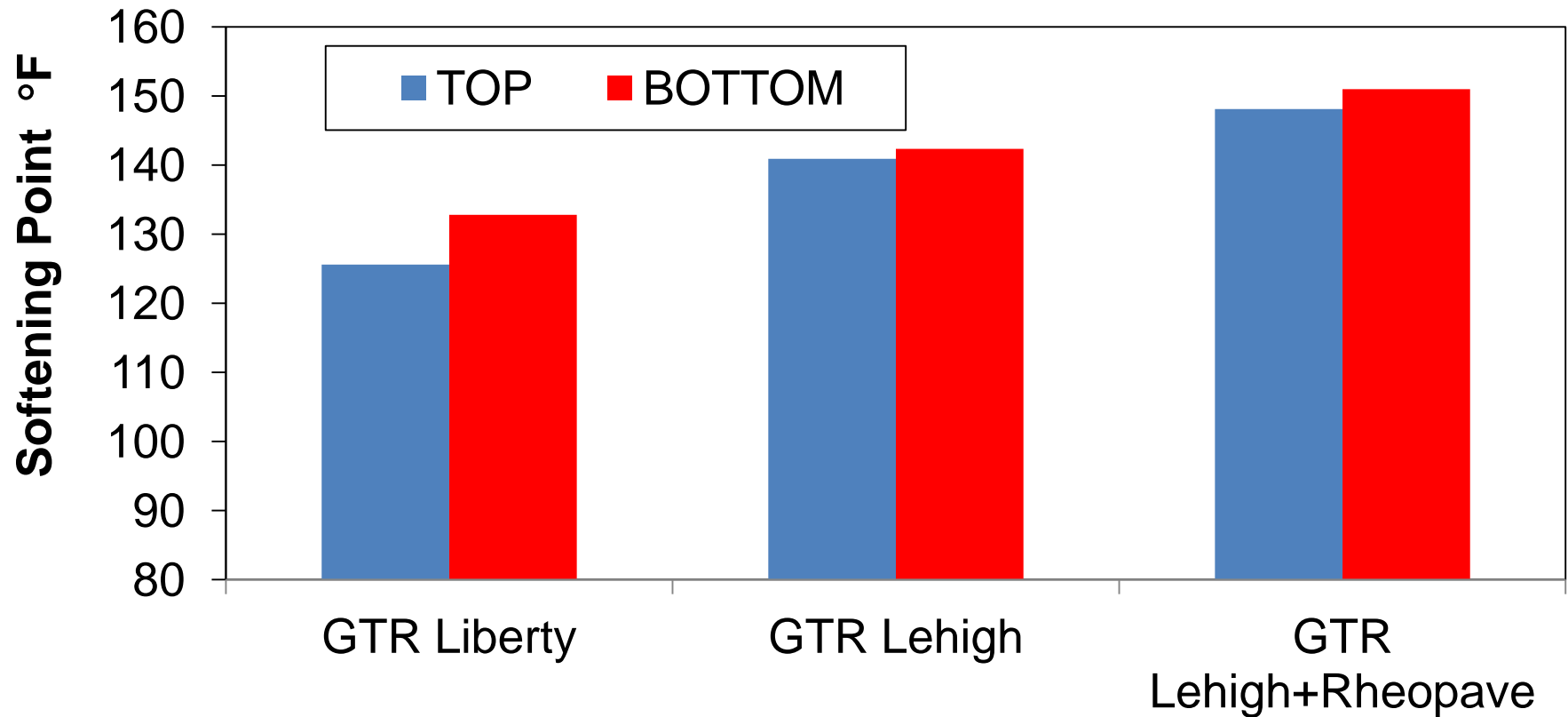
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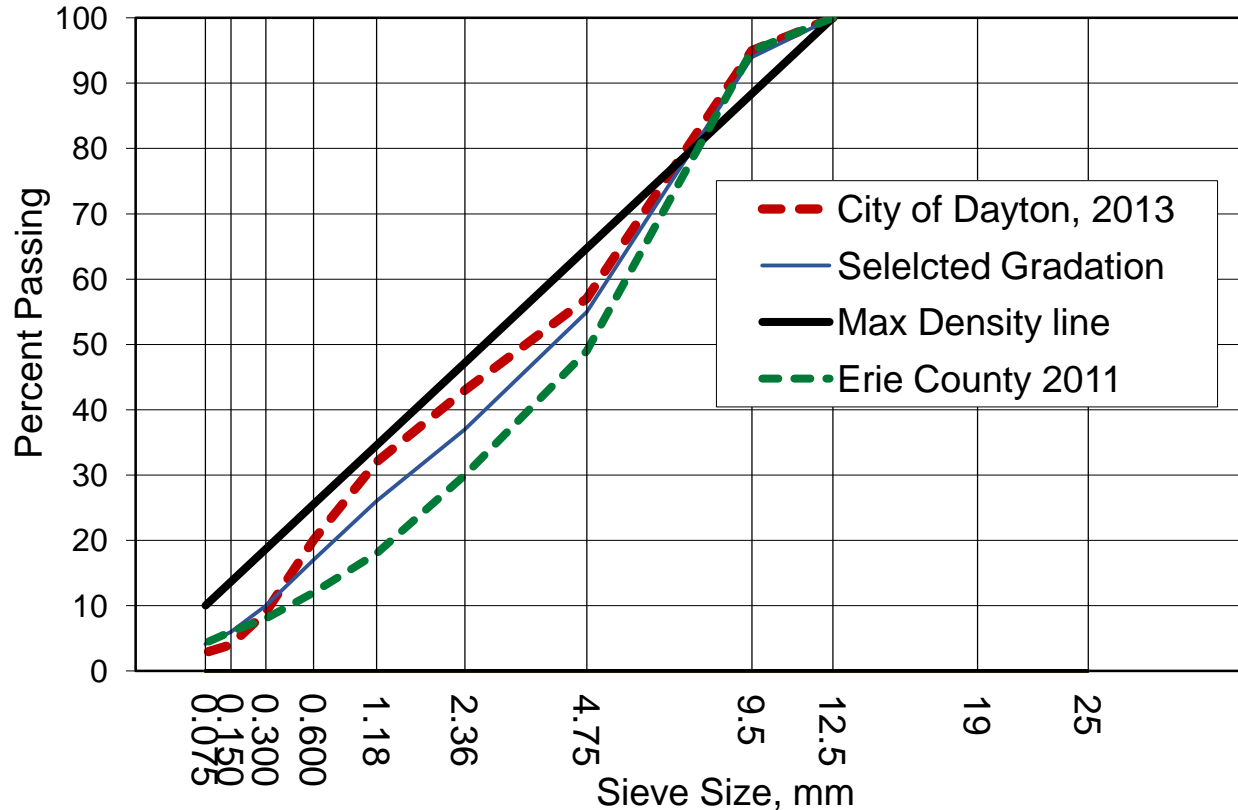


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Cigar Tube Test Results



Selected Mixture Gradation



- ❑ Mixture included:
- ✓ 47% limestone #8
- ✓ 16% natural sand
- ✓ 17% limestone sand
- ✓ 20% RAP

Mixtures Properties

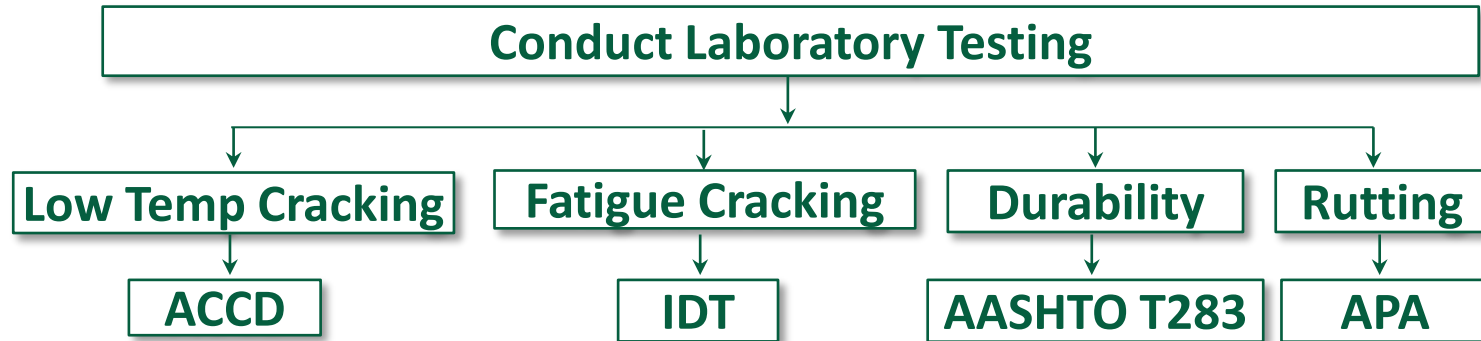
Property	70-22M	GTR Liberty*	GTR Lehigh*	GTR Lehigh+ Rheopave*
Design air Void (%)	3.5	3.5	3.5	3.5
Total Asphalt Binder Content (%)	6.1	6.3	6.2	6.2
Virgin Asphalt Binder Content (%)	5.1	5.3	5.2	5.2

