

Unlocking Profit Through Environmental Initiatives

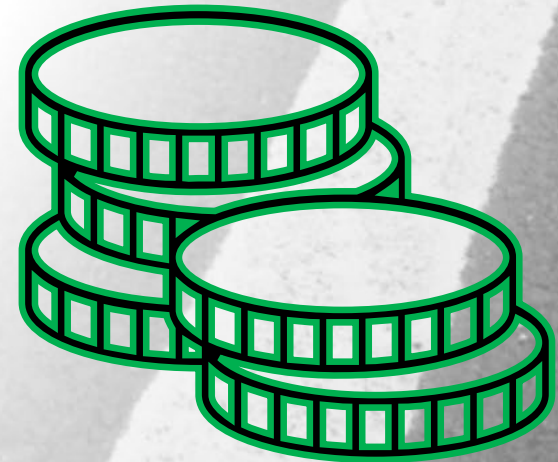
Buzz Powell
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Acknowledgements:
Shane Buchanan



Perspective





Welcome to Hey NAPA

What asphalt pavement questions can I answer for you?

I've been trained on hundreds of NAPA publications and have broad general knowledge of asphalt pavement topics. Ask me anything that you'd like and I'll do my best to provide a concise answer and point you to additional resources.

How can I reduce cost to produce mix?

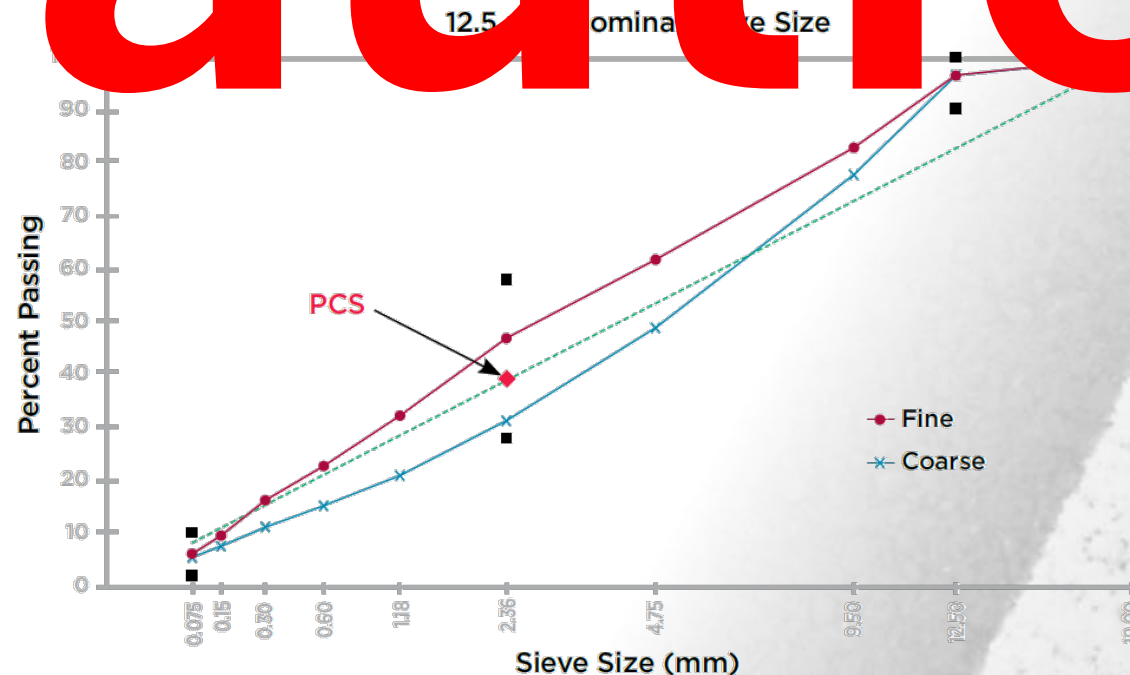


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- Blend aggregates (coarse) to reduce total binder content
- Increase recycling of RAP (and RAS) to reduce virgin materials
- Improve efficiency through modernization (bins, drum, flights, VFD...)
- Utilize warm mix asphalt technology (additive versus water foam)
- Enhance plant logistics to reduce waste, downtime, and delays
- Modernize for more consistent quality, reduced waste, and lower labor cost
- Utilize predictable mixes that minimize production uncertainty
- Invest in training for maintenance, efficiency, and best practices
- Engage in proactive maintenance for reliability and efficiency
- Monitor and manage inventory of raw materials and additives.

