4-YEARS OF OAETG
A PERFORMANCE REVIEW

Sina Varamini, Ph.D., P.Eng., MCSCE
Chair – Ontario Asphalt Expert Task Group (OAETG)
General Manager – Canada (CRM)

Presentation Prepared for Asphalt Technical Symposium (ATS)
June 11, 2024

CRUMB RUBBER MANUFACTURERS

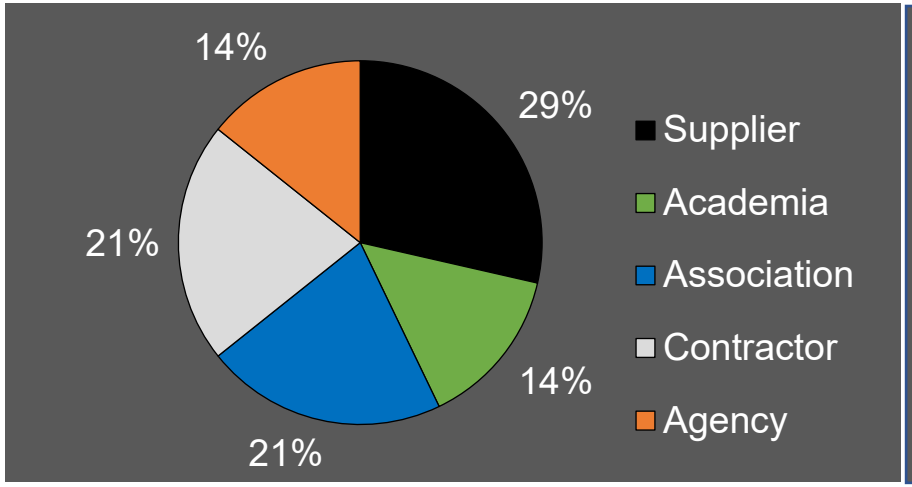
asphalt ontario rides on us

ORBA

oapc

OAETG

Open to all industry stakeholders



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

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

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

National-Level Access to
Academic Research Groups

University of Alberta
Canada NRC·CNRC
University of Waterloo
McMaster University
UNB Est. 1785 University of New Brunswick

Regional
User
Producer
Groups &
Associations

OAETG OBJECTIVES

OUR MANDATE
I-ABC

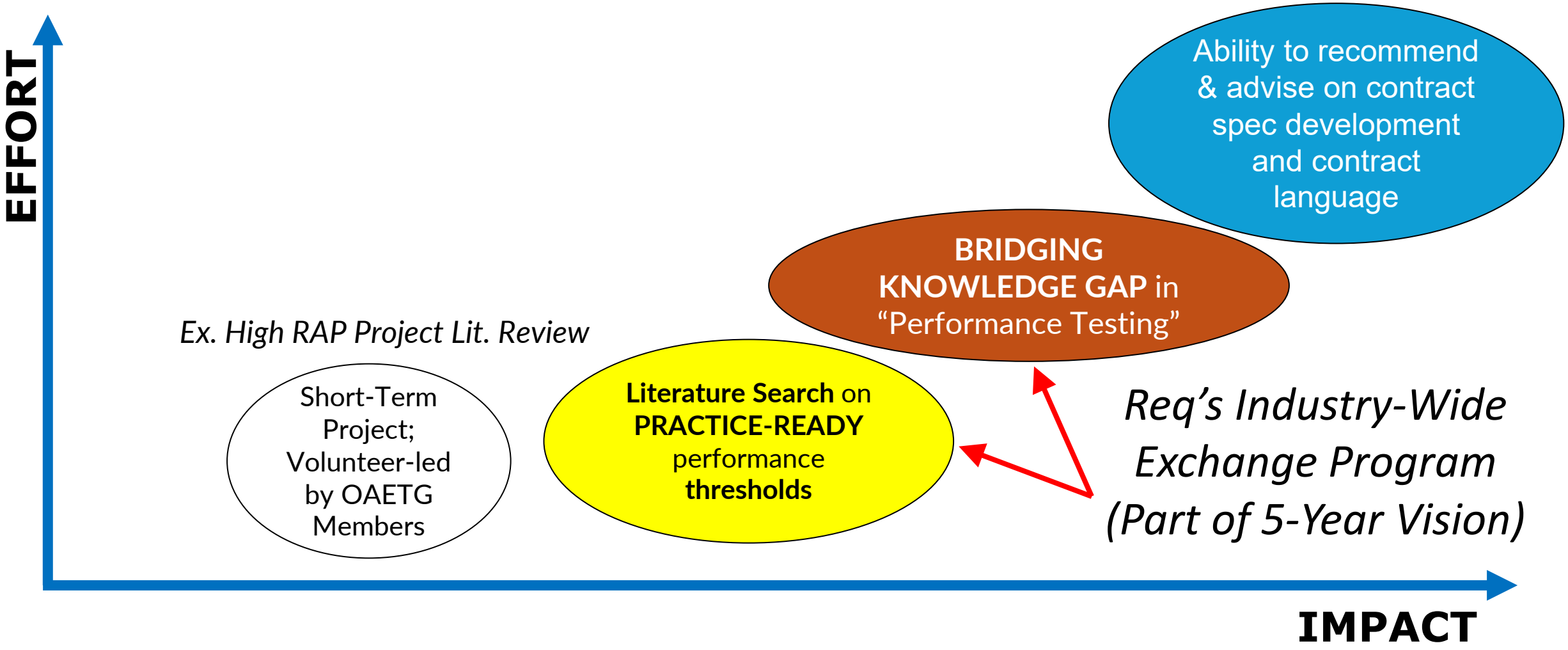
Identify improvements to binder and mixture specifications and testing methods *Ontario-specific climate and traffic conditions*

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)

OAETG APPROACH TO I-ABC



WHY FOCUS ON PERFORMANCE TESTING?

1890 – Barber Asphalt Paving Company
Mix of AC with Sand and Pulverized carbonite Lime

1905 – Clifford Richardson, New York Testing Company
Surface Sand Mix
Asphalt mix for lower layers
VMA terminology used

1920s – Hubbard-Field Method
Sand asphalt design
30 blow, 6" diameter with compression test

1927 – Francis Hveem (Caltrans)
Surface Area factors to determine binder content (Hveem stabilometer and cohesionmeter)

Air voids not used initially, mixes generally drier relative to others

Issues with fatigue cracking

1943 – Bruce Marshall (Mississippi DOT)
Refined Hubbard Field Method – standardization of compaction energy with drop hammer
Used only air voids (3 to 5%)
VFA and VMA added in 1962
Stability and flow utilized

1993 – Superpave
- Level 1 (volumetric-based approach) using 4% air voids, VFA, VMA, DP
- Introduction of gyratory compactor
- Level 2 (performance-based approach) – **Never implemented**

First Canadian trials in mid1990s

NOW?

