

Wisconsin RAM

presentation to RAP ETG May 20, 2010

Issues:

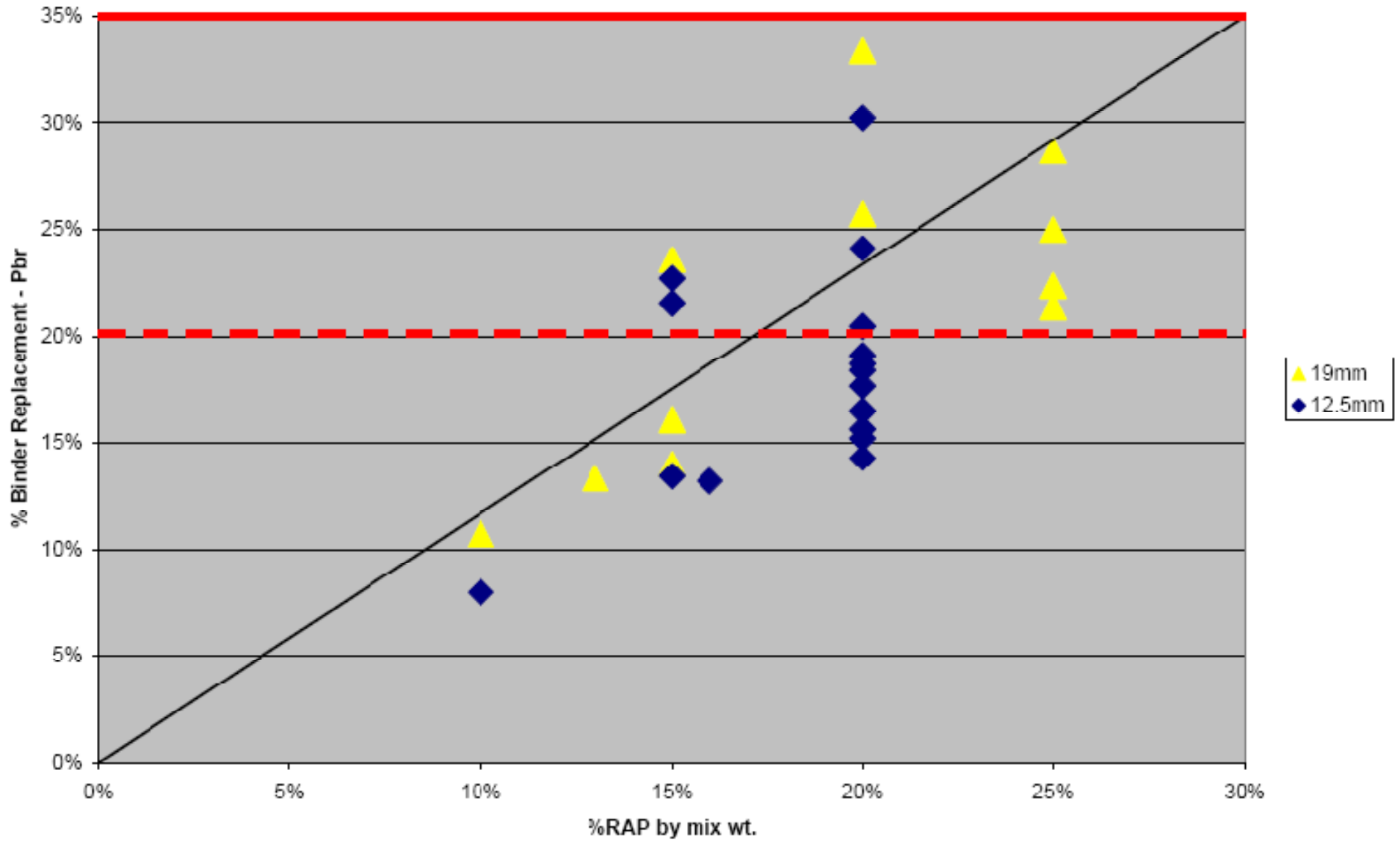
- What is the effect of changing from % RAP by wt. mix to % binder replacement, Pbr
- What are the binder effects?

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Mathy Construction Co.

Updated from 2008 WAPA presentation

Pbr vs %RAP



Effect of changing from %RAP total mix to %RAP as percent binder replacement (Pbr)