Lower Virgin Binder Content Mix Designs

- Lower effective binder content via gradation (coarser mix)
- Coarser mixes have higher macrotexture (potentially better safety)...
- We must not compromise mix grading performance!



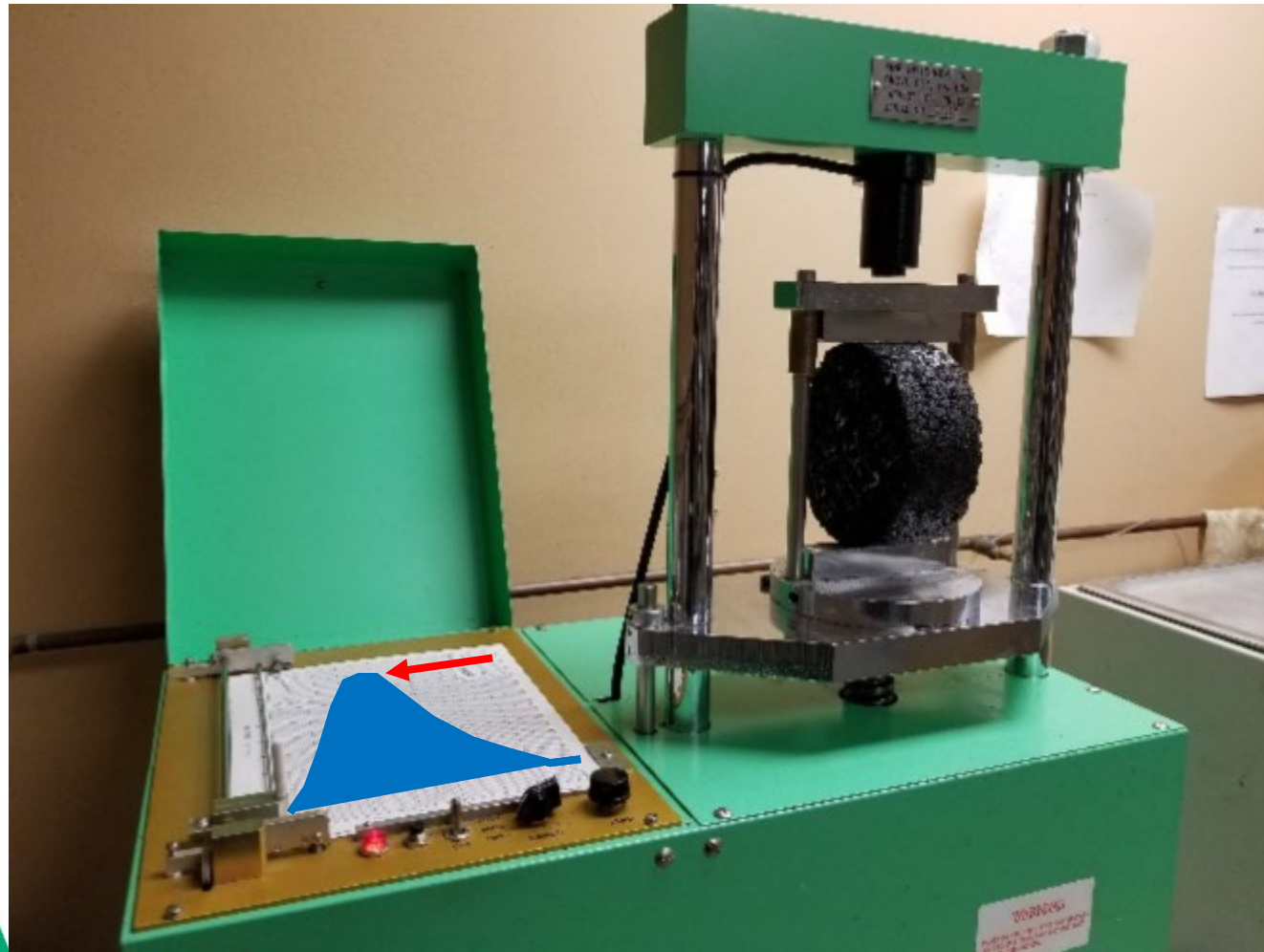
Increase Recycling

- Lower the demand for new raw materials (binder, aggregates)
- Recycling lowers cost but also reduces carbon, promotes sustainability
- At higher percentages, respect RAP more than virgin materials
- Manage RAP for higher residual binder content, consistent grading
- Goal for more consistent aggregate gradation, predictable dust (P200)
- Monitor in-coming to limit contamination, consider source segregation
- Process / screen / crush / fractionate to for best value (lowest carbon)
