



The Road
ForWard

**REFLECTING
ON THE FIRST
THREE YEARS**

(2022-2024)



In November 2020, the Board of Directors commissioned the formation of the Climate Stewardship Task Force, setting the stage for the development of The Road Forward: A Vision for Net Zero Carbon Emissions for the Asphalt Pavement Industry in 2021. The Road Forward (TRF) program officially launched at NAPA's 2022 Annual Meeting in Scottsdale, Ariz., with a rousing presentation by NAPA's Vice President for Engineering, Research, & Technology, J. Richard Willis, Ph.D. This report encapsulates progress and outcomes of the program's first three years and outlines forthcoming developments.

TRF OVERVIEW



MISSION

Engage, educate, and empower the U.S. asphalt community to produce and construct net zero carbon emission asphalt pavements.



VISION

Sustainable communities and commerce, connected by net zero carbon emission asphalt pavements.

The Road Forward is comprised of four industry goals. For complete details, see AsphaltPavement.org/Forward.



- 1 Achieve net zero carbon emissions during asphalt production and construction by 2050. (Scope 1 Emissions)
- 2 Partner with customers to reduce emissions through pavement quality, durability, longevity, and efficiency standards by 2050. (Downstream Scope 3 Emissions)
- 3 Develop a net zero materials supply chain by 2050. (Upstream Scope 3 Emissions)
- 4 Transition to electricity from renewable energy providers in support of net zero carbon electricity generation by 2050 and reduce electrical intensities. (Scope 2 Emissions)



19
tactics

78
abstracts
submitted to
#NAPADecarb

4
industry
goals

38

21
Climate
Stewardship
Task Force
members

57
glossary
terms



30
abstracts
submitted to the
2024 Perpetual
Pavement
Conference

1
federally accepted
EPD
benchmark

1
unifying
mission
and vision

The Road
Forward
A Snapshot
2022-2024



zero
our net carbon
emissions goal



5
deliverables
designed to launch
the initiative in
January 2022

47+
articles
published

11
podcast
episodes

21
research
publications

6+
external
meetings

16
webinars

51+
sessions

5+
ENERGY STAR®
activities



FIRST
official
The Road Forward
Sabbatical
participant



Jo Sias

9
research
partners

7+
events

500
hours
the Task Force's
commitment to
develop The Road
Forward



To share the background, purpose, and goals of the TRF program, NAPA built and distributed:

- › A climate website, where ongoing events and research are posted: AsphaltPavement.org/Forward

- › An inspirational video
- › An easy card game to facilitate picking up new vocabulary: Sequestered (The definitions were also shared in NAPA's e-newsletter throughout 2022 and 2023.)
- › A detailed brochure
- › A PowerPoint deck for State Asphalt Pavement Associations



To help fund the program, including numerous anticipated deliverables over two decades, NAPA developed a Partner program in collaboration with NAPA members. TRF Partners are asked to contribute \$10,000 annually, for which they receive various benefits and recognition. Peckham Industries, Inc., and Cargill Asphalt Solutions signed on as inaugural Partners, building momentum and support for the program, resulting in 24 Partners in the program's first year. By the end of its third year, the program was supported by 36 Partners. Current and previous TRF Partners are listed at the end of this report.

THE PARTNER PROGRAM IS UPDATED AND RELEASED ANNUALLY, COINCIDING WITH NAPA'S ANNUAL MEETING. FOR CURRENT DETAILS, SEE THE WEBSITE.

SUMMARY OF DELIVERABLES, YEARS 1-3

Events

Strategic Exercises

In response to evolving environmental mandates and industry claims, NAPA initiated two activities: Carbon Reduction Planning Workshop and Stakeholder Mapping.

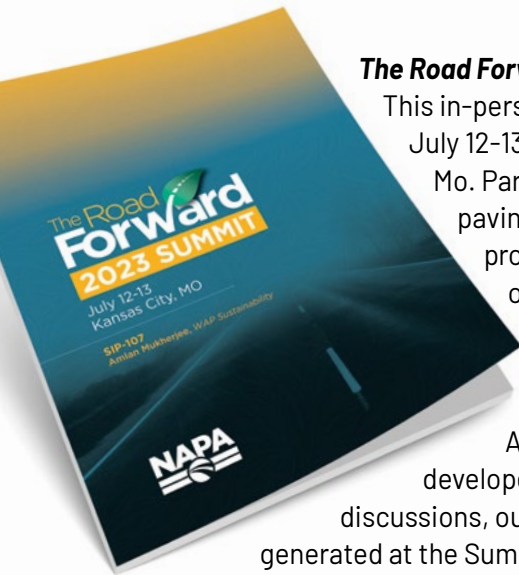
The workshop took place over two days in May 2022 in Baltimore. An environmentally focused Team Green alongside industry-focused Team Asphalt, each comprised of 10 participants, debated and challenged norms. The exercise was facilitated by Solutions 21, resulting in three strategic initiatives:

uniting the industry, fostering innovation, and gaining public support.

Stakeholder Mapping, conducted with public relations firm Golin, identified strategic partners such as mayors and the EPA to inform NAPA's net zero objectives. The outcomes were intended to guide future engagements and strategies to bolster asphalt's role in climate stewardship.

Low Carbon Asphalt Workshop

In February 2023, NAPA hosted a workshop at its headquarters for members, FHWA, and EPA to discuss how to define "low embodied carbon asphalt." NAPA engaged the group in conversations on moving forward where geographic nuances and specification restrictions are considered in efforts to label low carbon construction materials, then developed a set of initial activities and a strategy to continue agency engagement.



The Road Forward Summit

This in-person event took place July 12-13, 2023, in Kansas City, Mo. Participants included paving contractors, asphalt producers, representatives of various upstream material suppliers, as well as FHWA and EPA representatives.

A report (SIP-107) was developed to capture the discussions, outcomes, and next steps generated at the Summit.

Perpetual Pavement Conference

In 2021, the Climate Stewardship Task Force requested that NAPA bring this conference back as a part of our plan to achieve net zero. Following a call for abstracts in 2023, the conference convened in Louisville, Ky., October 28-30, 2024, featuring 25 papers, two workshops, and two general sessions, with roughly 100 people attending.

Partner Meetings

NAPA convened in-person meetings of TRF Partners at its 2023 and 2024 Annual Meetings, along with periodic virtual meetings. These events allowed Partners to network, update others on their climate progress, ask questions, provide feedback on the program, and get an inside view of achievements and forthcoming activities.

