Using More RAP

BUILT TO **CONNECT**

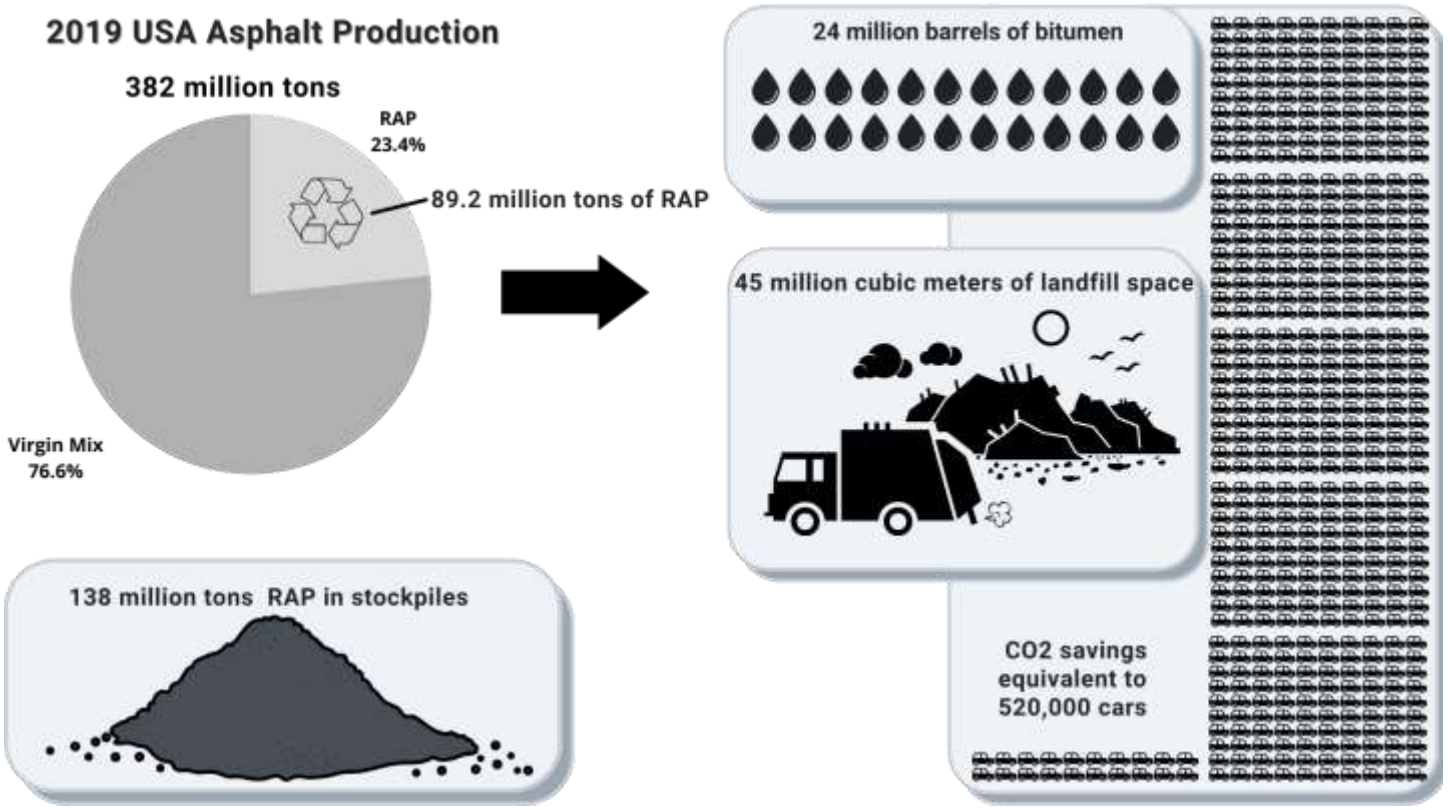
APAWV Pavement Conference

February 2025

The Impact of RAP

93% roads in USA paved with asphalt

HMA is 100% recoverable into reclaimed asphalt product (RAP)



Equivalent to ~ $5 Billion USD

Data source: Williams, B.A., Willis, J.R. and Shacat, J., 2020. *Asphalt Pavement industry survey on recycled materials and warm-mix Asphalt Usage: 2019* (No. IS 138 (10e)).

Why mess with RAP?

- Valuable source of binder – "Almost free" AC
- Valuable source of aggregate – sometimes the best source
- Valuable source of revenue – 10% RAP = $3/ton (at least!)
- Must run RAP to stay competitive – if you aren't running it, your competition is!
- You can thrive, not just survive!

Sustainability In Our Products

Our customers are looking for us to help them achieve sustainability goals within five pillars:

Emission Reduction

Efficiency

Alternative Fuels

Recycling

Decarbonization

New Products

Developing new products across our entire portfolio that target improvements in any of the five sustainability pillars.

Education & Engagement

Sustainability is in our legacy, and our current products have a powerful sustainability story to tell.

Data & Tools

Our customers need to be empowered to incorporate sustainability into their business decisions.

