



COLORADO  
Department of Transportation

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# Greenhouse Gas Transportation Report

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Associated with the  
CDOT FY2027-2036 10-Year Plan  
March 2026





**COLORADO**  
Department of Transportation

# Greenhouse Gas (GHG) Transportation Report

For the Colorado Department of Transportation

Submitted to the State Transportation Commission Pursuant to  
Code of Colorado Regulations 2 CCR 601-22  
March 2026

in support of the  
CDOT FY2027-FY2036  
10-Year Plan

by the  
Colorado Department of Transportation  
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# Acronyms and Abbreviations

## Greenhouse Gases (GHGs)

CO <sub>2</sub>	carbon dioxide
CH <sub>4</sub>	methane
N <sub>2</sub> O	nitrous oxide

## Other Abbreviations

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway & Transportation Officials
ABM	Activity-based model
ACTS	AASHTO Census Transportation Solutions
ADA	Americans with Disabilities Act
ADU	Accessory Dwelling Unit
APCD	Air Pollution Control Division
AT	Active Transportation
ATP	Active Transportation Plan
ATR	Automated Traffic Recorder
AVFT	Alternative Vehicles Fuels and Technologies
BEV	Battery-Electric Vehicle
BMP	Beneficiary Mitigation Plan
BRT	Bus Rapid Transit
CAFE	Corporate Average Fuel Economy Standards
CB	Crested Butte
CCR	Code of Colorado Regulations
CDLE	Colorado Department of Labor and Employment
CDOT	Colorado Department of Transportation
CEO	Colorado Energy Office
CFI	Charging and Fueling Infrastructure
CNG	Compressed Natural Gas
CO <sub>2</sub> e	CO <sub>2</sub> Equivalent
CO	Carbon monoxide
CO XX	Colorado State Highway (where XX is the highway number)
COA	Comprehensive Operational Analysis
COG	Council of Governments
COVID-19	Coronavirus Disease 2019
CR	County Road
CRS	Colorado Revised Statutes
CSU	Colorado State University
CTE	Clean Transit Enterprise

CTIO	Colorado Transportation Investment Office
CTPP	Census Transportation Planning Package
DAF	Division of Accounting and Financing
DEN	Denver International Airport
DI	Disproportionately Impacted
DOLA	Colorado Department of Local Affairs
DRCOG	Denver Regional Council of Governments
DRO	Durango-La Plata County Airport
DTR	Division of Transit and Rail
DUS	Denver Union Station
E85	Gasoline mixture with 85 percent ethanol
EPA	Environmental Protection Agency
EV	Electric Vehicle
FASTER	Funding Advancements Surface Transportation Economic Recovery Act
FREX	Front Range Express
FHWA	Federal Highway Administration
FRPR	Front Range Passenger Rail
FSM	FASTER Safety Mitigation
FTA	Federal Transit Administration
FY	Fiscal Year
GHG	Greenhouse Gas
GIS	Geographic information system
GJT	Grand Junction Regional Airport
GUI	Graphical user interface
GVMPO	Grand Valley Metropolitan Planning Organization
HB	House Bill
HD	Heavy Duty (vehicle)
HPMS	Highway Performance Monitoring System
HSIP	Highway Safety Improvement Program
I-XX	Interstate Highway (where XX is the route number)
IACT	Interagency Consultation Team
IIJA	Infrastructure, Investment and Jobs Act
I/M	Inspection and Maintenance
MAP	Mitigation Action Plan
MD	Medium Duty (vehicle)
MMOF	Multimodal Transportation and Mitigation Options Fund
MMT	Million Metric Tons
MOD	Montrose, Olathe, Delta
MOVES	Motor Vehicle Emission Simulator (EPA)
MP	Mile Point

MPH	Miles per hour
MPO	Metropolitan Planning Organization
MS	Microsoft
MT	Metric Tons
MTJ	Montrose Regional Airport
NAAPME	Nonattainment Area Air Pollution Mitigation Enterprise
NECALG	Northeast Colorado Association of Local Governments
NEI	National Emissions Inventory
NFRMPO	North Front Range Metropolitan Planning Organization
NOx	Nitrous Oxide
OMEGA	Optimization Model for reducing Emissions of Greenhouse gases from Automobiles
OTIS	CDOT's <a href="#">Online Transportation Information System</a>
PACOG	Pueblo Area Council of Governments
P&R	Park and Ride (or PnR for RTD lots)
PD	Policy Directive
PHEV	Plug-in/Hybrid Electric Vehicle
PM	Particulate Matter
PMT	Person (or Passenger) Miles Traveled
PPACG	Pikes Peak Area Council of Governments
QCEW	Quarterly Census of Employment and Wages
RFTA	Roaring Fork Transportation Authority
RIRO	Right-in-right-out (limited-movement side street access)
RMS	Revitalizing Main Streets
RRT	Road Runner Transit
RT/d	Round trips per day
RTA	Regional Transportation Authority
RTD	Regional Transportation District
RTP	Regional Transportation Plan
SACSIM	Sacramento Activity-Based Travel Simulation Model
SB	Senate Bill
SIP	State Implementation Plan
SMART	San Miguel Authority for Regional Transportation
SMCG	Statewide Model Coordination Group
SO <sub>2</sub>	Sulfur Dioxide
SoCoCAA	Southern Colorado Community Action Agency
SST	Steamboat Springs Transit
STIP	State Transportation Improvement Program
SU	Single unit
SUV	Sport Utility Vehicle

SWP	Statewide Transportation Plan
TAP	Transportation Alternatives Program
TC	Transportation Commission
TCS	Transit Connections Study
TOD	Transit-Oriented Development
TPR	Transportation Planning Regions
US XX	United States Highway (where XX is the highway number)
VHD	Vehicle hours of delay
VHT	Vehicle Hours Traveled
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound(s)
VRH	Vehicle Revenue Hours
VRM	Vehicle Revenue Miles
VRU	Vulnerable Road Users
ZEV	Zero Emissions Vehicle

# Executive Summary

This GHG Transportation Report developed by the Colorado Department of Transportation (CDOT) presents the planning strategies employed by staff and agency partners to develop the updated fiscal year (FY) 2027-2036 CDOT 10-Year Plan. CDOT's updated 10-Year Plan and associated GHG Mitigation Action Plan (MAP) comply with the Colorado GHG Pollution Reduction Planning Standard (the Standard), contained in Code of Colorado Regulations (CCR), 2 CCR 601-22, Section 8<sup>1</sup>. The Standard requires CDOT and the state's five metropolitan planning organizations (MPOs) to determine total GHG emissions expected from planned future transportation projects and reduce GHG emissions by set amounts from their baseline plan. Specifically, the Standard applies when CDOT adopts an updated 10-Year Plan<sup>2</sup>, and more specifically to:

- Regionally Significant<sup>3</sup> projects included in the plan; and
- Projects located outside the boundaries of the state's five MPO areas.

This GHG Transportation Report details CDOT's approach to comply with the GHG reduction levels established in the Standard. CDOT employed a combination of modeling proposed future infrastructure projects and GHG mitigation measures, as allowed by 2 CCR 601-22, Section 8.02.4, to demonstrate compliance with GHG reduction requirements. [Table 1](#) below summarizes results of these strategies across each compliance year. Of particular note, CDOT is no longer required to conduct an emissions analysis for the 2025 compliance year per Section 8.02.1 of the Standard since that year is now in the past.

CDOT did not add any new regionally significant projects in non-MPO areas as part of this updated plan. Based on updated modeling CDOT is able to meet the required GHG emission reduction level in compliance years 2030 and 2050 through modeling alone. For compliance year 2040 CDOT additionally relies on a GHG MAP to achieve compliance. CDOT will employ a variety of GHG Mitigation Measures established in [Policy Directive \(PD\) 1610 "Greenhouse Gas Mitigation Measures"](#) including land use,

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<sup>1</sup> 8.02.6 "Demonstrating Compliance. At least thirty (30) days prior to adoption or amendment of any Applicable Planning Document except amendments to MPO TIPs, CDOT for Non- MPO areas, and the MPOs for their areas shall provide to the Commission a GHG Transportation Report containing the following information..."

<sup>2</sup> The CDOT 10-Year Plan is an Applicable Planning Document as defined in the Standard in Section 1.02.

<sup>3</sup> Regionally Significant projects are projects that result in a fundamental change to the way people travel (for example, new highway lanes). This distinction, consistent with legislative direction, creates an important differentiation between those projects that materially alter how the infrastructure will be used or its impact on a community, versus those changes that are strictly asset management. CDOT developed a [guidance memo](#) detailing the process for evaluating projects to determine whether they are Regionally Significant.

transit, traffic operations, and Medium/Heavy duty electrification strategies further detailed in [Appendix A](#). CDOT’s GHG MAP goes above and beyond what is otherwise required by the Standard (i.e. Voluntary Mitigations) given that CDOT has already made progress on a number of these strategies and remains committed to reducing emissions. Additionally, this approach will also offer additional assurance that if progress on one measure is slow, other measures may fill the gap. Progress on the GHG MAP will be reported annually to the Transportation Commission (TC) as required by the Standard.

**Table 1. GHG Reduction Results and Compliance**

Compliance Year	2030 (MMT <sup>4</sup> )	2040 (MMT)	2050 (MMT)
GHG Reductions Achieved through Modeling <sup>5</sup>	0.391	0.254	0.188
Required GHG Reductions Achieved through Mitigations	-	0.046	-
Voluntary GHG Reductions Achieved through Mitigations	0.038	0.002	0.031
Total GHG Reductions Achieved	0.429	0.302	0.219
2 CCR 601-22 Table 1 Required GHG Reduction Amount	0.360	0.300	0.170
Compliance Achieved?	Yes	Yes	Yes

<sup>4</sup> MMT = Million Metric Tons

<sup>5</sup> These values represent the net reduction in MMT of GHG emissions between the Baseline 10-Year plan modeling ([Table 4](#)) and the updated 2027-2036 10-Year plan modeling ([Table 6](#)).

# Introduction

## Purpose

CDOT developed this Greenhouse Gas (GHG) Transportation Report to meet requirements of Colorado’s GHG Transportation Planning Standard (2 CCR 601-22) (the Standard) as the Transportation Commission (TC) takes action to adopt an updated CDOT 10-Year Plan for fiscal years 2027 through 2036. The Standard requires CDOT and the state’s five metropolitan planning organizations (MPOs) determine the total GHG emissions expected from the existing transportation network and future planned Regionally Significant transportation projects and reduce emissions by set amounts. This GHG Transportation Report details CDOT’s compliance with the GHG reduction levels established in the Standard.

The planning and project selection outcomes, emissions modeling analysis, and GHG mitigation measures collectively demonstrate that CDOT will meet the required GHG reduction levels for all future compliance years through this updated plan. CDOT relies on a number of GHG Mitigation Measures established in the TC’s Policy Directive (PD) 1610 “GHG Mitigation Measures” to demonstrate compliance including transit, traffic operations, Medium Duty (MD)/Heavy Duty (HD) electrification, and land use strategies.

This demonstration is based on modeling analysis conducted using CDOT’s Travel Demand Model, and the Environmental Protection Agency’s (EPA’s) Motor Vehicle Emission Simulator (MOVES) air quality model. GHG emissions reduction strategies (i.e. mitigation measures) that could not be effectively modeled were calculated off model using methodologies defined by PD 1610, documented in the Mitigation Action Plan (MAP) in Appendix A.

## Background

The TC’s adoption of CDOT’s updated 10-Year Plan for fiscal years 2027-2036 is an action which requires CDOT to demonstrate compliance with the GHG emissions reduction requirements of the Standard (2 CCR 601-22, Section 8.02.1), as the 10-Year Plan is an applicable planning document (2 CCR 601-22, Section 1.02). The Standard requires CDOT to model the existing transportation network and, at a minimum, all planned Regionally Significant projects contained in the updated 10-Year Plan to demonstrate compliance with the CDOT/Non-MPO GHG reduction levels contained in 2 CCR 601-22, Section 8.01.2, Table 1. For CDOT, emissions reduction requirements apply outside the boundaries of the state’s five MPOs. The emissions reduction levels required by the Standard are summarized in [Table 2](#) below. The TC is adopting CDOT’s

updated plan in 2026. As such, CDOT is no longer required to conduct an emissions analysis for the 2025 compliance year per Section 8.02.1 of the Standard since that year is now in the past. Notably, CDOT modeled compliance with the 2025 emission reduction level in the [2022 GHG Transportation Report](#) accepted by the TC.

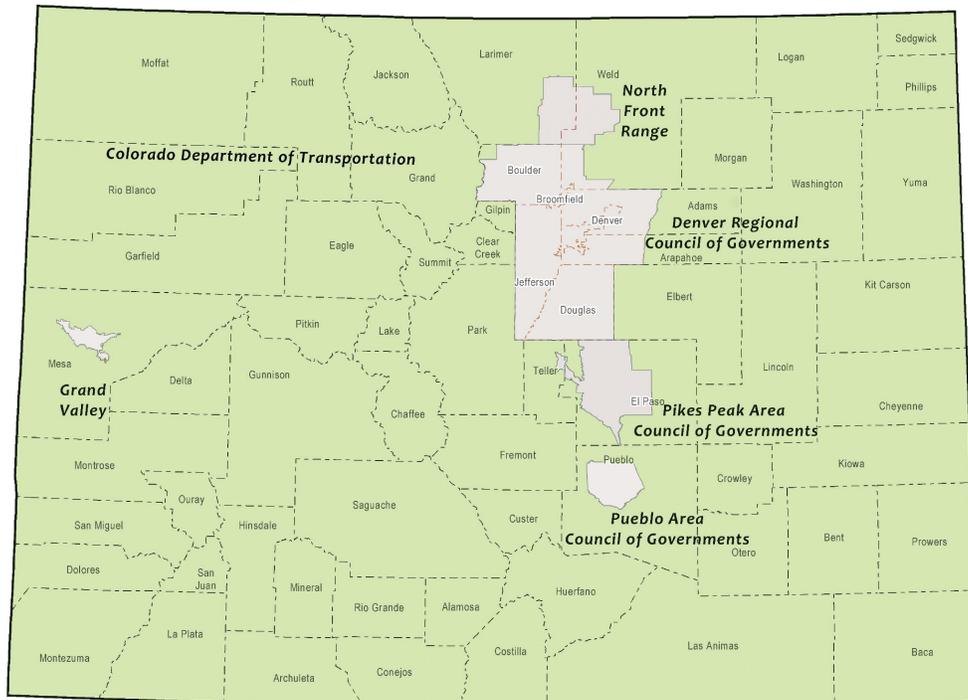
**Table 2. GHG Transportation Planning Reduction Levels in MMT of CO<sub>2</sub>e**

Regional Area	2030 Reduction Level (MMT)	2040 Reduction Level (MMT)	2050 Reduction Level (MMT)
DRCOG	0.82	0.63	0.37
NFRMPO	0.12	0.11	0.07
PPACG	0.15	0.12	0.07
GVMPO	0.02	0.02	0.01
PACOG	0.03	0.02	0.01
<b>CDOT/Non-MPO</b>	<b>0.36</b>	<b>0.30</b>	<b>0.17</b>
Total	1.50	1.20	0.70

## Planning Compliance Area

CDOT’s analysis requires modeling travel behavior and GHG emissions from existing infrastructure and planned Regionally Significant projects contained in the 10-Year Plan and located outside the boundaries of the state’s five MPO areas. [Figure 1](#) below highlights CDOT’s geographic compliance area in green, which does not include the MPO areas noted in gray.

**Figure 1. CDOT GHG Planning Standard Compliance Area**



## CDOT's Plan Development Overview of the Planning Process

CDOT follows a performance-based, multimodal transportation planning process that is continuous, comprehensive and cooperative (3C), as required by federal and state laws. This process involves updating plans every four to five years, ensuring broad public involvement in key decisions about Colorado's transportation system. It includes setting long and short-term goals, identifying strategies, and prioritizing investments. The process results in key planning documents, such as the long-range Statewide Transportation Plan (SWP) and associated Regional Transportation Plans (RTPs), 10-Year Plan, and the Statewide Transportation Improvement Program (STIP).

The SWP is a visionary plan spanning over 20 years while the 10-Year Plan contains the strategic projects that guide the infrastructure investments and transportation improvements across the state. These two plans are designed to work in tandem but serve different purposes in terms of scope, timeline and detail. Once transportation projects are funded, they are programmed into the 4-Year STIP.

The SWP, 10-Year Plan, and STIP are discussed in more detail below:

- 2050 Statewide Transportation Plan: Visionary, Long-Term Framework

- Purpose: The 2050 Statewide Transportation Plan provides the long-term vision for transportation in Colorado, addressing how the system should evolve by 2050 in response to changing demographics, climate, technology, and economic trends.
- Key Features:
  - A policy and planning document rather than a specific project list.
  - Identifies broad goals, performance measures, and strategies for improving the transportation system over 20+ years.
  - Considers multimodal transportation, air quality impacts, and land use.
  - Informed by data analysis and public and significant stakeholder input
  - Incorporates themes from long-range regional transportation plans
  - Adheres to federal and state planning requirements.
  - Updated every four to five years.
- CDOT's 10-Year Plan: Focused, Action-Oriented Investment Strategy
  - Purpose: The 10-Year Plan is a short-to mid-term project list designed to guide strategic funding decisions. The initial 4-year prioritized plan in this updated 10-Year Plan is for fiscal years 2027 through 2030.
  - Key Features:
    - Developed collaboratively with significant public and local input.
    - Focuses on high-priority, “strategic” transportation projects supported by flexible state and federal funding.
    - Operates in conjunction with other CDOT funding programs to maximize the budget and achieve performance goals.
    - Includes Regionally Significant highway, transit, bike/pedestrian (ped), and safety projects.
    - Updated regularly; Quarterly reporting to show real-time funding, scope and project status updates
    - Complies with the Colorado GHG Transportation Planning Standard (2 CCR 601-22, Section 8).
- 4-Year STIP: Near-term listing of all funded projects
  - Purpose: The STIP is a near-term project list that represents all CDOT funding.
  - Key Features:
    - Very detailed: Based on short-term budgets approved by the TC, which serves as the primary source for comprehensive project funding data. This detailed information encompasses the strategic projects within the 10-Year Plan as well as those funded through

CDOT's other major program areas, such as the Asset Management Program, Surface Treatment Program, and Bridge Program.

- Adheres to federal planning requirements
- Updated annually to include a full four years of projects and be fiscally constrained based on current CDOT revenue projections.
- Developed via the “4P” process (Project Priority Programming Process) involving regions, Transportation Planning Regions (TPR), MPOs, counties, local agencies, and public input.

While CDOT’s 10-Year Plan represents only a portion of CDOT’s overall construction budget, it is designed to operate in conjunction with other CDOT funding programs to maximize the budget outcomes and achieve performance goals. Further details are provided in the programing and funding section of this document.

In summary, the 10-Year Plan is the action plan, turning goals into funded, shovel-ready projects. The 2050 Statewide Transportation Plan is the blueprint, a long-term vision that guides investment priorities. CDOT uses the 2050 Statewide Transportation Plan to set the “why” and “what”, and the 10-Year Plan to define the “how” and “when”.

