



Maximizing Recycle

Problems, Solutions, and Best Practices

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ASTEC INDUSTRIES, INC.





RAP = Green



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Running High RAP....

Problems, Solutions, and Best Practices

1. **Stack (Baghouse) temperature too high.**
2. **RAP Segregation (AC/gradation variation)**



High Stack Temperatures...

1. Reduce baghouse bag life

- Aramid life shortened by operating temperature that exceed 375F
- Thermal damage to aramid fibers is cumulative
- Excess temperature causes shrinkage which hinders cleaning



High Stack Temperatures...

2. Increase fuel costs - **1.5% for every 24°F**

DESIGN: 300°F Mix; 5% H₂O, 240°F Stack Temp **1.69 gal/ton**

HIGH STACK: 300°F Mix; 5% H₂O, 264°F Stack Temp **1.71 gal/ton**

Assume... 100,000 tons per year, \$3/gal, & 264°F stack

(100,000 tons per year) x (1.69 gal per ton) x (\$3 per gal) x (0.015) = **\$7605**

What About... 200,000 tons per year, \$3/gal, & 290°F Stack

(200,000 tons per year) x (1.69 gal per ton) x (\$3 per gal) x (0.03) = **\$30420**

Over \$100 per Day!



High Stack Temperatures...

3. Reduce production capacity > 6tph for every 10°F

DESIGN: 400TPH, 300°F Mix; 5% H₂O, 240°F Stack Temp

➤ Airflow required is **148.6 cf/ton** **59,433 CFM**

10°F Increase: 400tph, 300°F Mix; 5% H₂O, 250°F Stack Temp

➤ Airflow required is **151.1 cf/ton** **60,447 CFM**

60°F Increase: 400tph, 300°F Mix; 5% H₂O, 300°F Stack Temp

➤ Airflow required is **164.0 cf/ton** **65,609 CFM**



High Stack Temperatures...

4. Increase production cost per ton

For every extra hour it takes to make a day's mix, the cost of that day's mix is increased by the cost of everything that has a fixed (it cost the same regardless of the amount of mix produced) cost in that hour.

Labor at the plant and on the road, trucks, loader, hot oil heater fuel, etc.



High Stack Temperatures... what can you do?

1. Modify flighting to reduce stack temperature, but...

Adding or modifying flights for one mix can cause problems for another mix.



Sometimes it is difficult to find a good balance.



High Stack Temperatures... Effect on Veiling



HIGH Stack Temperatures



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High Stack Temperatures... Effect on Veiling



Reduced Stack Temperatures



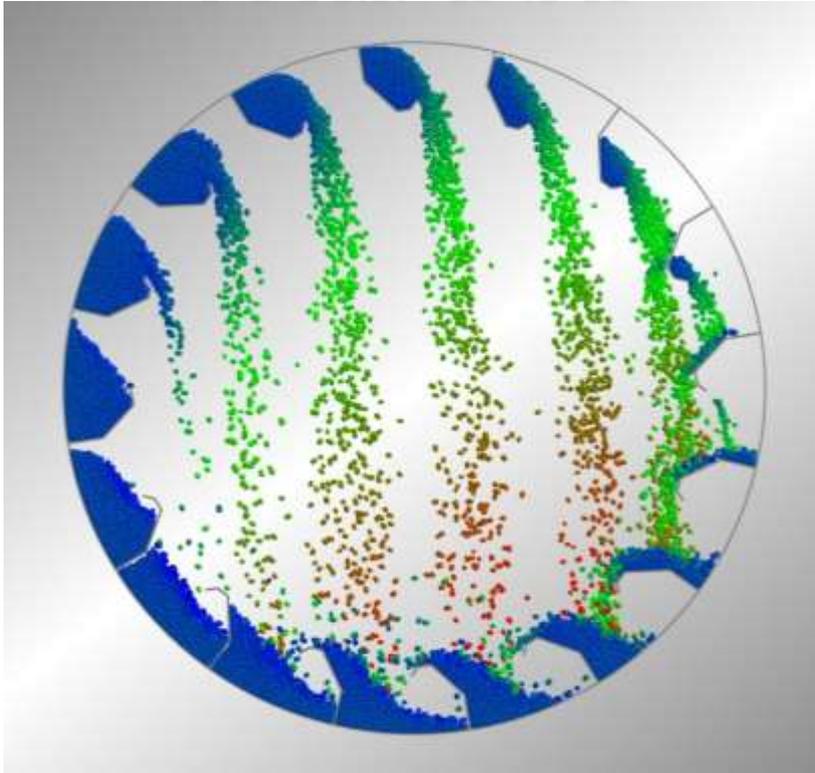
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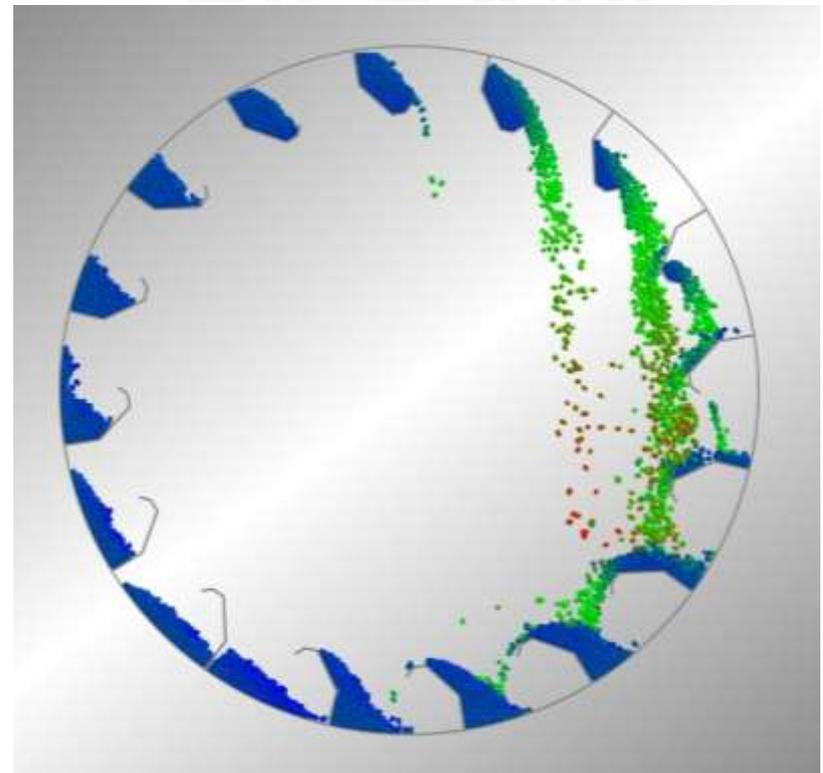
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High Stack Temperatures... Effect on Veiling

LOW RAP



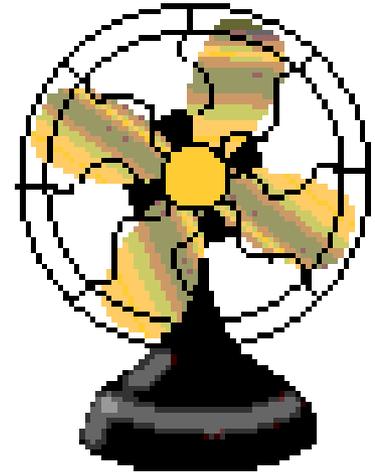
HIGH RAP



High Stack Temperatures...what can you do?

2. Dilution damper , but...

- The fan can only move its rated CFM.
- Leakage air adds to the CFM the fan must move.
- Leakage air “uses up” fan capacity



Leakage air that enters the system at 70°F...

