Northeast BMD Working Group

2024-2025 Interlaboratory Study (ILS)

Presented by:
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Agenda

- Northeast BMD Working Group
- Introduction
- Study Summary
- CT_{index} Results
- RT_{index} Results
- Takeaways
- Next Steps

Northeast BMD Working Group
Background

Northeast BMD Working Group

Mission Statement:

The Northeast Balanced Mixture Design Working Group is dedicated to advancing durable, sustainable, and resilient asphalt mixtures through the collaborative development of balanced mixture design in the Northeast region. Our mission is to foster collaboration, knowledge-sharing, and best practices among professionals in the asphalt materials community for responsible implementation of balanced mix design.

Northeast BMD Working Group

Objectives:

1. **Promote Standardization:** Advocate for the establishment of standardized BMD protocols and specifications (where appropriate) that can be more uniformly applied across the Northeast, providing clarity and consistency for industry practitioners.
2. **Collaborate with Stakeholders:** Forge partnerships with academia, industry associations, and material suppliers to create a collaborative network focused on the effective integration of BMD in construction projects in the Northeast region.
3. **Facilitate Knowledge Exchange:** Create platforms for the exchange of knowledge and experiences among states, fostering a community-driven approach to overcoming implementation challenges and optimizing BMD applications.

Through these efforts, the Northeast Balanced Mixture Design Working Group seeks to accelerate the integration of BMD into mainstream construction practices, ultimately contributing to the creation of infrastructure that not only meets the highest standards of performance but also aligns with the principles of sustainability and resilience.

Northeast BMD Working Group

Member Agencies:

- Maine
- New Hampshire
- Vermont
- Massachusetts
- Connecticut
- Rhode Island
- New Jersey
- Maryland
- Pennsylvania
- Quebec

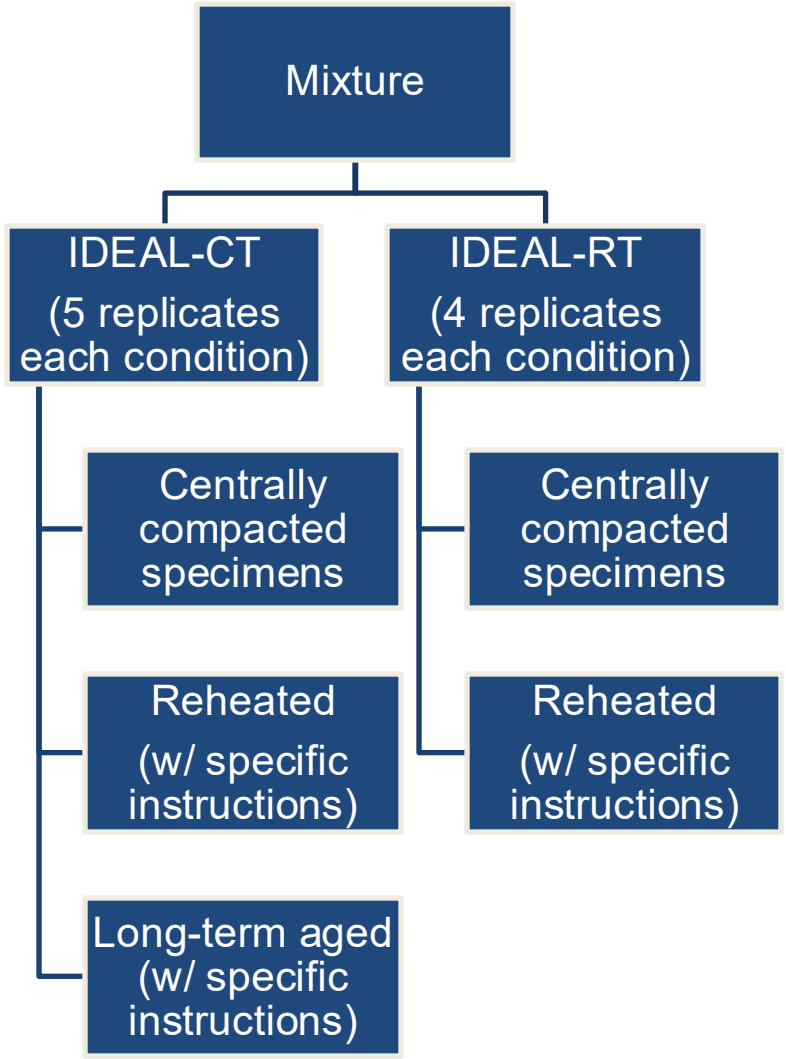
ILS Introduction

ILS Study Objectives

- To evaluate the repeatability and reproducibility of CT_{index} and RT_{index} between Northeast agency and academic testing laboratories, controlling for specimen fabrication.

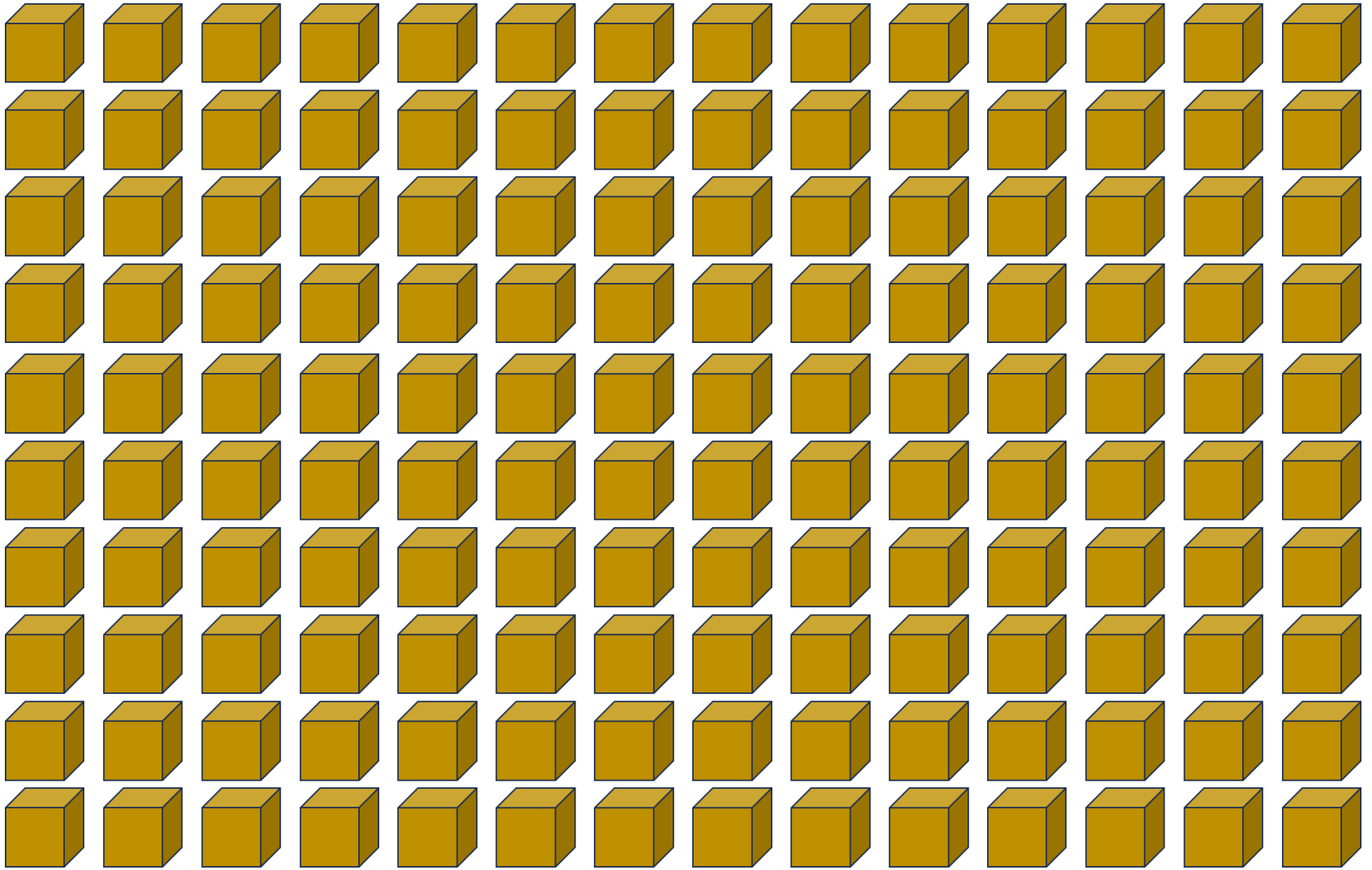
ILS Study Details

- Each lab received two mixtures
- Labs provided with detailed reheating and aging instructions
  - Time and temperatures for reheating
  - Target mass for specimens
  - G_{mm} for void determination.
- 13 participating laboratories
  - VTrans, MassDOT, PennDOT, CT DOT, MaineDOT, NJDOT, Quebec MOT, NHDOT, FHWA MATC, NYSDOT, CAP Lab, Penn State, UMass-Dartmouth