Sustainability is an opportunity, not a cost.

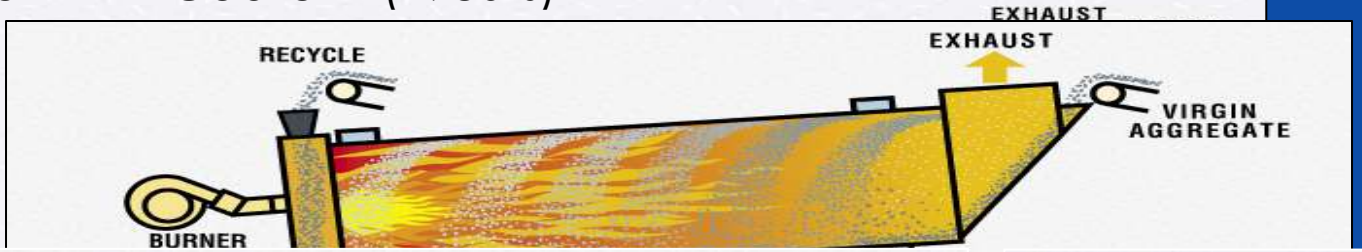
RAP and Plant Innovation

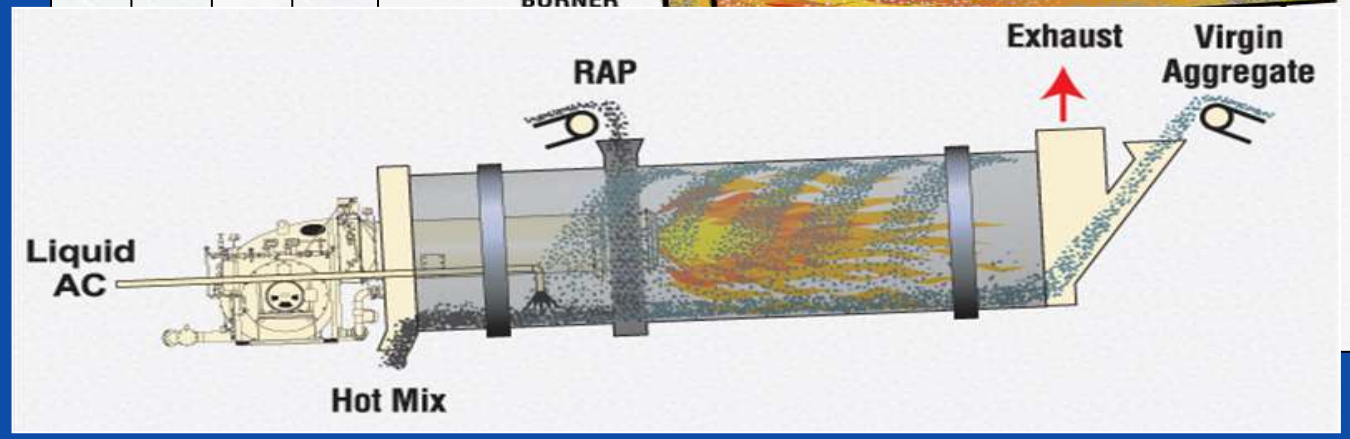
Original Parallel-Flow Drum Mixer (1970's)

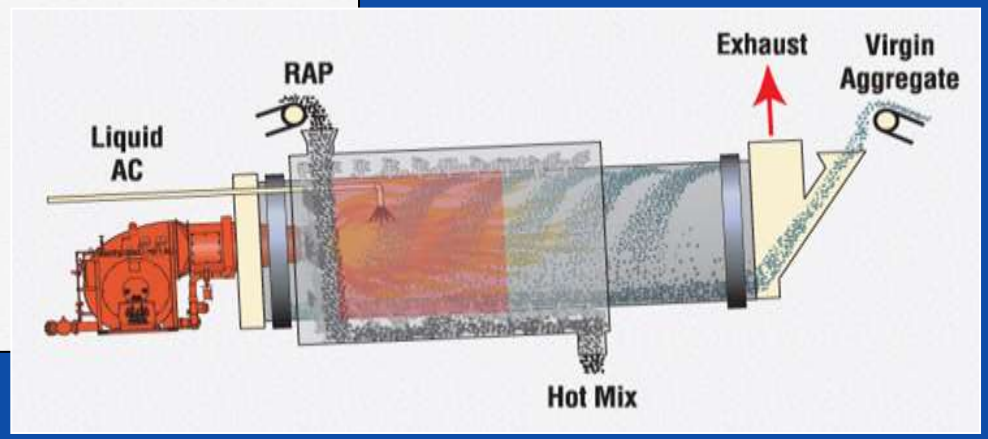
Drum Mixer with Center Inlet (1970's – 1980's)

Drum Mix Coater (1980's – 1987)

Drum Mix Coater II (1980's)

