NAPA
NATIONAL ASPHALT PAVEMENT ASSOCIATION

PRIORITIZING RAP
SAVES ROAD OWNERS MONEY, REDUCES EMISSIONS, AND IMPROVES PERFORMANCE

How to capture the highest value from infrastructure investments

Introduction

Reclaimed asphalt pavement (RAP) is a valuable material sourced from processes like milling or the removal of asphalt pavements. By detailing the economic, environmental, and performance advantages of RAP, this paper illustrates both the importance of giving priority to RAP utilization in new asphalt mixture production and why using RAP in aggregate replacement and shoulder construction provides a lower return on investment to the road owner.

Cost-Efficiency through Aggregate and Asphalt Binder Replacement

The incorporation of RAP in asphalt mixture production yields substantial cost savings. The aggregate and asphalt binder within RAP can efficiently replace virgin materials, resulting in reduced financial and environmental burdens associated with acquiring these natural resources.

Compared side by side, the savings achieved using one ton of RAP in a common asphalt surface mixture against the use of RAP as shoulder gravel are overwhelming.

Table 1: Costs of Virgin Materials (NAPA)

Material		% of Market	Cost/Ton 2021
Asphalt Binder	Unmodified	90	$490.65
	Modified	10	$614.01
	Weighted Average*		$519.45
Aggregate	Crushed Stone	90	$11.79
	Sand and Gravel	10	$8.98
	Weighted Average		$11.51

**The asphalt binder weighted average calculation takes into account that 37 states provide unmodified binder index pricing, while only 5 states provide both modified and unmodified binder pricing.*

The comparisons demonstrate how impactful capturing the asphalt binder replacement value of RAP is when utilized in the production of asphalt mix. As shown in Table 2, road owners save three times more by using RAP in a mix (valued at a cost equivalent to replacing *both* virgin aggregate and virgin asphalt binder in a new asphalt mixture) compared to using it as aggregate alone.

Table 2: Cost Savings of One Ton of RAP, Based on Use (Williams et al, 2023)

Material	% Agg.	% AC	Aggregate Cost Savings, $/Ton	Asphalt Binder Cost Savings, $/Ton	Total Cost Savings, $/Ton
RAP in Asphalt Mix	95	5	$10.93	$25.97	$36.90
RAP in Aggregate	100	0	$11.79	$0	$11.79

Sustainable Resource Management and Environmental Advantages

Utilizing RAP in new asphalt mixture production plays a unique role in conserving precious natural resources. By reducing the demand for new aggregates and virgin asphalt binders, using RAP significantly extends the lifespan of valuable resources, aligning with sustainability practices and policies, as well as global initiatives that champion environmentally responsible construction methods.

Integrating RAP into asphalt mixtures yields substantial environmental advantages. RAP use can conservatively lead to a 15% reduction in upstream energy requirements for asphalt production, accompanied by a notable 10-20% decrease in greenhouse gas emissions. These reductions are attributed to the decreased need for producing raw materials (aggregates and asphalt binder), as well as reduced raw material transportation to the asphalt plant.