Sampling and Randomization

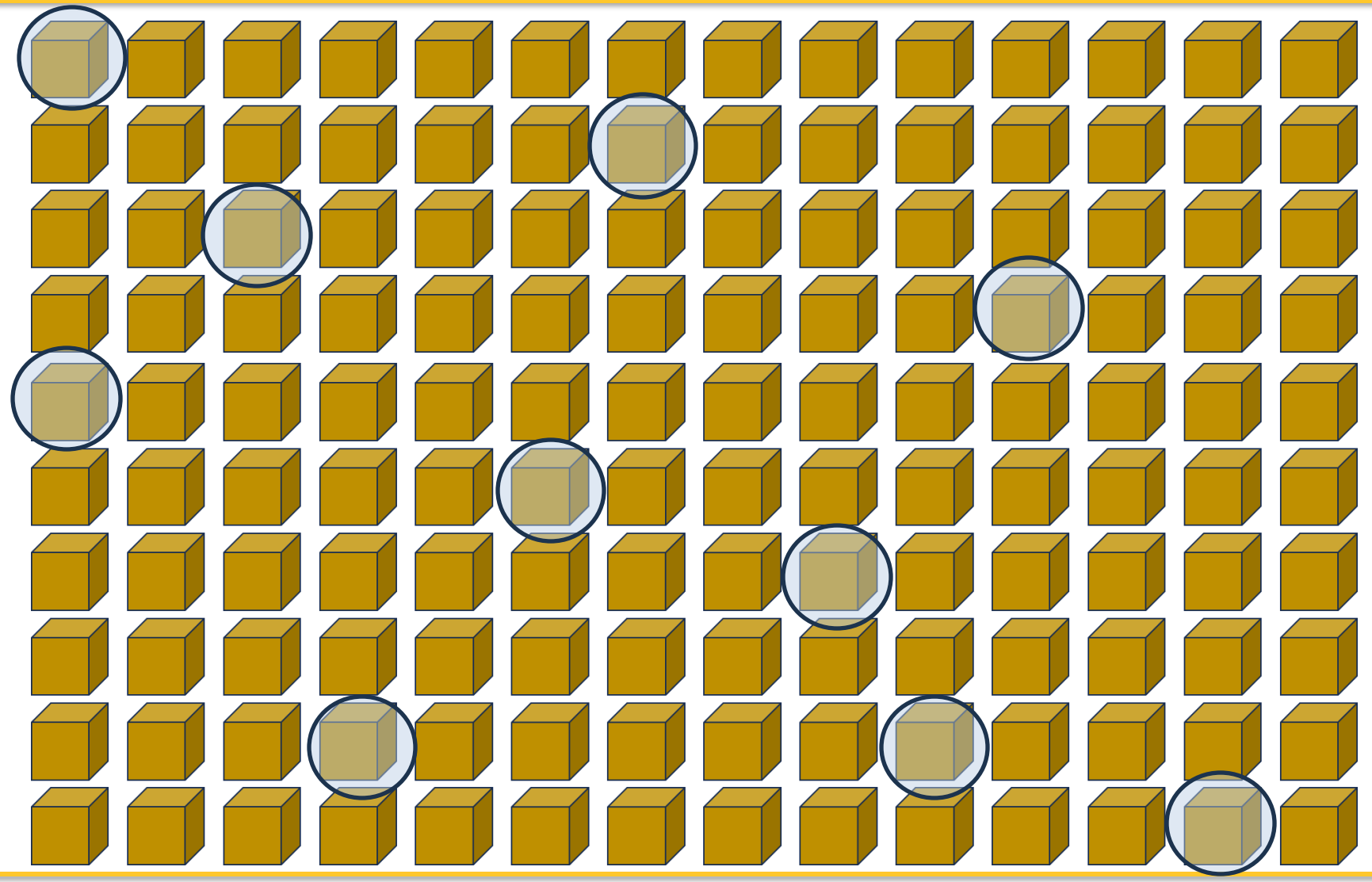
Sampled 150 boxes per mix



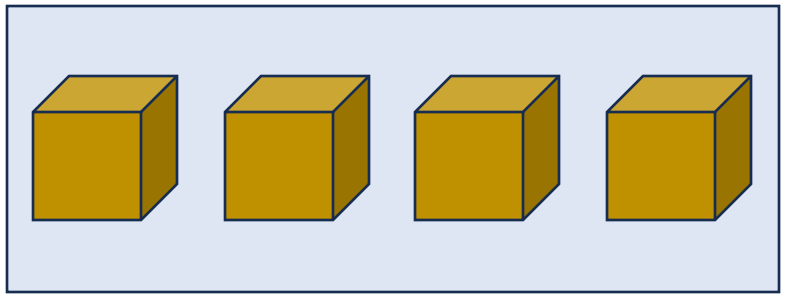
Sampling and Randomization

Sampled 150 boxes per mix

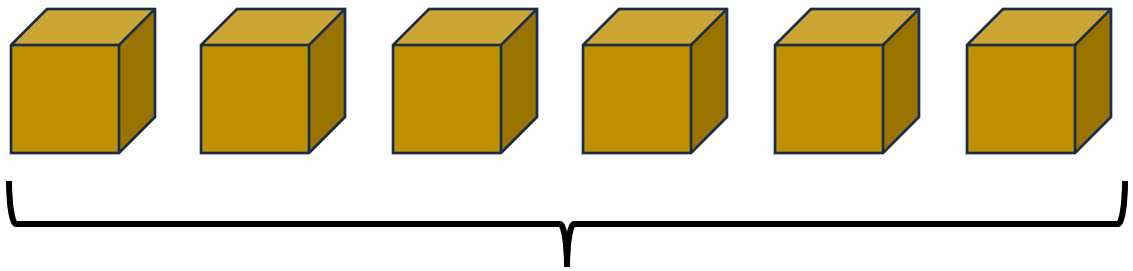
Ten randomly selected per laboratory



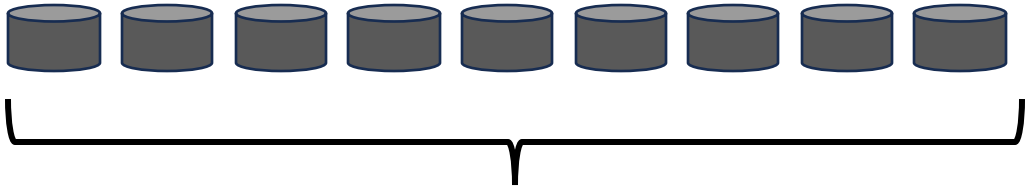
Sampling and Randomization



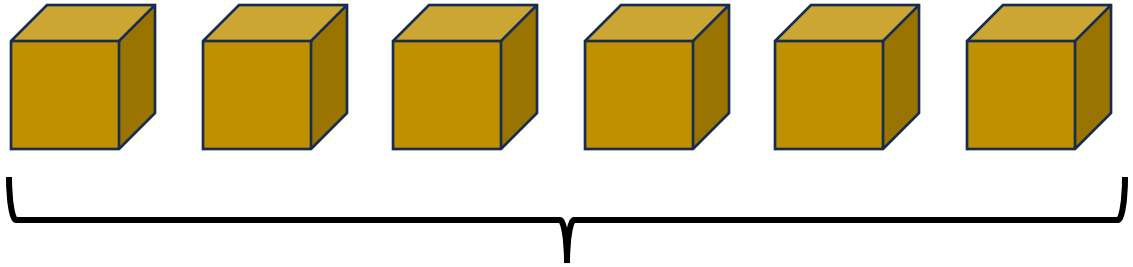
Four boxes for MaineDOT fabrication – all to be produced by same lab/technician on the same day.



Remaining six boxes for lab fabrication per provide instructions.



9+ specimens for IDEAL-CT / IDEAL-RT testing. Specimens will be assigned to a particular test.



Six boxes for lab fabrication per provided instructions. Boxes will be assigned to a particular test.

IDEAL-CT Results

CT_{index} - Phases

Phase I

Centrally compacted specimens tested by different labs

Phase II

Reheated mix used to fabricate specimens in each lab – then tested

Phase III

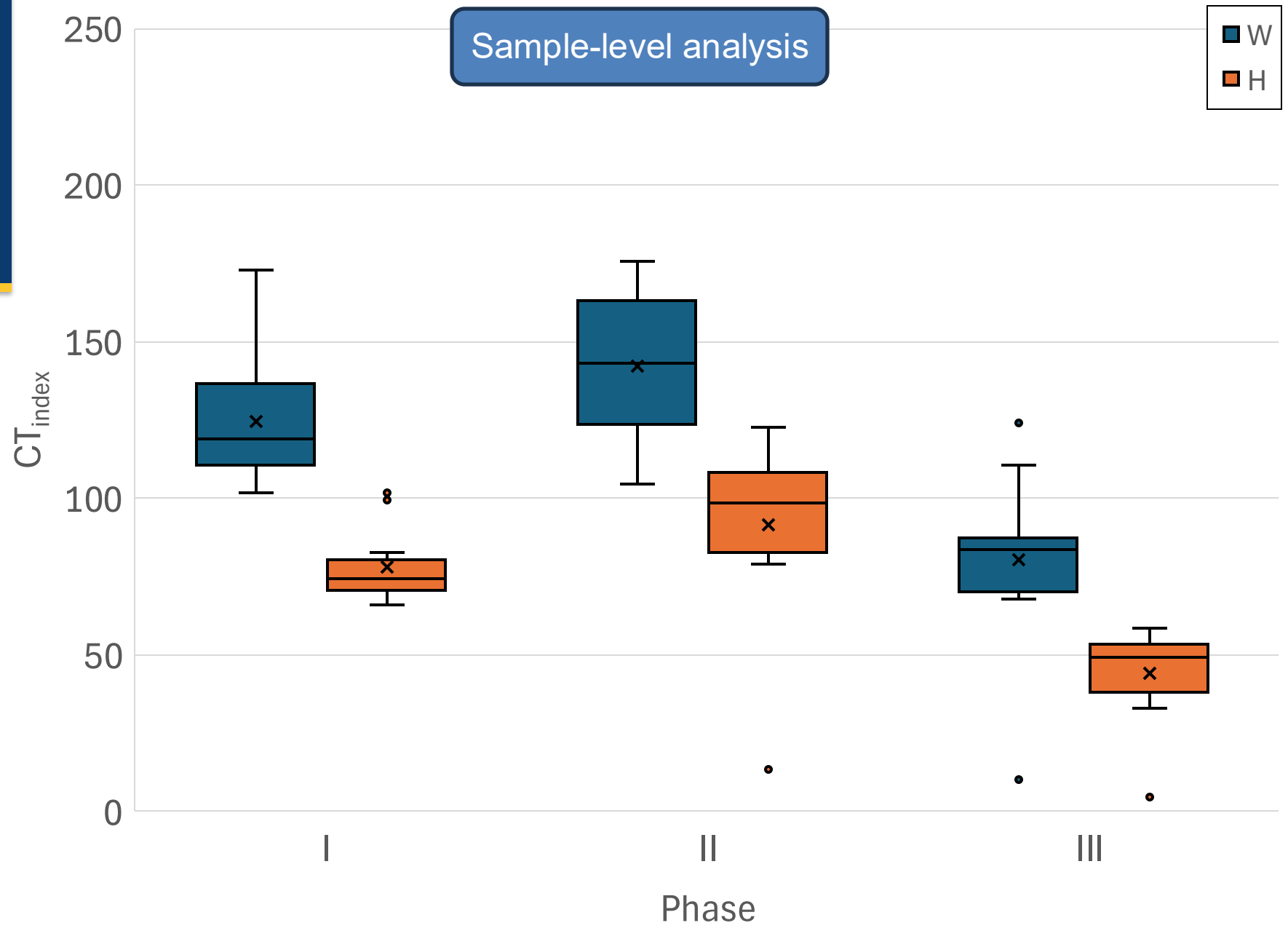
Reheated and aged mix used to fabricate specimens in each lab – then tested