***PG 64-22 +10%Liberty GTR**

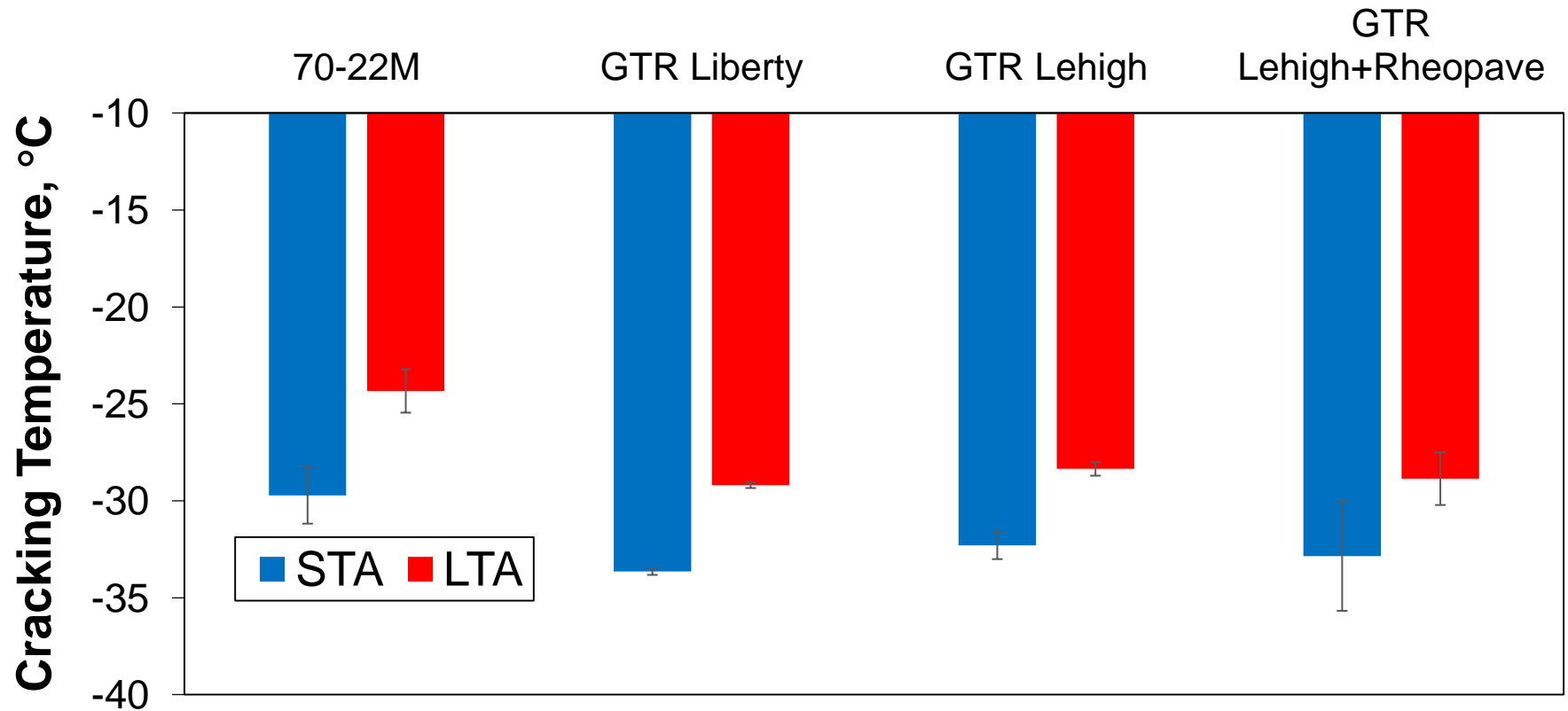
PG 64-22 +10%Lehigh GTR

PG 64-22 +7%Lehigh GTR+ 0.5%Rheopave

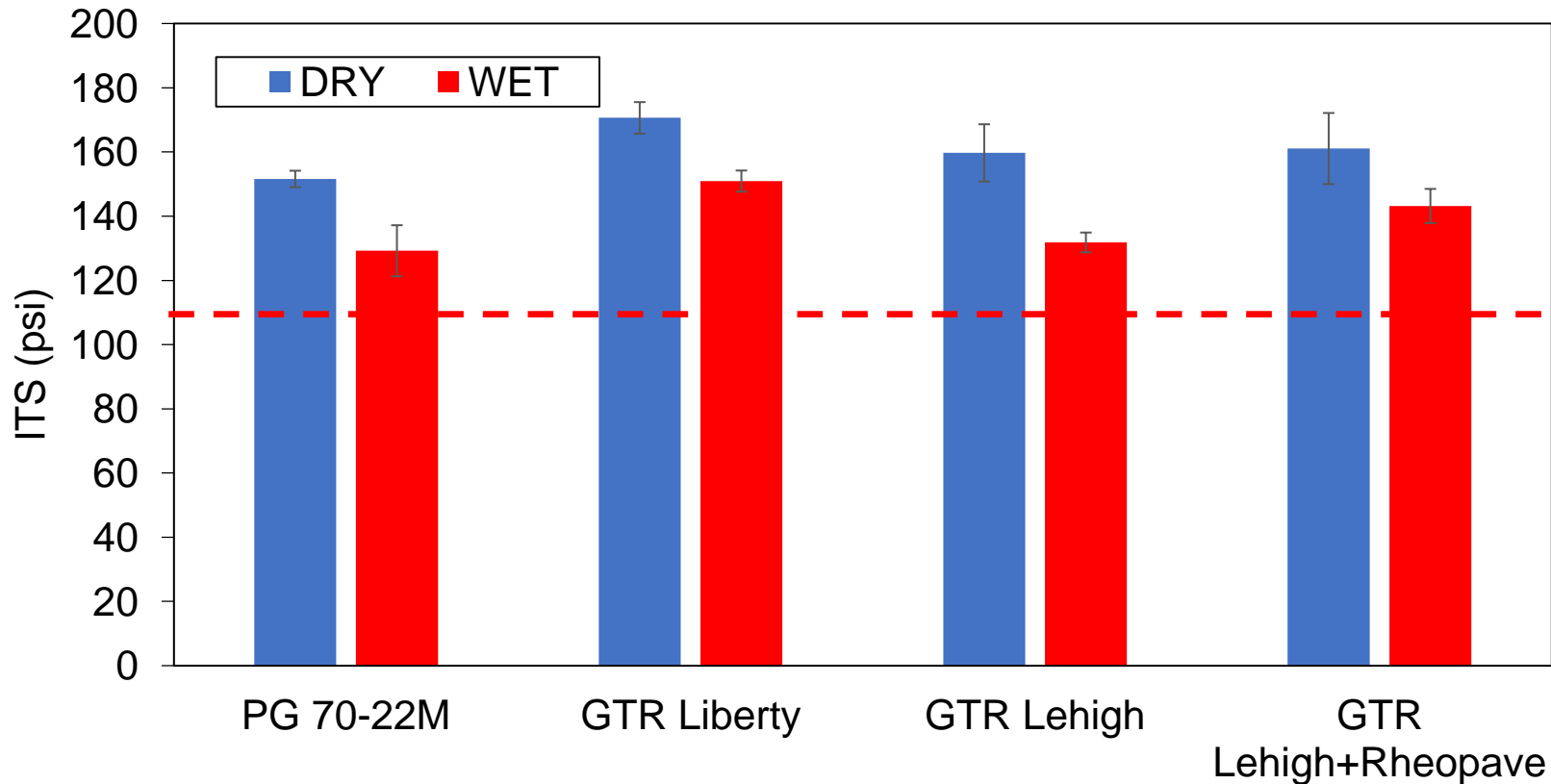
Lab Mixtures Testing



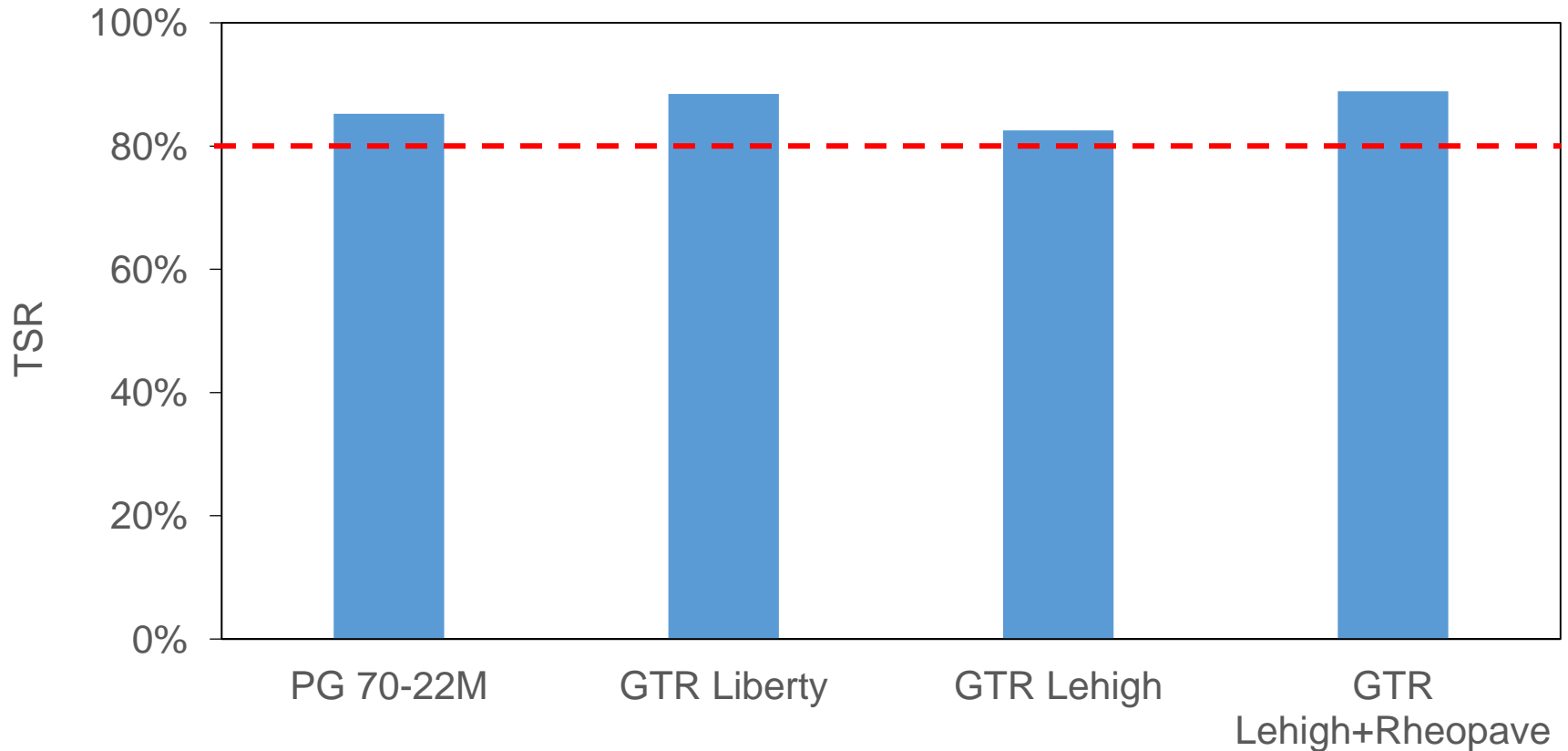
Low Temp. Cracking: ACCD Results



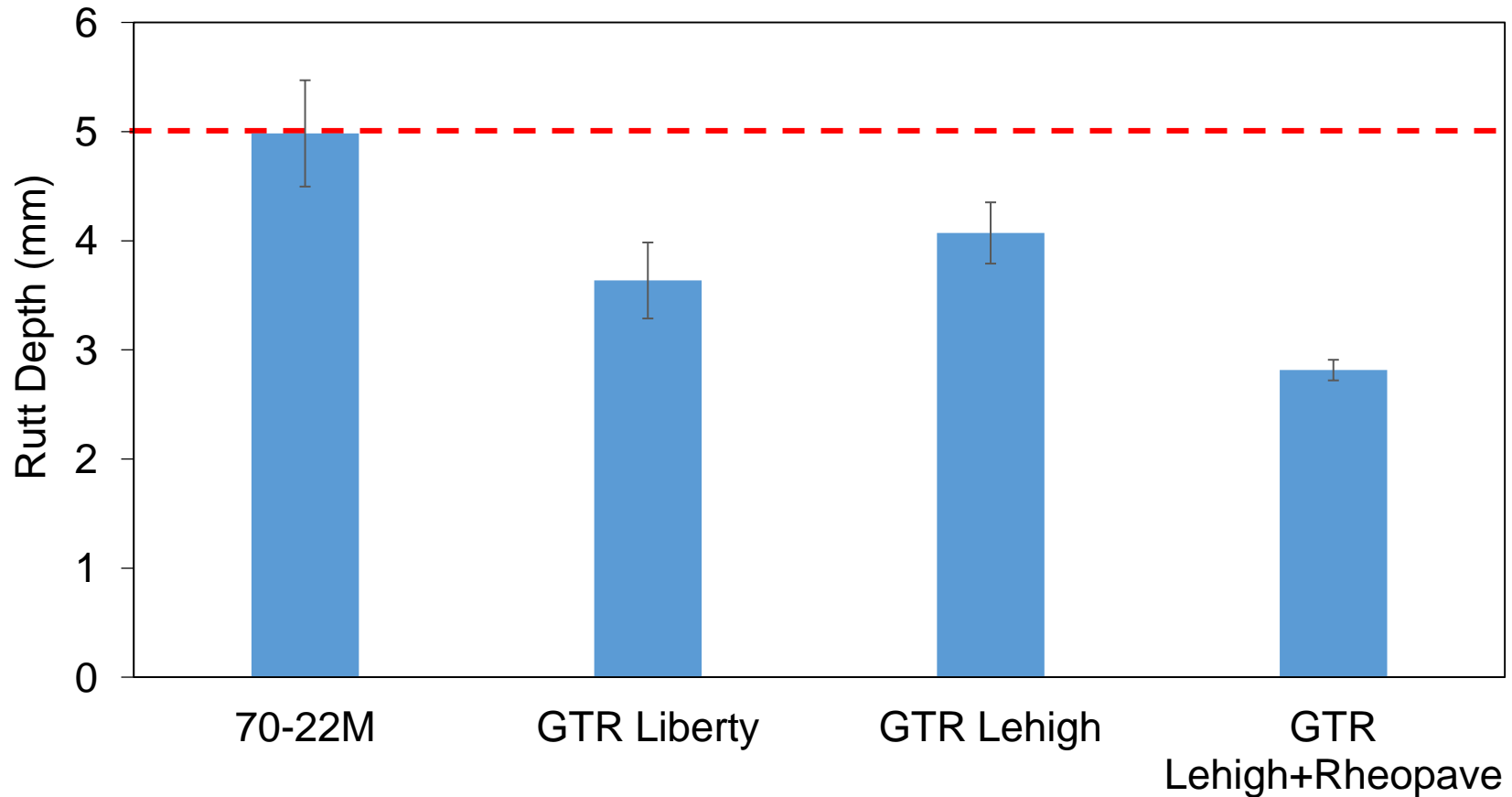
Fatigue Cracking: IDT Results



Durability: AASHTO-T283 Results



Rutting : APA Results



Lab Study Findings

- ❑ The GTR binders prepared using 10% Liberty GTR, 10% Lehigh GTR, or 7% Lehigh GTR and 0.5% Rheopave were the least expensive.
- ❑ The binders prepared using Liberty GTR, and Lehigh GTR had a continuous high PG grade higher than 76 °C and a low temperature PG grade lower than -22 °C.
- ❑ Mixtures prepared with Lehigh and Liberty GTR modified binders had better resistance to low temperature cracking than those prepared using PG 70-22 polymer modified binder

