MDOT
MISSISSIPPI DEPARTMENT OF TRANSPORTATION

MISSISSIPPI CARBON REDUCTION STRATEGY

November 2023

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INTRODUCTION

01 INTRODUCTION

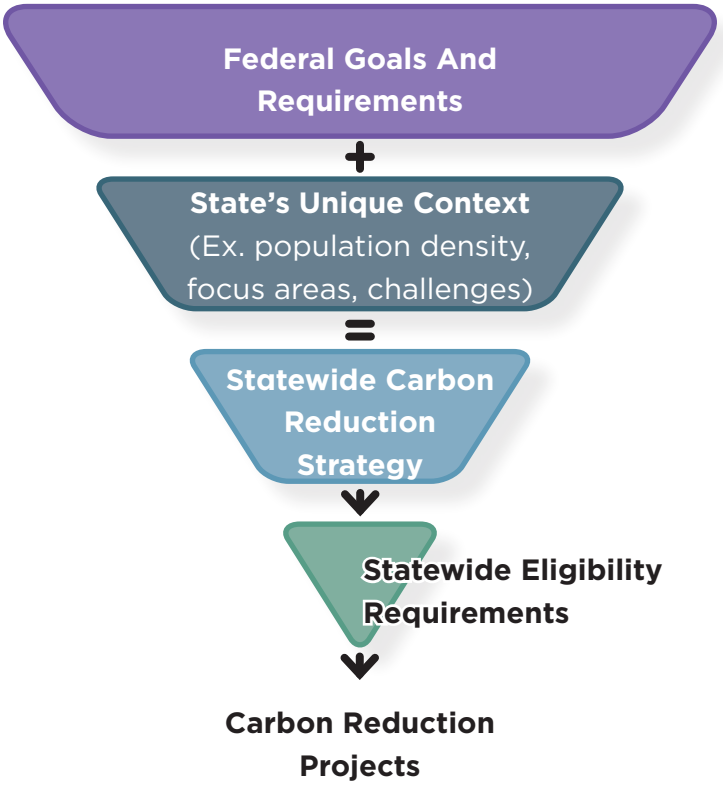
Background and Purpose

The Mississippi Department of Transportation (MDOT) has developed the Mississippi Carbon Reduction Strategy (MS CRS) to align with federal requirements and guidance to reduce carbon emissions produced by the transportation sector. These requirements were established as part of the Carbon Reduction Program (CRP), authorized by the Bipartisan Infrastructure Law (BIL) adopted in 2021 and codified in 23 U.S.C. 175.

The BIL is a generational investment in our nation's infrastructure, notably our transportation network. This law charges the Carbon Reduction Program to combine federal goals and requirements with each state's unique context to fund infrastructure projects that reduce CO2 emissions (Figure 1).

The federal government's goals for the country's transportation system relate to **safety, equity, climate resiliency, a strong workforce, and an efficient freight network**. The Federal Highway Administration (FHWA), which has been tasked with apportioning CRP funds for the 5-year duration of the program, encourages the use of CRP funds for projects that not only reduce emissions, but also directly advance one or more of these federal goals.

Figure 1. Carbon Reduction Program Overview



Please visit FHWA's website for more details.
https://www.fhwa.dot.gov/bipartisan-infrastructure-law/crp_fact_sheet.cfm

NATIONAL AND STATEWIDE TRENDS

> ***Understanding and monitoring current trends and conditions can assist in future planning, funding decisions, and policymaking for transportation projects. By better understanding both present and anticipated changes, Mississippi will be better equipped to meet the needs of the state.***

Greenhouse Gas Emissions by Sector

In 2021, transportation was the leading source of greenhouse gas emissions in the United States, accounting for 29%, and most emissions in the transportation sector come from cars and trucks.

Figure 2. 2021 Emissions by Sector, National

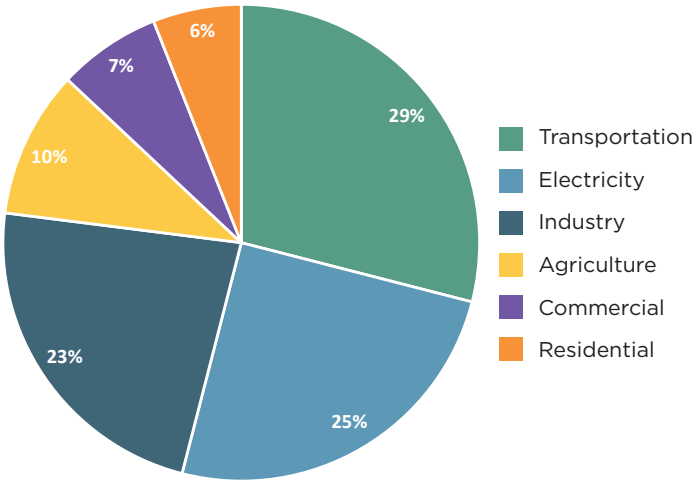
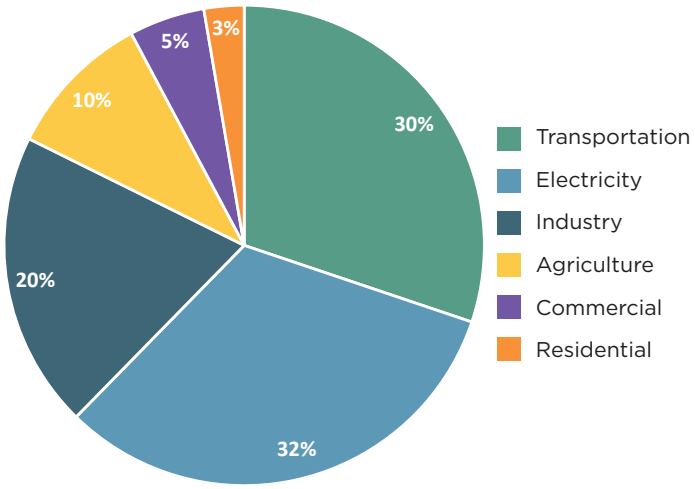


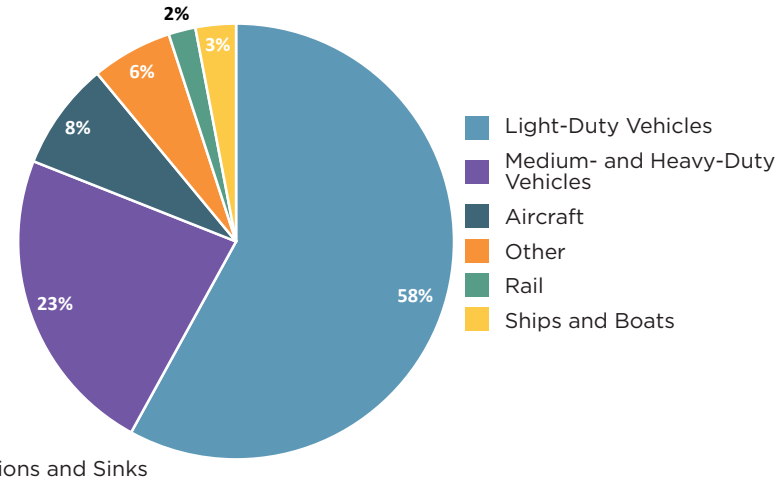
Figure 3. 2021 Emissions by Sector, Mississippi



National Transportation Related Emissions by Mode

In 2021, over 80% of emissions in the transportation sector came from cars and trucks.