- Avoid excessive crushing to prevent higher dust and lower binder.

BMD for Both Higher RAP and Healthier Mixes

- Legacy volumetrics only indicate binder quantity (not quality)
- BMD for both quantity and quality of effective binder content
- Regional need for between $\frac{1}{2}$ and $\frac{3}{4}$ percent more total binder content
- Other levers include WMA, long-term rejuvenators, additives, etc.
- Significantly relax volumetrics requirements to facilitate innovation
- Consider BMD_{C-D} implementation with collapsed voids prevention
- Only make production N_{des} if BMD specimens compact too quickly₁₀₋₁₅
- Plant documentation for material proportioning between BMD tests.

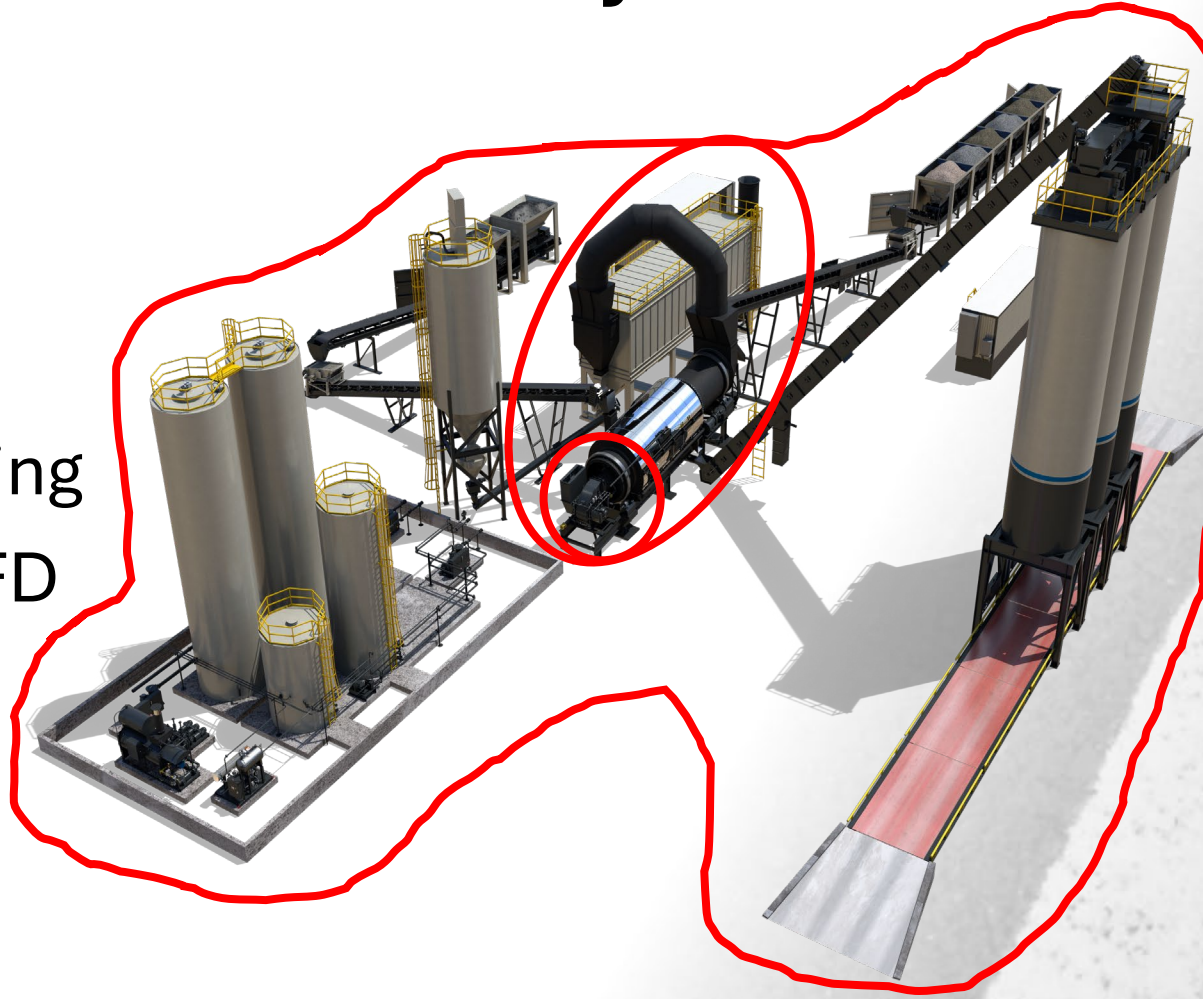
BMD for Both Higher RAP and Healthier Mixes



