



2024 FALL ASPHALT SEMINAR **NOVEMBER 28 - 2024**

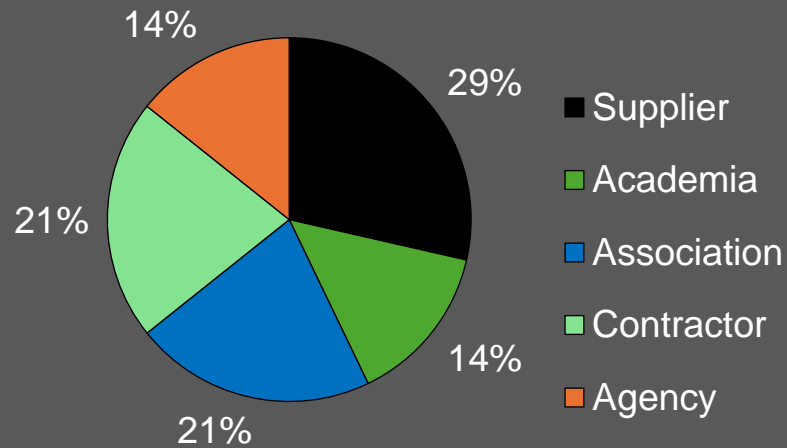
PATHWAYS TO A
SUSTAINABLE FUTURE
FOR ASPHALT TECHNOLOGY

*Ontario - Mix Asphalt Program (O-MAP) Round 3
Performance Testing Outcomes and Next Steps*

Sina Varamini, OAETG Chair, General Manager - Canada (CRM CO LLC)

ONTARIO ASPHALT EXPERT TASK GROUP (OAETG)

Open to all industry stakeholders



Chair: **Sina Varamini**, Ph.D., P.Eng., MCSCE
General Manager, CRM/Adjunct Professor



Vice-Chair: **Pejooan Tavassoti**, Ph.D.
Assistant Professor - University of Waterloo



Secretary: **Selena Lavorato**, B. Sc., C.E.T.
QS Manager at Green Infrastructure Partners

Access to Academic
Research Groups at the
National Level



Regional User
Producer
Groups &
Associations

OAETG OBJECTIVES

OUR MANDATE I-ABC

IDENTIFY improvements to binder and mixture specification and testing methods *Ontario-specific climate and traffic conditions*

ACT as an **advisory group**

Recommending and/or perform asphalt research interests and needs

BRAINSTORM asphalt-related and emerging issues

Particularly on subjects of RAC and Mix Performance acceptance

CONTRIBUTE to content development and organization of the Asphalt Technical Symposium (ATS)

UNDERSTANDING THE PERFORMANCE-RELATED MIX TESTS PART OF OAETG'S 5 YEAR VISION

BLD

Bridge the **knowledge gap** in “*Performance Testing methods and Acceptance*”

Literature search on **practice-readiness** of “mix performance” & thresholds

Develop industry-wide variability benchmarking program: **Mix Asphalt Program (MAP)**

2021

2022

2023

2024

2025

2026

OAETG
MIX
ASPHALT
PROGRAM
(MAP)

Three (3) rounds completed

ORBA/OAPC Budget & In-Kind Contributions from members

Understanding **Variability/Risk**

Inherent variability within test method – test variability

Interlaboratory variability

Variability due to sampling and fabrications methods

O-MAP ROUNDS – TEST METHODS

RUTTING



O-MAP ROUNDS – TEST METHODS

RUTTING

HAMBURG
WHEEL
TRACKING
TEST
AASHTO T342

Tracking 705N load wheel
while submerged
20,000 passes

Softer and harder binders tested at **44°C** and **50°C**

O-MAP ROUNDS – TEST METHODS

FATIGUE CRACKING



O-MAP ROUNDS – TEST METHODS

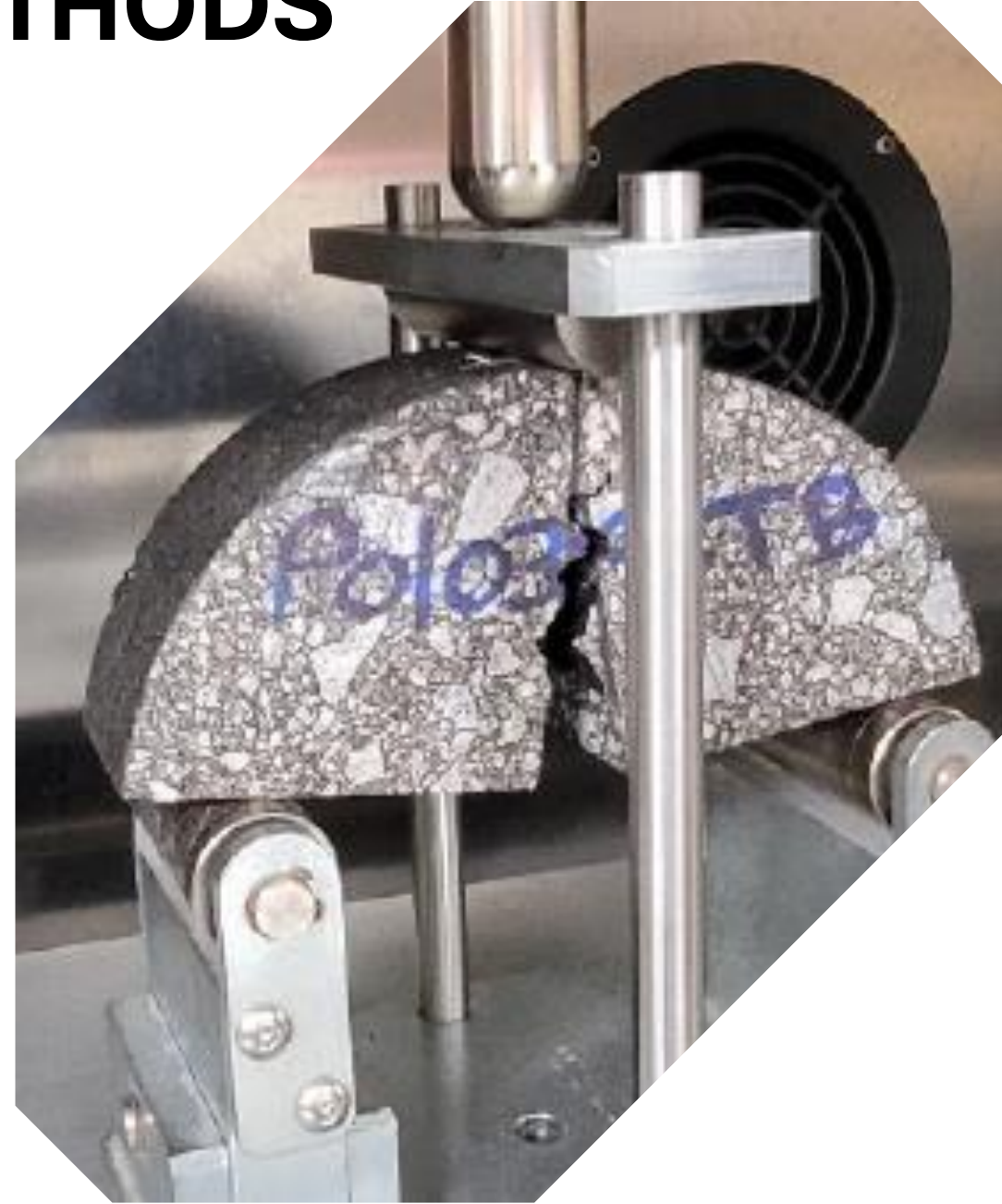
FATIGUE CRACKING


SEMI CIRCULAR BENDING TEST
FLEXIBILITY INDEX (I-FIT)

AASHTO T 393

Gyratory-sized (H 50 mm X D 150 mm)

Performed at **25°C**



A photograph of a road surface showing a crack in the asphalt. A concrete curb is visible in the foreground. The background shows a road with a guardrail and some vegetation. The text is overlaid on the left side of the image.