...expands more than **1.3 times** at a stack temperature of 240°F.

...expands more than **1.5 times** at a stack temperature of 300°F.

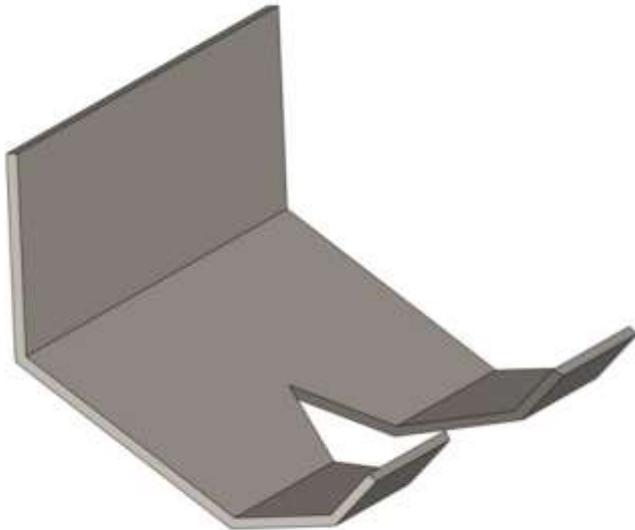
End Result?

LOWER PRODUCTION



High Stack Temperatures...what can you do?

3. V-PACK™ (V-Flights, VFD, Stack Temp. Control)

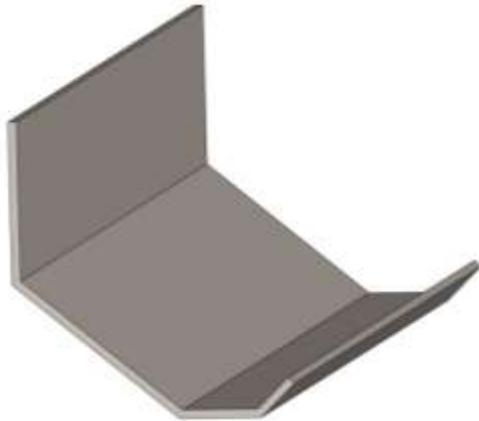


Control Logic

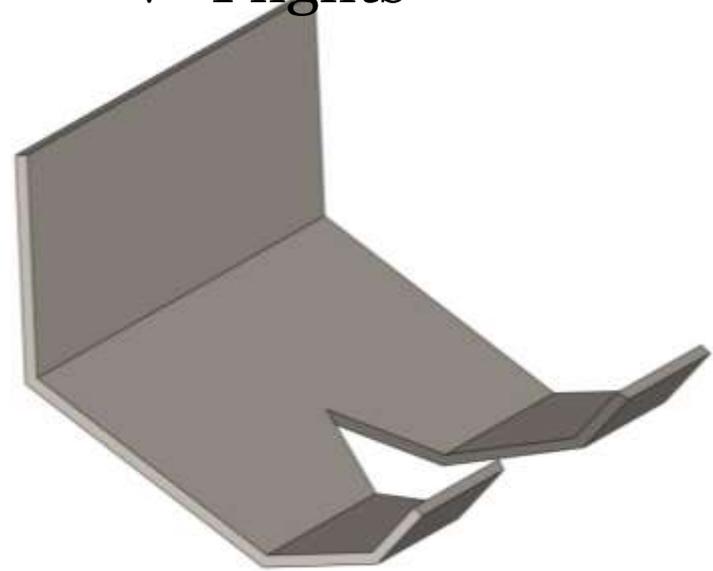


V-Flights... how do they work?