Figure 4. 2021 Emissions by Mode, National



Source: EPA's annual Inventory of U.S. Greenhouse Gas Emissions and Sinks

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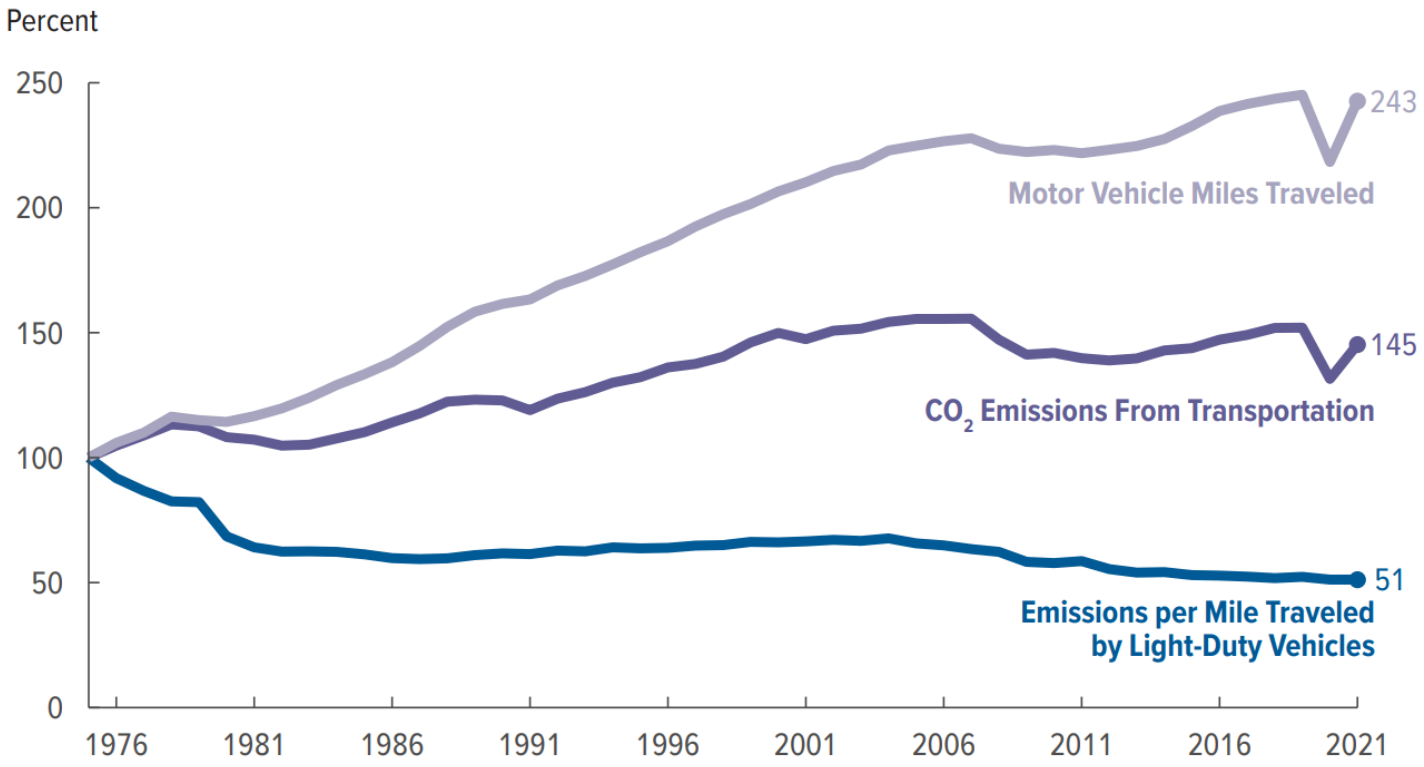
Fuel Economy and Vehicle Miles Traveled (VMT)

While fuel economy has greatly improved over time across the on-road vehicle fleet, the increase in VMT has risen more rapidly and offsets the benefit of increased fuel economy. This graph, from the Congressional Budget Office's report Emissions of Carbon Dioxide in the Transportation Sector, shows the values measured as a percentage of their value in 1975. CO_2 emissions are 145% of what they were in 1975, emissions per mile are 51% of what they were in 1975, and VMT is 243% what it is was in 1975. As noted later in this document, MULTIPLAN 2045 has projected a 26% VMT increase in Mississippi by 2045.

Figure 5. Historic Fuel Economy, Emissions, and VMT



Bipartisan Infrastructure Law Carbon Reduction Program

BUILDING A BETTER AMERICA: CONTEXTUALIZING THE CARBON REDUCTION PROGRAM

The BIL paves the way for a renewed partnership between FHWA and State departments of transportation to prioritize investments in our transportation system that help our communities Build a Better America. This includes updating the condition of streets, highways, trails, and bridges to make them safer; modernizing the transportation network to accommodate all users to foster a more equitable future; and making the transportation sector more sustainable and resilient to climate change.

The BIL aims to accomplish this, in part, through the new Carbon Reduction Program (CRP), and other funding programs like the Bridge Investment Program, the National Electric Vehicle Infrastructure (NEVI) Formula Program, and the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program.

CRP REQUIREMENTS

The CRP requires every state to develop a strategy that:

Supports the reduction of transportation emissions in the State and efforts to reduce transportation emissions

Identifies projects and strategies to reduce transportation emissions

Facilitates the use of vehicles or modes of travel that result in lower transportation emissions as compared to existing approaches

Is appropriate to the population density and context of the State, including any MPO designated in the State

In accordance with these federal requirements, the MS CRS supports efforts statewide to reduce transportation-related carbon emissions through projects and strategies that reflect Mississippi's unique context, population density, and goals.

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ELIGIBLE ACTIVITIES

To align with federal guidance, the Mississippi Carbon Reduction Strategy supports a wide range of activities and project types that will result in reduced carbon emissions, including:

- Traffic monitoring, management, and control programs, including truck stop electrification systems
- Public transportation projects, such as Bus Rapid Transit (BRT) or dedicated bus lanes
- Alternate mode transportation projects, such as on- and off-road trail facilities/multi-use paths for pedestrians, bicyclists, and other non-motorized modes
- Congestion management techniques
- Intelligent Transportation Systems (ITS) and vehicle-to-infrastructure communications systems
- Energy-efficient streetlight or traffic control device upgrades
- Development of a local carbon reduction strategy
- Congestion pricing strategy or project
- Projects to reduce environmental or community impacts from freight, including truck parking facilities
- Projects or programs that support deployment of alternative fuel vehicles/zero-emission vehicles and construction equipment
- Diesel engine retrofit projects for fleet vehicles
- Projects eligible under the Congestion Mitigation and Air Quality (CMAQ) Improvement Program to improve traffic flow
- Projects that advance port electrification
- Other projects not listed above that demonstrate reduction in transportation emissions over the project's life-cycle

Expected Funding Levels

The estimated annual BIL CRP funding is as follows:

FY 2022	$1.234B
FY 2023	$1.258B
FY 2024	$1.283B
FY 2025	$1.309B
FY 2026	$1.335B

CRP funds are available for obligation for 3 years after the last day of the fiscal year during which the funds are authorized. For instance, 2022 CRP funds are available for obligation until September 30, 2025. 2023 CRP funds are available for obligation until September 30, 2026, and so on and so forth.

35% of the CRP funds may be obligated in any area of the State. The remaining 65% of these funds must be utilized on projects in the following areas in proportion to their share of the population:

- Urbanized areas with a population of more than 200,000
- Urbanized areas with a population of 50,000 to 200,000
- Urbanized areas with a population of 5,000 to 49,999
- Other areas of the State with a population of less than 5,000

Of the 65% mentioned above, the Memphis Urban Area MPO (Desoto County), Central Mississippi Planning and Development District (CMPDD) MPO, Hattiesburg-Petal-Forrest-Lamar (HPFL) MPO, Gulf Regional Planning Commission (GRPC) MPO, and Pascagoula-Moss Point received a suballocation of CRP funds.

Mississippi's total CRP apportionment from FY 2022 – FY 2026 is approximately $81 million, roughly $16 million per year. FY 2022 and FY 2023 amounts are $15.6 and $15.9 million, respectively.

	Mississippi CRP Funding FY 2023
65% of CRP Funds to be utilized as indicated in Federal law	$10,356,306
35% of CRP Funds Available for Any Area in State	$5,576,473
Total	**$15,932,779**

Notably, if all eligibility requirements and applicable local matches for each program are met, CRP funds can be leveraged with other eligible USDOT funding for projects that support the reduction of transportation emissions. Examples of other funding programs to combine with CRP funds include:

- Congestion Mitigation and Air Quality (CMAQ) Improvement Program
- Surface Transportation Block Grant Program (STBG)
- National Highway Freight Program (NHFP)
- Highway Safety Improvement Program (HSIP)
- Safe Streets and Roads for All (SS4A)
- And Others

01 INTRODUCTION

MISSISSIPPI MPO COORDINATION

Per federal guidance, MDOT seeks to coordinate with each Metropolitan Planning Organization (MPO) in the state to develop the MS CRS. This way, the strategy will become an integral part of the transportation planning processes that occur throughout the state.

This coordination will be vital to meeting another federal requirement for the MS CRS since all projects identified for CRP funding must be identified in the Statewide Transportation Improvement Program (STIP) and any Transportation Improvement Plans (TIPs). They must also be consistent with the statewide Long Range Transportation Plan (LRTP) and each MPO's Metropolitan Transportation Plan (MTP).