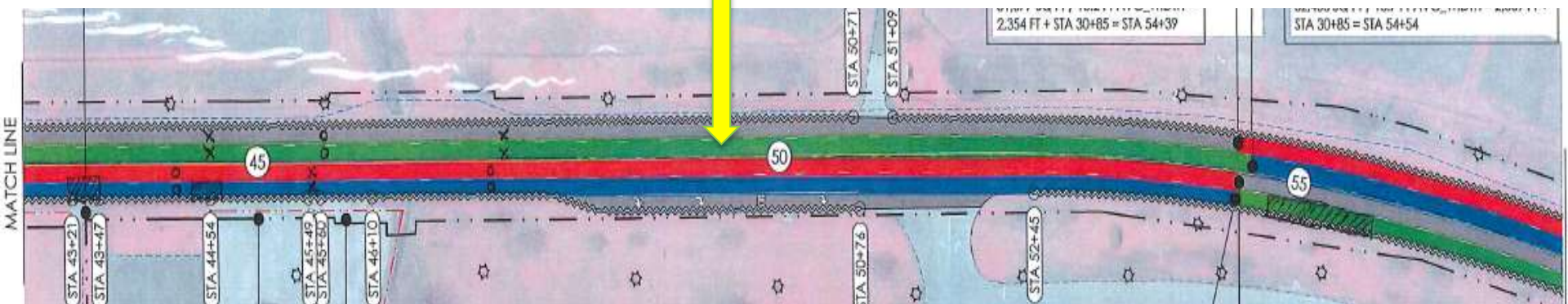
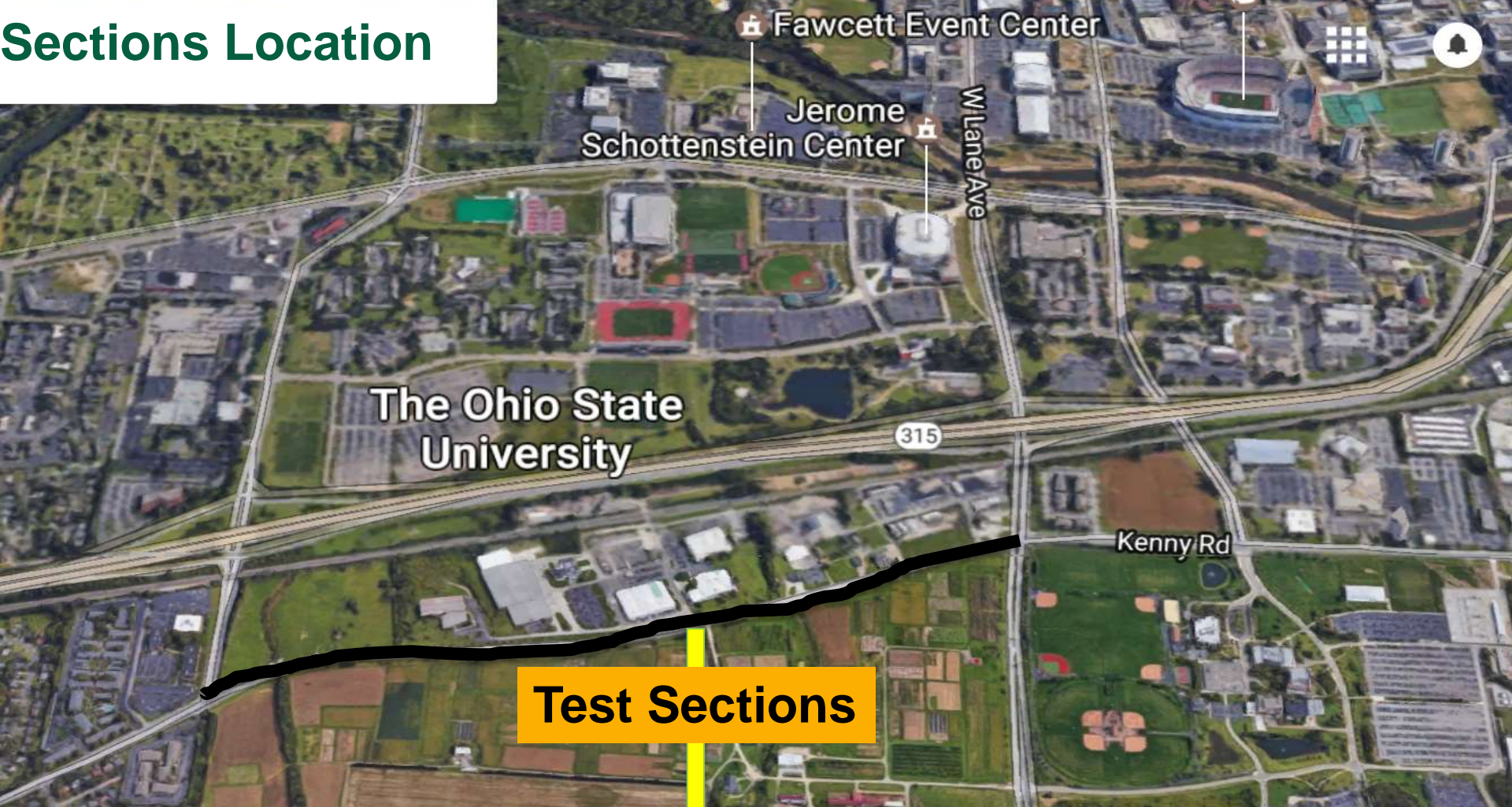
Lab Study Findings

- ❑ In terms of rutting, all GTR mixes had lower rutting in the APA test and are expected to have better rutting performance than PG 70-22 polymer mixes.
- ❑ GTR mixes had slightly higher indirect tensile strength values than those prepared using PG 70-22M polymer modified binder.
- ❑ The results of the modified Lottman test (AASHTO T283) indicate that GTR modified mixes had similar moisture damage resistance to those prepared using polymer modified binder meeting PG 70-22M.

Field Evaluation of GTR Mixes

- ❑ Four test sections with the following binders in the surface course mixture were constructed on Kenny Road in the City of Columbus:
 - ✓ Section 1: SBS polymer to meet requirements for a PG 70-22M binder.
 - ✓ Section 4: GTR modified binder-Liberty GTR (LI)
 - ✓ Section 2: GTR modified binder-MicroDyne™-400 (LE)
 - ✓ Section 3: GTR modified binder- MicroDyne™-400 GTR and Rheopave (LE-LH)
- ❑ Construction started on 08/25/2016 and was completed 08/30/2016. One day was allocated for each GTR section.