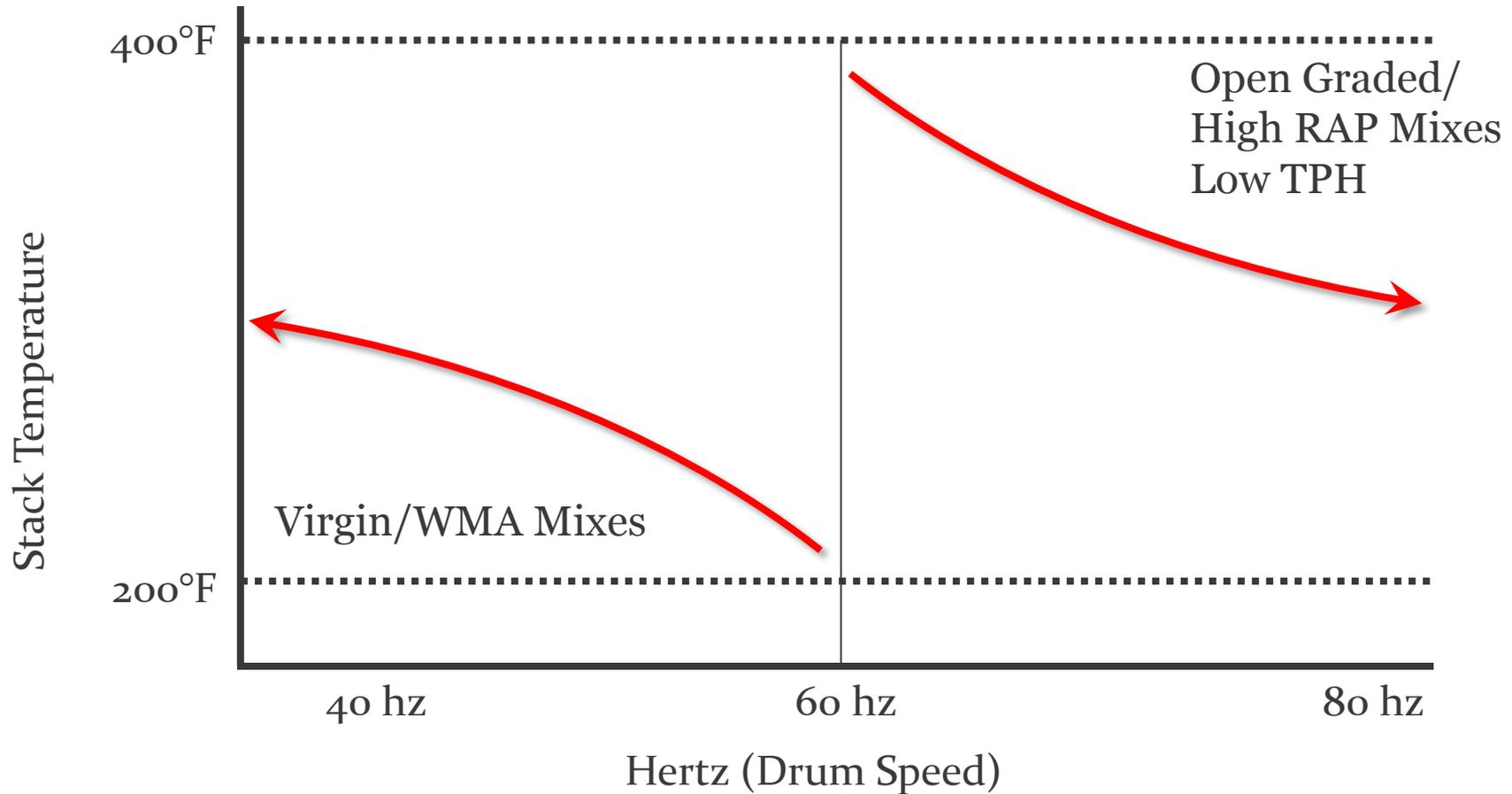
Previous Flights



V- Flights



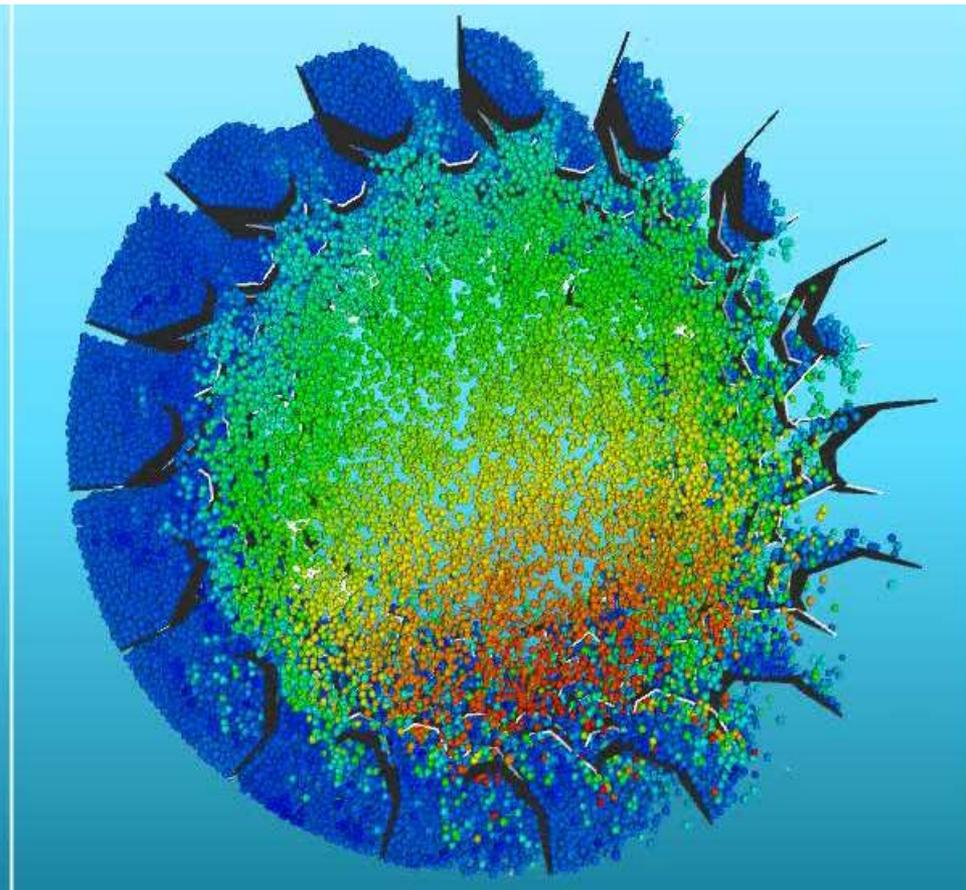
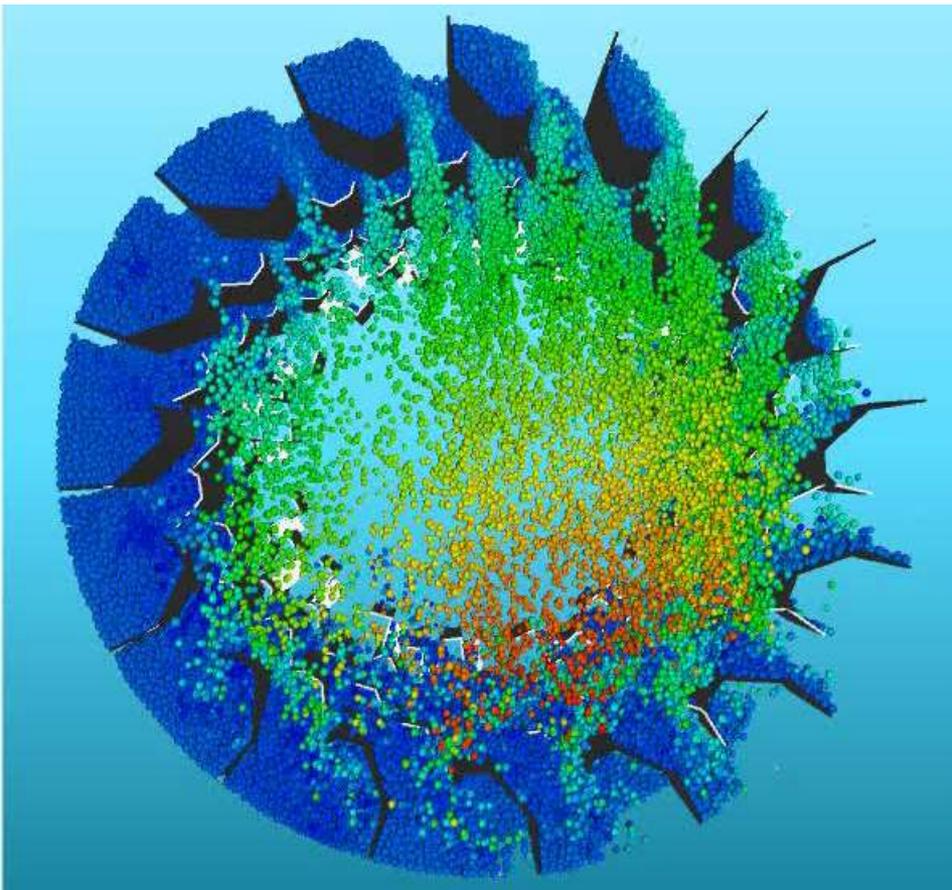
Effect on Stack Temperature



