



August 2023

CLIMATE CHANGE

State and Local Efforts to Reduce Greenhouse Gas Emissions from Vehicles

Accessible Version

Why GAO Did This Study

Greenhouse gas emissions contribute to climate change, which numerous studies have shown poses environmental and economic risks. The transportation sector is the largest source of greenhouse gas emissions in the U.S., with transportation activities accounting for 29 percent of total U.S. emissions in 2021, according to the Environmental Protection Agency. The vast majority of these emissions occur on the nation's 4-million-mile network of roads, most of which are owned and operated by state and local governments.

The Explanatory Statement on the Consolidated Appropriations Act, 2022 included a provision for GAO to examine the extent to which states and MPOs collect performance information on transportation-related greenhouse gas emissions, among other things. This report describes activities selected state DOTs and MPOs have taken related to estimating, analyzing the effects of transportation investments on, and using reduction targets for on-road greenhouse gas emissions.

GAO reviewed federal statutes, regulations, executive orders, and other information on greenhouse gas emissions. GAO also interviewed federal officials as well as officials from a non-generalizable selection of 10 state DOTs and 10 MPOs. GAO selected states that varied in greenhouse gas emission policies, population, and geographic area, and generally selected the largest MPO from each of these states.

View [GAO-23-106022](#). For more information, contact Elizabeth Repko at (202) 512-2834 or repkoe@gao.gov.

CLIMATE CHANGE

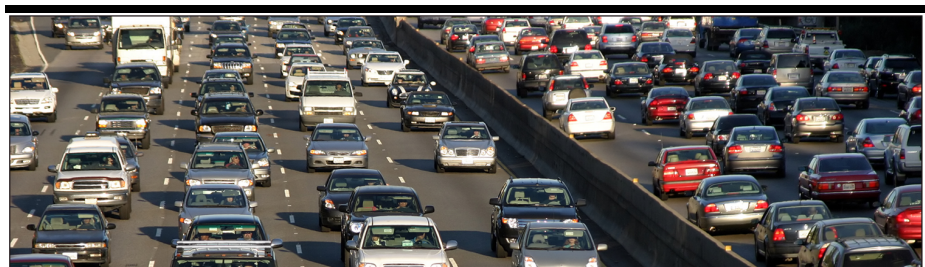
State and Local Efforts to Reduce Greenhouse Gas Emissions from Vehicles

What GAO Found

According to the Federal Highway Administration (FHWA), state departments of transportation (state DOT) and metropolitan planning organizations (MPO) play a key role in implementing activities to reduce transportation-related greenhouse gas emissions, including on-road emissions from vehicles. GAO found examples of state DOTs and MPOs engaging in these activities, including estimating emissions, analyzing the effects of transportation investments, and using reduction targets.

- **Estimating emissions.** GAO found examples of state DOTs and MPOs estimating on-road greenhouse gas emissions using different types of data as the basis of those estimates. These entities more commonly used data on vehicle miles traveled (e.g., annual traffic count data), while others used fuel data (gallons of fuel taxed by the state). The selected state DOTs that do not currently estimate on-road greenhouse gas emissions cited a number of reasons. For example, Montana state DOT officials said the majority of roads in the state are rural with no congestion issues. Officials from selected MPOs provided examples of resource challenges they face, such as not having readily available data or staff with the right subject matter expertise.
- **Analyzing the effects of transportation investments.** GAO found examples of state DOTs and MPOs analyzing the effects of transportation investments on greenhouse gas emissions. For example, officials from an MPO in Massachusetts said that they estimate emissions changes for every project the MPO funds. However, selected state DOTs and MPOs reported challenges to reliably quantifying the effects of specific investments on greenhouse gas emissions.
- **Using reduction targets.** GAO found a few examples of selected state DOTs and MPOs that have targets for reducing on-road greenhouse gas emissions. For example, the MPO representing the Washington, D.C. metropolitan area set targets to reduce on-road greenhouse gas emissions by 50 percent from 2005 levels by 2030, and 80 percent by 2050. However, selected state DOT and MPO officials provided examples of challenges to meeting reduction targets, such as having few ways to incentivize consumers to adopt particular fuels or vehicles.

Vehicle Traffic Congestion and On-Road Emissions



Source: Roza/stock.adobe.com. | GAO-23-106022

Contents

GAO Highlights		ii
	Why GAO Did This Study	ii
	What GAO Found	ii
Letter		1
	Background	4
	Selected State and Local Entities Estimate On-Road Greenhouse Gas Emissions Using a Mix of Approaches	9
	Selected State and Local Entities Use Different Approaches to Analyze the Effects of Transportation Investments on On-Road Greenhouse Gas Emissions	13
	Few Selected State and Local Entities Use Reduction Targets for On-Road Greenhouse Gas Emissions	17
	Agency Comments	22
Appendix I: Objectives, Scope, and Methodology		23
Appendix II: GAO Contact and Staff Acknowledgments		27
	GAO Contact	27
	Staff Acknowledgments	27
Table		
	Table 1: List of Stakeholders Interviewed	25
Figures		
	Figure 1: Total U.S. Greenhouse Gas Emissions by Economic Sector in 2021	5
	Figure 2: Examples of Transportation Investments That Can Reduce On-Road Greenhouse Gas Emissions	8

Abbreviations

DOT	Department of Transportation
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
MOVES	Motor Vehicle Emission Simulator
MPO	metropolitan planning organization
NCHRP	National Cooperative Highway Research Program
state DOT	state department of transportation
STIP	statewide transportation improvement program
TIP	transportation improvement program
VMT	vehicle miles traveled

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.



August 3, 2023

The Honorable Brian Schatz
Chair
The Honorable Cindy Hyde-Smith
Ranking Member
Subcommittee on Transportation, Housing and Urban Development, and
Related Agencies
Committee on Appropriations
United States Senate

The Honorable Tom Cole
Chair
The Honorable Mike Quigley
Ranking Member
Subcommittee on Transportation, Housing and Urban Development, and
Related Agencies
Committee on Appropriations
House of Representatives

Changes in the climate pose a risk to the safety and reliability of the U.S. transportation system, according to the 2018 *Fourth National Climate Assessment*.¹ Effects of climate change include heavy precipitation, coastal flooding, heat, and changes in average precipitation and temperature that affect individual assets across all transportation modes. Greenhouse gas emissions contribute to climate change through the greenhouse effect, a process in which atmospheric gases trap reflected sunlight, warming the planet. Limiting the federal government's fiscal

¹The Global Change Research Act of 1990 required the President to establish the U.S. Global Change Research Program. Pub. L. No. 101-606, § 103, 104 Stat. 3096, 3098 (1990). This program facilitates collaboration and cooperation across its 13 federal member agencies to advance understanding of the changing Earth system and maximize efficiencies in federal global change research. The U.S. Global Change Research Program most recently released a National Climate Assessment in 2018. See U.S. Global Change Research Program, *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment*, vol. 2 (Washington, D.C.: 2018). A fifth National Climate Assessment is expected at the end of 2023.

