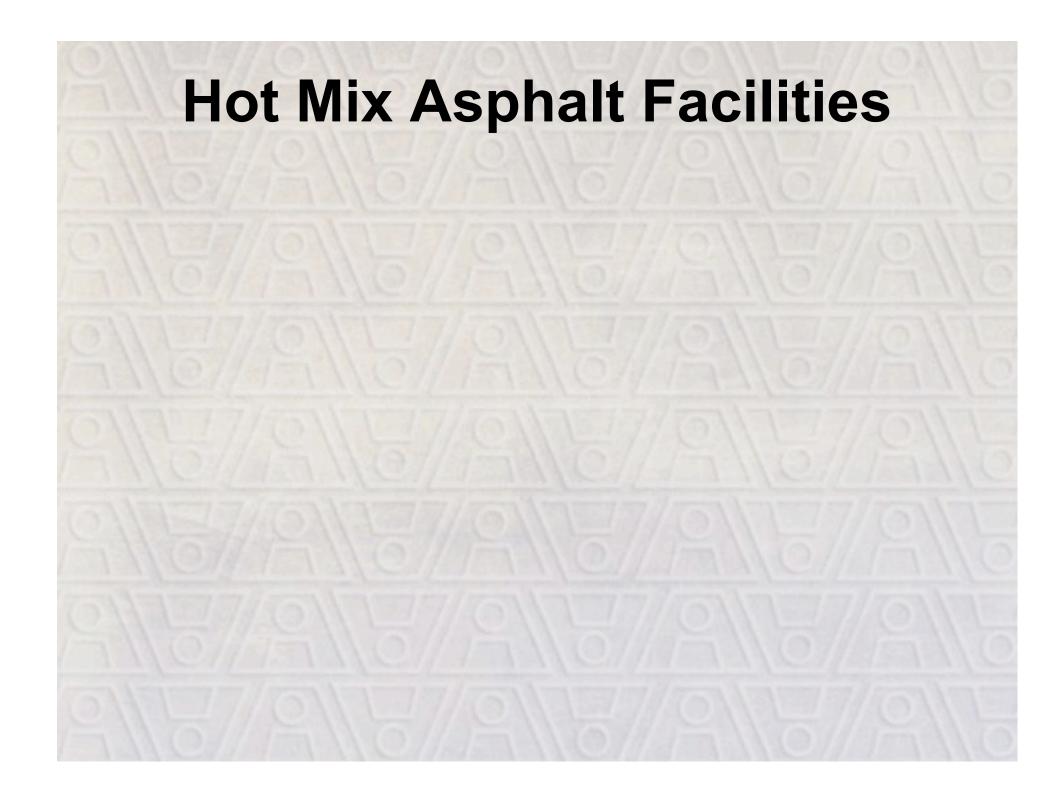


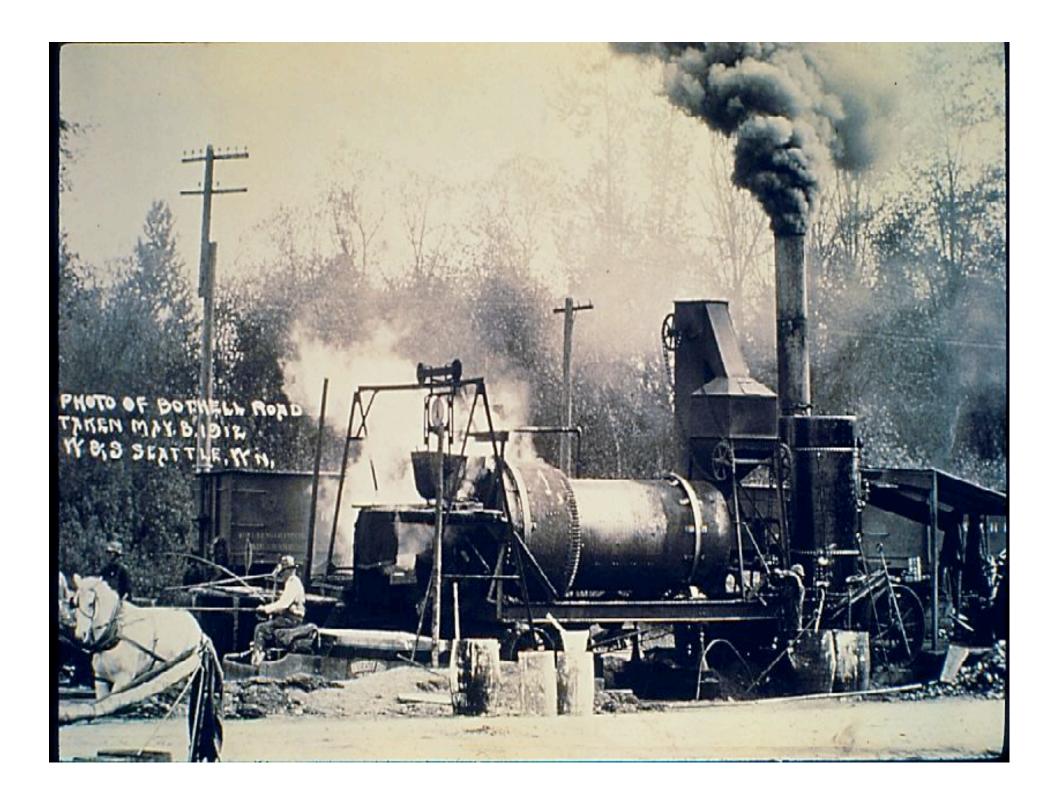
MORE EQUIPMENT ASTEC INDUSTRIES, INC.



AMERICAN AUGERS • ASTEC, INC • ASTEC MOBILE SCREENS • ASTEC UNDERGROUND BREAKER TECHNOLOGY • CARLSON PAVING • CEI ENTERPRISES • HEATEC JCI • KOLBERG-PIONEER • OSBORN • ROADTEC • TELSMITH • TRENCOR









Reducing Energy Costs at HMA Facilities

Illinois Bituminous Paving Conference December 2006



Hot Mix Asphalt Trivia...

- How many tons of HMA are produced/yr in USA?
- 675-750 Million Tons or 2.25-2.50/person
- How many tons HMA in Illinois?
- Around 20 Million Tons
- How many miles of roads in USA?
- 4 Million Miles of Roads
- How many miles are paved?
- 2.4 Million Miles



Hot Mix Asphalt Trivia

- How many of those are paved w/ Asphalt?
- 2.3 of the 2.4 Million Miles are paved w/ HMA
- How many tons HMA removed annually?
- 120 Millions tons
- How many tons HMA on roads today?
- About 18 Billion tons



Asphalt Plant Trivia...

- How many tons of HMA do states, cities and counties have in inventory?
- About 18 Billion Tons on the road alone
- How many Asphalt Plants are in the United States?
- About 3900
- How many Asphalt Plants are in Illinois?
- About 185