[History of asphalt mix design in North America, Parts 1 & 2| Asphalt magazine]

VOLUMETRICS

DON’T TELL US THE WHOLE STORY

Always need **PAST EXPERIENCE**
Navigating through different projects

Performance Testing and Specification Inclusion – A Journey We Must Travel

A **Recipe & Volumetric Selection**

B **Performance-Verified Volumetric Design**

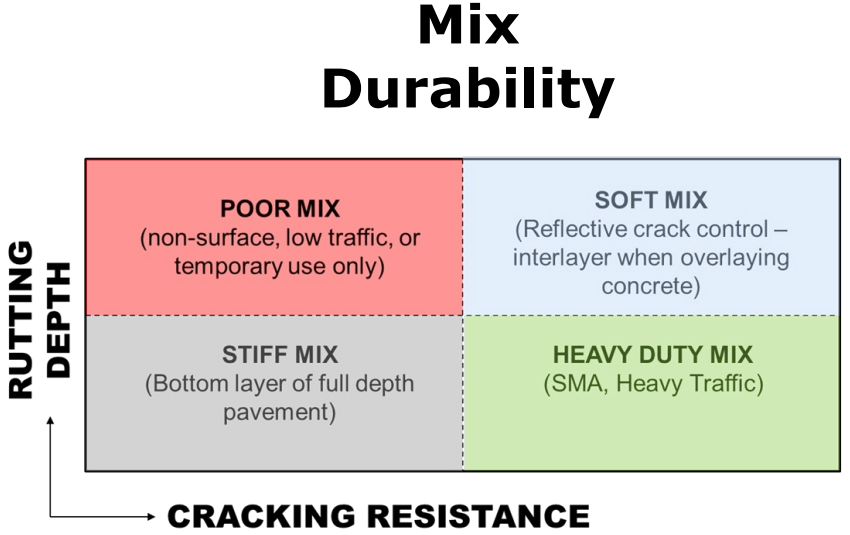
Verification of resistant to a specific distress
Example: Asphalt Cement (AC) modification to resist fatigue cracking

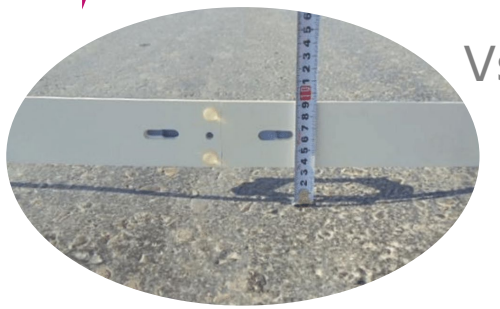
C **Performance-Modified Volumetric Design**

Adjustment of mix proportions to resist a specific distress
Example: AV & VMA changes to resist fatigue cracking.

D **Performance-Based Design**

Durability
Performance testing for **Pavement design input**
Conduct volumetric for QA





Vs.

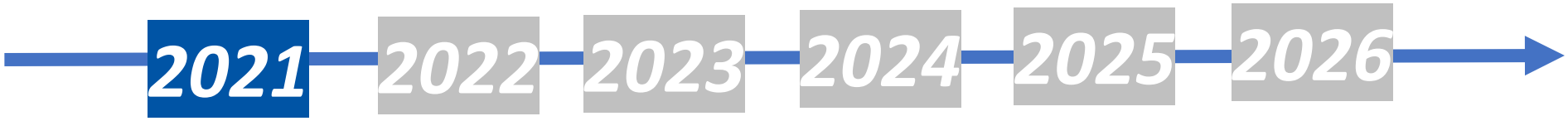
OATEG 5-YEAR VISION

BLD

Bridge the **knowledge gap** in "*Performance Testing methods and Acceptance*"

Literature search on **practice-ready** "mix performance" thresholds

Develop a framework to execute industry-wide **Mix Asphalt Program (MAP)**



OAETG MIX ASPHALT PROGRAM (O-MAP)

Two (2) rounds completed – Round 3 in progress

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

Multiple labs

Plant-Produced Lab Fabricated Samples (first two rounds)

Test Methods Used in O-MAP Round 1&2

RUTTING

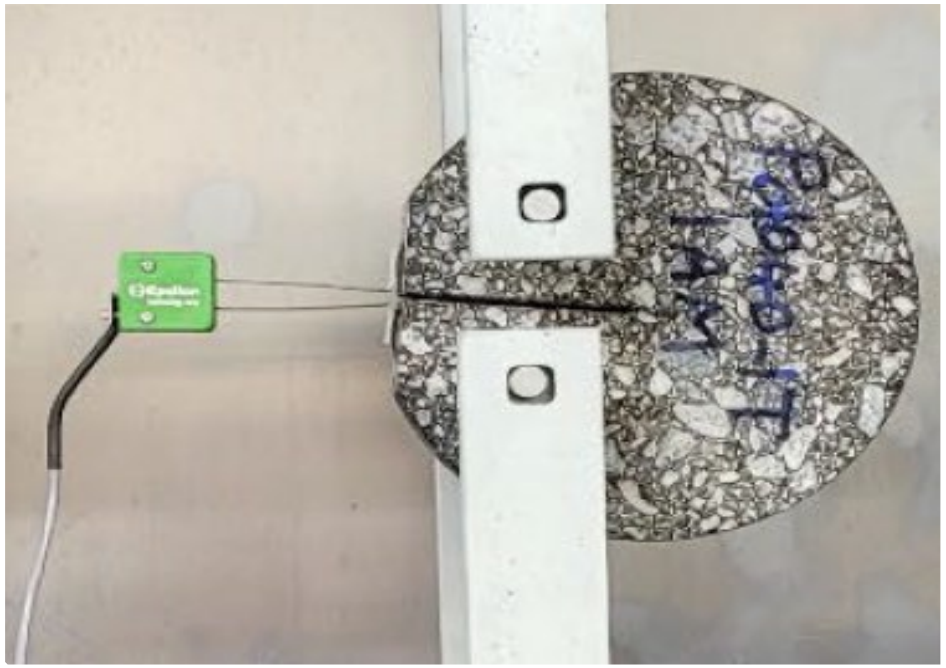
HAMBURG WHEEL TRACK
AASHTO T 342

FATIGUE

SCB CRACKING RESISTANCE (I-FIT)

