The Road Forward 2023 SUMMIT

July 12-13
Kansas City, MO

SIP-107
Amlan Mukherjee, *WAP Sustainability*

NAPA

NATIONAL ASPHALT
PAVEMENT ASSOCIATION

6406 Ivy Lane, Suite 350, Greenbelt, MD 20770-1441

AsphaltPavement.org NAPA@AsphaltPavement.org

Tel: 301-731-4748 | Fax: 301-731-4621 | Toll Free: 1-888-468-6499

@NAPATweets /AsphaltPavement /company/AsphaltPavement

/c/NatlAsphaltPavement @GoAsphalt

The Road Forward is an initiative of the asphalt pavement industry, with the committed support of NAPA members, partners, and staff, to achieve net zero carbon emissions by 2050.

Learn more about the initiative and find additional resources at AsphaltPavement.org/Forward.

NAPA thanks the following member companies for their generous support of The Road Forward.

ACKNOWLEDGMENTS

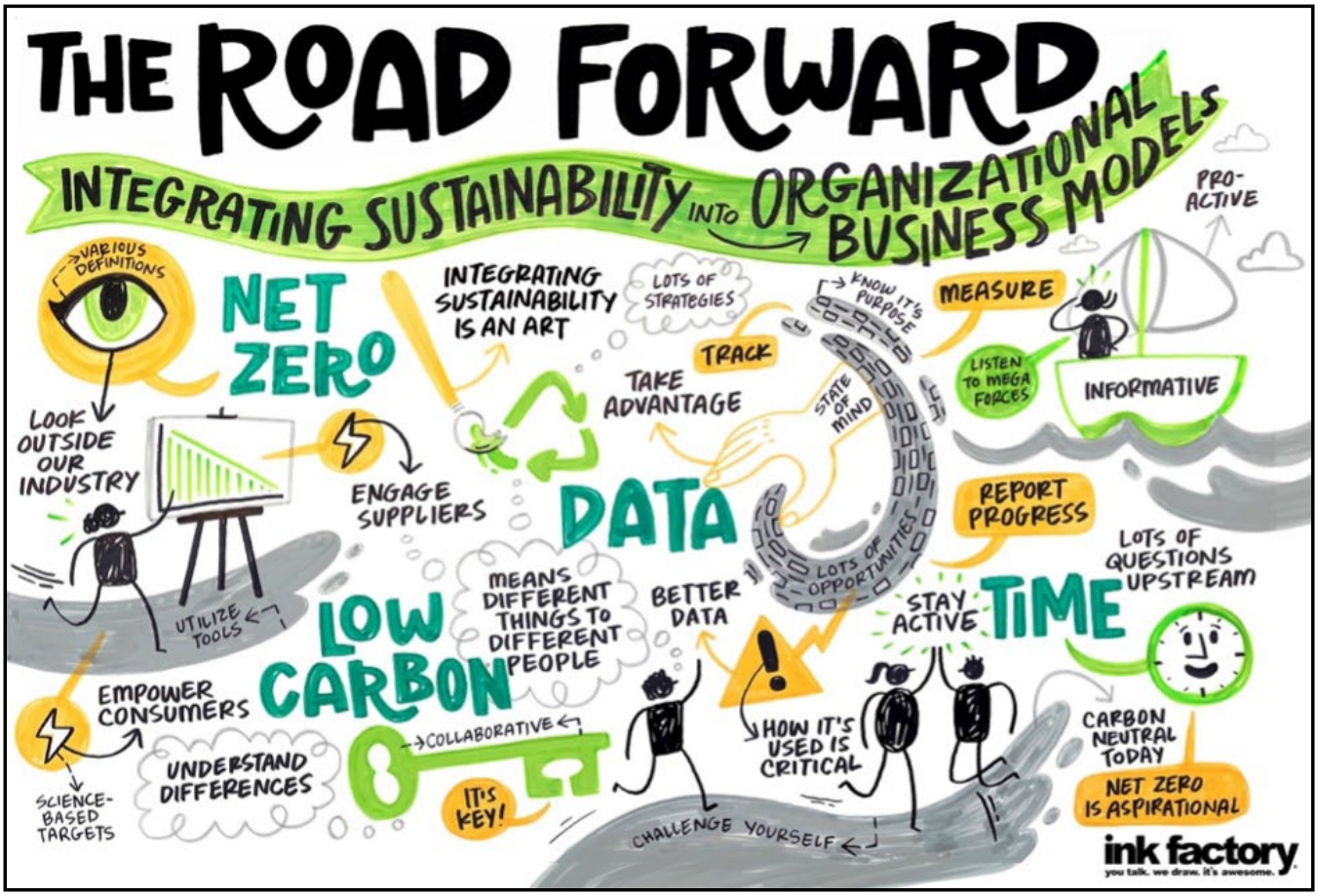
Thanks to The Road Forward Partners, whose contributions help fund this project, and to the following for contributing to this report: Benjamin Ciavola, Lianna Miller, Amlan Mukherjee, and William Paddock of WAP Sustainability Consulting; Ester Magorka, Joseph Shacat, and Brett Williams of NAPA; and Jo Sias, University of New Hampshire.

Introduction

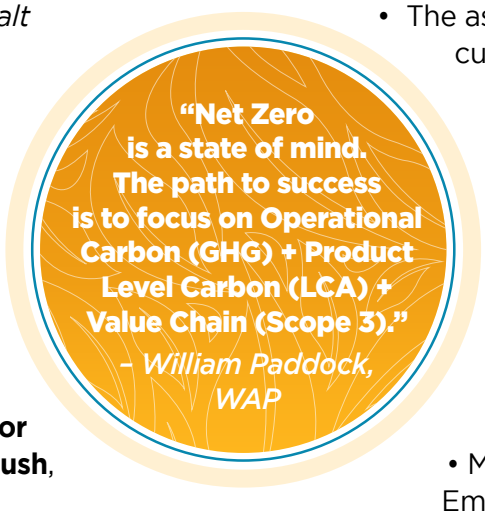
The National Asphalt Pavement Association (NAPA) organized The Road Forward Summit on July 12-13, 2023, in Kansas City, Missouri. Participants included asphalt industry stakeholders including paving contractors, asphalt producers, representatives of various upstream material suppliers and representatives from the Federal Highway Administration (FHWA) and the Environmental Protection Agency (EPA).

The format of the workshop was interactive with WAP Sustainability leading the breakout session conversations in collaboration with NAPA staff. The workshop was kicked off with a plenary presentation by **William Paddock** from WAP Sustainability Consulting. Paddock talked about Integrating Sustainability into Organizational Business Models, reflecting his experiences working with various industries and customers in prioritizing sustainability goals. He walked the audience through a discussion of what Net Zero means and its implications for the asphalt industry. The highlights of his discussion can be summarized as:

1. Tools, technology, and innovation will make achieving Net Zero easier over time, meanwhile it can help industry gain a competitive advantage.
2. The asphalt industry is well positioned, but success requires collaboration between the association and its members.
3. Data-driven solutions will be key to success, focusing on Operational Carbon (GHG) + Product Level Carbon (LCA) + Value Chain (Scope 3).



There were two panel discussions lead respectively by **Lianna Miller** and **Ben Ciavola**. Miller's panel discussed Opportunities for a Net Zero Supply Chain with panelists including **Susan Listberger**, *Cargill Asphalt Solutions*, **Anthony Veloso**, *Green Asphalt LLC*, **Ashley Batson**, *Ingevity* and **Chait Bhat**, *Asphalt Institute*. Ciavola's panel discussed Opportunities for Reducing Emissions by Partnering with Customers, with panelists including **Matt Valle**, *HaulHub*, **Raven Adams**, *Granite Construction Inc.*, **Trevor Wagoner**, *ASTEC*, and **Harry Bush**, *Vulcan Materials*.



The plenary talk and the panel discussions set the stage for participatory breakout groups that were organized to reflect the goals set by member companies of NAPA in their Road Forward plan. The Road Forward is a member driven initiative. The goals from NAPA's The Road Forward are as follows, with a mapping of each goal to associated greenhouse gas reporting scopes:

1. **Achieve net zero carbon emissions during asphalt production and construction by 2050.**

- Maps to Scope 1 Emissions.
- The industry will, on a net basis, not contribute any carbon emissions from its own operations (e.g., materials, equipment). Many countries, industries, and companies worldwide are pledging to reach net zero carbon emissions by 2050 — a goal echoed by the asphalt pavement industry.

2. **Partner with customers to reduce emissions through pavement quality, durability, longevity, and efficiency standards by 2050.**

- Maps to downstream Scope 3 Emissions
- The asphalt industry relies on customers and stakeholders to achieve net zero carbon emissions. Owners must ask for products and implement practices that lead to net zero emissions. NAPA commits to partnering with stakeholders to achieve a sustainable business case for these actions.