- Rutting indicator
 - “**Hot**” test for peak strength
- Cracking indicator
 - “**Cool**” test for curve shape
- Dry TSR w/ thinner sample
- 3-4 hrs from truck to results

Modernize for Efficiency

- Insulation
- Air leaks
- Burner fuel
- Burner Sizing/Tuning
- Drum/flighting, VFD



Modernize for Efficiency



Production Temperature

- Production “creep” over long periods of time for higher temperatures
- False perception by plant, paving crew that hotter is always better
- Are you running too hot, and is temperature reduction possible?
- 50F temperature drop is 10 percent less burner fuel
- Does the mix require antistrip protection, and is liquid allowed?
- Hydrated lime works great but has extremely high carbon footprint
- Many lower carbon liquid antistrips are also warm mix additives
- Is plant equipped with foaming device, and is it being utilized?
- Monitor exhaust temperature to prevent baghouse condensation.

Enhance Logistics

- Streamline your operations to reduce waste and downtime
- Robust scheduling and dispatch system to minimize delays
- Reduce hot stops, cold stops, waste, downtime, delays
- Production rate to avoid stopping and restarting plant
- Starting/stopping more than 3 times per shift uses $\frac{1}{3}$ more fuel
- Utilize silo(s) to stabilize production and maintain ideal rate
- Mix cooling in silo(s) is indicative of moisture issue.

Run Predictable Mixes

- Calibrated weigh bridges, bins, binder pumps, mix rates
- Mix designs that are cost-effective, meet performance requirements
- Designs less sensitive to material variations minimize adjustments
- Desire to save pennies on materials can cost dollars in production
- Cautious optimism with technologies marketed to reduce carbon
- Additive chemistries need to be compatible with binder packages
- Respect statistics of BMD testing during production (run BMD plus)
- Save binder samples in case BMD results change significantly.

Invest in Training

- Disconnect between plant/paving crew and check writers
- Invest in staff training on plant/production best practices
- Well-trained team can be on board with cost (carbon) savings
- Plant efficiency, materials management, equipment maintenance
- E.g., low hanging fruit in loader operator practices with stockpiles.

Conduct Proactive Maintenance

- Regular maintenance schedule for all plant equipment
- Prevents unexpected breakdowns and ensures critical operation
- Efficient operation reduces cost (carbon) to operate
- Savings on repair costs and reducing energy waste
- Rebuilding test sections due to missed maintenance.

Manage Inventory of Materials and Additives

- Effective stockpile and inventory management
- Ensure right amount of materials available when needed
- Reducing excess purchasing, handling, and shipping costs
- 1 percent less stockpile moisture is 10 percent less burner fuel
- 1 ft off ground drops 4% in sand, 2% in screenings, 1% in $\frac{3}{8}$ stone (\approx rain)
- Additive inventory may expand for BMD, cost, carbon (e.g., rejuvenator).