BIG THREE ENERGY COSTS

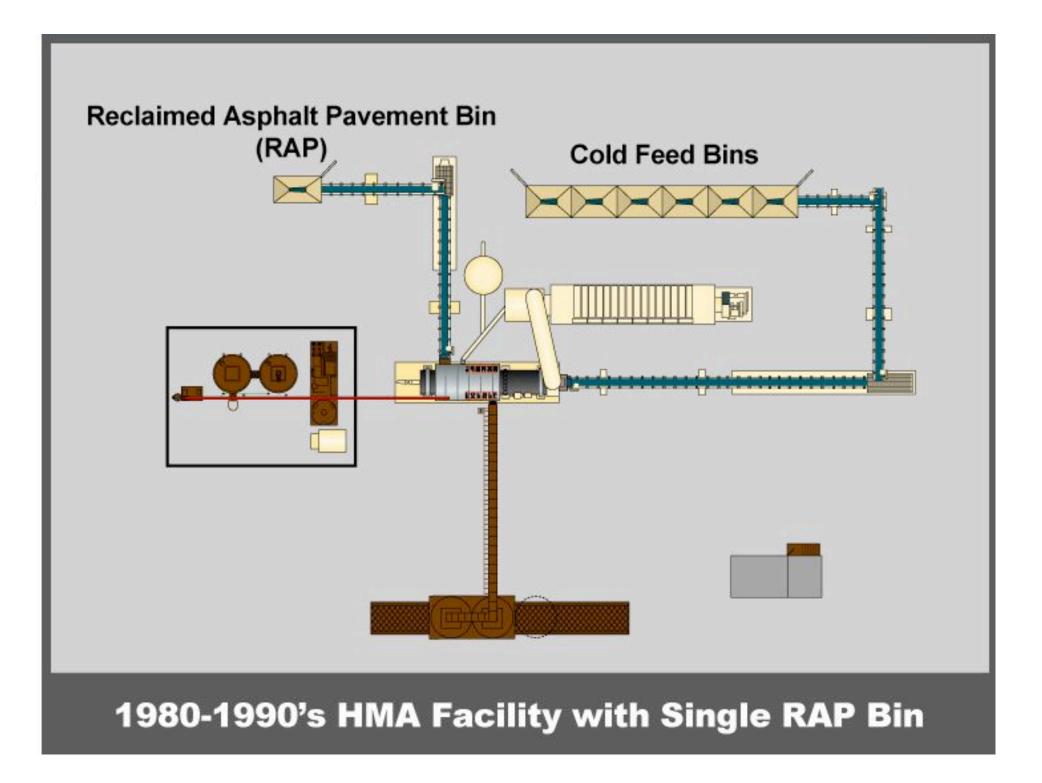
- ASPHALT CEMENT
- DRYING AND HEATING FUELS
- ELECTRICITY

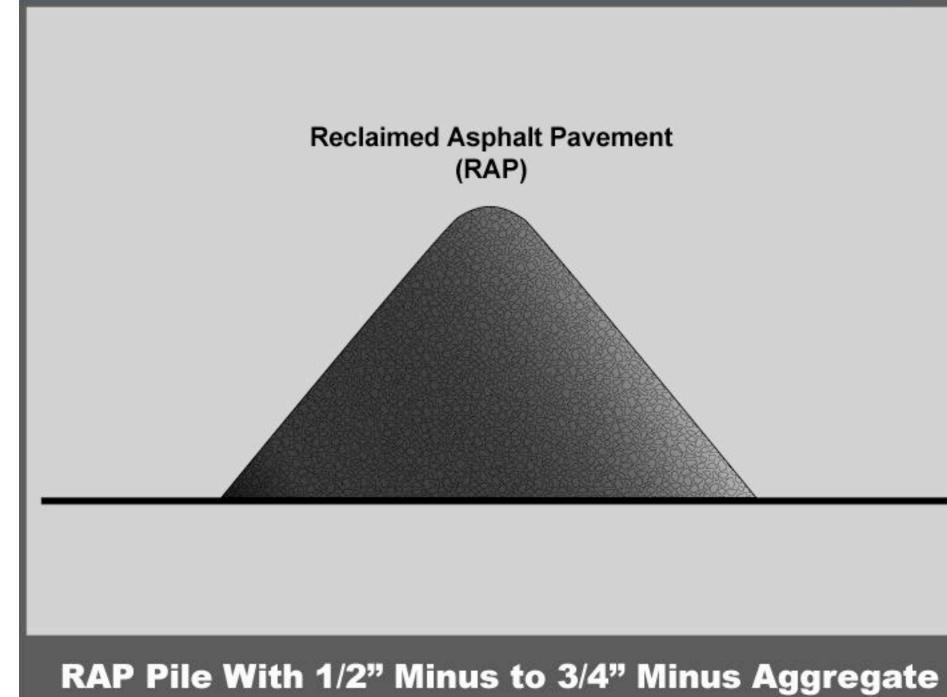


How can we run more RAP?