O-MAP ROUNDS – TEST METHODS

THERMAL CRACKING

O-MAP ROUNDS – TEST METHODS

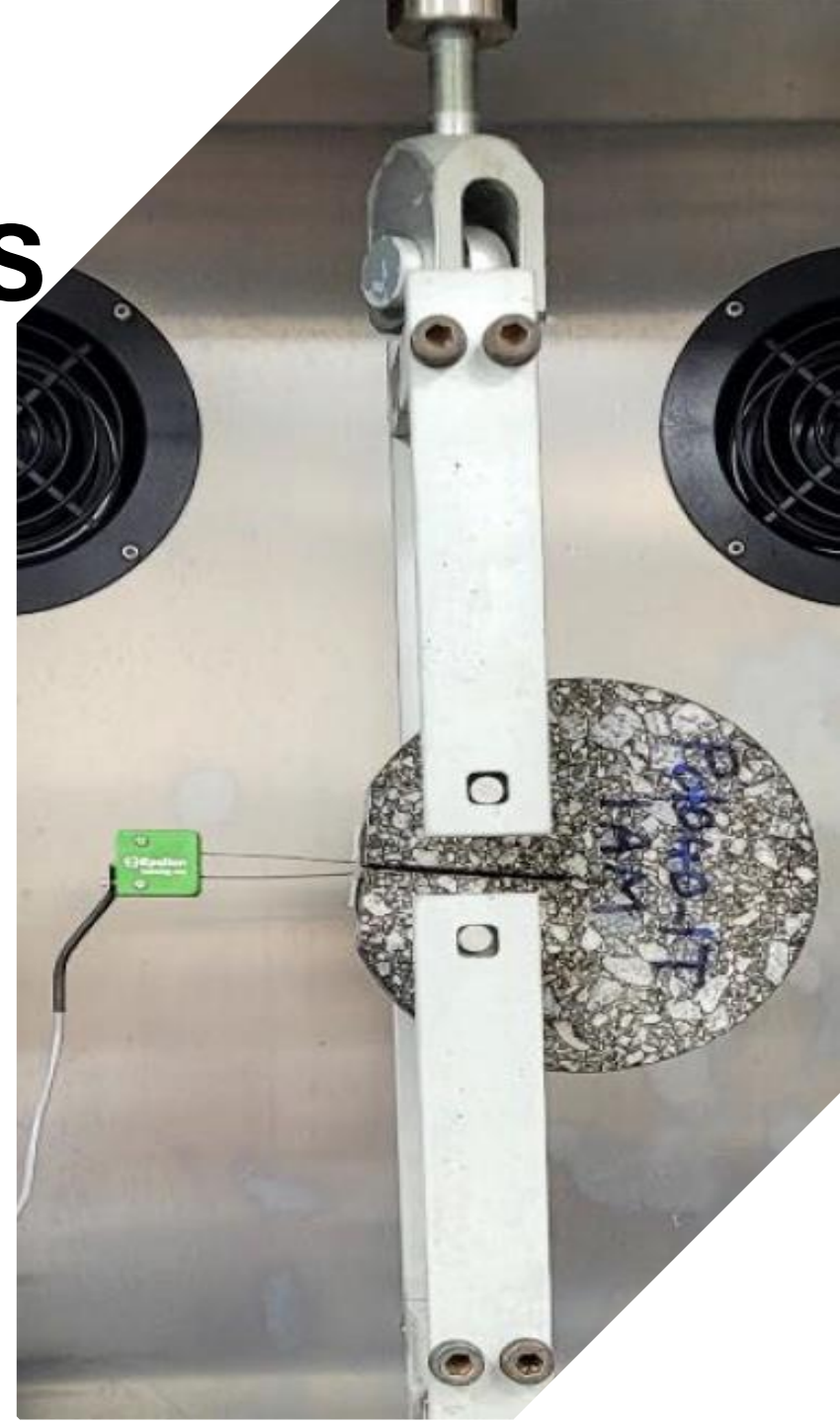
THERMAL CRACKING

DISCK-SHAPED COMPACT TENSION
ASTM D7313-13

SG compacted

160-mm+ thickness and then cut into 50-mm disks

Tested at 10°C above PG -YY



O-MAP Rounds in 3 Years

ZONE 1
PG 52-34

ZONE 2
PG 58-34

ZONE 3
PG 58-28

1

SP12.5 FC2 "CAT-E"
Zone 3 (PGAC 70-28 XJ)

Contractor A & B Mixes

Plant-Produced
Lab-Compacted

3 to 4 labs participated

2

SP12.5 FC2 "CAT-D"
Zone 3 (PGAC 70-28 XJ)

MTO's Superpave
Hot Mix Inter-Laboratory Testing
Program

Plant-Produced
Lab-Compacted

4 to 6 labs participated

3

SP12.5 FC2 "CAT-E"
Zone 3 (PGAC 70-28 XJ)