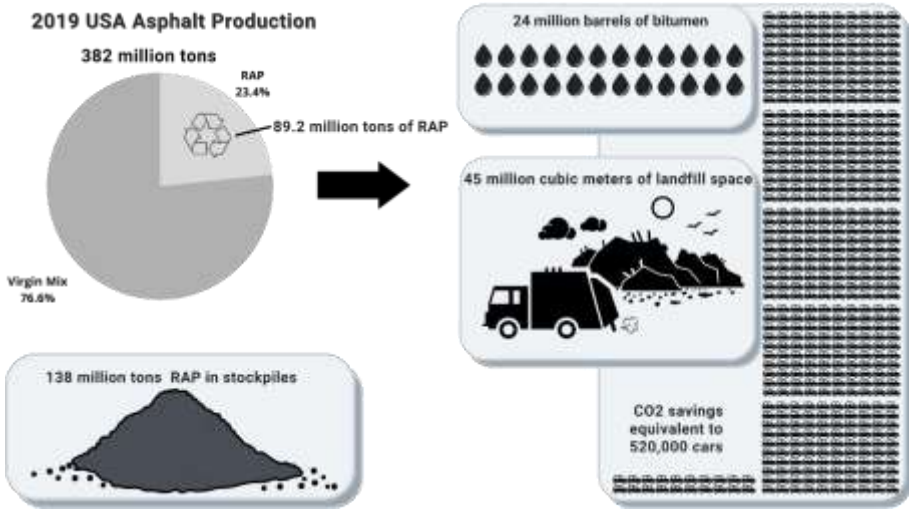




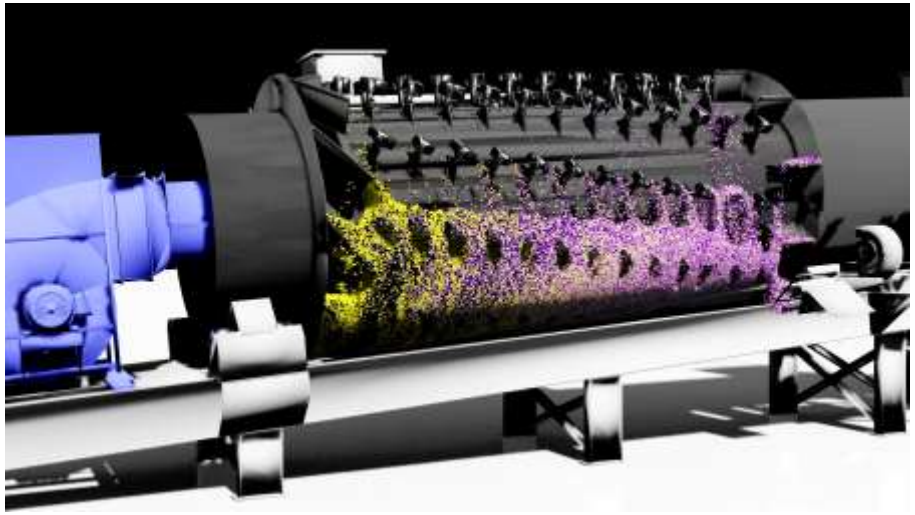


RAP has been a significant driver in plant innovation. The type of plant you have today is probably a result of the demand for RAP mixes decades ago.

High RAP Technology

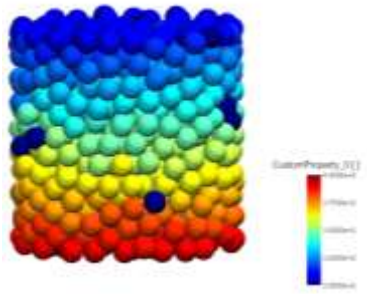


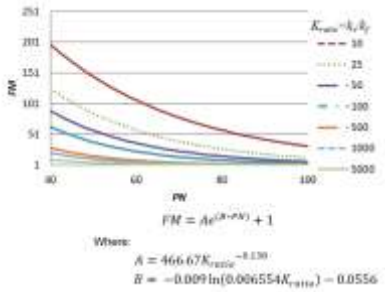
Increase sustainability through recycled, low-cost materials

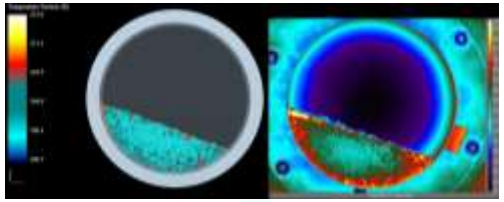


Simulation driven IP creation and improved RAP mixing

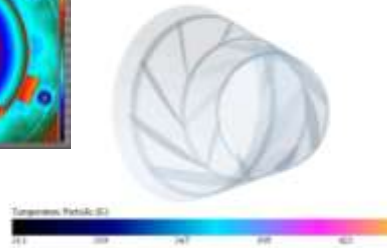
Fundamental research and model development