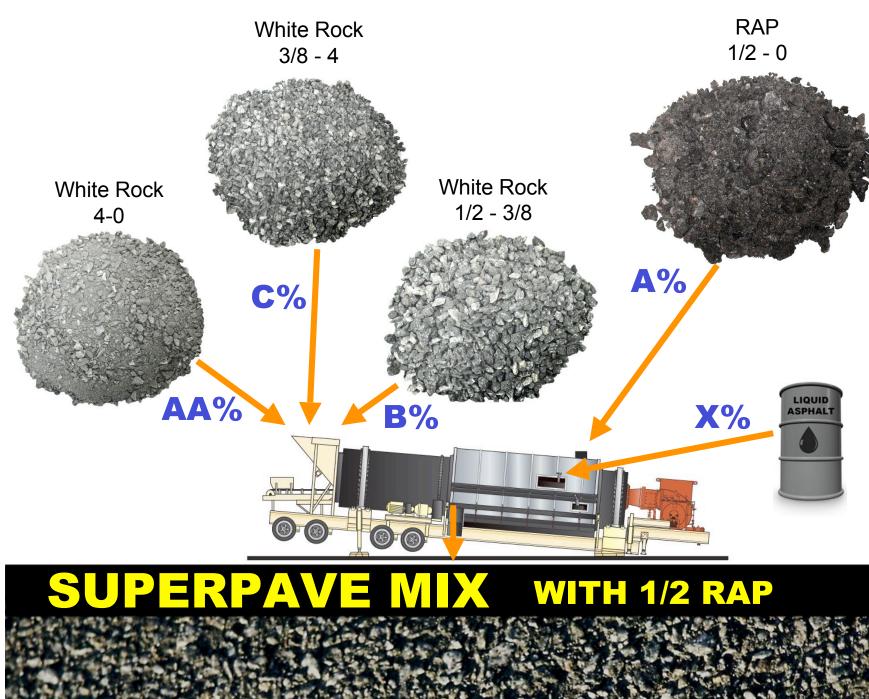
How can we reduce our energy costs related to our AC (OIL)?















Run More RAP

- With Superpave and other specifications, regardless of percentages allowed, we have found that:
 - Volumetrics force sizing RAP to same size as virgin materials to raise RAP percentage allowed in mix



Why Size RAP?

- In most cases with traditional handling, at over 20% RAP gradation can become an issue
 - Most RAP around the country is either milled material or ½" Minus Crusher Run
 - Tough on Lab to get
 uniform mix
 - Volumetrics





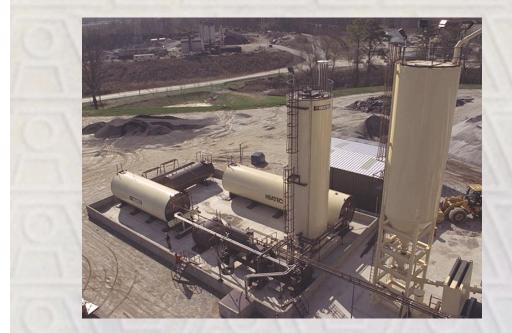
Why Size RAP

- Segregated piles usually give lab techs headaches
 - Depending on loader you can get too many fines and minus 200's that fill voids and have too much liquid...
 - 1970's, 1980's, 90's





Size RAP



- Variations in liquid content are due to surface area differences in aggregate size differences
 - Get lab to compare liquid in 1 pound of coarse vs. 1 pound of fine RAP to see...



Size RAP

- On average around the U.S. we see that in RAP:
 - ½ x ¼ = 3% AC
 - $-\frac{1}{4} \times 0 = 7\%$ AC
 - Easy to see how that could throw off mix design if pile is segregated







VOLUMETRICS

- Can be confusing, but not too difficult
 - Very basically
 - The lab makes a cylindrical sample in a gyratory compactor
 - A weight for the cylinder is calculated (DiaxHt)
 - That's compared to total weight of rock (based on the rock's specific gravity) and the liquid AC
 - What's left after adding those two together is assumed to be air (expressed as %)