Related Sessions

- ▶ Megatrends & the New Path to Profit: How Smart Companies Use Sustainability to Create Value (2022 Annual Meeting)
- ▶ Black, Green, & Gold: Exploring Climate Incentives & Initiatives (2022 Annual Meeting)
- ▶ EPDs & Embodied Carbon: A Deep Dive into Policy Considerations (2022 Annual Meeting)
- ▶ The Road Forward (2022 Asphalt Pavement Association of Oregon Meeting)
- ▶ EPDs (2022 Greater Iowa Asphalt Conference)
- ▶ The Road Forward (2022 NY Construction Materials Asphalt Paving Conference)
- ▶ The Road Forward & EPDs (2022 PAPA Environmental Workshop)
- ▶ The Road Forward & EPDs (2022 Virginia Asphalt Association Annual Convention)
- ▶ The Road Forward (2022 South Carolina Asphalt Pavement Association Annual Meeting)
- ▶ Buy Clean Procurement: An Opportunity to Grow Your Asphalt Pavement Market (2022 Midyear Meeting)
- ▶ Asphalt Recycling (2022 Asphalt Pavement & Materials Technical Feedback Group)
- ▶ EPDs (2022 Wisconsin Asphalt Pavement Association Annual Meeting)



- › The Road Forward (2022 Minnesota Asphalt Pavement Association Annual Meeting)
- › The Road Forward & Buy Clean (2022 Asphalt Pavement Association of Iowa Annual Meeting)
- › The Road Forward & Buy Clean (2022 Kansas Asphalt Pavement Association Annual Meeting)
- › Numerous presentations (2023 TRB Annual Conference)
- › Optimizing Operations to Reduce Emissions & Save Money (2023 Annual Meeting)
- › The New Frontier: Evaluating Asphalt's Competitive Advantage in a Sustainable World (2023 Annual Meeting)
- › Preparing for New Sustainable Bidding & Job Requirements (2023 Annual Meeting)
- › EPDs: Everything You Wanted to Know about Environmental Product Declarations (2023 CONEXPO-CON/AGG)
- › Building a Better Benchmark (2023 Midyear Meeting)
- › Sustainability Panel and EPD Update (2023 Nevada Asphalt Conference)
- › Trends in the Asphalt Industry (2023 AASHTO Tech Exchange conference)
- › The Road Forward, EPDs, and Buy Clean (2023 Ohio Asphalt Expo)
- › EPDs & Buy Clean (2023 Illinois Asphalt Pavement Association Annual Convention)
- › The Road Forward & Buy Clean (2023 TXAPA Sustainability Workshop)
- › Low Carbon Asphalt Poster Session (2023 ASCE Transportation & Development Institute Pavements Conference)
- › Three presentations at Highways USA 2023: Future of EPDs; Sustainable Attributes of Paving Materials; Triple Bottom Line
- › The Road Forward Update (2023 Wisconsin Asphalt Pavement Association Annual Meeting)
- › The Road Forward Update (2023 Asphalt Pavement Association of Iowa Annual Meeting)
- › EPD Workshop (2023 Urbana-Champaign for the Illinois Bituminous Paving Conference)
- › US Road Industry's Environmental Approach (2023 Bitume Quebec Technical Meeting)
- › Numerous presentations (2024 TRB Annual Conference)
- › The Next Steps: Preparing Your Company for a Sustainable Future (2024 Annual Meeting)
- › How Carbon Already Impacts Procurement (2024 Annual Meeting)
- › EPDs, Emerald Eco-Label, and Buy Clean (2024 Ontario Road Builders Association Annual Meeting)
- › The Road Forward (The Future of Roads 2024)
- › Going Gr\$\$n (2024 Asphalt Pavement Association of Michigan Annual Meeting)
- › Colorado EPD Benchmarking Workshop (March 2024)
- › 9 sessions in the People, Plants & Paving Conference at 2024 World of Asphalt including Developing a Sustainability Program That Works for Your Company and Optimizing the Use of RAP: Challenges and Effective Strategies
- › EPDs 101 (2024 Alabama Asphalt Pavement Conference)
- › Low Carbon / Buy Clean Procurement (2024 PAPA Environmental Seminar)
- › FHWA Climate Challenge Program Workshop (June 2024)
- › From RAP to WMA: New York's Drive Toward Sustainable Roads (2024 Midyear Meeting)
- › EPDs: The Next Steps (2024 Midyear Meeting)
- › Green Asphalt Lab & Plant Tour (2024 Midyear Meeting)
- › Industry Perspectives on EPDs & Buy Clean Policies (2024 AASHTO Committee on Materials and Pavements)
- › EPD Drivers and Policy Issues (2024 North Eastern States' Materials Engineers Association Meeting)
- › EPD Update (2024 North Central Asphalt User/Producer Group Meeting)
- › The Road Forward (Ontario Asphalt Pavement Council's 2024 Fall Asphalt Seminar)
- › Rethinking Sustainability (2024 Illinois Bituminous Conference)



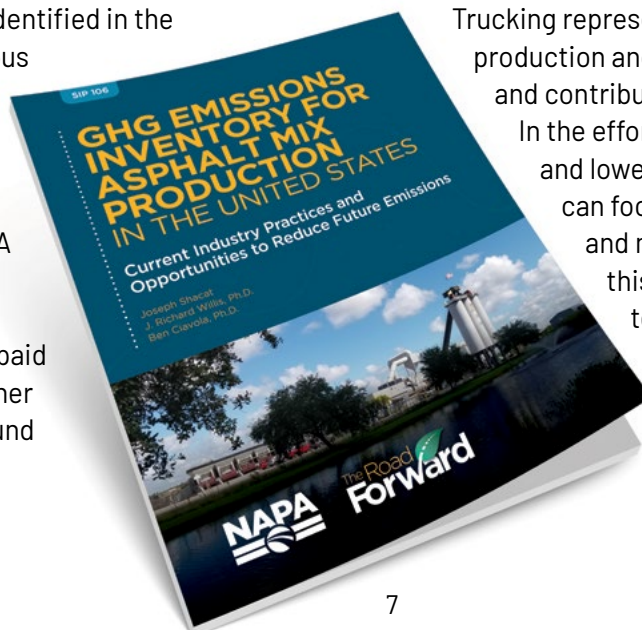


Other Meeting Attendance

- › 2022 UNR/ARA/FHWA Carbon Reduction for Asphalt Pavements Workshop
- › 2022 MNDOT Aggregate & Concrete EPDs
- › 2023 American Center for Life Cycle Assessment Annual Meeting
- › 2024 Minnesota Road Forward Workshop
- › 2024 American Center for Life Cycle Assessment Annual Conference
- › 2024 Sustainability Leadership Forum All Cities Summit

Published Research

TRF publications are designed to fill knowledge and implementation gaps identified in the industry goals. Numerous publications have already been developed or are in development, relying on expertise from NAPA staff and members along with academia, industry partners, and paid contributors. TRF Partner contributions help to fund this work.