CT_{index} – Summary of Results

Variable	Mix	Phase	N	Mean	SE Mean	Stan. Dev.	COV	Min	Q1	Median	Q3	Max
CTindex	W	I	13	124.2	5.5	19.9	16.0%	101.4	111.2	118.7	135.7	172.8
CTindex	W	II	12	142.2	6.3	21.9	15.4%	104.1	127.3	142.8	160.4	175.7
CTindex	W	III	12	80.1	7.9	27.4	34.2%	9.9	71.3	83.3	86.5	123.9
CTindex	H	I	13	77.9	3.0	10.9	13.9%	65.5	70.5	74.0	77.6	101.6
CTindex	H	II	12	91.1	8.1	27.9	30.7%	13.0	83.1	98.0	107.3	122.5
CTindex	H	III	12	44.0	4.3	14.9	33.9%	4.1	39.7	49.0	52.9	58.2

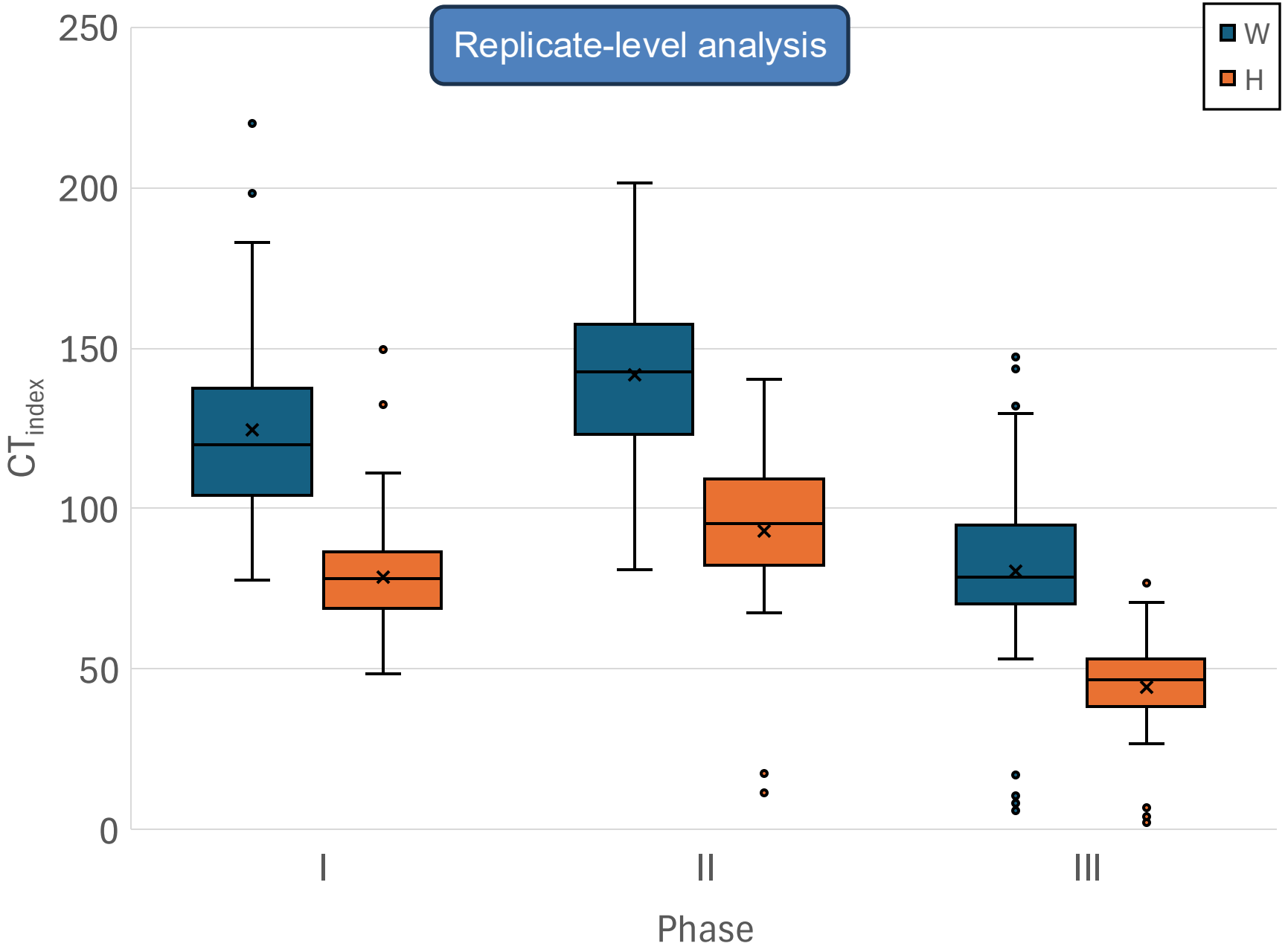
CT_{index} – Summary of Results

- Apparent increase in variability between Phase I to Phase II
- Reduced variability in aged condition (Phase III)
- Multiple outliers



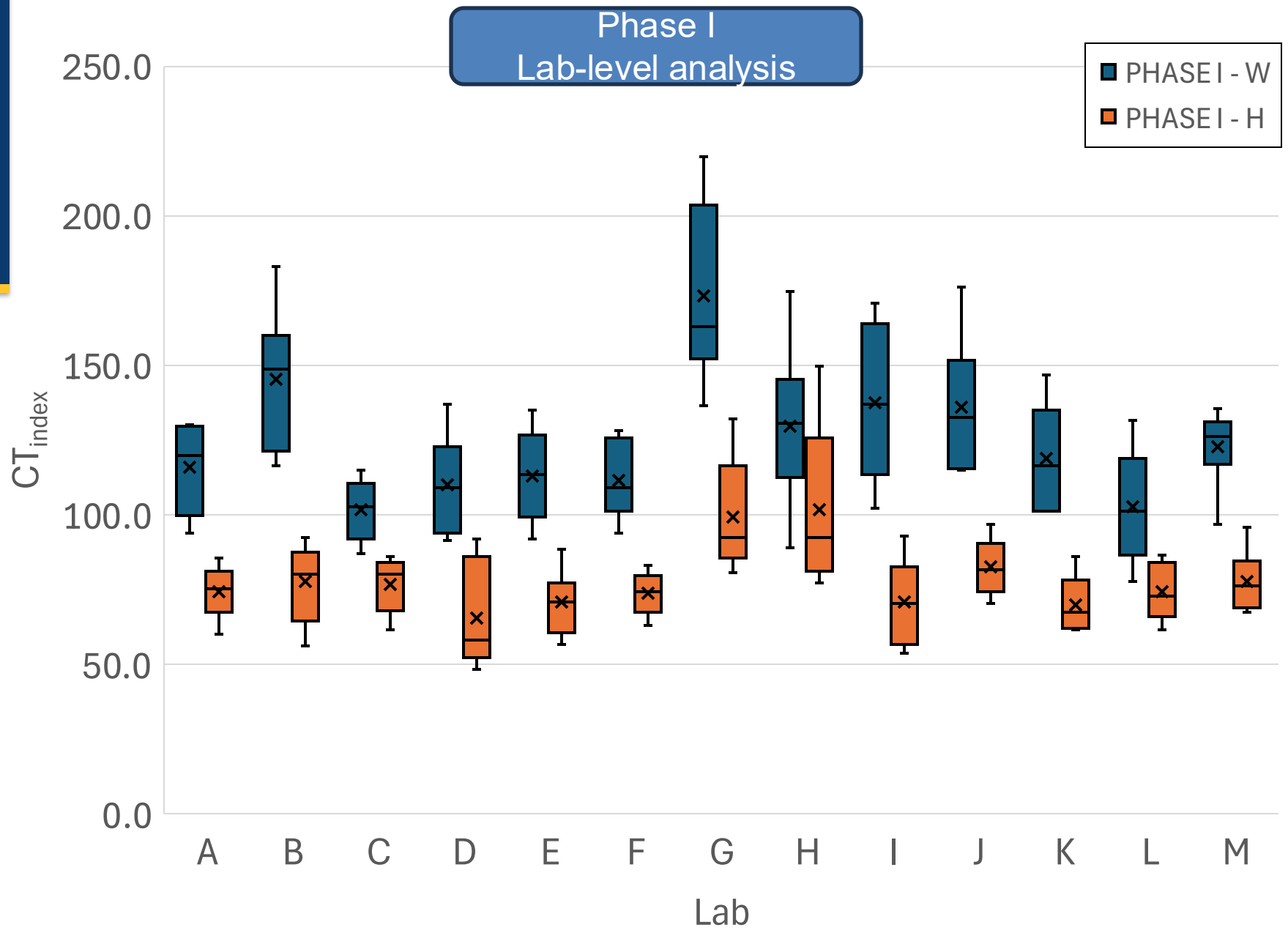
CT_{index} – Summary of Results

- Apparent increase in variability between Phase I to Phase II
- Reduced variability in aged condition (Phase III)
- Multiple outliers – confined to specific labs