## Considerations for Reducing GHGs

### Overview

CDOT’s previous 10-Year Plan was structured around two prioritized four-year funding periods (FY 2019-2022 and FY 2023-2026). Projects in the later years (FY 2027 and beyond) were included as out-year projects but were not prioritized for funding. CDOT is emphasizing GHG reductions through the strategic direction set by new concepts introduced for both the 2050 Statewide Transportation Plan and the updated 10-Year Plan (covering fiscal years 2027-2036). Those new concepts include the following:

- Sustainably Increase Transportation Choice goal area: The TC’s [Policy Directive \(PD\) 14 “Policy Guiding Statewide Transportation Plan Goals and Performance Measures”](#) establishes the overarching policy and objectives for the development and implementation of the long-range 2050 Statewide Transportation Plan and associated 10-Year Plan. Updated in September 2024, one of the three goal areas established in PD 14 is to Sustainably Increase Transportation Choice. This means providing alternatives to single-occupancy vehicle travel that increase choices and reduce air pollution from transportation. To meet evolving travel needs, Colorado must expand safe, convenient transportation options that go beyond personal vehicles. This means building a connected network that works across regions and modes, enabling

people to access jobs, education, and services whether they live in rural areas or urban centers. Region-specific approaches are essential, as mobility solutions must reflect local conditions. The goal is to create an inclusive system that supports daily life for all Coloradans. The associated performance measures and targets adopted in CDOT's updated PD 14 include:

- Clean Transportation:
  - Reduce surface transportation sector GHG emissions (CO<sub>2</sub>e) by 60% on or before 2037, compared to the 2005 baseline.
- Statewide Transit:
  - Collaborate with stakeholders, including local partners and rail operators, to expand statewide transit services by increasing statewide revenue service miles by 66.7 million by 2037, from the 2022 baseline.
  - Achieve a 1% annual reduction in Vehicle Miles Traveled (VMT) per capita from the 2023 baseline.
- “Complete-Project” concept: This concept prioritizes both people and place and thoughtfully tailors projects like traditional roadway and safety improvement to include a wider range of elements, such as transit and active transportation infrastructure. This approach helps to enhance access and connectivity among travel modes.
- Land Use and Air Quality Linkage: While local governments in Colorado are responsible for land use decisions, CDOT engages in land use discussions to promote coordination and efficiency between land use and transportation. Land use decisions directly influence the needs and costs of Colorado's transportation infrastructure. Early involvement from CDOT in the decision-making process can help ensure that infrastructure investments align with broader state goals. Additionally, Colorado has passed a number of land-use and transportation-related pieces of legislation. Most notably House Bill (HB)24-1313, the Housing in Transit Oriented Development, which establishes transit-oriented communities and requires those communities to meet housing opportunity goals.
- Mobility Hubs: CDOT is facilitating the development of ‘mobility hubs’ on key corridors that emphasize connections between multimodal options while providing access to modes other than single-occupant vehicle travel in coordination with local land use.
- Enterprise Funding: CDOT partners with three self-funded transportation enterprises that directly support funding for projects that may reduce air

pollution emissions, including GHGs. The Nonattainment Air Pollution Mitigation Enterprise (NAAPME) and the Clean Transit Enterprise (CTE) collectively contribute approximately \$80-144 million annually through targeted initiatives. Following the 2024 legislative session, Governor Polis signed [SB24-184](#) “Support Surface Transportation Infrastructure Development” which creates a dedicated funding source for rail and transit through the Colorado Transportation Investment Office (CTIO) by imposing a fee on rental cars, generating approximately \$50 million annually. By leveraging funding from these enterprises with traditional transportation funding, CDOT can stretch our budget further and invest more in projects that improve air quality.

In addition to the considerations outlined above, CDOT has supported the development of various additional plans to help guide our efforts to expand transit, support active transportation and encourage smart land use as discussed in further detail below. Additionally, CDOT has supported the [Colorado Freight and Passenger Rail Plan](#) and the [2050 Region Transit Plans](#) from each of the rural transportation planning regions. Combined, these plans will support CDOT’s broader efforts to reduce GHGs from transportation.

## Colorado Transportation Vision 2035

In November 2024, Colorado published the [Colorado Transportation Vision 2035](#) (Vision 2035) document. Vision 2035 is a systematic framework for expanded transportation choices that outlines goals and strategies that expand transportation options to meet Colorado’s climate, affordability, safety, and equity goals. By doing so, it will advance the State’s ability to increase access to, and improve the quality of, transportation options over the next ten years. Specifically, Vision 2035 focuses on the emissions that state, regional, and local policies and investments can impact by the year 2035 beyond vehicle electrification alone, mostly focused on mode shift. Mode shift is defined as being “a traveler’s choice to supplement or avoid driving to also use a lower cost and more convenient transportation modes such as transit, biking, walking and carpooling.” The main emissions reduction goal of Vision 2035 is additional reductions of 1.2 MMT from non-auto modes of travel. This goal is supported by the following subgoals:

- Double Colorado’s non-auto mode share from 9.6% to 19.2% by 2035.
- Increase current transit service from 79 million transit revenue miles to 145 million (about 83%) by 2035.
- Increase in bicycle infrastructure statewide by 81% (3,540 miles of new bicycle routes).

- Increase in sidewalks statewide by 3.4% (1,345 miles of new sidewalks on existing streets).
- A Transit-Oriented Development goal of at least 52% of new housing units in transit oriented areas and 77% within existing Census Urban Areas.

These sub-goals utilize strategies including the expansion of transit service, implementing policies to encourage compact land use and walkable communities, reducing the number and distance of vehicle trips, and increasing travel choice by investing in bicycle and pedestrian infrastructure and micro mobility services that assist with “first and last mile” connections to transit facilities to meet the main emissions reduction goal.

### Transit Connections Study

In July 2025, CDOT published the [Transit Connections Study](#) (TCS). Colorado boasts a robust public transportation system, with local and regional networks linked by a statewide network that includes intercity bus lines, Amtrak passenger rail, and CDOT’s Bustang interregional bus service. Building on this foundation and anticipating Colorado’s evolving transportation needs, the TCS aims to strengthen this system by creating a strategic vision for a more integrated statewide transit network that enhances mobility and connectivity across Colorado. The TCS achieves this through examining stops, stations, regional and interregional service gaps, and opportunities to better connect Colorado’s transit network. This involved a review of the current public transportation services, focusing on regional characteristics, opportunities, challenges, key corridors, demographics, and travel demand patterns across these regions and corridors. The primary objective is to identify and address service gaps in Colorado’s regional and interregional public transportation network. The key goals of the study include:

- Enhance Accessibility and Connectivity of Colorado’s Transit Network: Connect rural and urban areas to Bustang, passenger rail, and local transit networks.
- Foster Multimodal Integration: Strengthen Colorado’s statewide transit network.
- Promote Sustainability: Support modeshift and GHG reduction by increasing public transit use.

This study informs CDOT’s transit planning through its identification of gaps and needs in the public transportation network including Bustang service planning, statewide transit and transportation planning, and preparation for interregional passenger rail services. Ultimately, the TCS will support CDOT’s continued progress to expand transit

services, contingent upon adequate funding, which will further support CDOT's ability to comply with the Standard.

## Active Transportation Plan

Throughout 2024 and 2025, CDOT engaged in a robust statewide stakeholder process to develop the draft [Active Transportation Plan](#) (ATP). The ATP establishes goals, policy recommendations and methods to guide the next generation of active transportation improvements in Colorado, completed in collaboration with local agencies, community members and other stakeholder groups. The ATP establishes a framework for consistent, defensible and equitable evaluation and prioritization of active transportation projects – a recognition that the demand for investment in active transportation exceeds available resources. The ATP both builds from and informs other statewide planning initiatives to ensure active transportation is thoroughly considered and prioritized in broader discussions around mobility, equity, safety, connectivity and sustainability. The ATP will support CDOT's goal to increase the use of active modes of transportation and mode shift from single occupancy vehicle use.

## Statewide Strategic Growth Report

In 2024, the Colorado General Assembly adopted several pieces of legislation around housing, land use, water, and other related issues. One of these laws, [SB24-174](#), directs the Colorado Department of Local Affairs (DOLA) to submit a Strategic Growth Report to the state legislature by October 31, 2025. The law states that the report must include three major elements:

- 1) A land use scenario analysis
- 2) An analysis of the impact of state policies and programs on sprawl
- 3) Land use policy recommendations

With this analysis, the Strategic Growth Report is intended to further a statewide conversation on the intersections between facets of built and natural environments including housing, transportation, infrastructure, water supply, air quality, wildlife risk, parks and open space, resource lands, and critical areas; and why the way we grow is important to the affordability and sustainability of Colorado. In developing the Strategic Growth Report, the law directs DOLA to consider the context of communities and consult widely with a range of stakeholders. The law also states that jurisdictions must consider the Strategic Growth Report, where applicable and appropriate, when developing a comprehensive plan. Other work related to this report will include the Vital Landscapes and Resources Report and Planning Guide, the CDOT's Policy Barriers and Opportunities study, as well as guidance on Strategic Growth Elements that provide a "Local Policy Toolkit" to support jurisdictions in this effort. In October 2025,

DOLA published the [Colorado Strategic Growth Report](#). The Strategic Growth Report recommends that CDOT consider more collaborative corridor planning initiatives to ensure key intercity and interregional highways consider land use and the future multimodal opportunities. This report will support CDOT to achieve GHG mitigation measure land use goals in non-MPO areas of the state through encouraging greater long range planning initiatives that pair land use and transportation goals.

The confluence of strategic concepts outlined above supported CDOT's decision making process for projects included in the updated 10-Year Plan for fiscal years 2027-2036. CDOT worked with the engineering regions to prioritize complete projects which are intended to thoughtfully tailor traditional roadway and safety improvement projects to include a wider range of elements, such as transit and active transportation infrastructure.

## 10-Year Plan Project Mix

Working with regional and local partners, CDOT identified projects to carry forward from the previous 10-Year Plan and new projects to add to the updated 10-Year Plan that support the goals of PD 14 to sustainably increase transportation choice, advance safety, and fix our roads. The updated 10-Year Plan funding allocated during this planning cycle supports many previously planned projects and a limited number of newly planned projects.

### CDOT's Compliance Area

Classifying each project by type proves challenging, as many projects encompass multiple elements which serve more than one goal. Additionally, the use of strategic funds allocated in the 10-Year Plan supports projects both in MPO and CDOT compliance areas for the Standard. [Figure 2](#) below represents the number of projects in each region in the 10-Year Plan outside the MPO areas of the state that have either a transit or active transportation element or both. These are the projects that help to sustainably increase transportation choice in CDOT's compliance area.

**Figure 2. Non-MPO Area Projects with and without Transit and/or Active Transportation (AT) Elements**

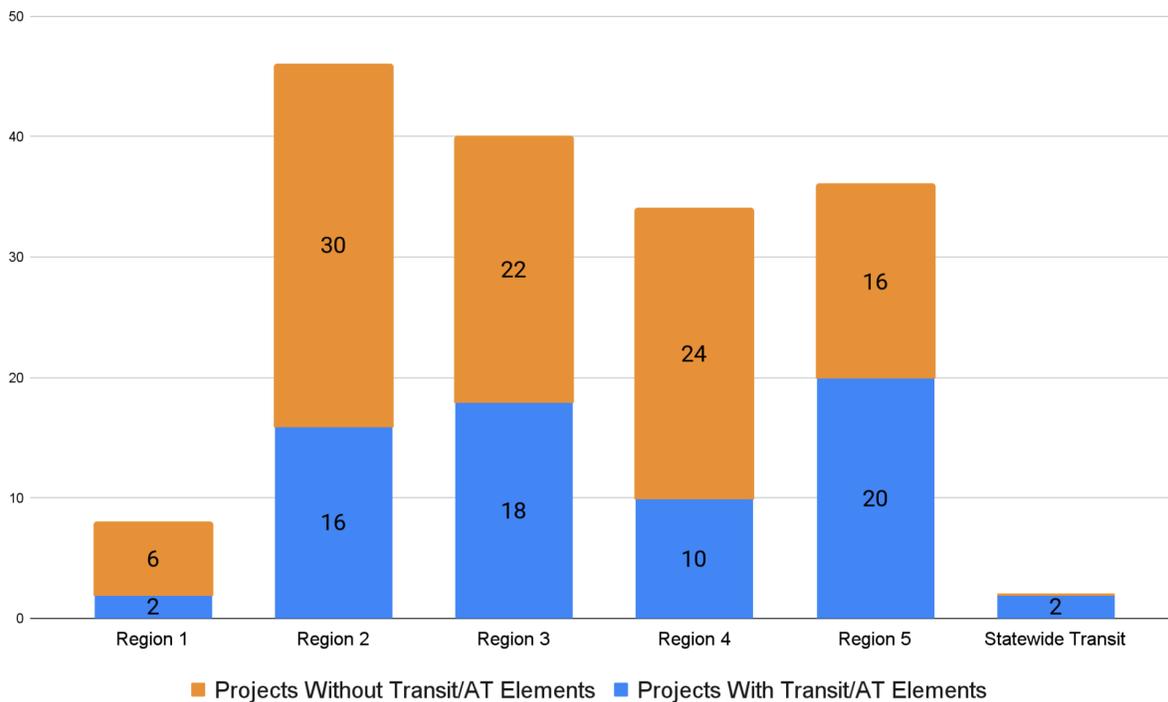
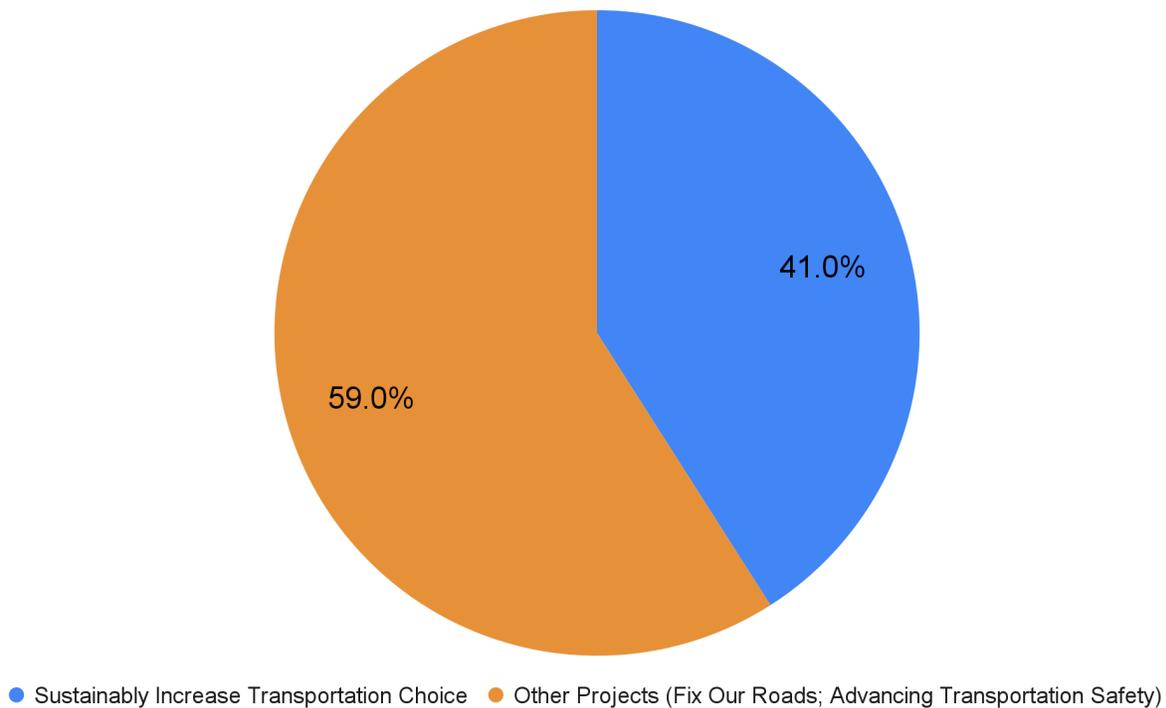


Figure 2 represents the 164 total projects in non-MPO areas (CDOT’s GHG compliance area), but there are many more projects in MPO areas that strategic funding in the updated 10-Year Plan is supporting to achieve statewide GHG reduction goals. While projects located within the MPO boundaries do not count towards CDOT’s compliance with Table 1 GHG reduction targets, some are highlighted in the MPO Compliance Areas section of this document that will help support meeting the state’s broader MPO area GHG emission reduction targets in Table 1. Beyond the 68 projects with transit/AT elements, there are five projects within non-MPO areas that are Regionally Significant (all of which were contained in CDOT’s previous 10-year plan) and 98 projects that are focused on improving safety and asset management that have neutral impact on GHGs.

The pie chart in [Figure 3](#) below categorizes 10-Year Plan projects by Policy Directive 14 goal area. Projects within the "Sustainably Increase Transportation Choice" goal area directly contribute to improving air quality and reducing GHG emissions in Colorado. Approximately 41% of projects in non-MPO areas statewide include a bicycle, pedestrian, or transit element. This represents 68 out of 164 total projects.

**Figure 3. Non-MPO Projects Supporting the Goal to Sustainably Increase Transportation Choice**



The Standard requires CDOT to model, at a minimum, Regionally Significant projects in the 10-Year Plan outside of MPO areas. The updated 10-Year Plan does not add any new Regionally Significant projects outside of MPO areas that were not otherwise included in the previous version of CDOT’s 10-Year Plan for FY19-FY28. These projects include the I-70 West Floyd Hill and I-70 climbing lane from Bakerville to Eisenhower Tunnel projects in Region 1, I-70 West Vail Pass Safety and Operational Improvements Region 3, and the US 160 Elmore’s Corner East project in Region 5. Additionally, CDOT modeled the US 40 Fraser Safety Improvements project in Region 3 under a conservative presumption that it will be regionally significant even though the project scope is yet to be fully determined.

There are several notable projects within CDOT’s GHG compliance area included in this update to the 10-Year Plan which are worth highlighting that will help reduce GHG emissions, including Mountain Rail, Bustang, local transit projects, and active transportation projects, described in further detail below.