3. **Develop a net zero materials supply chain by 2050.**

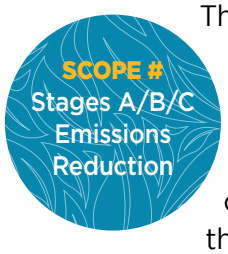
- Maps to upstream Scope 3 Emissions
- Supplier partnerships and net zero commitments are critical for the industry to achieve net zero carbon emissions. What the industry asks of and gets from its suppliers counts toward its own net zero goal.

4. **Transition to electricity from renewable energy providers in support of net zero carbon electricity generation by 2050 and reduce electrical intensities.**

- Maps to Scope 2 Emissions
- The power generation industry is moving
- toward net zero carbon, which the asphalt industry can leverage to reduce its own emissions.

The discussions focused on the first three goals and have been summarized in this report by priorities identified by the participants.

How to read this report:

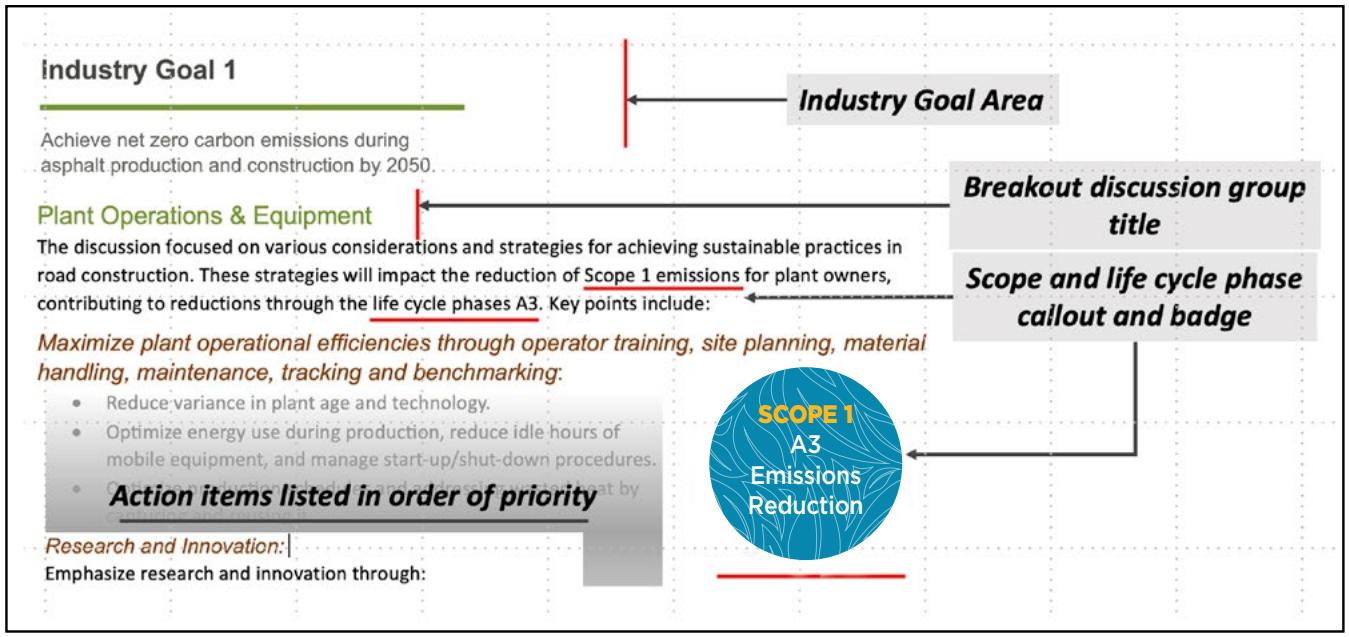


The report has been organized by the three main goals as set in The Road Forward plan. The discussions in each of the breakout sessions have been classified by the goal area they most closely align with. The conversations in each of the breakout groups have been distilled to establish a list of priorities that have been presented in the order of urgency. Relevant quotations that were reported by the scribes have been included along with the text to communicate the mood of the discussion. These quotes are not associated with an individual because they evolved in discussion. Where relevant Research and Innovation activities have been presented as identified in conversation.

The diagram below illustrates the structure of this report. The badges (like the one on this page) accompany the text as callouts for specific breakout discussion area, often indicating that a single goal area can span multiple life cycle stages and Scopes. The badges next to the text identify the life cycle stages as identified in ISO 21930 (Figure 2). The stages are as follows:

- **A**: Production & Construction Stage (**A1**: Extraction and upstream production, **A2**: transportation to factory, **A3**: manufacturing, **A4**: transportation to site, **A5**: Installation
- **B**: Use Stage (**B1**: use, **B2**: maintenance, **B3**: repair, **B4**: replacement, **B5**: refurbishment, **B6**: operational energy use, **B7**: operational water use)
- **C**: End of Life Stage (**C1**: deconstruction/ demolition, **C2**: transportation to waste processing, **C3**: waste processing, **C4**: disposal of waste)

In addition, each breakout topic is accompanied by the visual art that was developed by Ink Factory to develop a snapshot of the discussions.



Achieve net zero carbon emissions during asphalt production and construction by 2050.

The industry will, on a net basis, not contribute any carbon emissions from its own operations (e.g., materials, equipment). Many countries, industries, and companies worldwide are pledging to reach net zero carbon emissions by 2050 — a goal echoed by the asphalt pavement industry.