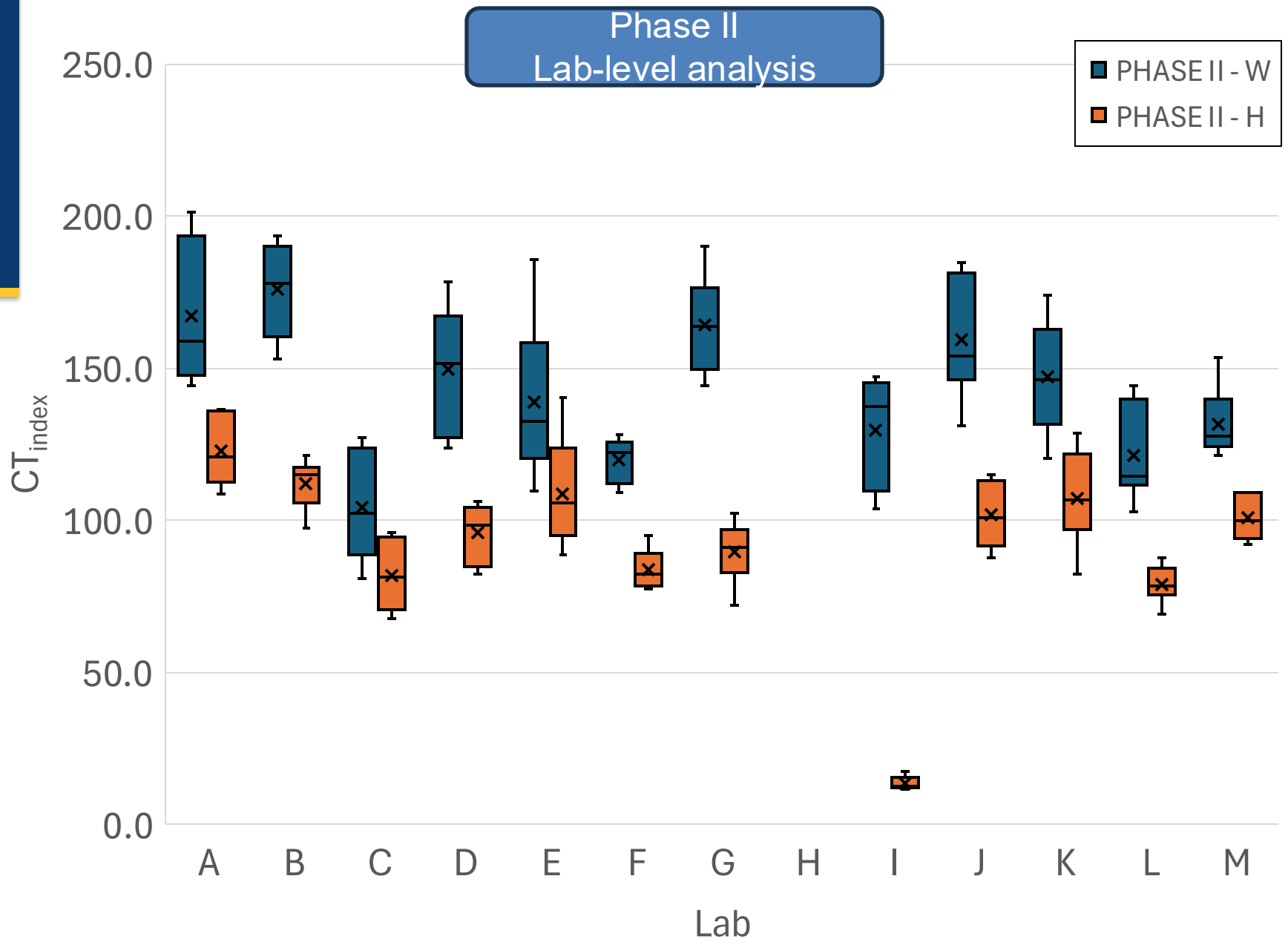
CT_{index} – Summary of Results

- No outliers when analyzed by lab
- Apparent reduction in variability for Mix H



CT_{index} – Summary of Results

- No outliers when analyzed by lab
- Extreme values for Lab I for H mix
- Difference between mixes varied by lab



CT_{index} – Summary of Results

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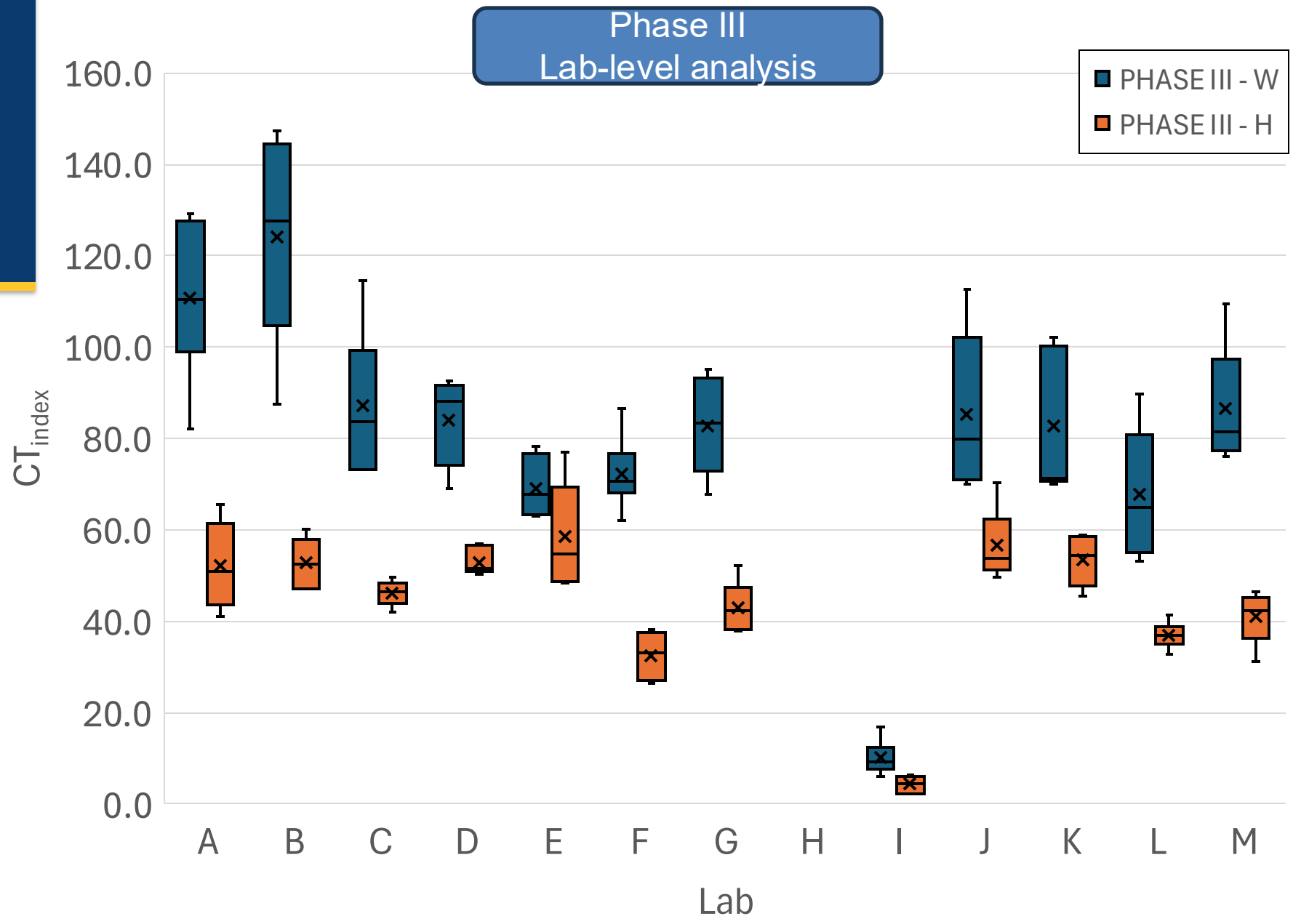
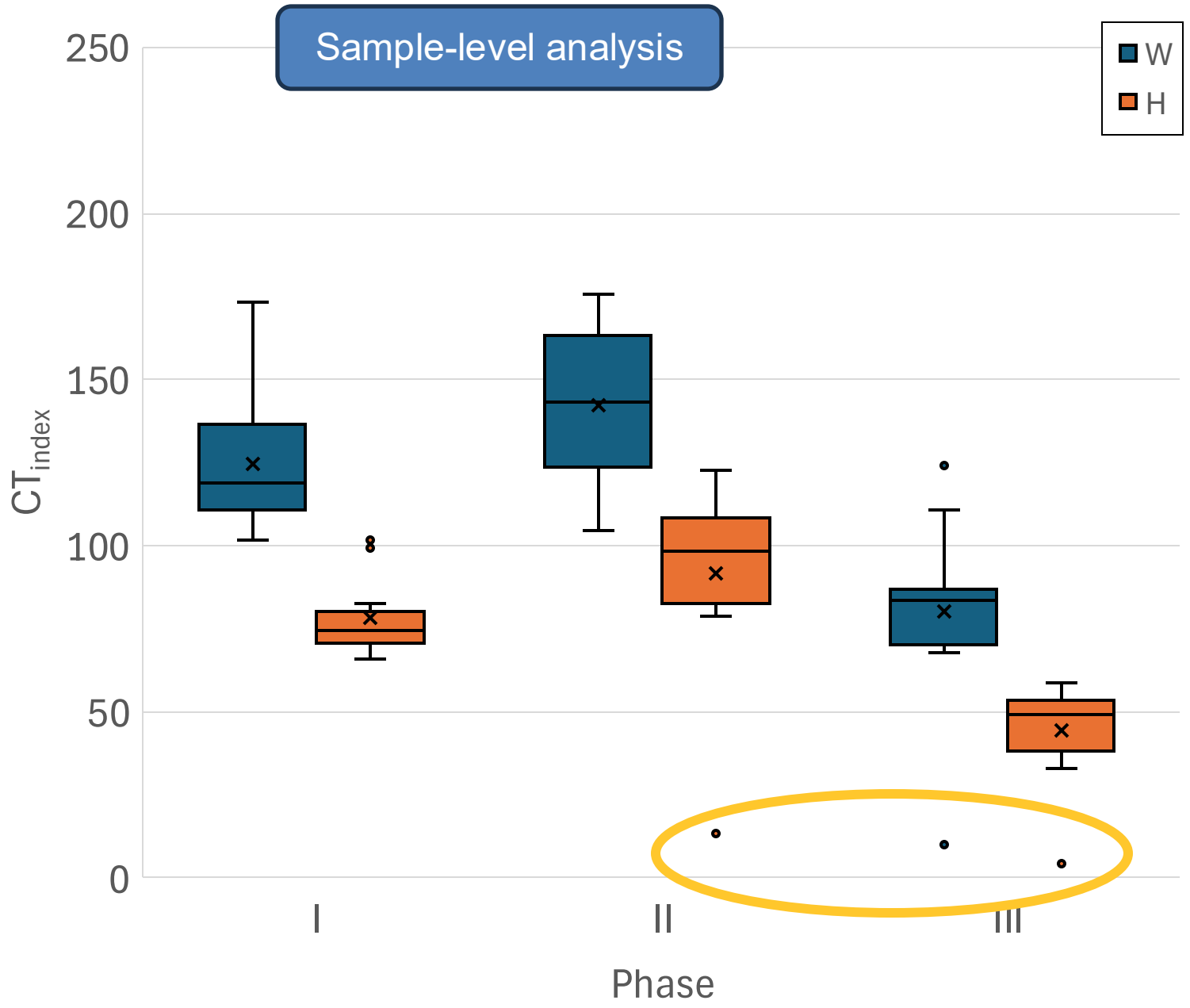


CT_{index} – Data Removal

- Decision made to remove the following data from the analysis before proceeding:
  - Lab H (only performed Phase I)
  - Lab I (Phase II – H, both Phase III)