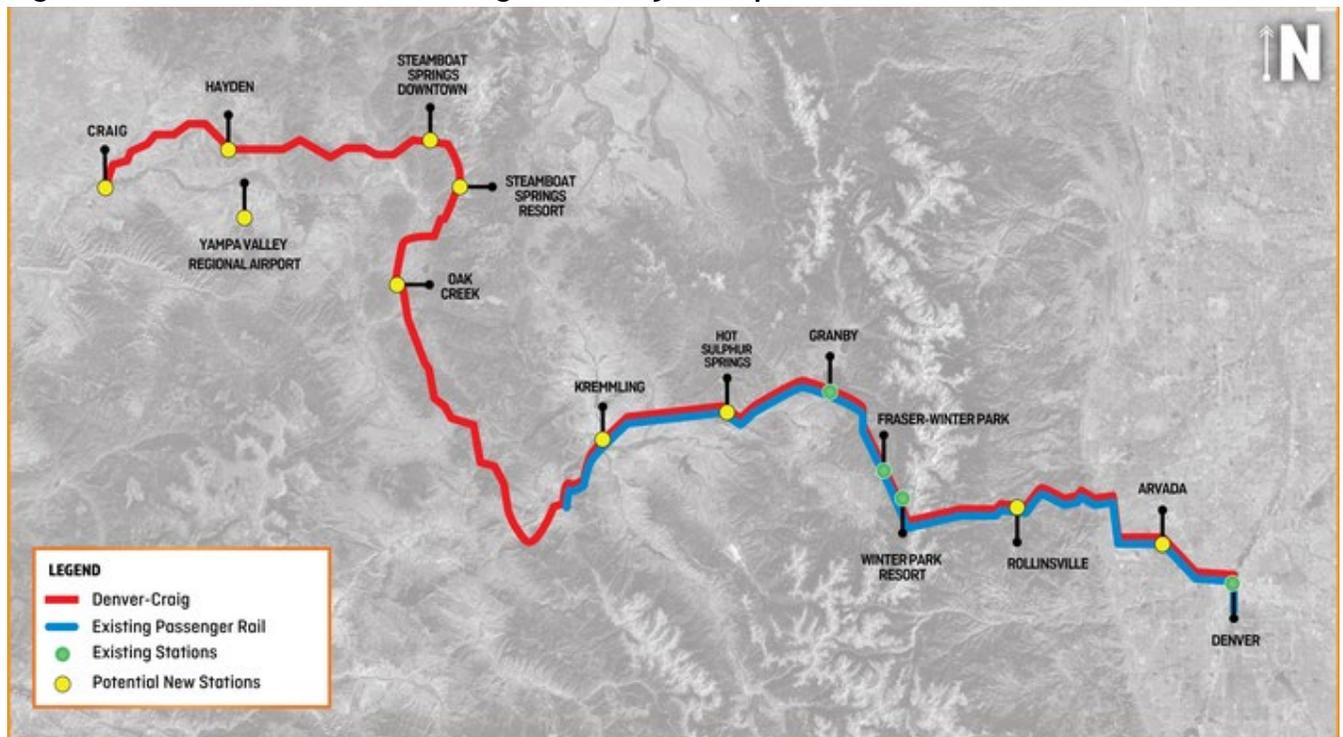
### **Mountain Rail**

Given the popularity of travel in the mountains and challenging geographical conditions, it is critical to provide reliable transportation alternatives to create better

connectivity to mountain towns, recreational opportunities, and transitional communities. A shift in the rail industry, with declining coal traffic, has opened opportunities to repurpose rail corridors for passenger use. Included in the 10-Year Plan for the first time, the plan for Mountain Rail involves developing a network of passenger rail lines that connect the mountain towns and regions with urban centers and recreational locations from Denver to Craig (see [Figure 4](#)). At the time of the development of this report, the specific station locations along the new route are still under consideration. As a part of this ongoing study, community feedback is crucial in shaping the final decisions. This input will be integrated with engineering requirements and design constraints to ensure the selected station locations meet both practical and community needs. The Mountain Rail project will provide alternative transportation options for visitors who want to experience mountain towns but who do not want to drive. Mountain Rail is also an affordable and reliable commuting option for workers in Steamboat who live in Craig and Hayden. Additionally, it would promote economic development, as housing, hotels, and retail establishments become attracted to areas served by rail.

Mountain Rail will receive dedicated funding through the congestion impact fees established by Senate Bill 24-184. The anticipated opening date for initial Mountain Rail service is November 1, 2026.

Figure 4. Colorado Mountain Passenger Rail Project Map



## Bustang Family of Services

As CDOT's interregional bus transit service, Bustang connects major populations, employment centers, and local transit entities and is a key component of providing more travel choices throughout the non-MPO areas of the state.

Bustang will be supported by a brand-new \$60 million in investment in its fleet in the updated 10-Year Plan, which will help to maintain the long distance and high-frequency service of routes such as:

- Bustang Outrider Services supports communities such as Steamboat Springs, Craig, Durango, Alamosa, Crested Butte, and many other communities.
- Bustang Mainline and Pegasus from Denver to Avon and Grand Junction.
- Bustang Snowstang Service to Arapahoe Basin, Breckenridge, Copper Mountain, & Loveland Ski Area.

Investing in Bustang's transit fleet will ensure riders experience dependable service, which in turn increases trust and ridership.

The updated 10-Year Plan continues to support Bustang in the non-MPO areas through 11 projects which invest in Outrider stops, and mobility hubs, including:

- Outrider Improvements at Montrose, Delta, and Gunnison (2454)<sup>6</sup>
- Outrider Improvements at Fraser, Granby, Kremmling, and Hot Sulphur Springs (2494)
- Outrider Improvements at Steamboat Springs, Milner, Hayden, and Craig (2748)
- Outrider Improvements at Winter Park and Tabernash (2749)
- Grand Junction Mobility Hub (2747)<sup>7</sup>

Improvements to bus stops along service routes increases ridership of the transit network. Upgrades which add Americans with Disabilities Act (ADA)-compliant platforms, curb ramps, level boarding pads, and wider sidewalks makes transit more accessible for wheelchair users and others with limited mobility. Further, transit stops with shelter, lighting, signage, and seating improvements make stops more comfortable, safe, and convenient - increasing the attractiveness of public transit and boosting ridership.

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<sup>6</sup> The numbers next to each project are their 10-Year Plan Project ID.

<sup>7</sup> While this project is located within the MPO boundary, it will serve as a new transit hub for Bustang, which supports travel throughout the non-MPO areas.

## Supporting Local Transit Service

CDOT is committed to supporting local transit service throughout the state, providing transportation choice for travel within communities through continued investment in the 10-Year Plan.

The updated 10-Year Plan carries forward planned projects that support the continued development of seven transit centers and mobility hubs with local partners, including:

- Montrose Multimodal Transit Center (1096)
- Gunnison Transfer Station (1102)
- Redesign and Construct the Steamboat Springs Transportation Center - Phase 1 (1246)
- Buena Vista Park & Ride and Intermodal Facility (1297)
- Poncha Springs Crossroads Welcome Center (1319)
- La Junta Multimodal Transit Center (1285)
- Mountain Express Transit Center (2766)

Building transit centers and mobility hubs improves connectivity between multiple routes, allowing riders to transfer easily by increasing reliability and predictability. Further, transit centers and mobility hubs allow routes to become coordinated - improving travel time speeds across the transit network. These facilities can become focal points for supporting additional first and last mile access, including car-share and scooter-share, microtransit pick-up zones, secure bike parking, or ride-hail drop-off areas. Together, these benefits work together to increase ridership across the transit network.

The updated 10-Year Plan also carries forward planned projects that seek to continue to support new or expanded local agency service, including:

- One project continuing onto the updated 10-Year Plan will support new service; between Gunnison and Montrose (2767). This would support a brand-new route from Crested Butte to Montrose, via Gunnison.
- Regional Transit Service between Montrose and Telluride (1028), which will provide additional service for the existing fixed-route transit service between Montrose and Telluride on US 550, CO 62, and CO 145. It is anticipated to run seven days/week with four trips/day which would require two full size buses. Potential stops include Montrose, Colona, Ridgway, Placerville, and Telluride.

- Bus Service between Pagosa Springs and Durango (2523), providing new service with one roundtrip per day.
- Teller Senior Coalition Outreach (1004A) and the Fremont County Transit Outreach (1004B) are new projects that will expand on demand access and assistance to meet the growing demand for programs and provide vital service to the public in the area.

## Active Transportation

To support public transportation projects and multimodal infrastructure, the updated 10-Year Plan incorporates 28 projects with active transportation elements in non-MPO areas. Active transportation projects help facilitate safe and accessible multimodal communities and, in many cases, improve the usability of public transportation.

The following highlights some of the active transportation projects contained in the updated 10-Year Plan and reflects previously planned and newly added projects focused on safety by adding, repaving, and improving sidewalks and intersections and meeting ADA requirements. They include the following:

- CO 14 Intersection and Preservation Improvements (New)<sup>8</sup>
- CO 82 Safety and Active Transportation Improvements (3318)
- CO 52/WCR 59 Roundabout and Safety Improvements (2772)
- US 24 Intersection Improvements at Steele in Buena Vista (2039)
- CO 12 ADA Ramps and Sidewalk Improvements in La Veta and Trinidad (1493)
- US 285 Safety and Mobility Improvements between Center and Saguache (1051)

The updated 10-Year Plan also incorporates previously planned and newly added active transportation projects focused on multimodal improvements such as the following:

- I-25 Wellington Preliminary Interchange Design and Pedestrian Crossing (New)
- Pagosa Springs' Main Street Reconstruction and Multimodal Improvements (1339)
- US 160 Multimodal Improvements in Alamosa (2038)
- US 285 Multimodal Improvements on CO 145 (1482)

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<sup>8</sup> The numbers next to each project are the previous 10-Year Plan Project ID. Newly added projects are listed as "New".

- Intersection and Pedestrian Improvements at CO 291 and US 50 (2070)
- US 50 Corridor Improvements in Poncha Springs (2456)

## MPO Compliance Areas

Under the Standard, CDOT is responsible for reducing transportation GHG emissions outside the MPO areas. As such, the GHG modeling conducted for this report and the projects highlighted focus only on 10-Year Plan projects in the rural areas of the state. However, the majority of projects in CDOT's updated 10-Year Plan are located within MPO boundaries, many of which support meeting the state's broader statewide GHG emission reduction goals and support an MPO's ability to meet the reduction levels in Table 1. Some noteworthy projects within MPO boundaries that are newly added to the updated 10-Year Plan include bus rapid transit (BRT) and Front Range Passenger Rail (FRPR).

There are several projects which support BRT within the MPOs in the updated 10-Year Plan. Worth highlighting are the two new projects in the Denver Regional Council of Governments (DRCOG) region which, in partnership with the Regional Transportation District (RTD), will construct side-running BRT infrastructure for an 18-mile section of Federal Blvd, from 120th Ave to Dartmouth Ave as well as a 7.5 mile section of Colorado Blvd, from 40th Ave to Amherst Ave. These projects will construct stations, signals, and roadway elements, and supporting bicycle and pedestrian infrastructure along these corridors.

FRPR is a newly included intercity passenger train project in the updated 10-Year Plan, with service from Fort Collins through Denver and south to Pueblo. FRPR will provide a safe, efficient and reliable transportation option, connecting major population and employment centers and key destinations. The passenger rail service will be competitive with car travel, expand travel options and foster regional economic vitality. From 2020 to 2050, millions more people are expected to live in Colorado and approximately 85% will travel along the Front Range. The existing highway system cannot accommodate growth without significant changes. On a typical weekday through Denver, I-25 averages eight or more hours of congestion. Every three to four days, the highway is partially or fully closed. Intercity passenger rail offers a safer and more reliable way to transport people and accommodate growth without adding to highway congestion or increasing GHG emissions.

## Programming and Funding

To make the most of every dollar, CDOT combines traditional funding with enterprise funding. Enterprise funding is described in more detail in the next section of this

document. By leveraging these resources together, CDOT can stretch the budget further and invest more in the projects that improve safety, mobility, and quality of life across the state. CDOT's 10-Year Plan was designed to do exactly that by combining state, federal, and enterprise funding to maximize every investment. By strategically aligning these resources, CDOT can take on more projects, accelerate timelines, and focus on the improvements that move the needle on meeting CDOT's performance goals, including reducing GHG emissions.

It is important to note that CDOT's 10-Year Plan represents only a portion of CDOT's overall budget. Furthermore, the 10-Year Plan strategically invests in the state's transportation infrastructure, utilizing approximately \$225 million annually from CDOT's total \$1.7 billion budget (excluding enterprise funding). This plan, supported by flexible state and federal funding, operates in conjunction with other CDOT funding programs to maximize the budget and achieve performance goals. Some of the additional funding directly supports GHG mitigation measures CDOT has committed to in the GHG MAP in Appendix A.

## Enterprises

A significant funding advancement for the state and CDOT is the creation and development of the [Clean Transit Enterprise](#) (CTE), as required by [SB21-260 "Sustainability of the Transportation System"](#). CTE plays an important role supporting CDOT's ability to comply with the Standard's requirements in non-MPO areas of the state by supporting CDOT's implementation of transit-aligned GHG mitigation measures. The CTE is an entity created within CDOT that is currently charged with implementing two pieces of legislation. The Enterprise was initially created by SB21-260, which allows the enterprise to impose a Clean Transit Retail Delivery Fee to fund support for public transit electrification planning efforts, facility upgrades, fleet motor vehicle replacement, as well as construction and development of electric motor vehicle Charging and Fueling Infrastructure (CFI). The second piece of legislation, [SB24-230 "Oil & Gas Production Fees"](#), provides funding for transit expansion including local transit capital and operational projects as well as passenger rail. Annual funding to support these programs is estimated to be approximately \$67 million in FY26 and then increase to approximately \$110-130 million per year in FY27 and beyond. Examples of projects that have been funded that support CDOT's GHG mitigation measures include EV transit bus purchases and local transit service expansions. Based on initial estimates, SB24-230 funding is expected to support an annual increase of 8.3 million vehicle revenue miles across the state by 2030.

The CTIO develops innovative funding solutions for priority projects, including new dedicated funding from SB 24-184 for rail and transit projects, presenting an

unprecedented opportunity for CDOT to advance multimodal projects and fortify the state's transportation system to address the mobility needs of the present and future. The rental car fee imposed by SB 24-184 will create a dedicated funding stream of approximately \$50 million per year for rail and transit, an anticipated \$500 million over the next 10 years and \$1.15 billion by 2050. The law also encourages regional coordination between the Regional Transportation District (RTD), FRPR District, and CDOT to explore opportunities in establishing train service from Denver to Fort Collins. In addition, it directs CTIO to develop a multimodal strategic capital plan that aligns with CDOT's 10-Year Plan and statewide GHG pollution reduction goals.

The NAAPME supports mitigation of the environmental and health impacts of increased air pollution from motor vehicle emissions in nonattainment areas that results from the rapid and continuing growth in retail deliveries made by motor vehicles and in prearranged rides provided by transportation network companies. NAAPME funding is for eligible projects that reduce traffic, including demand management projects that encourage alternatives to driving alone or that directly reduce air pollution, such as retrofitting of construction equipment, construction of roadside vegetation barriers, and planting trees along medians. NAAPME currently offers approximately \$15 million annually to fund projects including those in both MPO and CDOT's GHG compliance areas. Annual funding is expected to increase to approximately \$37 million in FY 2036. Examples of projects that have been funded that support CDOT's GHG mitigation measures include roundabout construction and active transportation infrastructure.

## Programs

Further, CDOT implements a number of funding programs that are managed externally from the strategic funding allocated in the 10-Year Plan. Many of these funds support projects that enhance active transportation opportunities and mode shift through grants or formula funding to non-MPO areas of the state.

The Highway Safety Improvement Program (HSIP) and FASTER Safety Mitigation (FSM) Program provide funding opportunities for safety projects, including projects that improve protection of Vulnerable Road Users (VRU), such as bicyclists and pedestrians. Some examples include separated bicycle lanes, road diets and new or enhanced sidewalks and walkways. These two programs offer approximately \$110 million dollars annually to projects statewide with approximately 15% of the funding for projects in non-MPO areas.

The Transportation Alternatives Program (TAP) awards grants to transportation projects that expand travel choice beyond the single occupancy vehicle, strengthen the local economy, improve quality of life, and protect the environment such as pedestrian and bicycle facilities. During the 2023 call for projects TAP awarded over

\$42 million to 37 projects statewide with approximately 43% of funding to projects in non-MPO areas. Future calls are expected every two to three years awarding approximately a similar amount of funding, depending on federal statute.

The Multimodal Transportation and Mitigation Options Fund (MMOF) funds multimodal transportation projects throughout the state including, for example, fixed route transit service and bicycle and pedestrian projects. In FY26 through FY32 the MMOF fund is expected to provide approximately \$6.3-9.3 million annually for projects in non-MPO areas of the state, with \$3-4.5 million of that being directed towards CDOT's Bustang services, improving statewide and rural transit.

The Safe Routes to School Program makes walking and bicycling to school safer and more appealing and facilitates the planning, development and implementation of projects that improve safety, and reduce traffic and congestion, fuel consumption, and air pollution in the vicinity of schools. In the two most recent project selections for FY23-26, \$11 million was awarded to local agency projects with 40% of funds awarded to projects in non-MPO areas.

## Greenhouse Gas Emissions Modeling Analysis and Results

### GHG Modeling Overview

The Standard requires newly adopted applicable planning documents, such as CDOT's updated 10-Year Plan for fiscal years 2027-2036, to demonstrate reductions in GHG emissions in each of the future compliance years relative to baseline GHG emissions levels. For CDOT, the baseline GHG emissions are those determined to result from the 10-Year Plan adopted as of January 30, 2022 (2 CCR 601-22, Section 1.04). Therefore, CDOT's baseline 10-Year Plan is the version adopted by the TC on April 16, 2020, also referred to as the CDOT's 2019 10-Year Plan in the previous GHG Transportation Report. CDOT initially demonstrated compliance with the Standard by updating the baseline 2019 10-Year Plan which the TC adopted in September 2022.

CDOT uses its statewide travel demand model, StateFocus, and EPA MOVES to model GHG emissions which will result from the projects included in the updated 10-Year Plan.

StateFocus is an activity-based model based directly on the DRCOG Focus model, which in turn was based on the Sacramento Activity-Based Travel Simulation Model (SACSIM) model developed for the Sacramento Area Council of Governments, coming into operations around 2007. Activity-based models (ABM) represent an improvement

beyond earlier trip-based models because ABMs consider travel decisions at an individual rather than aggregate level. For example, the trip generation step of a trip-based model is replaced by multiple components including Day Activity Pattern Choice (a decision on what reasons to leave home), Exact Number of Tours Choice (how many of which purpose tours to make), Work-Based Subtour Generation (whether to travel during the workday and why, such as for lunch or an off-site meeting) and Intermediate Stop Generation. Each of these ABM components can be sensitive to congestion levels by including accessibility terms as explanatory variables. One limitation of earlier trip-based models was that trip generation rates were typically assumed to be constant irrespective of congestion levels. When the ABM completes, it outputs a forecasted daily itinerary or schedule for each person in the model's synthetic population. More detail about the StateFocus model is available in [Appendix B](#).

EPA MOVES is a software model developed by the U.S. Environmental Protection Agency to estimate emissions from motor vehicles for various project types. MOVES is based on real-world testing of over one million vehicles by EPA in their mobile source research center. MOVES allows for calculation of emissions for pollutants like criteria air pollutants, GHGs, and air toxics from various sources, including but not limited to, tailpipe and fuel evaporation. EPA MOVES is able to account for various factors that influence emissions such as the age and type (i.e. car, SUV, Heavy duty truck) of the vehicle, fuel type and activity of the vehicle. MOVES modelers can also utilize case-specific inputs to the model such as future electric vehicle (EV)/zero emissions vehicle (ZEV) and other vehicle fuel type adoption rates as was done for this analysis. For this analysis, the CDOT EV/ZEV adoption rates that were directed for use by the state Interagency Consultation Team (IACT) in 2025 were simulated for future vehicle fuel mix. More information about the MOVES modeling methodology is available in [Appendix C](#).

CDOT used their statewide activity-based Travel Demand Model and EPA MOVES model version 4 to complete the GHG emissions analysis of CDOT's baseline 10-Year Plan and the updated 10-Year Plan for fiscal years 2027-2036. The capabilities and sophistication of the Travel Demand Model make it a powerful tool to evaluate the effects on travel behavior of a wide range of characteristics of regions, people and travel modes and therefore permit a realistic evaluation of transportation planning's effects on air pollutant emissions. Notably, the model:

- Depicts each person individually, including characteristics important to that individual's travel choices.
- Explicitly depicts the choice between work-from-home and work elsewhere, allowing scenarios in which changes in propensity to work from home are

affected by planning activities (programs or infrastructure) or by larger changes in society (for example, COVID effects).

