
# JUNE 13 2023

**Centre for Excellence in Transportation Infrastructure (CETI)**
95 Arrow Road, North York ON M9M 2L4

# 2023 OAPC ASPHALT TECHNICAL SYMPOSIUM (ATS)

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# 2023 OAPC ASPHALT TECHNICAL SYMPOSIUM (ATS)

# Mix Asphalt Program (O-MAP) Testing Study Round 2 Updates and Next Steps.


**Sina Varamini, Ph.D., P.Eng.**

Director, Pavements and Materials Group


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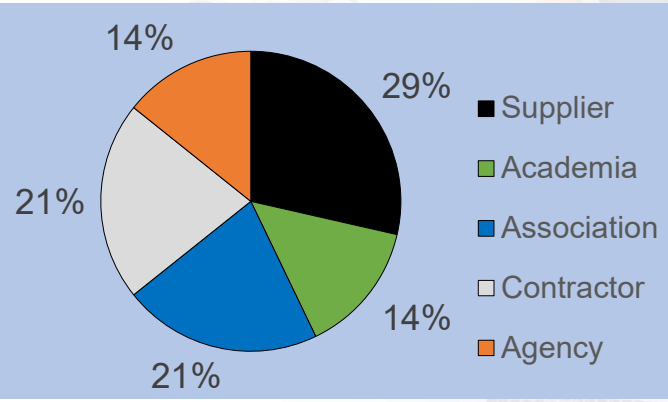
# Ontario Asphalt Expert Task Group (OAETG)

## Open to all industry stakeholders





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

Regional User Producer Groups & Associations

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# Ontario Asphalt Expert Task Group (OAETG)

## OUR MANDATE
I-ABC

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

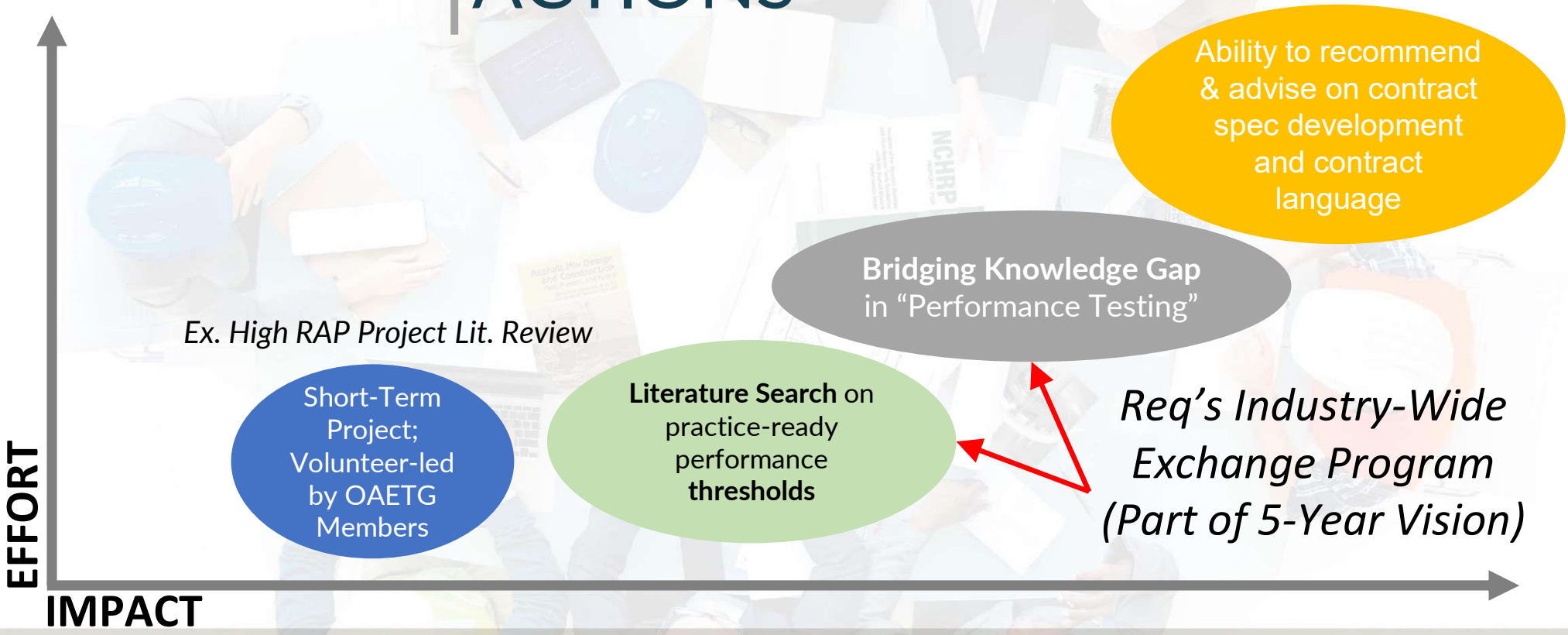
**Act** as an **advisory group**
*Recommending and/or perform asphalt research interests and needs*