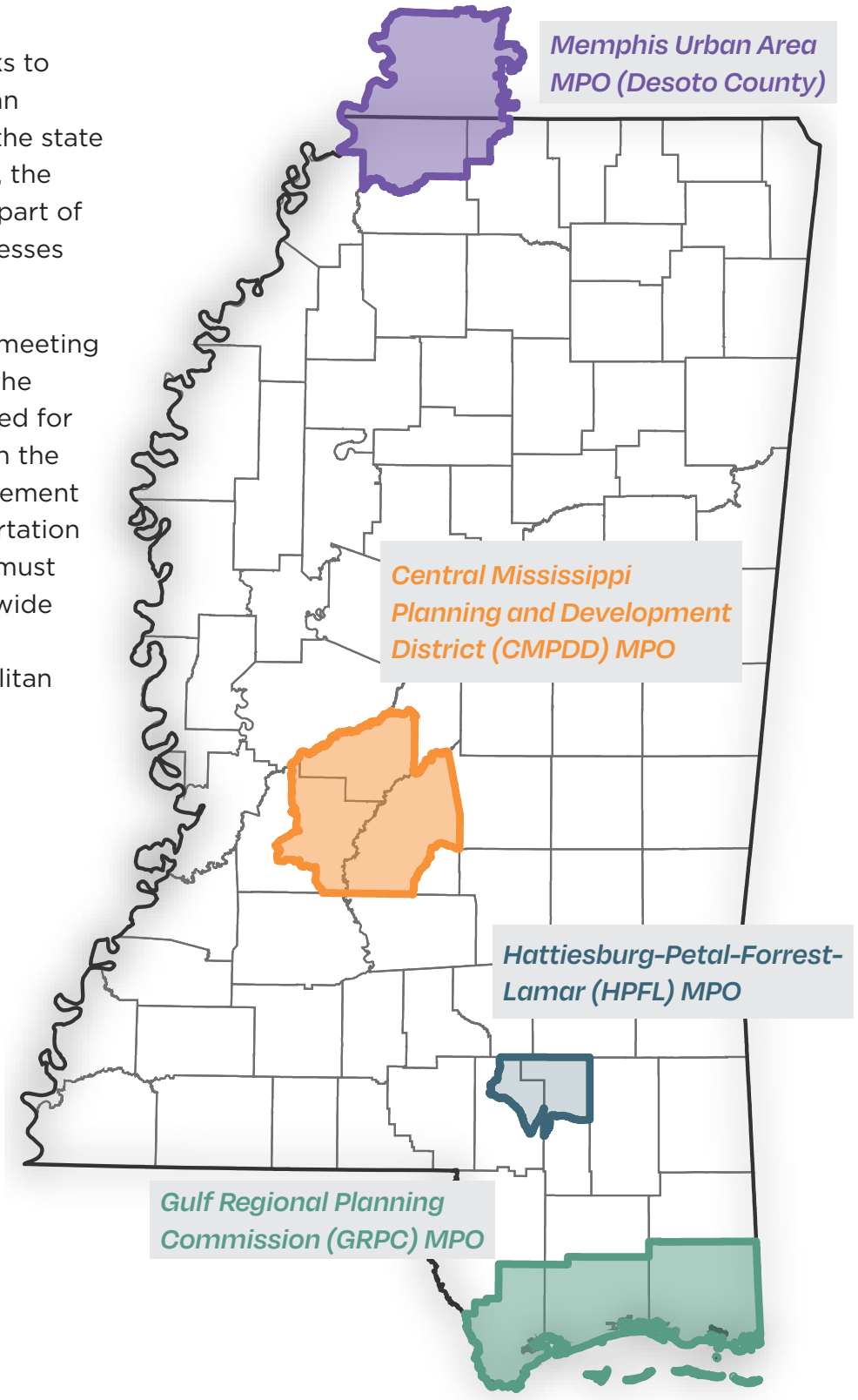


Figure 6. Mississippi MPO Map

02

CARBON REDUCTION STRATEGY DEVELOPMENT

02 CARBON REDUCTION STRATEGY DEVELOPMENT

Stakeholder Engagement

MDOT met with each of the state's four MPOs five times throughout the development of the CRS. In addition to five formal meetings, MDOT staff attended MPO board meetings and distributed information and updates with regards to the carbon reduction program and statewide efforts. Additionally, MDOT shared a presentation about the Carbon Reduction Strategy at the Freight Advisory Committee fall 2023 meeting.

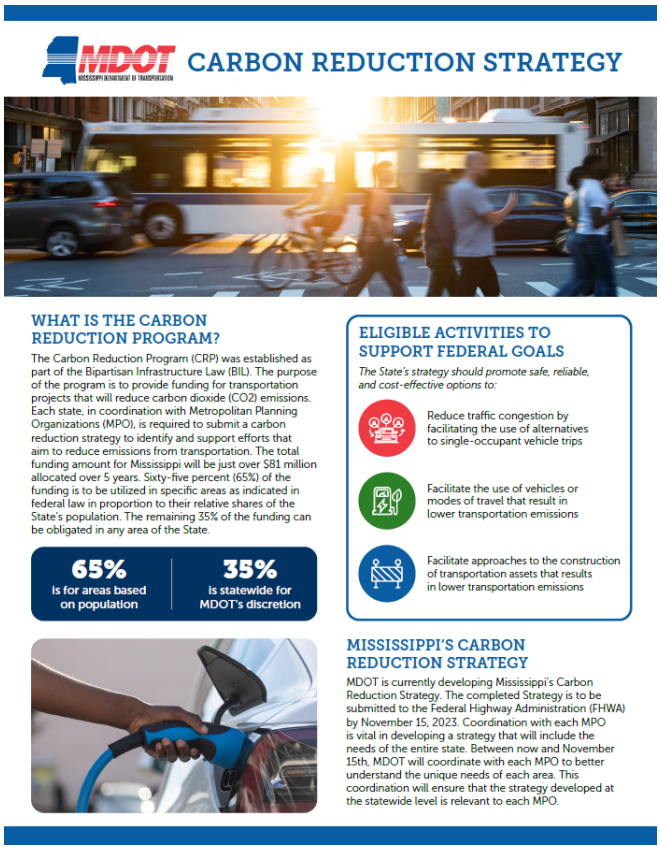
The objective of each coordination meeting with MPOs is briefly summarized below. Full notes for each meeting can be found in the Appendix.

MEETING #1

During Meeting #1, MPOs were briefed on the Carbon Reduction Program and given a CRP one-pager to share with their board and member jurisdictions. During this meeting, MPOs engaged in dialogue with MDOT staff and answered the questions outlined below. Responses from MPOs played a key role in the direction of the CRS and are summarized in full in the Appendix.

- What carbon reduction strategies are your agencies taking?
- When considering the "roll-up" categories of project types, which are you most likely to leverage?
- What information would be helpful for you to receive from MDOT's Carbon Reduction Strategy for use in your MPO Metropolitan Transportation Plan?

Figure 7. Carbon Reduction Program One-Pager



- Are there any trends and characteristics that your MPO is already measuring or that would be of particular value to understand?

MEETING #2

Meeting #2 focused on a review of national and statewide trends revolving around carbon emissions. The trends were shared for discussion with MPOs. Additionally, MDOT shared the annotated outline of the CRS with MPO partners for their review.

MEETING #3

Meeting #3 focused on an overview of potential carbon reduction strategies and their relative impact on reducing carbon emissions. MPOs also shared information about any strategies that may be missing from the initial list and guidance on which they felt best achieved at a statewide level. Figure 8 captures a snapshot of the results from the interactive polling exercise.

MEETING #4

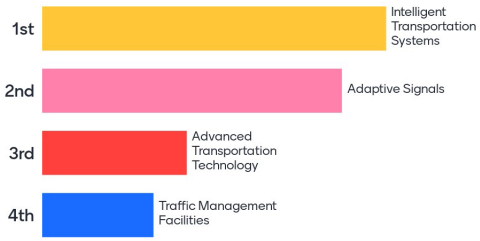
Meeting #4 spent time reviewing the six focus areas for the Mississippi CRS in greater detail and providing opportunity for MPO and FHWA comment.

MEETING #5

The final meeting with MPOs during the development of the CRS included reviewing the draft document and distributing to partners for their review.

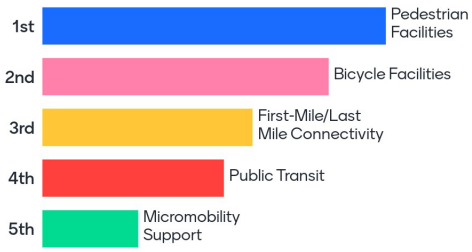
Figure 8. Interactive Polling Responses from MPO Meeting #3

Which transportation technology strategies are you most likely to leverage?

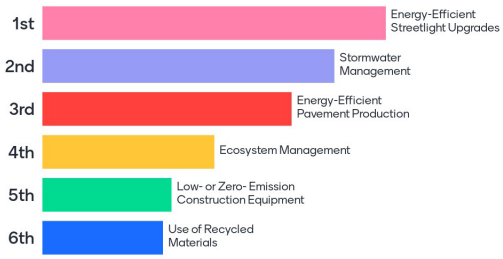


Which congestion mitigation strategies are you most likely to leverage?

Which active transportation strategies are you most likely to leverage?



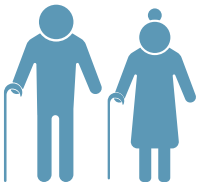
Which energy efficient or green construction strategies are you most likely to leverage?