Sections Location



Construction of Sections



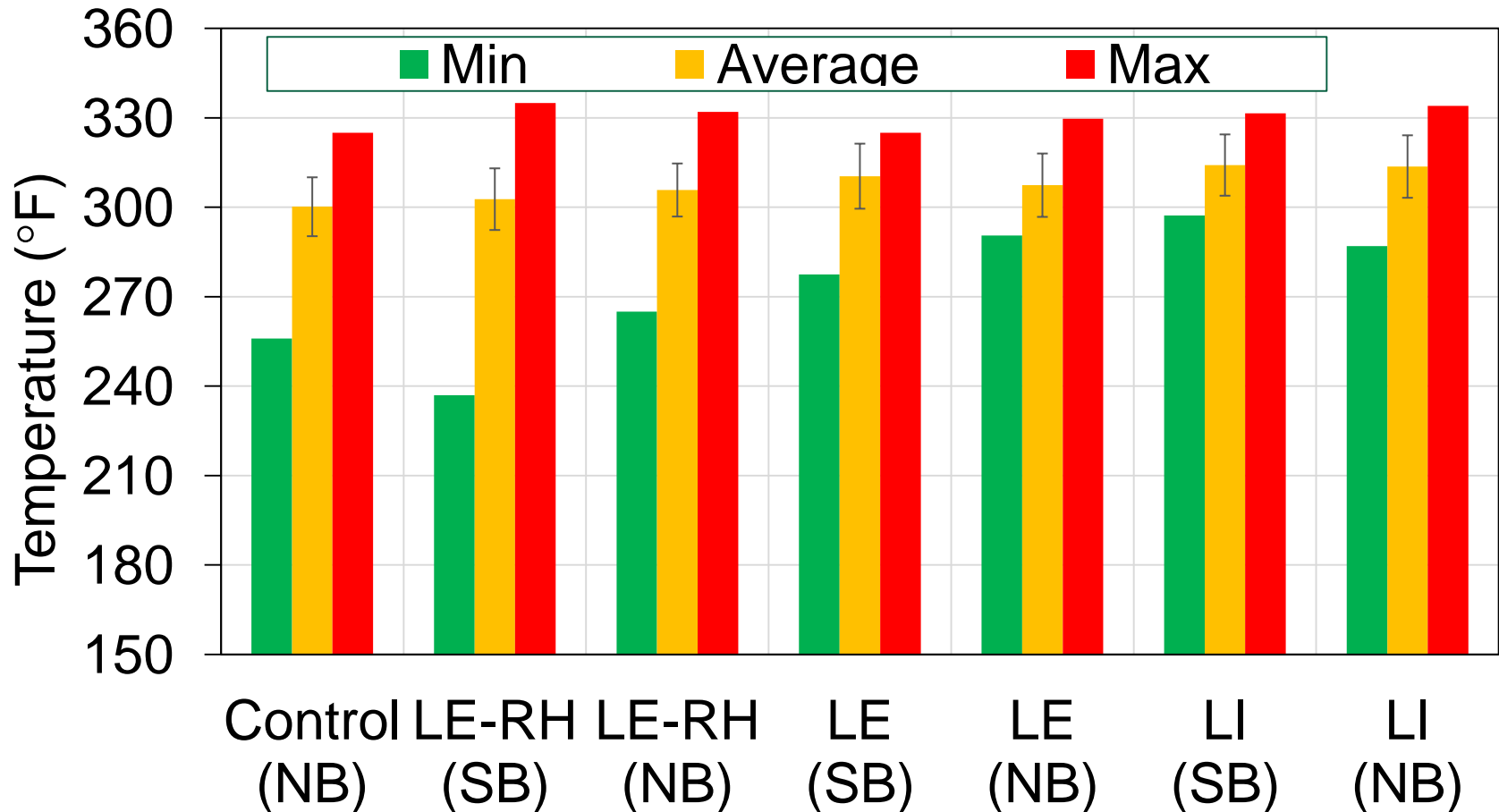
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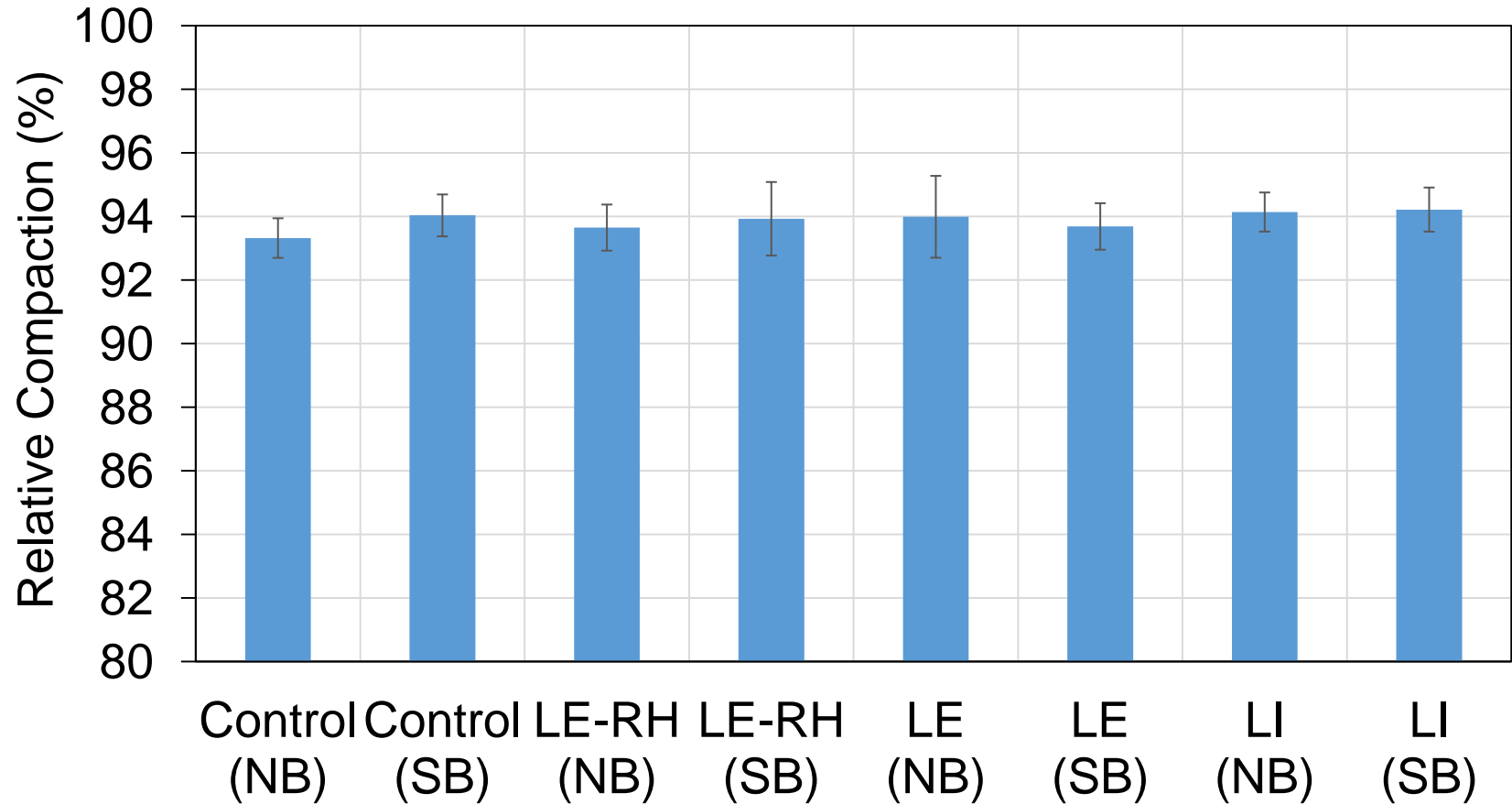