CT_{index} – ASTM E691 Analysis

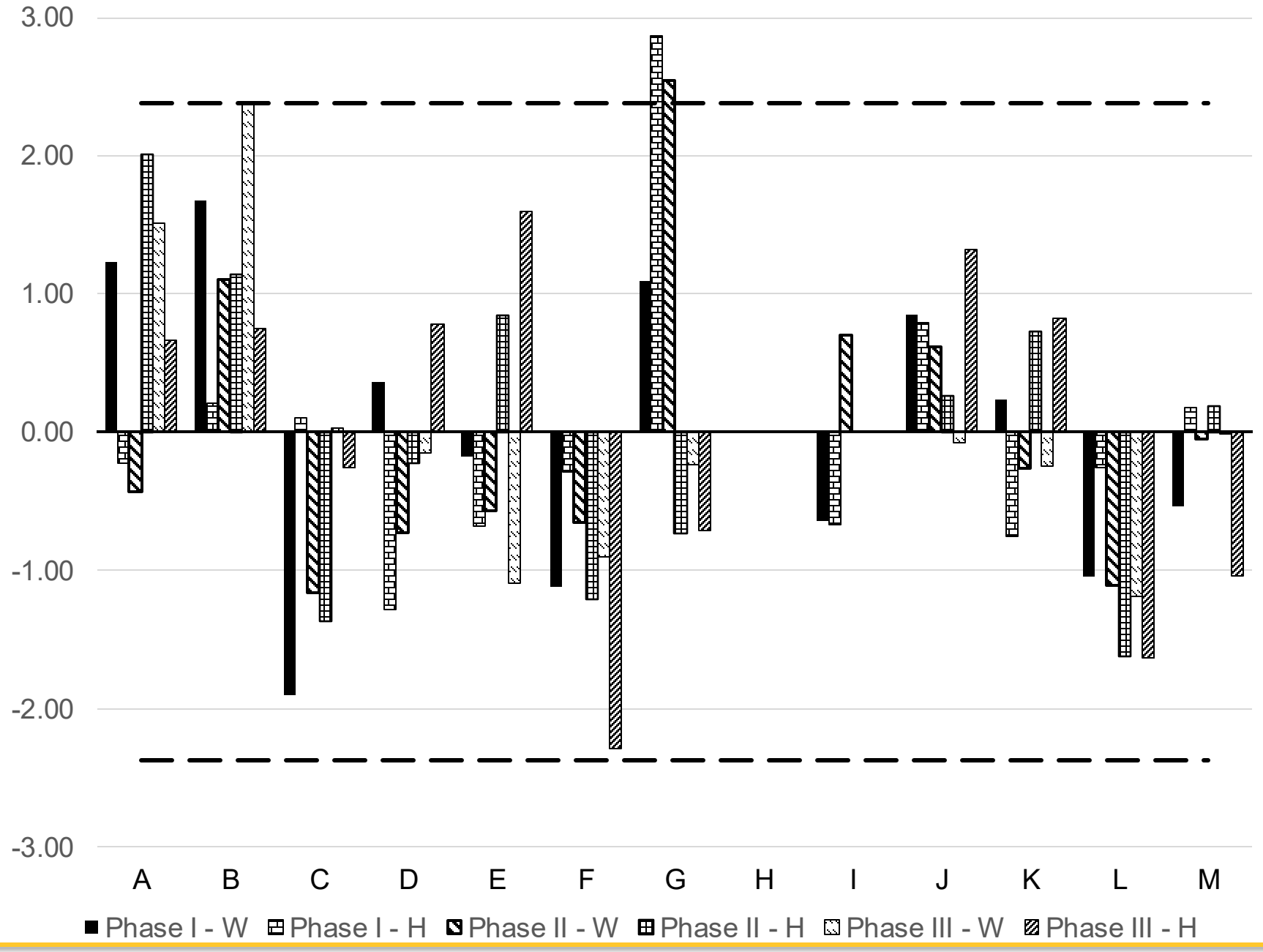
- Conducted ILS analysis per ASTM E691
- r = R for most due to "excellent" agreement between labs

Phase	Mix	Number of Labs	Average Result	Within Lab St. Dev.	Within Lab COV	Between-Lab St. Dev.	Between Lab COV
I	W	12	123.8	19.5	15.7%	19.7	15.9%
I	H	12	75.9	12.3	16.1%	12.3	16.1%
II	W	12	142.2	18.4	12.9%	19.1	13.5%
II	H	11	98.2	11.3	11.5%	11.9	12.1%
III	W	11	86.4	14.5	16.8%	15.0	17.4%
III	H	11	47.6	6.5	13.6%	6.9	14.5%
2024 NE BMD ILS							
Section 2	A	9	79.9	14.4	18.0%	18.6	23.3%
Section 3	A	9	97.0	18.7	19.3%	18.7	19.3%
Section 4	A	9	56.6	10.2	18.1%	12.2	21.5%

IDEAL-CT Index Study	Study Description	Estimates, COV%	
		Single Operator	Multi-Lab
NCAT, Phase 1	1 Mix; 5 replicates; 15 laboratories	19.5%	35.3%
NCAT, Phase 2	1 Mix; 5 replicates; 14 laboratories	18.8%	20.2%
Rutgers U.	5 Mixes; 3 replicates; 9 laboratories	15.2%	23.0%
VTRC 2 Mixes; 5 replicates; 41 labs	16 data sets per mix	18.3%	21.3%
	30 data sets per mix	20.7%	21.9%

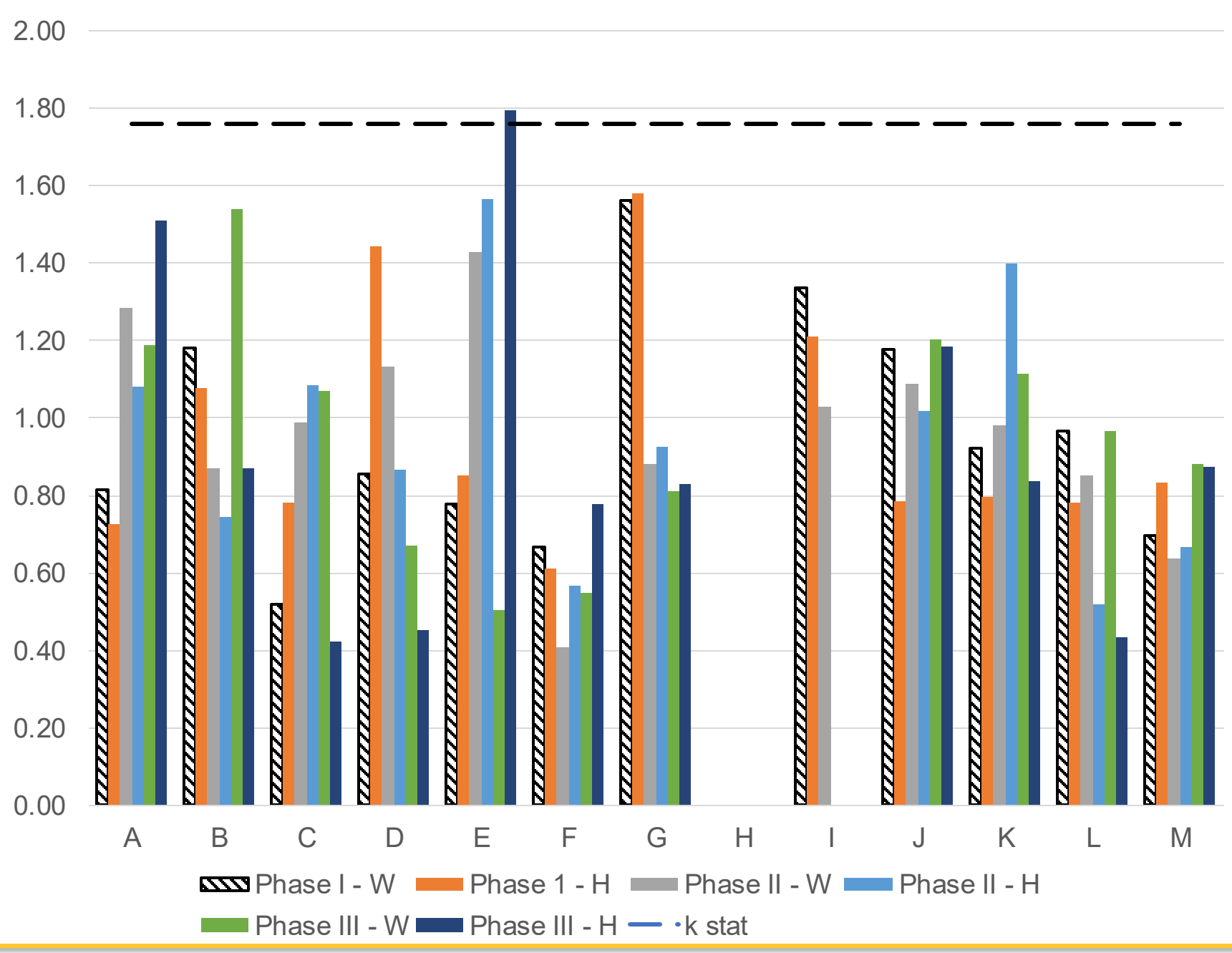
CT_{index} – ASTM E691 Analysis

- *h* = between-lab consistency statistic at 0.5% significance
- Two mix/phases for Lab G