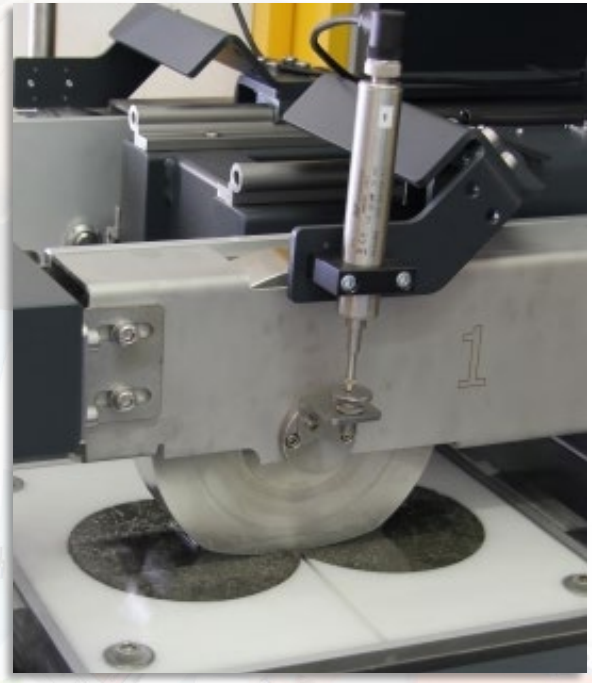
AASHTO T 393

THERMAL CRACKING



DISCK-SHAPED COMPACT TENSION
ASTM D7313-13

HAMBURG WHEEL TRACK



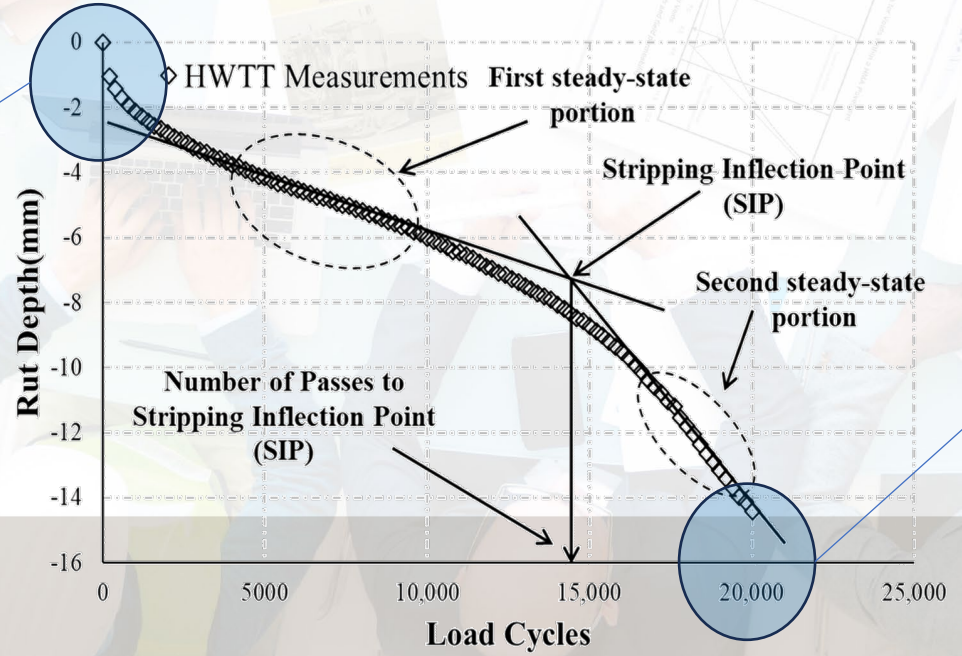
AASHTO T 342

Tracking 705 N of load wheel for 20,000 passes

Submerged at varying high temperature

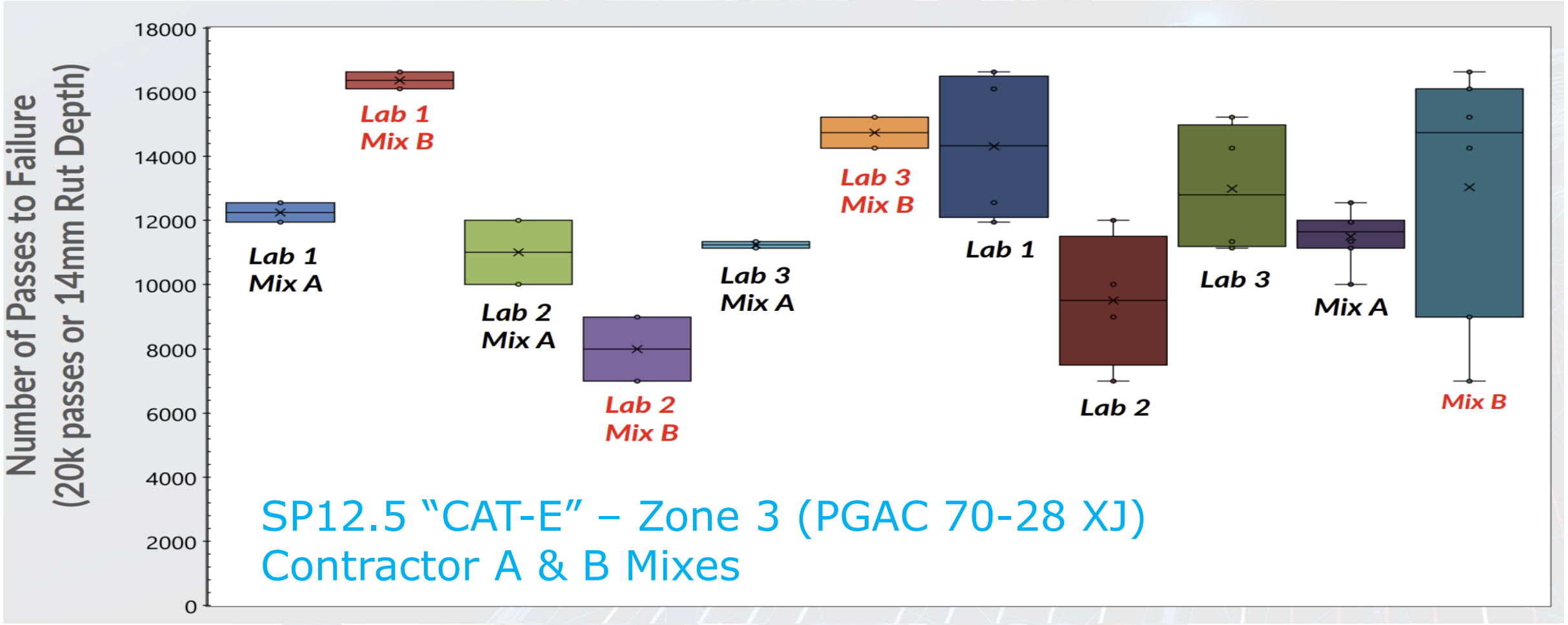
Softer and harder binders tested at 44°C and 50°C