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Mat Temperature



Relative Compaction

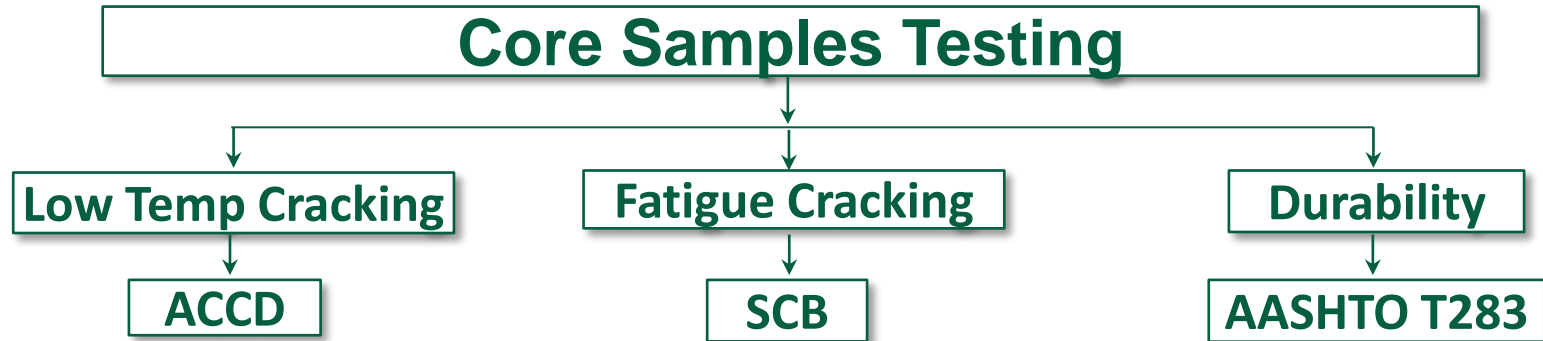


Binder & Core Sampling Testing

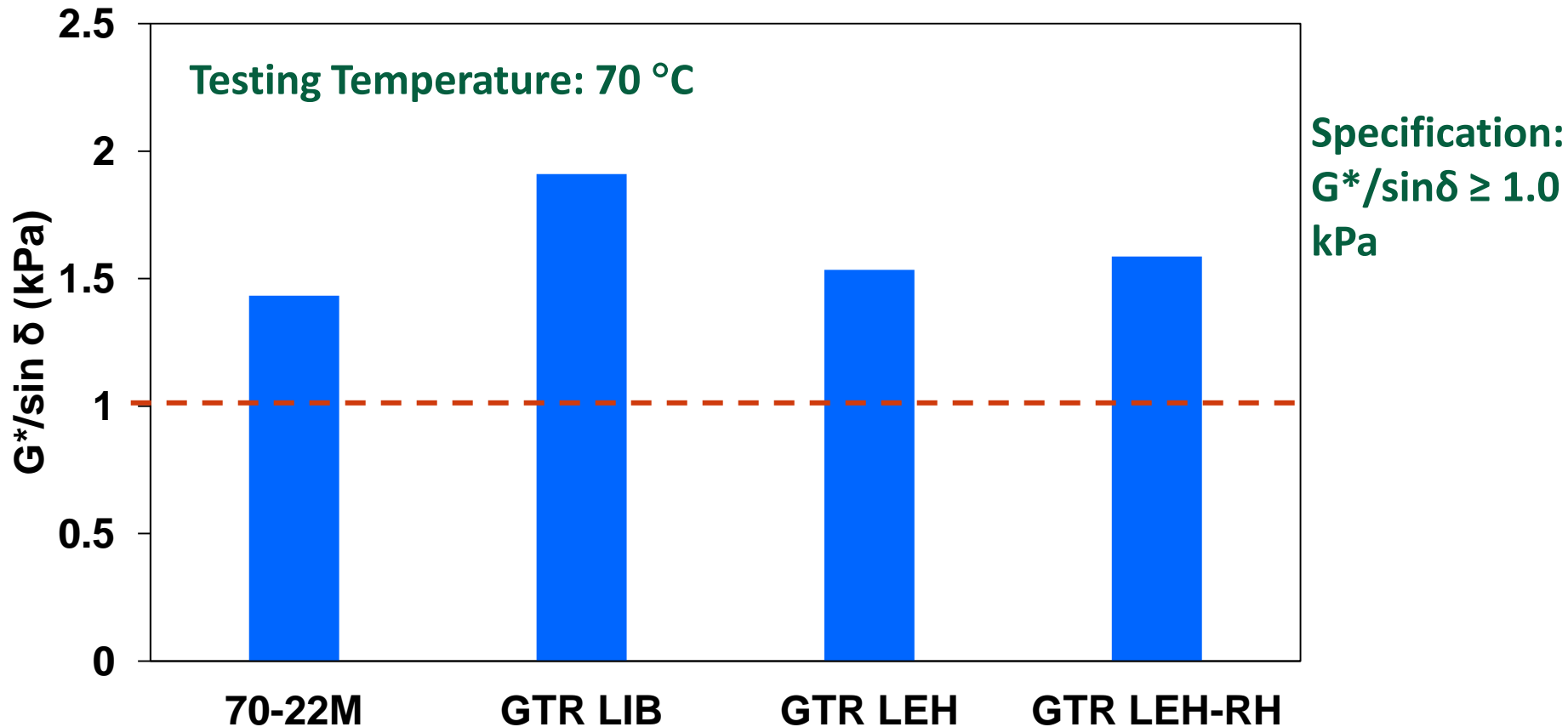
- ❑ Three quart samples of the GTR modified asphalt were obtained from the production line at the asphalt plant
 - ✓ DSR: high temperature grade
 - ✓ BBR&ABCD: Low temperature grade
- ❑ Twelve 6-inch cores were obtained from each test