CT_{index} – ASTM E691 Analysis

- *k* = within-consistency statistic at 0.5% significance



IDEAL-RT Results

RT_{index} - Phases

Phase I

Centrally compacted specimens tested by different labs

Phase II

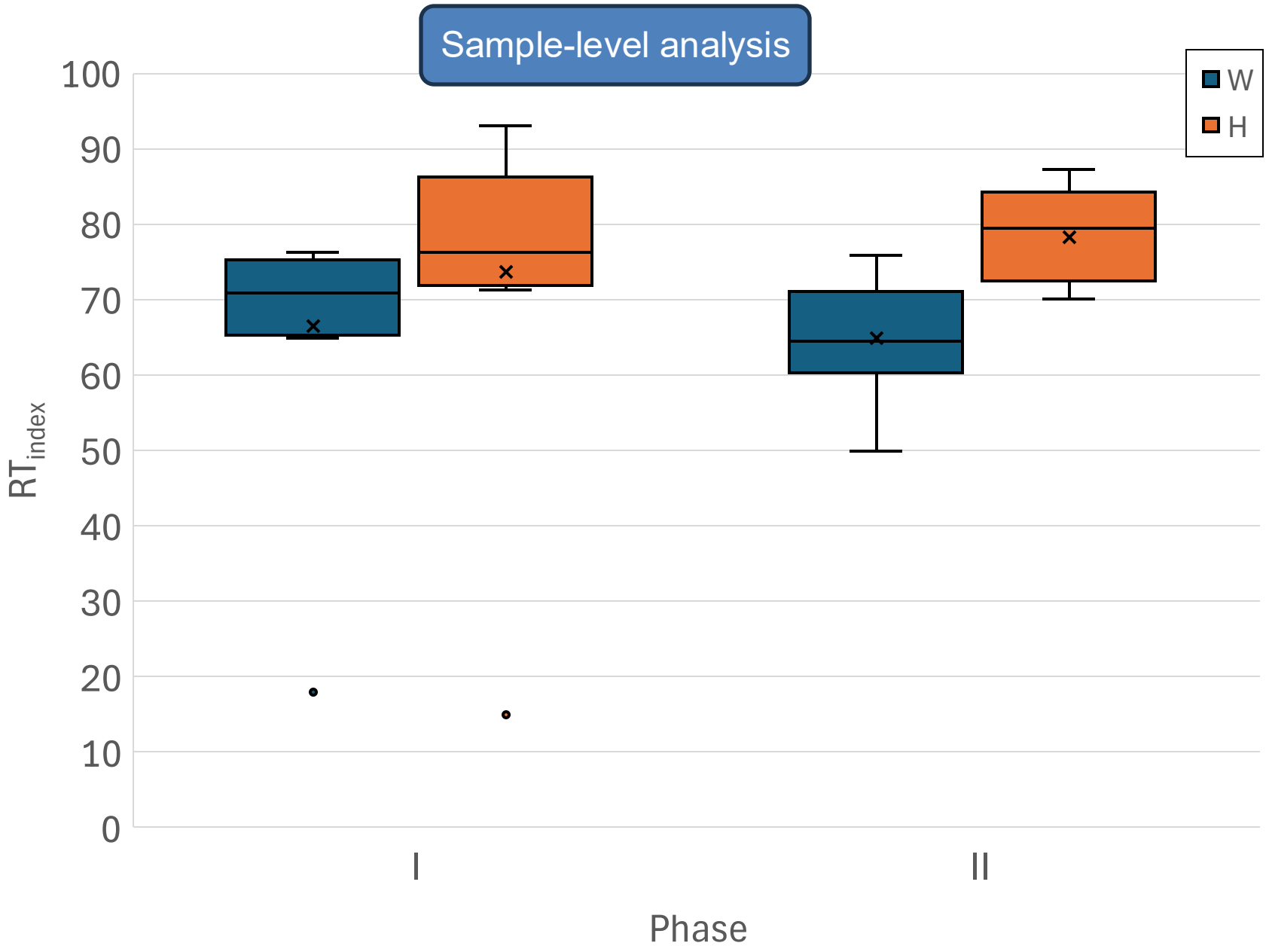
Reheated mix used to fabricate specimens in each lab – then tested

RT_{index} – Summary of Results

Variable	Mix	Phase	N	Mean	SE Mean	Stan. Dev.	COV	Min	Q1	Median	Q3	Max
RTindex	W	I	11	66.4	5.0	16.6	25.0%	17.9	66.2	70.8	74.5	76.3
RTindex	W	II	11	64.8	2.4	7.8	12.1%	49.8	60.3	64.4	69.4	75.8
RTindex	H	I	11	73.5	6.2	20.6	28.0%	14.9	72.4	76.1	83.4	92.9
RTindex	H	II	11	78.1	2.0	6.6	8.4%	70.1	72.7	79.5	82.9	87.2