exposure by better managing climate change risks has been on our high risk list since 2013.²

The transportation sector is the largest source of greenhouse gas emissions in the U.S., according to the Environmental Protection Agency (EPA). In 2021, the largest sources of greenhouse gas emissions within the transportation sector, according to EPA, were light-duty trucks, including sport utility vehicles, pick-up trucks, and minivans (about 37 percent); medium- and heavy-duty trucks (about 23 percent); and passenger cars (about 21 percent).³

The vast majority of transportation activity and transportation-related greenhouse gas emissions in the U.S. occur on the nation's 4-million-mile network of roads. Most of these roads are owned and operated by state or local governments. The Federal Highway Administration (FHWA) provides funding to state departments of transportation (state DOT) through the federal-aid highway program to preserve, build, and improve the nation's surface transportation.⁴ State DOTs make transportation investment decisions in concert with other entities, such as metropolitan planning organizations (MPO), which are policy boards responsible for carrying out the transportation planning process in metropolitan areas within a state.⁵ According to FHWA, state DOTs and MPOs play a key role in implementing activities to reduce transportation-related greenhouse gas emissions, including on-road emissions.

²See GAO, *High-Risk Series: Efforts Made to Achieve Progress Need to Be Maintained and Expanded to Fully Address All Areas*, [GAO-23-106203](#) (Washington, D.C.: Apr. 20, 2023).

³Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*, EPA 430-R-23-002 (2023).

⁴Under this program, states have considerable discretion to make transportation investment decisions and select which eligible projects will be federally funded. However, when using this program's funding, they must comply with applicable federal requirements. The Infrastructure Investment and Jobs Act authorized an annual average of about \$54.6 billion in funding for fiscal years 2022 through 2026 for the federal-aid highway program formula grants. Pub. L. No. 117-58, § 11101(a)(1), 135 Stat. 429, 443 (2021).

⁵An MPO must be designated for each urbanized area with a population of 50,000 or more, as determined by the Census Bureau. Metropolitan areas are geographic areas determined by agreement with the MPO for the area and the state governor. See 23 U.S.C. § 134(b), (d).

The Explanatory Statement on the Consolidated Appropriations Act, 2022 included a provision for us to examine the extent to which states and MPOs collect performance information on transportation-related greenhouse gas emissions, among other things.⁶ Our report describes examples of how selected state DOTs and MPOs approach

- estimating on-road greenhouse gas emissions,
- analyzing the effects of transportation investments on on-road greenhouse gas emissions, and
- using reduction targets for on-road greenhouse gas emissions.

For all objectives, we reviewed applicable statutes, executive orders, regulations, and other federal information related to on-road greenhouse gas emissions. We reviewed FHWA's notice of proposed rulemaking related to greenhouse gas emissions that was issued in July 2022. We also reviewed and analyzed responses by state DOTs to selected questions from a 2018 survey conducted as part of research published by the National Cooperative Highway Research Program in 2022 (NCHRP's 2022 report).⁷

In addition, we conducted semi-structured interviews with officials and reviewed information from 10 state DOTs and 10 MPOs.⁸ We selected states that varied in greenhouse gas emission policies, population, and geographic area. We generally selected the largest MPO from each of these states. In addition to these interviews, we reviewed selected state statutes and regulations; other documentation, such as technical guides; and any comments on FHWA's 2022 proposed rule submitted by our selected states and MPOs. We also interviewed federal agencies,

⁶Pub. L. No. 117-103, 136 Stat. 49 (2022); Explanatory Statement on the Consolidated Appropriations Act, 2022, 168 Cong. Rec. H3035 (Mar. 9, 2022).

⁷Cambridge Systematics, Inc.; Good Company; McVoy Associates, LLC; and Zamurs and Associates, LLC. *NCHRP Web-Only Document 308: Methods for State DOTs to Reduce Greenhouse Gas Emissions from the Transportation Sector*. Transportation Research Board, Washington, D.C.: 2022, accessed July 18, 2023, <https://doi.org/10.17226/26523>.

⁸We interviewed officials at state DOTs in Arkansas, California, Colorado, Georgia, Massachusetts, Michigan, Minnesota, Montana, Vermont, and Virginia. We also interviewed MPO officials at the Atlanta Regional Commission (Georgia), Boston Region MPO (Massachusetts), Chittenden County Regional Planning Commission (Vermont), Denver Regional Council of Governments (Colorado), Metroplan (Arkansas), Missoula MPO (Montana), National Capital Region Transportation Planning Board (District of Columbia/Maryland/Virginia), North Central Texas Council of Governments (Texas), Southeast Michigan Council of Governments (Michigan), and Southern California Association of Governments (California).

industry associations, and additional stakeholders recommended to us during our interviews.

While the findings from these interviews and our review of documentation and comments on FHWA's proposed rule are not generalizable to all stakeholders, they provide important perspectives and common themes. For reporting purposes, we have developed indefinite quantifiers to describe collective responses, including "most" (over half of the stakeholders in either the state DOT or MPO categories), "some" (half or less than half, but more than three in each category), and "few" (three stakeholders or fewer in each category). For more details on our methodology and a full list of stakeholders interviewed, see appendix I.

We conducted this performance audit from May 2022 to August 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

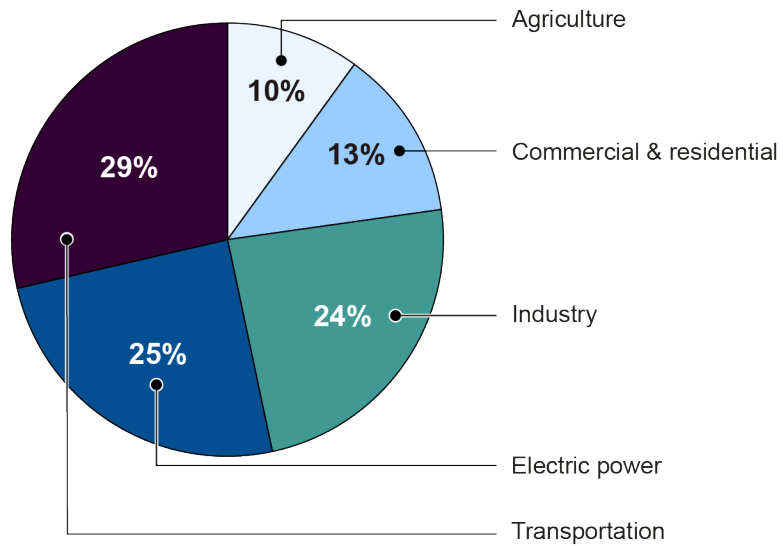
Greenhouse gases that contribute to climate change primarily consist of carbon dioxide, which numerous studies have shown poses environmental and economic risks. Transportation (e.g., fossil fuel combustion) was the largest source of carbon dioxide in 2021, accounting for 92 percent of carbon dioxide emissions, according to EPA. Additionally, fuel combustion emits small amounts of methane and nitrous oxide, as well as a small amount of hydrofluorocarbon emissions resulting from the use of vehicle air conditioners and refrigerated transport.⁹

Transportation activities are the largest source of emissions, accounting for 29 percent of total U.S. greenhouse gas emissions in 2021, according to EPA. (See fig. 1.) From 1990 to 2021, transportation emissions rose by approximately 19 percent due in large part to increased travel. Specifically, (1) the number of vehicle miles traveled (VMT) by light-duty vehicles increased by about 45 percent from 1990 to 2021, and (2) the

⁹Greenhouse gas emissions are typically presented in terms of metric tons of carbon dioxide equivalent, which is the combination of the pollutants that contribute to climate change adjusted using their global warming potential, according to EPA.

number of VMT by medium- and heavy-duty trucks increased 66 percent over the same period. While an increased demand for travel has led to generally increasing carbon dioxide emissions since 1990, improvements in average new vehicle fuel economy since 2005 have slowed the rate of increase.