GHG Emissions Inventory for Asphalt Mix Production in the United States (SIP-106, June 2022)

This first-of-its-kind report documents the asphalt pavement's contribution to GHG emissions nationwide, including avoided emissions achieved with current technologies, along with comparisons to related sectors and research needed to continue reducing emissions.

Readily Implementable Technologies (August 2022)

A searchable, sortable collection of nearly four dozen existing resources to begin implementing environmentally friendly practices, optimizing your operations, and addressing your bottom line.

Efficient Trucking (October 2022)

Trucking represents a significant cost in the production and placement of asphalt mixtures and contributes to greenhouse gas emissions. In the effort to optimize trucking operations and lower emissions, asphalt producers can focus on planning, scheduling, and management/execution. Download this report to find strategies and techniques within each of these areas, along with a Tactical Checklist to complete a self-audit and find opportunities to increase efficiency.

Electric Heated Tank Farm (Operational Tips Series, 2022)

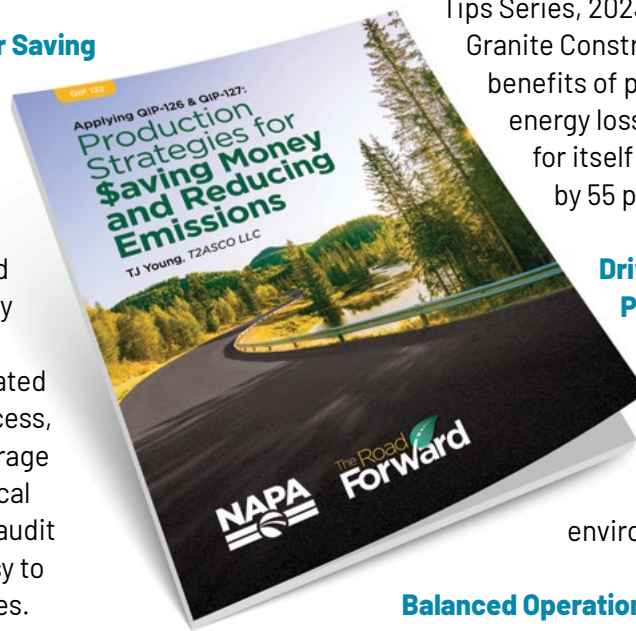
Learn how an electric asphalt tank farm, an existing technology, was leveraged by Orlando Paving Co. to reduce carbon emissions by 99.5% and save 16.5% on energy usage.

Paving Under Stockpiles Pays Off Environmentally & Economically (Operational Tips Series, 2022)

This case study shows how paving under stockpiles can reduce aggregate moisture and therefore reduce fuel consumption. Read how they did it at Michigan Paving & Materials, A CRH Co.

Production Strategies for Saving Money and Reducing Emissions (QIP-132, August 2023)

QIP-132 aims to help mix plant operators apply learnings from QIP-126 and QIP-127 to conserve energy and reduce costs. Details specific opportunities related to the drying/heating process, maintaining adequate storage temperatures, and electrical energy use. Includes self-audit worksheets to make it easy to evaluate individual facilities.



Benefits of Prioritizing RAP (November 2023)

This document underscores the economic, environmental, and performance advantages of prioritizing Reclaimed Asphalt Pavement (RAP) in asphalt mixture production. Road owners can achieve substantial cost savings, reduce environmental impact, and enhance pavement performance by embracing RAP, according to the comprehensive findings. The asphalt pavement industry is urged to prioritize RAP utilization for sustainable resource management, reduced emissions, and long-term cost efficiencies.

Using EPDs to Inform Decisions and Modernize Operations (Operational Tips Series, 2023) Green Asphalt LLC in Long Island City, NY, used NAPA's verified Environmental Product Declaration (EPD) tool to quantify the environmental impact of their asphalt mixtures.

The tool helps Green Asphalt make data-driven decisions, modernize operations, and provide better information to tell their story.

Using Liquefied Natural Gas to Lower Fuel Costs (Operational Tips Series, 2023)

E.T. Simonds Materials Co. and Kinetrex Energy partnered to reduce delivered fuel prices, obtain cleaner fuel, and reduce operational and maintenance costs with Liquefied Natural Gas (LNG).

Insulating to Prevent Loss of Thermal Energy, Reduce Fuel Use and Reduce Costs (Operational Tips Series, 2023)

Granite Construction Co. shares its data on the benefits of pipe insulation to minimize thermal energy loss – within one year the project paid for itself by reducing energy consumption by 55 percent.

Driving Sustainability with Key Performance Indicators (KPIs) in the Asphalt Industry (Plant Efficiency Series, January 2024)

The use of KPIs is increasingly hailed as an effective way to measure and manage environmental performance.

Balanced Operations: Strategies for Seamless Collaboration Between Paving Crews and Asphalt Plants (Plant Efficiency Series, January 2024)

This paper delves into potential strategies that can enhance collaboration, leading to operational efficiencies in asphalt manufacturing plants.

5 Benefits of Asphalt Pavement Milling (February 2024)

Milling is a fundamental practice in the maintenance and rehabilitation of asphalt pavements. This paper explores the multifaceted benefits of milling, highlighting its role in restoring pavement geometry, facilitating material recycling, removing deteriorated materials, aiding in surface preparation, and preserving existing infrastructure. By exploring each benefit, this paper illustrates the significance of milling as an essential component of modern pavement management strategies.

The Carbon Footprint of Asphalt Pavements: A Reference Document for Decarbonization

(SIP-109, March 2024)

In this follow-up to the GHG Emissions Inventory, NAPA is taking proactive steps to provide a roadmap for the industry and agencies to leverage unprecedented levels of federal funding in IIJA, IRA, and other federal programs to reduce greenhouse gas (GHG) emissions. It details specific actions individual companies and agencies can take to reduce GHG emissions – making it useful to pavement engineers, asphalt mix producers, paving contractors, policy makers, and other stakeholders with an interest in reducing embodied carbon emissions associated with asphalt pavements.

