ARC

Asphalt Research Consortium

# Estimating the Low Temperature PG-Grade of Binders in RAP without Extraction

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# Outline

- Relevance
- Testing Procedure
- Analysis Spreadsheet
- Next steps

# Research Needs

*2007 Survey - Cecil Jones*

- Modulus of RAP Mixes
- Fatigue Concerns
- *Final Effective Binder Grade*
- Performance of High RAP Mixes
- *Need to Bump Binder Grade*
- How to Better Control RAP - Fractionating

# New Terminology

- ***RAP:*** **Reclaimed asphalt pavement materials;**
  - ***Selective RAP (SRAP):*** sieved RAP material passing #8 sieve retained on single sieve or different sieves combined according to fixed gradation;
  - ***PAV RAP (PRAP):*** consists of the aggregates extracted from SRAP mixed with PAV binder according to the same gradation and AC with SRAP;
- ***Binders (B):***
  - ***Fresh binder (FB):*** original asphalt binder not exposed to any aging process;
  - ***SRAP binder (SB):*** aged binder in SRAP;
  - ***PAV binder (PB):*** asphalt binder subjected to aged process of RTFO+PAV;
  - ***Blended binder (BB):*** SRAP binder blended with fresh binder or PAV binder;
- ***Mortar (M):*** **RAP mixed with binder**
  - ***PAV mortar (PM):*** PAV RAP mixed with PAV binder by weight percentage;
  - ***SRAP mortar (SM):*** SRAP mixed with PAV binder by weight percentage;

1. Evaluate the selected binder properties

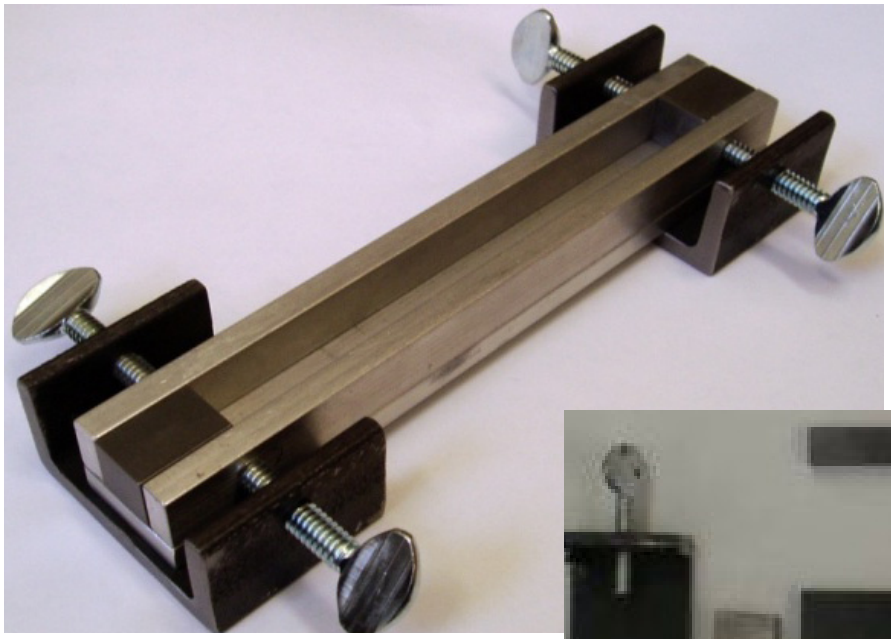
2. Evaluate the compositions of selective RAP