- Estimates the trips (number, type, etc.) that people make based on the activities they need to accomplish and the effect of travel conditions on one person's choice of how to accomplish those tasks. This modeling approach permits the model to estimate changes in people's demand for travel as travel conditions change.
- Depicts the location of households and jobs at the address level rather than at the coarse "zone" level that is common in older aggregate, trip-based models – also called four-step models. This is particularly important for modeling active transportation modes like walking and biking where trip lengths might often be smaller than many zones' dimensions.

The primary output of the Travel Demand Model is the estimated VMT for a given year at the level of a "link", which represents a roadway segment from intersection to intersection. Forecasted emissions rates developed from the EPA MOVES model are necessary to translate these link VMTs into GHG emissions. The forecasted emissions rates are stratified by vehicle type, roadway type, operating speed (in "bins" of up to five miles per hour [mph] - for example, 27.5 to 32.5 mph), rural or urban area roadway type, and hour of day. The emissions rates in individual vehicle mph are calculated from the operating speed bins that are output from MOVES through interpolation.

In 2025 three new considerations for how GHG emissions are calculated for the purposes of an agency demonstrating compliance with the Standard were adopted by consensus through the Statewide Model Coordination Group (SMCG). These considerations involve updates to (1) vehicle emissions rates, (2) vehicle mix assumptions, and (3) the number of vehicle classes considered. These three adjustments were applied to the remodeling of the baseline and the updated 2027-2036 10-Year Plan.

## Vehicle GHG Emissions Rates

The first change made was that new MOVES GHG emissions rates were developed using MOVES4.1.2. Previous GHG emissions rates were generated using MOVES3 which was replaced by EPA with MOVES4 in September 2023. The main difference between versions of MOVES is that MOVES4 integrates the latest light and heavy-duty vehicle fuel economy (Corporate Average Fuel Economy [CAFE]) standards. Notably, the majority of fuel economy and related emissions improvements demonstrated in MOVES4 are achieved through vehicle electrification present in the default data,

particularly for commercial vehicles. In the previous MOVES3 modeling the inputs in the model for current light-duty EV/ZEVs as well as significant growth in future years were already assumed at higher adoption levels than the default EV/ZEV rates present in MOVES4.

When new federal fuel economy standards are promulgated, an auto manufacturer demonstrates compliance by adjusting their product offerings such that the average fuel economy of the entire fleet of vehicles for a class (for example, light-duty vehicles or heavy-duty vehicles) available for sale by that auto manufacturer for the current model year meets the new standard. A manufacturer may adjust their product line by introducing new (more fuel economical) models, discontinuing existing models, or modifying an existing model (for example, using a different engine type or offering more alternative fuel options such as PHEV, BEV, E85 or CNG). These industry responses often result in the actual fuel economy changes having a high level of variation among individual makes and models - and also within model lines across model years. The different possible dimensions of industry responses result in the EPA needing to make assumptions about MOVES inputs regarding how the fuel economy standards will be achieved in future years, including switching vehicle fuel types vs. engine efficiency improvements.

When new fuel economy standards are issued at the federal level, the EPA forecasts future vehicle sales by fuel type and engine technology through their Optimization Model for reducing Emissions of Greenhouse gases from Automobiles (OMEGA) model. OMEGA considers factors such as vehicle costs, consumer purchasing preferences and the availability of market incentives. The results of the EPA analysis are coded as default values present in MOVES. A user can run MOVES using the national default values or revise them to reflect state or local data and assumptions, as was done in the development of the new GHG emissions rates for the Standard implementation (and was performed previously to develop the original GHG rates in MOVES3 that were used for previous analyses). Comparing the differences in default values present between versions of MOVES allows experienced users of the emissions rates model to evaluate changes in assumptions surrounding tailpipe emissions improvements and future vehicle sales at the national scale.

In a straight comparison of model versions, MOVES3 vs. MOVES4, the majority of fuel economy improvements associated with the new standards are achieved through sales of EV/ZEVs in future years and there is significantly less change in the GHG emissions rates for petroleum vehicles. Therefore, the previous high levels of EV/ZEV adoption that were already assumed in developing the original GHG emissions rates in MOVES3 (for the 2022 10-Year Plan) result in very little change from switching model versions of MOVES alone. New GHG emissions rates were needed to integrate the new EV/ZEV

adoption forecasts that were developed by the CDOT Division of Accounting and Finance (DAF) and adopted by IACT in 2025 for use in GHG modeling for the Standard. The new EV/ZEV adoption forecasts are used statewide and increase the amount of light-duty EV/ZEVs in future years, particularly for light-duty pickups and sport utility vehicles (SUVs) in vehicle Model Years 2030-2040 compared to the previous GHG emissions rates developed in 2021. No bus or commercial EV/ZEV adoption is reflected in the MOVES GHG emissions rates for current or future years, i.e., the default EV/ZEV adoption assumptions present in MOVES4 for these vehicle types were zeroed-out from the model runs.

## Vehicle Mix

The vehicle mix represents the type (i.e. motorcycles, passenger cars, SUVs, vans, trucks, etc.) of vehicles operating on a roadway. The GHG emissions rates are highly variable by vehicle type and generally increase with the size of the vehicle, for example, passenger cars emit significantly less GHGs per vehicle mile than heavy-duty trucks. While travel demand models forecast total on-road travel behavior, including trips from commercial vehicles, no travel demand model in the state is calibrated for commercial travel accurately enough to properly assign the on-road vehicle mix. Therefore, the vehicle mix used to calculate GHG emissions for the Standard are developed from traffic observations (counts) collected by CDOT's Automated Traffic Recording (ATR) stations as was performed previously using both continuous and short-duration hourly vehicle counts stratified by the 13 Federal Highway Administration (FHWA) vehicle classifications as well as roadway and urban or rural area type updated for more recently observed years. Each ATR station's counts were used in conjunction with VMT weighting for the roadway to develop a ratio of vehicle types by hour for all of the major roadway types in Colorado. The VMT-weighting of the counts is a refinement of the previous vehicle mix assignment that used unweighted (straight) counts that was used in the previous emissions calculations. The VMT-weighting method was developed by CDOT and APCD in order to better reflect the vehicle mix outside the Front Range where the majority of ATR stations are located. Furthermore, for the 2025 vehicle mix used to calculate GHG emissions rates, post-pandemic (2023) vehicle classification counts were used. In the previous GHG emissions calculations methodology, pre-pandemic (2017-2019) vehicle classification counts were used. It was determined that an update to post-pandemic vehicle classification counts should be made statewide to the emissions calculation methodology in order to more accurately reflect the vehicle mix that is currently present on roadways in the state as transportation behavior has altered since COVID due to factors including increased remote employment and land use changes.

## Vehicle Classes

The switch to the use of the post-pandemic vehicle mix resulted in the need for the final significant change to how GHG emissions are calculated, which is the aggregation of passenger cars with SUVs/light-duty trucks into a single vehicle emissions rate category in MOVES. Previously emissions rates for passenger cars had been separate from the larger passenger vehicles (SUVs and light-duty trucks). However, CDOT and APCD determined that the ATR network often records SUVs and light-duty trucks as passenger cars due to the axle-based nature of the classification count data collection system. Therefore, SUVs and light-duty trucks had previously been inadvertently underrepresented in the vehicle mix assignment. The aggregation into a single passenger vehicle emissions rate category is a refinement to more accurately represent the vehicle mix on the road in current conditions. It should also be noted that the rates of future EV/ZEV adoption are now assumed to be the same between these two vehicle categories in MOVES; thus, the emissions benefits of future EV/ZEVs through fleet turnover in SUVs/light-duty trucks are now also occurring at a higher levels than was previously assumed. The emissions benefits of increased levels of EV planning assumptions for SUVs and light-duty vehicles are particularly noticeable in the 2040 compliance year as significantly lower levels of EV adoption for SUVs and light-duty trucks were previously assumed for model years 2025-2040.

In order to calculate the GHG emissions, a database is developed by the APCD that integrates the MOVES emissions rates, the observed vehicle mix, and the travel demand modeling predicted transportation behavior. A lookup table approach is used to select the appropriate vehicle mix and emissions rates for each link modeled. Each emissions rate is multiplied by the hourly VMT for the appropriate vehicle class to calculate forecasted emissions.

The adjustments discussed above represent improvements in underlying data inputs for calculation of GHG emissions in this compliance demonstration compared to CDOT's prior demonstration in 2022. It is best practice to make adjustments and improvements in the emissions calculations methods over time as new data, planning assumptions and/or appropriate refinements are identified compared to previous work that provides for more accurate characterization of GHG emissions from transportation. Overall, while significantly more EV/ZEV adoption is assumed for SUVs and light-duty trucks results in more zero tailpipe emissions vehicles, the revision to more accurately account for the total number of SUVs and light-duty trucks that were previously underrepresented resulted in higher statewide MOVES GHG emissions rates for passenger vehicles for 2030, 2040 and 2050. This is due to the effect of more of these larger passenger vehicles overall, which are now more accurately represented, not being fully offset by the updated higher levels of EV/ZEV adoption now also being

assumed for these vehicles, which better accounts for the present statewide vehicle mix.

The refinements and adjustments to the GHG emissions calculation methodology were developed by the SMCG through a nearly two-year deliberative and collaborative process with participation from transportation and emissions modelers, as well as planners and other staff from CDOT, APCD, DOLA, Colorado Energy Office (CEO) and all MPOs in the state. The consensus outcomes of the SMCG process were adjustments and refinements to the method for calculating GHG emissions. The net effect of these adjustments was an increase in the predicted total average carbon intensity (i.e. grams GHG/VMT) of each vehicle mile traveled in the state in future years than the GHG emissions methodology used in 2022.

GHG reduction levels required by the Standard must be achieved relative to a modeled baseline amount of GHG emissions. The Standard requires each agency to determine the baseline emissions in addition to the GHG emissions that will result from the updated applicable planning document. CDOT's modeling analysis process is further described below.

## **Modeling the Baseline 10-Year Plan**

The baseline model run uses the CDOT 2019 10-Year Plan as adopted by the Commission in April 2020. This modeling analysis assumes full build-out of all Regionally Significant projects in the baseline 10-Year Plan. For this updated compliance analysis CDOT did not model the Standard's Table 1 2025 compliance year as the year has already passed. CDOT demonstrated compliance with the 2025 GHG reduction level through modeling of the previous updated 10-Year Plan for fiscal years 2019-2028 adopted by the TC in September 2022. As part of evaluating the updated 10-Year Plan for 2027-2036 CDOT remodeled the baseline 2019 10-Year Plan with MOVES modifications as discussed above in addition to the DOLA modifications below.

The land use (population, job totals, and locations) begins with existing development as built, with existing households and jobs located based on sources such as data from the Colorado Department of Labor and Employment (CDLE), the US Census, and county assessors' parcel/address data. Since the current StateFocus version only produces modeled outputs future years of 2030 and 2045, development growth for the years 2030 and 2045 is taken from county-level forecasts provided by the State Demographer's Office in the Colorado DOLA. (The model's existing horizon year of 2045 dictates which set of socioeconomic inputs are used. Interpolation and extrapolation are used to create forecasts for 2040 and 2050, as required by the regulation. Interpolated or extrapolated socioeconomic inputs to the model may not precisely match the DOLA forecasts for those specific years.) The DOLA 2024

socioeconomic forecasts used to develop this plan reflect post-pandemic expectations, while the 2022 plan was based on socioeconomic forecasts made by DOLA in 2018. Both sets of socioeconomic forecasts are compared in [Table 3](#) below. Outside MPO areas, additional households and jobs (due to projected growth beyond today’s levels) are placed in buildable areas in each county (for example, avoiding national forests, water, road rights of way, steep slopes, etc.) but are otherwise distributed randomly within each county.<sup>9</sup> Inside MPO areas, job and household locations are taken from the MPOs models.

Compared to the 2018 DOLA forecast used in CDOT’s 2022 GHG Report, the new 2024 DOLA Forecast used in CDOT’s 2025 travel demand modeling and associated GHG Report reflect significantly less future population and households, as well as slightly less employment for the travel demand modeling years of 2030 and 2045. A downward shift in population and households resulted in fewer predicted vehicle miles traveled and associated GHG emissions in both CDOT’s Baseline and Updated 10-Year Plan. A total emissions reduction of GHGs from reductions in predicted future populations that is overall beneficial towards reducing contributions to climate change would seemingly be supportive towards Colorado’s climate action goals; however, the reduction targets in Table 1 of the Standard are absolute total mass reductions, rather than a GHG per-capita reduction or GHG intensity reduction target. Therefore, when the predicted baseline emissions for a compliance year are reduced from fewer vehicle miles traveled due to a lesser population in a compliance year, it makes the reduction target for that year an overall greater percentage reduction of the baseline. This can result in making it more challenging for an agency to demonstrate compliance with the Standard.

The VMT resulting from these baseline Travel Demand Modeling runs are then analyzed within the non-MPO GHG databases that apply the correct EPA MOVES GHG emissions rates for each roadway segment in order to obtain the baseline plan GHG emission values for 2030, 2040, and 2050.

**Table 3. Comparison of DOLA Statewide Socioeconomic Forecasts over Time**

Modeled Year Statistic	DOLA Forecast from 2018 (2022 Report)	DOLA Forecast from 2024 (2025 Report)	Percentage Change
2030 Statewide Population	6,974,465	6,467,694	-7.3%
2030 Statewide Households	2,950,775	2,702,130	-8.4%

<sup>9</sup> CDOT does not have local zoning and comprehensive plans necessary to place future development in a manner more consistent with local government intentions.

Modeled Year Statistic	DOLA Forecast from 2018 (2022 Report)	DOLA Forecast from 2024 (2025 Report)	Percentage Change
2030 Statewide Employment	3,995,831	3,963,747	-0.8%
2045 Statewide Population	8,233,674	7,387,301	-10.3%
2045 Statewide Households	3,467,931	3,102,187	-10.5%
2045 Statewide Employment	4,463,682	4,341,638	-2.7%

Source: CDOT StateFocus model input files reflecting DOLA 2018 and DOLA 2024 forecasts

CDOT predicts travel behavior for non-MPOs areas by modeling the entire state and then removing results for the MPO areas. Thus, the baseline runs for the various horizon years called for in the Standard include specific highway and transit projects listed in CDOT and MPO plans that were adopted on or before the date of the Standard adoption (January 20, 2022). Categories/quantities of funds that are included in such plans, but have not been assigned to projects, are not included in baseline scenarios. Instead they are included in compliance scenarios. In general, the statewide model is well able to depict Regionally Significant highway projects, and fixed-route transit services in urbanized areas. CDOT’s statewide model does not explicitly depict bicycle and pedestrian facilities (except for where MPO models explicitly include these facilities, such as with the North Front Range Metropolitan Planning Organization [NFRMPO] model area). The effects of funds allocated to these active modes are approximated by adjusting parameters in the statewide model that depict people’s response to overall service levels afforded by the bicycle/pedestrian networks (for example, general perceptions of safety, convenience, speed, etc. and differences in these perceptions among people of different ages or genders). Plan elements by mode in the 10-Year Plan baseline model run are depicted as follows:

- Highway: Includes all Regionally Significant projects in the April 2020 10-Year Plan, including in some cases project clarification/detail provided by CDOT region staff. In the MPO areas, the networks include all Regionally Significant projects included in the MPO travel models. Outside MPO areas there are five Regionally Significant projects in CDOT’s baseline 10-Year Plan: I-70 West Vail Pass (0442/1161), US 40 Fraser Safety Improvements (1259), US 160 Elmore’s Corner East (1334), I-70 West Floyd Hill (0004), and I-70 climbing lane from Bakerville to Eisenhower Tunnel (2582).
- Transit: includes all existing services in the MPO areas, all existing services of rural transit providers, and all existing Bustang services that existed prior to April 2020. Short-distance circulator shuttles that are too fine to represent

under the statewide model’s current zone structure are omitted from both Baseline and Compliance scenarios. These omitted routes would represent a small fraction of the total rural vehicle revenue miles of service provided.

- **Bicycle/pedestrian:** bicycle and pedestrian service levels afforded by the current system are assumed to remain the same in all future baseline scenarios. This is reflected in the statewide travel model by leaving at their current value all model parameters that depict the extent to which various demographic groups choose to walk or bicycle. For example, the model includes parameters, developed from the 2010 Front Range Travel Counts survey data, that show women choosing to bicycle less readily than do men: the same is true of younger and older people of all genders.

Baseline VMT and emission results are listed in [Table 4](#) below. While VMT increases over time, total emissions decrease in the more distant future because of EV adoption and emissions improvements to internal combustion engines and hybrid vehicles.

**Table 4. CDOT GHG Emissions from Baseline 10-Year Plan by Horizon Year in MMT**

GHG Horizon Year	2030	2040	2050
Statewide weekday VMT	170,733,534	186,428,854	202,124,174
Non-MPO area weekday VMT	40,385,157	43,775,591	47,166,025
Baseline 10-Year Plan Emissions (MMT)	4.886	3.315	2.558

Sources: CDOT, APCD

Note: The statewide VMT presented in [Table 4](#) is estimated by the StateFocus model. Only the non-MPO portion of this VMT should be relied upon, since MPOs provide their own model estimates of VMT within their respective regions.

## Modeling the Updated 10-Year Plan

### Process of Development of the Updated 10-Year Plan

As described earlier, the updated 10-Year Plan is developed through a comprehensive process that begins with long-range Statewide and Regional Transportation Plan (RTP) development. This involves numerous meetings with rural Transportation Planning Regions (TPRs), MPOs, and other stakeholders. Priority projects are identified in RTPs through data analysis and public and stakeholder engagement. In addition to the regional plans, CDOT also uses modal, topical, and functional area plans like the Asset Management Plan, Strategic Highway Safety Plan, Freight Plan, Transit Plan, and

Active Transportation Plan to inform the development of the 10-Year Plan. This comprehensive process identifies projects that align with the TC's PD 14 goal areas.

The CDOT DAF is responsible for generating revenue projections for 10-Year Plan strategic funds. CDOT utilizes these projections to prioritize projects within the 10-Year Plan, working in four-year increments. In compliance with [SB24-184 “Support for the Development of Surface Transportation Infrastructure”](#), the CTIO enterprise is mandated to revise its strategic plan to align with the 10-Year Plan. Similarly, other partnering CDOT enterprises have adopted a model to ensure enterprise funding aligns with the 10-Year Plan.

Upon completion of the GHG emissions modeling to demonstrate compliance with the Standard, CDOT releases the draft 10-Year Plan for a 30-day public and stakeholder review and comment period. Once all comments are received and addressed, the draft 10-Year Plan is submitted to the TC for approval.

As required by the Standard, all Regionally Significant Projects within the updated 10-Year Plan were coded into the travel demand model, a process referred to here as the “compliance run.” Notably, there are no new Regionally Significant Projects for the non-MPO areas in the updated 10-Year Plan. The five Regionally Significant Projects in the non-MPO areas of the state that were included in CDOT’s baseline plan are still in the updated 10-Year Plan:

1. I-70 West Vail Pass (0442/1161),
2. US 40 Fraser Safety Improvements (1259),
3. US 160 Elmore’s Corner East (1334),
4. I-70 West Floyd Hill (0004), and
5. I-70 climbing lane from Bakerville to Eisenhower Tunnel (2582).

