Performance Evaluation of Asphalt Mixtures With High RAP Content

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OVERALL OBJECTIVES

a. Can current *design techniques* be used to design high RAP contents HMA mixes?
b. Validation of existing and new procedures for *characterizing RAP materials*.
c. Side-by-side comparison of *field performance* for HMA w/o and HMA with high RAP.
d. Can laboratory-produced mixtures' properties be used to *ensure quality field-produced mixtures*?

PTH-8 RAP PROJECT LAYOUT

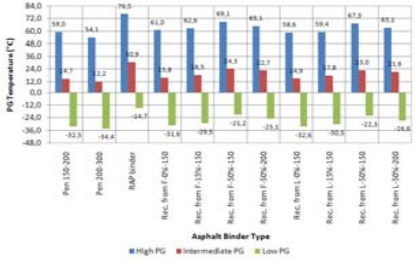
~1.5 miles	~1.5 miles	~1.5 miles	~1.5 miles
4th lift: HMA / 50% RAP	HMA / 50% RAP w/ grade change	HMA / 15% RAP	HMA / No RAP
3rd lift: HMA / 50% RAP	HMA / 50% RAP w/ grade change	HMA / 15% RAP	HMA / No RAP
2nd lift: HMA / 50% RAP			
1st lift: HMA / 50% RAP			

EXPERIMENTAL PLAN

- ❑ Evaluation of *field-produced* and *laboratory-produced* HMA mixtures with 0, 15 and 50% RAP content from field sections in ***Manitoba-Canada***.
- ❑ Evaluation of the applicability of the blending chart process to predict the PG of the blended asphalt binder.
- ❑ Comparison between the properties and performance of the field- and laboratory-produced mixtures

Property	F-0%-150	F-15%-150	F-50%-150	F-50%-200	L-0%-150	L-15%-150	L-50%-150	L-50%-200
AASHTO T283 at multiple F-T ▪ TS vs. F-T cycles: 0, 1 and 3 F-T ▪ TSR at 1 and 3 F-T	X X	X X	X X	X X	X X	X X	X X	X X
Modulus at multiple F-T ▪ |E*| vs. F-T cycles: 0, 1 and 3 F-T	X	X	X	X	X	X	X	X
Resistance to thermal cracking ▪ TSRT: 0 and 3 F-T	X	X	X	X	X	X	X	X

ASPHALT BINDERS TRUE GRADES



ASPHALT BINDERS PG GRADES

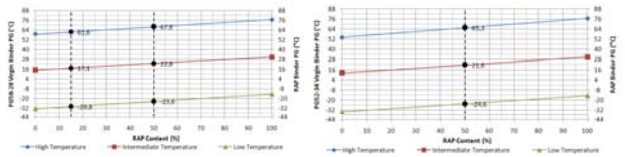
Binder	PG Grade
Pen 150-200	58-28
Pen 200-300	52-34
RAP Binder	76-10
Recovered from F-0%-150	58-28
Recovered from F-15%-150	58-28
Recovered from F-50%-150	64-16
Recovered from F-50%-200	64-22
Recovered from L-0%-150	58-28
Recovered from L-15%-150	58-28
Recovered from L-50%-150	64-22
Recovered from L-50%-200	58-22

BLENDING CHARTS

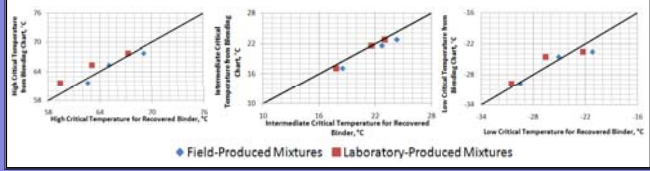
$$T_{virgin} = \frac{T_{Blend} - (\%RAPbinder \times T_{RAP})}{(1 - \%RAPbinder)}$$

where: T_{Blend} = critical temperature of blended asphalt binder
T_{virgin} = critical temperature of virgin asphalt binder
T_{RAP} = critical temperature of recovered RAP binder
$\%RAPbinder$ = percent RAP binder in the RAP expressed as a decimal

Blending Chart process for PG58-28 and PG52-34

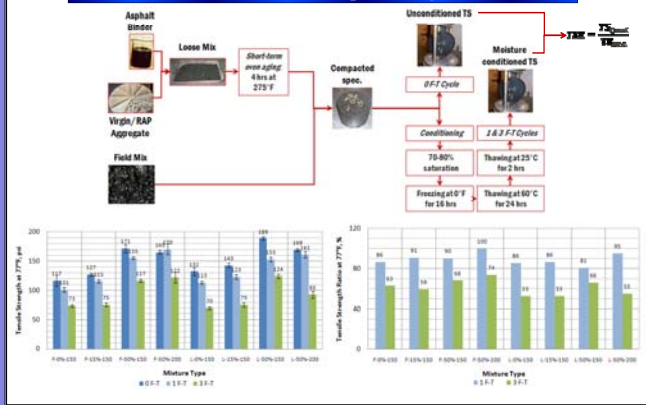


Estimated vs. measured Critical Temperatures



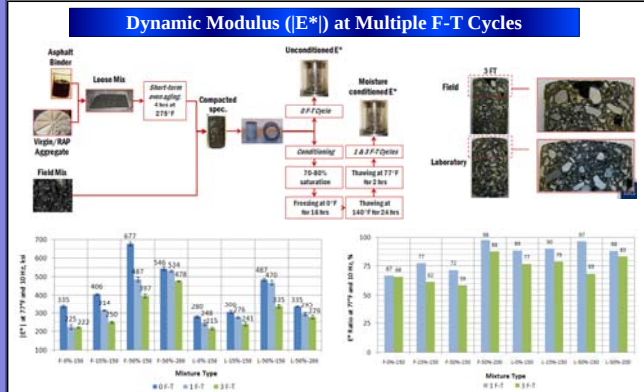
LABORATORY EVALUATION

TS and TSR at Multiple F-T Cycles

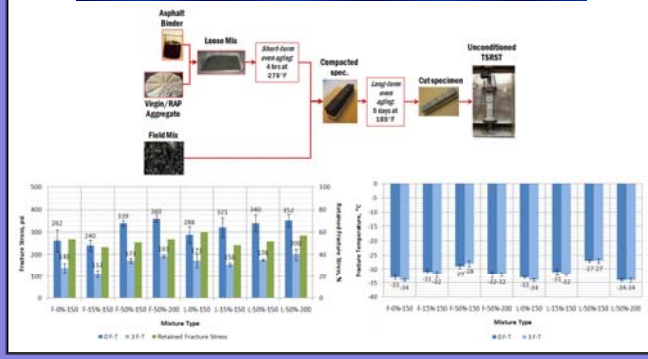


LABORATORY EVALUATION (cont…)

Dynamic Modulus (|E*|) at Multiple F-T Cycles



Thermal Cracking Resistance at Multiple F-T Cycles



FINDINGS AND CONCLUSIONS

- Good correlations were observed between estimated critical temperatures form the blending chart and measured ones from recovered asphalt binders.
- The use of multiple F-T cycles provided a better characterization of the mixtures resistance to moisture damage.
- Higher or similar TS were observed for the laboratory-produced mixtures when compared to the field-produced mixtures.
- Field-produced and laboratory-produced mixtures ranked similarly in the AASHTO T283, |E*| and TSRST tests.

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