2.1 For each source, extract and determine the gradation the RAP aggregates from the selective RAP;

2.2. Determine the selective RAP binder content for each RAP source material;

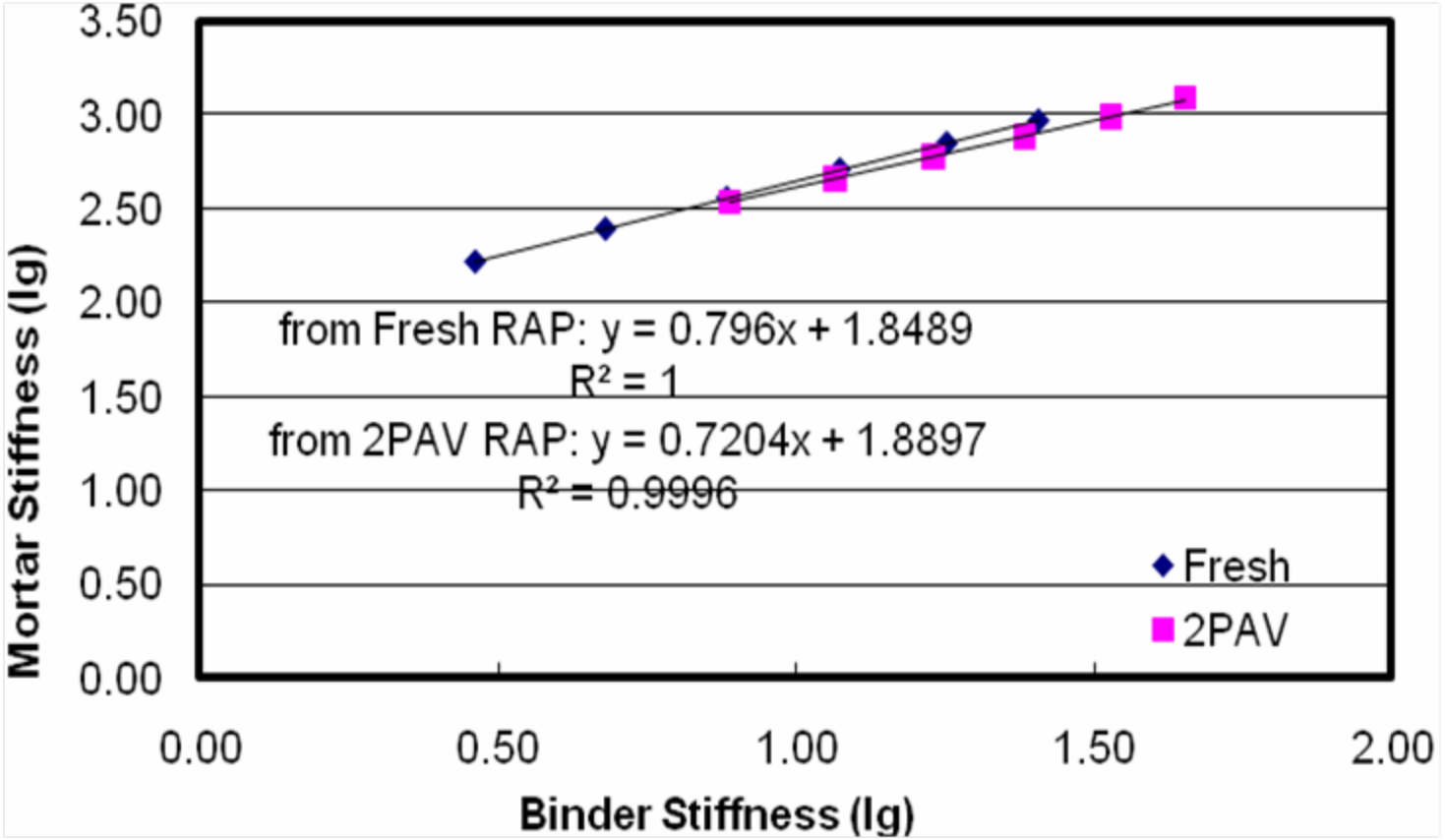
- Evaluate mortar properties
- Mix the SRAP and/ or extracted selective RAP aggregates with selected binder to get mortar with fixed gradation and binder content;
- Evaluate the properties of the mortar in the BBR.