200 TPH

Original J-Flights

New V-Flights



- Veiling starts later
- Veiling occurs only at edge

- Veiling starts sooner
- Veiling occurs at edge & notch

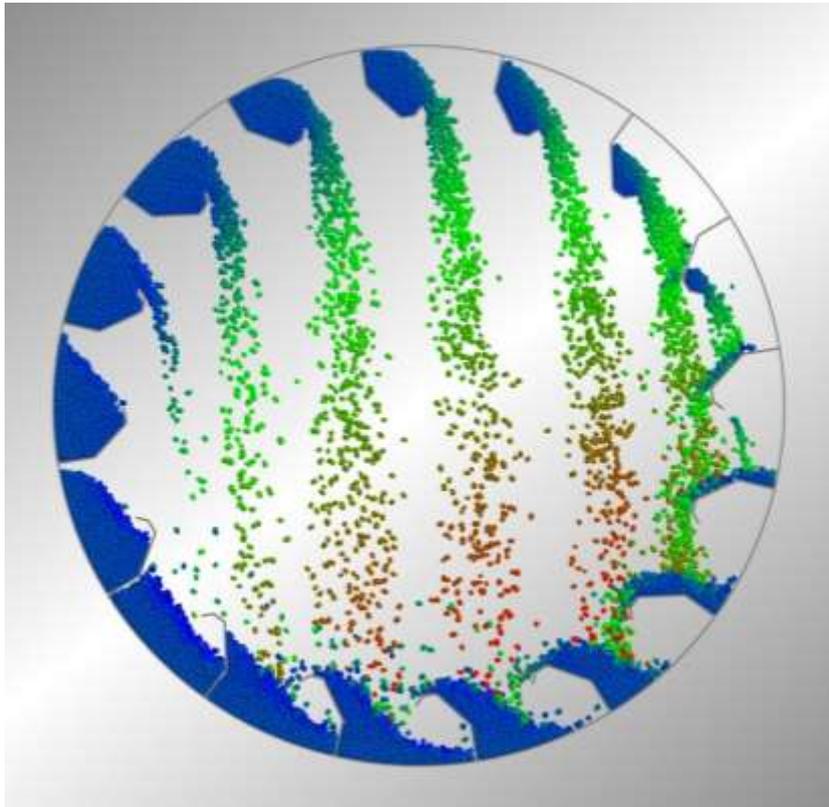


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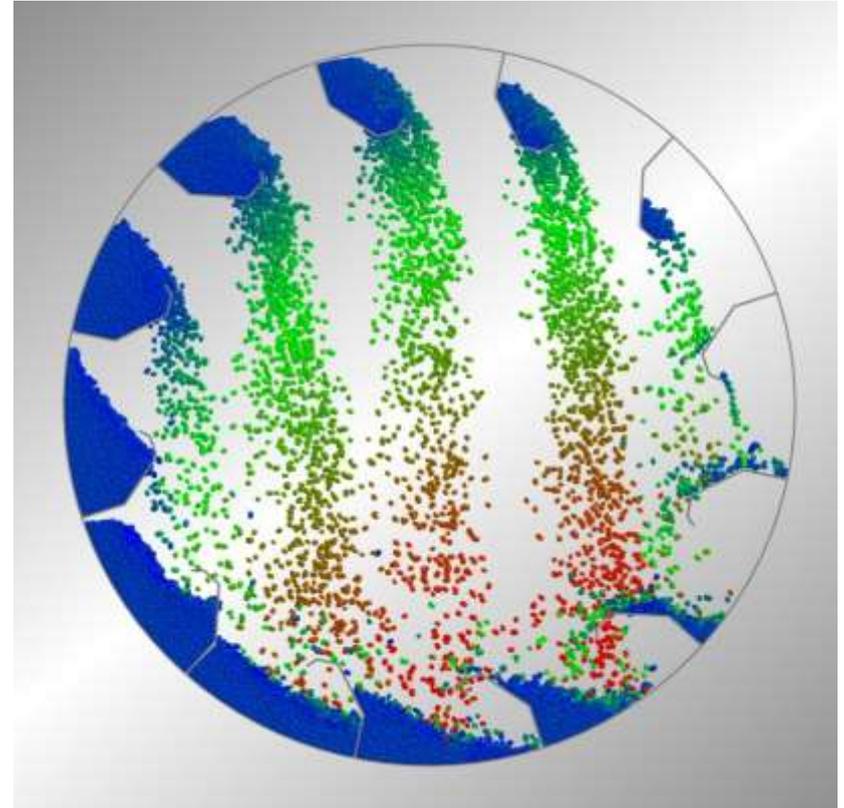
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Original J-flights



Deep Material Bed (Low RAP)

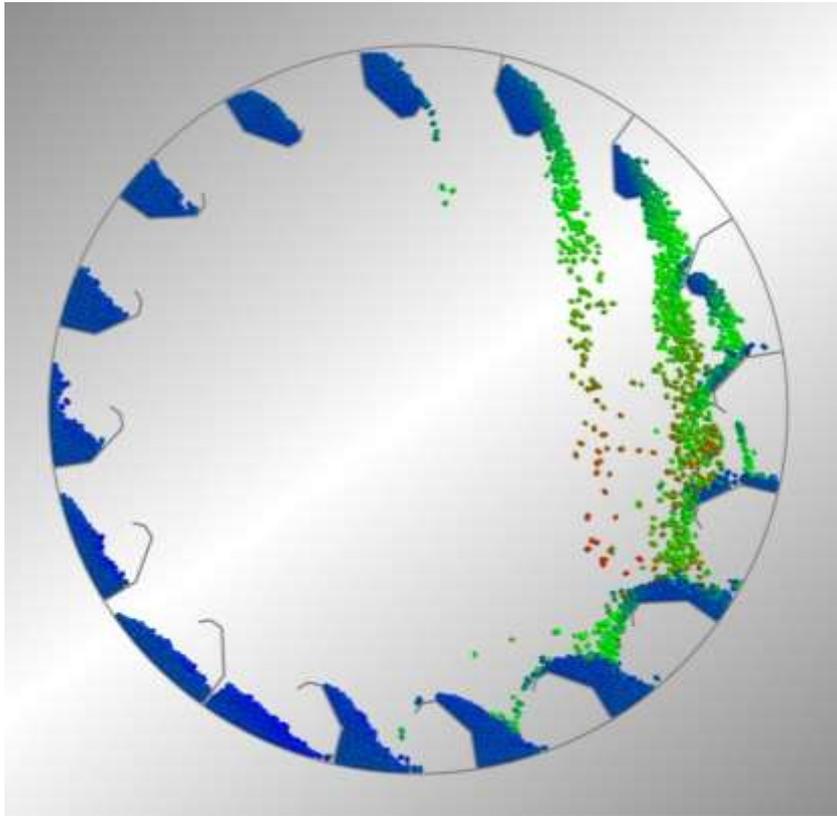
V-flights



Deep Material Bed (Low RAP)

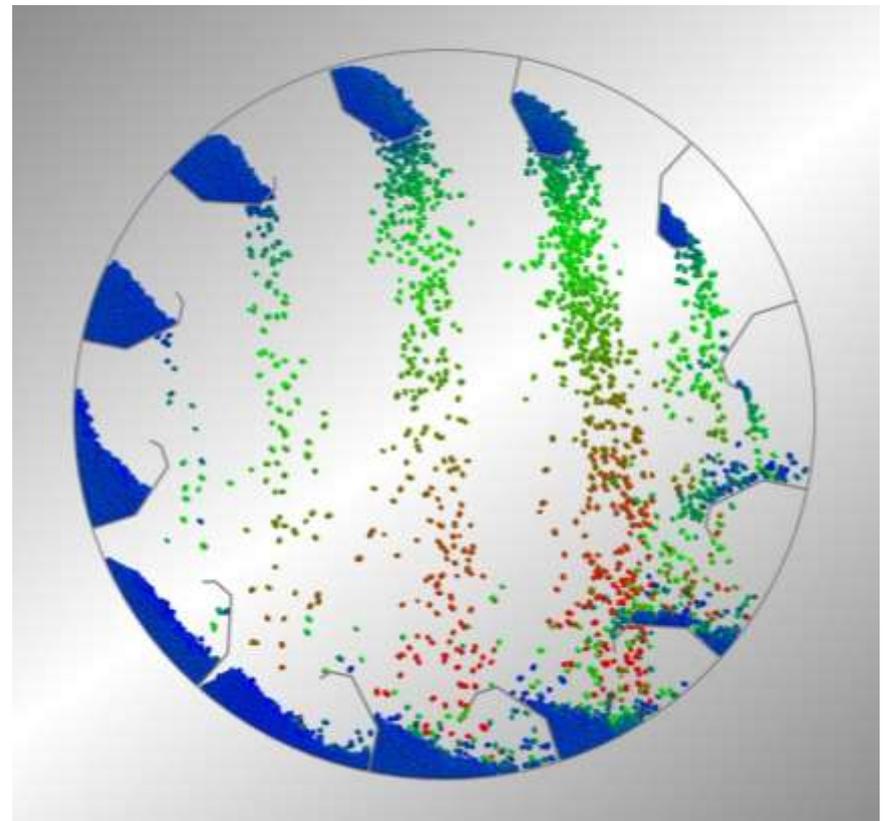


Original J-flights



Shallow Material Bed (High RAP)