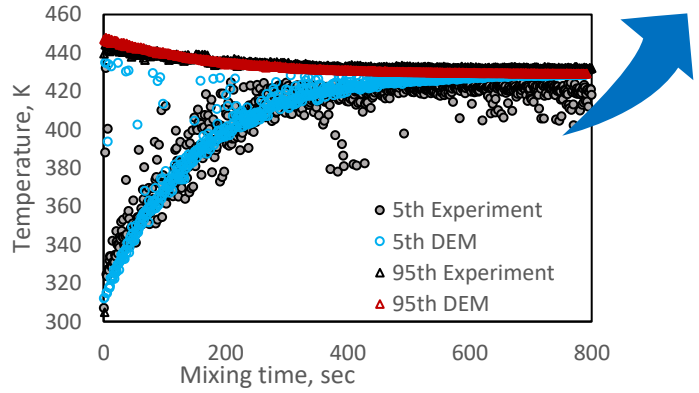






Arizona State University





The Decision

65%+ Recycle Capacity

Hot Mix Paradigm

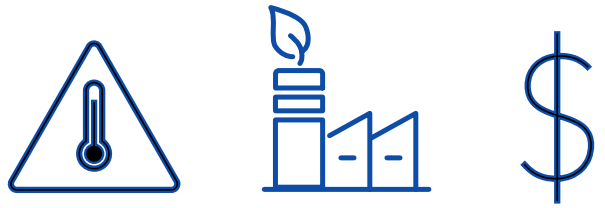
Low Equipment & Maintenance Cost

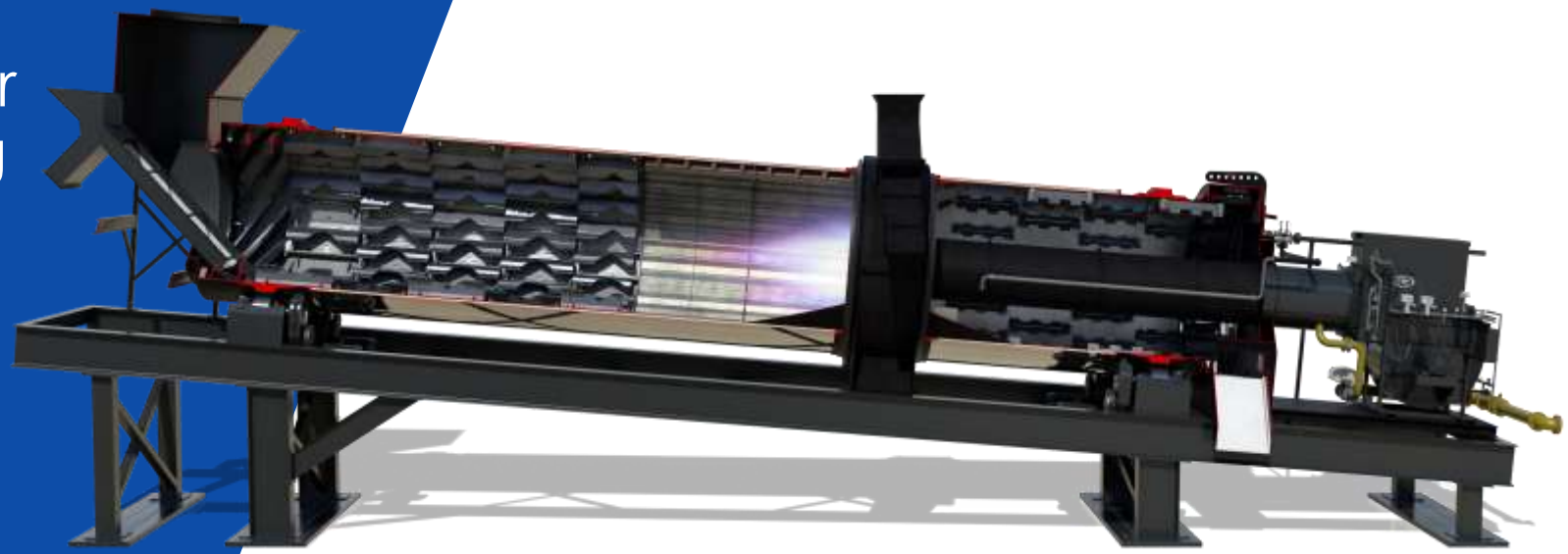
Most Stringent Emissions Compliance

Dillman UniDrum

- The workhorse of our industry – the "PC" to the DoubleBarrel's "Mac"
- Available with Green System and patented V-PAC system
- RAP added via a collar upstream of the mixing section
- **Capable of producing up to 50% RAP mixes**

Pick any three:



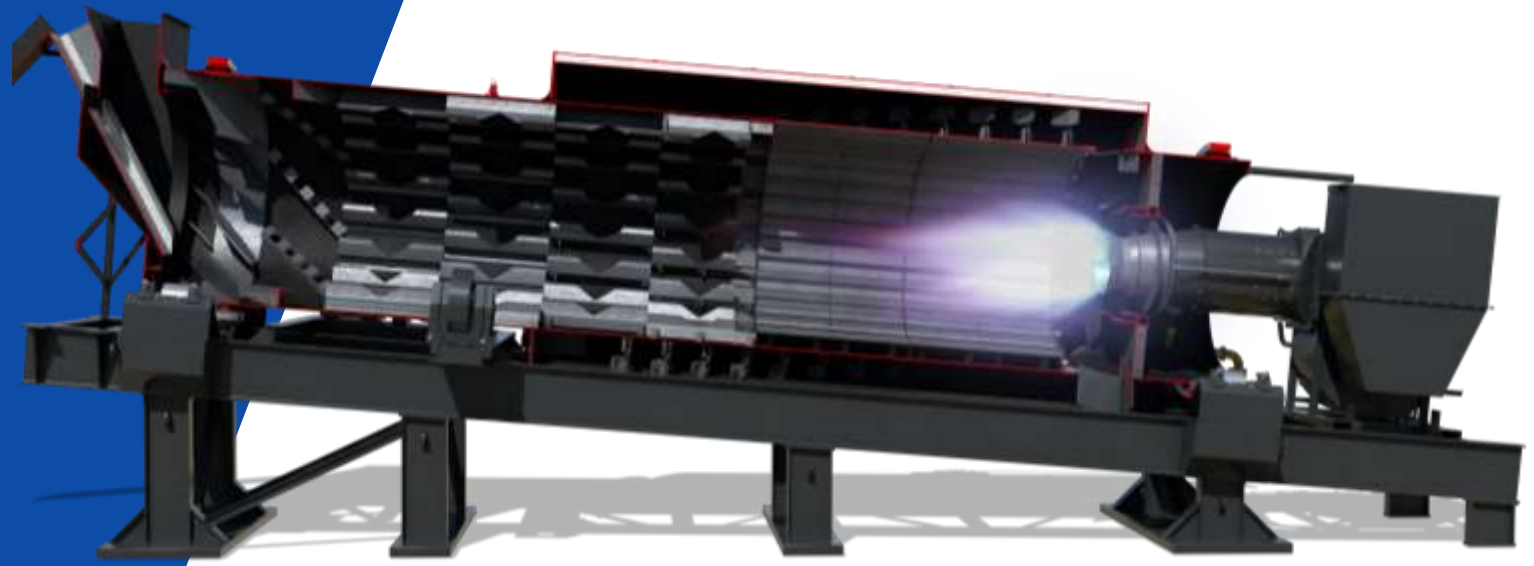


RAP performance is based on 5% moisture

DoubleBarrel

- Wrap-around mixing chamber improves thermal efficiency
- Available with Green System and patented V-PAC system
- RAP added to the outer shell, upstream of binder & other additives
- **Capable of producing up to 50% RAP mixes**

Pick any three:



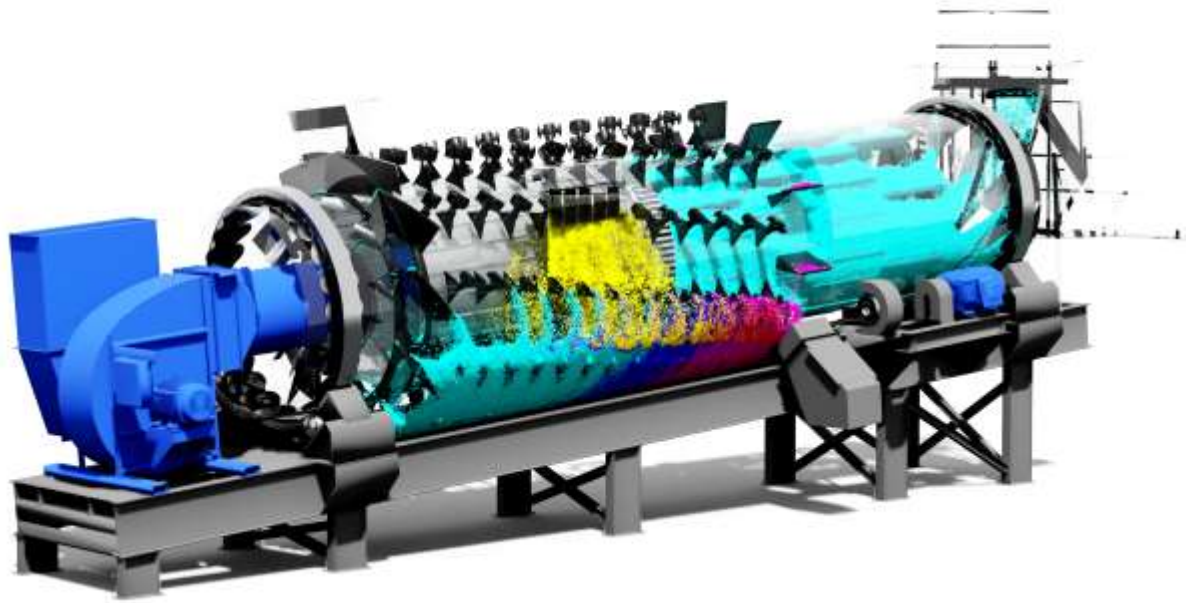
RAP performance is based on 5% moisture

Physics is unforgiving…

Cold Water
(Ambient Temp RAP)

Hot Water
(Above temp Agg)

Warm Water
(Mix at correct temp)