Figure 1: Total U.S. Greenhouse Gas Emissions by Economic Sector in 2021



Source: GAO analysis of Environmental Protection Agency data. | GAO-23-106022

Data table for Figure 1: Total U.S. Greenhouse Gas Emissions by Economic Sector in 2021

Agriculture	Commercial & residential	Industry	Electric power	Transportation
10%	13	24	25	29

Source: GAO analysis of Environmental Protection Agency Data. | GAO-23-106022

Note: Percentages do not add to 100 due to rounding.

Since 2021, the Biden Administration has outlined national policies and goals to reduce greenhouse gas emissions across the federal government. For example, the administration issued an executive order that called for putting the U.S. on a path to achieve net-zero emissions economy-wide by 2050.¹⁰ To help achieve this policy goal, the

¹⁰*Tackling the Climate Crisis at Home and Abroad*, Exec. Order No. 14008, §§ 101, 201 (Jan. 27, 2021).

Department of Transportation (DOT), the Department of Energy, EPA, and the Department of Housing and Urban Development entered into a Memorandum of Understanding in September 2022 to coordinate on cleaner and improved transportation.¹¹ These agencies issued a joint strategy in 2023 to eliminate nearly all greenhouse gas emissions from the transportation sector by 2050.¹² The strategy is meant to guide future policymaking and research in the public and private sectors.

In 2022, FHWA issued a notice of proposed rulemaking that would establish a performance measure for estimating on-road greenhouse gas emissions and setting targets to reduce them over time.¹³ According to FHWA, its proposed rule aligns with national policy to reduce greenhouse gas emissions by requiring state DOTs and MPOs to set declining carbon dioxide emission targets for transportation on the National Highway System.¹⁴ In addition to aligning with the recent executive orders, FHWA stated that reducing greenhouse gas emissions also supports one of the statutory national goals of the federal-aid highway program, specifically environmental sustainability.¹⁵

Under FHWA's proposed rule, state DOTs would be required to establish 2- and 4-year statewide emission reduction targets, and MPOs would establish 4-year emission reduction targets for their metropolitan planning areas. In 2017, FHWA established requirements for state DOTs and MPOs to assess and set targets for on-road greenhouse gas emissions

¹¹This Memorandum of Understanding was entered into in coordination with the National Climate Task Force. The Memorandum of Understanding is intended for coordination on policy and acceleration of the development of innovative solutions and technologies.

¹²U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, *The U.S. National Blueprint for Transportation Decarbonization: A Joint Strategy to Transform Transportation*, DOE/EE-2674 (Washington, D.C.: Jan. 1, 2023). DOT, EPA, and the Department of Housing and Urban Development also contributed to this strategy.

¹³Specifically, the notice of proposed rulemaking would amend FHWA regulations on national performance measures to, among other things, (1) require state DOTs and MPOs to establish declining targets for reducing tailpipe carbon dioxide emissions on the National Highway System; (2) establish methods for calculating greenhouse gas performance measures and metrics; and (3) require the reporting of greenhouse gas emissions associated with on-road mobile sources. National Performance Management Measures, Assessing Performance of the National Highway System; Greenhouse Gas Emissions Measure; 87 Fed. Reg. 42401 (proposed July 15, 2022).

¹⁴See 87 Fed. Reg. 42406.

¹⁵23 U.S.C. § 150(b)(6); 87 Fed. Reg. 42407.

on the National Highway System, but FHWA repealed this requirement in 2018.¹⁶

Estimating emissions and making investments to reduce them are key steps toward setting and meeting targets.

- **Estimates.** Stakeholders rely on estimates of greenhouse gas emissions because these emissions are very difficult to measure directly, according to NCHRP's 2022 report. Estimates can be described in various ways, including as an inventory or a carbon footprint.¹⁷ Estimating forecasted effects of investments for on-road greenhouse gas emissions requires setting a baseline that represents expected effects if no actions are taken. The baselines are extrapolated from historical trends or developed from forecasts using models, such as travel demand predictions.
- **Investments.** State and local governments make transportation investment decisions based on availability of funding and their communities' needs and priorities. As part of the statewide and nonmetropolitan area planning process, states must develop a long-range statewide transportation plan and a statewide transportation improvement program (STIP).¹⁸ The long-range statewide transportation plan establishes a state's strategic vision and direction for its overall transportation system investments for at least a 20-year forecast period. The STIP must include the state's prioritized listing or program of transportation projects covering at least a 4-year period that are proposed to be implemented with federal highway funds, and be consistent with the long-range statewide transportation plan.

The STIP must also include regionally significant projects requiring an action by FHWA, regardless of whether the projects are to be

¹⁶See National Performance Management Measures; Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program, 82 Fed. Reg. 5970 (Jan. 18, 2017); National Performance Management Measures, Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program, 83 Fed. Reg. 24920 (May 31, 2018).

¹⁷An inventory is a list of emission sources that are quantified using a standard method, and a carbon footprint is the total amount of gases that are emitted into the atmosphere each year, according to EPA.

¹⁸Statutes and regulations governing statewide and nonmetropolitan area transportation planning for federal-aid highway program funds are located in 23 U.S.C. § 135 and 23 C.F.R. Part 450.

federally funded. For metropolitan areas, MPOs are also required to produce a long-range transportation plan, referred to as a metropolitan transportation plan, and a transportation improvement program (TIP) similar to the STIP.¹⁹ We have previously reported that transportation officials are to consider a number of key factors when making transportation investment decisions during the planning process including economic, safety, efficiency, security, accessibility, and environmental factors.²⁰

NCHRP's 2022 report notes a number of investments that specifically help reduce on-road greenhouse gas emissions in transportation, including shifting travel to less carbon-intensive modes (e.g., investments that encourage travel by transit instead of cars), investing in electric and alternative fuel vehicle infrastructure, and improving the efficiency of transportation system operations (e.g., investments that reduce congestion). (See fig. 2.)

Figure 2: Examples of Transportation Investments That Can Reduce On-Road Greenhouse Gas Emissions



Public transportation, such as subway trains, provide a low-emissions alternative to driving passenger vehicles.



The total greenhouse gas emissions of manufacturing, charging, and driving an electric vehicle are typically lower than the total greenhouse gases associated with a gasoline vehicle over the lifetime of the vehicle.