Agencies & Contractors Surveys on Barriers to Higher RAP Usage in Asphalt Mixtures (SR-229, June 2024) and **Agencies & Contractors Surveys on Barriers to Reduce the Production Temperatures of Asphalt Mixtures** (SR-230, June 2024)

In this pair of reports, we examine what agencies and contractors say are barriers to increasing usage of reclaimed asphalt pavement (RAP) and warm-mix asphalt (WMA) technologies. Based on surveys conducted in 2023.

Sustainability and Resilience (Climate-Conscious Pavement Design Series, June 2024)

Sustainability and resilience are concepts that are increasingly at the forefront of the planning, design, construction, and management of transportation infrastructure in general and pavements in particular. The two terms are often used interchangeably, yet they are distinctly different concepts.



Resilience of Perpetual Pavements (Climate-Conscious Pavement Design Series, June 2024)

Perpetual pavements are well known for sustainability benefits, but did you know that they also provide substantial benefits with respect to resilience?

Climate Adaptable Materials for Resilient Infrastructure (Climate-Conscious Pavement Design Series, June 2024)

Climate change is increasingly becoming a primary concern in the design, construction, operation, and maintenance of transportation infrastructure. New approaches, techniques, and tools are needed to address the challenges posed by climate change to increase the resilience of our infrastructure to both gradual changes and extreme events.

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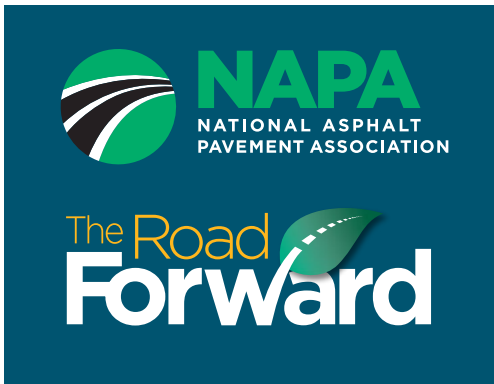
Climate change is increasingly becoming a primary concern in the design, construction, operation, and maintenance of transportation infrastructure. New approaches, techniques, and tools are needed to address the challenges posed by climate change to increase the resilience of our infrastructure to both gradual changes and extreme events.

Asphalt Mix Temperature Categories (SUST-008, September 2024)

This document is intended to be used as a communication tool. It categorizes average target production temperatures as a defining characteristic of the product from an asphalt plant. The ranges were developed to more effectively communicate industry efforts to reduce temperatures and implement technologies that allow asphalt plants to operate at lower temperatures and thereby reduce emissions.

A Network-Level Pavement Life Cycle Assessment Framework for Project Selection and Prioritization in Pavement Management Systems (SIP-110, September 2024)

Transportation is the largest U.S. greenhouse gas (GHG) emitter. This project develops a framework for state agencies to integrate GHG emissions into pavement management. Improving pavement smoothness can reduce emissions, extend vehicle life, and qualify for federal grants, with examples from California and Virginia demonstrating its application.



The Road to Zero Webinar Series: Making Sense (and Cents) of Climate Stewardship

This webinar series educates industry stakeholders on aspects of The Road Forward, the necessary investments to achieve net zero carbon emissions, and what we're learning as we travel the road together.

An Introduction to The Road Forward (May 2, 2022)

In January 2022, NAPA announced an industry vision for achieving net zero carbon emissions by 2050. This webinar introduces participants to the basics of net zero and provides insights into the industry plan for achieving this ambitious goal.

The Results Are In: NAPA & FHWA's Recycled Materials & Warm Mix Survey (May 25, 2022)

Since 2009, NAPA and FHWA have been collecting data on the use of recycled materials and warm-mix asphalt (WMA) technologies in the asphalt pavement industry. This webinar provides the latest data on the use of materials such as reclaimed asphalt pavement (RAP), recycled asphalt shingles (RAS), WMA, and more.

An Introduction to LCCA & LCA: The Tools of the Trade for Life Cycle Thinking (June 6, 2022)

Life cycle thinking provides a framework for understanding the economic and environmental aspects of a product over its complete life cycle. The pavement community commonly uses life cycle cost analysis (LCCA) to understand agency costs and user costs throughout the entire life cycle of a pavement. Agencies and other stakeholders are also starting to use life cycle assessments (LCAs) to quantify the potential environmental impacts of pavement designs at both an individual project

level and a network level. This webinar provides an overview of LCCA and LCA, with a focus on how these tools are applied to pavements to aid decision-making.

Quantifying GHG Emissions for the Asphalt Paving Industry (July 26, 2022)

Increasingly, paving contractors are being asked by stakeholders to quantify the greenhouse gas (GHG) emissions associated with their operations. This may come in the form of demand from shareholders for corporate GHG emissions reporting, customer requirements for environmental product declarations, or internal initiatives for process improvement to achieve emission reduction goals. Various tools exist that allow organizations to quantify GHG emissions, each of which has its own methodology, scope, and system boundaries. This webinar explores the various tools and approaches that organizations use to quantify GHG emissions associated with asphalt pavements, ranging from direct emissions associated with operations to cradle-to-grave life cycle assessments (LCAs).

The Low Hanging Fruit: Readily Available Technologies and Practices to Reduce GHG Emissions (August 18, 2022)

The previous webinar in NAPA's Road to Zero series focused on ways to quantify GHG emissions. But with an ambitious goal of achieving net zero GHG emissions by 2050, lots of folks in the asphalt pavement community want to know what they can do now to reduce GHG emissions. The good news is that there are numerous opportunities to optimize asphalt pavement materials, mix production practices, paving operations, and pavement design. This webinar explores the readily available technologies and practices that can be used to reduce GHG emissions.

GHG Emissions Inventory for the U.S. Asphalt Mix Production Industry (September 22, 2022)

In July 2022, NAPA published the first national assessment of GHG emissions associated with asphalt mixture production in the United States. This webinar takes a deep dive into the details of the emissions inventory report. We explore the methodology and the underlying datasets that were used to calculate GHG emissions, with a goal of understanding how changes in industry practices have affected GHG emissions during the period from 2009 to 2019. We then explore the potential GHG emissions reductions that can be achieved through widespread implementation of readily available technologies and practices.