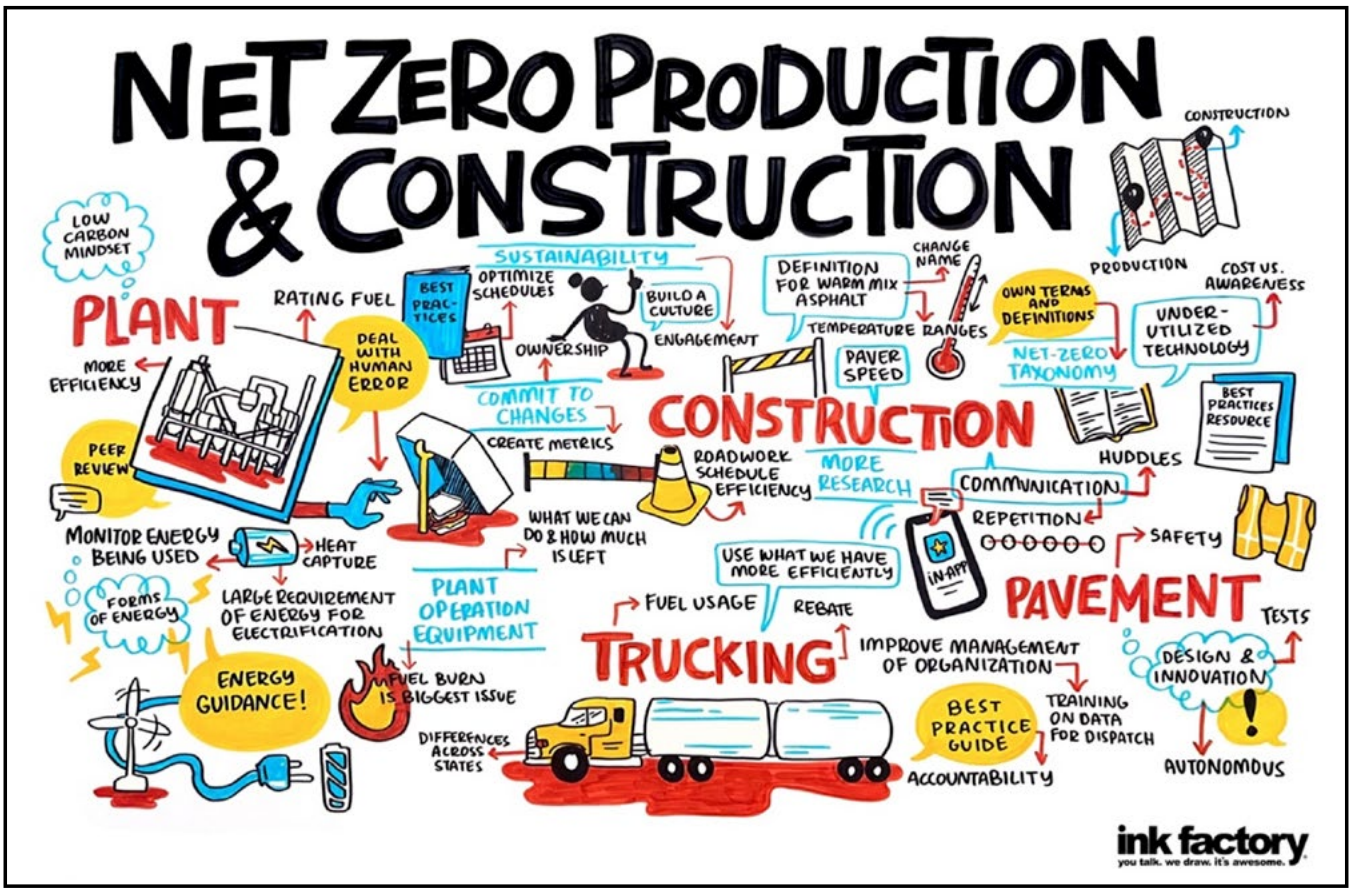
Plant Operations & Equipment

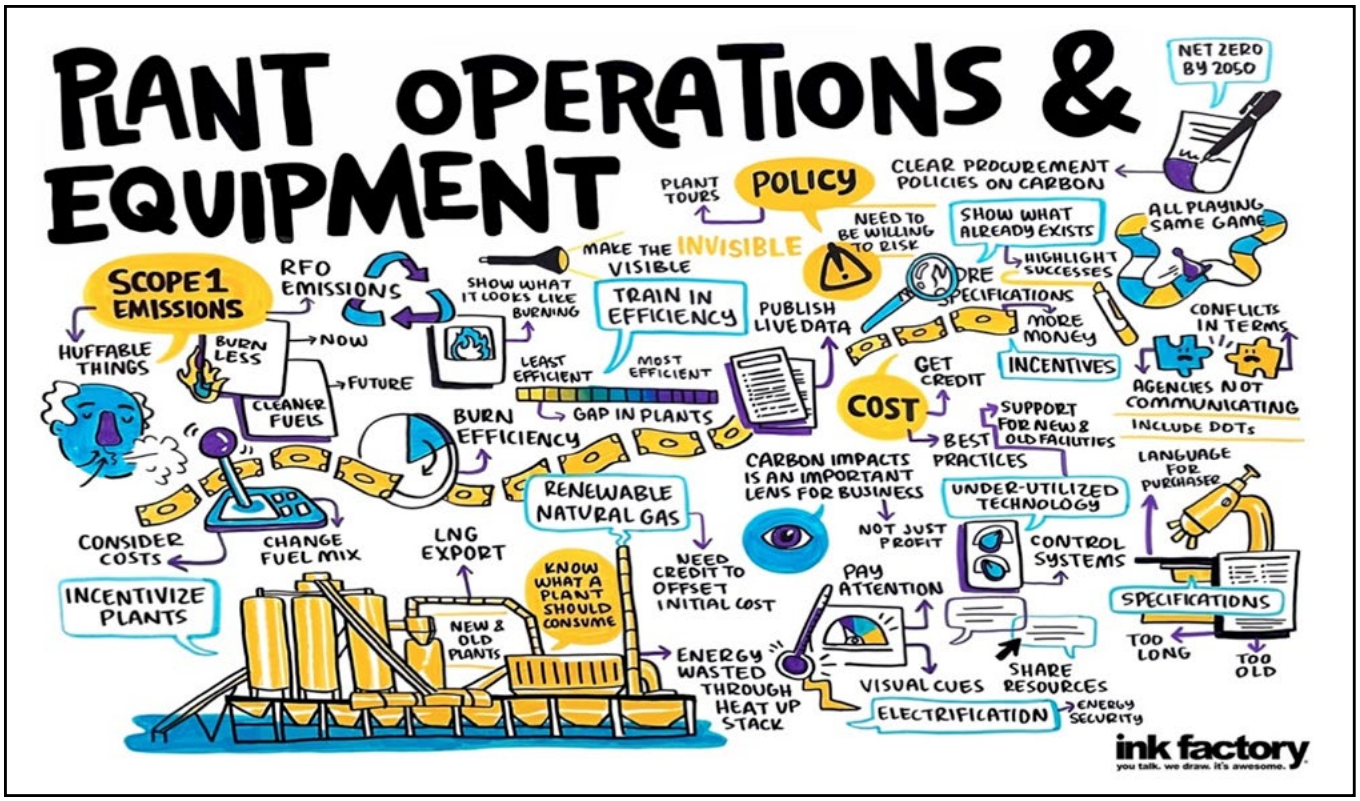
The discussion focused on various considerations and strategies for achieving sustainable practices in road construction. These strategies will impact the reduction of Scope 1 emissions for plant owners, contributing to reductions through the life cycle stages A3. Key points include:

Maximize plant operational efficiencies through operator training, site planning, material handling, maintenance, tracking and benchmarking:

SCOPE 1 A3 Emissions Reduction

- Modernize the asphalt plant population and ensure producers are using latest technologies to increase efficiencies.
- Optimize energy use during production, reduce idle hours of mobile equipment, and manage start-up/shut-down procedures.
- Optimize production schedules and addressing wasted heat by capturing and reusing it.
- Transition to cleaner alternative fuels, accounting for cost and regulatory controls.





Engage management at all levels at the plant to create active commitments towards a pathway to net zero:

- Account for carbon emissions in making decisions about capital investments and equipment purchases.
- Create plant level managerial tools and metrics to challenge the team to create a culture that embraces meaningful change.
- Showcasing successful case studies
- Create engagement between government and industry to address challenges related to permitting, specifications, and resistance to change.

"We know how to get 50% reduction, but don't have answer for zero yet."

Research and Innovation:
Emphasize research and innovation through:

- Enhanced use of automation and control technologies.

"Transition to best-in-class control/ automation technologies"

- Energy revolution in the plant, including technologies involving electrification, hydrogen production, solar energy capture, and energy storage.
- Understand where to appropriately use low energy and cold asphalt mixes.

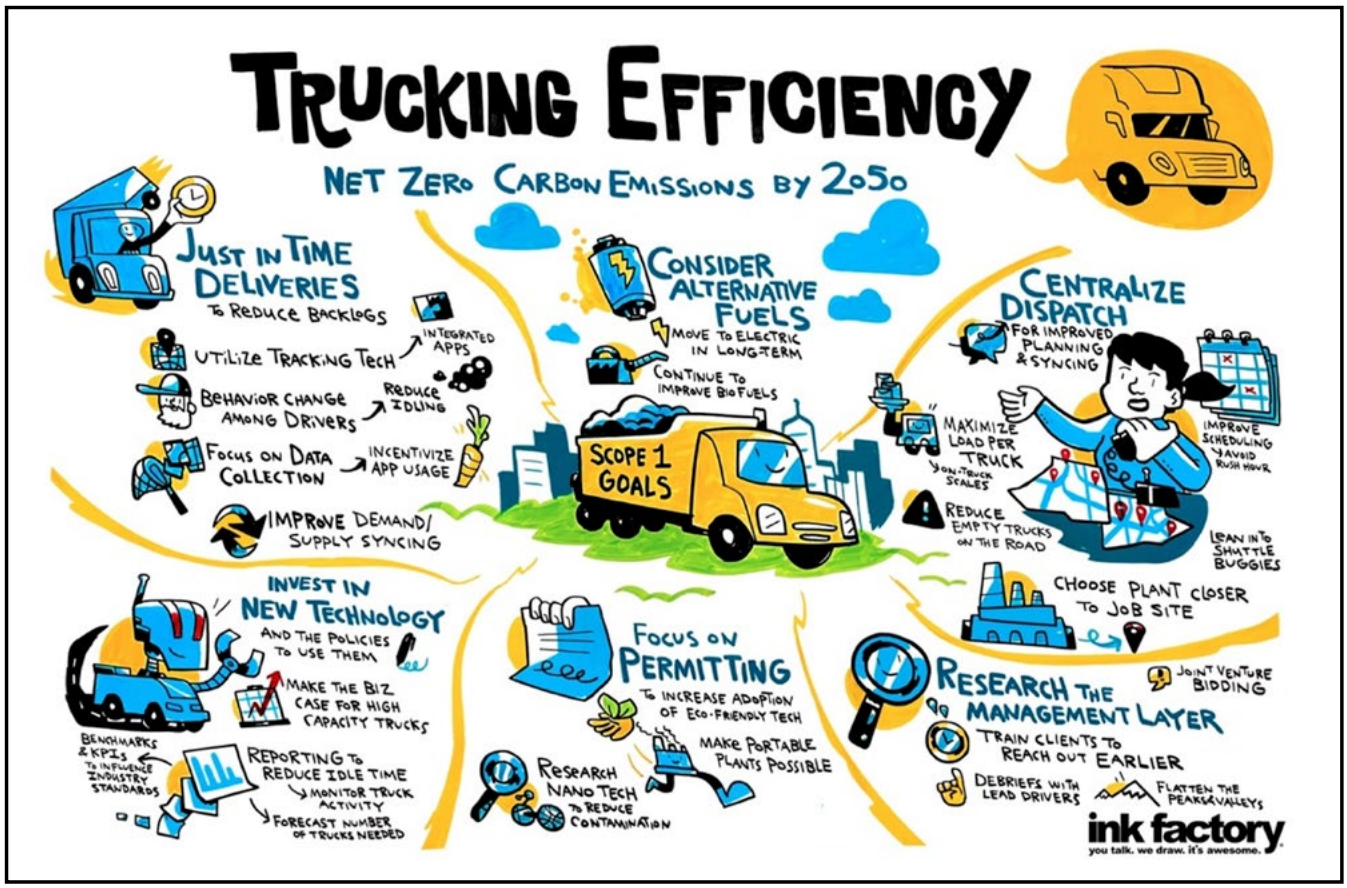
Trucking Efficiency

SCOPE 1
A2, A4
Emissions
Reduction

The discussion highlighted strategies and considerations related to achieving Net Zero emissions by 2050 in construction trucking. These emissions are considered Scope 1 for whoever owns and operates truck hauling operations, as well as contributing to reductions through the life cycle stages A2, and A4.