Adaptive signal control technology adjusts the timing of red, yellow, and green lights to accommodate changing traffic patterns and ease traffic congestion.

Sources: GAO analysis of National Cooperative Highway Research Program, Department of Transportation, and Environmental Protection Agency information; (photos left to right) Pink Badger, Destina, and ako-photography/stock.adobe.com. | GAO-23-106022

¹⁹Statutes and regulations governing metropolitan transportation planning are located in 23 U.S.C. § 134 and 23 C.F.R. Part 450. Once the TIP is approved by the MPO and state governor, the state must include it without change in the STIP.

²⁰GAO, *Surface Transportation: Many Factors Affect Investment Decisions*, [GAO-04-744](#) (Washington, D.C.: June 30, 2004).

- **Targets.** We previously reported in 2002 that numerical targets or other measurable values facilitate future assessments of whether overall goals and objectives—such as reducing greenhouse gas emissions—were achieved, because comparisons can be easily made between projected performance and actual results.²¹ Statute and FHWA regulations currently require states to set performance targets and periodically report progress toward meeting them to achieve a number of national goals, including goals for infrastructure condition, transportation safety, and system reliability. FHWA’s proposed rule would require state DOTs and MPOs to set declining on-road greenhouse gas emission targets, but the proposed rule does not establish specific targets for them. Rather, according to FHWA, state DOTs and MPOs have flexibility to set targets that are appropriate for their communities, as long as the targets indicate reduced emissions over time.²²

Selected State and Local Entities Estimate On-Road Greenhouse Gas Emissions Using a Mix of Approaches

We identified examples of approaches that selected state DOTs and MPOs used to estimate greenhouse gas emissions. Nationwide, less than half of state DOTs estimated greenhouse gas emissions for the transportation sector as of 2018, according to a survey published as part of NCHRP’s 2022 report.²³ About 40 percent of the states that responded (16 of 39) to the question reported that they had developed greenhouse

²¹GAO, *Tax Administration: IRS Needs to Further Refine Its Tax Filing Season Performance Measures*, [GAO-03-143](#) (Washington, D.C.: Nov. 22, 2002).

²²87 Fed. Reg. at 42402. Statute requiring state DOTs and MPOs to establish targets for the performance of the National Highway System does not provide FHWA the authority to approve or reject these self-set targets. See *Moving Ahead for Progress in the 21st Century Act*, Pub. L. No. 112-141, § 1203(a), 126 Stat. 405, 526 (2012) (codified as amended at 23 U.S.C. § 150(d)).

²³The survey was distributed to officials at all 52 state DOTs. For the purposes of the federal-aid highway program, a state is defined as any of the 50 states, the District of Columbia, or Puerto Rico. 23 U.S.C. § 101(a)(28). A total of 41 of these state DOTs responded to the survey, though not all answered every question. The survey did not specifically ask about whether state DOTs calculated on-road greenhouse gas emissions estimates.

gas inventories for the transportation sector or worked with a partner agency to develop one.²⁴ A little over half of the states that responded (23 of 39) indicated that they had not developed a greenhouse gas inventory or forecast for the transportation sector.

Emissions are typically estimated using a combination of observed and modeled data, according to *Reducing Greenhouse Gas Emissions: A Guide for State DOTs*.²⁵

- **Observed data.** These data can include gallons of fuel taxed by the state (fuel data), or annual traffic count data (VMT data) that are reported to FHWA by the states.
- **Modeled data.** These data include emissions factors that can be derived from emissions models. According to EPA, an emissions factor is a representative value that attempts to relate the quantity of a pollutant emitted with an industrial activity. Emissions factors are tools for building emissions inventories, guiding air quality management decisions, and developing emissions control strategies.

Our review found examples of state DOTs and MPOs using different types of observed data to estimate on-road greenhouse gas emissions.

- **Fuel data.** We found examples of state DOTs using fuel data to estimate on-road greenhouse gas emissions—which are also data that FHWA included in its proposed rule—either alone or in conjunction with other data. For example, Vermont DOT officials told us that fuel data are currently the basis of their estimates. California state officials said that they have 28 sources of data that contribute to their tracking of on-road greenhouse gas emissions, including fuel and travel demand data.
- **VMT data.** However, the state DOTs and MPOs we interviewed more commonly used VMT data when estimating greenhouse gas emissions. In comments submitted to FHWA on the proposed rule,

²⁴Specifically, the survey asked state DOTs whether they had developed a transportation sector greenhouse gas inventory or forecast of greenhouse gas emissions. For those that had developed an estimate, the survey also asked whether it had been developed for transportation planning (three had) or to specifically support performance metrics (four had).

²⁵Cambridge Systematics, Inc.; Good Company; McVoy Associates, LLC; and Zamurs and Associates, LLC. *NCHRP WebResource 1: Reducing Greenhouse Gas Emissions: A Guide for State DOTs* Transportation Research Board, Washington, D.C.: 2022, accessed July 18, 2023, <https://crp.trb.org/nchrpwebresource1/>.

some state DOTs and stakeholders stated that using VMT data had advantages over using fuel data.²⁶ For example, although they supported FHWA's proposed rule, 11 state DOTs noted that VMT data may be better aligned with existing state programs and practices than fuel data.²⁷ Similarly, the Association of Metropolitan Planning Organizations commented that using VMT data would provide consistency between regions and states. According to these comments, VMT data would help states and MPOs identify whether any emissions reductions were due to VMT-reducing strategies or technological changes. We also found examples of state DOTs and MPOs using a combination of VMT data and other data. For example, officials from an MPO in Vermont told us that they use a combination of vehicle mix, speed, roadway, and other data along with VMT data when estimating emissions.

Our review also found examples of the modeled data that selected state DOTs and MPOs used to estimate on-road greenhouse gas emissions. These entities most commonly used EPA's Motor Vehicle Emission Simulator (MOVES).²⁸ MOVES is an emissions modeling system that estimates emissions for mobile sources at the national, county, and project level for greenhouse gas and other air pollutants. California is a notable exception to using MOVES, because the state has developed its own model. According to state officials, this model can estimate emissions rates of air pollutants, including greenhouse gas emissions, for on-road vehicles that are operating in California across a range of past and future years.

The selected state DOTs that do not currently estimate on-road greenhouse gas emissions cited a number of reasons, such as the type of traffic in their state, status of state planning efforts, and state priorities. Montana DOT officials told us they do not track or estimate on-road greenhouse gas emissions because the majority of the roads under their jurisdiction are rural roads that are not on the National Highway System,

²⁶FHWA asked for comments in its proposed rule on other approaches to estimating on-road greenhouse gas emissions. Both comment submissions discussed here recommended flexibility in the type of data used if the proposed rule is finalized.

²⁷These advantages and others are described in an October 2022 joint letter. The 11 state DOTs that signed this letter are California, Colorado, Connecticut, the District of Columbia, Hawaii, Illinois, Minnesota, Oregon, Pennsylvania, Vermont, and Washington.