BEFORE



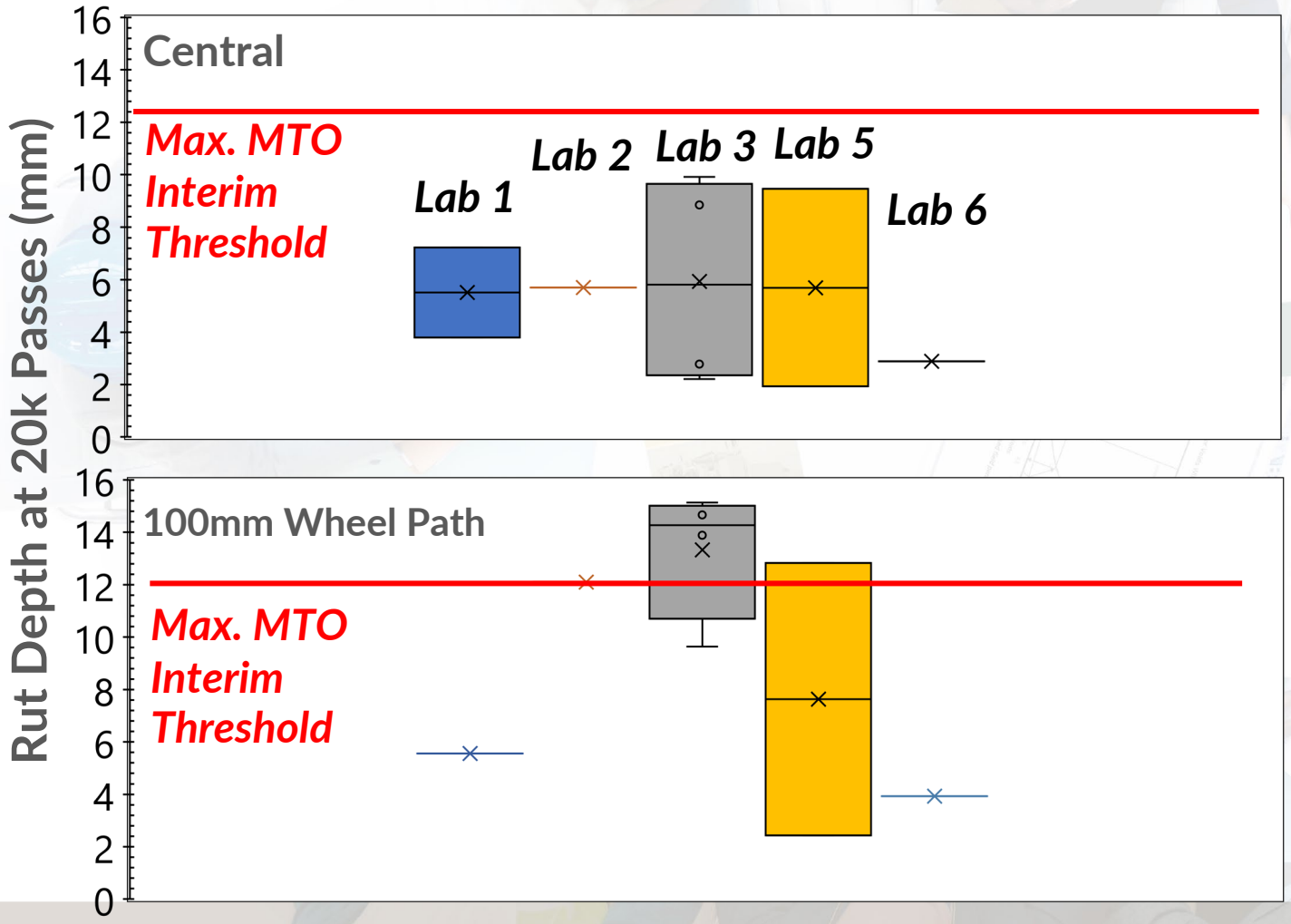
AFTER

HWT – Round 1 Results



SP12.5 "CAT-E" – Zone 3 (PGAC 70-28 XJ)
Contractor A & B Mixes

HWT – Round 2 Results



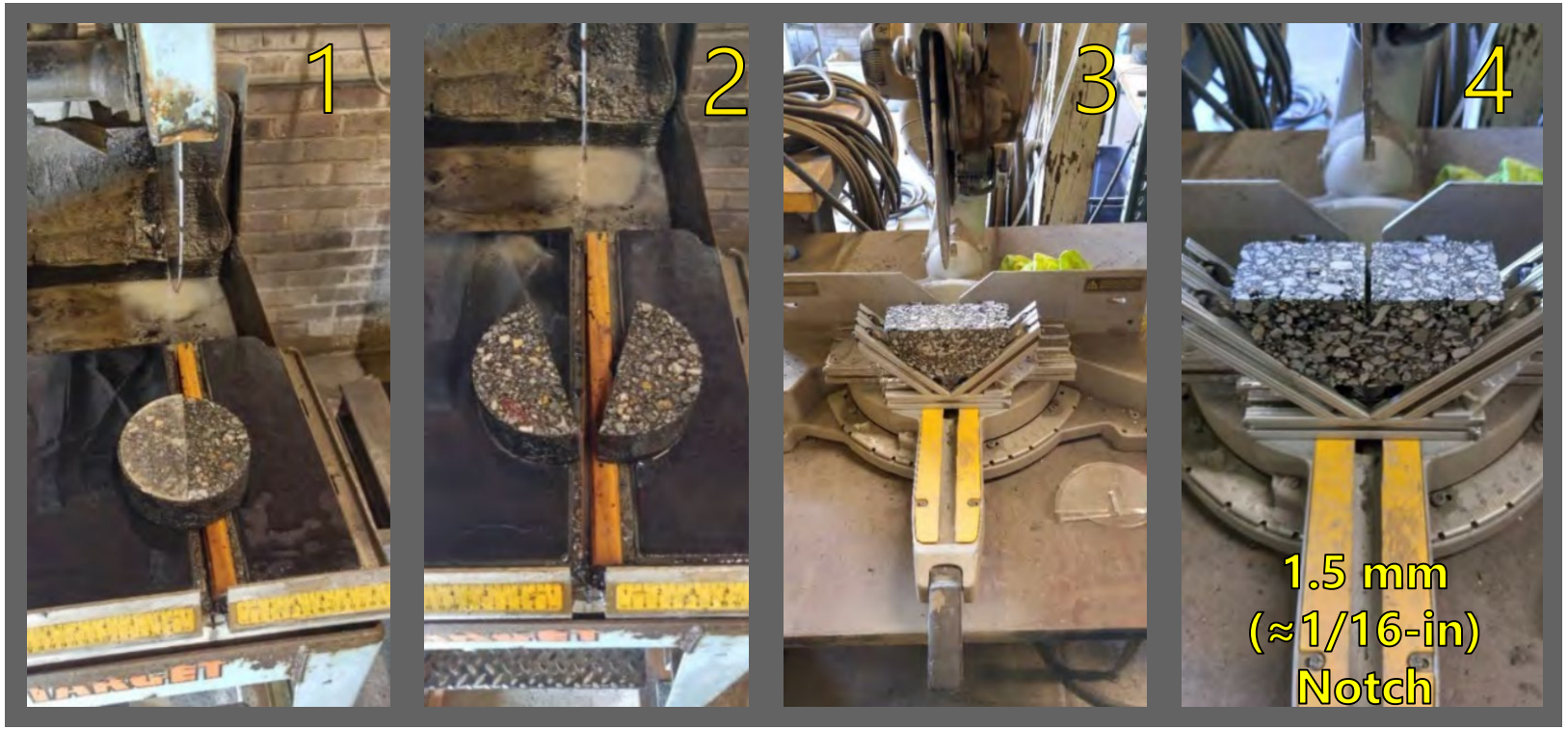
SP12.5 "CAT-D" – Zone 3
(PGAC 70-28 XJ)

SCB FATIGUE CRACKING RESISTANCE (I-FIT)