**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)

# Ontario Asphalt Expert Task Group (OAETG)

OAETG's approach to I-ABC | ACTIONS



# Ontario Asphalt Expert Task Group (OAETG)

## MIX ASPHALT PROGRAM (MAP) ROUND-2

## OBJECTIVES

Understanding **Variability/Risk**

- Inherent variability within test method – test variability
- Interlaboratory variability

Bridge the knowledge gap in “Performance Testing Methods and Acceptance” within the Industry

# Ontario Asphalt Expert Task Group (OAETG)

## MIX ASPHALT PROGRAM (MAP) ROUND-2

## OBJECTIVES
## RESOURCES

**Plant-Produced Loose-Mix**

MTO Superpave Hot Mix Inter-Laboratory Testing Program [Round 4]
SP12.5 “CAT-D” – Zone 3 (PGAC 70-28 XJ)

**Test Methods**

Hamburg Wheel Tracking Test (**HWT**)
Semi-Circular Bend Test – Flexibility Index (**FI**)
Disk-Shaped Compact Tension Test (**DCT**)
IDEAL type of test methods.

**Nine Labs each with partial or full testing capabilities**

**Info kindly provided by the MTO**

| TEST | Sample: MTO-Q | | | | |
|---|---|---|---|---|---|
| | This Lab | | All Participants | | Lab Rating |
| | Result | Z-Score | Mean | Standard Deviation | |
| **MIX COMPOSITION** | | | | | |
| *% A.C. Content* | | | | | |
| • | | | 5.129 | 0.073 | |
| *Aggregate Gradation (% Passing Sieve, mm)* | | | | | |
| • *25.0* | | | | | |
| • *19.0* | | | | | |
| • *12.5* | | | 97.54 | 0.76 | |
| • *9.5* | | | 84.31 | 1.44 | |
| • *4.75* | | | 55.44 | 1.58 | |
| • *2.36* | | | 48.05 | 1.22 | |
| • *1.18* | | | 32.80 | 0.75 | |
| • *0.600* | | | 21.18 | 0.42 | |
| • *0.300* | | | 12.66 | 0.29 | |
| • *0.150* | | | 7.23 | 0.21 | |
| • *0.075* | | | 4.46 | 0.18 | |

# Ontario Asphalt Expert Task Group (OAETG)

## MIX ASPHALT PROGRAM (MAP) ROUND-2

## OBJECTIVES

## RESOURCES

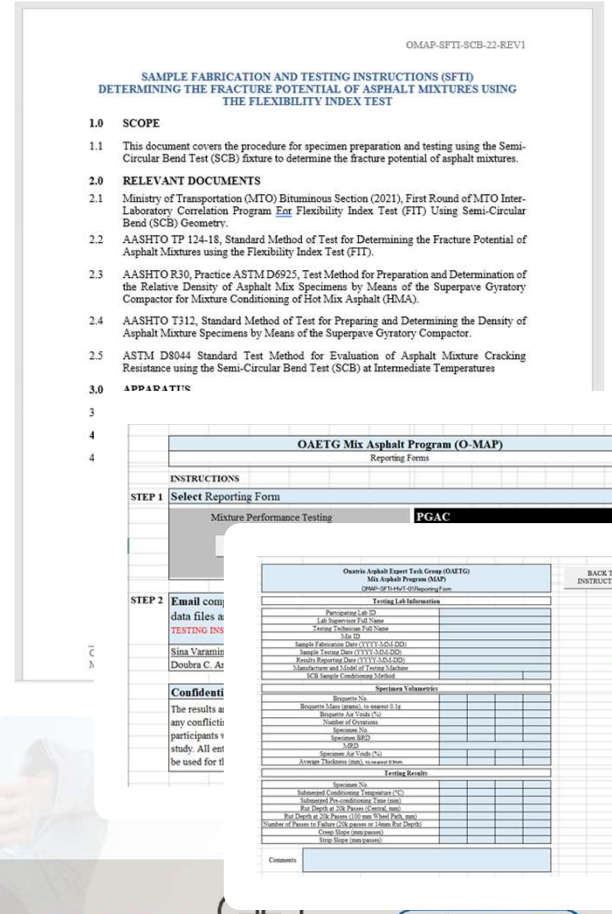
**Procedures and Instructions Developed**