²⁸EPA officials noted that modeled data from MOVES rely on some observed data.

and do not have congestion issues.²⁹ According to Michigan DOT officials, the state only recently developed a climate plan in 2022, and they are early in the process of identifying implementation strategies to align with the plan, including how they will estimate on-road greenhouse gas emissions. Arkansas DOT officials stated they would not estimate on-road greenhouse gas emissions as standard practice unless specifically required to do so by a federal or state regulation.³⁰

Most of the state DOTs and some MPOs we interviewed agreed that calculating emissions using fuel data as described in FHWA's proposed rule would not be difficult. For example, after FHWA repealed its 2017 rule establishing a similar performance measure for on-road greenhouse gas emissions, Minnesota DOT officials said that as an exercise, they performed the analysis and completed a draft report in about 2 hours that would have met the requirements of FHWA's 2017 final rule. Arkansas DOT officials said that they are technically capable of doing the calculations in FHWA's proposed rule, even though they are not currently estimating on-road greenhouse gas emissions. Although Colorado DOT officials use VMT data instead of fuel data, they said these calculations would not be difficult, as the data are easily accessible.

However, MPO officials identified examples of particular resource challenges related to estimating on-road greenhouse gas emissions.

- **Staff challenges.** Officials from the Association of Metropolitan Planning Organizations told us that MPO efforts vary greatly based on the size of the MPO and the number of staff. Specifically, they noted that two-thirds of all MPOs are small, with potentially one or two staff members. As a result, they often do not have the subject matter expertise or staff resources of medium- and large-sized MPOs to analyze greenhouse gas emissions.
- **Data challenges.** Some MPO officials said that they do not have data readily available in a format that is useful to them. For example, officials from an MPO in Vermont told us that data on certain fuel (oil, propane, and gasoline) at the municipal level are not readily available, creating challenges for them in making estimates. Officials from an

²⁹Montana DOT officials noted that the federal focus on states' work has been on the National Highway System.

³⁰Arkansas DOT officials said that they analyzed greenhouse gas emissions as part of developing some National Environmental Policy Act documents and benefit-cost analyses for competitive grant applications, but that greenhouse gas analysis is not currently a routine practice.

MPO in Georgia told us that private sector movement data are too expensive for most MPOs to purchase.

- **Challenges related to analysis tools.** Officials from an MPO in Georgia told us that analysis tools that are more scalable to organizations of different sizes would be needed for state, regional, and local levels. Similarly, officials from an MPO in Arkansas told us that MPOs need tools and guidance readily and easily accessible to incorporate greenhouse gas emissions into existing travel demand models.

These challenges notwithstanding, MPOs we interviewed—including those that do not estimate on-road greenhouse gas emissions—reported having modeling experience that could help them estimate on-road greenhouse gas emissions in the future. For example, officials from an MPO in Texas told us that they use a travel demand model to look at road and traffic data, as well as other information that can be used to estimate on-road greenhouse gas emissions. Officials from an MPO in Montana said that they do not currently use the MOVES model to estimate on-road greenhouse gas emissions, but they have used it for air quality analysis. Since the region has improved its air quality, officials said that they may move toward estimating greenhouse gas emissions using MOVES in the future. Similarly, according to the Association of Metropolitan Planning Organizations, even if MPOs are not specifically estimating on-road greenhouse gas emissions, the information may be indirectly captured through other federal requirements, such as those pertaining to air quality.

Selected State and Local Entities Use Different Approaches to Analyze the Effects of Transportation Investments on On-Road Greenhouse Gas Emissions

We found examples of approaches selected state DOTs and MPOs used to analyze the effects of transportation investments on greenhouse gas emissions. More broadly, according to the survey included in NCHRP's 2022 report, 17 of 39 responding state DOTs reported considering

greenhouse gas emissions in project development.³¹ Only five of those 17 states considered the emissions quantitatively (e.g., in terms of tons of greenhouse gas emissions).³²

Selected state DOT and MPO officials described using approaches such as analyzing the effects on greenhouse gas emissions along with other priorities, and estimating emissions changes resulting from planned projects. However, implementation of these approaches varied. For example:

- Virginia DOT officials evaluate potential transportation investments based on the extent to which they will improve safety, reduce congestion, and affect the environment, among other priorities. The state DOT scores projects based on criteria related to these priorities. The potential of a project to improve air quality and reduce greenhouse gas emissions is one of the environmental quality criteria.³³ The environmental quality criteria are weighted as 10 percent of the total project score.
- Officials from an MPO in Massachusetts told us they estimate changes in greenhouse gas emissions for every project the MPO funds.³⁴ Officials said they conduct analysis to estimate carbon dioxide emissions, to determine how much the project will produce or reduce those emissions. For project types that can be quantitatively assessed, like bike paths or intersection improvements, officials report emissions changes in kilograms per year. Officials said the MPO considers and scores potential projects in its transportation improvement plan based on various criteria, including how the project changes greenhouse gas emissions. Specifically, projects can gain or

³¹The survey asked whether agencies considered the effects of greenhouse gas emissions in project development or alternatives analysis. The survey did not specify on-road greenhouse gas emissions. Twenty-two states reported that they did not consider greenhouse gas emissions in project development or alternatives analysis.

³²The other 12 states said they considered the effects of greenhouse gas emissions through qualitative consideration or reported analysis of an unspecified type.

³³This criterion is scored based on potential benefits to non-single occupancy vehicle users (e.g., improvements to bicycle or passenger rail facilities) and an estimated carbon dioxide offset based on the potential increase in non-single occupancy vehicle users.

³⁴Under Massachusetts' regulations, MPOs must quantify net transportation greenhouse gas emissions impacts resulting from projects in their transportation plans. 310 Mass. Code Regs. § 60.05.

lose points depending on the annual estimated changes in carbon dioxide emissions resulting from the project.

- California state officials said that transportation agencies in California conduct quantitative analysis of the change in VMT resulting from capacity-increasing projects—such as constructing a new highway or adding a lane on an existing road. Officials said that, according to California Environmental Quality Act guidelines, if a transportation project is expected to significantly increase VMT, California transportation agencies or other agencies need to consider actions that would mitigate this increase, such as providing new transit options or supporting low-VMT land uses.³⁵ Officials said that these alternatives could include providing new transit options or supporting low-VMT land uses. More broadly, the California Air Resources Board Scoping Plan quantifies the VMT reductions necessary to meet California’s long-term greenhouse gas emission targets and identifies a need for VMT reduction in California.

Selected state DOTs and MPOs commonly reported challenges related to reliably quantifying the effects of specific investments on greenhouse gas emissions. For example, Colorado DOT officials said that it is difficult to model certain investments and to evaluate the effects of potential investments over time, such as estimating the effect of adding 1 mile of bike lane on greenhouse gas emissions 10 years later. Additionally, as previously mentioned, officials from an MPO in Massachusetts said that they can quantitatively assess some types of projects. However, for other project types, such as transit marketing or adding bike racks, the officials make qualitative assumptions of “increasing” or “decreasing” emissions, because they cannot precisely estimate the effects.