Adopt process and technology improvements to eliminate waste and reduce idling:

- Implementation and utilization of trucking logistical software using real-time information and load cell technology to create just-in-time delivery and reduce idling.
- Utilizing historical data for better demand forecasting and project management.



- Research increasing load limits for trucks and optimizing backhaul operations.
- Exploring options, including working with specifiers, to eliminate hauling through in-place recycling and portable pugmill plants.

Changing the culture of hauling:

- Incentivize technology adoption, better driver behavior, and limiting over-trucking.
- Develop training tools for dispatch/driver.
- Encouraging technology adoption by brokers and third parties, especially in truck-shortage states.
- Engage agencies to support flexible time-of-day scheduling, and evaluating policies that encourage local extraction/ production.

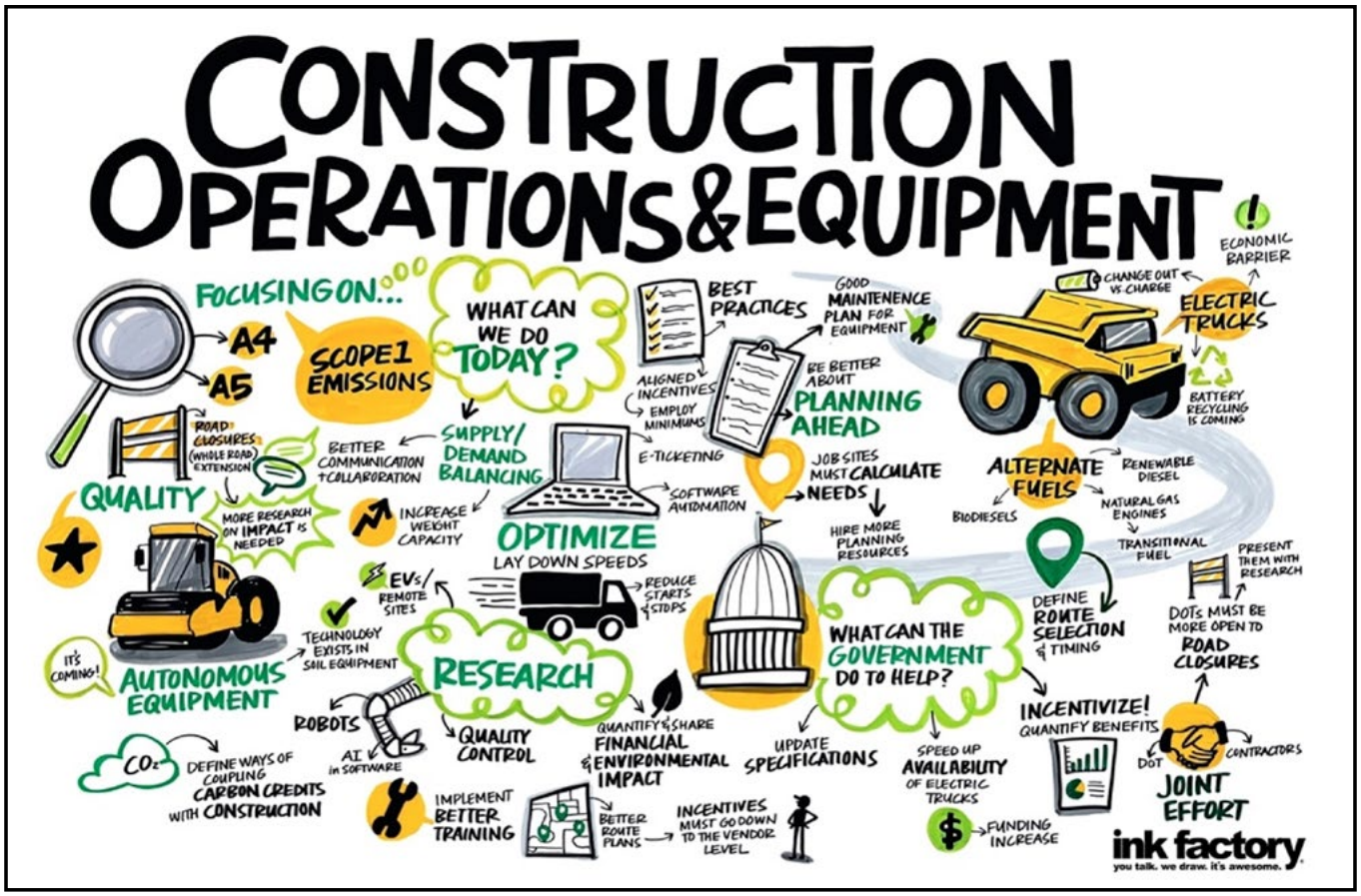
"Smart and energy efficient hauling"

"Embrace underutilized technology like Intelligent Compaction, Thermal Scanning, and other tools that improve efficiency and quality."

Research and Innovation:

- Investigating autonomous and electric trucks, as well as assessing the life cycle analysis (LCA) of alternative fuels like hydrogen and biofuels.
- Creating standards for including trucking impact data in environmental product declarations (EPDs).
- Building cost-effective portable asphalt plants, lightweight aggregates in mixes, and in-place recycling.

The discussion emphasized various strategies, innovations, and partnerships needed to drive sustainable practices in construction trucking and reduce emissions across the industry.



Construction Operations and Constructability

The discussion outlined various goals, strategies, and considerations related to reducing carbon emissions and enhancing efficiency in construction operations encompassing Scope 1 emissions for contractors. These strategies will impact the reduction of emissions through life cycle stages A4 and A5.

SCOPE 1 A4, A5 EMISSIONS REDUCTION

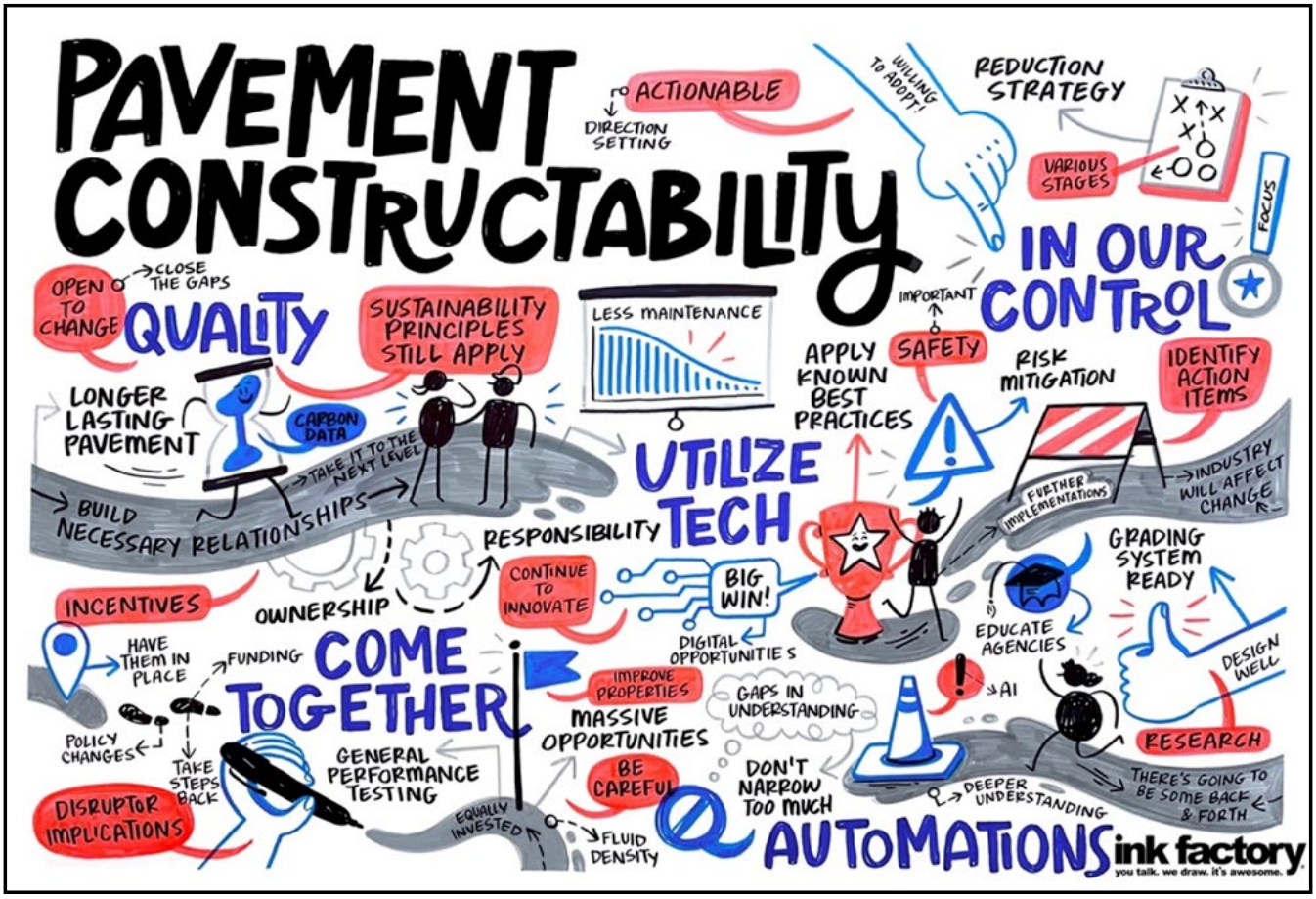
Adopting novel construction technologies emphasizing energy efficiency and automation gains:

- Increasing the viability of and incentives for electrification of construction equipment.
- Balancing supply and demand through better communication, route optimization, and coordination between field, plant, and logistics.
- Integrating autonomous equipment and optimizing construction operations using methods like intelligent compaction, ground-penetrating radar, drones and tools like BIM and digital contracts.
- Exploring alternative fuels and quantifying benefits through analysis.

Changing organizational processes in coordination with agencies to incentivize innovation:

- Enhancing education, accountability, planning, and incentive structures for more efficient practices.
- Collaborating with road owners on design- enhancement processes, involving incentive contracts and innovative project delivery methods.
- Incentivizing innovation by focusing on final product specifications over construction processes, including revisioning of specifications for specialized equipment and lift thickness requirements.
- Aligning road owner involvement in carbon reduction with legislative authority.

"Incentivize technology adoption and streamlining of specifications to allow for more innovation and higher quality."



Integrate sustainability into design and construction to improve constructability and construction quality:

- Changing the agency's approach to binder-modified mixes to focus on mix performance rather than recipe requirements.
- Transition to lower production temperatures while still achieving optimal density.
- Incentivizing the creation of longer-lasting pavements through proper joint construction, achieving density via intelligent compaction.
- Establishing industry values for embodied carbon and consensus-based protocols for performance-based testing.
- Ensuring worker health and safety through innovative approaches, reduced construction time, and cooperation between agencies and suppliers.

Research and Innovation:

- Exploring in-place recycling and autonomous construction techniques.
- Planning the transition to electric vehicles and integrating AI technologies for improved operations.
- Balancing thicker pavements' embodied carbon with enhanced structure and performance using fiber/plastics/warm mix technologies and RAP other recycled products, and performance/efficiency-enhancing additives.
- Exploring equipment automation or remote operation, including roller technology and loaders.

The discussion underscored various strategies for reducing emissions and enhancing sustainability in construction practices, while also emphasizing the need for collaboration, innovation, and research to achieve the stated goals.

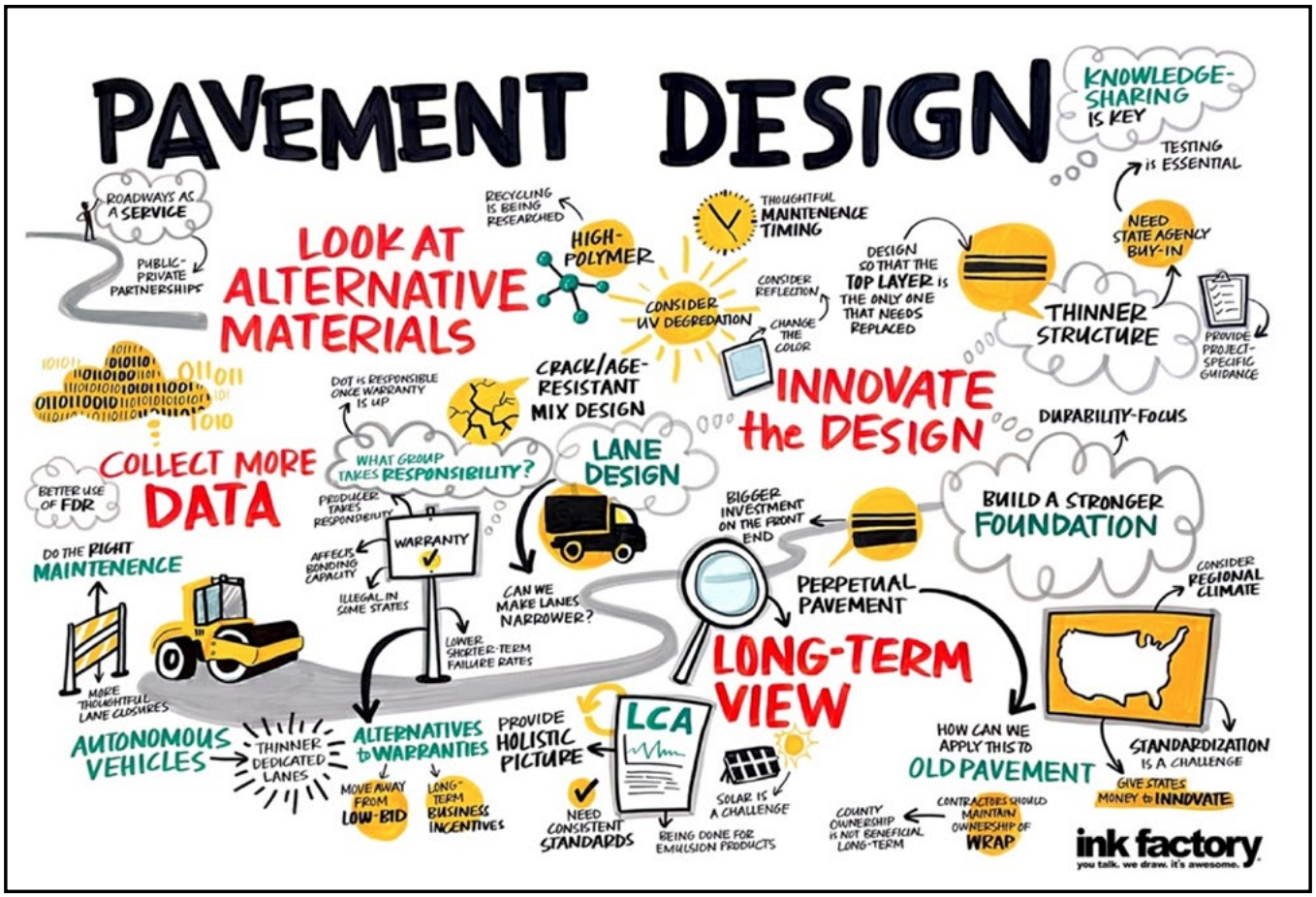
Industry Goal 2

Partner with customers to reduce emissions through pavement quality, durability, longevity, and efficiency standards by 2050.

Know the Customer: Partnering for Innovation

- Shifting the paradigm of relationships between industry and agencies.
  - Build a toolkit for industry to create partnerships with state/local agencies.
  - Engage with Leadership to create top-down pressure with an emphasis on outcomes.
  - Engage risk averse engineering culture at agencies: a stumbling block for innovation.
  - Align value proposition: affect agencies' long-term strategy by providing them tools to support the selection of programmatic priorities.
- Associate funding opportunities with sustainability policies that are needed to reduce emissions.
- Consider partnering with other trade associations and other NGOs such as:
  - Third Way, RMI, Building Transparency, Breakthrough Energy, Clearpath, etc.
  - ASTM, AASHTO, TRB: Let them help carry the message for us.

"An Innovation Insurance: How do we create financial instruments to reduce agency risk?"



- Support partners with guidelines and education resources.
- Engage partners in blue sky "What if" or "What would it take to" type of thinking.
- Invest in developing tools that help industry members while also furthering agency goals.

Partnering Through Design and Construction

The discussion emphasized the importance of considering future pavement design, different materials, and performance solutions. Specific goals and scopes discussed include thinner structures, in-place recycling, Comprehensive Condition Performance Review (CCPR), warranty systems, national standards for life cycle cost analysis (LCCA) and life cycle assessment (LCA), urban heat island concerns, design/build/operate strategies, carrying capacity in terms of emissions, and more.

"NAPA can amplify communication of the results of projects through case studies and other educational resources."

Pavement Design Priorities:

- Evaluate in-place recycling options, including bio-based, foam, and emulsion methods.
- Incorporate Cold Central Plant Recycling (CCPR) where surplus RAP is available.
- Investigate other adaptation measures to address urban heat island concerns.
- Incorporate embodied carbon metrics into federal pavement condition reporting.
- Assess integrated project delivery systems, especially with evolving mobility requirements and autonomous vehicles.
- Develop strategies, like adapting perpetual pavement concepts, for effective rehabilitation and reconstruction while Investigating technologies in roads, such as solar and piezo systems.
- Explore the importance of minimum lift thickness and the impact of heavier vehicles on pavement structure.