Same as Round 1

Lab-Produced
Lab-Compacted

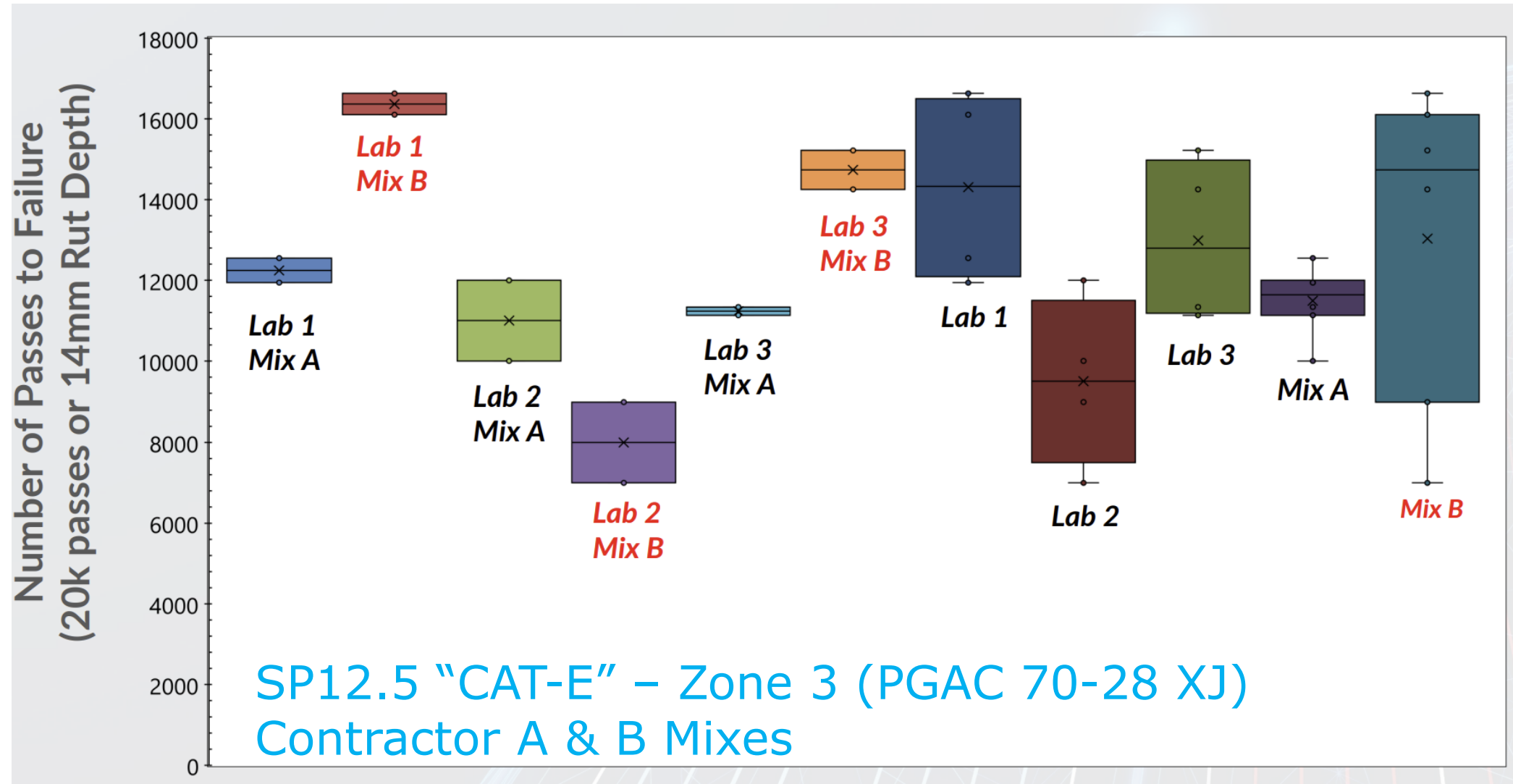
4 to 11 labs participated

Round 3

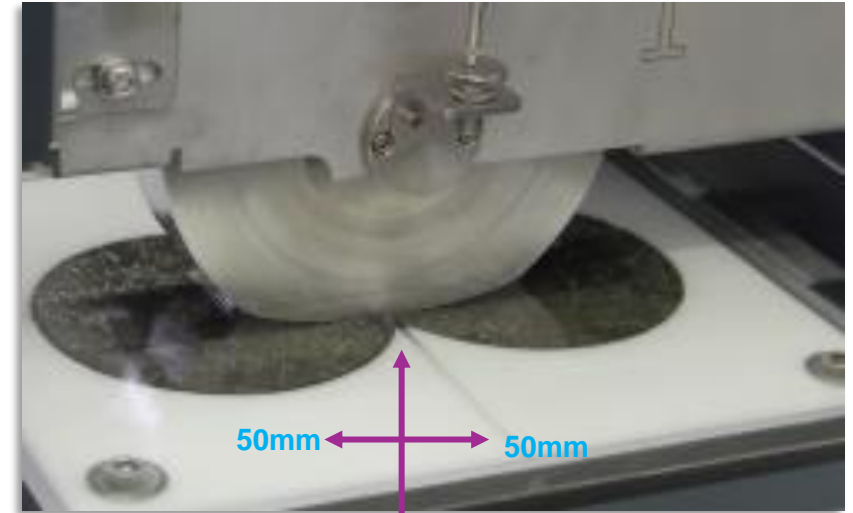
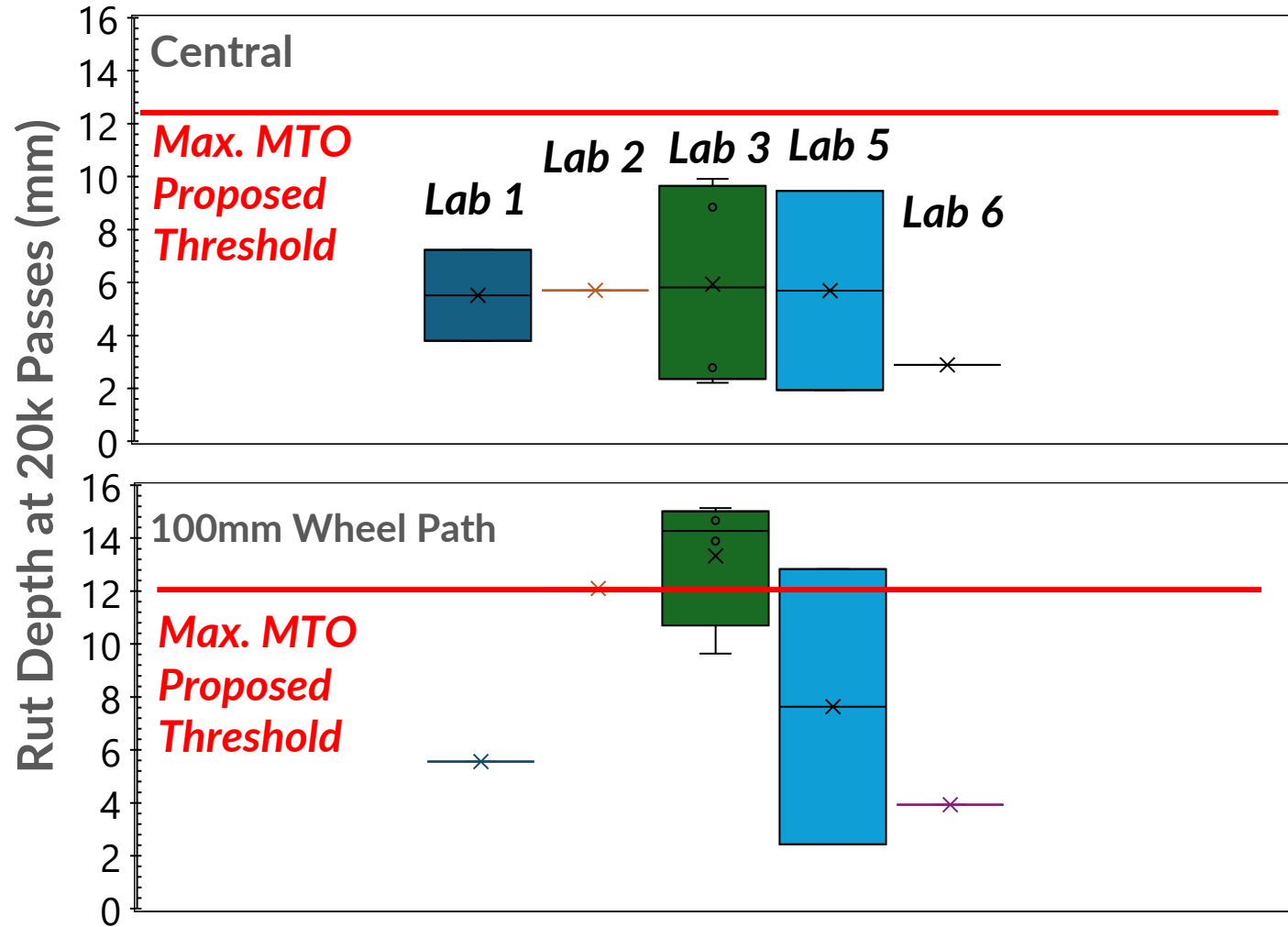
*Included **BMD** exercise*