VOLUMETRICS

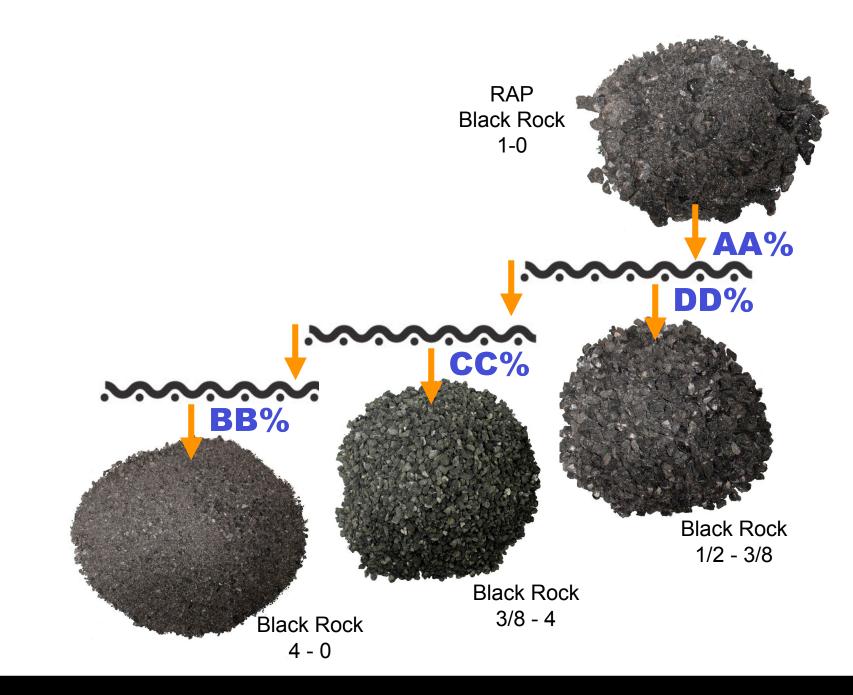
- Continuing...(based on most mix designs today)...
 - 4-5% air is usually desired, expecting the traffic to take it to 3%
 - Below 3% will move on you
 - Above 6% too open and can oxidize on you



Why Size...

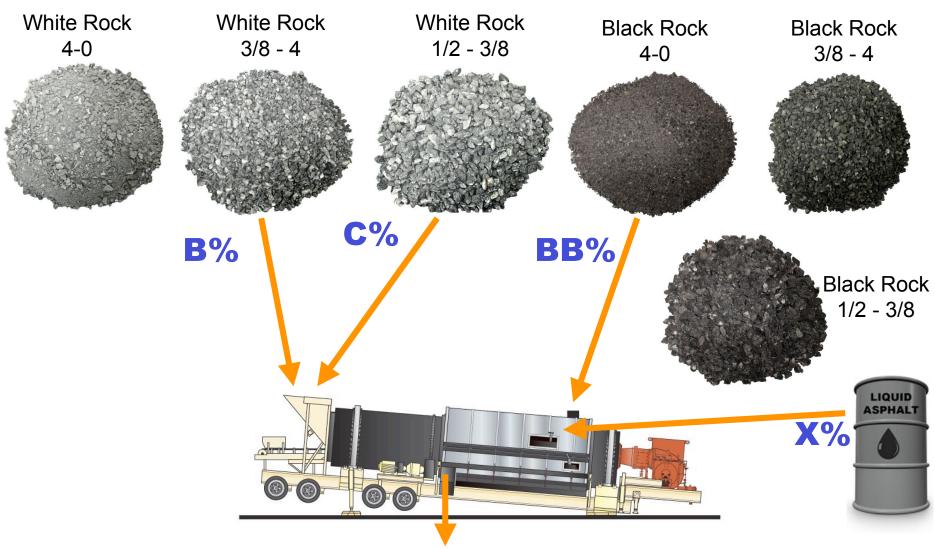
- Typically what we see around the country is too many fines in the loader over a certain time period leading to poor numbers and issues in the lab and field due to liquid variations and stability issues.
 - Contractors Sizing the RAP to match virgin rock sizes have virtually eliminated this problem and have been able to increase RAP USE
 - Play with designs, use RAP in different ways