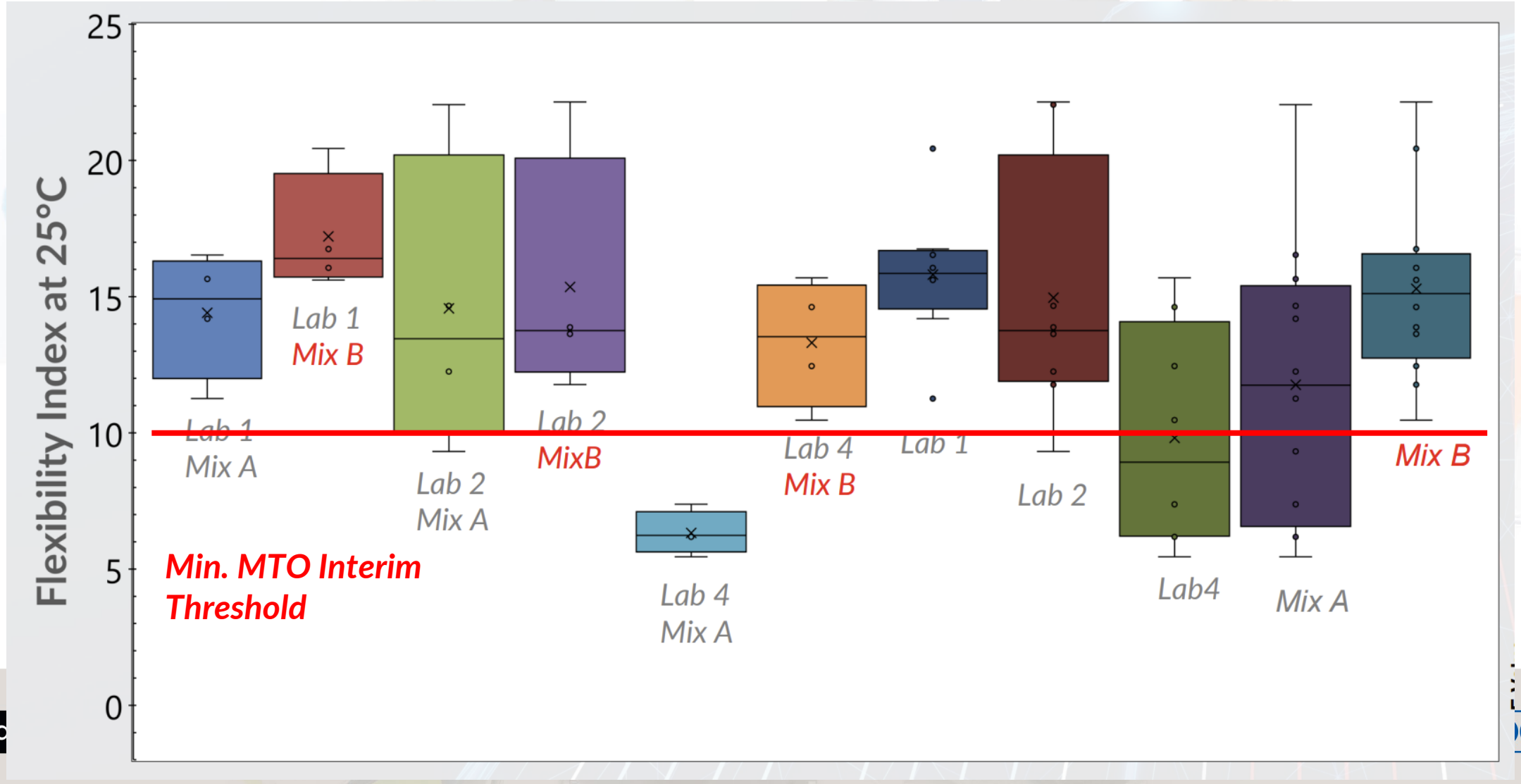
AASHTO T 393

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

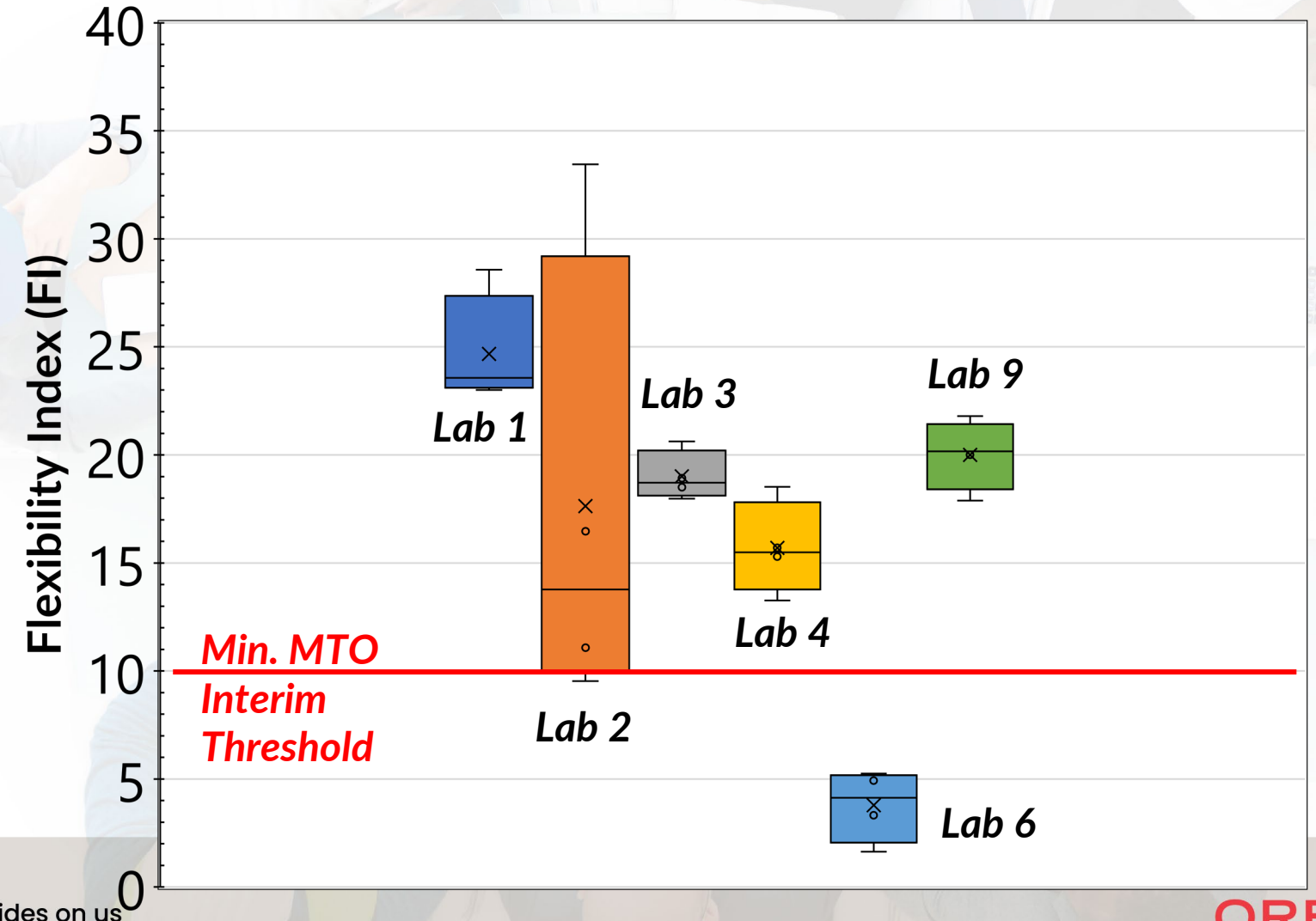
Performed at 25°C or lower



O-MAP Round 1 SCB RESULTS



O-MAP Round 2 SCB RESULTS



Semi-Circular Bend Test (Flexibility Index)

What is the most influencing Parameters?