Pushing the Envelope: Long-Term Research and Implementation Needs to Reduce GHG Emissions (October 4, 2022)

Several of the previous webinars in NAPA's Road to Zero series have discussed the GHG emissions reductions associated with readily available technologies and practices. Although substantial reductions can be achieved, it is clear that getting to net zero will require the development of new mix production technologies and low carbon materials, and widespread implementation of these practices, akin to no less than a 'moon shot' for the asphalt pavement community. This webinar explores the long-term research and implementation efforts that will be needed over the coming decades to achieve net zero GHG emissions across the asphalt pavement industry.

The Road Does What? How Pavements Impact Fuel Economy (December 15, 2022)

A lot of effort has recently been spent on zero-emission vehicles; however, most drivers don't understand that the pavement can have some impact on their vehicle fuel economy as well. Over the past 40 years, people have been trying to better understand and model how pavement smoothness, texture, and structure impacts excess fuel consumption.

Tools for Cutting Costs and Emissions during Asphalt Production (October 18, 2023)

Are you interested in learning about strategies to optimize asphalt production with a focus on proven methods to save money and reduce emissions? This webinar delves into the practical implications

of QIP-126 and QIP-127, exploring how they can be effectively applied in real-world asphalt production facilities. This webinar is a must for those looking to enhance their plant operations efficiency and make meaningful strides towards achieving the industry's sustainability goals set out in The Road Forward.

US Asphalt Industry EPD Benchmark: 1st Edition (October 19, 2023)

In order to use funds available in the Inflation Reduction Act for substantially lower carbon construction materials, agencies have to be able to compare environmental product declarations (EPDs) to industry benchmarks. Over the summer, NAPA worked with WAP Sustainability to create the first set of industry benchmarks. In this webinar, we present the results of data submitted by more than 300 asphalt plants across the country.

Conversations on Decarbonization, Part 1: The Carbon Footprint of an Asphalt Pavement (May 1, 2024)

This session explores the results from NAPA's 2022 research into the greenhouse gas (GHG) emissions of asphalt mix production by examining the sources of emissions throughout the life of an asphalt pavement. Attendees learned which components within mix design have the greatest impact on the carbon footprint of the asphalt mix, as well as the contributions of certain activities during use and end of life.

Conversations on Decarbonization, Part 2: Asphalt Pavement Opportunities (May 23, 2024)

We explore how engineers can use greenhouse gas (GHG) emissions knowledge to determine the most critical and effective solutions for decarbonization and the opportunities for industry and agencies to reduce GHG emissions throughout the life cycle of asphalt pavements.

Sustainable Operations Assessment: Understanding Opportunities to Lower Your Carbon Footprint (December 18, 2024)

Numerous efforts are available for companies interested in reporting and reducing their carbon footprint, including renewable energy credits (RECs) and carbon offsets. However, different rules apply to these strategies, and contractors should be aware of how they could impact activities like greenhouse gas reporting.

Additional Webinars

Though not part of the Road to Zero webinar series, the following webinars may also be of interest to readers.

U.S. Asphalt Industry EPD Benchmark (May 21, 2024)

This session explains the innovative methodological framework used to develop industry average global warming potential (GWP) reference values for asphalt mixture environmental product declarations (EPDs). The method can be used by agencies to develop GWP benchmarks for FHWA's Low Carbon Transportation Materials Grants and other low embodied carbon procurement and project delivery programs.

Survey Findings: Recycled Material Use & Barriers to Widespread Adoption (June 13, 2024)

Participants learned about the current status of recycled asphalt materials usage, as well as the challenges faced by contractors and agencies in increasing RAP usage and strategies for overcoming these challenges to promote sustainable asphalt practices.












Survey Findings: Use of Warm-Mix Asphalt & Barriers to Widespread Adoption (June 14, 2024)

The webinar focuses on results from two separate surveys conducted by NAPA with agencies and industry stakeholders to identify barriers to WMA adoption for lowering production temperatures and potential solutions for addressing those challenges.

PAVE IT BLACK, SEASON 5: CLIMATE & THE ROAD FORWARD



Following the launch of The Road Forward in January 2022, NAPA's flagship podcast invited members and guests to discuss climate initiatives for 11 episodes, April – September 2022.

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UPCOMING DELIVERABLES, YEAR 4

Reaching the goals of The Road Forward requires a multi-year, multi-pronged, sustained effort. It relies upon staff, volunteers, funders, and researchers to ideate and execute. To continue the work, the following efforts are under way, with more on the roadmap.

International Conference on Decarbonization of Asphalt Pavements

Scheduled for September 29 – October 1, 2025, in Chicago, this event aims to explore innovative solutions and best practices for reducing the carbon footprint associated with asphalt pavements. The event provides

an unparalleled platform for sharing research findings, discussing challenges, and networking with global leaders committed to sustainable pavement technologies. A call for abstracts was issued in 2024 to develop the program, which will take shape in early 2025.



Half-Warm-Mix: A Synthesis

Associate Research Professor Carolina Rodezno, PhD, of the National Center for Asphalt Technology (NCAT) at Auburn University examines the state of knowledge on half-warm mix asphalt (HWMA). Her report emphasizes HWMA's potential for energy savings and emission reductions, reviews production methods such as foamed asphalt and emulsions, highlights regional usage trends, and identifies knowledge gaps in mix design and long-term performance evaluation.

Climate-Conscious Design Series

Five additional papers are forthcoming on WMA and RAP.

World of Asphalt 2025

6 sessions in the People, Plants & Paving Conference including Sustainability [Decarbonization] and the Asphalt Industry: Kindred Spirits or Arch Enemies and Treasure Hunt Triumphs: How Asphalt Producers Unearth Efficiency Wins.

ENERGY STAR

While not directly related to The Road Forward, NAPA's active involvement with EPA's ENERGY STAR program is highly complementary to TRF goals. Significant developments include the following.

- ▶ NAPA named an ENERGY STAR Industrial Partner of the Year in 2023 and 2024.
- ▶ Asphalt Plant Energy Performance Peer Exchange (APEX) launched in 2022 as a free program for companies to reduce environmental impacts associated with asphalt

plant operations, reduce energy costs, and get formal recognition from the ENERGY STAR program for managing and reducing energy consumption.