More RAP
=
Less material for heat transfer

DoubleBarrel XHR

- Lengthened virgin aggregate drying section
- Increased use of stainless steel to tolerate higher drying temperatures
- External mixer (drum mixer or pugmill)
  - Allows use of entire outer shell length to heat RAP
  - Ultra low maintenance
- Standard Green System & VPAC System
- **Capable of producing 65%+ RAP mixes**

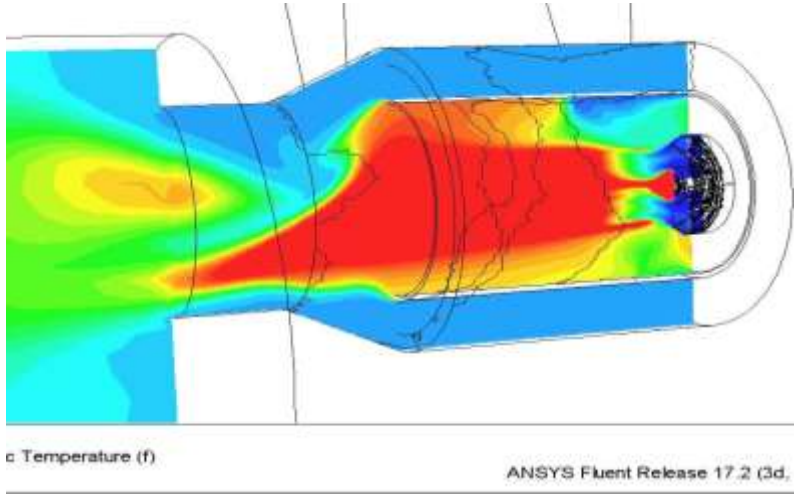
Pick any three:

RAP performance is based on 5% moisture

RAP Pre-Dryer

Additional drum to dry and pre-heat RAP

- Heated with exhaust from aggregate drum
- Augmenter burner firing into a refractory for gentle heating of RAP



There are drawbacks!

Screen heated material to remove chunks
Modified flight design
Hot rock scrub to remove buildup (every ~175k – 200k tons)

ReMix CCPR System

- Goal: To give hot mix producers the tools they need to produce CCPR
- Highly modular and configurable
  - RAP metering
  - Water metering
  - AC metering (foam or emulsion)
  - Fines additive metering
- Operator-friendly design
- **Capable of producing up to 100% RAP mixes**

Pick any three:

Cold Central Plant Recycle

- Incredibly cost-competitive (40%+ lower cost)
- Incredibly environmentally friendly (40%+ lower carbon footprint)
- Challenges with regulatory approval & adoption
- Challenges with perception

Astec CCPR Product Page
Links to: NCAT Research, NCHRP Construction Guidelines, And more!

Astec's High RAP Portfolio

RAP %	UniDrum	DoubleBarrel	DoubleBarrel + Ext. Mixer	DoubleBarrel XHR	DoubleBarrel + RAP Predryer	ReMix CCPR System
0%	✓	✓	✓	✓	✓	✓
30%	✓	✓	✓	✓	✓	✓
50%	✓	✓	✓	✓	✓	✓
65%+				✓	✓	✓
70%+					✓	✓
100%						✓
						

RAP performance is based on 5% moisture

It's more than "just" the plant!

1. Fractionation (what is it, why should you do it)
2. Moisture & Stockpile Management
3. Best practices for start-up, midstream (hot stop), shut-down
4. Milling (how you get more RAP)

CREATE A CULTURE OF QUALITY

Fractionation

What is it?

✓ Separating RAP into discrete sizes (not just ½" minus and ¾" minus)

Why fractionate?

- ✓ Gradation control (treat it like aggregate)
- ✓ AC control (RAP feeder is an "asphalt pump")

Moisture & Stockpile Management

- ✓Keep RAP piles small and mixed (turned).
- ✓Load at least 1 ft from the bottom of the pile.
- ✓Don’t let the RAP bin(s) run near empty.
- ✓Run as many RAP bins as possible.
- ✓Cover stockpiles.
- ✓Pave & slope under stockpiles.

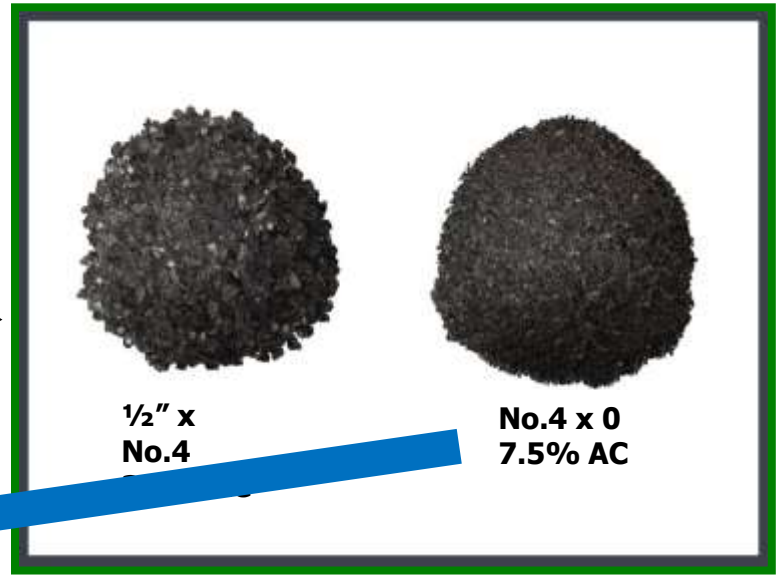
IntelliPac Moisture System Product Page

How much can RAP AC vary?