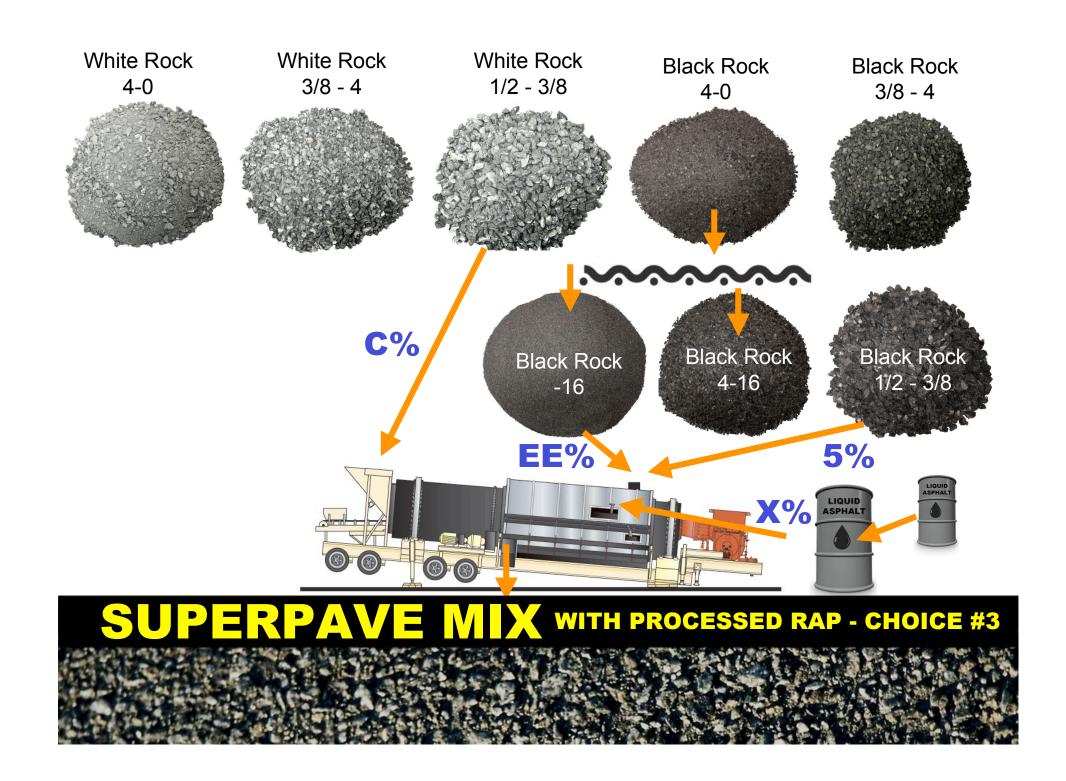
PROCESSED RAP SCREENED TO ORIGINAL INGREDIENTS





WITH PROCESSED RAP - CHOICE #1 ERP Ξ D





Increasing RAP: Success Story

- Banks Const SC
 - Gov't HMA RAP increases 10% on average
 - Private Mix HMA
 RAP increases 15 20% on average
 - Over 500,000 tons