02 CARBON REDUCTION STRATEGY DEVELOPMENT

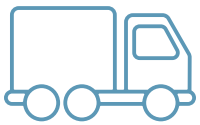
Carbon Reduction Strategy Vision

Mississippi's transportation investments are guided by MULTIPLAN 2045 – the State's long range transportation plan. MULTIPLAN 2045 highlights several key themes and trends that tie back to the federal goals for the carbon reduction program and guide the Mississippi CRS. MULTIPLAN 2045 laid out clear expectations that the current funding levels for transportation in Mississippi are not adequate and that maintenance and preservation of existing assets will be difficult and come at a cost, including an **increase of almost 28 metric tons of carbon**. The new carbon reduction program will help supplement the budget analyzed as part of MULTIPLAN 2045 and address the following challenges:



Mississippi's population is getting older, and transit ridership is growing in rural areas. Since 2008, Mississippi's rural transit providers have experienced a 266% increase in ridership. Rural transit providers in Mississippi often serve older populations who need access to critical resources like doctor appointments and grocery stores. As the population in Mississippi continues to age, rural transit will need to remain a reliable option to connect residents where they need to go. Rural transit can benefit from the Carbon Reduction Program through converting existing vehicles to lower emission alternatives or expanding the existing fleet with alternative fuel vehicles.

Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT) are projected to increase by 21% and 26%, respectively, by 2045. As Mississippi continues to grow, increases in VMT and VHT will lead to greater carbon emissions. VHT is anticipated to increase at a faster pace than VMT, suggesting that congestion will increase, resulting in greater carbon emissions. Many of the eligible activities within the Carbon Reduction Program can support lessening the impact from or even decrease anticipated VMT and VHT. Intelligent transportation system solutions and alternative mode projects can offset the anticipated increases in VMT and VHT, in return reducing carbon emissions.



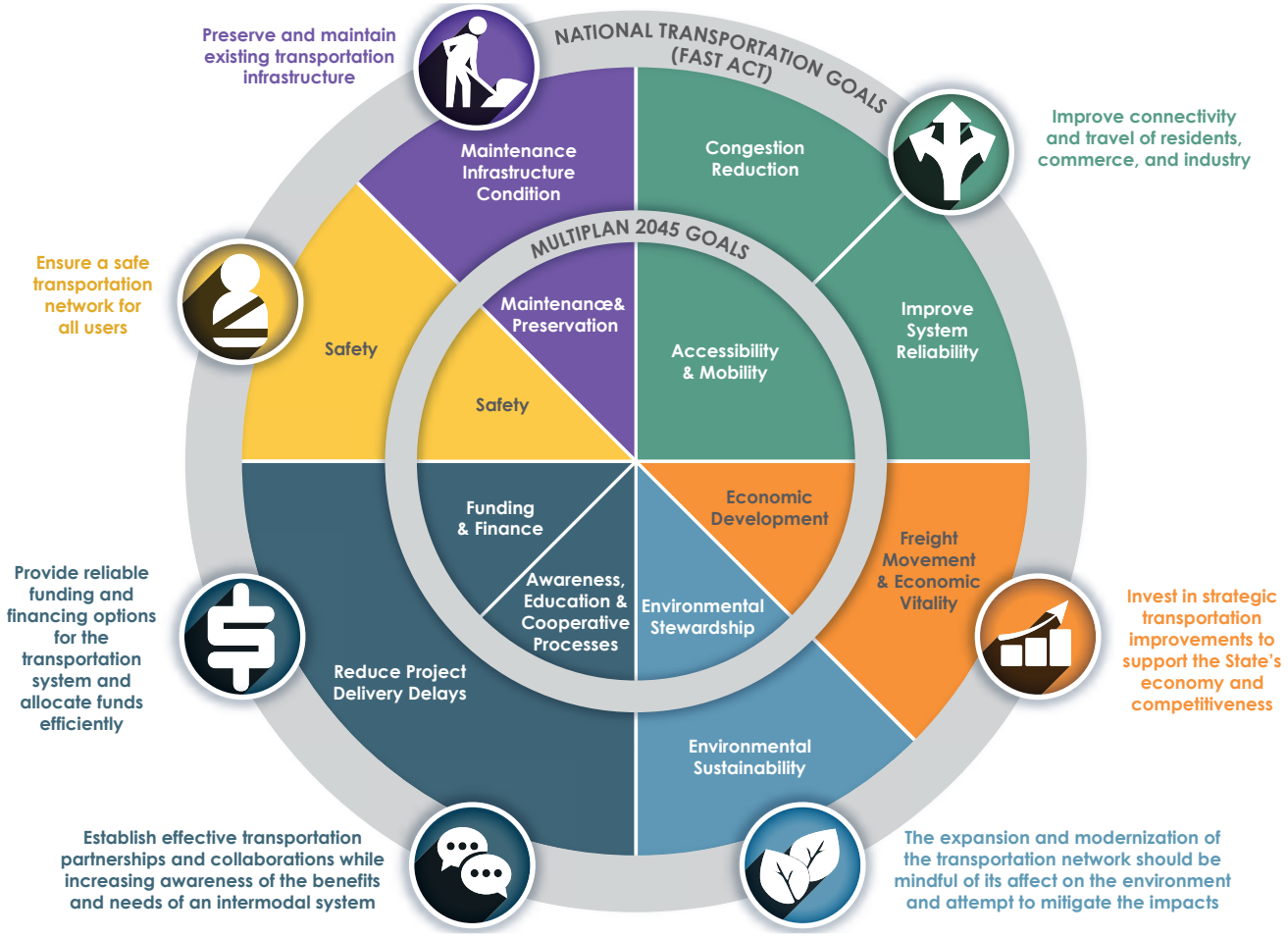
Freight movement is projected to increase. Truck freight in Mississippi is anticipated to increase 77% by 2045. On average, truck drivers spend 56 minutes per day searching for parking. Almost all truck drivers say that they struggle to find parking. Of this, 98% of drivers say struggling to find parking is a regular (one or more times per week) issue.[1] Naturally, this additional time spent on the road or idling while searching for available parking leads to an increase in carbon emissions. This is particularly relevant as the MS State Freight Plan includes technology as a way to increase access to existing truck parking and make freight more environmentally sustainable. Additional truck parking and truck parking availability systems may help improve safety and compliance with hours of service requirements, while supporting less driving time in search of parking and lower emissions.

Alignment with the State's Long Range Transportation Plan

In addition to the overarching trends described earlier, there are goals and objectives within MULTIPLAN 2045 that support carbon reduction, including:

- Improve connectivity and travel of residents, commerce, and industry through system reliability and congestion reduction.
- Be mindful of the impacts of expansion and modernization of the transportation network on the environment and attempt to mitigate the impacts.

Figure 9. MULTIPLAN 2045 Goals and Objectives



03

CARBON REDUCTION STRATEGIES

03 CARBON REDUCTION STRATEGIES

Menu of Strategies

In consultation with MPO partners, MDOT identified five overarching categories of transportation strategies and project types that support carbon reduction in Mississippi.

Outlined in the tables on the following pages are specific project types and strategies that lay the foundation for how Mississippi will aim to reduce carbon emissions throughout the State's transportation system. MDOT, MPOs, and local jurisdictions can use these lists to identify projects and strategies appropriate to their area and local context.

Every project type or strategy listed here may or may not be utilized by the state and/or the MPOs due to the needs of each area or restrictions due to state or local policies, laws, and regulations. However, these lists should be considered a universe of project types and strategies to accommodate each area of the state and the ever-changing needs of the transportation system over the longer term.

TRANSPORTATION TECHNOLOGY

CONGESTION MANAGEMENT AND MITIGATION

ACTIVE TRANSPORTATION AND VMT REDUCTION

ENERGY EFFICIENT AND GREEN CONSTRUCTION PROCESSES

FREIGHT EFFICIENCY

TRANSPORTATION TECHNOLOGY

Strategies that use technological solutions to improve roadway operations through improved information sharing, data analytics, and traffic control methods.

Traffic Management Facilities

Traffic monitoring or control facilities

Adaptive Signals

Systems that adjust signal timing to improve traffic flow

Intelligent Transportation Systems

Capital improvements, such as traffic signal control systems, ramp metering, dynamic message signs, connected vehicle infrastructure

Advanced Transportation Technologies

Advanced traveler information systems, collision avoidance technology, transportation management technologies, automated and connected vehicle infrastructure, integrated payment systems, shared-use and on-demand mobility applications, integration with energy systems, parking reservation systems, etc.

CONGESTION MANAGEMENT AND MITIGATION

Strategies that reduce congestion through design solutions and by reducing the demand for roadway trips.

