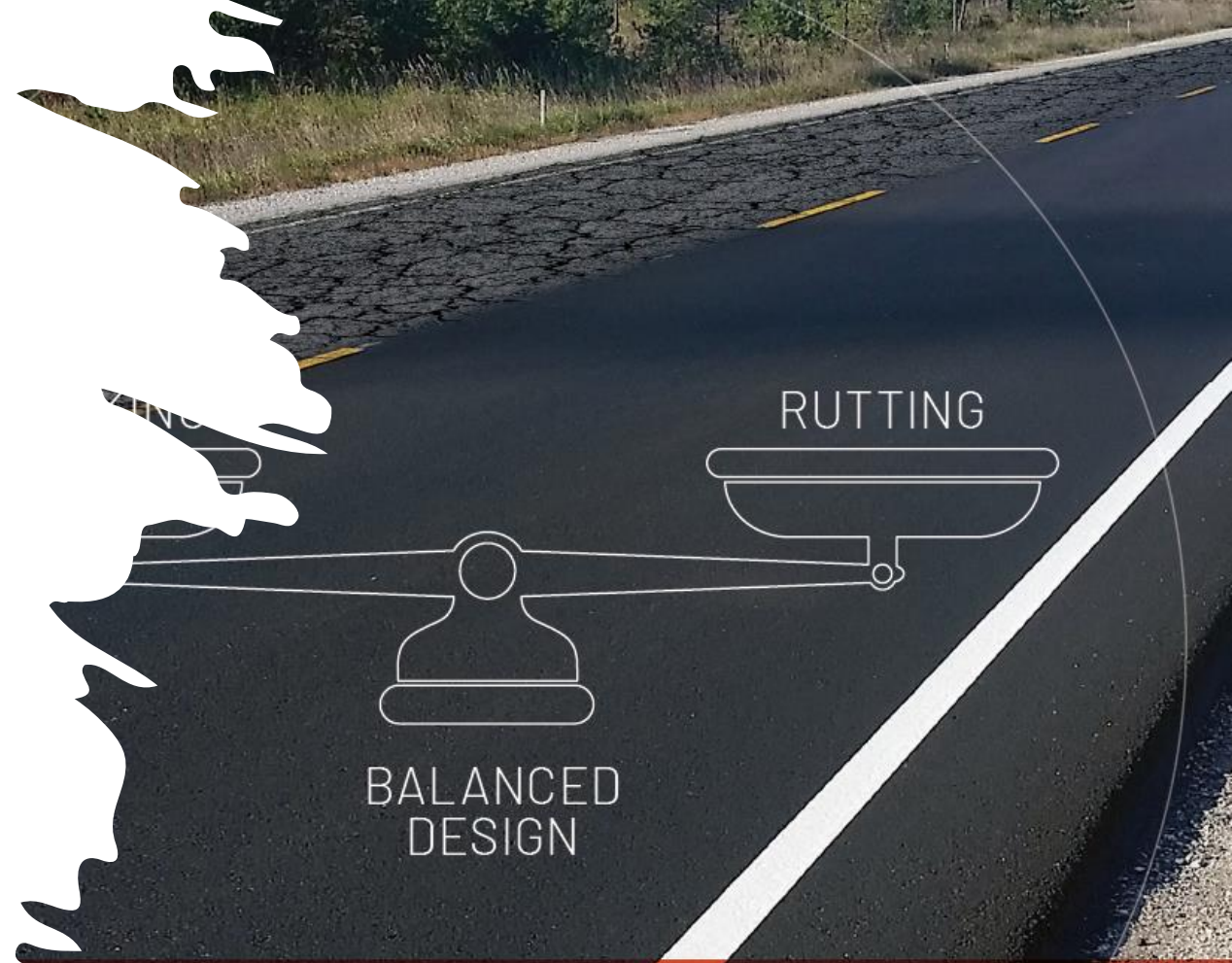


O-MAP Round 3 and the Future of OAETG

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2024 OAPC ASPHALT TECHNICAL SYMPOSIUM

asphalt ontario rides on us

**2024 OAPC ASPHALT
TECHNICAL SYMPOSIUM** (ATS)
JUNE 11 2024 Scarborough Convention Center
20 Torham Pl, Scarborough, ON M1X 0B3