Controlling consistency

Sample Fabrication and Testing Instructions **(SFTIs)**

Interactive Reporting Forms **(IRFs)**

Large Input from MTO's round of correlations



OMAP-SFTI-SCB-22-REV1

SAMPLE FABRICATION AND TESTING INSTRUCTIONS (SFTI)
DETERMINING THE FRACTURE POTENTIAL OF ASPHALT MIXTURES USING THE FLEXIBILITY INDEX TEST

**1.0 SCOPE**

1.1 This document covers the procedure for specimen preparation and testing using the Semi-Circular Bend Test (SCB) fixture to determine the fracture potential of asphalt mixtures.

**2.0 RELEVANT DOCUMENTS**

2.1 Ministry of Transportation (MTO) Bituminous Section (2021), First Round of MTO Inter-Laboratory Correlation Program For Flexibility Index Test (FIT) Using Semi-Circular Bend (SCB) Geometry.

2.2 AASHTO TP 124-18, Standard Method of Test for Determining the Fracture Potential of Asphalt Mixtures using the Flexibility Index Test (FIT).

2.3 AASHTO R30, Practice ASTM D6925, Test Method for Preparation and Determination of the Relative Density of Asphalt Mix Specimens by Means of the Superpave Gyratory Compactor for Mixture Conditioning of Hot Mix Asphalt (HMA).

2.4 AASHTO T312, Standard Method of Test for Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor.

2.5 ASTM D8044 Standard Test Method for Evaluation of Asphalt Mixture Cracking Resistance using the Semi-Circular Bend Test (SCB) at Intermediate Temperatures

**3.0 APPARATUS**

OAETG Mix Asphalt Program (O-MAP)
Reporting Forms

INSTRUCTIONS

STEP 1 Select Reporting Form

Mixture Performance Testing | PGAC

STEP 2

Ontario Asphalt Expert Task Group (OAETG)
Mix Asphalt Program (MAP)