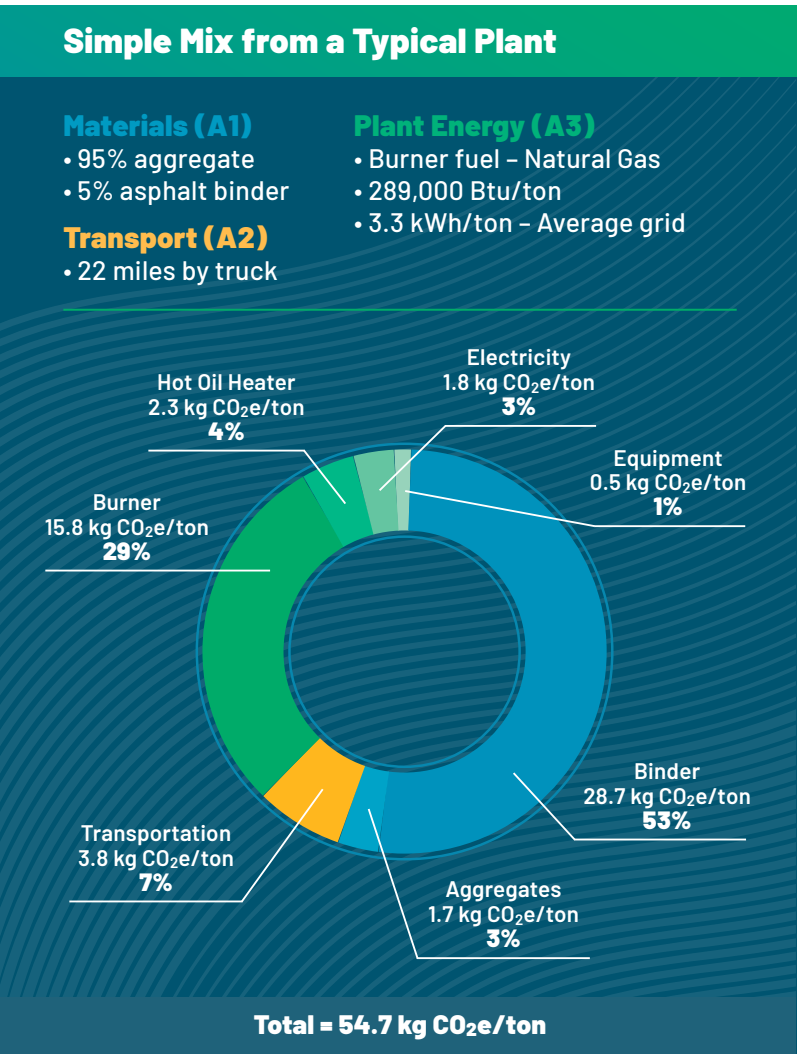

Figure 1: Levers to Reduce Emissions at a Typical Mix Plant (NAPA)

Figure 1 demonstrates that processing the asphalt binder component accounts for 53% of emissions, though it represents just 5% of the mix. Meanwhile, the emissions associated with the aggregate account for just 3% of emissions, while representing 95% of the mix. By using RAP as a substitute for asphalt binder and aggregate (saving 28.7 kg emissions), as opposed to only aggregate (saving just 1.7 kg emissions), road owners save 16 times more upstream emissions associated with virgin material procurement.

Enhanced Pavement Performance

Incorporating RAP into asphalt mixtures does not lead to a degradation in quality. With an engineered mix design and stringent RAP quality control, the performance of asphalt mixtures can be elevated through RAP incorporation in new asphalt mixes. When executed correctly, asphalt mixtures with RAP can match or even surpass the performance of asphalt mixes composed solely of virgin materials (West et al, 2011), resulting in longer-lasting pavements, minimizing maintenance needs and repairs, and generating long-term cost efficiencies.

Conclusion

Given the substantial cost savings, sustainable resource management, environmental gains, and performance enhancements, road owners would be wise to prioritize use of RAP in new asphalt mixture production. Rigorous quality assurance and adept mix design practices are pivotal in maximizing these advantages. By prioritizing the use of RAP, the asphalt pavement industry can reduce costs for road owners and reduce emissions for communities, while enhancing pavement performance for roadway users—enabling road owners to improve the sustainability of their asphalt pavements.

The Road Forward

West, R., et al. Use of Data from Specific Pavement Studies Experiment 5 in the Long-Term Pavement Performance Program to Compare Virgin and Recycled Asphalt Pavements. Transportation Research Record: Journal of the Transportation Research Board, January 2011.

Williams, B.A., J.R. Willis, & J. Shacat. (2022). *Annual Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage: 2021, 12th Annual Survey* (IS 138). National Asphalt Pavement Association, Greenbelt, Maryland. DOI:10.13140/RG.2.2.23149.26081