- ▶ Maximizing Profitability with Energy Management Workshop held in 2024, with a second workshop scheduled for 2025, including hands-on technical sessions and an asphalt plant action plan.
- ▶ Quick Guide for Managing Energy while saving money and reducing emissions published in 2023.
- ▶ Energy Performance Indicator benchmarking tool developed in 2024 (coming soon).



ENVIRONMENTAL PRODUCT DECLARATIONS (EPDs)

Over the past decade, and especially over the last two years, EPDs have played an expanding role in design and procurement. NAPA has invested in improving upon the industry-standard Emerald Eco-Label tool by adding Optimizer and Simulator functionality, releasing ongoing updates in accordance with the Product Category Rules for Asphalt Mixtures 2.0, and engaging with members, State Asphalt Pavement Associations, and agencies on EPD usage. In 2023 and 2024, NAPA worked with WAP Sustainability to collect data and develop an EPD Benchmark, which was accepted by FHWA as the standard for asphalt pavements as part of its Low Carbon Transportation Materials (LCTM) program.

Also in 2024, NAPA was selected to receive a five-year, \$10 million EPA grant under the Inflation Reduction Act. NAPA will use the grant to further improve asphalt mix EPDs by expanding data collection, upgrading the Emerald Eco-Label software, and facilitating knowledge transfer about EPDs and life cycle analysis.

The extensive knowledge gained through producing EPDs and leveraging the EPD benchmark supports the goals of The Road Forward and the industry's ongoing sustainability efforts.

YOUR ROAD FORWARD



Richard Willis urges Annual Meeting attendees to get started now on The Road Forward, beginning with the key ingredients: education.

BEYOND RECYCLING

DRIVING TOWARD A NET ZERO FUTURE

BY BILL ROWAN
NAPA DIRECTOR, COMMUNICATIONS
& MARKETING

THREE DECADES AGO, I was inspired by *50 Simple Things You Can Do to Save the Earth* to establish recycling efforts at home and even at my after-school job. Little did I know, I was already a decade behind the asphalt pavement industry's recycling efforts! Spurred by market forces, mix producers began using recycled asphalt pavements (RAP) in new pavements in the 1970s and 1980s.

According to the NAPA report, *How to Increase RAP Usage and Ensure Pavement Performance*, "Asphalt shortages at that time made it necessary to find practical means of extending the materials supply. At about that time, milling machines started being used to remove asphalt pavement surfaces in preparation for overlays. With a ready supply of materials, the industry began to explore ways to reuse the reclaimed pavement."

PHOTO: ENR/ASA

For decades since, asphalt pavement has been America's most recycled product. "Recycling benefits society by reducing the cost of paving as well as by preserving precious natural resources in the form of aggregates and asphalt cement," former NAPA President Mike Acott stated in IS-133, *Bold Initiatives in the Asphalt Industry to Safeguard Health, Safety, and the Environment*.

"Today, the use of RAP and recycled asphalt shingles (RAS) in paving projects has increased 60% over the past decade alone, following nearly a half-century of research showing RAP is cost-effective and that its usage and storage are not detrimental to the environment," added current NAPA President & CEO Audrey Copeland, PhD, PE.

And yet, recycling is not enough to ensure sustainability and longevity.

According to the Intergovernmental Panel on Climate Change (IPCC), "It is unequivocal that human influence has warmed the atmosphere, ocean, and land." Further, the IPCC said this warming is unprecedented, already affects the weather, and will worsen without substantial action. Arresting this trend requires reaching net zero carbon emissions, which is why the United States, as part of a global coalition, has committed to that goal.

In my personal journey toward living in a more environmentally sustainable manner, recycling was a meaningful entry point – but not the end point. From RAP to warm-mix asphalt and beyond, the journey continues for the asphalt pavement industry, too.

2022 NAPA Chairman Jim Mitchell, President of Superior Paving Corp., recognized the industry's steps thus far and added, "By embracing our decades-long spirit of innovation, we can and will do more toward sustainability – spurring development and implementation of new technologies to further reduce emissions."

GETTING TO THE ROAD FORWARD
In November 2020, NAPA's member leaders authorized the creation of the Climate Stewardship Task Force to formulate the asphalt industry's

“Achieving net zero requires collaboration and corporate support.”

goals and action plan related to carbon emissions. They understand a concerted industry-wide effort is necessary to address the issue – one that is certain to have profound environmental, human, and business implications in the coming years.

They outlined four goals and 19 tactics that will help the asphalt pavement industry reach net zero carbon emissions by 2050. Executing these goals and tactics, while also working to bridge eight research and implementation gaps, NAPA guidance

will help the asphalt industry proactively reduce carbon emissions to ensure long-term viability and prosperity.

"We're not just setting goals. We're developing methods and ideas to move us toward these goals," said NAPA Vice President for Engineering, Research, and Technology Richard Willis, PhD. "We're taking action now, because if we're going to be a viable industry in 2050, we've got to be moving toward the number 0 – net zero carbon emissions."

Emphasizing that reaching net zero is a collaborative effort, Willis added, "This is one mission and one vision for the entire industry to point us where we need to go to proactively lower emissions and accelerate beyond the industry's past efforts in environmental stewardship and sustainability. It's going to take the entire asphalt community to make this happen."

UNVEILING THE ROAD FORWARD
Weaving a story with numbers – for example, the 21-member Climate Stewardship Task Force invested more

Environmental Visionaries

NAPA thanks the members of the Climate Stewardship Task Force for their visionary leadership and dedication.

LEADERSHIP

Chair: Ron Sines, CRH Americas Materials Inc.
Vice-Chair: Dan Gallagher, Gallagher Asphalt Corp.
NAPA Staff: Richard Willis & Joseph Shacat

PRODUCERS

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Dan Gannon, Lindy Paving Inc.
Allen Hendricks, Eurovia USA
Gerald Huber, The Heritage Group
Jay Lemon, Huskell Lemmon Construction Co.
Jamie Moretz, CWIR Contracting Inc., a Construction Partners Inc. Co.
Craig Parker, Silver Star Construction Co. Inc.
Robert Ponton, Colas Inc.
Susan Witt, Gerken Materials Inc.

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Adam Hand, Consultant
Steve Muehle, University of Washington

Watch as The Road Forward is unveiled.

While announcing the initiative and explaining the four industry goals, Richard Willis also unveiled materials to help the industry and its partners join The Road Forward: a climate-focused website, an inspirational video, a game and glossary, and more to come – including 34 activities planned for 2022 alone.