The Idea

High RAP
Literature
Review



Development
of O-MAP R3



Refinement
and Further
Research

The Concepts

- Today's big concepts:
 - Ontario needs to understand what design changes will be most effective for our materials
 - We need to understand how to incorporate RAP effectively
 - We need to understand how to use performance tests to modify performance
 - Looking at mix design changes that increase effective binder content
- Today's side concepts:
 - Understanding impact of cutting samples after fabrication on variability

New Jersey Experience

- Surface: 20% Minimum
- Base/Intermediate: 30% Minimum
- Lead to 1% VMA increase in specification
- Air Voids Controlled between 95 and 98.5% during production
- Specification based on virgin mixes

Test	Requirement			
	Surface Course		Intermediate Course	
	PG 64-22	PG 76-22	PG 64-22	PG 76-22
APA @ 8,000 loading cycles (AASHTO T 340)	< 7 mm	< 4 mm	< 7 mm	< 4 mm
Overlay Tester (NJDOT B-10)	> 150 cycles	> 175 cycles	> 100 cycles	> 125 cycles

New Jersey Experience

- First trial: 2012 on Interstate 295
- Final mix had 25% in surface, 35% in intermediate
- Binder selection left to whatever was most appropriate for performance
- No issues with compaction, IRI and density measurements confirmed this

Property	I295 Final HRAP Mixtures	
	9.5M76 (Surface Course)	12.5M64 (Intermed. Course)
RAP % Used	25%	35%
JMF Asphalt Content (%)	6.0%	5.8%
% Binder Replacement	27.4%	29.7%
PG Grade of Virgin Binder (Continuous Grade)	PG70-22 (74.6-26.99)	PG64-28 (64.8-28.29)
Fractionated RAP Portion Used	100% Fine RAP Fraction	50% Fine RAP Fraction 50% Coarse RAP Fraction

Georgia Experience

- Began investigating performance issues in 2012
 - Implemented multiple changes including reduced gyrations, finer gradations, performance testing on specialty mixes
- Corrected Optimum Asphalt Content:
 - 60:40 currently in specification
 - Essentially treats RAP as only contributing 60% of binder

If ranges in asphalt content and gradation are equal to or less than:

% asphalt cement	≤ 0.65	0.66 - 0.90	0.91 - 1.00	1.01 - 1.20	1.21 - 1.30	> 1.30
% passing No 200 Sieve	≤ 5.0	5.1 - 7.0	7.1 - 7.75	7.76 - 8.0	8.1 - 8.8	> 8.8
% passing control sieves	≤ 8.0	8.1 - 13	13.1 - 18	13.1 - 18	18.1 - 20.0	> 20.0

the maximum % RAP allowed is:

Max	35%	30%	25%	20%	15%
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The Materials

- Mix Type: SP 12.5 FC2
 - AC Content: 5.2%
- PG Grade: 74.0-33.6
- RAP Grade: 85.2-18.8

Original Mix

JOB MIX FORMULA - GRADATION PERCENT PASSING

AC%	Sieves	50.0	37.5	25.0	19.0	16.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
5.2	JMF	100.0	100.0	100.0	100.0	100.0	97.3	81.4	51.8	41.8	28.4	18.4	11.8	7.5	5.3