We also found examples of selected state DOTs and MPOs that do not explicitly analyze the effects of their investment decisions on greenhouse gas emissions, but that made investments to support other priorities that may also reduce greenhouse gas emissions. For example, officials from an MPO in Arkansas told us that the MPO plans to spend \$50 million to expand its bicycle network, as part of a broader strategy to improve air

³⁵In 2013, the California legislature required the Governor’s Office of Planning and Research to propose revisions to the state’s guidelines establishing criteria and to recommend metrics for determining the significance of transportation impacts of projects within certain areas. The legislature required the criteria to promote the reduction of greenhouse gas emissions, and the Office was expressly permitted to recommend VMT as a metric. 2013 Cal. Legis. Serv. Ch. 386 (S.B. 743), § 5. Prior to using VMT analysis, California transportation agencies typically used changes in automobile delay in analyzing their investments, which might have included metrics such as how fast vehicles could travel at rush hour. See *id.* § (1)(a)(2).

quality. The officials noted this project may also contribute to reduced greenhouse gas emissions, even though the MPO does not use greenhouse gas emissions as a criterion to select projects. Similarly, while Montana DOT officials said that while they do not have any policies or requirements specific to greenhouse gas emissions, they do have policies encouraging mode shifts, including improving accommodations for non-motorized travel, such as biking or walking. Officials said that these policies can reduce greenhouse gas emissions.

We found examples of MPOs that analyzed the effects of their transportation investment decision-making on greenhouse gas emissions—even when the state DOTs did not—in response to local initiatives. For example, officials from an MPO in Montana said that when ranking projects, they analyze the effects of investment decisions on greenhouse gas emissions even though they said there is no state requirement to do so. Officials said the MPO has climate and sustainability goals, primarily based on reducing VMT. According to these officials, a city and county covered by the MPO also have greenhouse gas reduction goals for their operations. Additionally, while Georgia DOT officials told us in April 2023 that they had started analyzing greenhouse gas emissions effects for certain projects since our initial interview in December 2022, officials from an MPO in Georgia said that they have factored greenhouse gas emissions reduction into their transportation improvement plan since 2015. Specifically, the MPO officials said they use tools such as MOVES to estimate and forecast projects' effect on greenhouse gas emissions.

Certain selected state DOTs and MPOs said they might develop ways to analyze the effects of transportation investments on greenhouse gas emissions into their decisions in the future due to new federal funding sources. Specifically, officials from an MPO in Texas said they are considering how to use data on greenhouse gas emissions to make transportation investments now that there is federal funding related to climate change and greenhouse gas emissions. Similarly, Montana DOT officials said that while they are not currently analyzing the effects on greenhouse gas emissions of their transportation investment decisions,

they will likely consider emissions when developing the state's carbon reduction strategy as part of FHWA's Carbon Reduction Program.³⁶

Few Selected State and Local Entities Use Reduction Targets for On-Road Greenhouse Gas Emissions

A Few Selected State DOTs and MPOs Have Set Emissions Reduction Targets in Response to State and Regional Initiatives

We found that few selected state DOTs and MPOs had specific targets for reducing on-road greenhouse gas emissions. Similarly, according to nationwide survey results in NCHRP's 2022 report, a relatively small number of states had set transportation-related reduction targets. Specifically, six of 40 responding state DOTs reported having a policy as of 2018 that sets system-wide goals or targets for reducing transportation greenhouse gas emissions, according to a survey in NCHRP's 2022 report.³⁷ (The survey did not ask whether states had targets specific to on-road emissions.) Additionally, 16 of 39 responding state DOTs reported having some sort of goals, objectives, or performance measures related to greenhouse gas emissions in their long-range transportation

³⁶The Carbon Reduction Program, a new formula grant program authorized under the Infrastructure Investment and Jobs Act, provides funding for projects designed to reduce carbon dioxide emissions from on-road highway sources. As part of this program, states are required to develop a carbon reduction strategy in consultation with their MPOs. Infrastructure Investment and Jobs Act § 11403 (codified at 23 U.S.C. § 175).

³⁷Whether the state DOT had a policy that set system-wide goals or targets for reducing transportation greenhouse gas emissions was one response option to a survey question about whether the agency has a policy or policies related to greenhouse gas emissions reductions. The other 34 of 40 responding state DOTs reported they did not have policy that set system-wide reduction goals or targets. Specifically, 27 responding state DOTs reported that they did not have any policies related to greenhouse gas emissions. The remaining seven state DOTs reported that they had some other kind of policy related to greenhouse gas emissions, such as a policy to consider greenhouse gas emissions in planning, programming, project development, or operations.

plans, but only three of those states reported having quantitative performance measures and reduction targets.³⁸

A few selected state DOT and MPO officials provided us with examples of their reduction targets for greenhouse gas emissions and described how they set targets in response to state requirements or regional initiatives.

- The Colorado DOT, along with all MPOs in the state, has established on-road emissions reduction targets. Colorado regulations require that the state DOT and Colorado MPOs each adopt long-term transportation plans that address greenhouse gas emissions to meet regional reduction levels or targets based on modeling.³⁹ Officials said these reduction targets—for 2025, 2030, 2040, and 2050—compare action to no action, and are stated in terms of million metric tons of carbon dioxide equivalent emissions. To develop these targets, officials at Colorado DOT said they did extensive modeling and outreach, including holding 10 hearings throughout the state. According to officials, they incorporated edits based on oral and written comments resulting from this outreach into their rulemaking to provide clarity, improve implementation, and find compromise among diverse opinions.
- In June 2022, the MPO representing the D.C. metropolitan area set targets to reduce on-road greenhouse gas emissions 50 percent from 2005 levels by 2030 and 80 percent by 2050. The MPO adopted seven strategies to achieve these targets, including deploying a region-wide charging network for electric vehicles and improving pedestrian and bike access to high-capacity transit stations. The MPO also identified seven other strategies for further study, including pricing travel through a fee for VMT.
- MPOs in California have established per-capita targets for reducing greenhouse gas emissions specifically for passenger vehicles, which California state officials said are expressed in terms of pounds of emissions per-person per-day. In 2008, the California legislature required the California Air Resources Board to set regional targets.⁴⁰

³⁸The question asked whether state DOTs had established long-term transportation plan goals, objectives, or performance measures related to greenhouse gas emissions. Twenty-three of 39 responding state DOTs reported that they had not done so.

³⁹See 2 Colo. Code Regs. 601-22. The greenhouse gas emission reduction targets and modeling requirements are located in Section 601-22:8.00 of the Colorado Code of Regulations.

⁴⁰2008 Cal. Legis. Serv. Ch. 728 (S.B. 375), § 4.

California state officials said the board set these targets collaboratively with California's 18 MPOs. The California legislature also required MPOs to develop a "sustainable communities strategy" as part of their regional planning process, to reduce greenhouse gas emissions to meet those targets. According to California state officials, these strategies include efforts to reduce greenhouse gas emissions through changes to transportation planning and land use. California state officials said the California Air Resources Board first established these targets in 2010, and has since set them every 4 and 8 years. Officials from one MPO in California told us that they are in their third phase of trying to reach their target, and are aiming for a 19-percent reduction by 2035.