REPORTING

NAPA uses its media and email networks to share updates about The Road Forward and TRF Partners.

- ▶ **Driving Toward Net-Zero Carbon Emissions** (Asphalt Pavement, Jan/Feb 2022)
- ▶ **Beyond Recycling** (Asphalt Pavement, Mar/Apr 2022)
- ▶ **A Vision for Net Zero Carbon Emissions** (Asphalt Pavement, Mar/Apr 2022)
- ▶ **Moving the Conversation Forward** (Asphalt Pavement, May/June 2022)
- ▶ **Recruit the Next Generation of Employees by Having a Climate Action Plan** (Asphalt Pavement, May/June 2022)
- ▶ **Engagement Is Key** (Asphalt Pavement, Jul/Aug 2022)
- ▶ **Sustainability Is Profit** (Asphalt Pavement, Sep/Oct 2022)
- ▶ **The Road to Zero: Online and On-Demand** (Asphalt Pavement, Nov/Dec 2022)
- ▶ **We Can Do This** (Asphalt Pavement, Nov/Dec 2022)
- ▶ **One Year Later** (Asphalt Pavement, Jan/Feb 2023)
- ▶ **Paving Under Stockpiles Pays Off Environmentally & Economically** (Asphalt Pavement, Jan/Feb 2023)

- ▶ **GHG Report Offers First Look at Net Zero Challenges** (Asphalt Pavement, Jan/Feb 2023)
- ▶ **The Future Is Now: Embracing Opportunities in Low Carbon** (Asphalt Pavement, Mar/Apr 2023)
- ▶ **Electric Heated Tank Farm Lowers Energy Use** (Asphalt Pavement, Mar/Apr 2023)
- ▶ **A Leap of Faith** (Asphalt Pavement, May/June 2023)
- ▶ **Insulating to Prevent Loss of Thermal Energy, Reduce Fuel Use, and Reduce Cost** (Asphalt Pavement, May/June 2023)
- ▶ **Nurture the Curiosity of Sustainability** (Asphalt Pavement, Jul/Aug 2023)
- ▶ **Setting the Sustainability Standard** (Asphalt Pavement, Sep/Oct 2023)
- ▶ **Using Liquefied Natural Gas to Lower Fuel Costs** (Asphalt Pavement, Sep/Oct 2023)
- ▶ **Not Another Meeting!** (Asphalt Pavement, Nov/Dec 2023)
- ▶ **Using EPDs to Inform Decisions and Modernize Operations** (Asphalt Pavement, Nov/Dec 2023)
- ▶ **Why Should You Reduce Your Temperatures? and Net Zero: It's a Gas** (NAPA Quarterly, Spring 2024)
- ▶ **Emissions and Fuel Savings Using WMA at Reduced Asphalt Mixture Production Temperatures** (NAPA Quarterly, Summer 2024)
- ▶ **Greener Roads Ahead** (NAPA Quarterly, Fall 2024)

Greener Roads Ahead

Driving More Sustainable Practices with Balanced Mix Design in Asphalt Pavement



1. Reclaimed asphalt pavement (RAP) stockpiles sit at the Superior Paving Corp. Bull Run plant in Chantilly, Va. 2. Asphalt mixture producers are increasingly utilizing recycled materials in their products, according to 2022 data. 3. A conveyor belt carries the RAP from its feed bin to the drum. PHOTO BY TONY HARRIS

AS THE WORLD GRAPPLES with the pressing need to adopt more sustainable practices, the asphalt pavement industry is paving the way towards greener roads. The 2022 construction season recycled materials and warm mix survey reveals a significant shift towards sustainability, with asphalt mixture producers increasingly utilizing recycled materials and decreasing production temperature through the use of Warm-Mix Asphalt (WMA) technologies. These practices not only conserve natural resources and reduce greenhouse gas emissions but also offer economic benefits by lowering

material costs and extending the lifespan of pavements. In addition to these strides in sustainability, the industry is also working on implementing Balanced Mix Design (BMD) as a new approach to asphalt mix design. BMD focuses on performance-based criteria, addressing the limitations of traditional volumetric mix design systems and ensuring that asphalt mixtures meet the durability and cracking resistance requirements specific to project needs. By freeing asphalt mixtures from prescriptive material limits, BMD allows for more sustainable solutions, optimizing material use



while reducing greenhouse gas emissions by 2.7 million metric tons CO₂e which is equivalent to removing around 600,000 passenger vehicles from the road each year.

WARM-MIX ASPHALT (WMA)
Warm-Mix Asphalt technologies were employed in 175 million tons of

asphalt mixtures in 2022, comprising 39.6 percent of the market. These technologies allow for the reduction of mix production temperatures, thereby cutting energy consumption and emissions. During the 2022 construction season reducing production temperature resulted in an estimated reduction of 0.18 million



SR-229 AGENCIES & CONTRACTORS SURVEYS ON BARRIERS TO HIGHER RAP USAGE IN ASPHALT MIXTURES

NAPA's report on barriers to higher RAP usage in asphalt mixes identified barriers to increasing RAP usage, highlighting agency concerns about durability, cracking resistance, and mix consistency in high RAP mixes.