*Understanding effect of **RAP** up to 30%*

HWT – Round 1



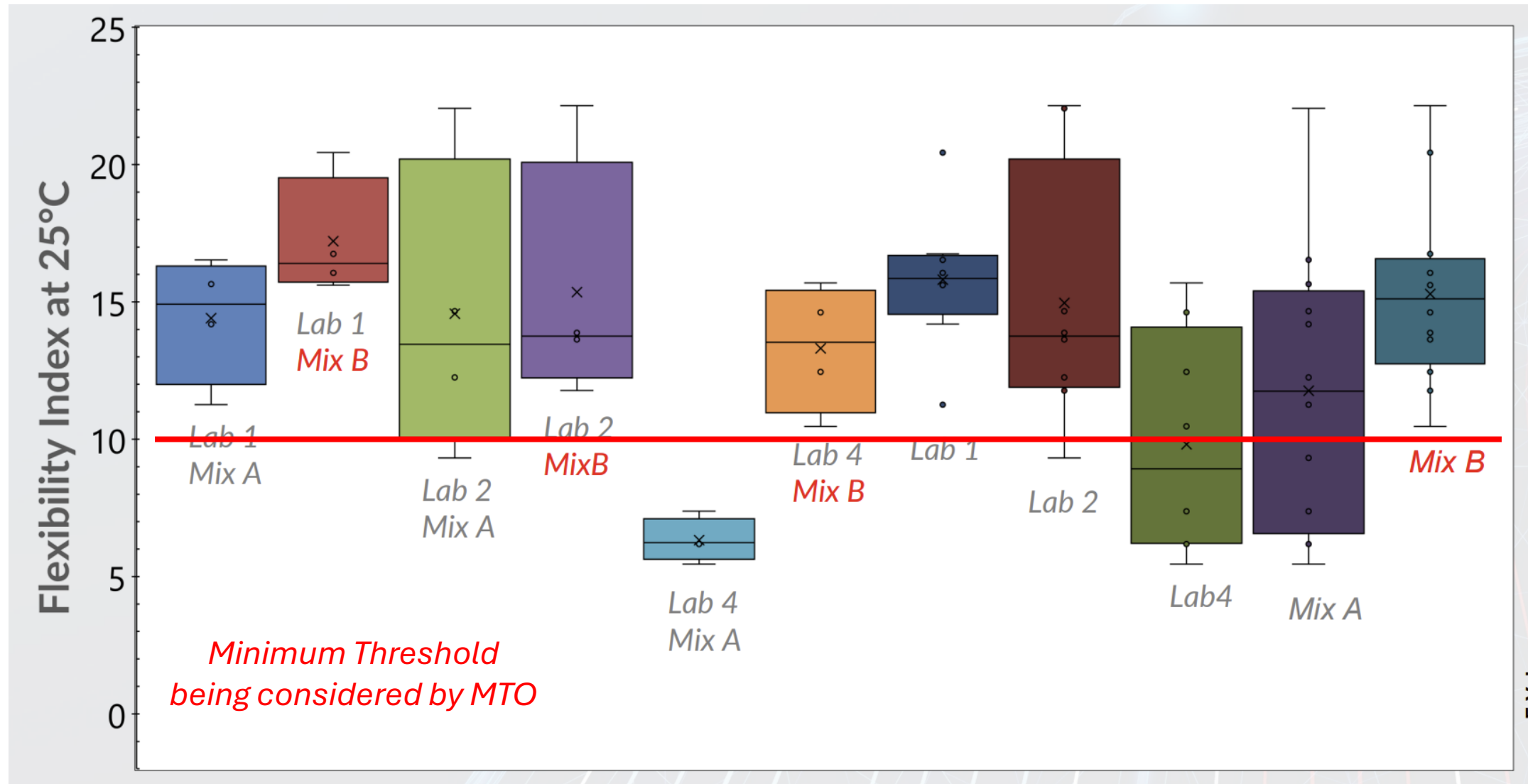
HWT – Round 2



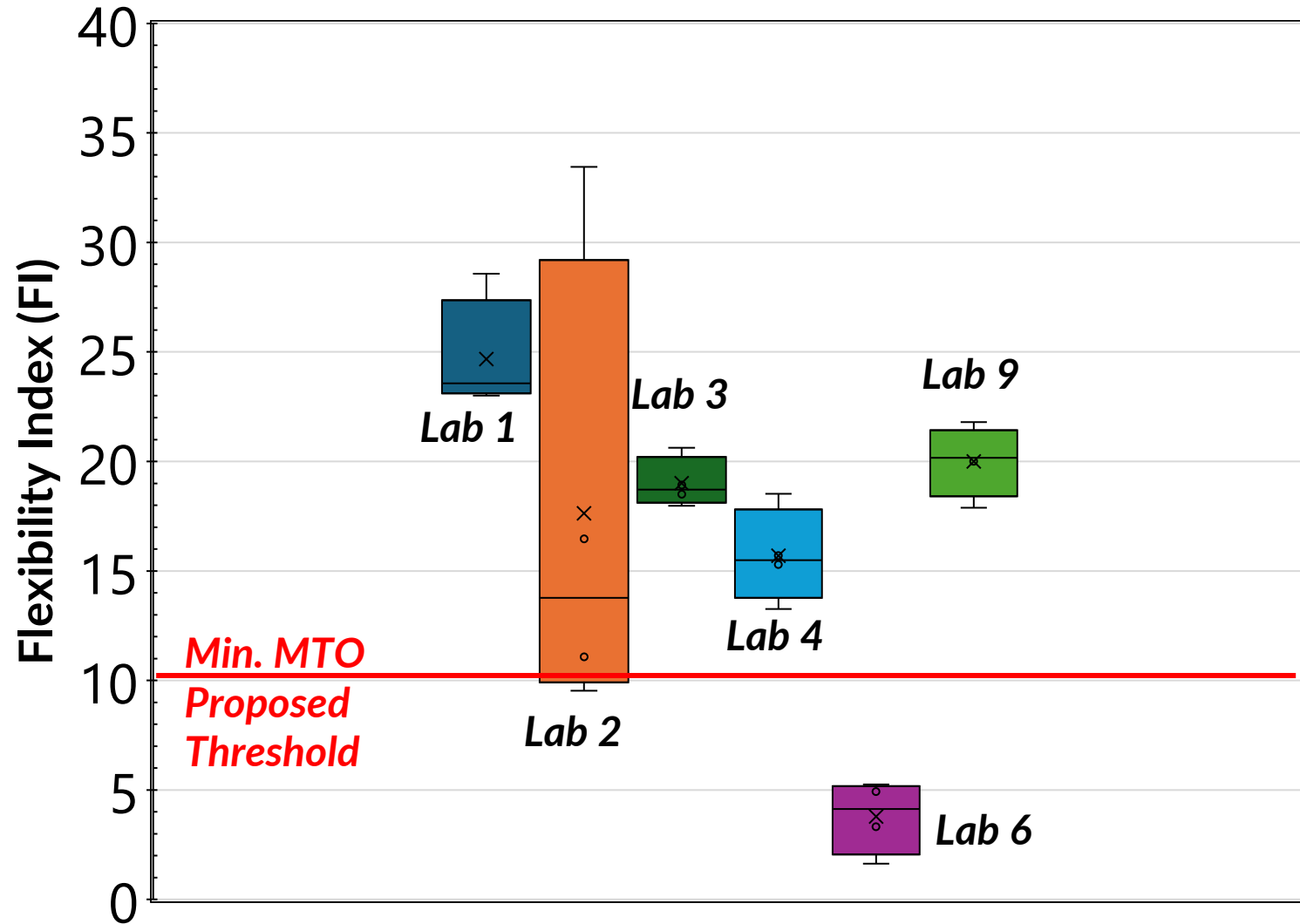
Central

SP12.5 "CAT-D" – Zone 3 (PGAC 70-28 XJ)