V-flights

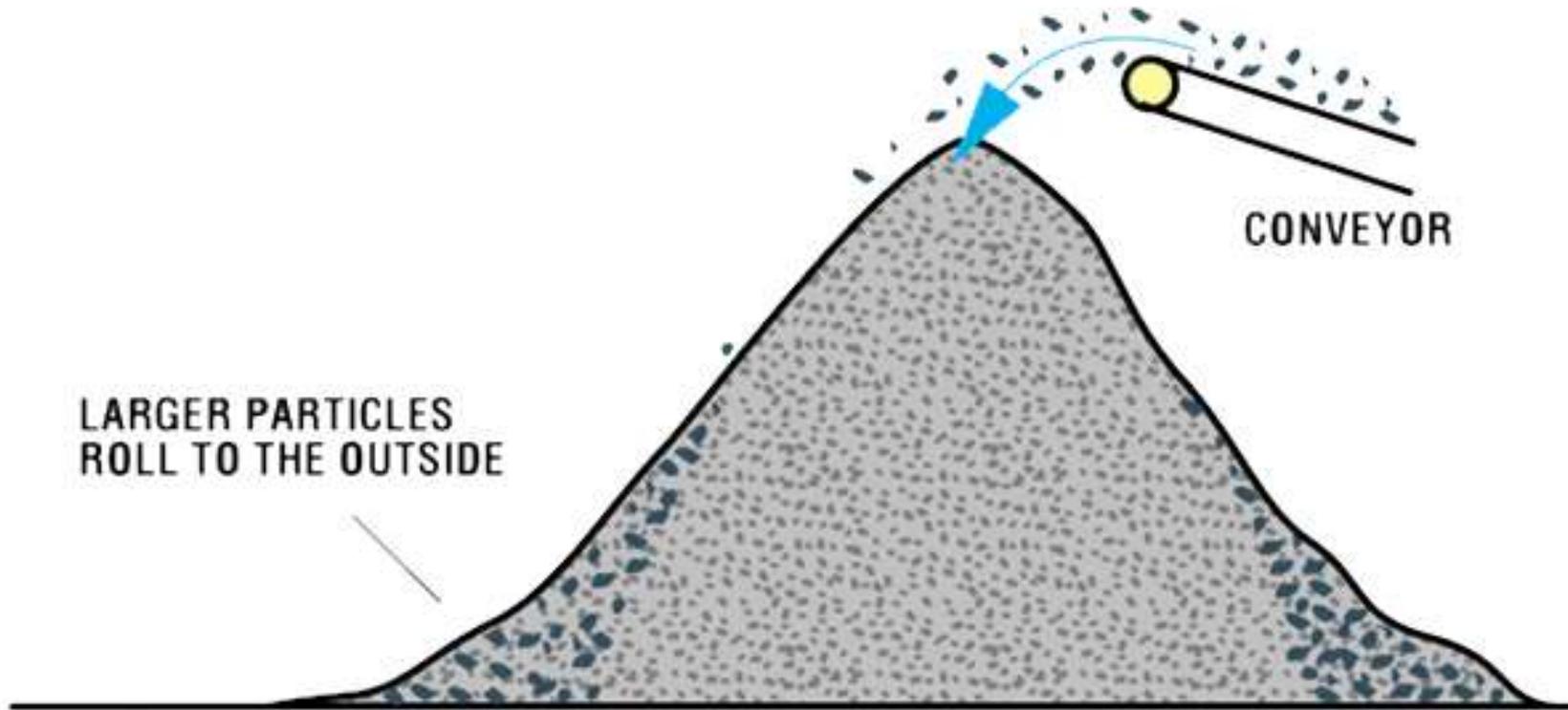


Shallow Material Bed (High RAP)



RAP Segregation... Often overlooked

1. Blended gradation in the stockpile



Technical Paper T-117 – SEGREGATION: Causes and Cures available at AstecInc.com



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RAP Stockpile Segregation





**Varying surface
areas need
different amounts
of asphalt**

2009 3 16

RAP Segregation... Often overlooked

2. Segregation in RAP bin as material depletes

Fine RAP
(High AC)

Coarse RAP
(Low AC)



RAP Segregation

BAD

- AC content variations (AC)
- Gradation variations (aggregate)
- Mix voids (AC and fines)

When RAP goes from a trickle to a significant %, RAP segregation becomes ...

CRITICAL

Take care of your RAP, it will take care of you!





1/2 x 4
1/2" x No.4
3.5% AC



4 x 0
No.4 x 0
7.5% AC

It's all about surface area!



RAP Segregation...



Fine RAP
(High AC)

Coarse RAP
(Low AC)



Let's talk about how surface area relates to AC content...

MESH NUMBER AND SIZE	SURFACE AREA (FT ² /LB)
200	150.2
100	73.9
50	37.2
30	18.8
16	9.3
8	4.65
4	2.33
3/8"	1.16
1/2"	0.87
3/4"	0.58
1"	0.43
1-1/2"	0.29
3"	0.145

$$\frac{150.2}{0.29} = 518$$

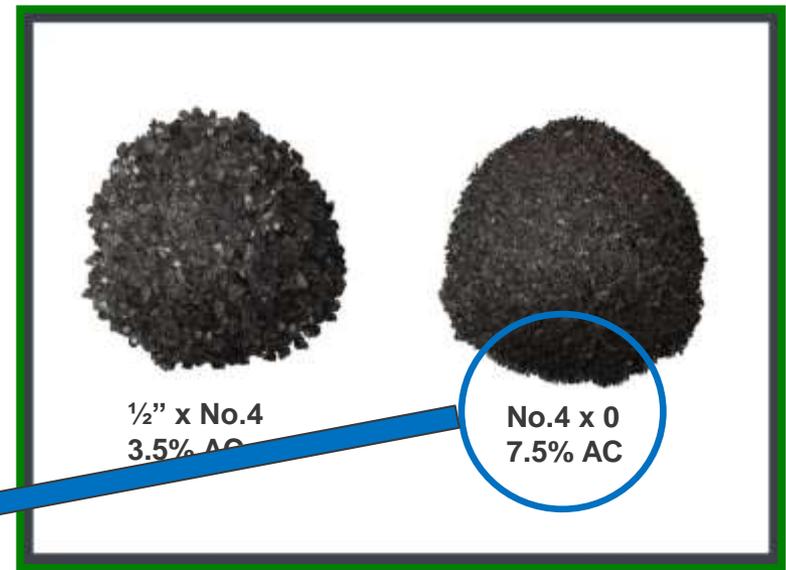
518 times the surface area



Example: RAP Segregation

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

Will this make a difference? →



20% RAP Mix:

$$0.2 \times 7.5\% \text{ AC} = 1.5\% \text{ AC}$$

$$0.2 \times 3.5\% \text{ AC} = 0.7\% \text{ AC}$$

SUBTRACT

0.8% Potential AC swing

Coarse
RAP

Fine
RAP

40% RAP MIX, 1.6% AC SWING

DONE



What's the solution?