SCOPE 3 A1 Emissions Reduction

Maintenance and Rehabilitation Strategies:
The discussion highlighted various action items, topics requiring government or industry support, and areas needing further research and innovation related to pavement maintenance and improvement. Here's a summary of the key points:

SCOPE 3 B2-B5 Emissions Reduction

- Cold in place recycling/full depth reclamation to reduce environmental impact and promote carbon reduction.
- Better materials for pothole repair, including hydrophobic rejuvenators.
- Strategies to improve longevity, like base material design and base stabilization methods.
- Implementing value engineering principles.

Overall, the discussion addressed immediate action items, medium-term topics requiring support, and ongoing research areas to enhance pavement maintenance, sustainability, and innovation.

Improving Construction Quality Control Standards/Specifications:
Discussion emphasized on Goal 2, impact if any on downstream Scope 3 emissions (performance related, polymer modification).

SCOPE 3 A5 Emissions Reduction

- Move beyond pilot projects: Broaden acceptance of the performance of a pilot toward other municipalities, regions, and states (NAPA communications, marketing, AASHTO). Build into the pilot plan the idea that these can be used directly implemented once proven.
- Examine the desired service life: Do we want longer lasting pavements or do we build in obsolescence. Balance service life, environmental performance, and performance. Examine the paradigm. Impact of maintenance.
- Examine specifications for current technology: Are we designing pavements now with the technology of today in mind – tires, cars, aggregates, etc.

- Develop collaborative relationships: SAPAs and contractors work with state DOTs, and NAPA work with AASHTO to move the needle on greater acceptance of other state's pilot projects. Have the industry become managers of the infrastructure.
- Develop real-time QA/QC Reporting: Use equipment to scan the pavement and have all the quality information provided to you, immediately. Can we leverage existing technology used by the concrete industry (e.g., carbon capture and utilization technologies)?

Partnering through Policy:

Partnering to develop incentives around the implementation of Buy Clean Policies as follows:

- Create alternative procurement mechanisms that account for regional variability in conditions and availability of materials, specification-driven material requirements, and transport to the jobsite.
- Develop partnerships between industry and agencies to develop, pilot, refine, and implement policies, including industry support to agencies on pursuing low carbon procurement and taking advantage of available federal funding.
- Establish performance and GWP benchmarks during development of BMD specifications within the context of Buy Clean implementation and green public procurement.
- Investigate methods that ensure transparency and quality assurance to ensure contractor performance matches bids.
- Create open standards for data transfer protocols/chain-of-custody, as well as funding for partners such as Federal LCA Commons.


BUY CLEAN POLICIES/ INCENTIVES
INFORMED BY INDUSTRY
ENCOURAGE INNOVATION
ASAP
START WITH REVIEW
TURN INDUSTRY UPSIDE DOWN
ACCOUNT FOR VARIABILITIES
CONTRACTOR INVOLVEMENT EARLIER IN THE PROCESS
ALTERNATE PROCUREMENT METHODS
MANDATED
TOO LOOSE
BE AGGRESSIVE IN FINDING INCENTIVES
TRY NEW TECH
BE READY
OPEN STANDARDS
UNLOCK DATA
EDUCATING
PLAY THE SAME GAME
GOOD LANGUAGE
INFORM RIGHT PEOPLE
REBRAND FORMULA
PREPARED IN ADVANCE
UNDERSTANDS NUANCES OF OUR MATERIAL
FUNGIBLE
IMPORTANT
MOVE IN RIGHT DIRECTION
ACCESS FUNDING
FACTOR IN USAGE
WORK TOGETHER TO DEVELOP POLICIES
WORTH THE EFFORT
LOW CARBON ENVIRONMENT
UPSTREAM DATA
ADVOCATE
BALANCE
ALL OF NAPA ON BOARD
MAKE it EASY
HOLISTIC
UNDERSTAND IMPACT
THEY TRICKLE UPSTREAM
FACTOR IN VALUE IN EVERY PROJECT
BUILD INCENTIVES INTO PROCESS
WORK OUT THE DETAILS
AHEAD OF THE CURVE
WRITE THE ROADMAP
ink factory
you talk. we draw. it's awesome.

Develop a net zero materials supply chain by 2050.

Supplier partnerships and net zero commitments are critical for the industry to achieve net zero carbon emissions. What the industry asks of and gets from its suppliers counts toward its own net zero goal.

The discussion outlined various goals, strategies, and considerations related to reducing carbon emissions through innovations in pavement materials for contractors. These strategies will reduce Scope 1 emissions for asphalt plants with reductions through life cycle stages A1 for asphalt mixtures. In the case of additive and binders, the emissions reductions could be considered Scope 3 for the asphalt plants.

Encouraging project delivery systems and contracting methods that incentivize use of innovative construction materials, and control associated risks:

LIFE CYCLE STAGE A1 Emissions Reduction

- Move towards performance specifications that allow for innovation including a shift from low bid to performance-based systems.
- Incentives/credits for using recycled or low carbon materials/processes with a holistic view beyond embodied carbon.
- Integrate carbon into the bid and inspection processes, including consideration of potential carbon taxes.

- Develop iterative risk mitigation strategies for agencies and contractors that allow for continuous improvement, including transitioning to warranties and/or risk-reduction mechanisms such as Extended Producer Responsibility (EPR), for agencies to adopt recycled materials.

Support for material suppliers in assessing GWP for their materials:

- Develop requirements for material suppliers to provide data into the Emarald Eco Label Tool.
- Creating guidance for suppliers to input LCA data into EPD software.
- Create collaboration among consultants and agencies for developing training and developing example specifications.
- Publish white papers on "failures" to share valuable lessons learned.

"Collaborate and partner to develop a flexible pavement vision, that focuses on mix design, and innovations in low-carbon materials to enhance performance."

Research and Innovation:

- Investigate novel low carbon, high performing materials that use regionally available aggregates, potentially synthetic aggregates, and bio binders. Examples of innovative materials are Graphene, Nano clay, Steel fibers, Natural fibers, Basalt fibers, Phase Change Materials, Enzyme-based, Microbial Metabolic Products.
- Establish methods for incorporating climate change and the impact of low carbon materials in pavement performance modeling.
- Develop field quality control guidelines and acceptance testing methods for using recycled and novel materials.
- Investigate bidding system and project delivery systems to integrate low carbon considerations.
- Addressing agency risk tolerance and its impact on innovation.

Balanced Mix Design

The discussion highlighted the need for changes in agency approaches, improved collaboration, and research to achieve sustainability goals in asphalt production, incorporating alternative materials, and addressing emissions considerations.

Priorities for supporting the development of Balanced Mix Design:

- Implementing BMD for in-place recycling and other additives.
- Integrating sustainability and carbon considerations into BMD particularly in approach D.

"BMD (type C or D) by 2030 to support use of more advanced material technologies that get us on a glide slope to net zero by 2050."