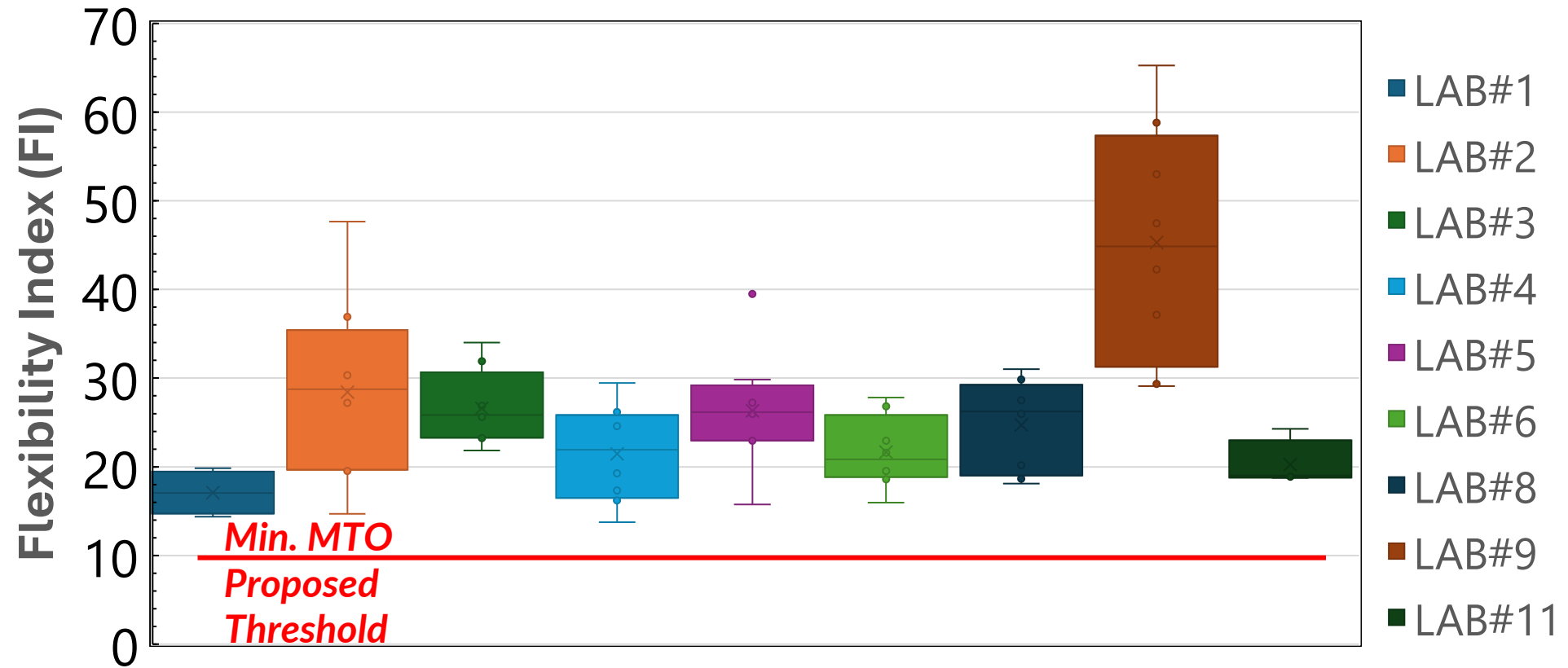
SCB - Round 1



SCB – Round 2

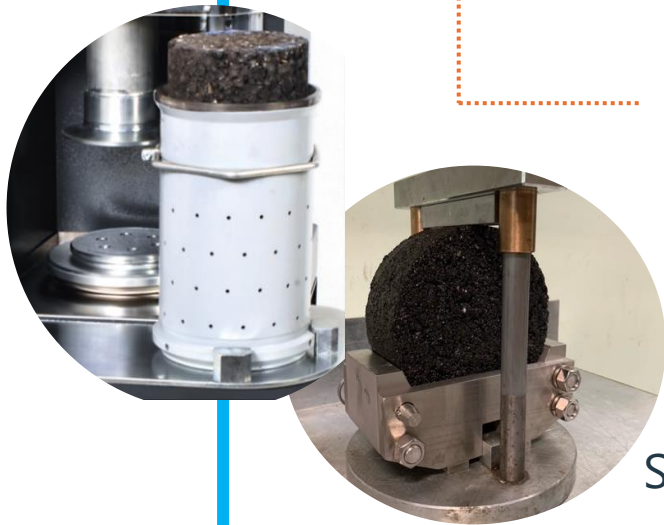


SCB – Round 3



Variability Needs To Be Controlled Before Agency-wide Acceptance

STANDARD (AASHTO, or ASTM) provide **MINIMAL GUIDANCE** to consistently fabricate laboratory specimens (i.e.: aging conditions and acceptance criteria) given lab can have unique way of sample prep..



Loose asphalt mixture (laboratory or plant-produced) made into finalized test specimens for mechanical characterization.