BACK TO INSTRUCTIONS

Testing Lab Information

Specimen Volumetrics

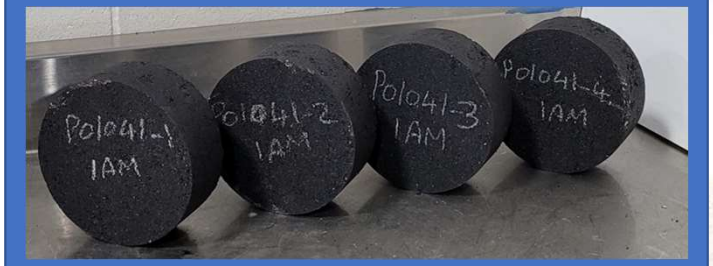
Testing Results

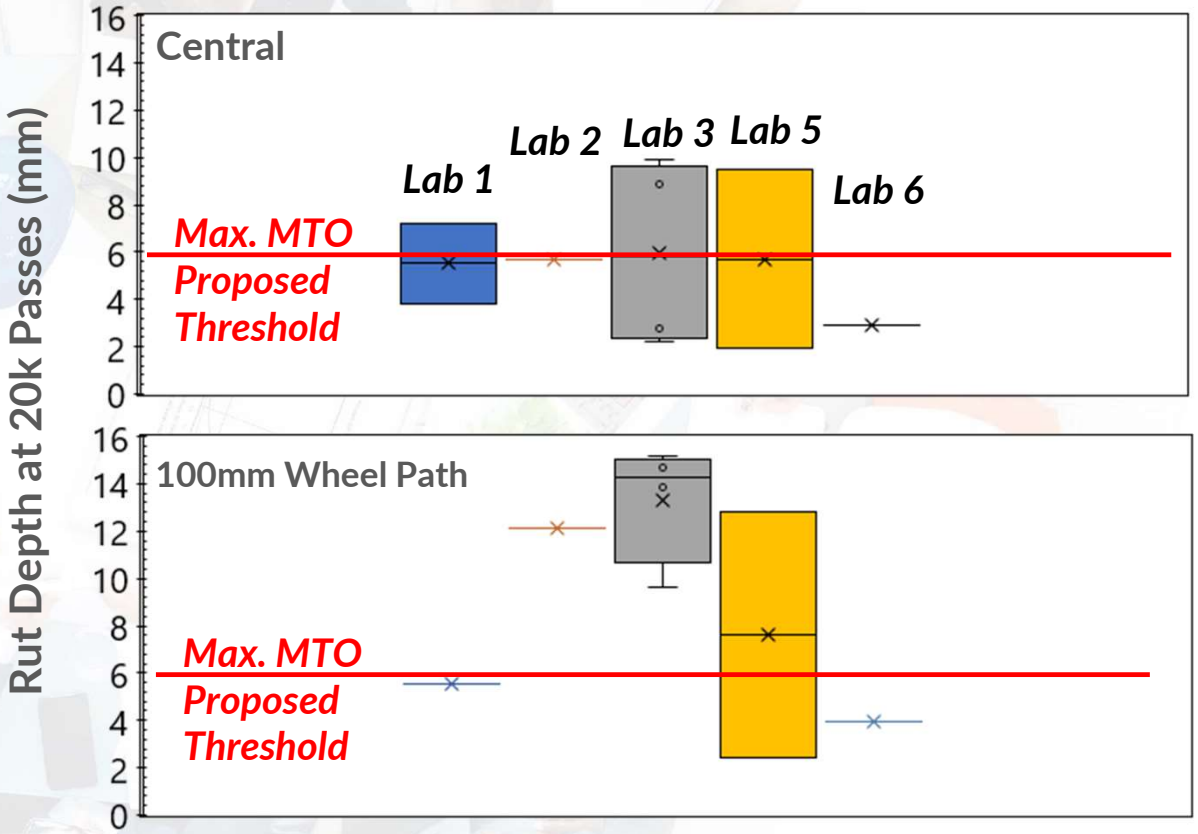
Comments

# Hamburg Wheel Tracking (HWT) Device

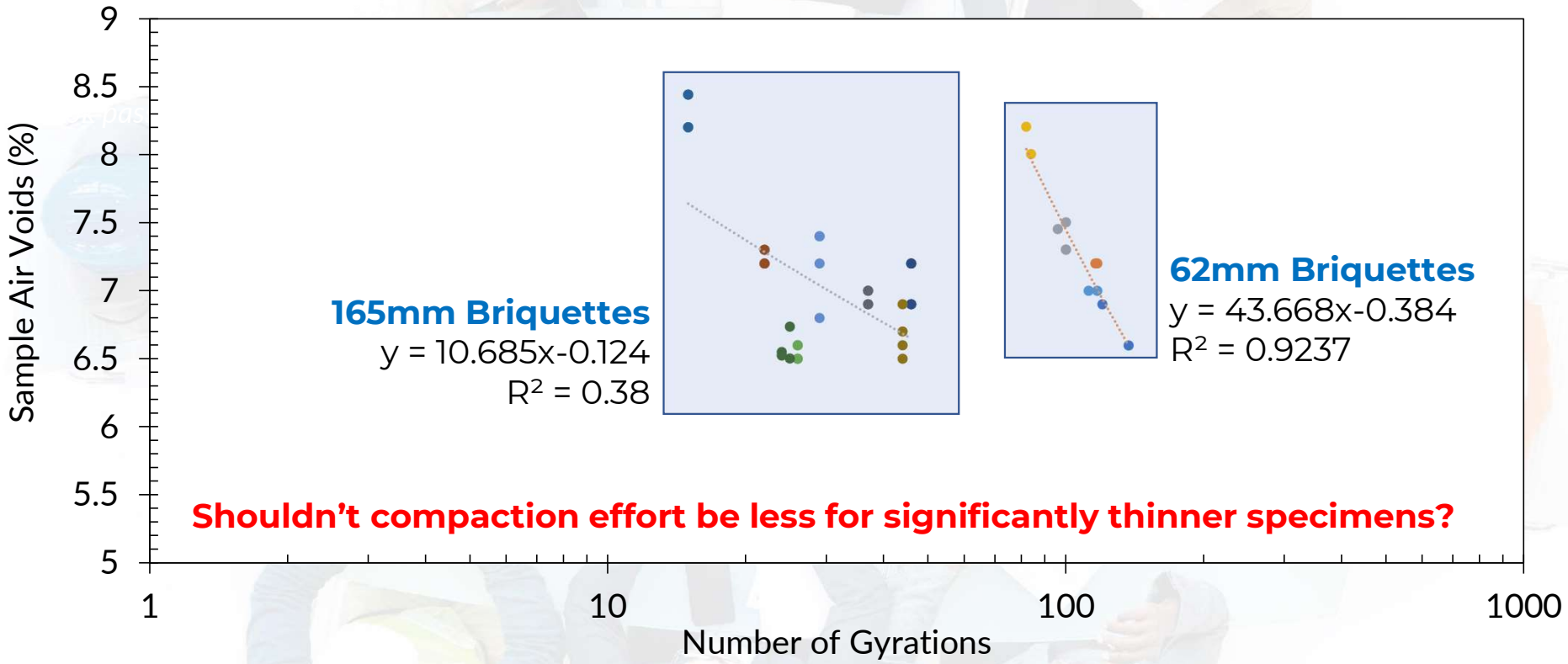
**TEST INFO**

*SG compacted (**60-mm** thickness)*
*Tested at **50°C** or **44°C***
*MTO preliminary spec Max. 6 mm or 12.5 after 20k passes*