Most selected state DOTs and MPOs did not have specific targets for on-road greenhouse gas emissions. However, we found examples of states that had broader targets. For example, Virginia DOT officials told us that state law set a target for net zero greenhouse gas emissions across all sectors in the state including the transportation sector. Similarly, Michigan DOT officials told us the state has a 2050 economy-wide target for carbon neutrality, but that it was unclear whether Michigan DOT would have specific targets or requirements associated with that goal. These types of economy-wide targets appear to be more common than on-road greenhouse gas emission targets. For example, as of August 2022, the Center for Climate and Energy Solutions found that 25 states and the District of Columbia had statutory or executive order targets to reduce greenhouse gas emissions economy-wide.⁴¹

Other selected state DOT and MPO officials said that they plan to set targets in the future. For example, officials from an MPO in Georgia said that while they track data on greenhouse gas emissions, they have not yet set targets to reduce on-road emissions. However, they said they have started preparing tools for estimating emissions in anticipation of creating the targets described in FHWA's proposed rule. Additionally, Minnesota DOT officials said they were in the process of developing a new, aspirational greenhouse gas emission target based on outreach to the public and federal partners.

⁴¹The Center for Climate and Energy Solutions, formerly known as the Pew Center on Global Climate Change, is an environmental think tank that conducts research and analysis and convenes city, state, and national policymakers together with businesses and other stakeholders.

Selected State DOTs and MPOs Identified Multiple Challenges to Meeting Reduction Targets

Regardless of whether they are currently using targets, selected state DOTs and MPOs provided potential examples of challenges related to meeting reduction targets. The challenges related to the following:

- **Vehicle and fuel choice.** Selected state DOT officials said they may not have the authority to regulate fuel composition and consumer vehicle choice, which could make meeting targets difficult. Officials identified increased use of low-carbon fuels and fuel-efficient vehicles—including electric vehicles—as strategies to reduce greenhouse gas emissions and help states and MPOs meet their targets. However, selected state DOT officials indicated that they may have few ways to incentivize consumers to adopt particular fuels or vehicles within their existing authority. For example, Virginia DOT officials said that they do not have many ways to affect statewide fuel sales or fuel efficiency directly.
- **Local land use.** Selected state DOT and MPO officials said the characteristics of local land use, such as zone and population density, can affect the number and distance of trips that people take and available transportation options. For example, Georgia DOT officials said characteristics such as where people live and work, and the availability and use of public transit, affect VMT and therefore greenhouse gas emissions. Officials explained that these characteristics are generally determined based on local authorities' decisions, and that the state DOT has limited influence on these decisions. Officials from the MPO for the D.C. metropolitan area said that land use strategies will be extremely important to reducing greenhouse gas emissions. These officials said the MPO works with the area's council of governments to help bring jobs and housing closer together, and closer to transit stations. However, officials said the vast majority of land use plans have already been put into place and may be challenging to modify.
- **Cost of strategies for reducing greenhouse gas emissions.** Selected state DOT and MPO officials also reported that certain investments to reduce emissions may not be considered cost-effective, which could stretch resources and make it difficult to build support for them. For example, while transit projects can help reduce VMT and greenhouse gas emissions, we previously reported that they can require significant funding and planning to construct, operate, and

maintain, and are generally complicated projects.⁴² Minnesota DOT officials said that states may want to pursue multimodal projects to help reduce greenhouse gas emissions, but these types of projects can be very expensive, and states may lack the funds to implement them. Additionally, officials from an MPO in Texas said that while the City of Dallas has invested in projects that reduce greenhouse gas emissions, smaller cities do not always have the resources for such investments.

- **State and local characteristics.** Selected state DOT and MPO officials noted that state and local characteristics—such as whether an area is rural or how rapidly an area is growing—may affect their ability to meet a reduction target. For example, Montana DOT officials said that some strategies for reducing greenhouse gas emissions—such as adding electric vehicle infrastructure—may be more challenging or take longer to implement in a rural state with a lower population density. Furthermore, Montana DOT and four other state DOTs have noted that cold weather and high elevations could reduce the effectiveness of some electric vehicles, which may make individuals less likely to purchase them.⁴³ A state or region’s rate of population growth may also affect its success in meeting a target. For example, Georgia DOT officials said that since the state population is rapidly growing, reducing VMT and corresponding greenhouse gas emissions may be more difficult.

FHWA officials said that, in general, the issues described above related to achieving and setting targets are under consideration as the rulemaking process continues. According to FHWA officials, they were evaluating over 39,000 comments received in response to the proposed rule at the time of our review. In its proposed rule, FHWA did not propose any

⁴²For example, see GAO, *Rail Transit: Federal Transit Administration Could Improve Information on Estimating Project Costs*, [GAO-19-562](#) (Washington, D.C.: July 22, 2019).

⁴³This challenge was noted in the joint comments submitted by the Idaho, Montana, North Dakota, South Dakota, and Wyoming DOTs in response to FHWA’s proposed rule. In a 2015 report, FHWA found that colder and hotter climates reduced the range, and therefore utility, of certain electric vehicles due to impacts on battery performance. Additionally, they found that mountainous terrain also reduced the range due to the additional power required to climb hills. See: Department of Transportation, Federal Highway Administration, *Feasibility and Implications of Electric Vehicle (EV) Deployment and Infrastructure Development*, FHWA-HEP-15-021 (Washington, D.C.: January 2015).

penalties specifically for failure to meet reduction targets. As of June 2023, FHWA has not issued a final rule.⁴⁴

Agency Comments

We provided a draft of this report to DOT and EPA for review and comment. DOT and EPA provided technical comments, which we incorporated, as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Transportation, and the Administrator of the Environmental Protection Agency. In addition, the report is available at no charge on the GAO website at <https://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-2834 or repkoe@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix II.



Elizabeth Repko
Director, Physical Infrastructure Issues

⁴⁴ According to the Spring 2023 Unified Agenda of Regulatory and Deregulatory Actions, FHWA is planning to issue the final rule in August 2023. DOT/FHWA, Greenhouse Gas Emissions Measure, RIN 2125-AF99, Unified Agenda of Regulatory and Deregulatory Actions (Spring 2023).

Appendix I: Objectives, Scope, and Methodology

The Explanatory Statement on the Consolidated Appropriations Act, 2022 included a provision for us to examine the extent to which states and metropolitan planning organizations (MPO) collect performance information on transportation-related greenhouse gas emissions, among other things.¹ This report describes examples of how selected state departments of transportation (state DOT) and MPOs approach 1) estimating on-road greenhouse gas emissions, 2) analyzing the effects of transportation investments on on-road greenhouse gas emissions, and 3) using reduction targets for on-road greenhouse gas emissions.