# Mold Modification

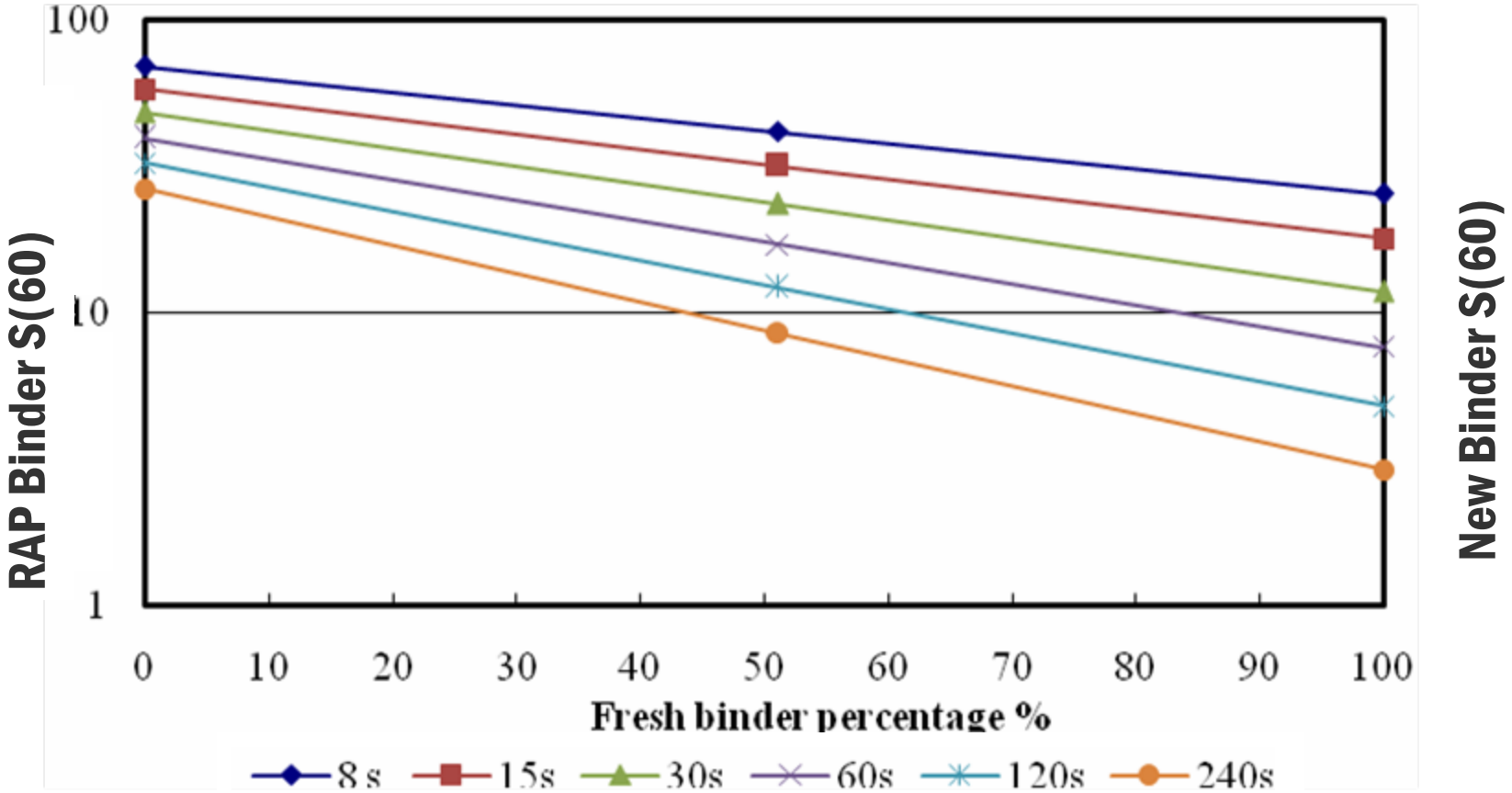


1. Wider Sample
   12.5 x 10.0 mm
2. Teflon coated
3. Stronger end holders

# First Approach: Test Mortars, Correlate to Binder



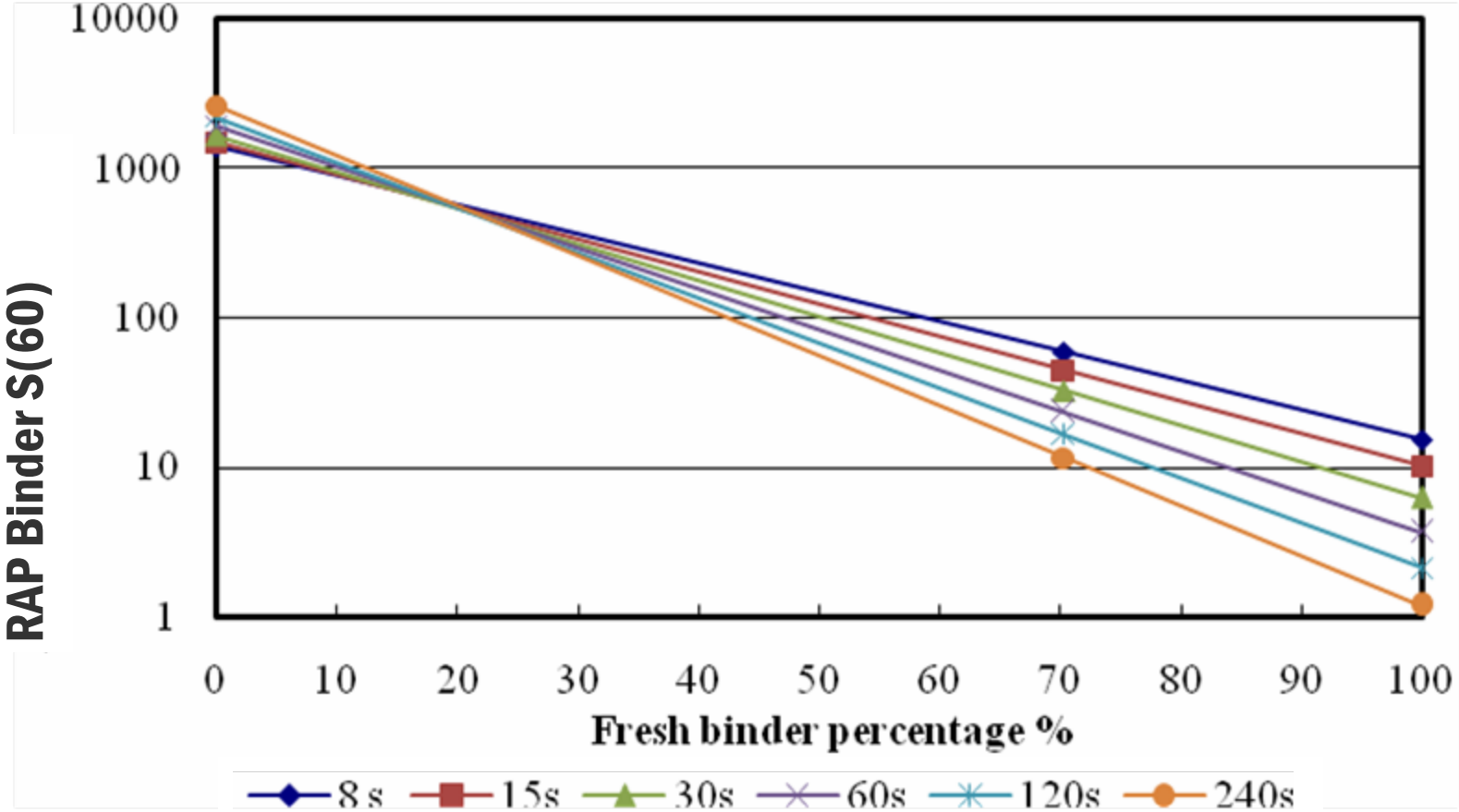
# First Approach: Use Blending Chart to Estimate RAP Binder Grade



# Many Problems

- Correlations vary
- Highly temperature dependent
- RAP mortars very hard to control molding
- Blending charts do not work for all loading times

# Example of the problem



# New Approach

- Selective RAP to control molding
  - # 30, #50, #100
- Use PAV aged binder for blending
  - Can test at same temp as mortar
- Use more PAV binder to make molding better
- New analysis procedure avoiding blending charts and focus on S(60), m(60).
- It appears to be working based on verification

| Time (s) | 2PAV | Fresh | Blended with 51.2% of fresh | | | Blended with 74.9% of fresh | | |
|---|---|---|---|---|---|---|---|---|
| | | | Calcul-ated | Tested | Differ (%) | Calcul-ated | Tested | Differ (%) |
| 8 | 55.6 | 10.9 | 24.2 | 23.6 | -2.2 | 16.4 | 16.1 | -1.9 |
| 15 | 44.0 | 6.9 | 17.1 | 17.2 | 0.4 | 11.0 | 11.2 | 1.2 |
| 30 | 33.3 | 4.2 | 11.5 | 11.8 | 2.5 | 7.0 | 7.2 | 2.4 |
| 60 | 25.1 | 2.4 | 7.6 | 7.9 | 3.7 | 4.4 | 4.6 | 4.5 |
| 120 | 18.6 | 1.4 | 4.9 | 5.2 | 5.3 | 2.6 | 2.8 | 4.4 |
| 240 | 13.6 | 0.8 | 3.1 | 3.4 | 7.0 | 1.6 | 1.6 | 4.2 |

# The blending concept
# New binder is a PG 70-16 (TG PG70-20)