Signal Upgrades and Enhanced Intersection Design

Projects that improve traffic flow that are eligible under the CMAQ program (23 U.S.C. 149(b)(5), such as intersection improvements including roundabouts, signal upgrades, adding turn lanes, etc.

Managed Lanes

Lanes separated from general-purpose lanes for the purpose of increasing the capacity of the system by allowing certain travelers access to the lanes. Examples include high-occupancy vehicle (HOV) lanes, high-occupancy toll (HOT) lanes, or bus-only or truck-only lanes. Various methods are used to control the right to access, such as pricing, vehicle eligibility (e.g., low-emission vehicle), and access control at particular points along the roadway.

Congestion Pricing

Charges incurred by drivers choosing to make trips on heavily congested routes or during peak periods, usually in the form of a toll or usage tax. Congestion pricing is often touted as a particularly valuable method to reduce traffic congestion.

Parking Fees/Parking Restrictions

Imposing parking fees or parking restrictions in heavily congested areas can discourage trips made by car, reducing demand on roadways

Electronic Toll Collection

A wireless system that automatically collects fees from drivers using toll roads, managed lanes, etc., reducing bottleneck and congestion and tolling facilities

Land Use Access to Transit/Alternate Modes

Supporting land uses that make it easier to access transit or travel via alternate modes (e.g., biking, walking) can support reductions in trips taken by car. Examples include land uses that support density, like transit-oriented development (TOD) and mixed-use development.

Commute Trip Reduction

Programs or initiatives that support single-occupancy vehicle trip reduction, such as carpooling, shuttle systems, or work-from-home programs.

ACTIVE TRANSPORTATION AND VMT REDUCTION

Strategies that encourage users to take trips via non-vehicular modes, such as active transportation or public transit.

Pedestrian Facilities

Facilities that make traveling as a pedestrian safe and accessible, including sidewalks, greenways and trails, crosswalks, curb ramps, pedestrian overpasses, etc.

Bicycle Facilities

Facilities that make traveling via bicycle safe and accessible, including separated bicycle lanes, greenways and trails, bicycle crossing signals, bicycle overpasses, etc.

Public Transit

Provision of and investment in mass transit that lead to more efficient operations and higher ridership

First-Mile/Last Mile Connectivity

Provision of infrastructure specifically designed to support travel of transit riders at the beginning or end of individual transit trips, such as safe and easy-to-access bicycle/pedestrian routes, well-lit sidewalks, wayfinding signage, etc.

Micromobility Support

Programs and infrastructure to support the use of lightweight vehicles, such as e-bikes and scooters, as well as regulations to maintain safety and management of these uses in the right-of-way but not necessarily in the travel lanes

ENERGY EFFICIENT AND GREEN CONSTRUCTION PROCESSES

Strategies that encourage roadway construction techniques that reduce carbon emissions, while maximizing the life of the roadway.

Use of Recycled Materials

Using recycled materials (e.g., crushed concrete, reclaimed asphalt pavement) in pavement materials to reduce waste and save costs

Energy-Efficient Streetlight Upgrades

Replacing existing streetlights with LED alternatives

Energy-Efficient Pavement Production

Allowing the use of warm-mix asphalt (WMA) and use of bio-binders to reduce costs and energy consumption

Ecosystem Management

Implementing eligible activities to mitigate impacts to natural ecosystem and habitat

Stormwater Management

Properly controlling stormwater runoff and instituting appropriate erosion control measures

Low- and Zero-Emission Construction Equipment

Using low- and zero-emission construction equipment decreases the fossil fuel energy consumed during construction

FREIGHT EFFICIENCY

Strategies that improve the efficiency, safety, and mobility of freight traffic within and through Mississippi

Truck Parking

Additional parking specifically designated for trucks to provide drivers with safe locations to park to meet federal regulations for hours-of-service, rest breaks, or staging ahead of delivery or pickup, as well as dynamic signage alerting drivers to the locations and capacities of public truck parking

Freight Specific ITS

Improvements such as the provision of freight signal priority, freight advanced traveler information systems, better integration into transportation management centers, and dynamic messaging signs

Freight Bottleneck Mitigation

Capital improvements that minimize or eliminate freight bottlenecks such as turn lane additions, intersection modification, or managed freight lanes

03 CARBON REDUCTION STRATEGIES

Cost Effectiveness of Select Strategies

To help MDOT and partner agencies better understand the cost-effectiveness of certain strategies, the 2020 CMAQ Cost-Effectiveness Tables Report[2] was reviewed and shared below. Projects funded by the Congestion-Mitigation and Air Quality Improvement Program were analyzed using the U.S. Environmental Protection Agency's MOtor Vehicle Emissions Simulator (MOVES) software to better quantify the cost-effectiveness in dollars per ton of emissions reduced. This information is shared to aid MDOT in making decisions that stretch Carbon Reduction Program funding to achieve the greatest carbon reduction benefits.

Figure 10. 2020 CMAQ Cost-Effectiveness Table of Select Strategies

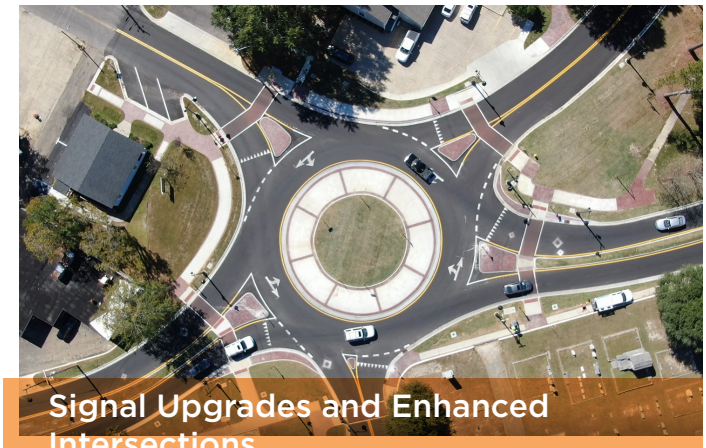
Project Type	CO	NOx	VOCs	PM_{10}	$PM_{2.5}$	Total Median Cost per Ton
Dust Mitigation				A	B	$ 15,932
Idle Reduction Strategies	A	A	A	B	B	$ 58,999
Diesel Engine Retrofit Technologies	B	B	C	D	D	$ 407,684
Intermodal Freight Facilities and Programs	B	A	C	D	D	$ 494,834
Carsharing	A	B	B	D	E	$ 766,199
Incident Management	B	B	D	D	D	$ 1,071,991
Transit Service Expansion	A	C	C	E	F	$ 2,766,431
Traffic Signal Synchronization	C	D	F	D	F	$ 3,042,950
Park and Ride	A	C	D	E	F	$ 3,622,288
Natural Gas Re-Fueling Infrastructure	A	B	D	F	F	$ 3,675,107
Electric Vehicle Charging Stations	A	C	D	F	F	$ 6,380,581
Transit Amenity Improvements	B	D	D	F	G	$ 7,457,446
Rideshare Programs	B	D	D	F	G	$ 8,194,085
Roundabouts	D	D	F	G	F	$ 8,786,402
Extreme Temperature Cold-start Technologies	B	F	D	F	F	$ 10,850,034
Bikesharing	B	G	F	F	G	$ 13,834,816
Bicycle and Pedestrian Improvement Projects	B	D	E	F	H	$ 19,423,016
Intersection Improvements	D	F	F	H	H	$ 30,823,921
Employee Transit Benefits	D	F	F	H	I	$ 50,281,268
Subsidized Transit Fares	D	F	F	H	I	$ 50,281,268
Heavy-Duty Vehicle Replacements	D	D	F	I	I	$ 69,830,233

Median Cost-Effectiveness (Dollars per Ton Reduced)	
A	<10,000
B	10,000 - 50,000
C	50,000 - 100,000
D	100,000 - 500,000
E	500,000 - 1,000,000
F	1,000,000 - 5,000,000
G	5,000,000 - 10,000,000
H	10,000,000 - 20,000,000
I	>20,000,000

MDOT's Carbon Reduction Strategy

While the prior section outlines a universe of strategies that may be funded with CRP funds, this next section draws attention to the six areas of focus for MDOT and/or the MPOs. These six strategies focus on:

Streetlight Upgrades



Signal Upgrades and Enhanced Intersections

ZEV Infrastructure

Bicycle and Pedestrian Facilities

ZEV Fleet Conversion

Intelligent Transportation Systems

ENERGY-EFFICIENT STREETLIGHT UPGRADES

Strategy Category | Energy Efficient and Green Construction

Description

LED street lights can help cities become more sustainable by shrinking their carbon footprint, thanks to lower energy consumption. Also, LED lighting systems can be integrated with smart technologies to cut costs, save energy, and make public lighting infrastructure more versatile, flexible, and efficient.