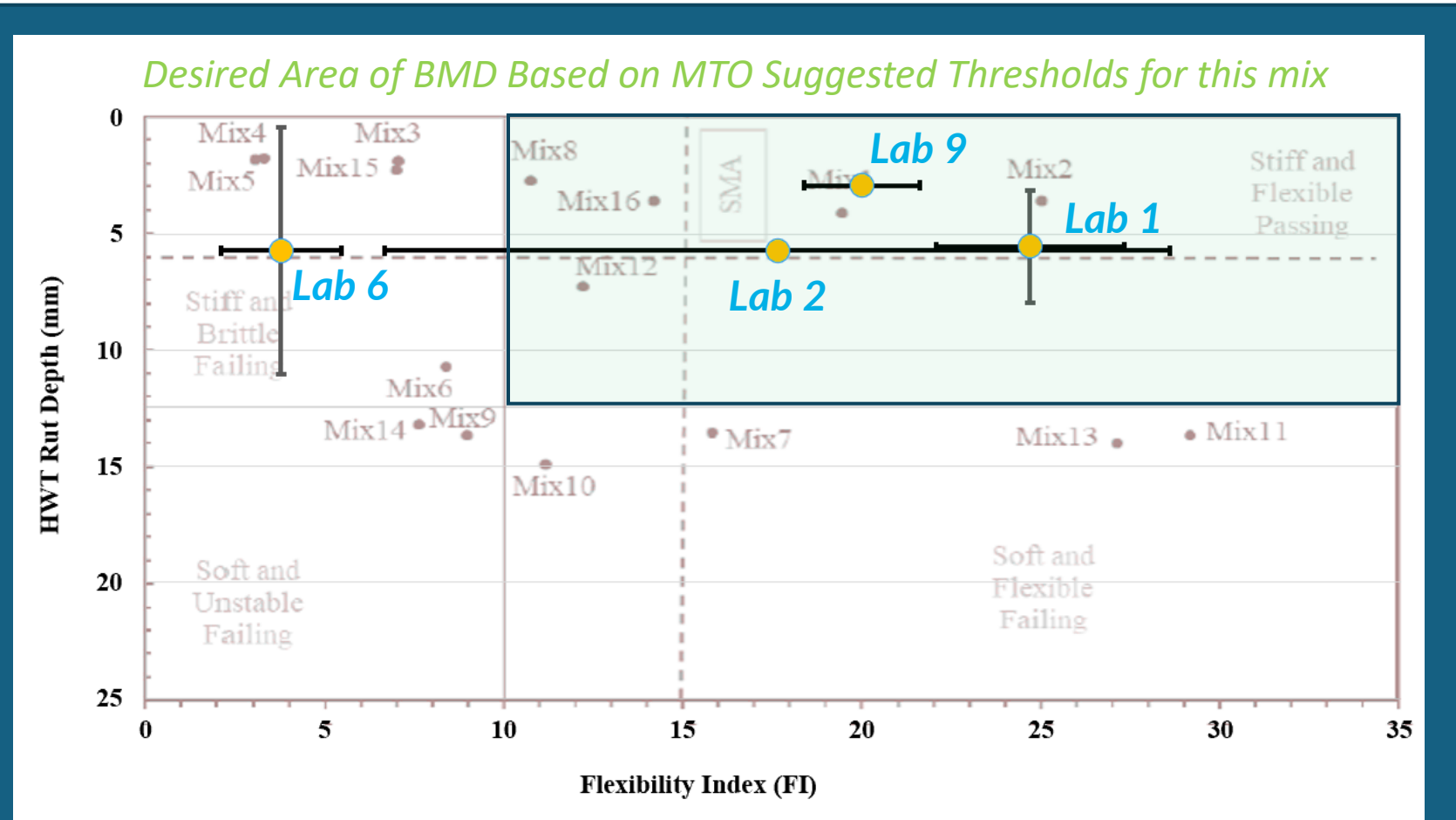
Reheating, compaction, conditioning, cutting/notching, air void determination, etc.



Studies have shown that different specimen **fabrication methods** can significantly **affect** measured performance properties, which will impact design, evaluation, and acceptance of asphalt mixtures

EFFECT OF VARIABILITY ON “BALANCE MIX DESIGN” OUTCOME

PERFORMANCE SPACE DIAGRAM (PSD)



Results superimposed over Performance Space Diagram (PSD) retrieved from: *Bashir I, Salehi-Ashani S, Ahmed D, Tabib S, Vasiliu G. “MTO’s Experience with Post-Production Asphalt Mixture Performance Testing”. Proceedings, Canadian Technical Asphalt Association, 65. 316-344 (2020).*

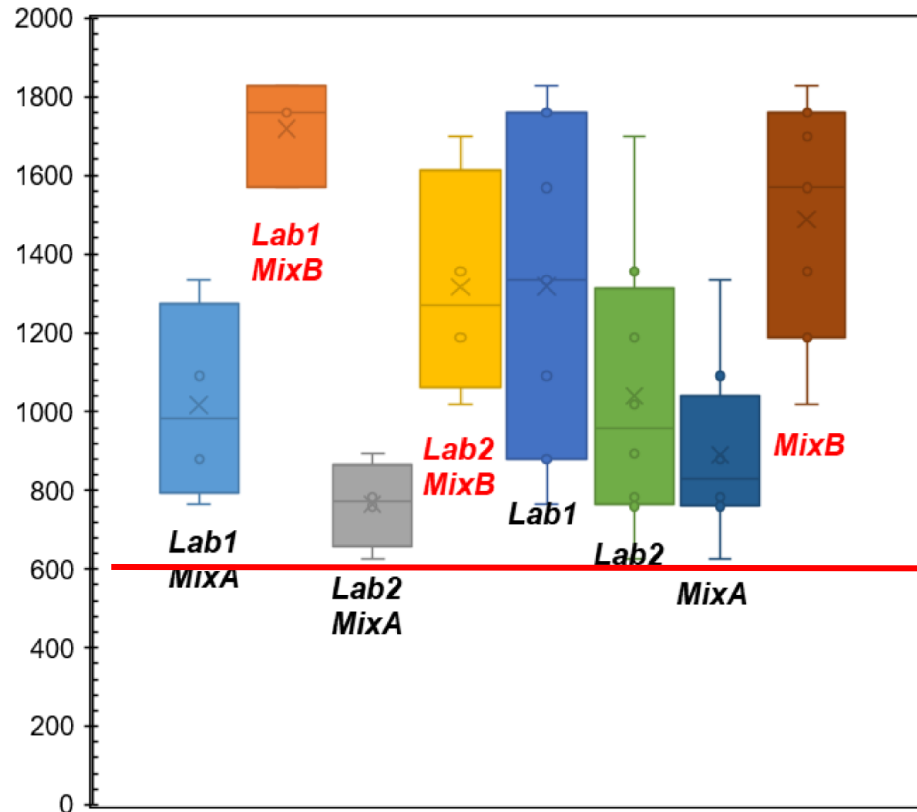
Mixes Studied By MTO

Mix No.	Mix Type ¹	%RAP ² Content	Specified PGAC ³	Traffic Category
1	SMA 12.5	-	70-28	E
2	SMA 12.5	-	70-28	E
3	SP12.5 FC2	-	70-28	E
4	SP12.5 FC2	20	70-28	E
5	SP12.5 FC2	20	70-28	E
6	SP12.5 FC2	20	64-28	C
7	SP12.5 FC2	20	64-34	D
8	SP12.5 FC2	-	64-34	E
9	SP12.5 FC2	-	58-28	D
10	SP12.5 FC2	-	58-28	D
11	SP12.5 FC1	-	58-34	D
12	SP12.5 FC1	-	58-34	D
13	SP12.5	-	58-34	C
14	SP12.5	-	52-40	B
15	SP12.5	-	52-40	B
16	SP12.5	-	52-40	C

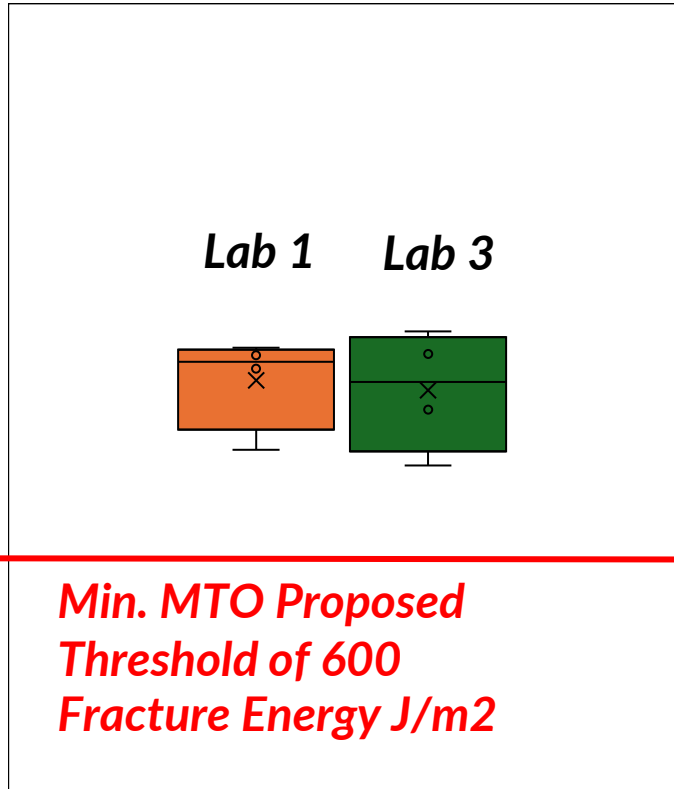
Error bars represent one standard deviation from the average value of four replicates tested per mix (≈ 68% reliability)