EARNED MEDIA

- › **Full Steam Ahead: The IRA Hits the Accelerator on Low-Carbon Procurement** (Roads & Bridges, Mar. 1, 2024)
- › **The Road Forward** (Routes/Roads, Q1 2024)
- › **How Asphalt Pavement Industry Will Decarbonize** (Asphalt Contractor, Apr. 10, 2024)
- › **What Contractors Really Think About EPDs** (Asphalt Contractor, May 18, 2023)
- › **The FUTURE of Civil Engineering: Sustainability, Tech, & Asphalt Innovation** (The Civil Engineering CEO Show, May 2024)
- › **Audrey Copeland & The Road Forward** (HC+M, May 2024)
- › **Biden-Harris Administration Announces Nearly \$160 Million in Grants to Support Clean U.S. Manufacturing of Steel and Other Construction Materials** (EPA, Jul. 16, 2024)
- › **EPA Looks to Reduce Embodied Carbon Materials With \$160M in Grants** (Engineering News-Record, Jul. 16, 2024)
- › **OAPC explores pathways to sustainability** (On-Site, Nov. 29, 2024)
- › **PennDOT among 39 states in federal program to lower carbon emissions in road, bridge work** (Pittsburgh Union Progress, Dec. 1, 2024)
- › **Paving the way to sustainability: OAPC keynote outlines several methods** (Daily Commercial News, Dec. 6, 2024)
- › **Asphalt Industry Commits to Net-Zero Pavements by 2050** (Asphalt Contractor, Jan. 27, 2022)
- › **NAPA unveils Climate Action Plan for asphalt pavement industry** (Roads & Bridges, Jan. 31, 2022)
- › **NAPA Releases First-of-its-Kind Emissions Inventory for Asphalt Pavement Mixtures** (Construction Equipment Guide, Jul. 5, 2022)
- › **Aggregates Help Pave the Road Forward** (Asphalt Pro, Jul. 19, 2022)
- › **Zooming in on Infrastructure with James Mitchell** (Roads & Bridges, Aug. 15, 2022)
- › **Climate Law a 'Game Changer' for Highways and Bridges** (The New York Times, Sep. 6, 2022)
- › **What Everyone in the Asphalt Industry Needs to Know About EPDs** (Asphalt Contractor, Feb. 21, 2023)
- › **Asphalt is an ENERGY STAR Award-Winner** (Asphalt Pro, Mar. 30, 2023)
- › **How to Set a Vision, Fast** (Associations Now, Apr. 16, 2023)
- › **Road Forward Summit Engages Asphalt Pavement Community On Net Zero Action Plan** (Construction Equipment Guide, Jul. 24, 2023)
- › **Why Climate Change Matters for Every Leader** (Associations Now, Aug. 27, 2023)



THE ROAD FORWARD SABBATICAL

In 2024, NAPA formalized The Road Forward Sabbatical to host tenured professors interested in furthering their asphalt pavement research in support of TRF goals. In this role, participants contribute to industry’s vision for net zero carbon asphalt pavements, while obtaining crucial knowledge to take back to their respective universities and research networks. Participants join an exclusive community of scholars and forge lasting industry relationships.



University of New Hampshire Professor Jo Sias, PhD, PE, FASCE, spent the 2023-2024 academic year on sabbatical at NAPA, primarily focused on resilience. Her work is captured in the deliverables section of this report. Additionally, she was profiled in *Asphalt Pavement*, Sep/Oct 2023, and her work culminated in an article for *NAPA Quarterly*, Winter 2024. Dr. Sias shared some thoughts on the sabbatical program in an Instagram video.

University of Nevada, Reno, Professor Adam Hand is the TRF Sabbatical participant for the 2024-2025 academic year. For 2025-2026, applications were solicited in Summer 2024, resulting in the selection of UMass Dartmouth Commonwealth Professor Walaa Mogawer.

The Road
Forward
 SABBATICAL

ACKNOWLEDGEMENTS

Thanks to the Climate Stewardship Task Force (2021) for envisioning The Road Forward.

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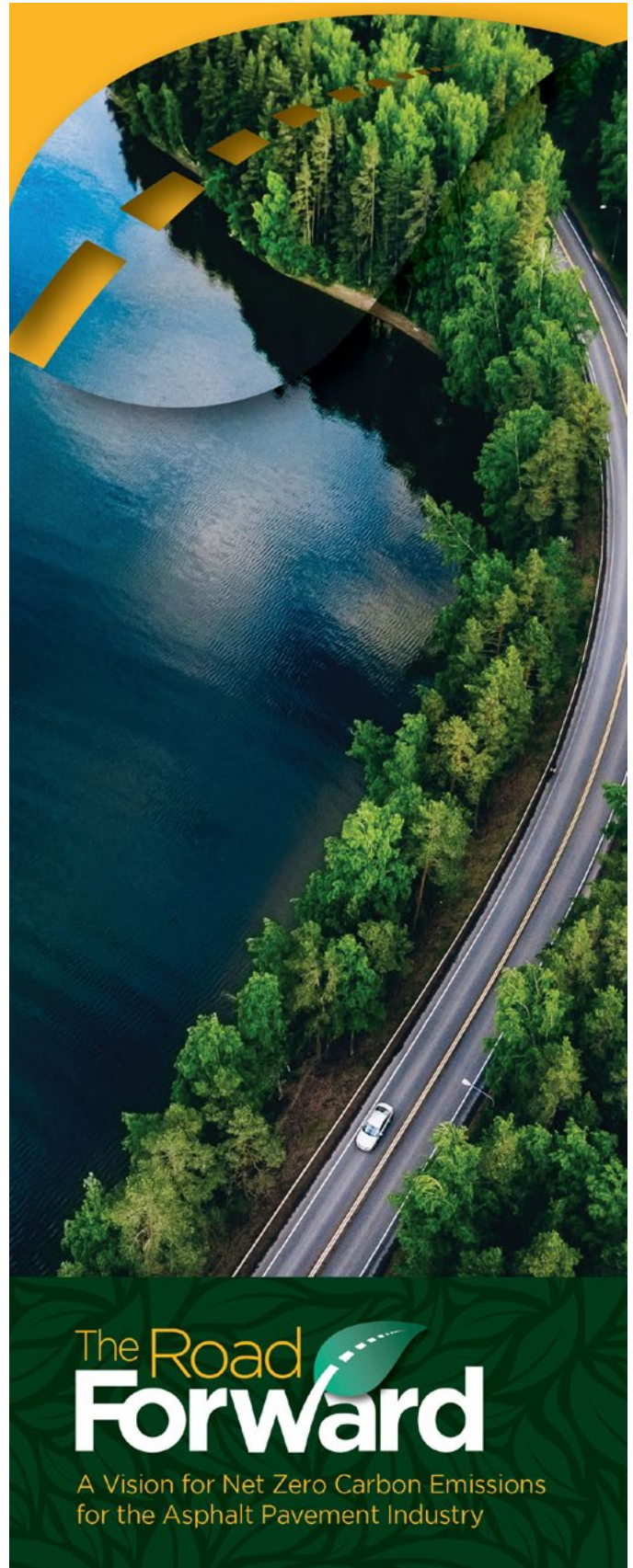
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- › **Adam Hand**, Consultant
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The Road Forward

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Thanks to The Road Forward Partners for supporting this work.

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PARTNERS 2022-2023



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- › National Center for Asphalt Technology (NCAT) at Auburn University
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- › University of Washington
- › WAP Sustainability Consulting
- › West Contracting