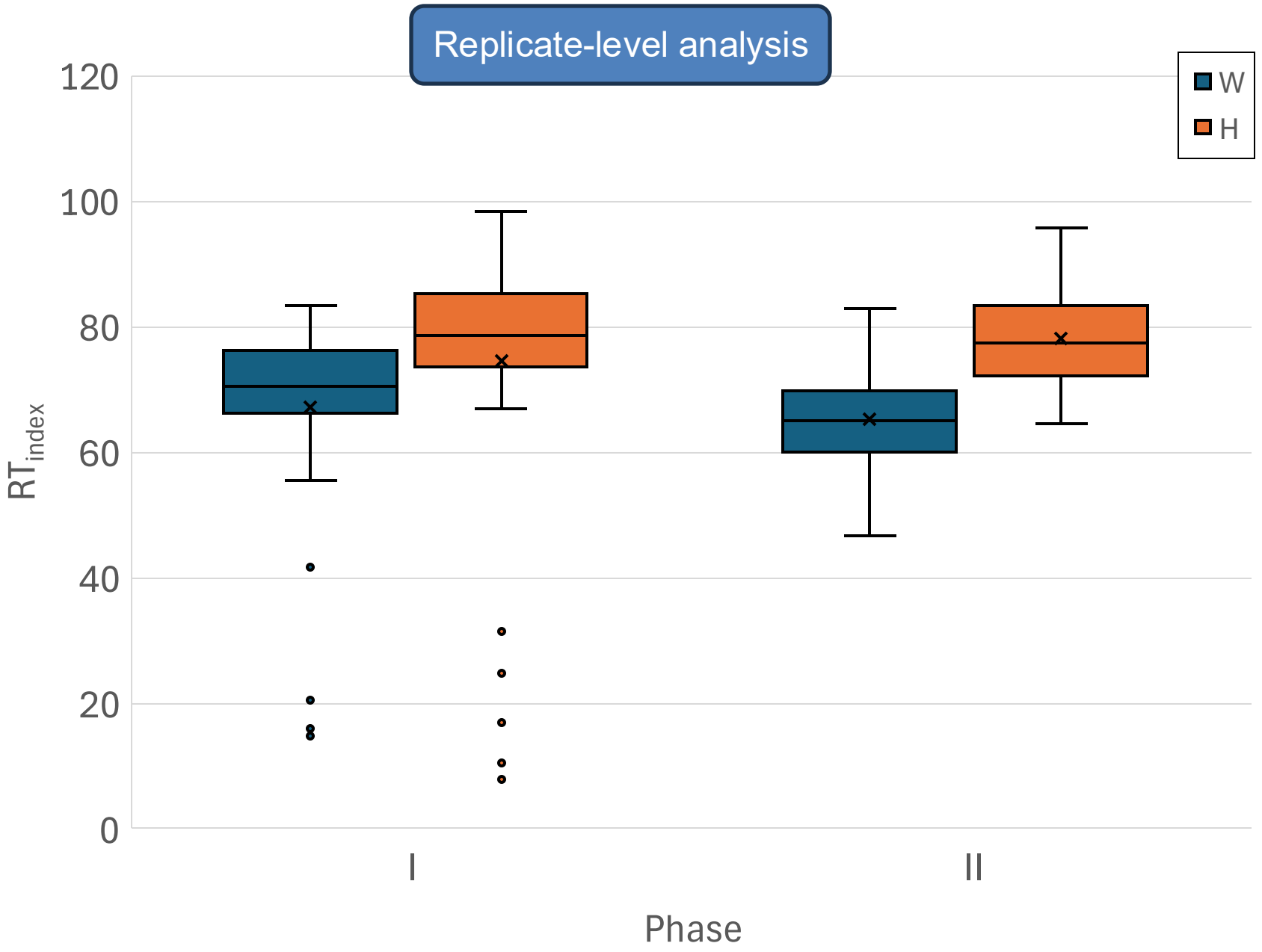
RT_{index} – Summary of Results

- Outliers from one lab



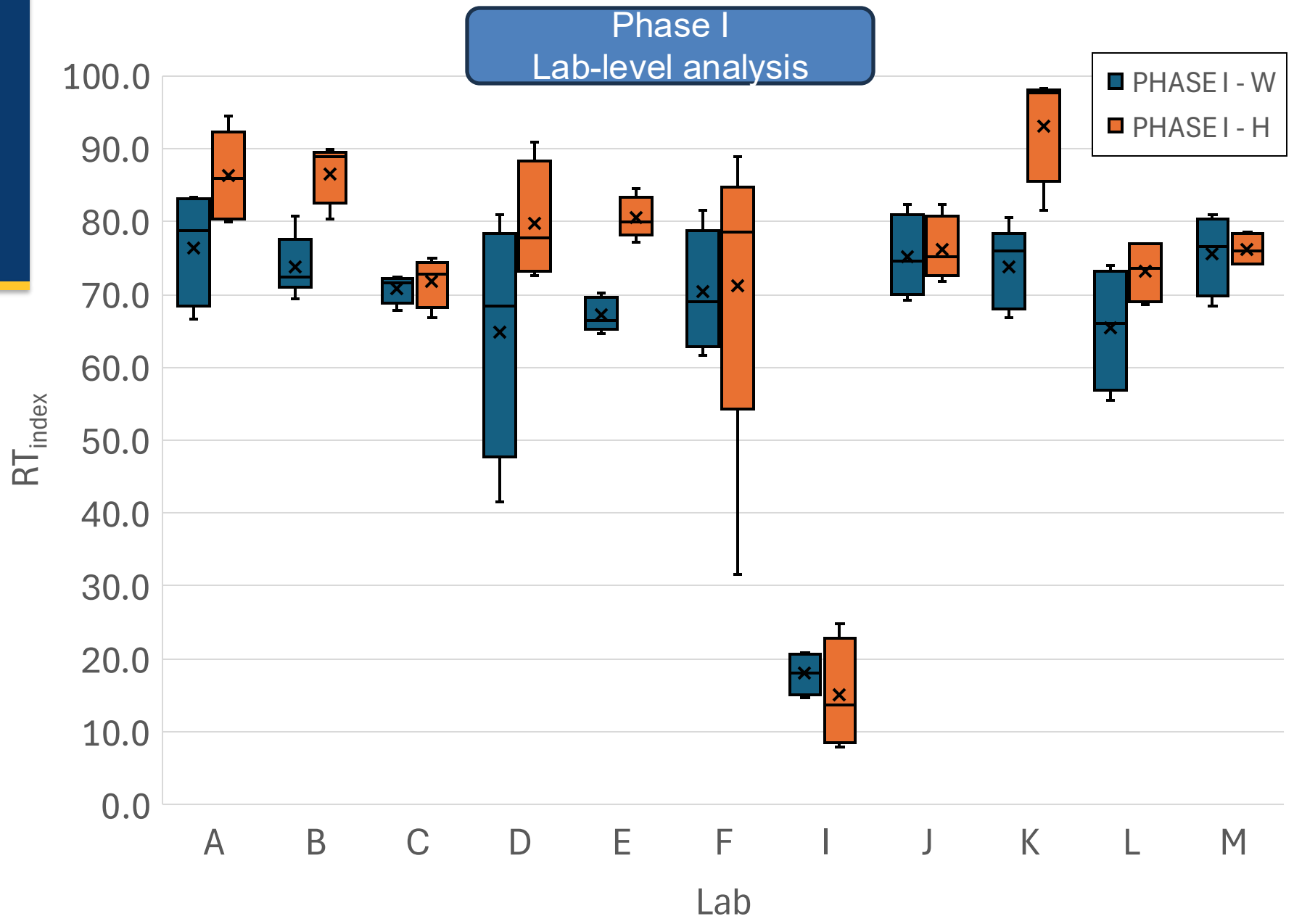
RT_{index} – Summary of Results

- Multiple outliers – confined to specific labs



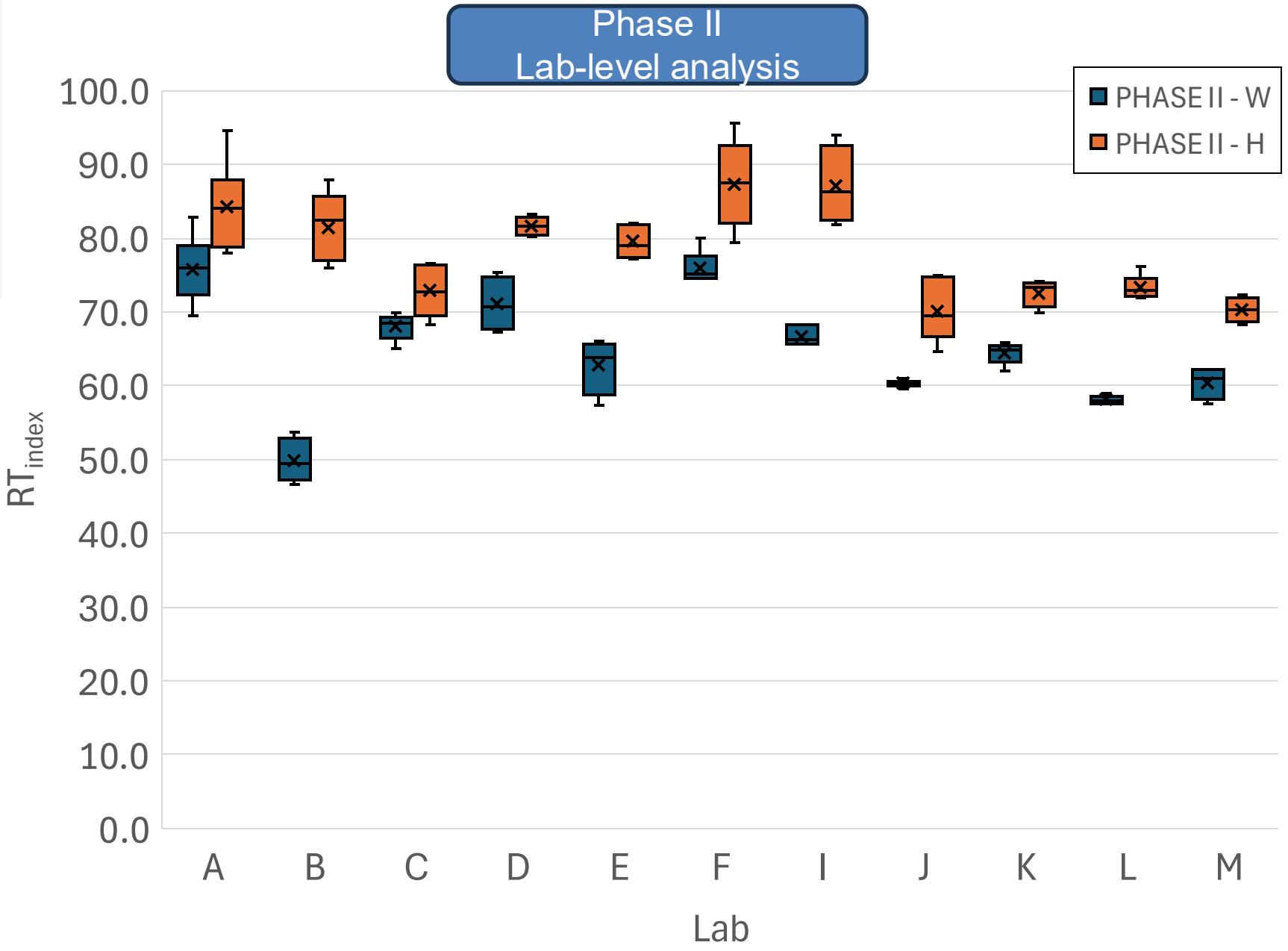
RT_{index} – Summary of Results

- No outliers when analyzed by lab



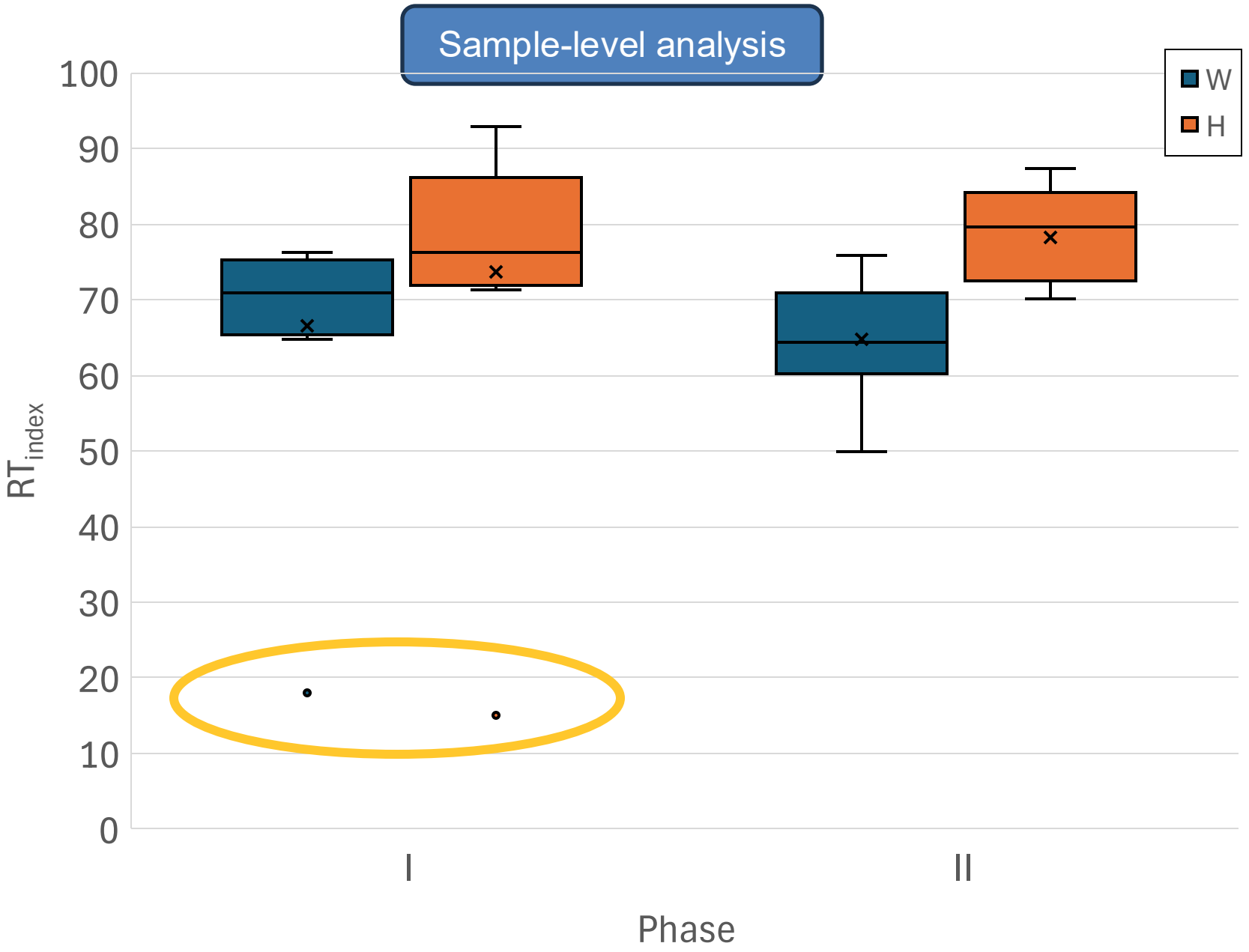
RT_{index} – Summary of Results

- No outliers when analyzed by lab
- Difference between mixes varied by lab



RT_{index} – Data Removal

- Decision made to remove the following data from the analysis before proceeding:
  - Lab I (both Phase I)



RT_{index} – ASTM E691 Analysis

- Conducted ILS analysis per ASTM E691
- r = R for most due to “excellent” agreement between labs

Phase	Mix	Number of Labs	Average Result	Within Lab St. Dev.	Within Lab COV	Between-Lab St. Dev.	Between Lab COV
I	W	10	71.3	7.7	10.9%	7.7	10.9%
I	H	10	79.4	8.7	10.9%	8.7	10.9%
II	W	11	64.8	2.6	4.1%	4.2	6.5%
II	H	11	78.1	3.9	5.0%	4.6	5.8%