Allowable for Surface*

Mix	Nom. Max.	JMF %-binder	Extracted RAP %-AC	Old Spec by mix wt.	%AC from RAP	P _{ba}	P _{be}	New Spec P _{br}	Additional %RAP
E0.3	12.5	5.3	4.2	20%	0.8	0.8	4.5	19%	1%
E1	12.5	5.4	3.5	20%	0.7	0.6	4.9	14%	6%
E1	12.5	5.1	4.2	20%	0.8	0.7	4.4	19%	1%
E3	12.5	5.2	6.6	15%	1.0	1.0	4.6	22%	-2%
E3	12.5	5.3	6.5	15%	1.0	1.1	4.3	23%	-3%
E3	12.5	5.3	6.5	20%	1.3	1.0	4.3	30%	-10%
E3	12.5	5.3	5.3	20%	1.1	1.0	4.4	24%	-4%
E3	12.5	5.3	4.5	20%	0.9	0.9	4.4	20%	0%
E3	12.5	5.4	4.2	20%	0.8	0.4	5.1	16%	4%
E3	12.5	5.7	4.5	20%	0.9	0.7	5.1	18%	2%
E3	12.5	5.1	3.5	20%	0.7	0.5	4.6	15%	5%
E10	12.5	4.8	3.5	10%	0.4	0.4	4.4	8%	12%
E10	12.5	5.1	4.2	15%	0.6	0.4	4.7	13%	7%
E10	12.5	5.5	4.2	16%	0.7	0.4	5.1	13%	7%
E10	12.5	5.6	4.5	20%	0.9	0.7	4.9	18%	2%
E10	12.5	5.1	3.6	20%	0.7	0.5	4.6	16%	4%
E1	19	5.6	4.1	25%	1.0	0.9	4.8	21%	14%
E1	19	4.9	4.2	25%	1.1	0.7	4.2	25%	10%
E1	19	4.7	4.7	25%	1.2	0.6	4.1	29%	6%
E3	19	4.8	4.3	13%	0.6	0.6	4.2	13%	22%
E3	19	4.7	6.6	15%	1.0	0.5	4.2	24%	11%
E3	19	5.0	6.5	20%	1.3	1.2	3.9	33%	2%
E3	19	5.4	5.4	20%	1.1	1.2	4.2	26%	9%
E3	19	5.0	4.2	25%	1.1	0.3	4.7	22%	13%
E10	19	5.3	4.5	10%	0.5	1.1	4.2	11%	24%
E10	19	5.0	4.5	15%	0.7	0.9	4.2	16%	19%
E10	19	4.9	4.2	15%	0.6	0.5	4.5	14%	21%

Binder PG	RAM	%RAM	RAM PG	Predicted PG		Actual PG
58 -28	Shingles	10	129 34	65	-22	PG 59-28
64 -22	Shingles	5	129 34	67	-19	PG 68-22
64 -22	Shingles	10	129 34	71	-16	PG 69-22
64 -22	RAP	10	76 -22	65	-22	PG 68-24

Binder PG	RAM	%RAM	RAM PG	Predicted PG	Actual PG	
58 -28	RAP	15	76 -22	61 -27	PG 63-28	HMA
58 -28	RAP	15	76 -22	61 -27	PG 63-28	HMA
64 -22	RAP	15	76 -22	66 -22	PG 68-26	Warm
58 -28	RAPw/sulf	20	76 -22	62 -27	PG 58-28	HMA
58 -28	RAP	20	76 -22	62 -27	PG 70-28	HMA
52 -34	RAP	23	76 -22	58 -31	PG 52	HMA
52 -34	RAP	35	76 -22	60 -30	PG 62-30	HMA
58 -28	RAP	35	76 -22	64 -26	PG 67-27	HMA
58 -28	RAP	25	76 -22	63 -27	PG 65-28	HMA
58 -28	aged for 2 weeks			58 -28	PG 68	HMA
58 -28	RAP	40	76 -22	65 -26	PG 63-29	REVIX™
64 -28	RAP	17	76 -22	66 -27	PG 72-26	HMA-c
64 -28	RAP	35	76 -22	68 -26	PG 68-31	REVIX™

WisDOT RAM Specification

Current specification limits

MAXIMUM ALLOWABLE PERCENT BINDER REPLACEMENT

RECYCLED ASPHALTIC MATERIAL	LOWER LAYERS	UPPER LAYER
RAS only	20	15
RAP only	35	20
FRAP only	35	25
RAS and RAP	30	20
RAS and FRAP	30	25
RAS, RAP, and FRAP	30	25

WisDOT RAM Specification

Proposed 2011 specification

MAXIMUM ALLOWABLE PERCENT BINDER REPLACEMENT

RECYCLED ASPHALTIC MATERIAL	LOWER LAYERS	UPPER LAYER
RAS only	25	20
RAP only	40	25
RAS and RAP	35	25

Advantage of Pbr

- Control of what is in the mix.
- Examples 2010 Warranty project:
 - 12.5 mm E30 fine gradation 20% RAP 14.9% Pbr
 - 19 mm E30 fine gradation 20% RAP 16.1% Pbr
 - 25 mm E30 Gap graded 30% RAP 30.5% Pbr

Key to Wisconsin program

- Testing of RAP – by contractor
 - Gradation
 - Binder content
- Limitations on %Pbr
 - Control of minus no. 200
- RAM Definition

460.2.5 Recycled Asphaltic Materials

- (1) The contractor may use recycled asphaltic materials from FRAP, RAP, and RAS in HMA mixtures. Stockpile recycled materials separately from virgin materials and list each as individual JMF components.