Example: RAP Segregation

We have input a correct AC percentage into the computer -- but this RAP is segregated.

Will this make a difference?



Coarse RAP

Fine RAP

20% RAP Mix:

0.2 x 7.5% AC = 1.5% AC

0.2 x 3.5% AC = 0.7% AC

(SUBTRACT) **0.8%** Potential AC swing

40% RAP MIX, 1.6% AC SWING

Startup, Midstream & Shutdown

Startup

- To start with a high % requires high heat fast.
- Easier to start at 20% RAP. Less heat req'd (lower agg temp)
- Start at ½ plant rating or 25 tph less than that.
- If you struggle with high baghouse temp, can add mat'l to cool mix.

Midstream

- If you are having to midstream 3-4 times a day, slow the plant down.
- If you know you are going to midstream, reduce the production rate.
- Less equipment stress during midstream start-up.
- Midstream ("emergency stop") only if necessary.

Plants that start and stop more than 3 times per shift use up to 35%* more fuel!

Shutdown

- Don't have to reduce tph before shut-down, but there could be less waste at a lower tph.

*When compared to theoretical steady-state operation. Percentages from NAPA Publication QIP-132.

The Value of RAP

AGGREGATE ..... 0.95 X $15.00 = $14.25 / TON
ASPHALT ..... 0.05 X $500.00 = $25.00 / TON
TOTAL ..... = $39.25 / TON

RAP is worth what it replaces!

MILLING ..... = $ 3.00 / TON
TRUCKING ..... = $ 3.00 / TON
PROCESSING ..... = $ 3.00 / TON
COST..... = $9.00 / TON
RAP VALUE ..... = $30.25 / TON

10% RAP… 0.1 X $30.25/TON = $3.03 / TON

20% RAP… 0.2 X $30.25/TON = $6.05 / TON

30% RAP… 0.3 X $30.25/TON = $9.07 / TON

Small improvement = HUGE value!

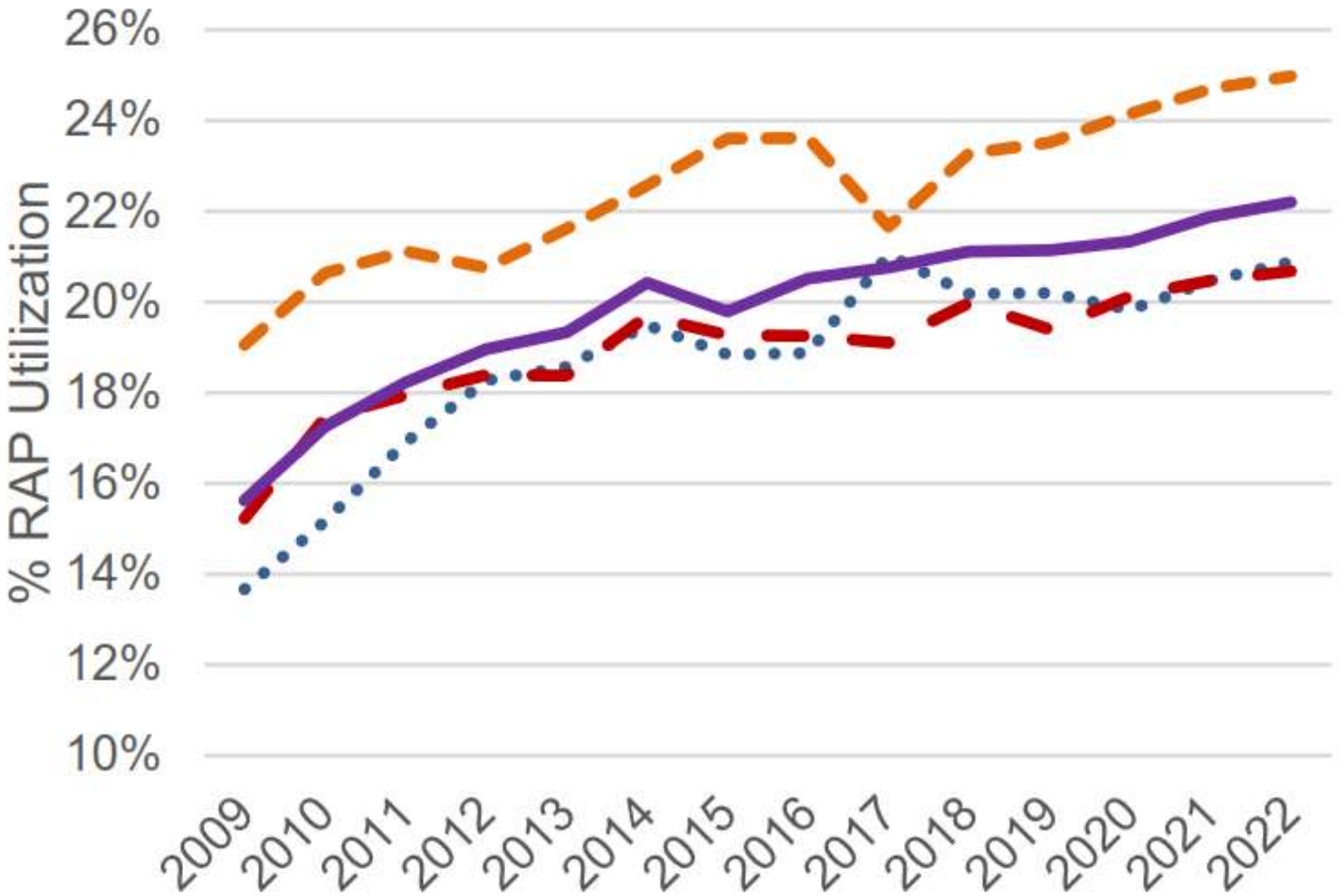
"We don't have much RAP"