These projects are reflected in both the baseline and compliance Travel Demand Model runs.

CDOT also adjusted several assumptions within the model to reflect changed travel patterns resulting from the COVID-19 pandemic and increased investments in multimodal funding. The final assumptions used in the modeling that supports this report are summarized in [Table 5](#) below. These model adjustments for the updated 10-year plan remain identical to the assumptions made in CDOT’s 2022 compliance demonstration.

- The percentage of Coloradans working from home increased. Prior to the COVID pandemic, US Census Bureau data used by CDOT in its modeling work estimated that 6.3% of Colorado workers worked from home on a typical day. During the COVID pandemic, the Census Bureau conducted a series of weekly “pulse”

surveys, in which as many as 45% of Colorado households said that some adults in their household had shifted some or all work trips to work-from-home due to COVID, over and above pre-existing work-from-home habits. While these data do not of course provide certainty of future work-from-home behaviors, there are no indications that work-from-home behaviors will return fully to their pre-COVID levels. CDOT therefore has adjusted the statewide model to produce approximately 20% work-from-home. This level of working from home corresponds well to the 19.9% of Colorado workers reporting working from home in the [1-year 2024 American Community Survey data](#). This represents a somewhat more conservative assumption than is being used by DRCOG and the NFRMPO. Teleworking opportunities are generally more plentiful in denser urban areas, where broadband infrastructure has long been in place, and many jobs are in the information sector. In contrast, rural jobs in the agriculture, extraction or recreation sectors by their nature require in-person presence.

- Rural residents will use an increased amount of tele-health and tele-university due to broadband expansion. On December 2, 2025 the Colorado Broadband Office was approved to receive \$420.6 million in federal funding from the Infrastructure, Investment and Jobs Act (IIJA) for the state’s broadband infrastructure. The funds are anticipated to be strategically deployed to connect Colorado’s most remote communities, providing high-speed internet to more than 96,000 Coloradans.
- Changes to average bicycling and walking speed and adjustments in model factors reflect increased adoption of e-bikes and a greater perception of bicycle/pedestrian safety, comfort and convenience among some demographic groups that currently are less likely to use active modes. All these changes contribute to more trips using these modes and are expected to occur due to expanded investments in bicycle and pedestrian infrastructure.

**Table 5. Model Assumption Changes between Baseline and Compliance Scenarios**

Parameter	Baseline (all horizon years)	2030 compliance	2040 compliance	2050 compliance
Tele-work	6%	20%	20%	20%

Parameter	Baseline (all horizon years)	2030 compliance	2040 compliance	2050 compliance
Telehealth and teleuniversity	Low in pre-COVID period	Telehealth: replaces 2% of personal business trips by non-MPO residents Teleuniversity: replaces 2% of personal business trips by non-MPO residents (3 of 5 days on campus)	Telehealth: replaces 2% of personal business trips by non-MPO residents Teleuniversity: replaces 40% of trips by non-MPO students (3 of 5 days on campus)	Telehealth: replaces 2% of personal business trips by non-MPO residents Teleuniversity: replaces 40% of trips by non-MPO students (3 of 5 days on campus)
(Perceived) <sup>10</sup> Walk speed	3 mph	5 mph	5 mph	5 mph
Bike speed	12 mph	13 mph	13.7 mph	14.3 mph
E-bike adoption <sup>11</sup>	negligible	25%	42%	58%

Plan elements by mode in the 10-Year Plan compliance model run are depicted as follows:

- Highway: In the non-MPO areas, the plan contains a number of highway projects, none of them added substantial lane miles, interchanges, etc., so in the non-MPO areas, the network is essentially the same as the baseline scenario.
- Transit: the travel model network includes all existing urban and small town fixed-route services, and existing Bustang services. New rural transit and Bustang/Outrider expansion (post 2020) was evaluated in the context of the Mitigation Action Plan, separate from the travel model. The compliance scenarios include the FRPR and Mountain Rail services anticipated during each horizon year. In 2030 the anticipated services are Joint Rail between Denver

<sup>10</sup> Pedestrians are not assumed to walk faster in the future. Rather, improvements to the pedestrian infrastructure and environment will make a one-mile walk “feel like” it only takes 12 minutes in the future, compared to the (actual) 20 minutes it takes today.

<sup>11</sup> Future bike speeds are a result of e-bike adoption. Assumes 12 mph for “classic” bikes and 16 mph for e-bikes.

Union Station (DUS) and Fort Collins’ South Transit Center, and Mountain Rail between DUS and Granby. Service for 2040 and beyond assumes full build-out of Pueblo to Fort Collins for FRPR and Craig to DUS for Mountain Rail.

- Bicycle/pedestrian: as discussed above, bicycle/pedestrian parameters simulating lower use of these modes by some demographic groups were reduced by 50%, simulating improved acceptance of these modes in these demographic groups.

Compliance run emissions results are summarized in [Table 6](#) below.

**Table 6. CDOT GHG Emissions from Updated 10-Year Plan by Horizon Year in MMT**

GHG Horizon Year	2030	2040	2050
Statewide weekday VMT	155,788,468	169,634,853	183,481,237
Non-MPO area weekday VMT	37,156,273	40,541,169	43,926,065
2027-2036 10-Year Plan GHG Emissions (MMT)	4.495	3.061	2.371

Sources: CDOT, APCD

Note: The statewide VMT presented in the table is estimated by the StateFocus model. Only the non-MPO portion of this VMT should be relied upon, since MPOs provide their own model estimates of VMT within their respective regions.

## GHG Modeling Result Summary

The effects on total estimated annual GHG emissions of the 2024 DOLA revised development forecast and of the updated GHG emissions calculation methodology (both described above) have effects in opposite directions. The revised DOLA forecast reduces the total amount of predicted VMT and associated GHG emissions in the state; whereas the updates to the emissions calculations methodology increase the amounts of GHGs emitted per VMT.

The net effect of these changes is more heavily influenced by the increases in the GHGs emitted per VMT than the decrease in overall VMT. This increases total predicted annual onroad GHG emissions in future years and modeled emissions reductions as reductions in vehicle miles traveled are associated with a higher emissions benefit.

**Table 7. GHG Modeling Result Summary**

GHG Horizon Year	2030	2040	2050
Baseline 10-Year Plan GHG Emissions (MMT) <sup>12</sup>	4.886	3.315	2.558
Updated 2027-2036 10-Year Plan GHG Emissions (MMT)	4.495	3.061	2.371
Total Modeled GHG Reductions (MMT)	0.391	0.254	0.188
2 CCR 601-22 Table 1 Required GHG Reduction Amount (MMT)	0.360	0.300	0.170
<b>Additional Reductions Needed from a GHG Mitigation Action Plan (MMT)</b>	<b>None</b>	<b>0.046</b>	<b>None</b>

## GHG Mitigation Measures

As shown in [Table 7](#), CDOT needs to implement GHG mitigation measures for compliance year 2040 through a GHG MAP to meet the reduction levels required for compliance with the Standard. CDOT also recorded voluntary mitigation measures for 2030 and 2050 for projects and programming which have already occurred or have dedicated future funding, but were not included as part of the modeling work. CDOT is committed to implementing GHG mitigation measures that in some cases go above and beyond what is required to maintain compliance with the Standard based on the most recent 2025 modeling, to provide assurance necessary reductions are achieved. CDOT intends to use a combination of GHG mitigation measures including land use, transit, medium/heavy duty electrification and traffic operation strategies. These measures are described in detail in the GHG MAP in Appendix A of this document. [Table 8](#) below summarizes the mandatory and voluntary GHG mitigations to be implemented by CDOT to meet the reduction levels and achieve compliance. Progress on achieving these GHG mitigation measures will be reported to the TC annually as required by the Standard under Section 8.02.7. Based on modeling the baseline and updated 2027-2036 10-Year Plan CDOT is only required to achieve an additional 46,000 metric tons of GHG mitigation reductions in 2040. The remainder of the GHG mitigation reductions referenced below are voluntary and go above and beyond what is required by the Standard for this compliance demonstration.

<sup>12</sup> These emissions values represent the updated GHG emissions calculations for the baseline plan based on the 2025 modeling.

**Table 8 - GHG Mitigation Measures Summary Table**

Mitigation Measure	Greenhouse Gas Reductions		
	2030 (MT/year)	2040 (MT/year)	2050 (MT/Year)
<b>Land Use Strategies</b>			
Increase residential density	0	3,900	1,800
Mixed-use Transit-Oriented Development (TOD) - moderate intensity	0	14,950	7,150
<b>Land Use Strategy Subtotal</b>	<b>0</b>	<b>18,850</b>	<b>8,950</b>
<b>Transit Strategies</b>			
Rural Transit Service Recovery	4,457	3,175	4,038
Bustang and Outrider	9,355	4,678	4,678
CTE SB24-230 Formula Grant Program	8,664	4,435	4,503
<b>Transit Strategy Subtotal</b>	<b>22,476</b>	<b>12,288</b>	<b>13,219</b>
<b>Medium-Duty and Heavy-Duty Electrification Strategies</b>			
Electric Transit Vehicle for Rural Transit Agencies	5,950	8,360	6,438
<b>Traffic Operations Strategies</b>			
Roundabout Construction	5,636	6,850	2,833
Traffic Signal Retiming	4,165	1,584	0
<b>Traffic Operations Strategy Subtotal</b>	<b>9,800</b>	<b>8,434</b>	<b>4,623</b>
<b>Grand Total</b>	<b>38,227</b>	<b>47,932</b>	<b>31,440</b>

## Conclusion

CDOT’s priorities for updating the 10-Year Plan, as described in PD 14, are to sustainably increase transportation choice, advance safety, and fix our roads. Through the development of the updated 10-Year Plan CDOT also focused on aligning the

project mix to achieve compliance with the GHG Planning Standard and reduce GHG emissions in non-MPO areas of the state for each future compliance year. In 2030 and 2050 CDOT will achieve the required GHG reductions through modeling the project mix alone. In 2040 CDOT will achieve the required GHG reductions through both modeling and implementation of GHG mitigation measures. A summary of CDOT’s compliance is provided in [Table 9](#) below.

**Table 9. GHG Reduction Results and Compliance**

<b>Compliance Year</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>
GHG Reductions Achieved through Modeling (MMT)	0.391	0.254	0.188
Required GHG Reductions Achieved through Mitigations (MMT)	-	0.046	-
Additional Voluntary GHG Reductions Achieved through Mitigations (MMT)	0.038	0.002	0.031
Total GHG Reductions Achieved (MMT)	0.429	0.302	0.219
2 CCR 601-22 Table 1 Required GHG Reduction Amount (MMT)	0.360	0.300	0.170
<b>Compliance Achieved?</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

# Appendix A - GHG Mitigation Action Plan

## Appendix A.1 - Greenhouse Gas Emissions Reductions

Based on the results of CDOT’s modeling of GHG emissions impacts from the baseline 10-Year Plan and updated future action scenario 10-Year Plan CDOT will need to implement a GHG MAP as allowed by 2 CCR 601-22 Section 8.02.6.3. Mitigation measures are needed to help meet the GHG reduction targets in 2040 but not 2030 and 2050. Voluntary mitigations not needed for compliance are also reported for 2030 and 2050 to reflect projects and programs which have already occurred or have dedicated funding streams. For the purposes of this report mitigations are counted and accredited out through 2050. A summary of the necessary GHG reductions necessary to achieve through mitigation measures to comply with the requirements of Table 1 in the Standard is provided in [Table A-1](#).

**Table A-1. GHG Mitigations Summary**

Compliance Years	2030	2040	2050
GHG Reductions achieved through modeling the 10-Year Plan's mix of projects (MT)	391,000	254,000	188,000
Required GHG Reductions achieved through Mitigation Measures (MT)	-	46,000	-
Voluntary GHG Reductions achieved through Mitigation Measures (MT)	38,245	1,931	32,869
Total GHG Reductions Achieved (MT)	429,245	301,931	220,869
Table 1 GHG Reduction Target (MT <sup>13</sup> )	360,000	300,000	170,000
Compliance Achieved?	Yes	Yes	Yes

The mitigation measures outlined below represent an update to the original GHG MAP CDOT developed in 2022. Some previous strategies have been removed, such as transportation demand management, while others have been added, such as signal retiming as a transportation operations strategy. Furthermore, some existing strategies have been modified to increase target metrics based on CDOT’s increased focus in those areas.

<sup>13</sup> Metric Tons (MT)

## Appendix A.2 - GHG Mitigation Measures Analysis

### Land Use Strategies

#### CDOT Multimodal Investments and Internal Policies to Encourage High-Density, Mixed-Use Development

The benefits of dense, mixed-use land use patterns for transit, multimodal travel, and VMT reduction are widely accepted. PD 1610 acknowledges these foundational dynamics by including land use as an option for mitigation credit. The land use mitigation measures described below as part of CDOT's compliance framework focus on increasing residential density and mixed-use transit-oriented development in the non-MPO areas of Colorado.

Non-MPO areas of Colorado are a unique mix of communities and regions. Many of Colorado's rural communities with agricultural based economies may not be the best suited for increased mixed use transit-oriented designs. However, mountain towns and rural resort communities that have been experiencing faster population growth and development pressures from their tourism-based economy may be primed to invest in mixed-use, transit-oriented nodes. Due to the winter weather, mountain topography, and resulting limitations for buildable land or expanding highways, many of these non-MPO areas with strong tourism-based communities are already linking land use and transportation solutions. Further investments may increase potential VMT reductions by increasing infill development and expanding regional transit and multimodal networks.

CDOT's GHG MAP (2022) identified that with strategic investments and support from CDOT, the potential to increase the amount of high-density zoned areas in non-MPO Colorado as a whole exists. Increasing opportunities to walk, bike, and take transit are critical for high-density development to be an attractive option for communities to apply in appropriate areas. CDOT's role in providing multimodal investments, in partnership with local governments, was identified as critical to making the reductions in GHG emissions via land use a viable option.

Since 2022, several main activities have supported this strategy to become a reality and two elements have created challenges for state-level GHG emission reduction goals:

- Supportive: The State Legislature has taken action to increase housing opportunity across Colorado's communities by passing several bills, which began

implementation largely by the DOLA in 2024 and 2025 (discussed more in External Policies section).

- Supportive: The same laws have varying levels of partnership and collaboration with CDOT’s Land Use Program.
- Supportive: Governor Polis has required state department funding opportunities to prioritize scoring for communities who are “Strategic Growth Law Compliant” through two Executive Orders ([D 2025 005](#) in May and [D 2025 011](#) in August, 2025).
- Supportive: PD 1610 acknowledges the interrelationship between mixed use land uses, active transportation opportunity, and the ultimate reduction of GHG.
- Supportive: A “built environment” component was added to the scoring within the last Transportation Alternatives Program (TAP) funding call to align transportation decision making with land use.
- Challenge: Shifting federal priorities has created funding and other challenges for state-level GHG emission reduction strategies.
- Challenge: State budgeting constraints have reduced funding for dedicated multimodal and innovative transportation funding opportunities.

### **External Policies to Encourage High-Density, Mixed-Use Development and CDOT Collaboration**

The 2024 and 2025 legislative sessions saw the passage of seven State Land Use and Housing bills largely being implemented by the DOLA. These bills ([HB24-1007](#), [HB24-1152](#), [HB24-1313](#), [SB24-174](#), [HB24-1304](#), [HB25-1273](#), [SB25-002](#)) span many topics in land use and housing including:

- Removing residential occupancy limits that are based solely on family relationships;
- Allowing and streamlining review and approval processes for certain types of homes such as Accessory Dwelling Units (ADUs);
- Removing parking minimums in specific areas of certain jurisdictions for small and moderate sized residential development;
- Requiring building code amendments;
- Identifying transit oriented communities and ensuring more zoning capacity for multifamily housing near transit;
- Requiring new components of comprehensive plans; and more.

These laws rely on best practices to densify communities over time through increased zoning capacity in infill areas and near transit and streamlined approval processes; encouraging opportunities for mixed-use redevelopment so communities can offer more types of homes and businesses in a smaller land footprint; and identifying

specific areas suitable for greater access to transit and active transportation as a result of increases in residential capacity.

These laws all influence the way Colorado continues to grow, which has an effect on how Coloradans travel and move in their communities, regionally, and across the state. Due to the growth patterns in the state, the majority of these laws apply to urbanized communities along the Front Range that are within MPOs; for several of the laws, communities outside of these subject jurisdictions may opt-in voluntarily. While generally, all of these laws have a tertiary impact on the State Highway system and assets; two laws in particular, HB24-1313 and SB24-174, are responsible for creating the [Neighborhood Centers](#) program. The Neighborhood Centers program and these two laws require CDOT's involvement and consideration, and also have potential to reduce transportation related GHG emissions in the non-MPO areas of the state.

Identified in SB24-174 and HB24-1313, the Neighborhood Centers program is an interagency incentive program that builds on the tradition of state and local support for “mixed-use pedestrian-oriented neighborhoods”. Neighborhood Centers are voluntarily designated by local governments in areas that meet the criteria established by DOLA. Generally, Neighborhood Centers are dynamic focal points in neighborhoods where housing, commerce, community, and mobility converge, like the main streets of Colorado's historic mountain towns, small towns, or walkable neighborhoods in cities. Neighborhood Centers may be designated in areas that currently exist as mixed-use pedestrian-oriented neighborhoods, or in areas that anticipate becoming a mixed-use pedestrian-oriented neighborhood over time through plans and policies.

[SB24-174](#) (Sustainable Affordable Housing Assistance) creates the opportunity for communities across Colorado to voluntarily designate as “neighborhood centers.” By December 31, 2026, State departments (Departments of Local Affairs, Transportation, Natural Resources, Public Health and Environment, Personnel and Administration, as well as the CEO and Office of Economic Development) who provide grants for the primary purpose of supporting housing and land use planning must determine how to prioritize areas that are designated as a neighborhood center. As a Department that does not typically provide grants for the designated purposes, by December 31, 2026, CDOT must determine appropriate grant opportunities to prioritize funding to communities who designate as a neighborhood center.

The strategic streamlining and prioritization of funding is presented in this law in relationship to the [Neighborhood Centers](#) concepts. Currently, the Neighborhood Centers concept is in a pilot designation phase to finalize the criteria that will be used in 2026. SB24-174 has additional components with important implications for increasing residential density in the non-MPO areas of the state. Three components

most relevant to CDOT are the strategic growth element, Housing Needs Assessment, and Housing Action Plan. The strategic growth element is required for all comprehensive/master plans across Colorado's communities, unless a county or region meets particular criteria to be excluded from this requirement outlined within the bill. The Housing Needs Assessment and subsequent Housing Action plan have varying applicabilities for subject jurisdictions, but the criteria is based on population and affects communities in both non-MPO and MPO boundaries.

[HB24-1313](#) (Transit Oriented Communities) applies to the MPO areas of the state and seeks to improve opportunities to construct housing near transit, create more accessible and affordable housing options, and improve access to transit and multimodal services. Notably, many of the identified transit corridors are on state highways and will require a level of coordination and collaboration with CDOT. Additionally, this bill requires that CDOT create a "Policy Flexibility & Context Study" that examines the Access Code, Roadway Design Guide, and pedestrian and bicyclist crossings. The study must examine the impacts that these policies have on neighborhood and transit centers, housing production, the implementation of context sensitive design, complete streets, and pedestrian and bicyclist safety. This study is anticipated to be completed in 2026.