Despite the initial investment and due to the overall energy and cost savings that result, LED street light upgrades are seen as a relatively low-risk investment. LED lights are as much as 40 to 60% more energy efficient than traditional lighting technologies.[3]

Characteristics

Applicable Context	Rural and Urban
Implementation Challenges	Cost

Relative Cost

Innovative financing program exists. See additional resources at right.

Expected Outcomes

LED street lights can help cities become more sustainable by shrinking their carbon footprint thanks to lower energy consumption. As well, LED lighting systems can be integrated with smart technologies in order to cut costs, save energy, and make public lighting infrastructure more versatile, flexible, and efficient.

Success Stories—Kansas City, MO

This innovative, cost-saving, and energy-efficient project will replace 84,000 streetlights with modern LED lights that will bring many benefits to the City and its residents:

Photo Courtesy City of Kansas City, MO

- Longer lifespan: LED bulbs last 10 years or more
- Lower maintenance costs
- Energy conservation: LEDs use up to 50% less energy than standard bulbs
- Dramatically reduce carbon emissions (because of lower energy usage)
- Safer streets and more visibility with better lighting
- Generate savings to taxpayers of $27 million over 10 years

Additional Resources

Information about the cost effectiveness and innovative finance of LED street lighting upgrades can be found HERE or by using the provided QR code.

ZERO-EMISSION VEHICLE INFRASTRUCTURE

Strategy Category | Transportation Technology; Freight Efficiency

Description

Zero-emission vehicle (ZEV) infrastructure are improvements designed to accommodate low- to zero-emission vehicles like electric vehicles. This can include constructing public electric charging stations, hydrogen fueling stations, and designating EV-only parking spaces. This includes infrastructure for light-, medium-, and heavy-duty ZEV vehicles.

ZEV infrastructure programs can also include ZEV infrastructure needs assessments to evaluate an area's charging and fueling needs to support carbon emission reduction goals. These assessments can include the number, type, and distribution of chargers and fueling stations, as well as the cost. The assessment can also identify gaps in the current ZEV supportive infrastructure network, particularly in rural areas and along major highways.

Characteristics

Applicable Context	Rural and Urban
Implementation Challenges	Cost, time, land and development constraints, electrical grid capacity, loss of fuel tax revenue

Relative Cost

Expected Outcomes

Creating a network can positively influence the pace of transition to non-fuel-burning vehicles. A robust network of charging and fueling stations will allow users to take longer trips in ZEVs. More ZEVs in the transportation sector will reduce VMT by fuel-burning vehicles, including passenger and freight vehicles.

Success Stories—ChargeOK

Oklahoma's Department of Environmental Quality (DEQ) is currently implementing an EV infrastructure program to install EV charging stations throughout the state. Using funds from the Volkswagen State Environmental Trust, available tax credits through the US Department of Energy, and other sources (including grant programs), the program distributed $3.1 million for EV chargers between 2019 and 2021, which funded 90 new DC fast and dual-port Level 2 charging stations.

As part of the program, DEQ initiated a robust stakeholder engagement process with stakeholders including the Oklahoma Department of Transportation (ODOT), the Oklahoma Secretary of Energy and Environment (OSEE), the Oklahoma Corporation Committee (OCC), Central Oklahoma Clean Cities, and Tulsa Area Clean Cities. This helped the Department quickly and efficiently distribute funding.

Additional Resources

Information about the US Department of Energy Alternative Fueling Infrastructure Tax credit can be found HERE or by using the provided QR code at right.

Another helpful resource includes the Federal Highway Administration's Alternative Fuel Corridors program. Information about the program can be found HERE or by using the provided QR code at right.

ZERO-EMISSION VEHICLES (FLEET CONVERSION)

Strategy Category | Freight Efficiency; Energy Efficient and Green Construction

Description

Converting fleets to electric vehicles can be completed at once or using a phased approach. There are various options for charging fleet EVs. Fleet managers may install charging facilities on location, choosing from Level 1 or Level 2 charging apparatuses. Fleet vehicles may also be equipped to utilize public charging stations, allowing these vehicles to have longer (and potentially long-haul) range.

Considerations for fleet conversion include cost, phasing, installation, vehicle maintenance, required training for technicians, vehicle ability (medium- vs. heavy-duty vehicles—including construction vehicles), and charging considerations.

Characteristics

Applicable Context	Rural and Urban
Implementation Challenges	Cost, Charging/Fueling Station Availability and Capacity, Purchasing Agreements, Vehicle Range and Charging Times

Relative Cost

Innovative financing program exists. See additional resources at right.

Expected Outcomes

Due to their energy efficiency and low-emissions, fleet conversions can allow organizations to meet local, state, and federal carbon reduction goals and requirements—as well as improve their public image. Despite the initial up-front costs, EV fleet vehicles lower costs overall, with higher fuel economy and lower operating costs. According to the US General Services Administration, light-duty EVs cost on average 3 cents per mile.

Success Stories—Cobb County, GA

Cobb County, Georgia has been an early adopter of zero-emission vehicles. Through collaboration with multiple partners, the County started its transition to electric vehicles in 2013 by leveraging state and federal tax credits. The County analyzed telematics data and targeted vehicles with a duty cycle of 40 to 50 miles for replacement. These vehicles were prioritized first, and as of 2022, the County had nearly 70 light duty electric vehicles, 140 hybrids, and 40 other alternative fuel vehicles in operation.

Click the image to read more

Additional Resources

Fleet conversion programs may be eligible for Commercial Electric Vehicle (EV) and Fuel Cell Electric Vehicle (FCEV) Tax Credits through the US Department of Energy. More information can be found HERE or by using the QR code.

SIGNAL UPGRADES AND ENHANCED INTERSECTION DESIGN

Strategy Categories | Transportation Technology; Congestion Management Mitigation; Freight Efficiency

Description

Intersections are a major source of congestion on arterial streets. They remain a significant source of vehicle emissions because stop-and-go traffic and associated acceleration/deceleration patterns have been linked to increased emissions.[4] Most intersections have traffic control (stop signs and traffic signals) that requires a significant percentage of traffic to slow and ultimately stop, followed by acceleration through the intersection. There are several techniques that can be used to reduce or eliminate delays and congestion including traffic signal optimization, alternative intersection designs, or the creation of alternative routes for traffic. Many of these options also offer efficiencies for freight movement. This section highlights the use of traffic signal optimization and intersection design.

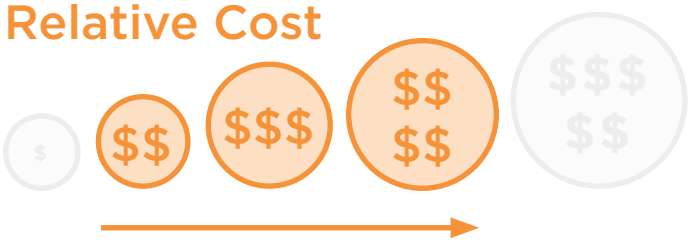
Traffic Signal Optimization: Adaptive signals optimize intersection traffic flow using advanced analytics, modern hardware, and software. This is a solution that can significantly reduce vehicle emissions and improve safety within a targeted area.

Enhanced Intersection Designs: Another way to reduce emissions is through geometric designs that significantly reduce or eliminate the need to stop so that delays are reduced, and rapid acceleration is minimized. The most popular of these intersection designs are roundabouts and continuous flow intersections. Their design typically involves minimizing the number of conflict points. The combination of slower navigation speed combined with reduced number of conflict points has the added benefit of improved safety.

Characteristics

Applicable Context	Rural and Urban
Implementation Challenges	Right-of-way, Cost, Community Support, Education

Relative Cost



Expected Outcomes

Adaptive Signals automatically adapt to unexpected changes in traffic conditions. They improve travel time reliability and reduce congestion and fuel consumption. Many studies have shown that adaptive signal control improves average performance metrics (travel time, control delay, emissions, and fuel consumption) by 10 percent or more. In systems with particularly poor conditions, the improvement can be 50 percent or more. Improvement might be somewhat less in areas with high-performing pre-time systems in which fluctuations are rare, but every system experiences some fluctuations.[5]

Roundabouts can have operational and safety benefits over signalized intersections under certain circumstances. For example, the average vehicle delay can be significantly lower during off-peak periods for roundabouts compared to signalized intersections, and under peak traffic conditions, roundabouts can often match or even outperform traffic signals operationally. Due to the geometric and design characteristics of roundabouts, they can function as a traffic calming device, and they have been shown to provide substantial safety benefits over signalized intersections.

Continuous Flow Intersection, or CFI, is an innovative intersection that allows vehicles to travel more efficiently through an intersection. A CFI enhances safety and increases traffic flow through intersections by allowing left-turning traffic and through-traffic to move simultaneously.[6]

CFI's typically require less right-of-way to increase intersection capacity when compared with adding lanes and are quicker and cheaper to implement, compared with building overpasses or underpasses.