Fractionated RAP

3/4 x 3/16" RAP
In back

-3/16"
RAP

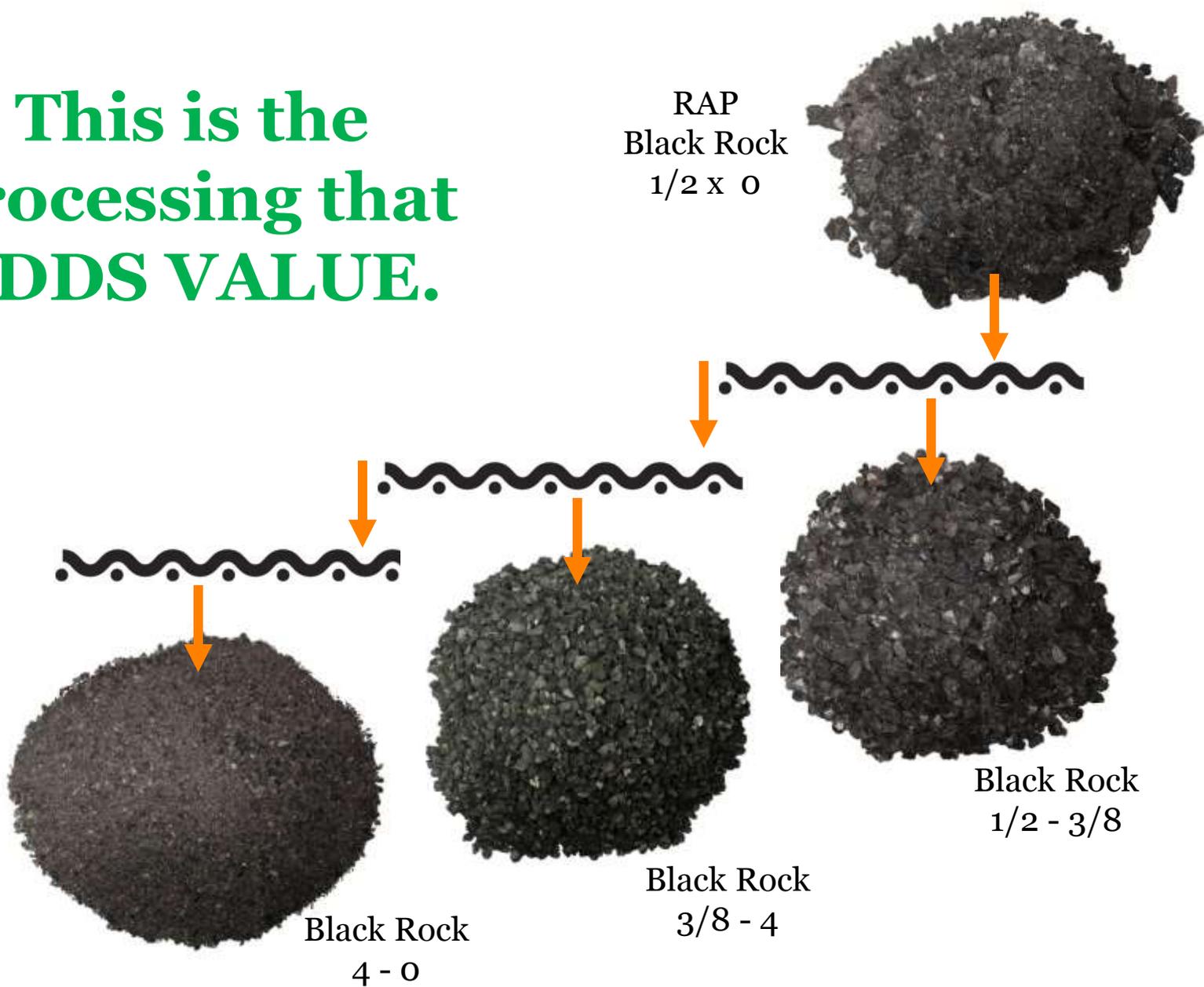
+3/4"
RAP



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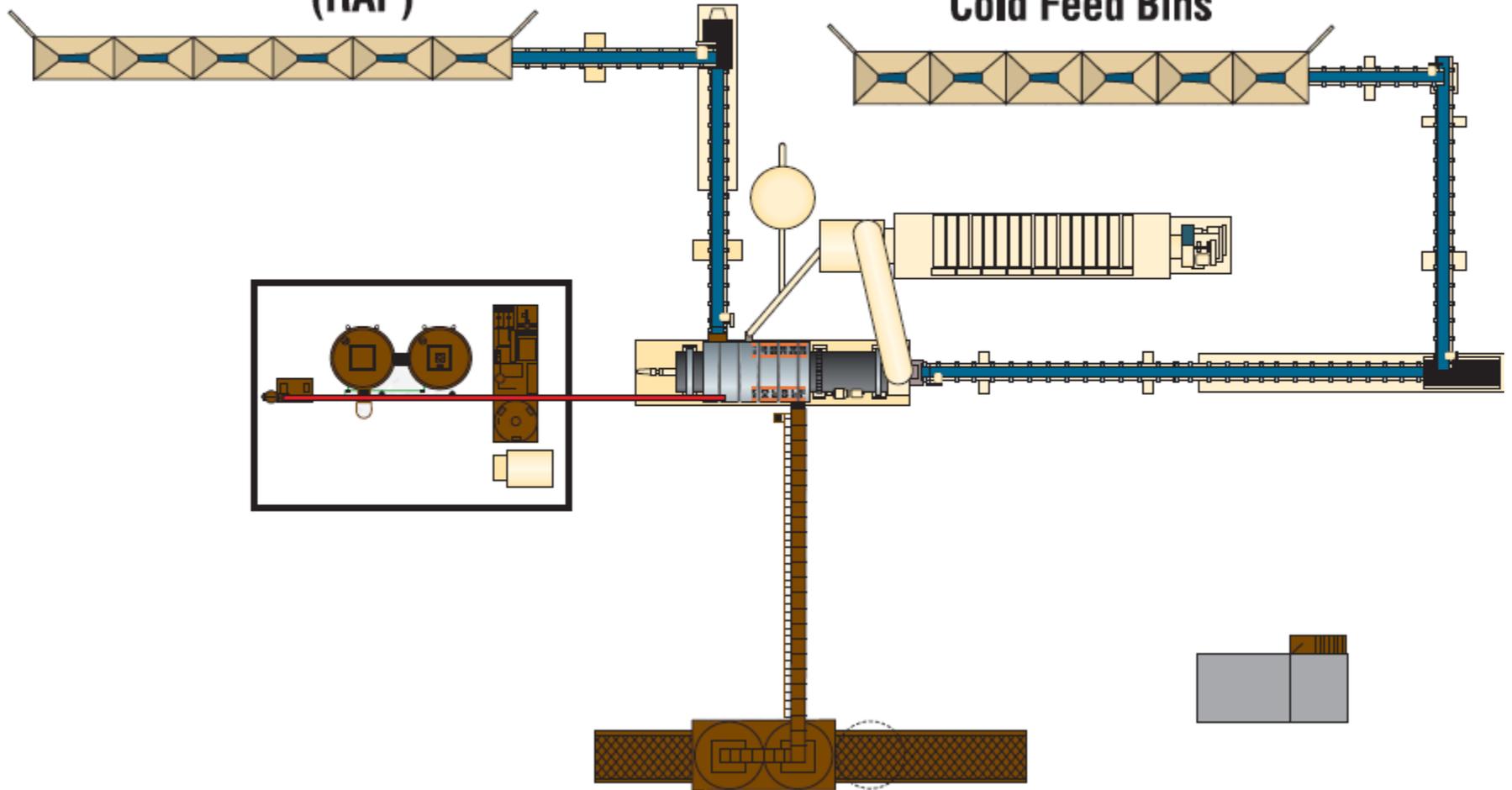


**This is the
processing that
ADDS VALUE.**



Reclaimed Asphalt Pavement Bins (RAP)

Cold Feed Bins



RAP/RAS Maximum Asphalt Binder Replacement (ABR) Percentage

HMA Mixtures ^{1/, 2/}	RAP/RAS Maximum ABR %		
	Binder/Leveling Binder	Surface	Polymer Modified
Ndesign			
30	30	30	10
50	25	15	10
70	15	10	10
90	10	10	10
105	10	10	10

FRAP/RAS Maximum Asphalt Binder Replacement (ABR) Percentage

HMA Mixtures ^{1/, 2/}	FRAP/RAS Maximum ABR %		
	Binder/Leveling Binder	Surface	Polymer Modified ^{3/, 4/}
Ndesign			
30	50	40	10
50	40	35	10
70	40	30	10
90	40	30	10
105	40	30	10



Best Practices without FRAP...