Together, these laws and Executive Orders create a shared state agency investment strategy that will reduce costs of the extension of utilities and services, promote infill and redevelopment of underutilized parcels, promote development near transit and job centers, and preserve natural and agricultural lands (see Measure Origin and History). Given this focus, it is rational to conclude that existing trends, state agency strategic investments, and support from CDOT, could lead to an increase in the amount of high-density zoned areas in non-MPO Colorado as a whole. Increased options to walk, bike, and take transit are critical for high-density development to be an attractive option for communities, and CDOT's role in providing multimodal investments in partnership with local governments is critical to making the reductions in GHG emissions via land use discussed here a viable option.

## Land Use Strategies GHG Reduction Benefits and Timing

**Table A-2. PD 1610 GHG Mitigation Benefit Emissions Factor Summary - Land Use Strategy**

Mitigation Project Type	Unit	Project Lifetime (Years)	MT GHG/ Unit 2030	MT GHG/ Unit 2040	MT GHG/ Unit 2050
Increase residential density	Per acre rezoned from <10 units/acre to at least 15-25 units/acre meeting "smart growth" criteria	30	22	13	6
Mixed-use TOD - moderate intensity	Per acres of area rezoned for mixed-use TOD accommodating at least 15 residential units/acre and 100 jobs/acre, within ½ miles of high-frequency bus transit or fixed guideway station	30	40	23	11

[Table A-2](#) forms the basis of the GHG reduction estimates in Table A3. For example, 300 acres of increased residential density by 2040 results in 3,900 MT of GHG reduction in 2030 (300 acres \* 13 MT), as shown in [Table A-3](#). Land use measures in PD 1610 have a 30-year lifetime, so any measure that occurs by 2040 will also be garnering GHG reduction in 2050, which is reflected in the GHG emission reduction calculations.

For the purposes of this MAP, acres of TODs act as a temporary proxy for acres that may decide to become designated as Neighborhood Centers. The Neighborhood Centers concept most closely mirrors TOD, with a focus on mixed-use qualities, dense housing, and proximity to transit - but it is not a perfect match. Given the relative newness of the Neighborhood Centers program, CDOT plans to add a Neighborhood Centers specific mitigation measure to PD 1610 once the criteria have been further defined following the current pilot round.

**Table A-3. Land Use GHG Mitigations for CDOT’s Compliance, 2030-2050**

Project Type	2040 Units (Acres)	MT GHG Reduction 2040	MT GHG Reduction 2050
Increase residential density	300	3,900	1,800
Mixed-use TOD - moderate intensity	650	14,950	7,150

**Co-benefits**

Land use changes also generate co-benefits in the form of VMT reduction and the reduction of harmful air pollutants. These benefits are quantified in [Table A-4](#) below.

**Table A-4. Annual Estimated Pollutants Avoided (kg) and VMT avoided from the Combined Land Use Mitigation Measures, 2040-2050**

Co-benefit	2040	2050
CO	138,534	47,789
NOx	1,415	503
PM 2.5	785	657
SO <sub>2</sub>	149	65
VOCs	3,789	1,767
VMT reduction	94,364,850	94,364,850

VMT avoided is based on the calculations associated with built environment changes in PD 1610, which assumes 77,800 VMT is reduced annually for every acre of increased residential density, 174,706 VMT is reduced for every acre of mixed-used TOD (higher intensity), and 109,268 VMT is reduced for every acre of mixed-used TOD (moderate intensity).

**Measure origin and history**

The 2022 MAP recognized four land use strategies as an effective way for CDOT to strategically invest in communities' active transportation, transit, and complete street

programs to spur local rezonings, development, and interest in more compact and dense communities. CDOT has decided to remove the “increase jobs density” component of the previous mitigation strategy after determining the threshold established in PD 1610 is not achievable for the non-MPO areas of the state. Originally, 43 communities across Colorado were identified as non-MPO communities to track local rezonings and TOD changes to contribute to the previous MAP. To further CDOT’s intent to support these goals, a built environment scoring component was added to the 2023 Transportation Alternatives Program (TAP) call. The 2026 TAP call for new grantees will integrate Strategic Growth and [Neighborhood Centers](#) into the scoring rubric to decide awarded projects.

Due to the collaborative efforts between CDOT and other state agencies on the strategic growth laws passed in 2024 and 2025, there are a few new, expanded elements to understand land use as a strategy to reduce GHG emissions and meet the standard. These expanded elements are occurring because of an increased and coordinated state-level approach to “strategic growth.” Defined in the [Strategic Growth Report](#), strategic growth is “a fiscally and environmentally sustainable approach to land use planning, housing, community well being, and infrastructure that promotes the development or redevelopment of vacant and underutilized influx parcels and mitigates the need for extensions of infrastructure and public services into natural and agricultural lands.” This coordinated approach is aligning funds, programs, and data availability.

The Strategic Growth Report (required from SB24-174) completed a “Transect Analysis”, supported by work from the CDOT travel modeling unit and explains typologies of place as it relates to metrics like density, housing costs, household expenses, water use, VMT, and GHG emissions.

Using the “Transect Analysis” from the Strategic Growth Report, it is more likely the “downtown” and “urban core” place types will have the potential to yield the greatest GHG Emissions and VMT reductions from the State’s Strategic Growth Laws (see Transect of Place Types in Colorado in [Figure A-1](#)). The “downtown” and “urban core” are within more heavily populated and economically dense MPO jurisdictions. It is unrealistic to assume Colorado’s non-MPO jurisdictions would evolve or develop to experience the same, or even a similar, scale of residential, commercial, and economic densities as Census Urban Areas<sup>14</sup> that are required to be part of a MPO jurisdiction. As a result, the “Traditional Neighborhoods” category are the most likely place types that may see the greatest GHG reductions from coordinated CDOT

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<sup>14</sup> Federal law requires Census Urban Areas with a population of 50,000 or more to form an MPO.

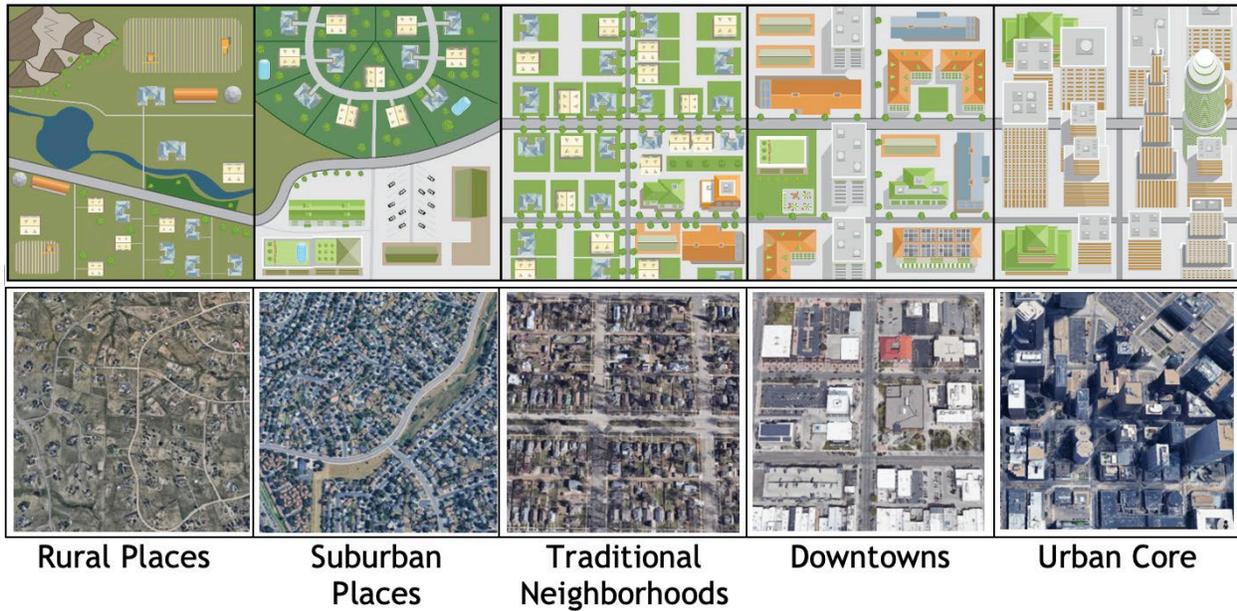
investments in non-MPO areas and will be the focus area for the GHG land use category moving forward.

Traditional Neighborhoods (see [Figure A-1](#)) are characterized by walkable areas with mixed housing options, more affordable homes, and moderate densities; this most closely aligns with Area Type 3 (AT 3)<sup>15</sup> in CDOT's travel demand model. For example, the two largest "urban areas" in the non-MPO areas are Cañon City and Montrose, which each have populations of just under 25,000 and their downtowns are represented as Area Type 3 in the CDOT model. Approximately 70 potential locations totaling over 10,000 acres have been identified through CDOT's Model that meet these characteristics and type specification and highlights the potential to achieve the land use changes proposed by this mitigation measure.

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<sup>15</sup> Within the model's description, AT 3 has a population density between 5,200 and 10,000 persons per square mile in a half-mile radius around the zone centroid or 2,300 to 8,000 jobs/square mile.

**Figure A-1. Transect of Place Types in Colorado**



**Funding/Resources/Partnerships**

For strategic growth funding priorities to be successful, collaborative and coordinated approaches between land use and transportation are essential. Currently, state agencies are developing coordinated and collaborative approaches to implement the state’s land use and housing laws which will affect how the Land Use GHG mitigation measures develop in the near and long term. There are a few notable items affecting the implementation of these laws.

First, Governor Polis signed two related Executive Orders, [D 2025 005](#) in May and [D 2025 011](#) in August 2025. [D 2025 005](#) directs DOLA to [summarize a framework, criteria, and benchmarks](#) established in HB24-1007, HB24-1152, HB24-1304, HB24-1313, SB24-174, HB25-1273, and SB25-002. This process [identifies and certifies Strategic Growth Compliant Local Governments](#) to establish priority for state funding opportunities on at least a quarterly basis. The second Executive Order, [D 2025 011](#), lists specific state funding opportunities that must prioritize scoring for local governments who are certified as Strategic Growth Compliant. Eight CDOT funding opportunities are required to integrate prioritized scoring: MMOF, TAP (statewide), Safe Routes to School, E-mobility Education and Awareness Grants, Transportation Demand Management Innovation Grants, Roadside and On-board Unit In-Kind Grant, Transportation Management Organization Seed Funding, and RMS.

Additionally, funds like the NAAPME and CTE are being implemented through CDOT and have sizable distributions. NAAPME’s 10-Year Plan (2024) and Community Clean

Transportation Assistance support active transportation and transit projects, mostly within MPO areas, but still have important implications for the greater transportation network. CTE invests in a variety of transit and electrification efforts and the SB230 Formula Program requires a “local zoning” component as part of the apportionment formula for transit agencies around the state.

Last, SB24-174 “Sustainable Affordable Housing Assistance” requires prioritized scoring for community locations that are designated as “Neighborhood Centers.” Per SB24-174, by December 1, 2026, CDOT is required to identify applicable and appropriate grant fund opportunities that will prioritize scoring for locations designated as “neighborhood centers.” To date, the TAP funding has been identified as a logical funding opportunity to prioritize scoring for locations that are certified as Neighborhood Centers. As the Neighborhood Centers program grows, it is possible CDOT may want to consider more funding opportunities that prioritize Neighborhood Center locations to create a greater return on our investments to meet our GHG Goals through the land use measure.

Historically, state transportation policy and funding have interacted with land use development patterns in a way that moves both systems further from strategic growth principles, often leading to increased sprawl and increased long-term system costs. Highways and roads have traditionally been more reliably funded than transit, bicycle, and pedestrian infrastructure, encouraging development in areas best served by highways, i.e. areas further from city centers, as roads make commuting feasible from more distant locations. More miles of road and longer service utility lines (including water, electricity, and sewer) increase system maintenance and capital costs. However, the last decade has seen the state increase in dedicated funding for transit and active transportation, despite the reductions seen over the last few years due to state budget constraints.

While these land use changes will not be directly funded by CDOT, CDOT will seek to understand how SB21-260, SB22-180, SB24-230, and 10-Year Plan Strategic funds can be used to fund the transportation programs, projects and grants that seek to encourage and support such built environment changes.

### **Other info as needed**

While large MPOs have many advantages in measuring GHG emissions reductions via improved land use patterns due to land use models that supplement travel demand models and more robust data from local governments, CDOT is in the beginning stages of understanding and considering how to track, measure, report and support sustainable land use with appropriate transportation infrastructure in the non-MPO

areas of the state. This effort will be supported by the tracking and reporting components built into the Sustainable Affordable Housing and Transit Oriented Communities laws.

Further, DOLA has begun a Neighborhood Center [Pilot Round](#) to finalize the criteria established by DOLA which was published on June 30, 2025. The [Program Guideline](#) outlines the criteria for Neighborhood Centers based on location, efficient approval processes, density, and pedestrian oriented and mixed use characteristics. The Neighborhood Center criteria will be finalized in 2026.

## Transit Strategies

### Bustang and Outrider

Bustang, CDOT's interregional express bus service, began operation in 2015 to connect urbanized areas across the State. This service has three main lines: the North Line (Denver to Fort Collins), West line (Denver to Grand Junction), and the South Line (Denver to Colorado Springs). In 2022, SB22-180 was passed, providing \$30M in direct funding to the expansion of Bustang service through a three-year pilot program. This pilot program planned to expand service along the I-25 corridor by 200% on weekdays, 200% on weekends, and service along I-70 west increased by approximately 250%. The full expansion of the North and South lines was achieved in November 2024 and the final phase of expansion of the West Line was completed in December 2024. This mitigation measure assumes the continuation of this expanded service from present day out to 2050.

Outrider was launched in 2018, and builds and expands transit service to connect rural areas to primary corridors and larger cities and towns. This transit service offers eight routes and focuses on providing reliable and affordable transportation options, often partnering with local transit agencies to ensure comprehensive and accessible service. In 2022, there was a service expansion that included an increased frequency of the Sterling to Denver Route, increasing from one daily round trip on Tuesday and Thursday to running daily Monday through Friday. Outrider had another update in 2024 by adding a stop at Denver International Airport (DEN) and eliminating other stops that saw low ridership, resulting in a decrease in the trip time from Sterling to Denver by an hour.

### GHG Reductions Benefit and Timing

As seen in [Table A-5](#) below, Bustang and Outrider are both considered to be new or increased fixed route transit service between cities. Each project is measured per 1,000 vehicle revenue miles and the lifetime of each project is one year. Therefore,

the VRM goals established below are expected to be achieved within each respective compliance year.

**Table A-5. PD 1610 GHG Mitigation Benefit Emissions Factor Summary - Transit: Regional Service Expansion**

Mitigation Project Type	Unit	Project Lifetime	MT GHG/Unit 2030	MT GHG/Unit 2040	MT GHG/Unit 2050
New or increased fixed-route transit service - intercity fleet average bus	Per 1,000 vehicle revenue miles	1 year	2	1	1

CDOT plans to continue to invest in these transit services moving forward. To calculate the GHG reduction benefit of these services, annual VRM must be known or estimated. The VRM in Table A6 for Bustang are based on the final phase of expansion achieved as a result of SB22-180, continued in each compliance year. The VRM estimates for Outrider in [Table A-6](#) are based on the service expansions that have occurred since 2021. The GHG reduction benefits for each compliance year presume the established VRM goal will be achieved within each respective compliance year. CDOT bases the VRM goal only upon the VRM that is achieved within non-MPO areas, as some of the VRM occurs within the boundaries of the state’s five MPOs.

**Table A-6. Transit Mitigations for CDOT’s Compliance, 2030-2050**

Transit Service	Unit (new VRM)	MT GHG Reduction 2030	MT GHG Reduction 2040	MT GHG Reduction 2050
Bustang	3,913,568	7,827	3,914	3,914
Outrider	763,897	1,528	764	764
Total	4,677,465	9,355	4,678	4,678

**Co-benefits**

While bus services can help reduce single occupancy VMT which reduces GHG emissions overall, Bustang and Outrider also provide other benefits. They reduce cars on the roadways, resulting in less traffic congestion and time savings for commuters. They

also reduce the need for personal vehicle use, allowing for cost savings through vehicle fuel and maintenance costs. By reducing the need to drive a personal vehicle, bus services can also reduce costs associated with vehicle crashes. Reducing vehicle crashes can lead to reduced medical, insurance, vehicle property, and lost workplace productivity costs.

**Table A-7. Annual Estimated Pollutants Avoided (kg) and VMT avoided from the combined effects of Bustang and Outrider**

Co-benefit	2030	2040	2050
CO	89,561	39,817	15,023
NOx	-	-	158
PM 2.5	110	197	206
SO <sub>2</sub>	62	40	21
VOCs	1,628	994	555
VMT avoided	43,033,000	43,033,000	43,033,000

VMT avoided is based on the calculation associated with intercity transit service in PD 1610, which assumes 9,200 VMT is reduced for every 1,000 new VRM.

### Measure Origin and History

CDOT launched Bustang in 2015, aiming to provide much needed transit to and from the communities along the I-25 and I-70 corridors. Then, in 2018 CDOT launched the Outrider service, aiming to bring rural connections to the Bustang I-70 and I-25 services.

### Funding/Resources/Partnerships

A handful of different funding sources will be used to sustain Bustang service. One funding source is MMOF, which funds multimodal transportation projects and can be used to improve statewide and rural transit. MMOF is expected to provide \$3-4 million to Bustang service from FY 26 through FY32. Another funding source is SB 09-108, or the Funding Advancements Surface Transportation Economic Recovery Act of 2009 (FASTER). Along with supporting the improvement of roadway safety and repairing deteriorating bridges, it also aims to support and expand transit. FASTER does not sunset or expire, ensuring that there is a reliable source of funding for Bustang for years to come, and therefore continuing to allow for reliable transit service through

Bustang. Other funding sources include the fare revenue from Bustang users and SB21-260, the Sustainability of the Transportation System bill, which will be used for Bustang mobility hubs and other similar projects.

### Rural Transit Service Recovery

Following the COVID-19 pandemic, traffic in many parts of the state returned to pre-pandemic levels, while transit ridership and service remained low. Through state and federal funds, CDOT aims to support the return of intercity, local, and demand response service levels of the state’s rural transit agencies to pre-COVID levels by 2030 or earlier.

### GHG Reductions Benefits and Timing

This measure uses three mitigation project types from PD 1610 to calculate the project GHG benefits of local, intercity, and demand response transit service recovery throughout the non-MPO areas of the state. The GHG reduction benefits are measured by tracking increases in either vehicle revenue service miles (VRM) or vehicle revenue-hours (VRH) and the lifetime of each project is one year. Therefore the VRM and VRH goals established below will need to be achieved within each respective compliance year.