"State is holding all the RAP"

"If we use that much RAP, we will run out"

RAP is a valuable resource, NOT a waste product!

So… now what?



22%

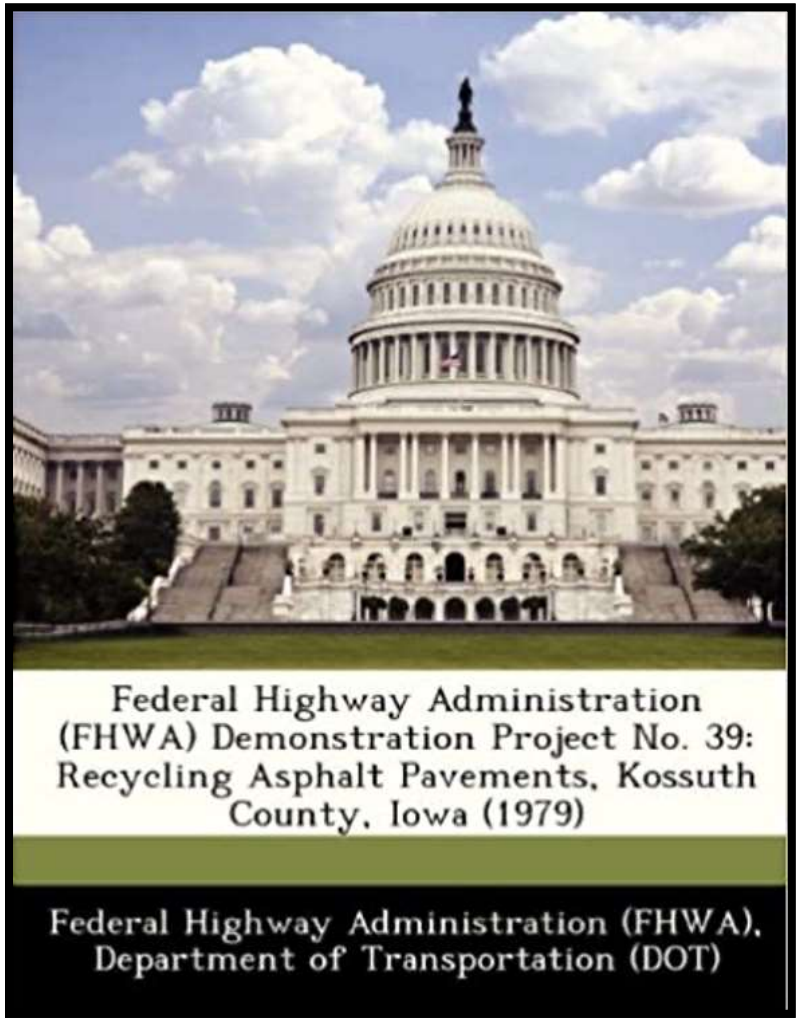
U.S. Industry Average RAP Usage

14%

West Virginia Average RAP Usage
… and trending down!

Data from NAPA's Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage

45 Years ago…



FHWA Demonstration Project 39 – Asphalt Recycling

"The pressing need to conserve energy and minimize costs in highway construction requires that special effort be made to identify and make the maximum use of procedures that will result in reduced energy usage and minimum cost.

These are the experimental projects initiated by various states between 1978 and 1983 to recycle pavement materials."

We need YOU!

- Advocacy – it's been heavily researched. Make sure your people know…make sure your customers know!
- Sell what you believe in
  - To your private customers
  - To your local agencies – counties, cities, municipalities
  - To your state and federal agencies – DOT's, FHWA, GSA
- Do RAP the RIGHT WAY *(this is a massive topic!)*
  - Equipment, Mix Design, People, Practices

Questions?

My Contact Information
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