- Make today's RAP into a pile and keep it mixed or turned.
- Load at least 1 ft (1/3m) from bottom to control gradation, lower moisture, and have more consistent moisture.
- Don't let RAP bins run low. Keep RAP at or just above grizzly. Reduces segregation.
- Run as many RAP bins as possible. Reduces segregation.
- Cover RAP.
- Pave stock pile.
- Slope stock pile.



Feeding and Metering RAS... a few thoughts

- RAS rich in liquid
- Control of RAS content critical
- Weigh Feeders can work, but...
 - dynamic issues due to feed
 - small amount of material weighed
 - finicky to set up...
 - NOT recommended
- Live-Bottom with bins on load cells
 - NOT versatile... RAS or sand only, no RAP
 - Requires dry material to prevent sticking
 - NOT recommended due to lack of versatility
- Standard bins “work”, but...
 - lack individual feed “visibility” when run with RAP
 - *Cautiously* recommended
- Bins on Load Cells w/conventional feeder...
 - Proven, conventional feeders
 - “Smart” software, allows bin loading without changing RAS feed
 - Successful implementations
 - RECOMMENDED



Producing RAS Mixes... a word of caution

BACKGROUND INFO...

- Relocatable 8ft Double Barrel
- No issue with base and binder
- Problem appeared on thin-lift surface
- High asphalt content balls of tar
- Caused pulls in mix
- Required handwork to fix
- Fine RAP bin used as a RAS bin.
- RAP and RAS run across a 5/8" (16mm) screen
- RAS described as very dry
- Customer uses contractor to grind shingles
- RAS is covered at problem plant



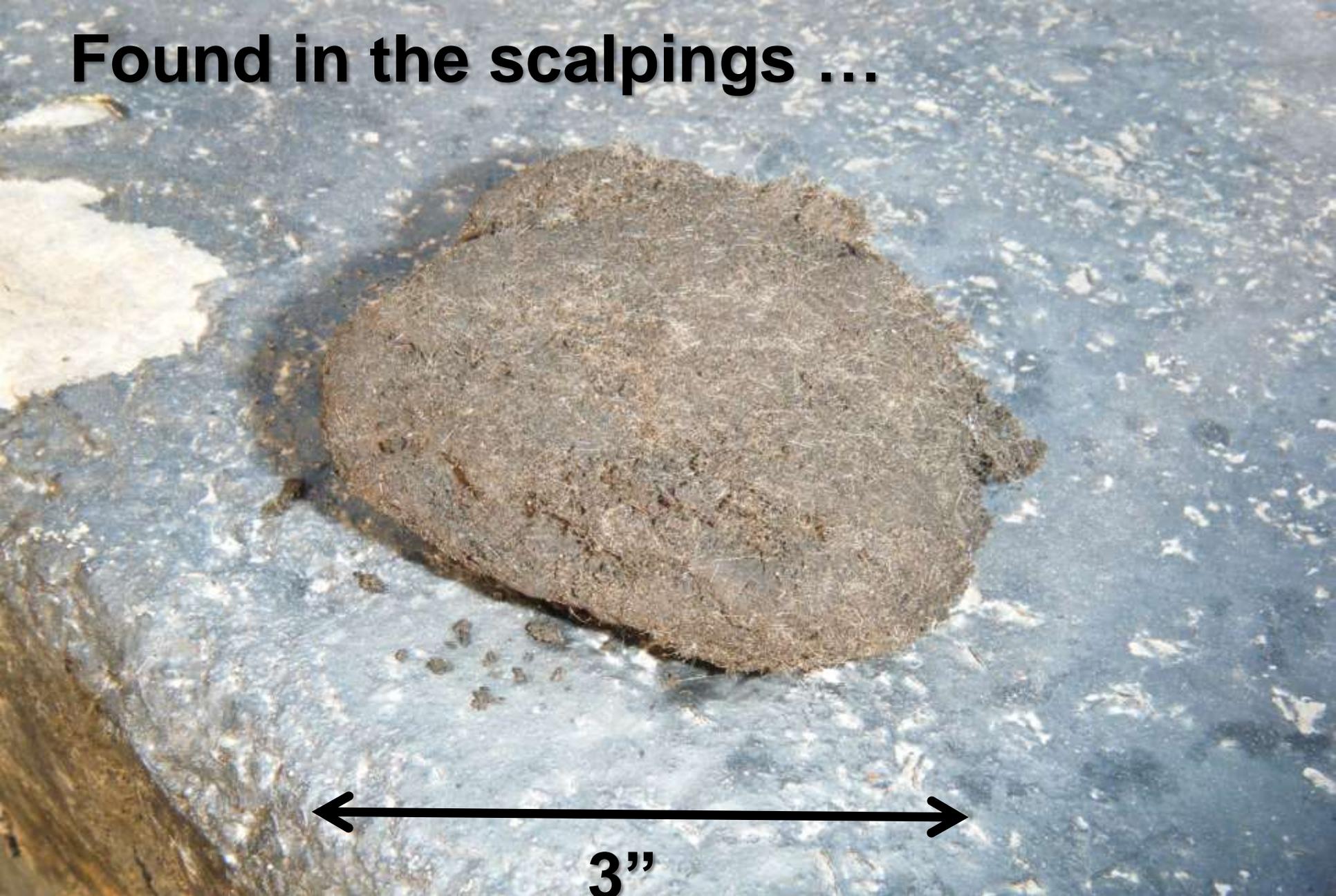
RAS stockpile ...



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Found in the scalplings ...