# OMAP GYRATORY RESULTS



# Let's Talk About Gyratory Compactor

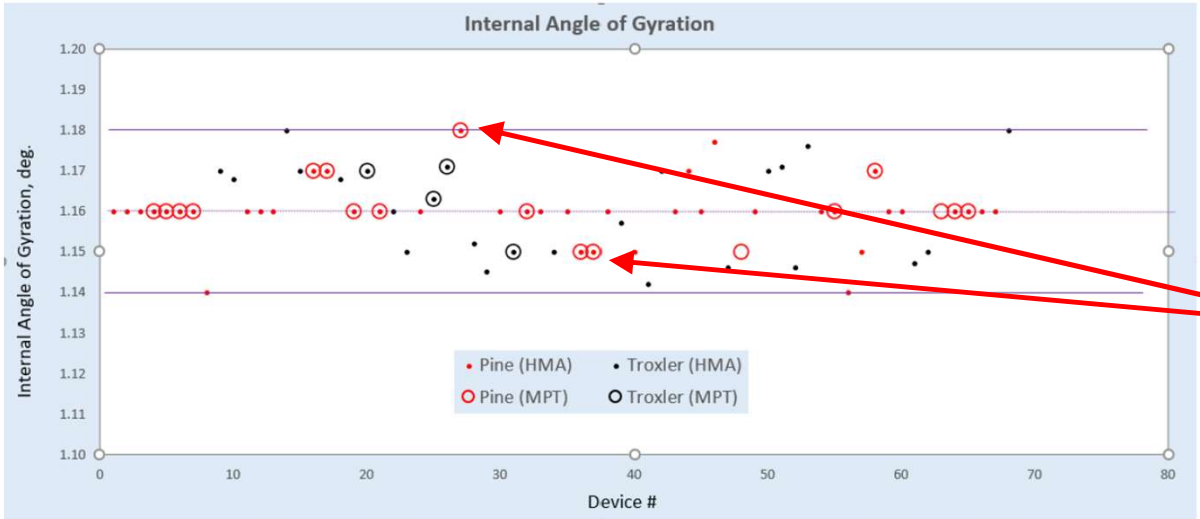


Gyrocomp Gyratory Compactor


**NOT all SGCs the same!**

# Let's be assured...

Gyratory equipment in Ontario are <u>well calibrated for their intended **volumetric-only** mix design purposes</u>