1. *Hydraulic Loading*
2. *Housed Environmental Chamber*

1. *Screw-Driven Loading*
2. *External Environmental Chamber*

Let's Rethink…

STANDARD (AASHTO, or ASTM) to conduct performance tests

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

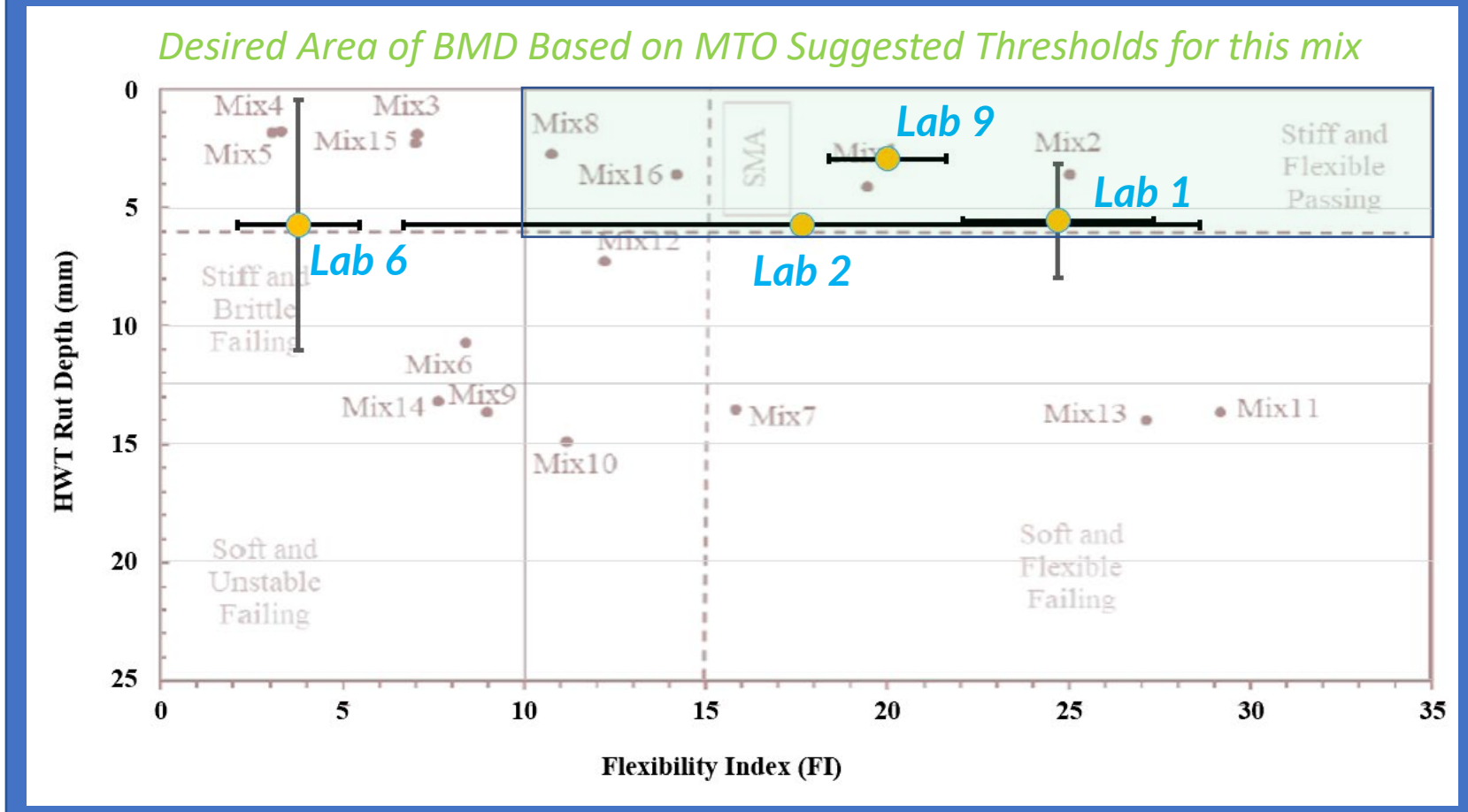
Loose asphalt mixture (laboratory or plant-produced) made into finalized test specimens for mechanical characterization.

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

Slide Retrieved from "Industry Standardization of Asphalt Mixture Sampling Preparation and Aging for Performance Testing" CTAA 2022