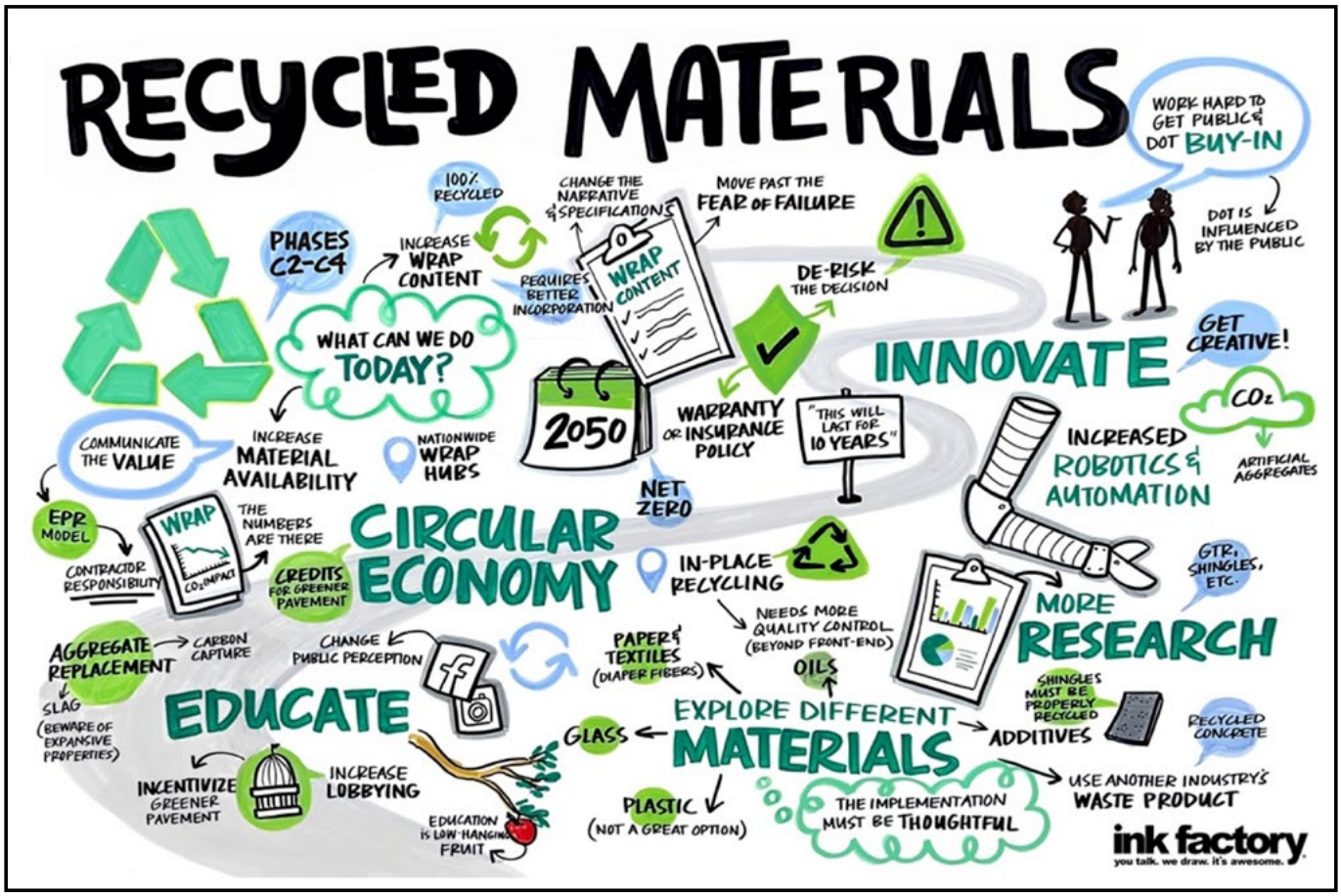
Recycled Materials

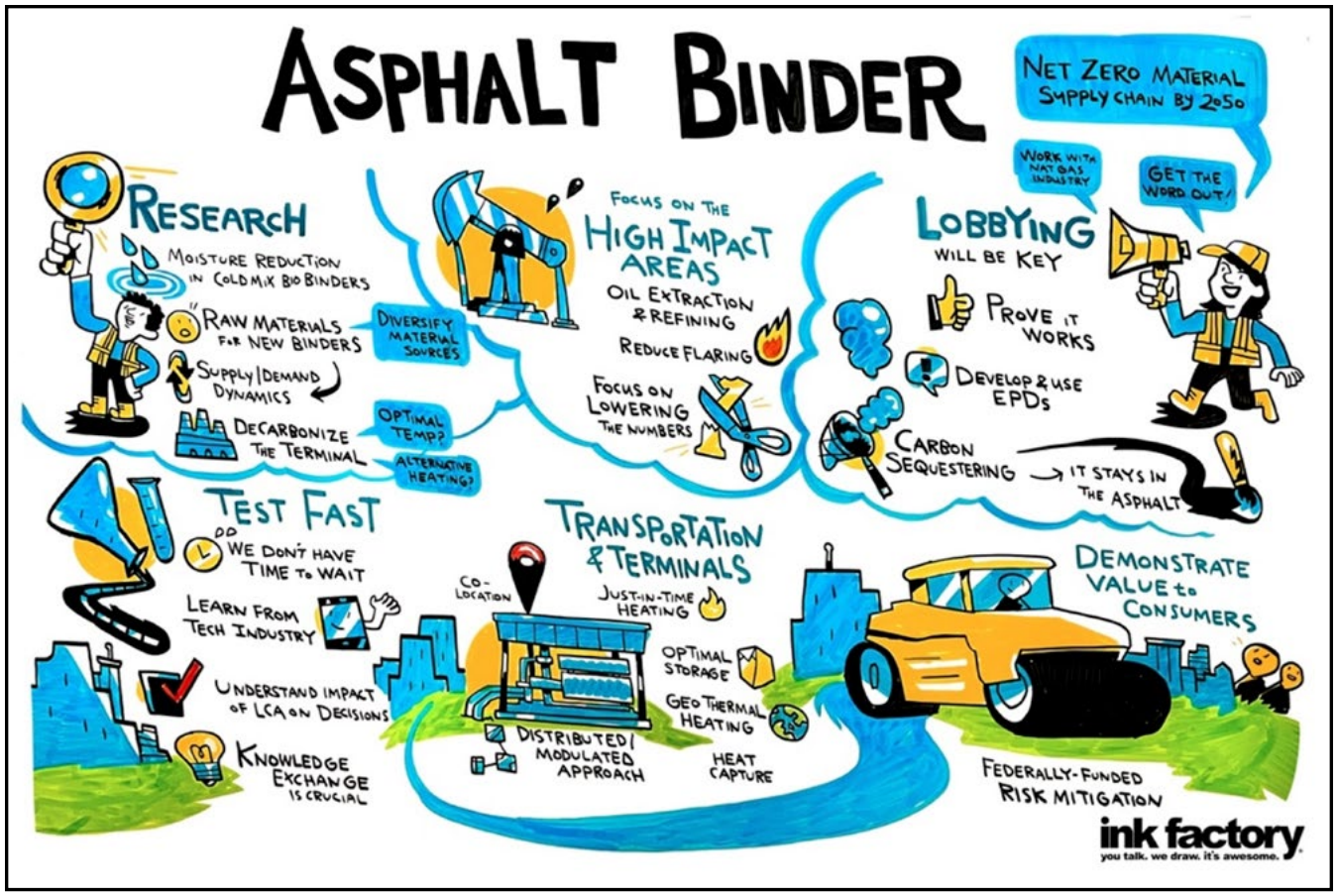
The discussion highlighted strategies for achieving Net Zero emissions by 2050 in recycling and incorporating reclaimed asphalt pavement (RAP) in construction. Here are the key points:

LIFE CYCLE STAGE
C2-C4
Emissions Reduction

Priorities for supporting the development of Balanced Mix Design:

- Responsible increase in RAP content with a performance- based approach including optimization and effective use of RAP in construction.
- Develop a consensus on performance tests for recycled materials.
- Upgrading plant equipment to accommodate recycling.
- Enhancing in-place recycling and cold central plant processes including use of alternative emulsions for cold mix.
- Design pavements with future recycling in mind including exploring options for aggregate replacement.





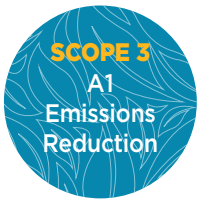
The discussion underscored the importance of responsible RAP utilization, stakeholder engagement, policy changes, and ongoing research to achieve sustainable and environmentally friendly practices in asphalt construction.