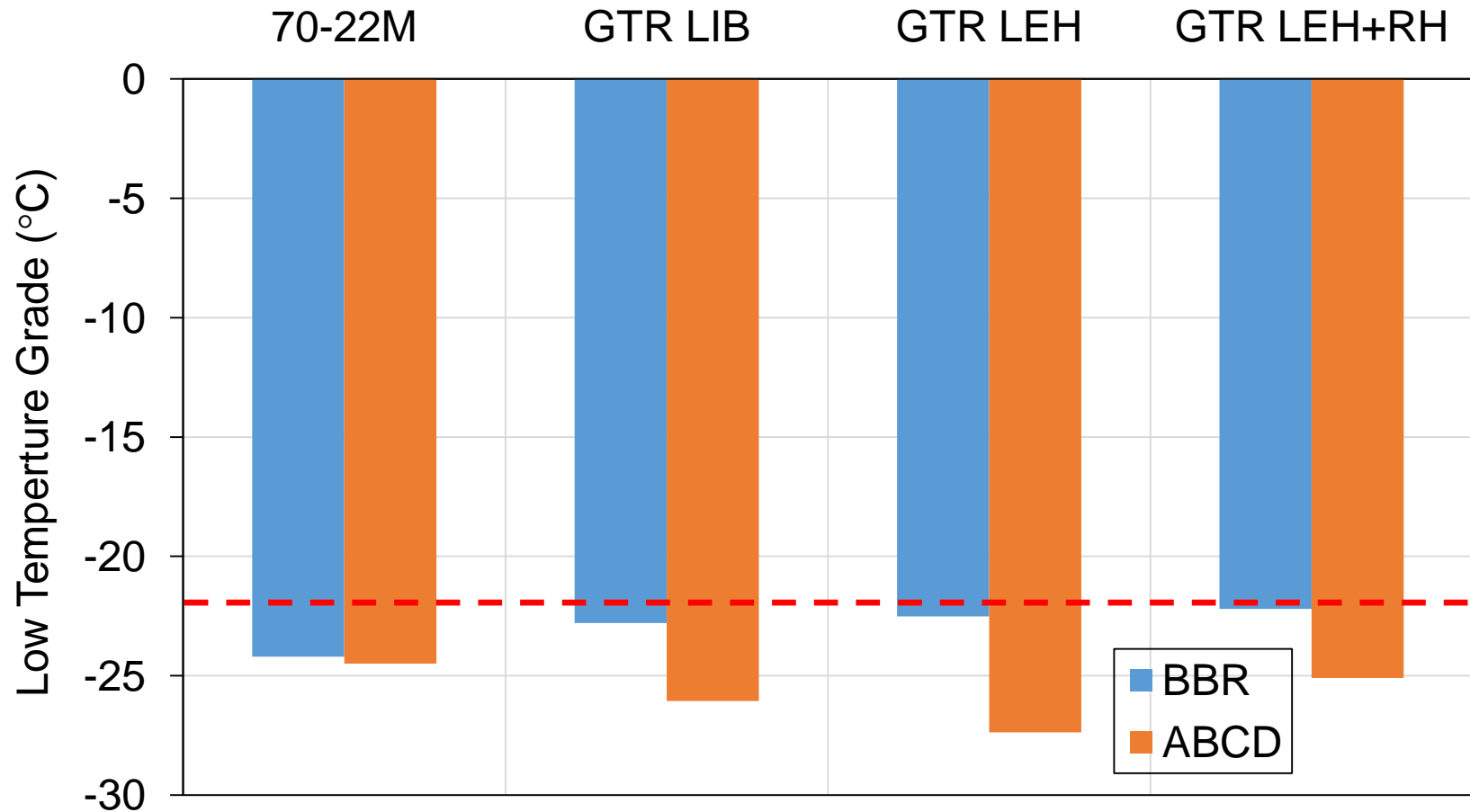
Core Samples Testing



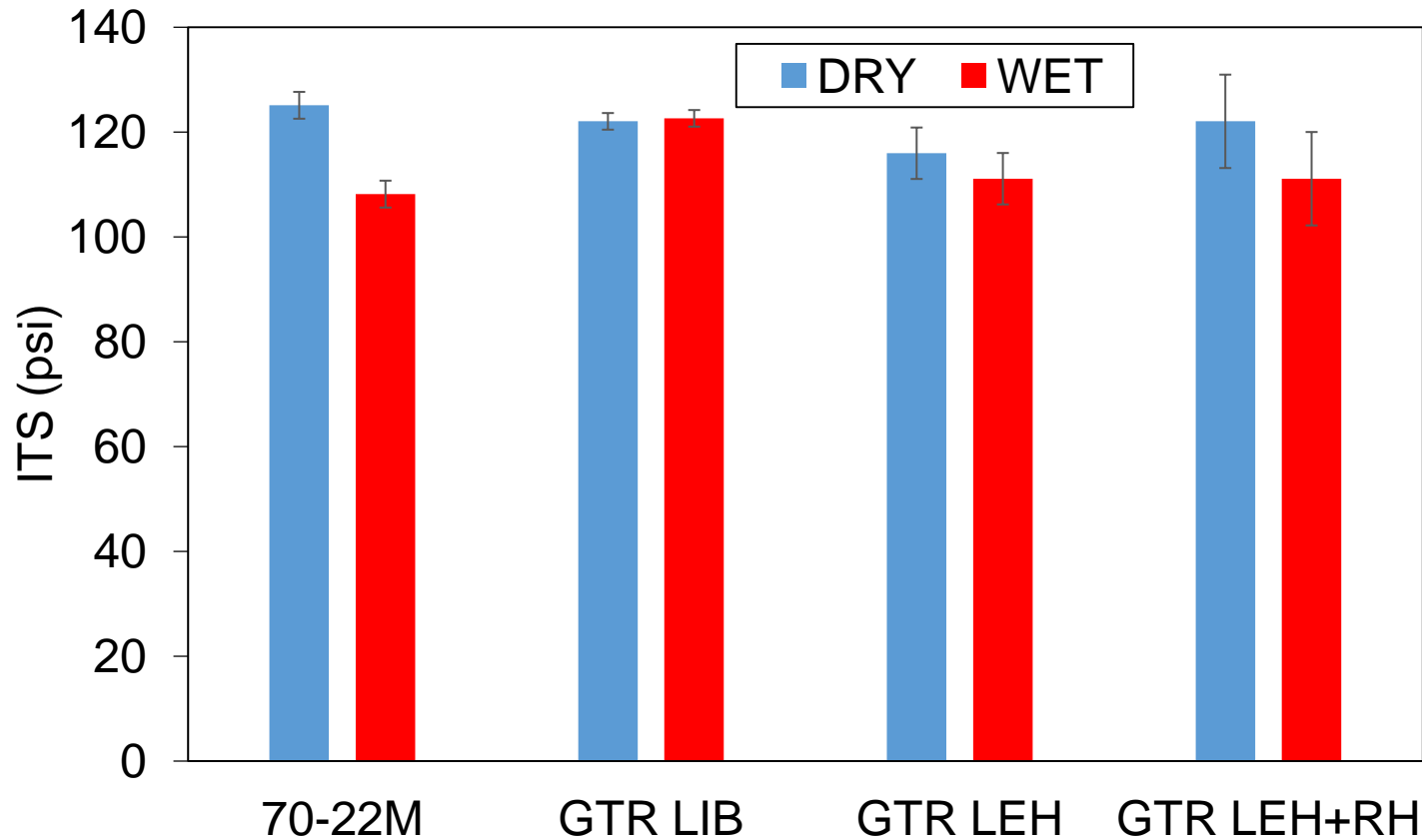
DSR Testing Results



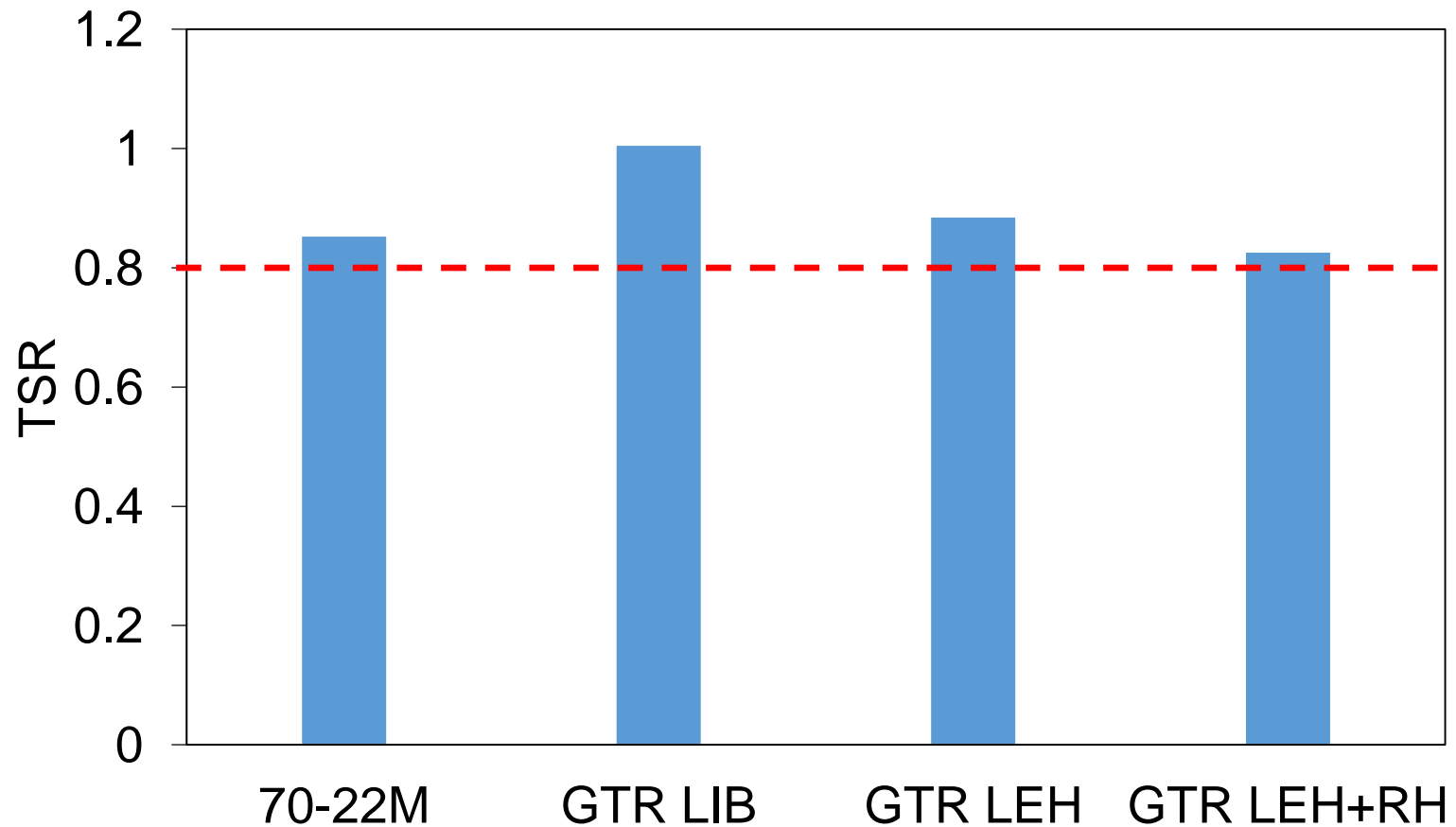
BBR Testing Results



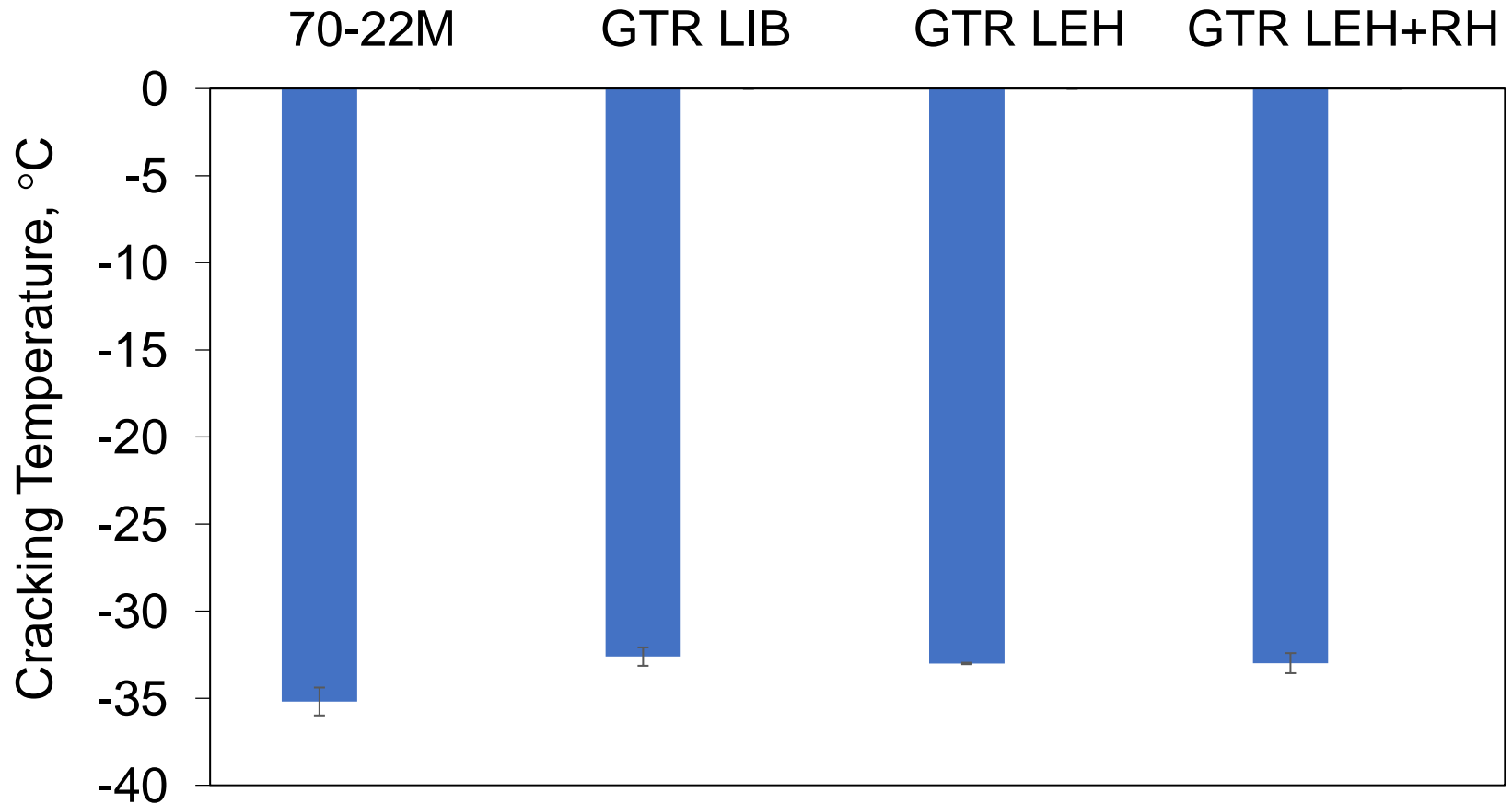
AASHTO 283 Test Results



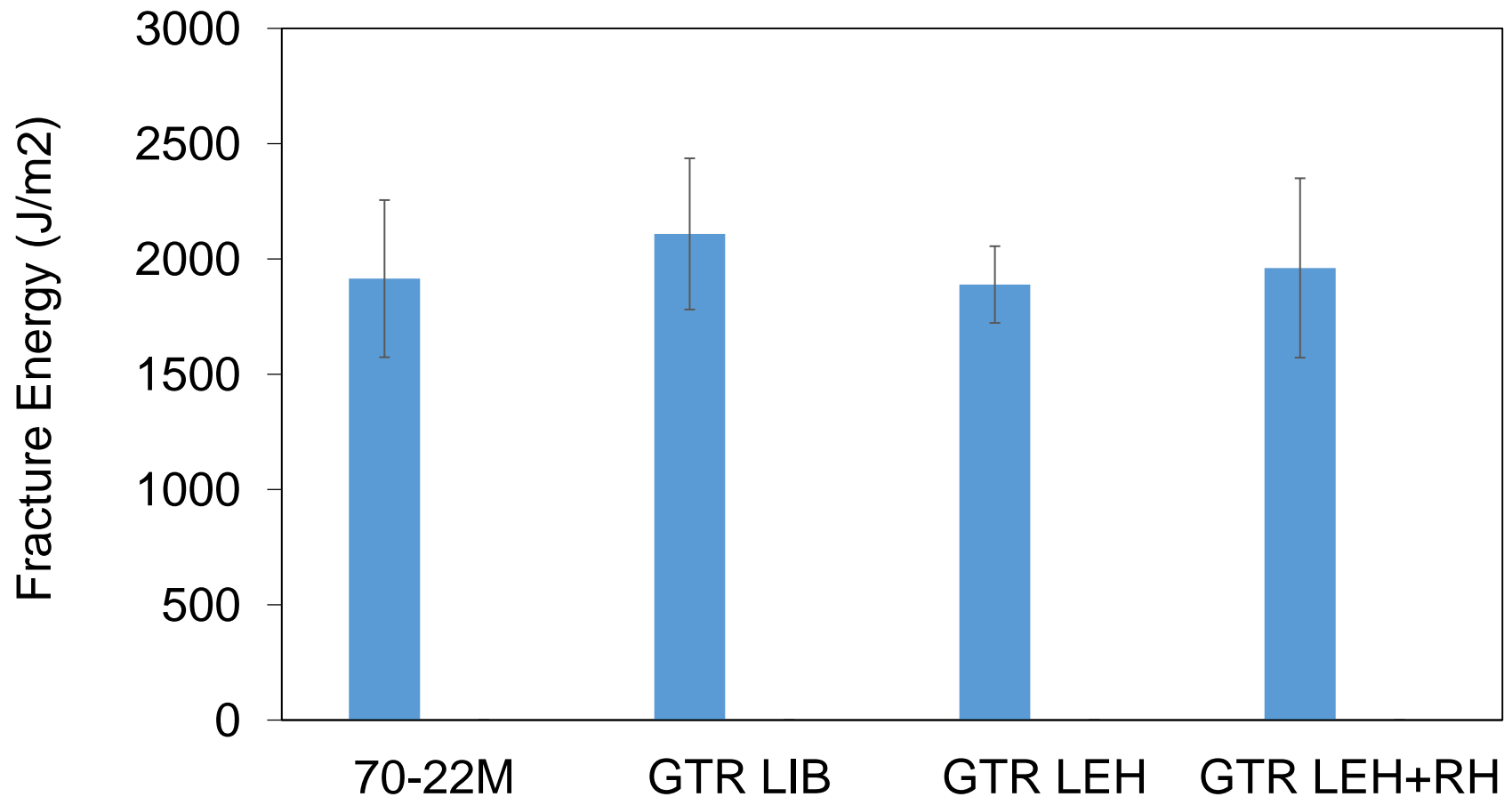
AASHTO 283 Test Results



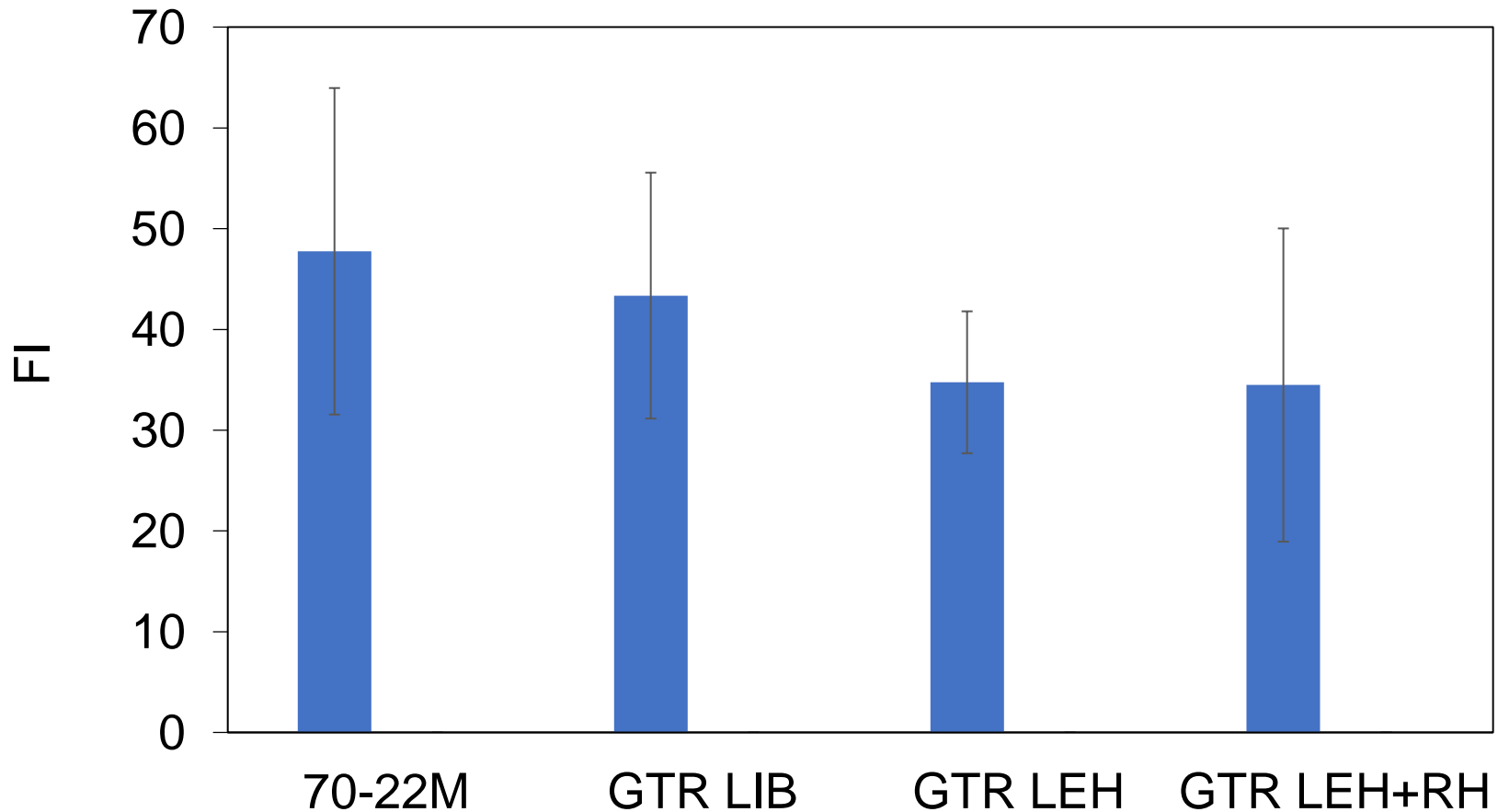
ACCD Test Results



SCB Test Results



SCB Test Results



Two Month Field Evaluations

Control



LEH



LEH-RH



LIB



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Field Study Preliminary Findings

- ❑ All GTR mixtures were produced and compacted in the field without any problems.
- ❑ Binders obtained from the production line at the asphalt indicated that all GTR binders met PG70-22 specifications.
- ❑ The results of the laboratory tests showed that cores obtained from GTR sections had similar resistance to low-temperature and fatigue cracking as well as to moisture-induced damage as those obtained from the polymer modified PG 70-22M binder.



Thank you!!



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