**Table A-8. PD 1610 GHG Mitigation Benefit Emissions Factor Summary - Transit: Rural Service Recovery**

Mitigation Project Type	Unit	Project Lifetime	MT GHG/Unit 2030	MT GHG/Unit 2040	MT GHG/Unit 2050
New/increased fixed-route transit service - intercity fleet average	Per 1,000 vehicle revenue-miles	1 year	2	1	1
New/increased fixed-route transit service - electric/diesel fleet average	Per 1,000 new vehicle revenue hours	1 year	4	5	7
New/increased demand-response bus service	Per 1,000 new vehicle revenue hours	1 year	-	1	2

To determine the GHG reduction benefit for rural transit service recovery, VRM for intercity transit and VRH for local transit and demand response must be known or

estimated. To develop the VRM and VRH estimates in [Table A-9](#), CDOT compared National Transit Database service data for rural agencies in 2019 (pre-pandemic) and 2020 (during pandemic) to determine how much service was lost and set a recovery target based on the difference.

**Table A-9. Rural Transit Service Recovery GHG Calculation of GHG Benefits, 2030-2050**

Transit Service	Unit	MT GHG Reduction 2030	MT GHG Reduction 2040	MT GHG Reduction 2050
Recovered intercity service	2,060,742 VRM	4,121	2,060	2,060
Recovered local service	84,004 VRH	336	420	588
Recovered demand response service	695,128 VRH	0	695	1,390
Total	-	4,457	3,175	4,038

### Co-benefits

**Table A-10. Annual Estimated Pollutants Avoided (kg) and VMT avoided from the combined effects of Rural Transit Service Recovery, 2030-2050**

Co-benefit	2030	2040	2050
CO	76,692	38,297	16,226
NOx	-	-	171
PM 2.5	-	150	223
SO <sub>2</sub>	47	37	22
VOCs	866	824	600
VMT avoided	46,502,800	46,502,800	46,502,800

VMT avoided is based on the calculation associated with intercity transit service, fixed-route (local) transit service, and demand response service measures in PD 1610. PD 1610 assumes intercity service avoids 9,200 VMT for every 1,000 new VRM, local

service avoids 89,700 VMT for every 1,000 VRH, and demand response service avoids 28,800 VMT for every 1,000 VRH.

### **Measure Origin and History**

The following rural transit agencies saw decreases in transit service operations due to the COVID-19 pandemic. These agencies also receive state and federal funding: Bent County Transit, The Lift (City of Winter Park), ECO Transit (Eagle County), Gunnison Valley RTA, Mountain Express, Northeast Colorado Association of Local Governments (NECALG), RFTA, San Miguel Authority for Regional Transportation (SMART), Senior Resource Development Agency, Southern Colorado Community Action Agency (SoCoCAA, based in Ignacio), Steamboat Springs Transit (SST), Summit Stage, Black Hawk & Central City Tramway, Cripple Creek Transit, Durango Transit, Ride Glenwood Springs, La Junta, Envida, East Central Council of Local Governments, All Points Transit (Montrose), Prowers County, Summit Stage, Teller County, Canon City, Avon Transit, Mountain Village, Snowmass Village, Galloping Goose, Via Mobility Services, Wet Mountain Valley Rotary, Dolores County, South Central COG, and Montezuma County. The majority of these transit agencies' services are not captured in CDOT's travel demand model and thus are suited for off model calculation.

This strategy was identified in CDOT's 2022 MAP. As part of the annual mitigation updates to the Commission, CDOT has tracked rural transit service recovery through the National Transit Database and seen a steady increase in VRM and VRH, as well as increases in ridership, throughout rural transit agencies.

### **Funding/Resources/Partnerships**

Rural transit agencies operations are funded primarily through Federal Transit Administration (FTA) formula funds for rural areas (FTA 5311 and FTA 5310), and local funding sources. Rural capital projects are funded through FASTER, SB17-267, FTA 5304, 5310, 5311, and 5339 funds.

### **CTE SB24-230 Formula Grant Program**

The SB24-230 Formula Grant Program focuses primarily on expanding transit operations throughout the state by investing in public transit, including vehicles, infrastructure, equipment, materials, supplies, maintenance, and operations and staffing, to achieve the level of frequent, convenient and reliable transit that is known to increase ridership by replacing car trips with bus and rail trips and forms of transit known to support denser land use patterns that future reduce pollution due to shorter trip lengths and greater walking and cycling mode share. The program is run by CDOT's CTE and funded by the Oil and Gas Production Fee, discussed further below.

## GHG Reductions Benefits and Timing

Similar to Rural Transit Service Recovery, each project within the CTE SB24-230 Formula Grant Program is measured per 1,000 vehicle revenue miles or vehicle revenue-hours and the lifetime of each project is one year. In each compliance year the VRM and VRH goals established below will need to be achieved within each respective compliance year. Based on initial applications for the grant program received in the fall of 2025, these CTE funds will be used for both local and intercity service expansions in non-MPO areas of the state. Local service is represented by the “new/increased fixed-route transit service - electric/diesel fleet average” mitigation measure, which is associated with slower transit vehicle speeds and more frequent stops - resulting in reduced emissions benefits from a decrease in transit vehicle operating efficiency.

**Table A-11. PD 1610 GHG Mitigation Benefit Emissions Factor Summary - Transit: CTE Formula Grant Program**

Mitigation Project Type	Unit	Project Lifetime	MT GHG/Unit 2030	MT GHG/Unit 2040	MT GHG/Unit 2050
New/increased fixed-route transit service - intercity fleet average	Per 1,000 vehicle revenue-miles	1 year	2	1	1
New/increased fixed-route transit service - electric/diesel fleet average	Per 1,000 vehicle revenue-hours	1 year	4	5	7

To estimate the VRM and VRH increases associated with this grant program, which are necessary to calculate the GHG reduction benefit, CDOT reviewed the comprehensive operational analysis (COA) documents received by applicants in the first round of CTE applications. These COAs describe how rural transit agencies intend to use the SB24-230 funds to expand their transit operations over the next five years, including money requested and expected increases in VRM, VRH, and unlinked passenger trips. However, not all of the COAs have been received for agencies that intend to use SB24-230 funds, as some agencies needed more time. CDOT estimated future revenue for the grant program, and used existing COA data on service and costs to estimate how the additional funds may translate to increases in VRH or VRM for rural transit agencies interested in the program. As additional COAs come in and CTE continues to track progress on this program, CDOT will be able to update this mitigation measure appropriately.

**Table A-12. CTE Formula Grant Program GHG Mitigation Benefit in the non-MPO areas**

Transit Service	Unit	MT GHG Reduction 2030	MT GHG Reduction 2040	MT GHG Reduction 2050
New/increased fixed-route transit service - intercity fleet average	4,438 VRM	8,527	4,263	4,263
New/increased fixed-route transit service - electric/diesel fleet average	34 VRH	137	171	240
Total	-	8,664	4,435	4,503

### Co-benefits

**Table A-13. Annual Estimated Pollutants Avoided (kg) and VMT avoided from the combined effects of the CTE Formula Grant Program in the non-MPO areas, 2030-2050**

Co-Benefit	2030	2040	2050
CO	196,755	86,799	36,676
NOx	-	-	386
PM 2.5	-	211	504
SO <sub>2</sub>	126	87	50
VOCs	1,457	1,775	1,356
VMT avoided	105,057,440	105,057,440	105,057,440

VMT avoided is based on the calculation associated with intercity transit service and fixed-route (local) transit service in PD 1610. PD 1610 assumes intercity service avoids 9,200 VMT for every 1,000 new VRM and that local service avoids 89,700 VMT for every 1,000 VRH.

### Measure Origin and History

Senate Bill 24-230 was passed in the Spring of 2024, expanding the business purpose of the CTE by setting up the Local Transit Operations Formula Program (known as the

SB230 Formula Grant Program). The program establishes a new funding source for mitigation measures and is thus being added to CDOT’s MAP. Apportionments of the grant are based on a formula that incorporates the following six factors: population, population density, local zoning, transit ridership, vehicle revenue miles, and the share of disproportionately impacted community population or Transportation Disadvantaged Communities. The CTE has been working since January 2025 to implement the SB230 Formula Grant Program and allocate resources to agencies, is in the process of making the first grant awards, and anticipates the distribution of funds to eligible transit entities will begin in the second half of FY26.

### **Funding/Resources/Partnerships**

The Oil and Gas Production Fee, enacted as part of SB24-230, requires CTE to implement a production fee, based on quarterly average spot prices, that is paid quarterly by every producer of oil and gas in the state and applies to all oil and gas produced in the state on and after July 1, 2025. Proceeds from the fees are allocated to three programs: The SB230 Formula Program (70% of revenues), a discretionary transit grant program (10% of revenues), and a passenger rail program (20% of revenues). The SB230 formula Program will enable CTE to fund more transit-oriented projects across the state to expand transit service, increase ridership, and contribute to reductions in GHG emissions because of the additional business purpose and revenue stream from the Oil and Gas Production Fee. and For FY26, limitations on CTE funding levels resulting from Proposition 117 will result in SB230 Formula Program funding of about \$37 million. For FY27 and beyond, CTE projects annual funding levels will average \$70 to 80 million. However, because program funding levels are tied to oil and gas prices, they are likely to fluctuate over time.

### **Medium-Duty and Heavy-Duty Electrification Strategies**

#### **Electric Transit Vehicles for Rural Transit Agencies**

This strategy measures the outcomes of CDOT’s support for the replacement of diesel transit buses with electric transit buses in non-MPO areas. In CDOT’s previous GHG MAP (2022) we established a goal of replacing 25 diesel transit buses with electric buses between 2020 and 2030. From 2020 to 2025, 13 electric transit buses have been placed into service in the state’s rural areas through a combination of grant money from the CTE, the Volkswagen Diesel Emission Settlement Program, and federal grants. In the years to come, the CTE will play an important role in facilitating the transition of Colorado’s transit fleet to zero emission vehicles (ZEVs). The CTE is an entity created within CDOT by SB21-260 which collects revenues through a Clean Transit Retail Delivery Fee to fund support for public transit electrification planning efforts, facility

upgrades, fleet motor vehicle replacements, as well as construction and development of electric motor vehicle charging and fueling infrastructure. The CTE public transit electrification program has now been operating for over three years and has awarded a total of approximately \$15.5 million in grants to entities around the state to support a transition to zero-emission transit services. This includes eight Zero-Emission Transition Planning grant awards (totalling just over \$500,000) and 11 Zero Emission Transit Capital Grant awards - one facility project, one infrastructure project, and nine vehicle projects which will result in 28 zero emission transit vehicle purchases (totalling \$15 million). The CTE opened a new round of grants on September 29, 2025 which will close on December 5, 2025.

### GHG Reductions Benefits and Timing

**Table A-14. PD 1610 GHG Mitigation Benefit Emissions Factor Summary - MD/HD: Electric Transit Vehicles**

Mitigation Project Type	Unit	Project Lifetime	MT GHG/Unit 2030	MT GHG/Unit 2040	MT GHG/Unit 2050
Replace diesel transit buses with battery-electric buses	Per new vehicle	12 years	85	76	74

**Table A-15. Currently Awarded EV Bus Grants**

Time Period	Number of EV buses placed into service	MT GHG Reduction 2030	MT GHG Reduction 2040	MT GHG Reduction 2050
2020 -2025	13	1,105	0	0
2026-2027 (estimated)	19	1,615	0	0
2028-2030 (estimated)	17	1,445	1,292	0
Total	49	4,165	1,292	0

[Table A-15](#) estimates the GHG reduction benefit achieved by grants for transit ZEVs in the non-MPO areas of the state. [Table A-14](#) re-displays the GHG reduction rates for transit bus electrification from PD 1610.0, which were used to calculate the benefits in Table A-15. From 2020 to 2025, 49 buses have been awarded to the non-MPO areas through CTE and other grants, 13 of which have been placed into service. The remaining 36 are expected to be placed into service over the next 5 years. Notably, the lifetime of an EV bus is 12 years, so any vehicle placed into service from 2020 to

2027 will not result in GHG emission reductions in 2040 or 2050. Additionally, any vehicle placed into service from 2020 to 2030 will not result in GHG emissions reductions in 2050.

In [Table A-16](#), CDOT estimates the GHG reduction benefit associated with how many new transit ZEVs the CTE might be likely to fund from grants that have yet to be awarded, between the most recent call for applications (beginning September 2025) through 2050. To develop the estimates on the number of transit ZEVs placed into service in the non-MPO areas of the state due to this program, CDOT forecast estimated Retail Delivery Fee revenues from the CTE 10-Year Plan, considered the relative percentage of grants that have been awarded to rural transit agencies, estimated the cost of transit ZEVs, the grant amount per vehicle, and the number of rural transit ZEVs funded per year. CDOT will revisit these future projections as more data becomes available.

**Table A-16. Future CTE Grant Projections for EV Bus Grants**

Timeframe	Number of ZEV Buses Placed into Service (estimated)	MT GHG Reduction 2030	MT GHG Reduction 2040	MT GHG Reduction 2050
2028-2030	21	1,785	1,596	-
2031-2037	57	-	3,876	-
2038-2040	21	-	1,596	1,554
Total	165	1,785	7,068	1,554

### Co-benefits

**Table A-17 - Annual Estimated Pollutants Avoided (kg) from the combined EV bus replacement strategy in the non-MPO areas, 2030-2050**

Co-Benefit	2030	2040	2050
CO	10,438	14,769	10,388
NOx	12,916	14,932	10,455
PM 2.5	418	280	196
SO <sub>2</sub>	15	21	15
VOCs	781	845	583

## Measure Origin and History

The CDOT Division of Transit & Rail (DTR) has helped to support the regular replacement of transit vehicles reaching the end of their service life with new transit vehicles (including hybrid and zero-emission models) for many years. In 2018, Colorado adopted its state Beneficiary Mitigation Plan (BMP) for the approximate \$68.7 million allocation of the national Volkswagen Diesel Emission Settlement, which dedicated \$30.6 million in the state’s funding for the Settlement Program transit bus replacement grants. Settlement Program grants can fund up to 110% of the incremental cost of replacing an existing diesel vehicle with a zero-emission alternative, and since 2019 more than \$21 million of the original amount has been awarded. The grant programs created by the CTE in 2022 will continue this work into the future, with funding secured by the Clean Transit Retail Delivery Fee. With the increases in funding established by CTE CDOT decided to update this measure compared to the original commitments made in GHG MAP (2022).

## Funding/Resources/Partnerships

The CTE Board includes six members appointed by the governor, and executive directors or their designees from CDOT, Colorado Department of Public Health and Environment and the CEO. Appointed board members will serve terms of three or four years. SB 21-260 established several new fees on the delivery of items that are subject to the state sales tax, including the retail delivery fee, a portion of which funds the activities of the CTE, the Clean Transit Retail Delivery Fee, allowing it to issue grants, loans, and rebates to support electrification of public transit. Colorado Revised Statute (CRS) 43-4-1203 (7)(b) initially set the rate at \$0.03 per delivery, which is the maximum amount established by SB21-260, although the fee may be adjusted for inflation in future years. Since then, the CTE Board has made periodical adjustments of the fee to account for inflation.

## Traffic Operations Strategies

### Roundabout Construction

Roundabouts have long been recognized for their safety and mobility benefits. In addition, the increased efficiency they provide at intersections benefits air quality by reducing GHG emissions. In developing CDOT’s updated Mitigation Action Plan we assessed more fully both local agency and CDOT funded projects since the adoption of CDOT’s 2020 baseline 10-Year Plan. PD 1610 states, “A locally-driven project, not otherwise prompted or developed as a result of CDOT or MPO action (e.g. funded or directly incentivized) may be included in the MAP if it is a GHG Mitigation Measure

contained in Appendix A of this Policy.” The statewide travel model does not distinguish between a roundabout and traditional signalized intersection. Therefore, CDOT has included roundabout construction in the MAP to capture the additional air quality benefits the newly added roundabout projects provide. The scale of this measure is statewide for projects located outside of MPO areas.

### GHG Reductions Benefits and Timing

Replacing an existing signalized intersection with a roundabout or installing a completely new roundabout in lieu of an intersection are both treated as creditable under this measure since the air quality benefits are similar. The lifetime GHG reduction benefit of constructing a roundabout is considered to be 30 years. Therefore, any roundabouts constructed in 2020 and beyond will have a GHG reduction benefit through the last 2050 compliance year of the Standard. The PD 1610 emissions factors for this strategy are summarized below in [Table A-18](#).

**Table A-18. PD 1610 GHG Mitigation Benefit Emissions Factor Summary - Traffic Operation Strategies: Roundabouts**

Mitigation Project Type	Unit	Project Lifetime	MT GHG/Unit 2030	MT GHG/Unit 2040	MT GHG/Unit 2050
Replace Signalized Intersection with Roundabout	Per 10,000 AADT per roundabout	30 years	221	133	55

To determine the GHG reduction benefit the Annual Average Daily Traffic (AADT) must be known or estimated for the intersections. Data to develop these estimates was obtained from CDOT traffic counters. CDOT determined that between 2021 and 2025 twelve local agency and CDOT funded roundabouts were constructed in non-MPO areas with a total estimated combined AADT of 142,000. In addition, between 2026 through 2030 CDOT anticipates an additional 13 roundabouts will be constructed with an estimated combined AADT of 113,000. Beyond 2030 CDOT is setting some initial aspirational goals to build an additional 26 roundabouts with a minimum combined AADT of 260,000 between 2031 through 2040. Replacing a signalized intersection with a roundabout has a 30 year lifetime benefit. Any measure that occurs by 2030 will also be garnering GHG reductions in 2050, which is reflected in the GHG emissions reduction calculations. The projected rolling combined GHG reduction benefit for each horizon year is contained in [Table A-19](#) below.

**Table A-19. Projected Rolling Combined GHG Reduction Benefits for Roundabouts, 2030-2050**

Time Period	Number of Roundabouts Constructed within Time Period	Combined Total AADT of New Roundabouts	MT GHG Reduction 2030	MT GHG Reduction 2040	MT GHG Reduction 2050
2021 through 2030	25	255,000	5,636	3,392	1,403
2031 through 2040	26	260,000	-	3,458	1,430
Total	51	515,000	5,636	6,850	2833

### Co-benefits

Roundabouts improve air quality compared to traditional intersections by reducing vehicle idling and fuel consumption which reduces emissions. The primary reason for this is the continuous, free-flowing movement of traffic, which eliminates the need for vehicles to stop and accelerate frequently. Roundabouts are not a VMT reduction strategy. A detailed evaluation of pollutant co-benefits would require individual project level traffic simulation modeling and therefore was not possible. However, one study<sup>16</sup> indicates rebuilding of a signalised intersection into a roundabout resulted in an average decrease in CO emissions by 29% and NOx emissions by 21%.

### Measure Origin and History

While the safety and mobility benefits of roundabouts have been widely accepted in the transportation sector, in developing the Standard in 2021 CDOT also began to explore how roundabouts have the potential to lower GHG emissions. Through extensive analysis, CDOT has established that in addition to the extensive set of safety and mobility benefits, roundabouts also go a long way towards reducing emissions. The benefits of roundabout construction are considered additional because the GHG reduction benefits of roundabouts cannot be distinguished from a more conventional at-grade intersection by the travel demand model.

### Funding/Resources/Partnerships

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<sup>16</sup> <https://www.sciencedirect.com/science/article/abs/pii/S1361920901000116>

Funding of roundabout projects may include support from local governments as well as state and federal funding. The combination thereof will not be determined until project programming occurs either by the local agency or CDOT through the 4-year prioritized plan as part of the 10-Year Plan process or the Statewide Transportation Improvement Program (STIP) through other CDOT Programs.