For all objectives, we reviewed applicable statutes, executive orders, regulations, and other federal information related to on-road greenhouse gas emissions. We reviewed the Federal Highway Administration's (FHWA) notice of proposed rulemaking related to greenhouse gas emissions that was issued in July 2022.²

We also reviewed and analyzed a previous survey on state DOT activities and needs regarding considerations for greenhouse gas emissions. Specifically, we analyzed selected questions related to our objectives—such as whether state DOTs considered greenhouse gas emissions in project development—from the 2018 survey reported in the *National Cooperative Highway Research Program (NCHRP) Web-Only Document 308: Methods for State DOTs to Reduce Greenhouse Gas Emissions from the Transportation Sector* (NCHRP's 2022 report).³ The survey was distributed to agency directors and key planning and environment staff at

¹Pub. L. No. 117-103, 136 Stat. 49 (2022); Explanatory Statement on the Consolidated Appropriations Act, 2022, 168 Cong. Rec. H3035 (Mar. 9, 2022). MPOs are policy boards responsible for carrying out the transportation planning process in metropolitan areas within a state. See 23 U.S.C. § 134(b), (d).

²National Performance Management Measures; Assessing Performance of the National Highway System, Greenhouse Gas Emissions Measure, 87 Fed. Reg. 42401 (proposed July 15, 2022).

³Cambridge Systematics, Inc.; Good Company; McVoy Associates, LLC; and Zamurs and Associates, LLC. *NCHRP Web-Only Document 308: Methods for State DOTs to Reduce Greenhouse Gas Emissions from the Transportation Sector*. Transportation Research Board, Washington, D.C.: 2022, accessed July 18, 2023, <https://doi.org/10.17226/26523>.

all 52 state DOTs.⁴ A total of 41 of these state DOTs completed the survey. Five state DOTs began the survey without completing it. As such, the item response for the questions we report varies.

For data reliability purposes, we reviewed documentation for NCHRP's 2022 report on, among other things, the outreach methodology and response results of this survey. We also interviewed stakeholders knowledgeable about the survey. We found the data were sufficiently reliable for our purposes of using it to select states for semi-structured interviews and to supplement the information from those interviews.

We conducted semi-structured interviews with officials and reviewed information from 10 state DOTs and 10 MPOs on our objectives. We selected states that varied in terms of (1) having policies related to reducing greenhouse gas emissions, (2) population, and (3) geographic area.⁵ To determine previous policies related to the reduction of greenhouse gas emissions, we used state DOTs' responses to the 2018 survey in NCHRP's 2022 report on efforts to reduce these emissions. We generally selected the largest MPO, based on population, in each of our selected states.⁶ In addition to these interviews, we reviewed selected state statutes and regulations; other documentation, such as technical guides; and any comments on FHWA's proposed rule from our selected state DOTs and MPOs. We also interviewed federal agencies, including FHWA, the Environmental Protection Agency, and the Department of Energy; industry associations; and additional stakeholders recommended to us during our interviews. Table 1 lists the stakeholders we interviewed.

⁴For the purposes of the federal-aid highway program, a state is defined as any of the 50 states, the District of Columbia, or Puerto Rico. 23 U.S.C. § 101(a)(28).

⁵We selected two state DOTs for preliminary interviews based on other stakeholders' identification of them as leaders in this area.

⁶We selected two MPOs for preliminary interviews. We selected one of these MPOs based on an industry stakeholder's descriptions of the MPO's ongoing efforts in this area. We selected the other MPO as a pilot interview based on its geographic location and population.

Appendix I: Objectives, Scope, and Methodology

Table 1: List of Stakeholders Interviewed

Federal agencies	Department of Energy, Federal Energy Management Program
	Department of Transportation, Federal Highway Administration
	Energy Information Administration
	Environmental Protection Agency
	General Services Administration
State agencies	Arkansas Department of Transportation
	California Air Resources Board, California Department of Transportation
	Colorado Department of Transportation
	Georgia Department of Transportation
	Massachusetts Department of Transportation
	Michigan Department of Transportation
	Minnesota Department of Transportation
	Montana Department of Transportation
	Vermont Agency of Transportation
Virginia Department of Transportation	
Metropolitan planning organizations	Atlanta Regional Commission (Georgia)
	Boston Region Metropolitan Planning Organization (Massachusetts)
	Chittenden County Regional Planning Commission (Vermont)
	Denver Regional Council of Governments (Colorado)
	Metroplan (Arkansas)
	Missoula Metropolitan Planning Organization (Montana)
	National Capital Region Transportation Planning Board, Metropolitan Washington Council of Governments (District of Columbia/Maryland/Virginia)
	North Central Texas Council of Governments (Texas)
	Southeast Michigan Council of Governments (Michigan)
Southern California Association of Governments (California)	
Research and industry stakeholders	American Association of State Highway and Transportation Officials
	Association of Metropolitan Planning Organizations
	Environmental Defense Fund
	Transportation Research Board
	University of North Texas

Source: GAO. | GAO-23-106022

While the findings from these interviews and our review of documentation and comments on FHWA’s proposed rule are not generalizable to all stakeholders, they provide important perspectives and common themes. We intentionally selected state DOTs and MPOs for their varied experiences, and therefore all topics were not relevant to all state DOTs

and MPOs. For these reasons, we generally did not provide counts on the experiences of state DOTs and MPOs related to on-road greenhouse gas emissions; rather, we described illustrative examples of themes we heard. For reporting purposes, we developed indefinite quantifiers to describe collective responses, including “most” (over half of the stakeholders in either the state DOT or MPO categories), “some” (half or less than half, but more than three in each category), and “few” (three stakeholders or fewer in each category)

We conducted this performance audit from May 2022 to August 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: GAO Contact and Staff Acknowledgments

GAO Contact

Elizabeth Repko, (202)-512-2834 or repkoe@gao.gov

Staff Acknowledgments

In addition to the contact named above, Matt Voit (Assistant Director), Amy Higgins (Analyst in Charge), Alexa Francesconi, Gina Hoover, Mary-Catherine P. Overcash, Malika Rice, Amy Rosewarne, Joe Thompson, Madeline Welter, and Alicia Wilson made key contributions to this report.

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through our website. Each weekday afternoon, GAO posts on its [website](#) newly released reports, testimony, and correspondence. You can also [subscribe](#) to GAO's email updates to receive notification of newly posted products.

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <https://www.gao.gov/ordering.htm>.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on [Facebook](#), [Flickr](#), [Twitter](#), and [YouTube](#).
Subscribe to our [RSS Feeds](#) or [Email Updates](#). Listen to our [Podcasts](#).
Visit GAO on the web at <https://www.gao.gov>.

To Report Fraud, Waste, and Abuse in Federal Programs

Contact FraudNet:

Website: <https://www.gao.gov/about/what-gao-does/fraudnet>

Automated answering system: (800) 424-5454 or (202) 512-7700

Congressional Relations

A. Nicole Clowers, Managing Director, ClowersA@gao.gov, (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, DC 20548

Strategic Planning and External Liaison

Stephen J. Sanford, Managing Director, spel@gao.gov, (202) 512-4707
U.S. Government Accountability Office, 441 G Street NW, Room 7814,
Washington, DC 20548



Please Print on Recycled Paper.