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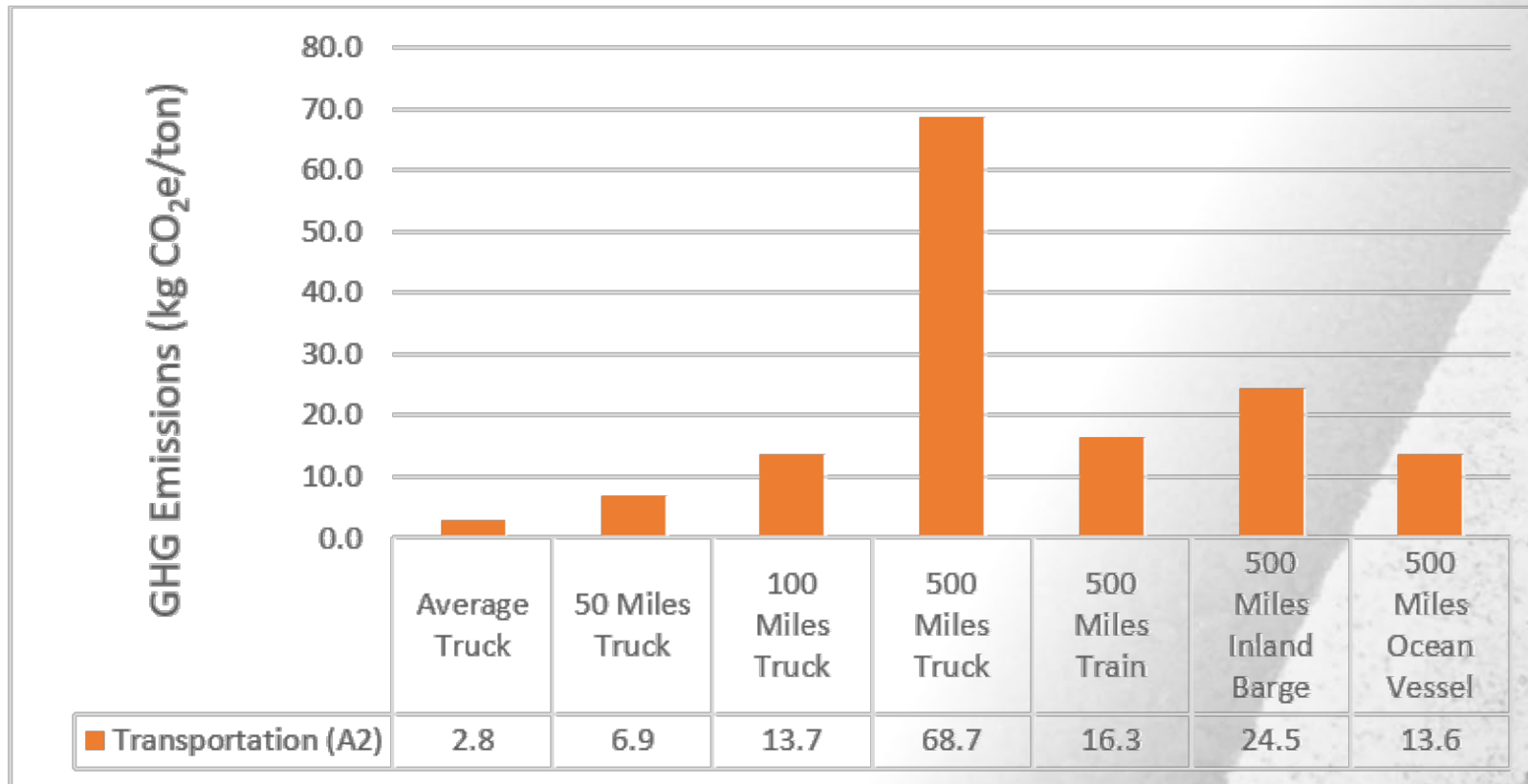