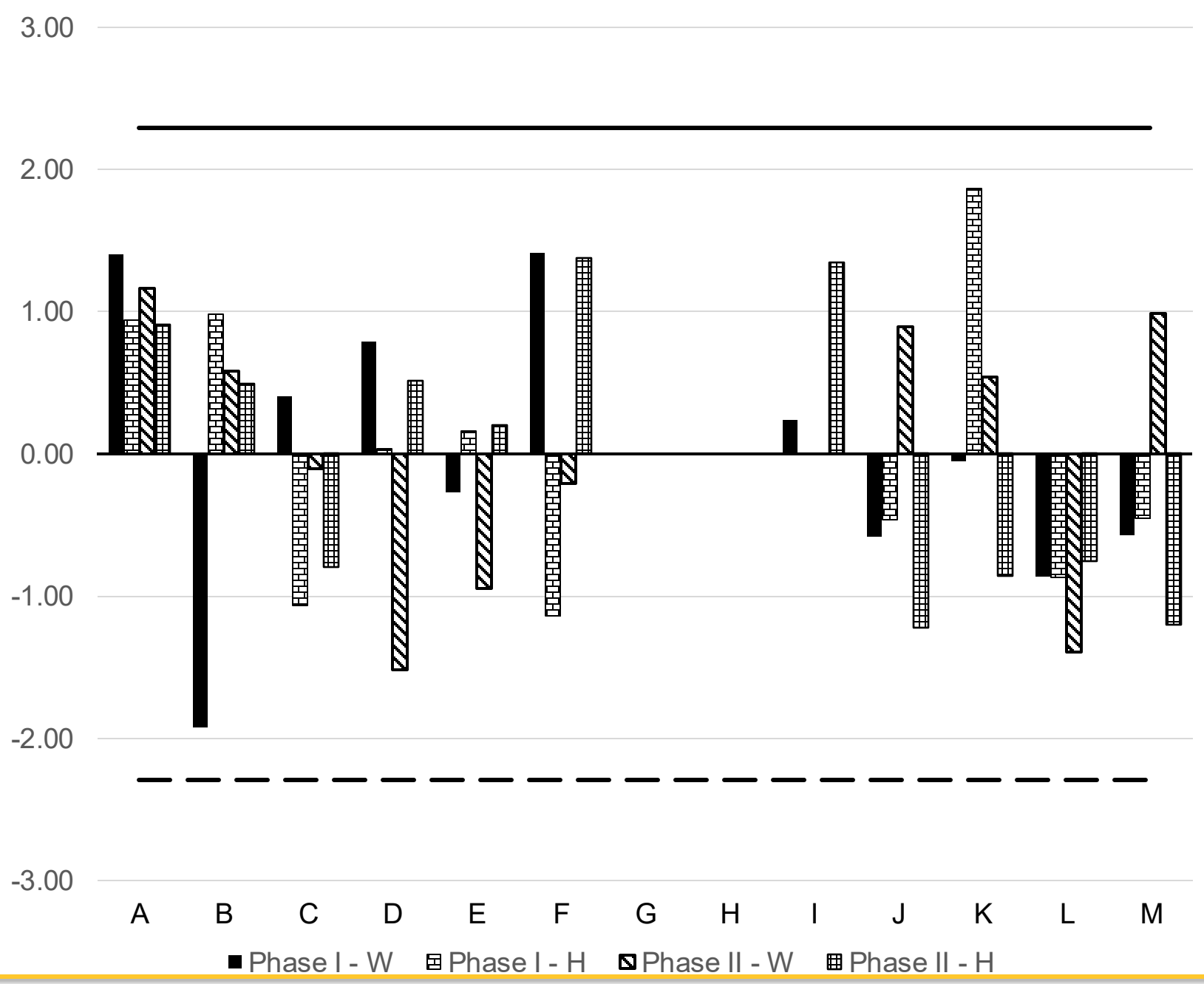
Table 15. Summary of Precision Estimates of the IDT-HT and IR Tests

Test/Parameter	Condition	Precision Estimate Values, COV, %	
		Single-Operator	Multi-Laboratory
IDT-HT/Strength	Five-replicate	10.8	12.8
	Three-replicate/Lowest	7.3	10.7
	Three-replicate/Highest	13.7	13.9
IR/RT Index	Three-replicate	8.5	17.0

COV = coefficient of variation; IDT-HT = indirect tensile at high temperature; IR = ideal rutting; RT = rutting tolerance.

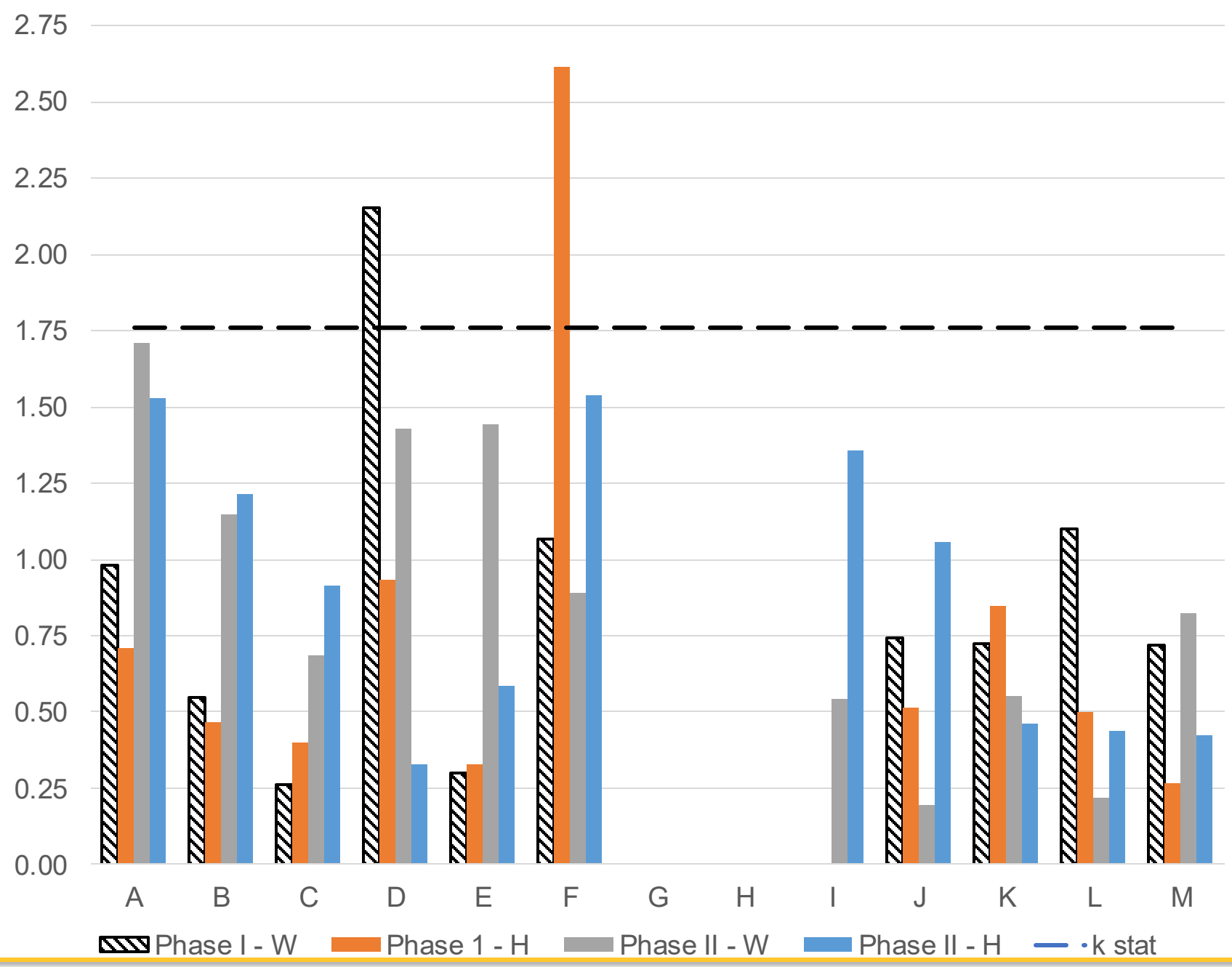
RT_{index} – ASTM E691 Analysis

- *h* = between-lab consistency statistic at 0.5% significance



RT_{index} – ASTM E691 Analysis

- *k* = within-consistency statistic at 0.5% significance



Findings

Findings

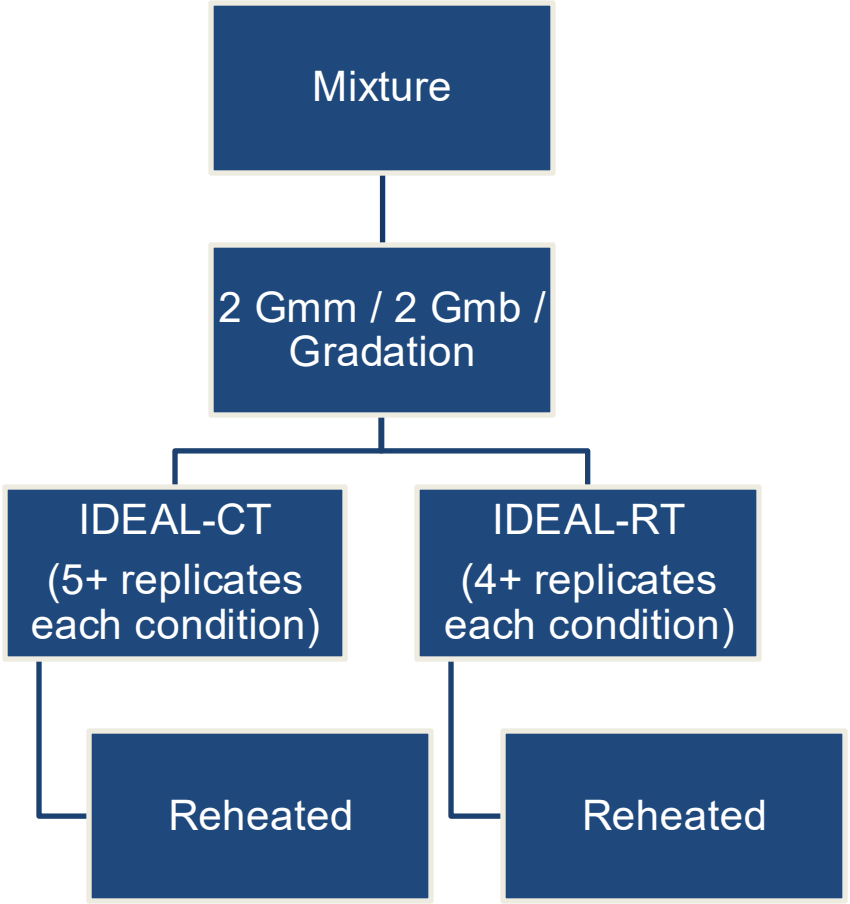
- Better than last year…
  - Northeast showing better repeatability / reproducibility than other national ILS
  - CT_{index} ~ 13% COV
  - RT_{index} ~ 6% COV
- Reproducibility ≈ Repeatability
- Handling outliers is key
- See benefit of added experience
- Shipping issues for centrally compacted specimens

Northeast BMD Working Group
Next Steps

2026 NE BMD ILS

- Two different mixtures
  - High Polymer (PG76E-28)
  - Typical mixture (PG64-28)
- Testing Window:
  - Material distribution: Winter 2026
  - Anticipated data submission deadline: March 1, 2026
- How to Participate:
  - Laboratories interested in joining the study should contact: Derek Nener-Plante – derek@dnpinfrastructure.com
  - Interested parties need to indicate interest by: *November 21, 2025*

Standard Testing



Thank You

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