DCT RESULTS

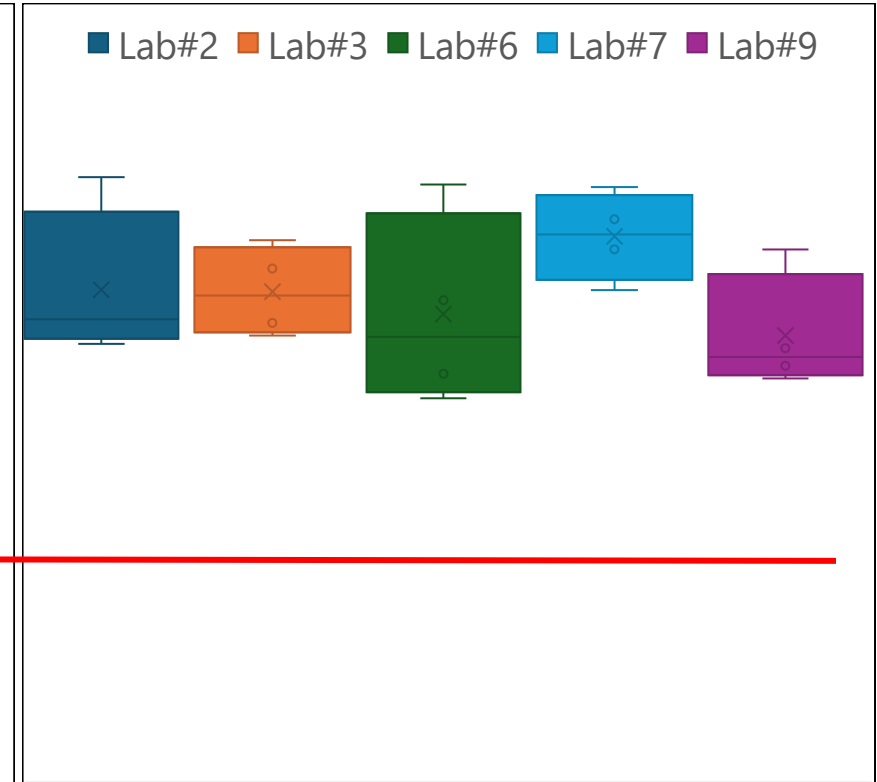
ROUND 1



2

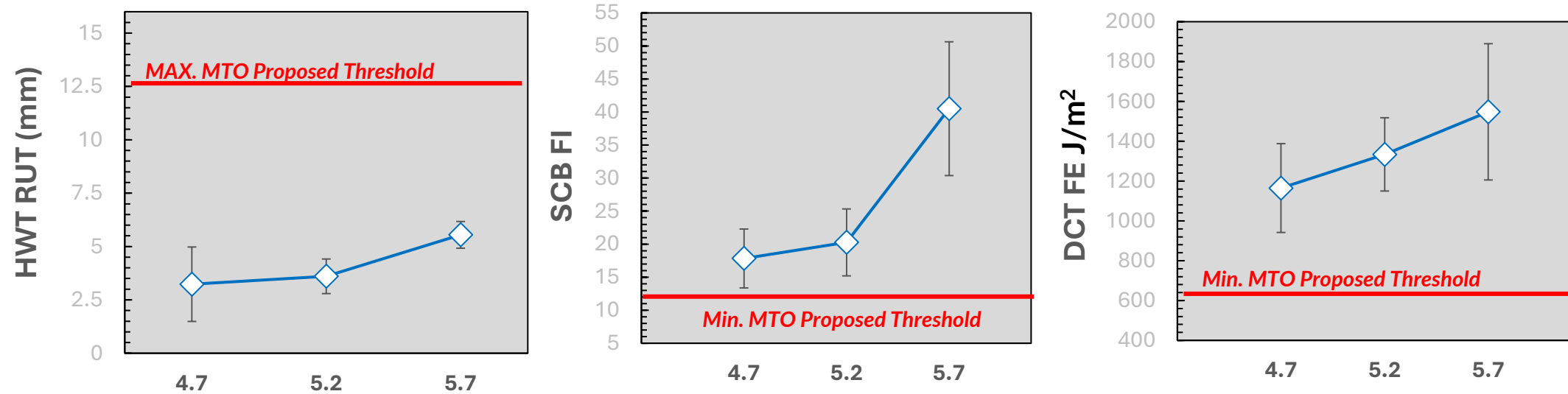


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**Min. MTO Proposed
Threshold of 600
Fracture Energy J/m²**

BALANCED MIX DESIGN (BMD) OAETG ROUND 3

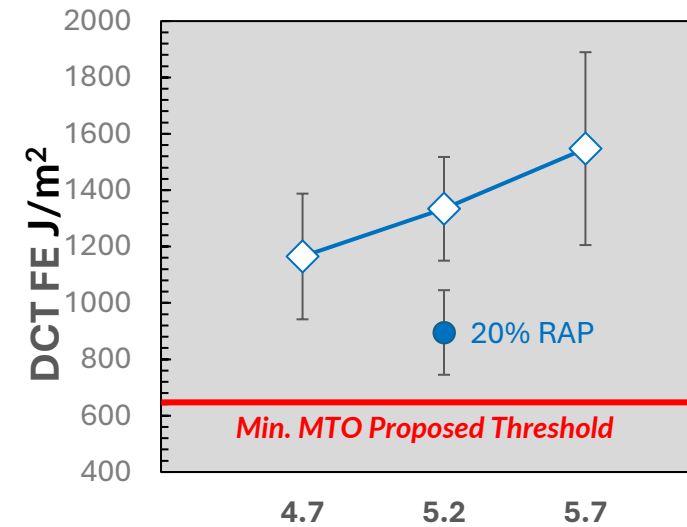
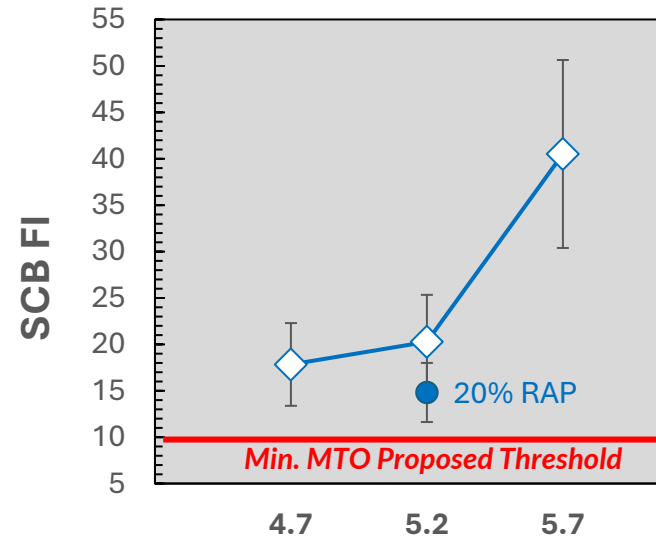
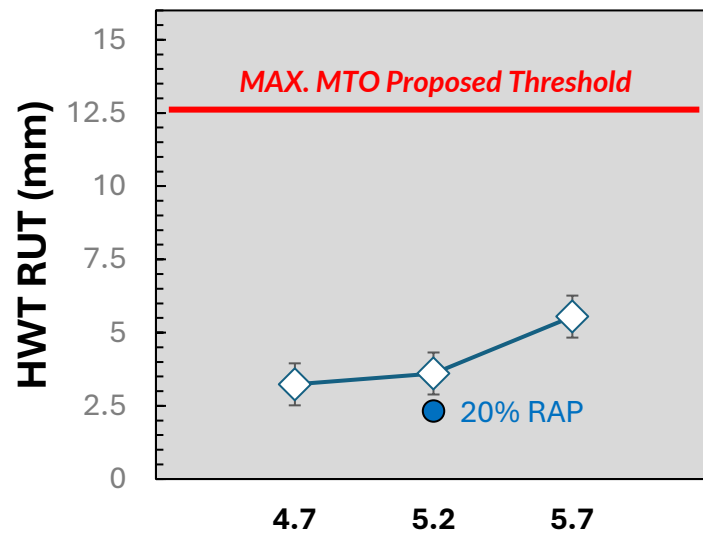