**<u>Questions..</u>**

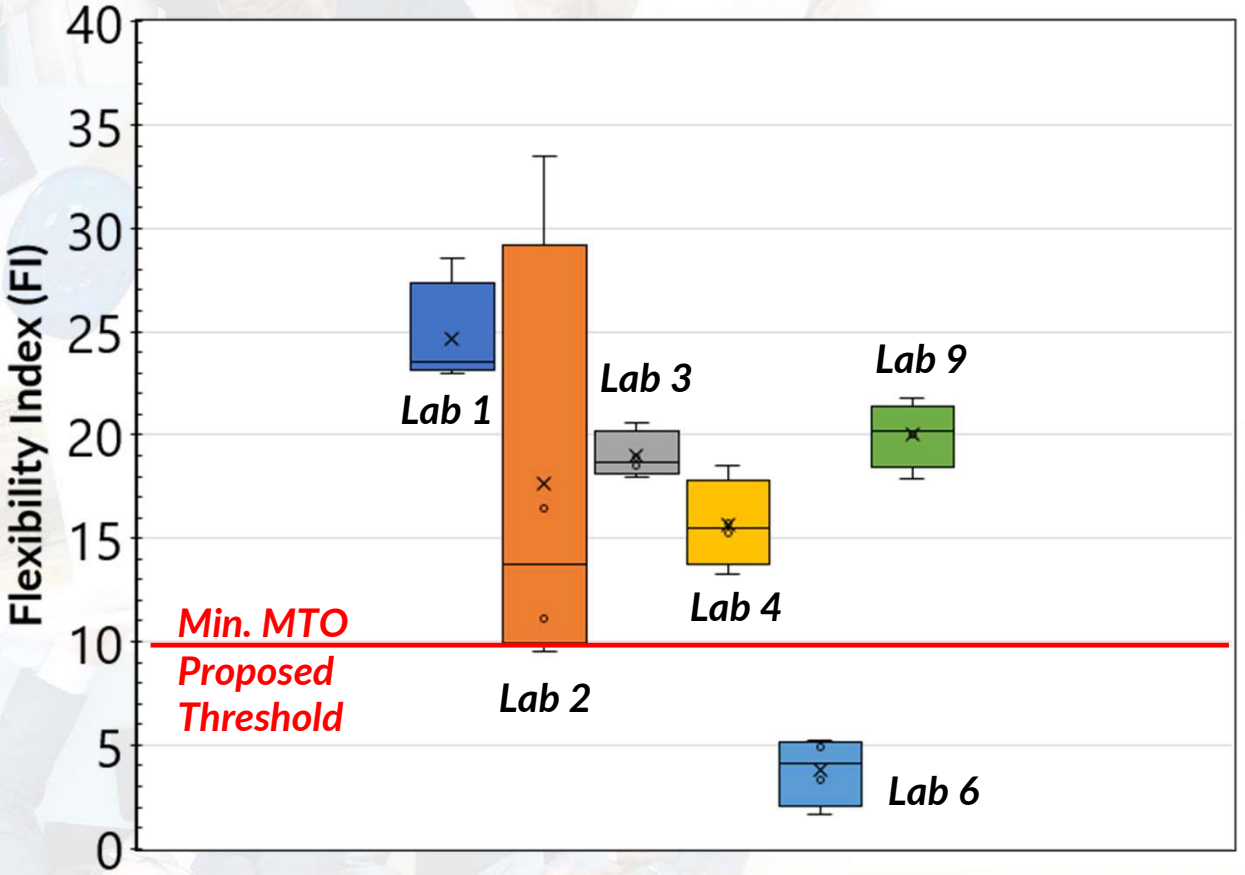
How about thinner specimens?

What is the statistical difference between the Hamburg results of these two labs? (1.18 vs 1.15 internal angle for Pine)

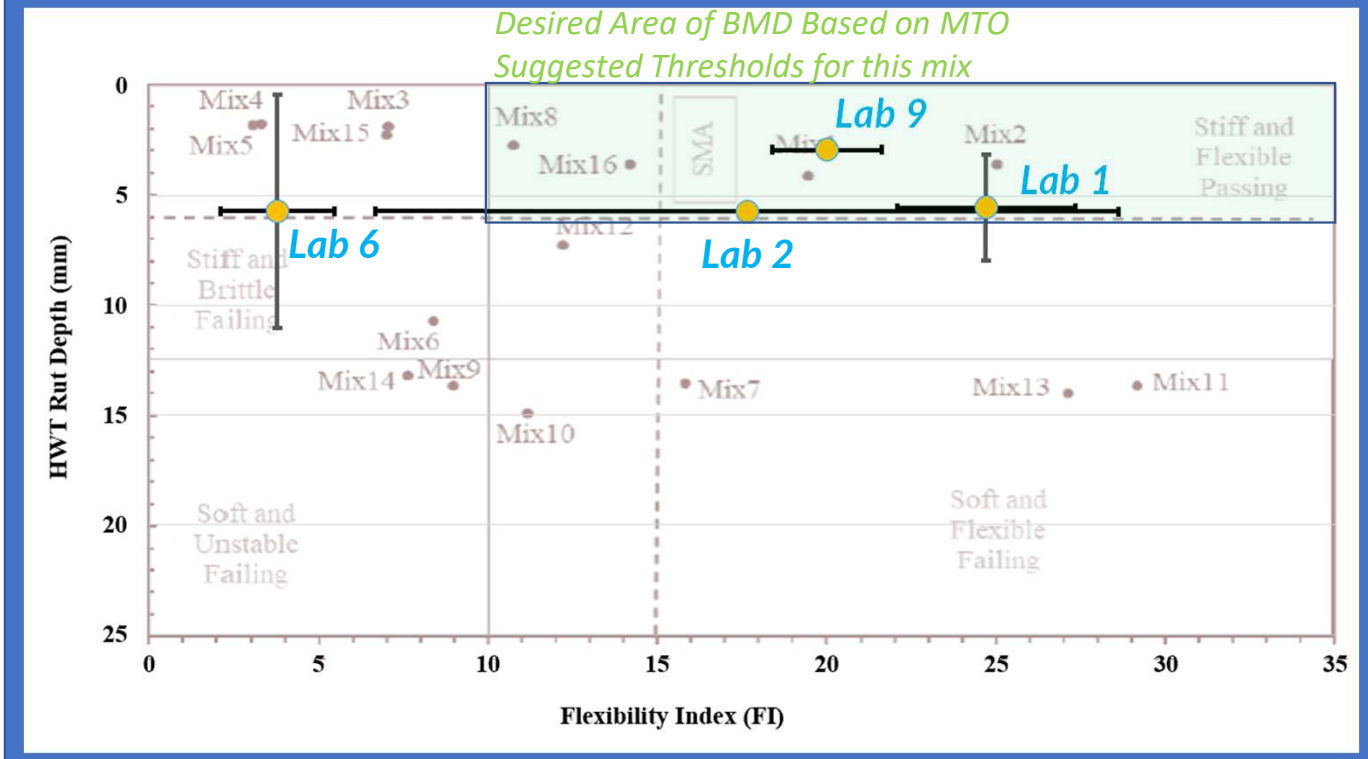
# Semi-Circular Bend Test (Flexibility Index)