Additional Resources

USDOT/FHWA ACST Brochure

DriveSmart MS–CFIs

USDOT/FHWA Roundabouts

BIKE AND PEDESTRIAN FACILITIES

Strategy Category | Active Transportation and VMT Reduction

Description

Bicycle and pedestrian facilities, or active transportation facilities, provide nonmotorized travel options for walkers, cyclists, those using wheelchairs, micromobility riders, and others. Facilities can include sidewalks, bike lanes, shared-use paths, greenways, and trails, among others. These facilities may be added through more comprehensive complete street or road diet projects. Providing a variety of active transportation options can encourage users to choose modes that are more carbon friendly, like biking and walking. They also support recreational opportunities that support healthy lifestyles and quality of life for residents and visitors.

Characteristics

Applicable Context	Rural and Urban
Implementation Challenges	Time, Community Support, Limited Right-of-Way, Cost

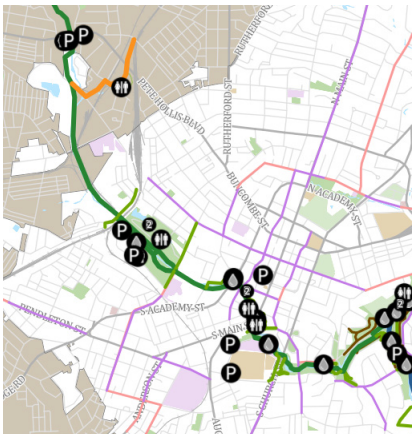
Relative Cost

Expected Outcomes

Decreased motorized vehicle use contributes to reduced air pollution, helping meet local, state, and federal carbon reduction goals and requirements. A robust active transportation network helps decrease congestion, particularly on local and collector roads. Bike and pedestrian facilities also help improve public image and provide options for those without vehicle access.

Success Stories—Swamp Rabbit Trail

The Swamp Rabbit Trail is a 22-mile trail in Greenville County, South Carolina. In addition to providing recreational opportunities, the location makes it a viable option for commuters, which helps to remove these vehicles from the roadways, helping alleviate traffic congestion. The greenway is so successful that, in 2022, the County reported over 700,000 runners, walkers, and bicyclists using the trail, and over 14% of trips were noted as trips from home to work.



Click the image to explore the interactive map

Additional Resources

In addition to CRP funds, variety of funding options are available for implementing bicycle and pedestrian facilities. For more information, click HERE.

INTELLIGENT TRANSPORTATION SYSTEMS

Strategy Category | Transportation Technology; Congestion Management Mitigation; Freight Efficiency

Description

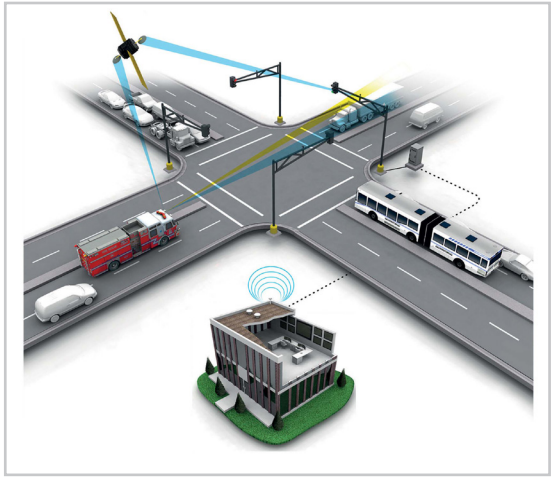
Intelligent Transportation Systems (ITS) include the use of technology to advance safety and mobility in transportation by integrating various communications and traffic management technologies into vehicles and the infrastructure. ITS is a constantly evolving field given the pace of technology and there is an array of possible solutions for each need identified by an agency. Several ITS applications are recognized as carbon reduction strategies, especially those that result in reduced VMT, lower levels of congestion, and reduced idling and acceleration. Most of these options fall into one of the following categories:

Signal System Modernization	Guidance and Communication
Advanced Signal Systems	En Route Travel Information
Emergency Vehicle Preemption (EVP)	Dynamic Route Guidance
Transit Signal Priority (TSP)	Real-Time Parking Demand Management

Characteristics

Applicable Context	Rural and Urban
Implementation Challenges	Cost, Fiber and Communication Infrastructure

Relative Cost



ITS International TSP ESP

Expected Outcomes

Signal System Modernization | These types of enhancements are often reliant on fiber optics infrastructure and associated communication hardware and software. They are often implemented along corridors of significance or system-wide and can be used to increase the efficiency of signalized intersections and corridors, allowing for emergency vehicle pre-emption (EVP) that results in improved response times and faster recovery to optimum traffic flow. Similar systems are also being used to provide transit priority (TSP) that increases route reliability, a characteristic that helps promote transit usage. A recent Carnegie Mellon pilot program demonstrated that smart traffic signals could reduce emissions by upwards of 20 percent, while greatly improving congestion and commute times for citizens.

Guidance and Communication | Several technologies use real-time data to communicate with transportation system users in ways that improve navigational and routing decisions. En route ITS communicates with drivers (and vehicles), providing routing suggestions that avoid congested corridors. Similarly, Dynamic Route Guidance leverages fixed communication infrastructure to provide advance warning of incidents, congestion, and travel time with the potential to offer alternate routes when available. Similar ITS technology is being used in urban environments to help direct drivers to accessible/vacant parking as well as charging infrastructure for electric vehicles. The net result of all of these technologies is the ability to manage congestion, reduce idle-time, and reduce VMT.

Success Stories—TDOT and TXDOT

Tennessee DOT Traffic Signal Modernization Program (TSMP) | TDOT began a modest program to help local communities modernize aging and inefficient traffic signal infrastructure. In the first year of this program, the Department received 162 grant applications representing 672 signalized intersections with an overall funding request totaling over $30M. This is evidence that investments in improving traffic signals is both popular and effective. The low-cost signalization improvements included in the TSMP projects are proven to be a cost-effective way to reduce crash rates and improve safety and reliability of the transportation system while also reducing emissions. TDOT has made the program permanent and plans to expand the size and scope of the program in the coming years.

Texas DOT – My35 | The focus of the My35 program has been to expand and enhance the 96-mile stretch between Hillsboro and Salado, a vital section of the corridor north of Austin traveled daily by 100,000 to 130,000 motorists. For the last seven years, the Texas A&M Transportation Institute (TTI) has provided logistical and technical support to TxDOT in the corridor, including developing a first-of-its-kind traveler information system. TTI installed Bluetooth® readers, Wavetronix sensors, and end-of-queue warning systems along I-35 and then formulated algorithms to integrate and mine the massive amounts of data gathered. The results are reliable traffic forecasts and regular construction incident reports passed along as driver alerts delivered via various media.[7]

Additional Resources

USDOT ITS Information

Transit Signal Priority Information

ParkMobile Parking App Benefits

04

IMPLEMENTATION PLAN

04 IMPLEMENTATION PLAN

MDOT's Role in Carbon Reduction

As the State works to obligate and program CRP funding, it is important to highlight the extent of MDOT's influence in reducing carbon from transportation. A recent National Cooperative Highway Research Program (NCHRP) project shares that the emission sources under direct control of DOTs is limited compared to that of system users. NCHRP estimates that within a "typical" State about 94% of emissions are from system users, while the remaining 6% are from construction, maintenance, and operations of the system, and 0.2% are from the DOT's administrative activities such as light-duty fleet vehicles.[8]

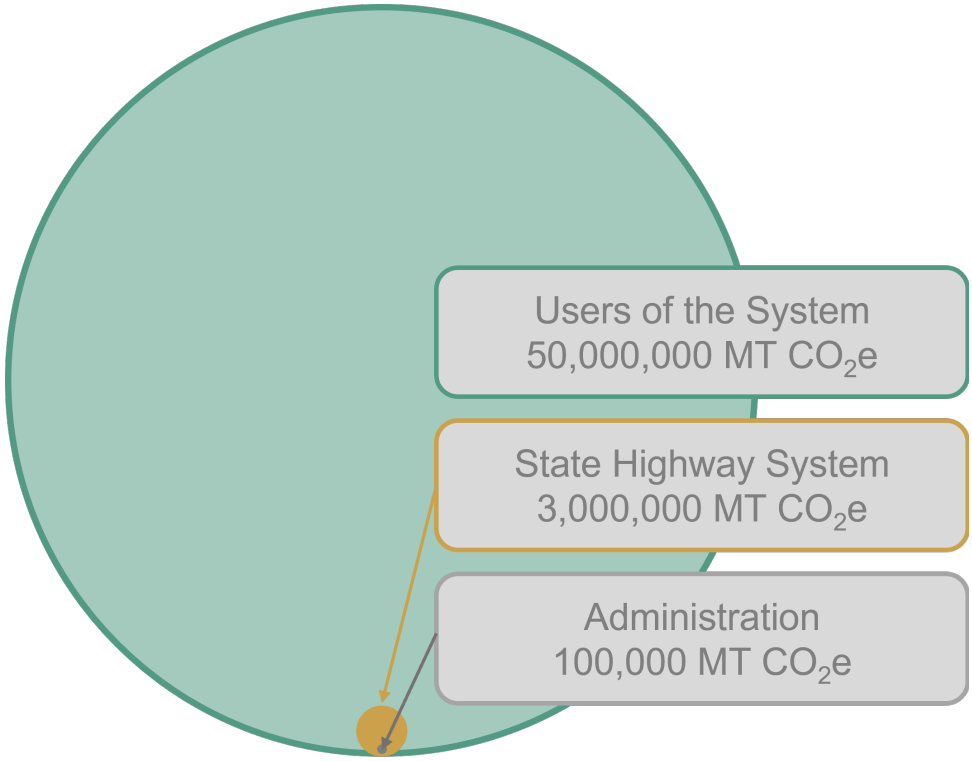


Figure 11. Typical Transportation Carbon Emissions (metric tons of carbon dioxide equivalent)