1. Low AC 4.7% AC demonstrated excellent performance test results! Could this indicate that the threshold is not adequately reflecting real-world field conditions?
2. How can the balancing act in BMD be achieved if current test methods lack sufficient sensitivity?
3. If the mix meets performance thresholds with RAP, would agency owners approve it? If not, what is the purpose of performance testing and transitioning to BMD?

BALANCED MIX DESIGN (BMD)

OAETG ROUND 3

Responsible Premium-RAP inclusion up to 20%



MIX ASPHALT PROGRAM (MAP)

FINDINGS

Mix Properties

Mix properties do play a role in performance, especially during fabrication of HWT thinner briquets

Procedures and Instructions

Controlling consistency needed – **CCIL** or MTO technician certification required
Sample Fabrication and Testing Instructions (**SFTIs**) requires specifics on **sample heating, splitting, compaction temp. tolerances and cutting**

Collaboration

MTO and other agencies must collaborate with academia and industry in researching on sources of variability...Minimizing risk to all parties involved.

Thresholds still need to be evaluated for their practicality

Certified Technician Training Program

agencies and industry need to establish hands-on technician certification training course... through Good Roads, ORBA Academy, or Local Universities

OAETG RECOMMENDATIONS

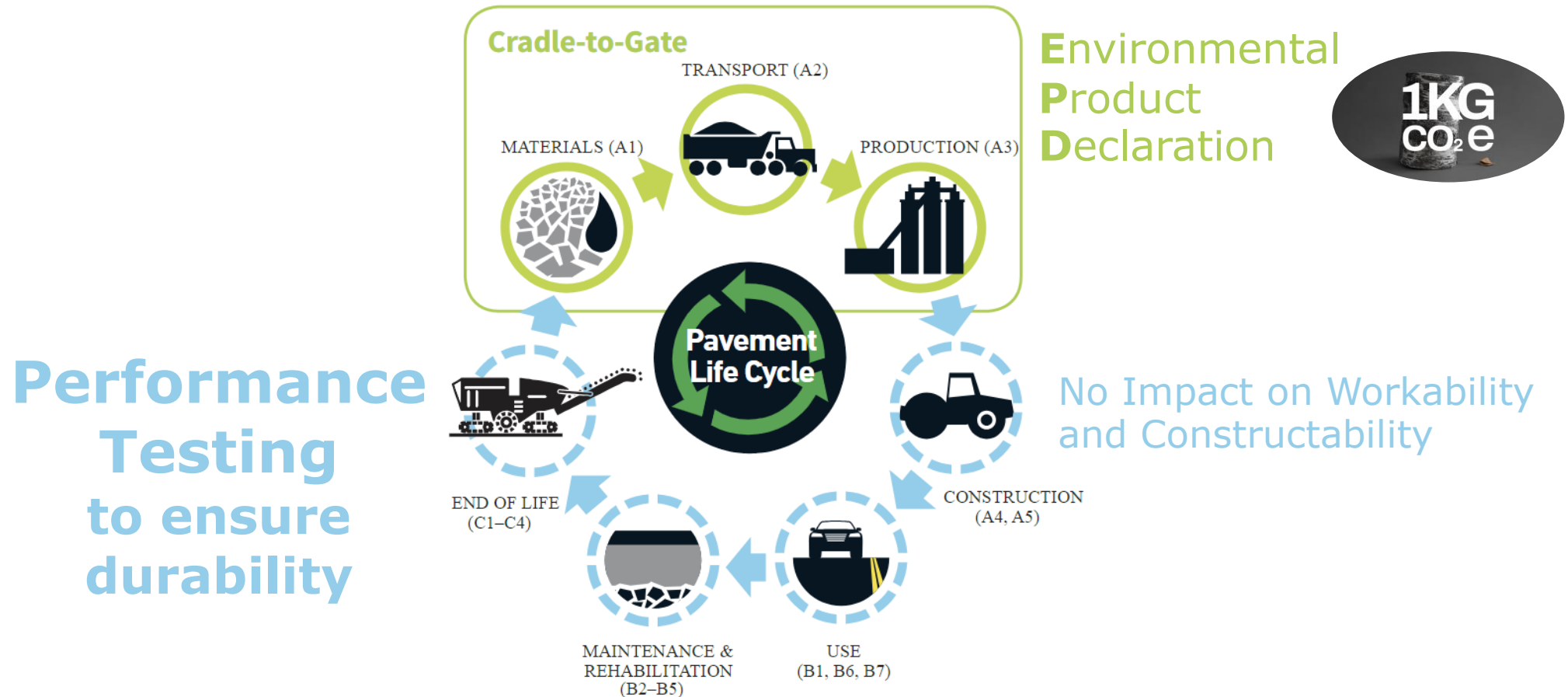
Enhancing our understanding, while being practical

1. Understand the thresholds
2. Collect at least **2-YEAR** for “information only” testing as part of **MIX DESIGN SUBMISSION**
3. Understand efforts required in coarse and fine-tuning phases of thresholds – avoid any desperate changes to mix design to just pass the test (i.e. aggregate changes, PGAC and etc.)
4. Request **PERFORMANCE-VERIFIED MIX DESIGN SUBMISSION**
5. Control the Performance throughout the contract using traditional Quality Assurance Measures (i.e. gradation and AC%)
6. **ONLY** do performance testing on plant-produced, field retained, and field compacted if **Forensics** required

Last Few Words....

WE NEED PERFORMANCE-BASE DESIGN SUBMISSIONS FOR DECARBONIZED FUTURE

Focusing on EPDs considering Low-Carbon Life Cycle Analysis (LCA) & Buy-Clean Policies



ACKNOWLEDGEMENT

All OAETG Members, and specially Oversight Study Team listed in alphabetical order:

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- Amin Mneina (Good Roads)

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