Air Voids 3.2%
VMA- 15.3%

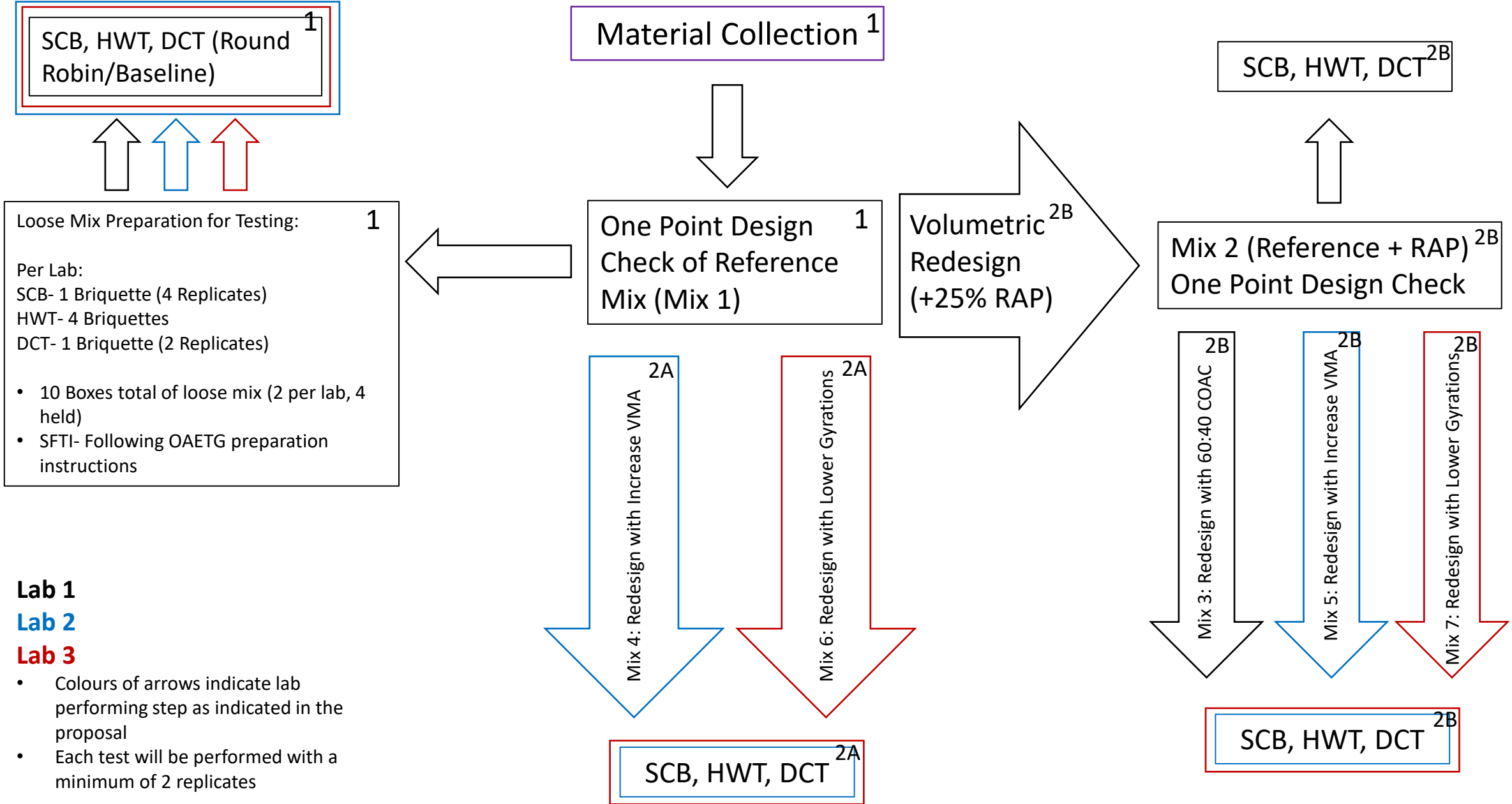
Adjusted Mix

JOB MIX FORMULA - GRADATION PERCENT PASSING

AC%	Sieves	50.0	37.5	25.0	19.0	16.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
5.2	JMF	100.0	100.0	100.0	100.0	100.0	97.4	82.0	52.4	41.0	27.9	18.3	12.1	8.0	5.8

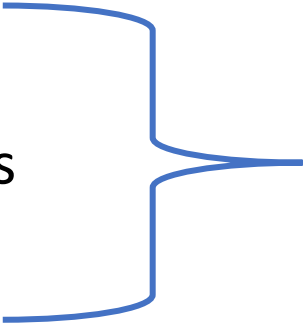


Air Voids 4.1%
VMA- 16.2%



***Redesign of mixtures will target 4% air voids with an acceptable tolerance of +/- 1%

The Details

- Benchmarking:
 - Use round robin testing to establish performance benchmark
 - SCB vs IDEAL CT
 - Increase Design VMA
 - Lower Design Gyration
 - 60:40 COAC
- 
- Increase effective binder content
- 25% RAP Content
 - Higher “safe/comfortable” concentration
 - Higher than threshold where softer binder should be used

The Timeline

Stage 1 (~6-8 weeks):

1. Material Collection (1 week)
2. One Point Design Check of Reference Mix (3 weeks)
3. Performance Testing of Reference Mix (2 weeks)
4. Oversight Team Data Analysis (2 weeks)

Stage 2A- Mix 4 and 6 (~3-4 Weeks)

1. Redesign of mix using designated design change (1-2 weeks)
2. Performance testing of new mixes (2 weeks)

Stage 2B- Mix 3, 5 and 7 (~3-4 Weeks)

1. Redesign of mix using designated design change (1-2 weeks)
2. Performance testing of new mixes (2 weeks)

Stage 1 Participants

Mix - 1				
Lab ID	HWT	SCB	DCT	Ideal CT
A	1	1		
B			1	
C	1	1		
D	1	1	1	1
E		1		
F	1	1	1	1
G	1	1		
H	1	1	1	
J	1	1	1	
K	1			1
L		1		
M				1
N	1	1	1	1
	9	10	6	5
	4	2	2	3
	36	20	12	15

This one is me



What else should we explore?