EFFECT OF VARIABILITY ON "BALANCE MIX DEISGN" 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

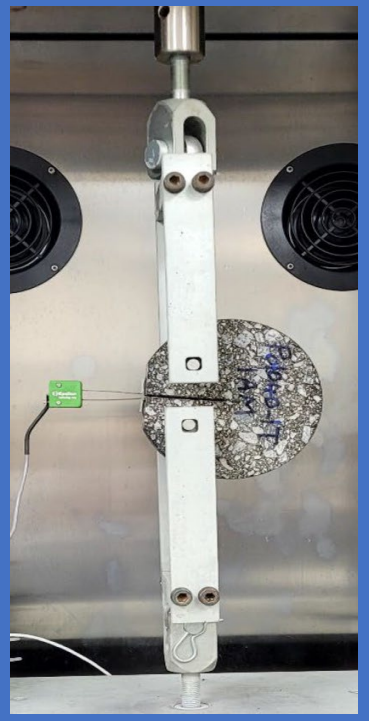
Mix No.	Mix Type[1]	%RAP[2] Content	Specified PGAC[3]	Traffic Category
1	SMA 12.5	-	70-28	E
2	SMA 12.5	-	70-28	E
3	SP12.5 FC2	-	70-28	E
4	SP12.5 FC2	20	70-28	E
5	SP12.5 FC2	20	70-28	E
6	SP12.5 FC2	20	64-28	C
7	SP12.5 FC2	20	64-34	D
8	SP12.5 FC2	-	64-34	E
9	SP12.5 FC2	-	58-28	D
10	SP12.5 FC2	-	58-28	D
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

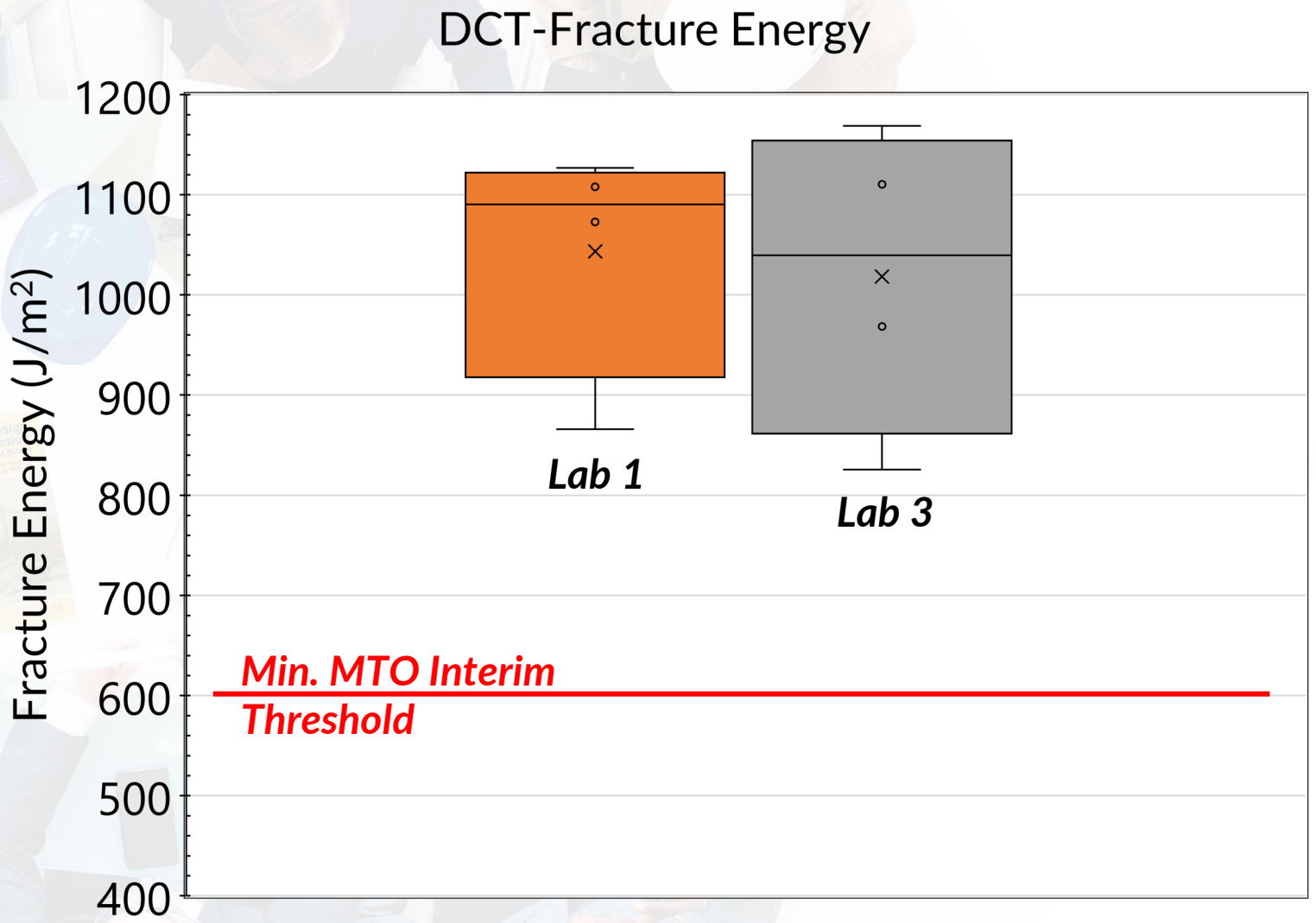
Error bars represent one standard deviation from the average value of four replicates tested per mix (≈ 68% reliability)