This underscores the importance of engaging in partnerships with other state agencies, regional and local governments, and the business community. These groups have authority or jurisdiction over many elements that move the needle on carbon reduction that MDOT may not.

OPPORTUNITY FOR CONTINUED PARTNERSHIPS

Other State Agencies

MDOT should continue existing partnerships with agencies such as the Mississippi Department of Environmental Quality (MDEQ). MDOT can partner with MDEQ on initiatives such as the administration of Diesel Emissions Reduction Act (DERA) funding to replace construction equipment with cleaner alternatives and the administration of funding from the Volkswagen settlement.

MPOs and Planning and Development Districts

MDOT should continue the partnership with regional councils and MPOs initiated through the development of the Carbon Reduction Strategy. The regional expertise of these organizations adds value to MDOT when it comes to relationships with local jurisdictions, understanding local context, and helping implement projects.

Local Jurisdictions

Local municipalities within the state have jurisdiction over many elements that prove effective in reducing carbon emissions, such as land use decisions, development patterns, and local policy. MDOT can continue to partner with local jurisdictions to provide education and technical assistance to better understand the benefits and impacts of different carbon reduction strategies.

Transit Agencies

Both urban and rural transit providers play a critical role in reducing carbon emissions. MDOT should continue to partner with local transit providers across the state to identify and assess projects that may be mutually beneficial to reducing carbon emissions.

Business Community

The business community and industry partners can contribute to the reduction of transportation-related emissions in Mississippi. Employers may be able to initiate commute-trip reduction programs or incentivize employees to leverage carpool and vanpool options. Freight and shipping companies may elect to use vehicles that minimize emissions whether it be through transition to electric vehicles or idle reduction technologies. Finally, the private sector will be essential to supporting the electrification of personal vehicles – whether that be the automotive manufacturers or those providing charging infrastructure.

04 IMPLEMENTATION PLAN

Identifying and Obligating Projects

MDOT intends to identify and obligate projects in alignment with their current Statewide Transportation Improvement Program (STIP) process and in alignment with the strategies outlined within the Carbon Reduction Strategy.

The MPOs intend to identify and obligate projects in alignment with their current project selection processes and TIP requirements consistent with the strategies outlined within the Carbon Reduction Strategy.

Some example projects that have been authorized by the Federal Highway Administration (FHWA) are found in the Appendix.

Update Process

The Mississippi Carbon Reduction Strategy must be updated every four years. As MDOT has the opportunity to update the plan, it will be important to reflect on the effectiveness of the Carbon Reduction Strategy, including understanding:

- What strategies are being leveraged most often?
- What types of projects are being programmed and where in the state?
- Has consideration for carbon reduction been included in other statewide planning efforts?

Additionally, a proposed rule by FHWA may require MDOT and MPOs to establish performance measures and targets for greenhouse gas emissions. When and if these targets are set, MDOT and MPOs must show progress toward achieving the targets. The Carbon Reduction Strategy and coordination held with MPOs throughout its development create a strong starting point for making transportation investments that will ultimately reduce transportation-related greenhouse gas emissions. After the final rule-making is determined related to the greenhouse gas performance measure, future updates would also take this into consideration.

Endnotes

1 FHWA NATIONAL COALITION ON TRUCK PARKING WORKING GROUP, DEC 2020

2 HTTPS://WWW.FHWA.DOT.GOV/ENVIRONMENT/AIR_QUALITY/CMAQ/REFERENCE/COST_EFFECTIVENESS_TABLES/FHWAHEP20039.PDF

3 HTTPS://BLOGS.WORLDBANK.ORG/ENERGY/LED-STREET-LIGHTING-UNBURDENING-OUR-CITIES

4 PUBLICATION NO. FHWA-SA-15-071, AUGUST 2020

5 FHWA ADAPTIVE SIGNAL CONTROL-FAQ, JULY 2016

6 TEXAS DEPARTMENT OF TRANSPORTATION FACT SHEET-CFI

7 TEXAS TRANSPORTATION RESEARCHER, TTI'S TRAVELER INFORMATION SYSTEM HELPS KEEP I-35 DRIVERS SAFER, BETTER INFORMED

8 HTTPS://CRP.TRB.ORG/NCHRPWEBRESOURCE1/2-0GREENHOUSE-GAS-BASICS/

APPENDIX

Project #	Detail	Termini	Stage	Est. Begin Date	External #	Current total estimated cost	County	Scope	Type	Grant(s)	Auth Date	Agency
109297	101000	Development of the Carbon Reduction Plan	4	11/1/2022	CRP-9999-09(344)	150,000	STATEWIDE	Study	PE	Y600	11/16/2022	MDOT
108776	301000	US 72 at MS 7	4	2/1/2023	HSIP-0007-01(096)	9,024,807	Benton	Roundabout	CON	Y608	1/25/2023	MDOT
108850	701000	Northeast Mississippi Community College - Campus Pedestrian Improvements on Ellis Avenue and Tiger Lane	4	2/16/2023	STP-0055-00(041) LPA	505,429	Prentiss	Not Assigned - Define Scope	CON	Y607	2/16/2023	LPA
109067	711000	City of Horn Lake - Horn Lake Road Sidewalk	4	4/25/2023	STP-7866-00(003) LPA	34,318	Desoto	Not Assigned - Define Scope	PE	Y301, Y601	4/25/2023	LPA
108795	701000	Copiah-Lincoln Community College - Campus Pedestrian Improvements	4	6/21/2023	STP-0279-00(012) LPA	873,594	Copiah	Not Assigned - Define Scope	CON	Y608	6/12/2023	LPA
109134	701000	City of Natchez - Downtown Sidewalk Improvements on Commerce Street from Main Street to Franklin Street	3	9/22/2023	STP-6090-00(001) LPA	469,100	Adams	Not Assigned - Define Scope	CON	Y607	9/21/2023	LPA
109201	701000	Desoto County Board of Supervisors - Multi-Use Agri-Ed Trail System	3	9/22/2023	STP-0017-00(046) LPA	1,163,420	Desoto	Not Assigned - Define Scope	CON	Y601, M301, M3E1, Z301, Z30E	9/22/2023	LPA
109194	701000	City of Starkville - Pedestrian Improvements at the Intersection of Spring Street and Hwy 12	4	9/26/2023	STP-0420-00(026) LPA	400,000	Oktibbeha	Not Assigned - Define Scope	CON	Y607	9/25/2023	LPA
102134	304000	US 82 Greenville Bypass from MS River Bridge to Leland. (ITS)	3	10/31/2023	NH-0011-01(063)	2,700,998	Washington	ITS - Intelligent Transportation Systems	CON	Y608	9/14/2023	MDOT
106947	301100	I-10 from 1.5 miles west of Hwy 603 to the Harrison County Line (ITS)	2	11/3/2023	NHPP-0010-01(179)	2,257,245	Hancock	ITS - Intelligent Transportation Systems	CON	Y600	9/25/2023	MDOT
106947	302100	I-10 from the Hancock County Line to 2 miles east of US 49 (ITS)	2	11/3/2023	NHPP-0010-01(179)	3,676,210	Harrison	ITS - Intelligent Transportation Systems	CON	Y600	9/25/2023	MDOT
106947	301200	I-10 from 1.5 miles west of Hwy 603 to the Harrison County Line (Ped)	2	11/3/2023	NHPP-0010-01(179)	8,532,212	Hancock	Pedestrian Walkway	CON	Y600, L22E	9/25/2023	MDOT
108812	302000	I-55 Fr MS 24 to US 98 Summit (West side)	2	3/1/2024	CRP-0055-01(123)	3,137,196	Pike	Roundabout	CON	Y607	9/25/2023	MDOT