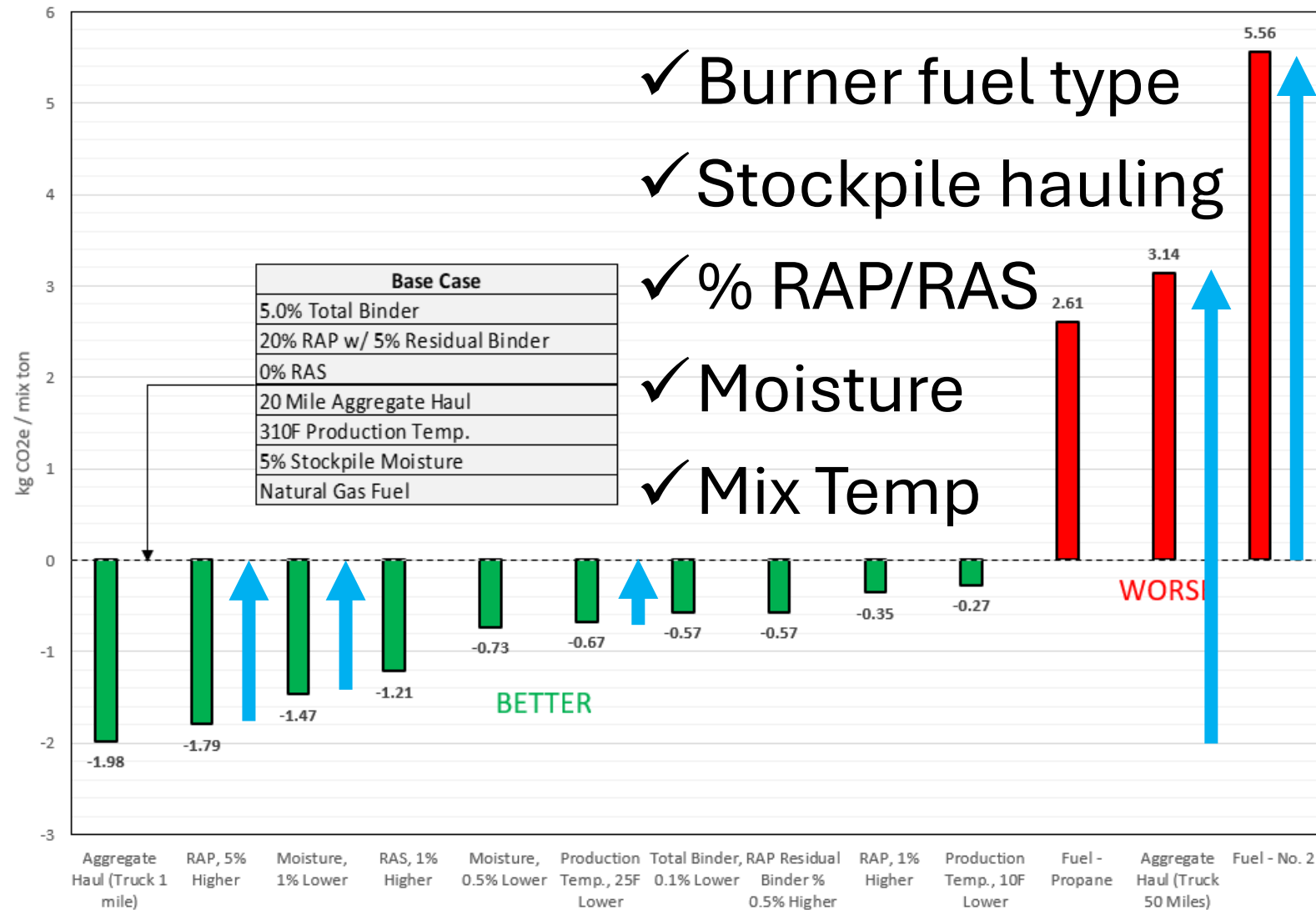
Figure 5. Impact of transport distance on transportation related (A2) GHG emissions. The Average Truck scenario assumes transport distances of 21.5 miles for aggregates and 3.9 miles for asphalt binder (Mukherjee, 2016).

Takeaways

- Train the team (buy in for success)
- Increase recycling (low hanging fruit)
- Utilize warm mix asphalt (lower energy)
- Enhance plant logistics (minimize stops)
- Improve efficiencies (hot oil insulation)
- Manage inventory (don't run out)
- Predictable mixes (save ¢ but lose \$)
- Proactive maintenance (before it breaks)
- Modernize plant (consistency, waste)
- Coarse mix designs (better safety, but...).

Impact of Initiatives

Isolated Variable Change Related to Base Case



Questions?

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