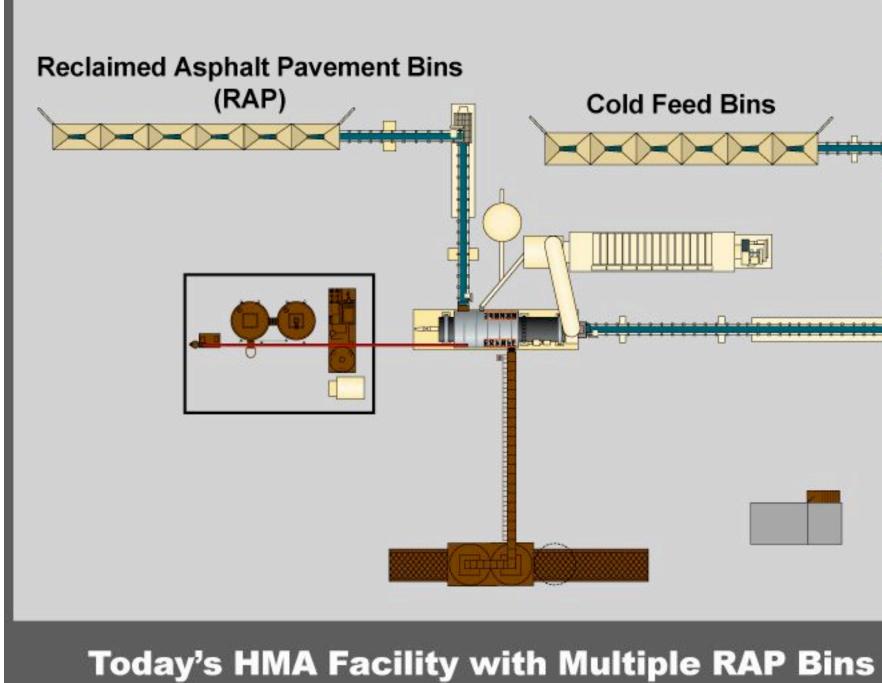




Sizing RAP and Equipment

- Screening equipment
- RAP Bins
- Crushing Equipment
- Plant RAP feed new look...



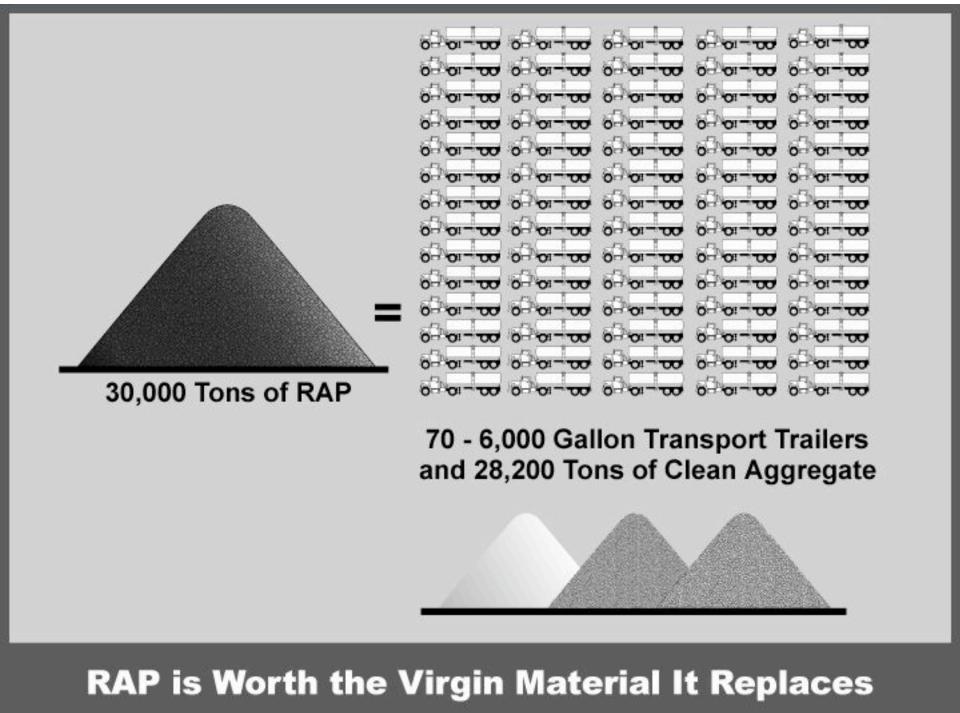




Hardness of AC in RAP

- Schools of Thought:
- Spec softer AC from suppliers
- Add 2% extender oil in AC line at Plant
- Do Nothing: It's better than what's being supplied anyway





Virgin Aggregate (per ton) \$10 x 0.94 = \$ 9.40 Liquid Asphalt (per ton) \$350 x 0.06 = \$21.00 \$30.40 RAP Milling Cost (in job) \$0 Trucking (per ton) - \$ 3.40 Difference \$27.00 10% RAP \$2.⁷⁰/ton 10 tons mix 20% RAP \$5.⁴⁰/ton 5 tons mix 50% RAP \$13.⁵⁰/ton 2 tons mix