Disk-Shape Compact Tension Test (DC(T))

TEST INFO

SG compacted
***160mm+** thickness and then cut into 50mm disks*
Tested at 10°C above PG -YY





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 to research 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 courses… through Good Roads, ORBA Academy, or Local Universities

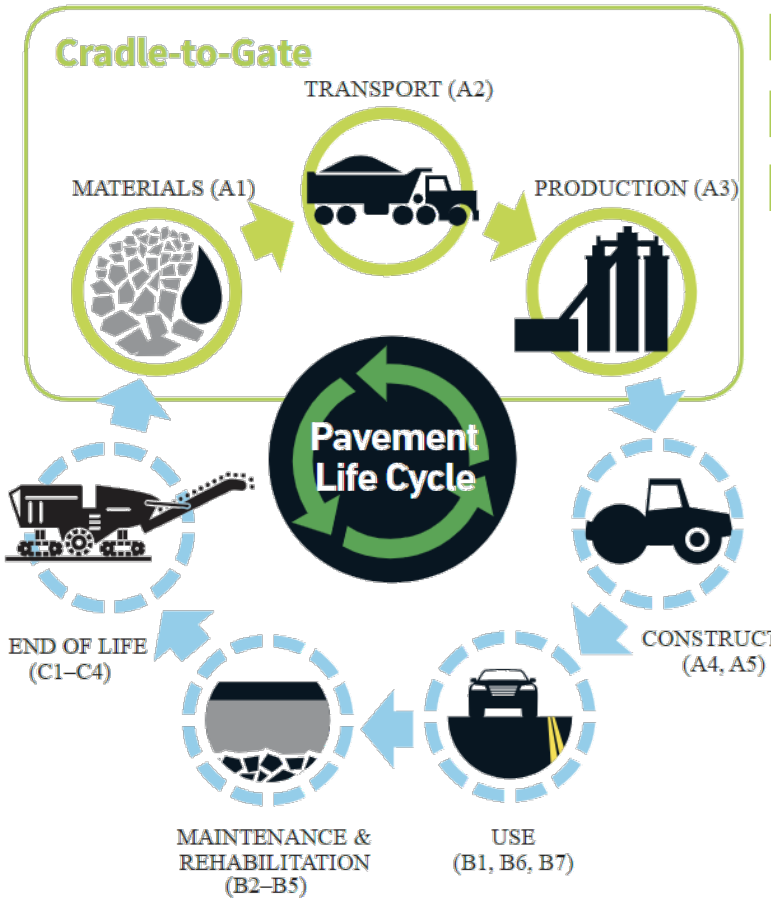
PERFORMANCE INCLUSION CHECKLIST

Enhancing our understanding, while being practical

1. **Benchmark** mix performance.
2. Understand the thresholds **specific** to your local climate and roads.
3. **Collect at least 2 years** of "**information only**" testing data as part of the mix design submission.
4. Understand the efforts required in the coarse and fine-tuning phases of threshold settings.
5. **Request** a performance-verified mix design submission.
6. **Control** the performance throughout the contract using **traditional quality assurance** measures (e.g., gradation and AC%).
7. Conduct performance testing on plant-produced, field-retained, and field-compacted samples only **IF FORENSIC** analysis is required. Include control sections in your DOE for **further root cause analysis.**

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



Environmental
Product
Declaration

Performance Testing to ensure durability

No Impact on Workability and Constructability

Knowledge Sharing is Empowering

Sharing Knowledge and findings of O-MAP with other user producer associations:

1. Nova Scotia User Producer Association
2. New Brunswick User Producer Association
3. Good Roads (formerly OGRA)
4. CTAA's CUPGA
5. Transportation Association of Canada (TAC) Soils & Materials Committee & Pavements Committee

OAETG PUBLICATION CONTRIBUTATIONS

Ambaiowei, D., Varamini, S., Aurilio, M., Almardy, Y., Toward Performance-Based Acceptance of Asphalt Mixtures in Ontario: Industry (O-MAP) Preliminary Findings. *Transportation Association of Canada*, 2023

Ambaiowei, D., Varamini, S., Tavassoti, P., Lavarato, S., Almardy, Y., Lessons Learned from Ontario-Mix Asphalt Program (O-MAP) – A Critical Look at Hamburg Wheel Tracking Test, *Proceedings of the Canadian Technical Asphalt Association Annual Conference*, 2023

Tavassoti, P., Wakefield,A., Sanchez, X., Varamini, S. Performance Evaluation of In-situ and Laboratory Prepared Asphalt Materials: Practical Considerations for Sample Preparation and Testing Methodology, *Transportation Association of Canada*, 2022

QUESTIONS

Sina Varamini, **Ph.D., P.Eng.,**
Ontario Asphalt Expert Task Group - Chair
General Manager – Canada (CRM)

ORBA

oapc

CRM
CRUMB RUBBER MANUFACTURERS