## TEST INFO

*SG compacted*
***160-mm+** thickness and then cut into 50-mm disks*
*Flexibility Index (FI)* ***Min. 10***
*Tested at* ***25°C***

# 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)

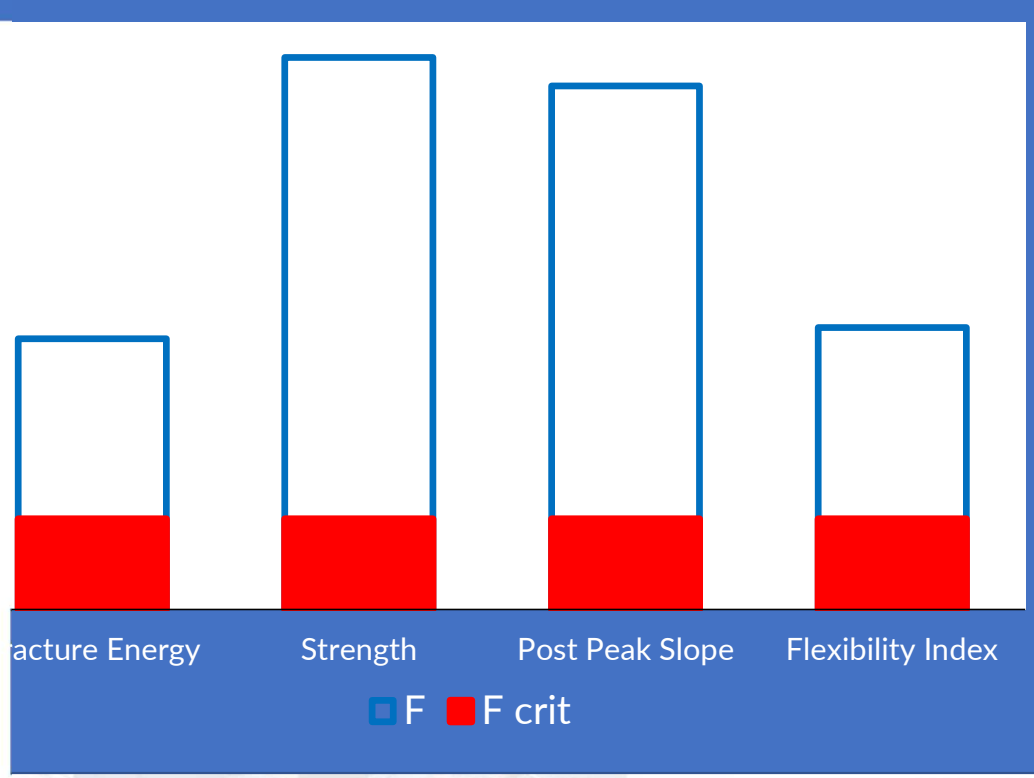
# Semi-Circular Bend Test (Flexibility Index)

**What is the most**

**ters?**


*raulic Loading*
*sed Environmental*
*mber*

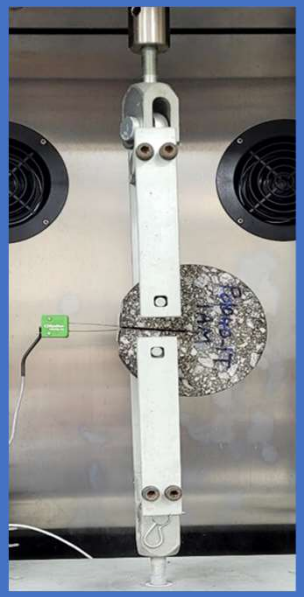
1. *Screw Driven*
2. *External Enviro*
   *Chamber*