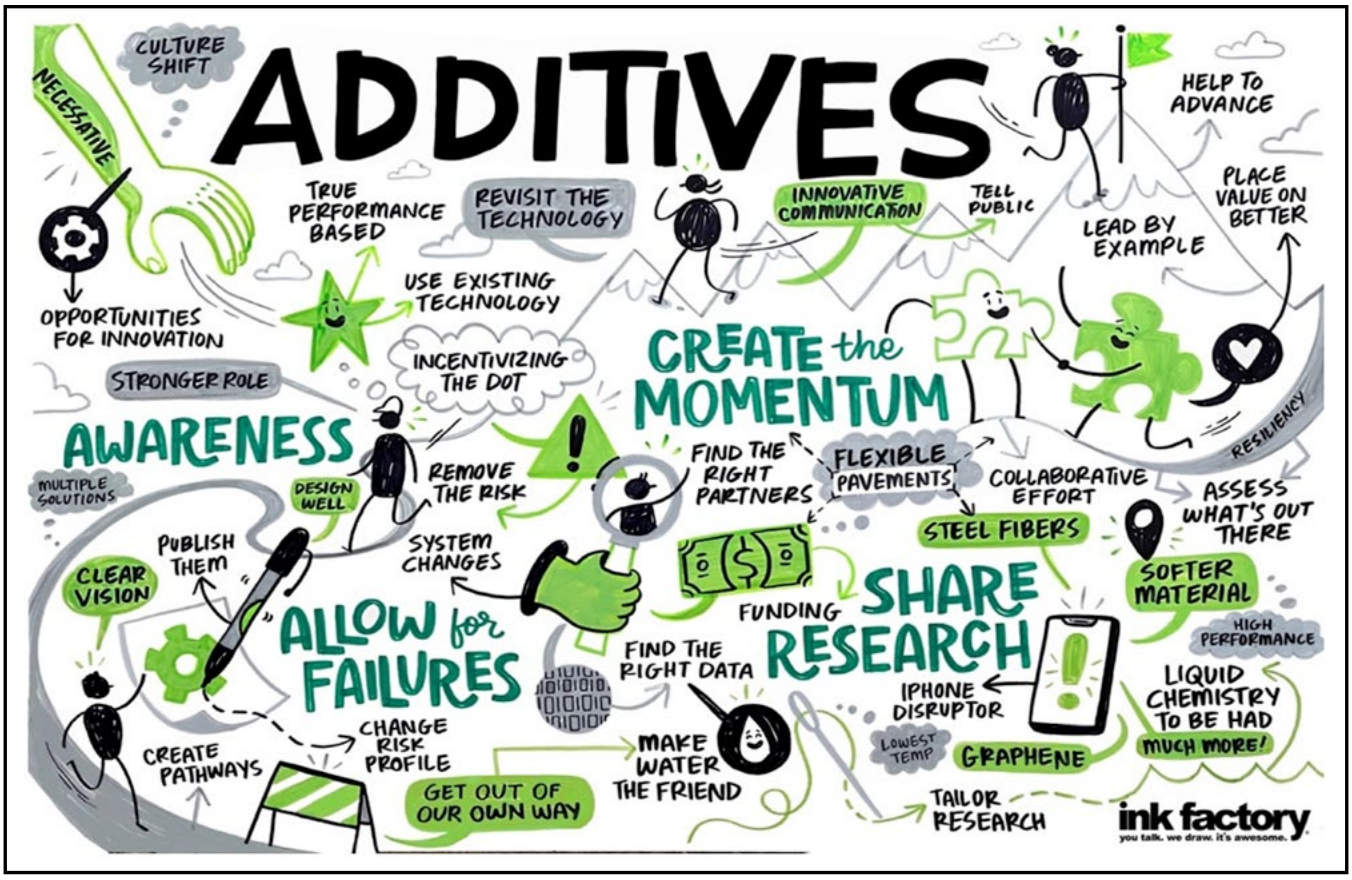
Asphalt Binder

The discussion highlighted various strategies and considerations for achieving sustainable practices and reducing carbon emissions in the asphalt industry across different timeframes.

Priorities for transitioning to low carbon binders:

- Assess and reduce embodied carbon of asphalt binders by developing EPDs for asphalt binders, and other strategies such as:
  - Optimizing terminal energy efficiency, including efficient storage, and encouraging use of alternative energies like solar, geothermal and landfill gas (LFG) for heating.
  - Underground storage of asphalt binder to enhance terminal energy efficiency.
  - Just-in-time heating of asphalt binder at terminals.
  - Develop distributed, lower-emission modular refineries producing asphalt binder.
  - Explore concepts like pelletized asphalt for cold storage.
- Collaborate with the natural gas industry to reduce upstream impacts of extraction and transportation.
- Assess the use of consequential life cycle assessment (LCA) and avoided burden methods to aid with carbon accounting.
- Explore carbon capture and sequestration during crude extraction (oil sands).





Conduct research into increasing the use and availability of biobased binders:

- Establish terminology and classifications for biobased binders, including additives/extenders.
- Study methods to reduce moisture content of biobased bio-binders for cold mix production.
- Analyze global supply/demand dynamics of feedstocks for biobased binder alternatives.
- Assess specifications for alternative binders and develop test methods to ensure performance.
- Understand the carbon footprint of alternative binders and binder extenders.

The discussion emphasized a comprehensive approach to achieving sustainability in the asphalt industry, encompassing technology, education, policy changes, and research across various timeframes.

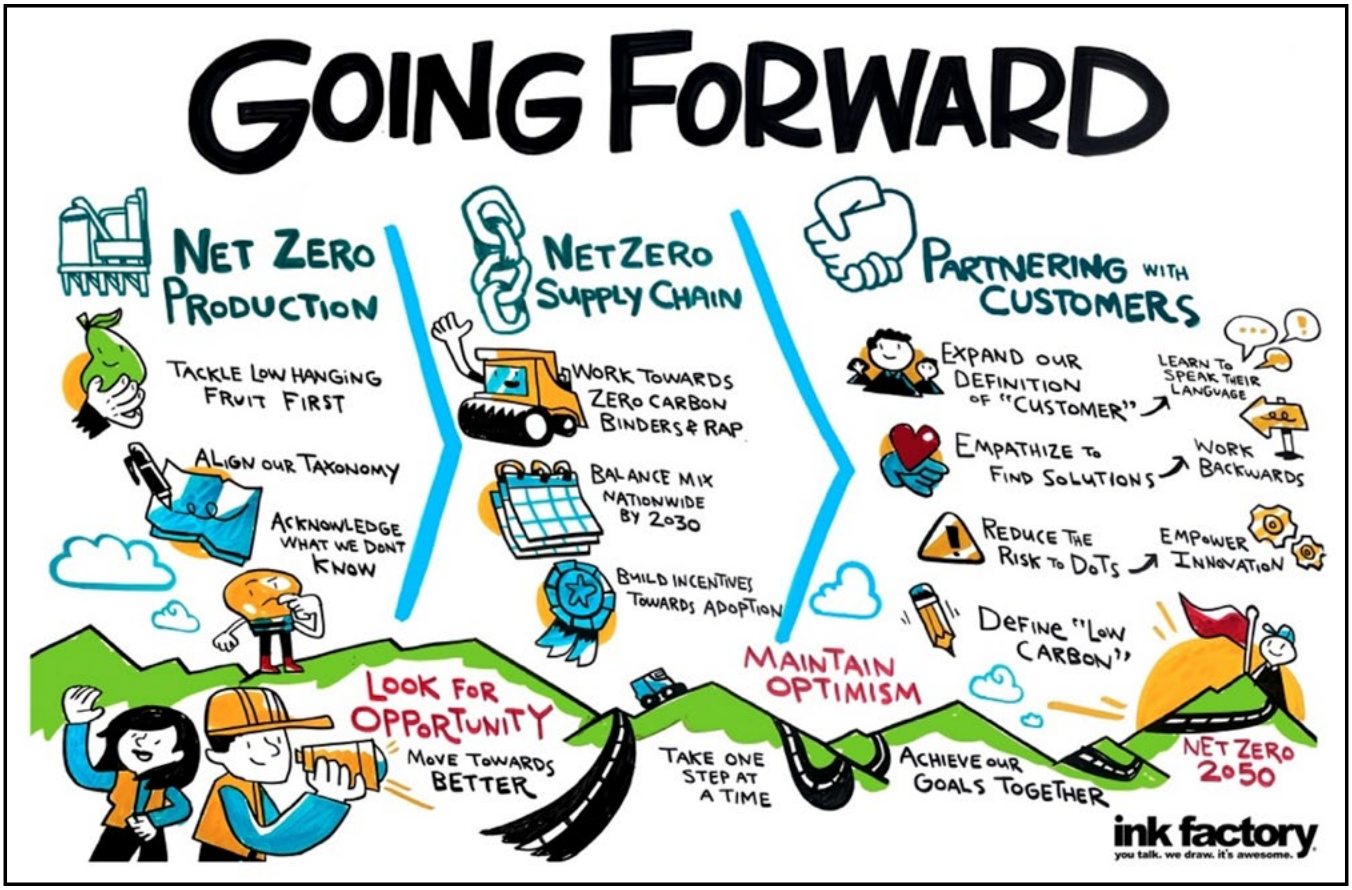
Additives

The discussion focused on discussions related to Goal 3 of reducing upstream Scope 3 emissions in the asphalt industry. It outlines various action items and strategies to achieve net zero emissions within the field.

Priorities for transitioning to additives which reduce the life cycle carbon impacts of asphalt pavements:

SCOPE 3 A1 Emissions Reduction

- Incorporating sustainability into the AASHTO NETPEP/PEAS program for evaluating additive products.
- Improve market penetration and active adoption of existing technologies like High RAP (Rejuvenators, Recycling Agents), and Warm Mix Asphalt.
- Emphasize long-term performance related benefits of using various additives.
- Foster a culture shift within the industry to lower production temperatures, leveraging contractor champions.
- Encourage public- private partnerships and design-build approaches.



The above diagram summarizes the overall discussions in the concluding session on July 13 at Kansas City.

In addition, upon analysis of the discussions a common theme that emerged from multiple breakout sessions was the need to develop a *Culture of Innovation.*

The road to Net Zero is directly aligned with incentivizing and encouraging innovation in the asphalt industry, including but not limited to adopting integrated project delivery methods, moving towards best value rather than low-bid procurement, and working with owners to allow for performance-based specifications. "Insurance instruments" may be necessary for managing risks associated with innovation, accompanied by documentation of methods that do not deliver as expected. Innovation works at its best when a new path forward is synthesized from lessons learned. Most importantly, innovation does not happen in a vacuum. Indeed, a culture of innovation by leveraging solutions that work while fostering strong partnerships with stakeholders, and communicating with customers.

RECOMMENDED NEXT STEPS

Distill identified priorities into industry initiatives with well-defined short-term and long-term objectives.

Fund a research program that furthers the innovation agenda across public procurement, production methods and the supply chain.

Create a collaborative industry representative group that shepherds progress on The Road Forward.