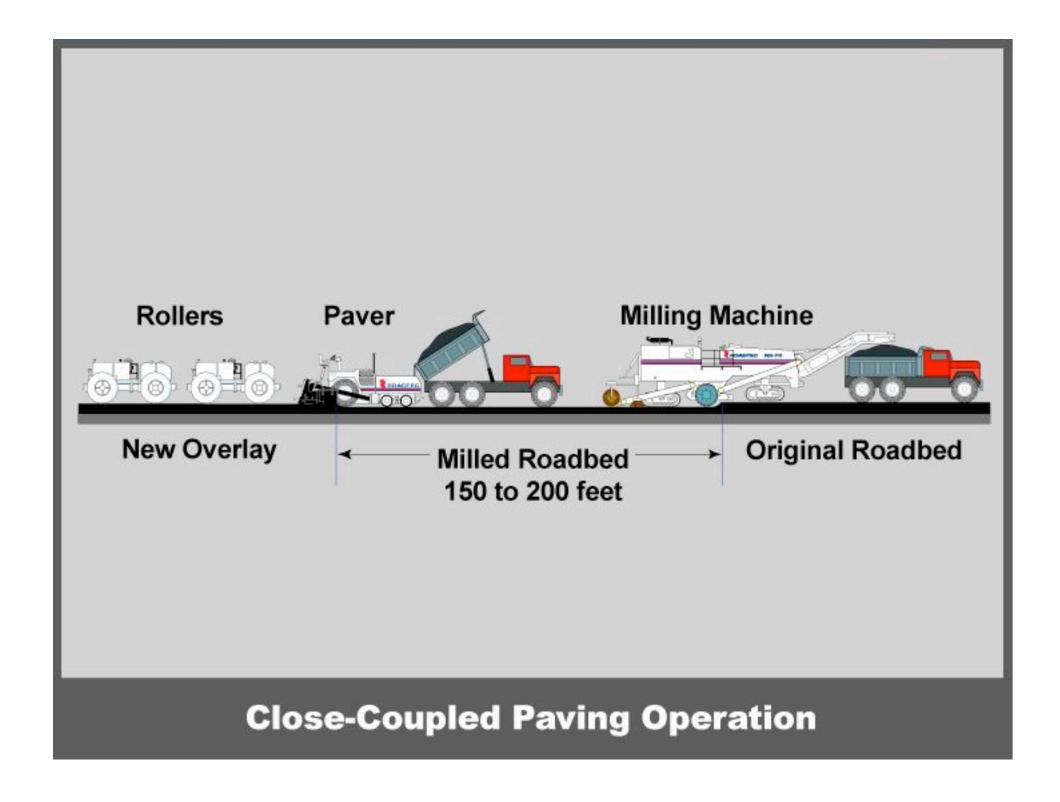
Savings: Virgin Materials vs. RAP (if RAP at no cost)



Virgin Aggregate (per ton)	$10 \times 0.95 = $ 9.50
Liquid Asphalt (per ton)	\dots \$350 x 0.05 = \$17.50
	\$27.00
Cost of RAP (per ton)	\$ 2 . ⁰⁰
Crushing Cost (per ton)	\$ 3.00
Total Cost of RAP (per ton)	\$ 5.00 \$ 5.00
	Difference \$22.00
10% RAP \$2.20/ton	10 tons mix
20% RAP \$4.40/ton	5 tons mix
50% RAP \$11.00/ton	2 tons mix

Savings: Virgin Materials vs. RAP (if RAP is purchased)







	000,000. ⁰⁰ to spend on mix… , no laydown, milling paid separately	
- \$450. - 5.5% - Proce - Haul (- Aggre - Plant	 ⁰⁰ Liquid – 64-22 ⁰⁰ Liquid when using Recycle Liquid essing Recycle Cost – \$3.00 / ton Cost – \$3.⁰⁰ / ton egate Cost – \$10.⁰⁰ / ton Processing Cost – \$6.⁰⁰ / ton nead and Profit – \$4.⁰⁰ / ton 	
1. If State D.O.T. purchases – All Virgin Mix		
Tons of Virgin Mix = 120,627 tons		
2. If State D.O.T. pur gets RAP	 If State D.O.T. purchases 50% RAP Mix – 2" Inlay – Contac gets RAP 	
Tons o	f RAP Mix = 166,113 tons	



Lane miles paved with All Virgin Mix	
162 miles	
Lane miles paved with 50% RAP Mix	
223 miles	

Additional miles paved through use of Recycle

61 miles