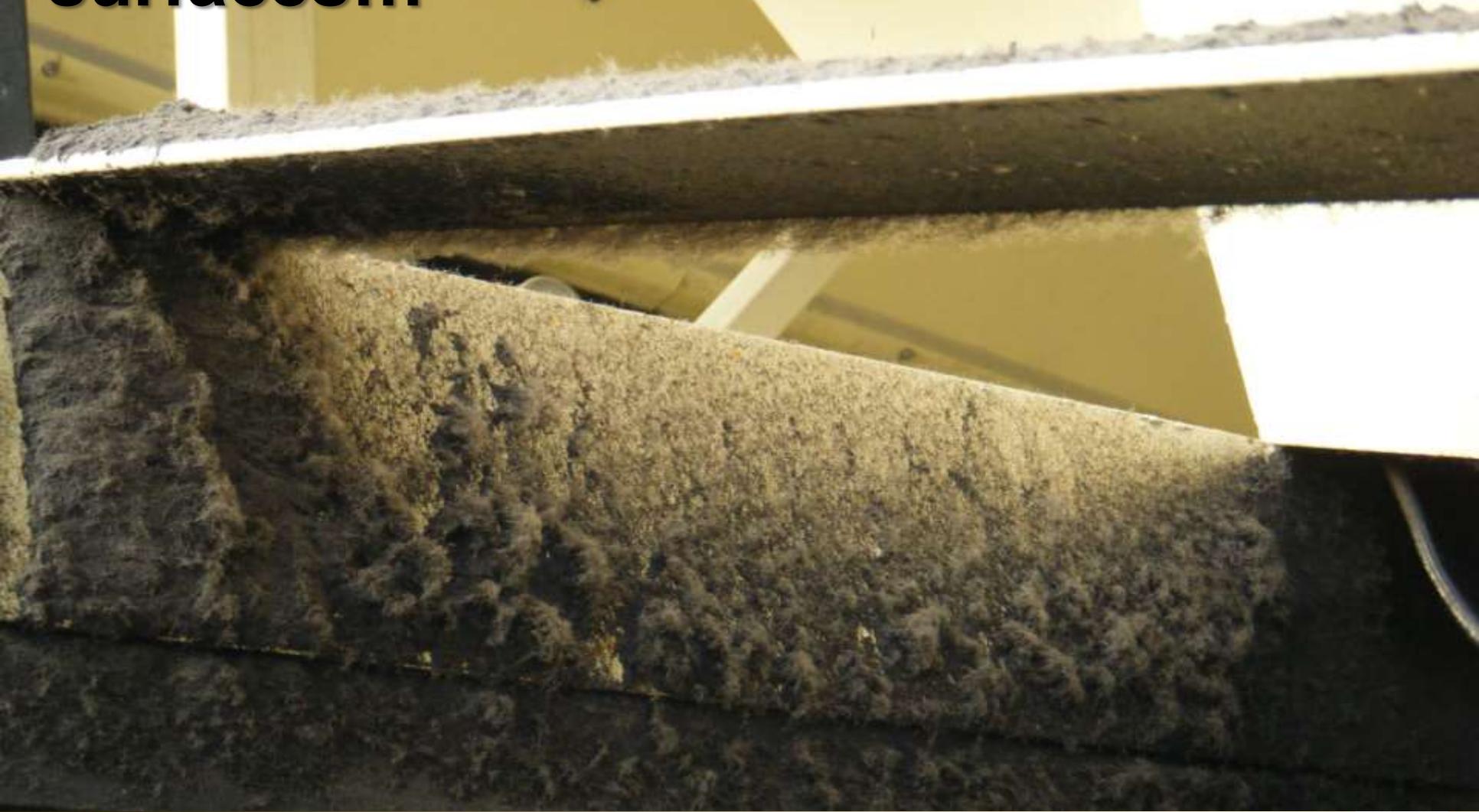


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Fines and fiberglass accreted on surfaces...



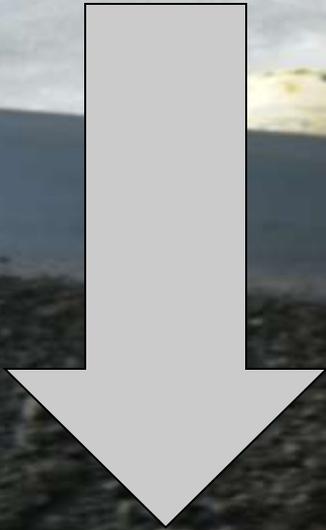
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Not the same consistency, soft...

- Then noticed chunks on the belt
- Chunks bigger than 5/8"
- Chunks coming from something after the screen



Found on the belt after the screen...



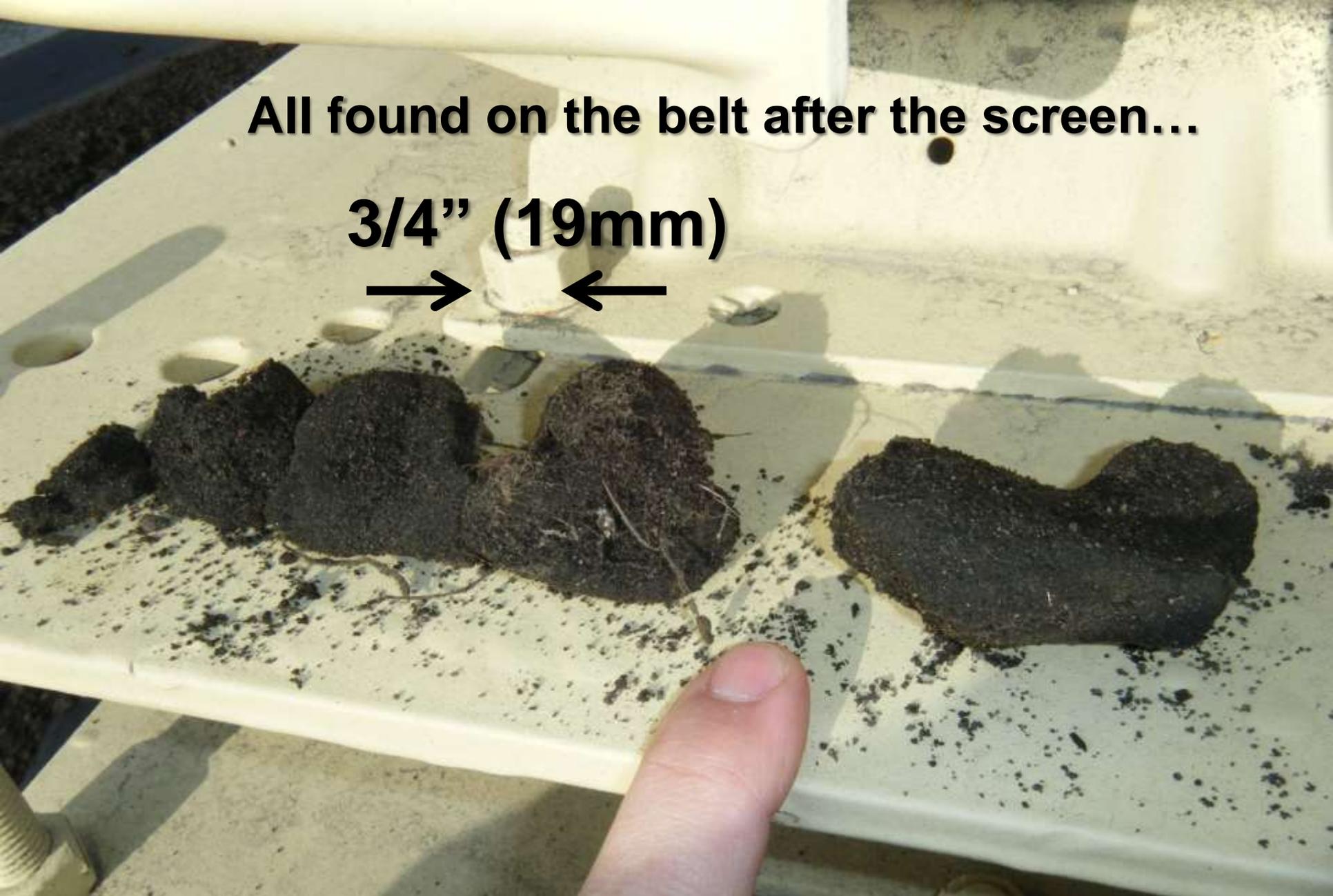
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All found on the belt after the screen...

3/4" (19mm)



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Contour indicates it dislodged from a surface...



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RAS stockpile ...

Dry?

22.5%



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Producing RAS Mixes... a word of caution

CAUSES...

- Tar balls are wet RAS accreting onto surfaces after the screen
- Balls dislodge and make it into the mix, through the mixing chamber, and to the road.
- Customer did not know actual RAS moisture
- Shingle grinding contractor caught spraying water on processed RAS.
- Shed for RAS not being used effectively.



Producing RAS Mixes... a word of caution

SOLUTIONS...

- Minimize RAS stockpile moisture.
- Monitor RAS processing contractor.
- Test processed RAS to ensure compliance.
- Consider incentives/penalties to discourage addition of excess water.
- Manage RAS stockpiles to prevent environmental moisture regain.
- Retain samples of tar balls, goo balls found by paving crews.





26/01/2010



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