Finer Mixes

- Bonus: Reduces permeability of mix, reduces long-term oxidation

RAP Gradation Requirements

- RAP particle size impacts available binder

Softening/Recycling Agents:

- Used to increase RAP content successfully by several DOTs

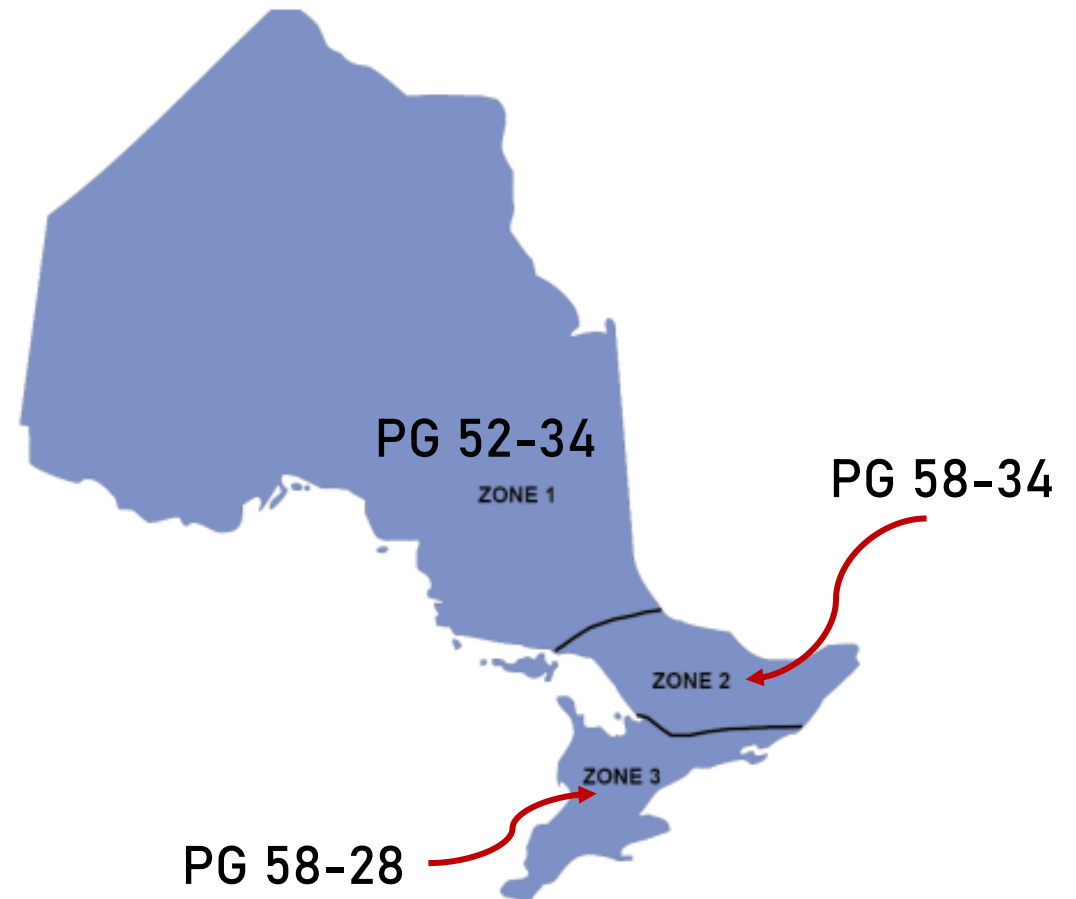
Where do we go next?

Provincial System?

- Low volume roads?
- Adoption for smaller municipalities?
- Impact of traffic on thresholds?

Sustainability?

- RAP usage, RAS usage?
- Pavement longevity





**FOR ANY INQUIRIES ABOUT
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