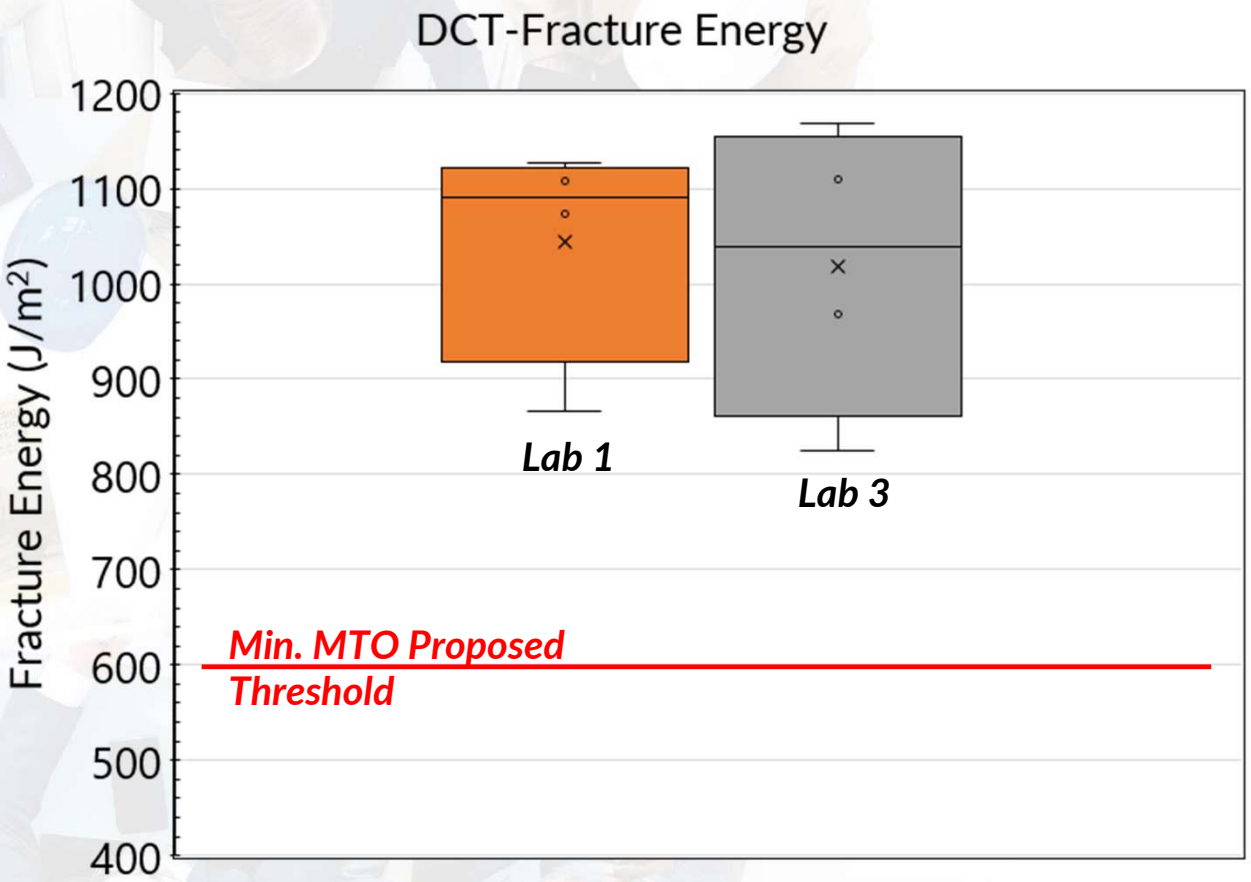


# Disk-Shape Compact Tension Test (DC(T))

## TEST INFO

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





# 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*

# MIX ASPHALT PROGRAM (MAP) ROUND-2

## FINDINGS

### Mix Properties

Mix properties do play a role in performance, especially during fabrication of HWT thinner briquets – need more research to adjust internal angle per mix type

### 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

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

**OAETG members for their contributions to the success of the group**

**Contractors donating materials and local testing labs**

**Special thank to Oversite Study Team (OST) for help with data analysis and reporting:**

Yashar Azimi Alamdary, WSP

Mike Aurilio, Yellowline Asphalt

Amin Mneina, Good Roads

Mehran KafiFarashah, York Region

Saied Salehi, Engtec Consulting Inc.

gtec Consulting Inc. – Sample Delivery

bheep Lubana, Engtec, Sample collection and storage

on us

# Questions and Discussions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