### Traffic Signal Retiming

Retiming traffic signals improves air quality and reduces emissions by smoothing traffic flow, which leads to less stop-and-go driving and less idling time. This results in less fuel consumption and fewer air pollutants such as GHGs. Additionally, these efforts provide cost savings to travelers by improving travel time reliability and reducing fuel costs. Minimizing stop and go traffic also increases safety by reducing the potential for crashes. In developing CDOT’s updated Mitigation Action Plan we assessed more fully CDOT regional efforts to complete signal retiming in non-MPO areas.

### GHG Reductions Benefits and Timing

The lifetime GHG reduction benefit of retiming/optimizing a signal is considered to be 5 years. Therefore, any signals retimed between 2025 and the end of 2030 will have a GHG reduction benefit in the 2030 compliance year of the Standard. To receive GHG reduction credit in the 2040 compliance year signals would need to be retimed between 2035 and the end of 2040. The PD 1610 emissions factors for this strategy are summarized in [Table A-20](#).

**Table A-20. PD 1610 GHG Mitigation Benefit Emissions Factor Summary - Traffic Operation Strategies: Signal Retiming**

Mitigation Project Type	Unit	Project Lifetime	MT GHG/Unit 2030	MT GHG/Unit 2040	MT GHG/Unit 2050
Retime/Optimize Arterial Signals	Per 10,000 AADT per signal optimized within 5 years prior to evaluation year	5 years	50	33	23

The 2030 GHG reduction benefits represented below are based on 43 traffic signals retimed during 2025 and an additional 20 traffic signals expected to be retimed by CDOT between 2026-2029 within non-MPO areas. Total combined AADT for these signals was estimated using CDOT traffic count data. CDOT has set aspirational goals

for the 2040 compliance year to retime 40 signals within 5 years of the 2040 compliance year. Benefits were calculated based on the presumption that across all 40 signals the average AADT would be 12,000.

**Table A-21. Projected Rolling Combined GHG Reduction Benefits for Signal Retiming, 2030-2050**

Time Period	Number of Signals Retimed	Combined Total AADT of Signals Retimed	MT GHG Reduction 2030	MT GHG Reduction 2040	MT GHG Reduction 2050
2025 through 2030	63	832,957	4,165	-	-
2035 through 2040	40	480,000	-	1,584	-
Total	103	1,312,957	4,166	1,584	0

### Co-benefits

Retiming signals improve air quality by reducing vehicle idling and stop-and-go traffic which increases efficiency and reduces fuel consumption and emissions. Signal retiming is not a VMT reduction strategy. A detailed evaluation of pollutant co-benefits would require individual project modeling and therefore was not possible.

### Measure Origin and History

Emission reduction benefits of signal retiming have been widely accepted in the transportation sector. CDOT developed an emissions factor included in PD 1610 to estimate the GHG reduction benefits from retiming signals. As part of the emissions factor development CDOT considered the disbenefit of induced VMT from vehicles that may choose to travel on a more efficient roadway. The benefits of signal retiming are considered additional because the GHG reduction benefits of signal retiming cannot be accounted for by CDOT’s travel demand model.

### Funding/Resources/Partnerships

Signal retiming is primarily managed at the regional level. Signal retiming is a function of local MPOs or initiated at the local government level as most signalized corridors pass through multiple jurisdictions, requiring a coordinated approach. CDOT regional staff support signal retiming on CDOT maintained roadways located within non-MPO jurisdictions. Regions typically initiate signal retiming projects on corridors that have experienced significant changes in land use, roadway geometry, or traffic patterns. Projects may also be prompted by public complaints, safety concerns, or prolonged

congestion. Commonly MPOs have programs that dedicate funding to signal retiming efforts, while CDOT uses a variety of state or federal funds to support these efforts.

## Appendix A.3 - Benefits to Disproportionately Impacted Communities

In 2021, Governor Polis enacted HB21-1266 which focuses on prioritizing a reduction in environmental health disparities to disproportionately impacted (DI) communities. A DI community as defined in CRS 24-4-109 (2)(b)(II), is a community in a census block group that meets one of the following criteria:

- the proportion of households that are at or below 200% of the federal poverty line is greater than forty percent,
- the proportion of households that identify as a minority is greater than forty percent,
- the prioritization of households that are housing cost-burdened is greater than forty percent,
- the proportion of people that are linguistically isolated is greater than twenty percent,
- Communities with cumulative environmental and socioeconomic impacts, which can be identified by having a Colorado EnviroScreen score above the 80th percentile,
- The Southern Ute and Ute Mountain Ute reservations,
- Mobile home communities,
- And historically marginalized communities.

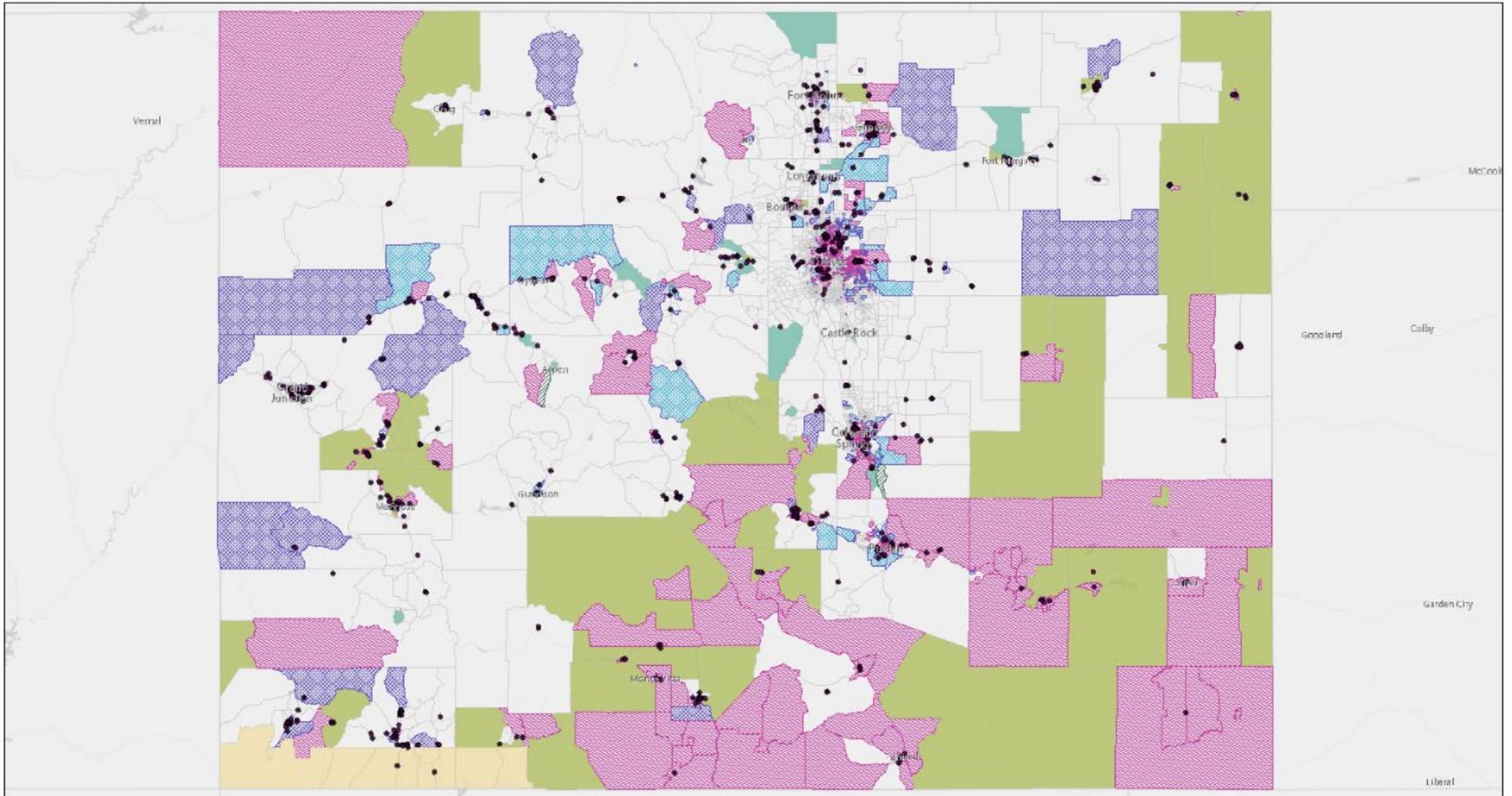
DI communities across Colorado are identified in [Figure A-2](#) below.

At this time, CDOT does not have a final GHG mitigation measure equity benefits standards document available for measuring DI community benefits of GHG mitigation measures, per PD 1610. A tool for this purpose is in the draft stages of development. Additionally, GHG mitigations established in this plan are in the early stages of project selection and development or programmatic in nature. Therefore, CDOT does not have enough details to determine and measure potential benefits to DI communities. However, their potential benefits for DI Communities is described below.

Land use changes like increased residential densities can lead to increased total housing availability and reduced transportation costs, especially when these residential areas are transit efficient and associated with affordable housing. Because the main goal of land use strategies is to help provide multimodal infrastructure resulting in shorter and fewer trips by single occupancy vehicles, land use changes lead to

decreased need for single occupancy vehicles altogether and, in turn, lead to savings for families in DI communities. Also, if a community is designated as a Neighborhood Center, that community will receive funding for more multimodal options and other GHG reduction efforts. This funding can significantly improve DI communities.

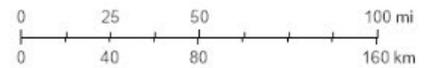
Figure A-2 - Disproportionately Impacted Communities in Colorado



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- ▲ Mobile home communities
- Disproportionately impacted community (Nov. 2024)
- More than one category
- Low-income population above 40% only
- People of color population above 40%
- Housing cost-burdened population above 50% only
- Linguistically isolated population above 20% only
- Colorado EnviroScreen percentile score above 80 only
- Within a Justice 40 census tract only
- Area under tribal jurisdiction
- Does not meet criteria

1:2,773,395



Esri, HERE, NPS, Esri, HERE, Garmin, USGS, EPA, NPS

Increasing public transit options in both urban and rural areas leads to transit-efficient communities that can create better access to education, community services, health care, and affordable housing for community members. Both Bustang and Outrider intersect with DI communities within Colorado. These public transit services help create better access to jobs, hospitals, grocery stores, among other destinations, positively benefiting these communities and decreasing the cost of transportation.

Electrifying MD/HD buses that intersect with DI communities not only has the potential to create the positive impacts listed above, but also will reduce emissions from the buses that are providing improved access. Eliminating tailpipe emissions from transit buses that are typically diesel fueled substantially decreases localized pollution in communities including at bus stops. Emissions reductions lead to improved air quality in DI communities resulting in improved public health and wellness.

Roundabouts and signal retiming are operational mitigation measures that are recognized for their safety improvements and mobility benefits. These operational strategies reduce vehicle crashes leading to reduced costs for individuals. They also create increased efficiency at intersections by reducing vehicle idling and therefore fuel use which benefits air quality in DI communities where they are located.

CDOT intends to work to quantify GHG mitigation benefits to DI communities through annual MAP updates to the TC as project specifics become more clear.

## Appendix B - Travel Demand Model Calibration/Methodology

This appendix presents detailed information about the modeling processes used to forecast travel demand in the non-MPO and the emissions associated with the forecasted automotive travel demand. This appendix is divided into sections as follows:

- [Section B.1](#) provides an overview of CDOT’s StateFocus travel demand model.
- [Section B.2](#) gives a more detailed description of the individual components within the StateFocus ABM.
- [Section B.3](#) explains how the StateFocus model addresses five of the six dimensions of choice behavior associated with what some stakeholders may call “induced demand.”
- [Section B.4](#) documents the many assumptions that underlie the StateFocus travel demand estimates for each of the horizon years and compliance scenarios considered.
- [Section B.5](#) provides a summary of the 2015 calibration run of the current version of StateFocus.
- [Section B.6](#) discusses the non-MPO portion of state-wide travel demand forecasts summarized in Section B.4

### Appendix B.1 - Model Technical Details and Methodology

CDOT’s statewide ABM meets all minimum modeling standards as described in the memo “Modeling Requirements to Meet Greenhouse Gas Standards”, prepared by the Statewide Model Coordination Group (SMCG). CDOT’s model:

- Has been extensively calibrated and validated against large databases of traffic counts (from CDOT’s count program), transit boarding counts (from numerous transit operators around the state), and traffic speed data (from the software-as-a-service and data vendor firm INRIX);
- Uses all the credible and official data sources as inputs, including the 2010 Front Range Travel Counts survey for model estimation; the state demographer’s office estimates and forecasts of population/households/jobs; the Colorado Department of Labor and Employment (CDLE) Quarterly Census of Employment and Wages (QCEW) employment data; Census Transportation Planning Package (CTPP)/AASHTO Census Transportation Solutions (ACTS); origin-destination data from the firm Streetlight Data; and other sources;

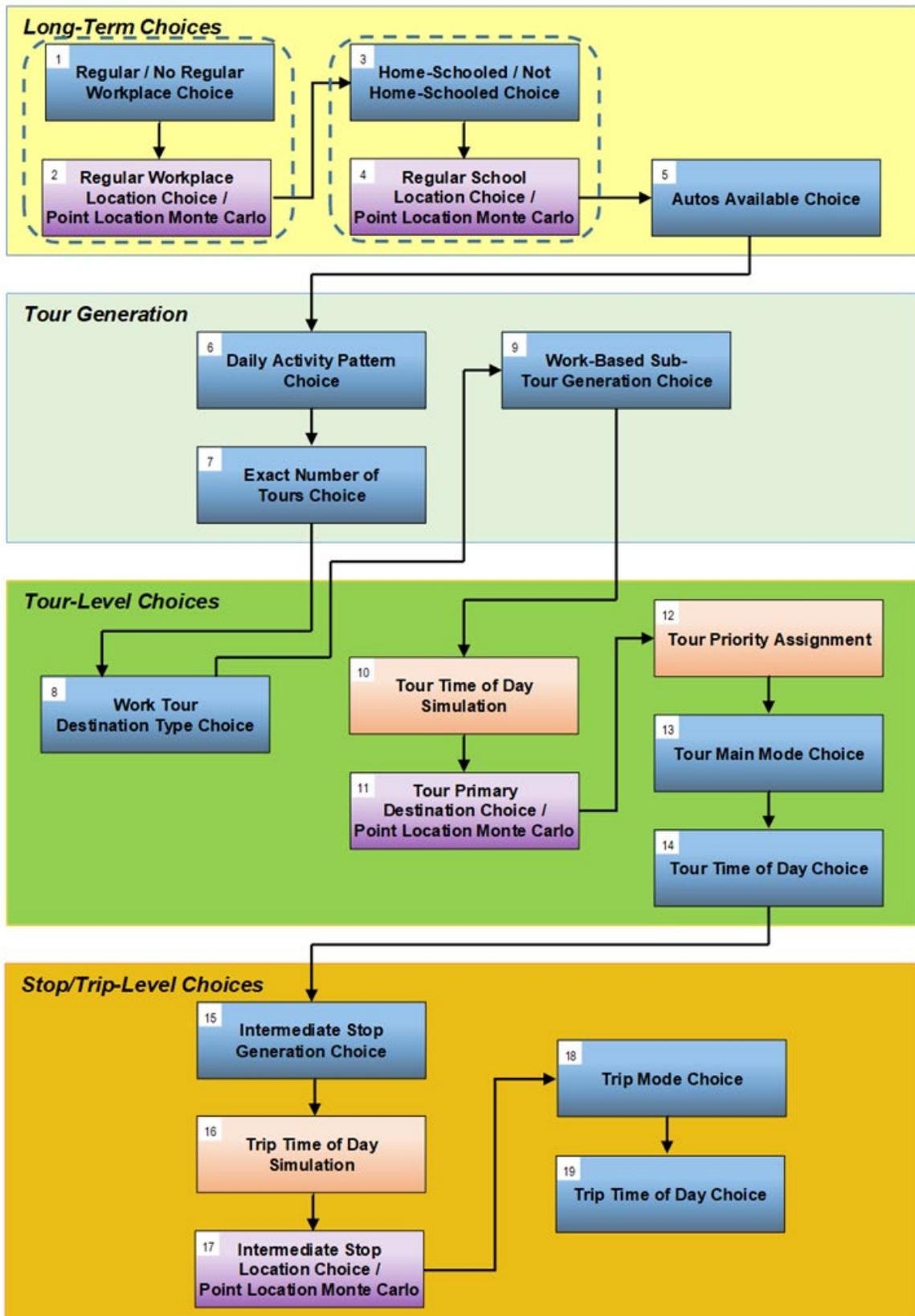
- Is supported by a detailed set of operational documentation, and a highly detailed set of model design and estimation documentation that exceeds 400 pages in length;
- Uses a household/person input dataset generated by the population synthesizer PopGen, a widely-used product of the Arizona State University’s faculty;
- Includes in its mode choice models the complete basic set of active transportation modes, including separate bicycle and pedestrian modes;
- And depicts the location of jobs and households individually, at specific address locations.

As an ABM, CDOT’s model possesses a number of important capabilities not well-supported by earlier model forms:

- It models work location choice, including an “at-home” choice;
- It derives travel from each person’s choice of daily activities, providing a realistic depiction of changes in people’s travel behavior as travel conditions change;
- It includes “accessibility variables” in all the model components that need them, providing sensitivity of various travel choices to travel conditions (for example, travel time, delay and cost);
- It depicts trips in “tours” (round trips), including depiction of multiple stops on tours, again a realistic depiction of travel that leads to more accurate model outcomes.
- These and other features permit CDOT’s statewide model to support sensitivity to “induced demand”, again much better than older model forms.

[Figure B-1](#) provides a diagram of CDOT’s statewide model components. The first five components are classified as Long-Term Choices: (1) Regular/No Regular Workplace Choice, (2) Regular Workplace Location Choice, (3) Home-Schooled/Not Home-Schooled Choice, (4) Regular School Location Choice, (5) Autos Available Choice. Components (6) Daily Activity Pattern Choice and (7) Exact Number of Tours Choice are classified as Tour Generation. The following component, (8) Work Tour Destination Type Choice, is the first Tour-Level Choice component. Component (9) Work-Based Subtour Generation, is the final Tour Generation component. Five more Tour-Level Choice components follow: (10) Tour Time of Day Simulation, (11) Tour Primary Destination Choice, (12) Tour Priority Assignment, (13) Tour Main Mode Choice and (14) Tour Time of Day Choice. The final five components are Stop/Trip-Level Choices: (15) Intermediate Stop Generation Choice, (16) Trip Time of Day Simulation, (17) Intermediate Stop Location Choice, (18) Trip Mode Choice and (19) Trip Time of Day Choice.

Figure B-1: CDOT's Statewide Activity-Based Model



## Appendix B.2 - Model Component Descriptions

The activity-based modeling element of StateFocus produces a simulated set of itineraries for a typical weekday (spring or fall, when schools are in session, but before seasonal roadways such as Independence Pass or Trail Ridge Road have closed for the winter) using a sequential process of around 20 distinct types of travel or activity decisions. The choice components presented in [Figure B-1](#) are described below:

- Regular or no regular workplace choice. For employed people, does the person have a regular location of employment (like an office worker) or not (like a plumber.)
- Regular workplace location choice. For workers who have a regular workplace location, where is it (home, or one of many possible locations in the state.)
- Home schooled or not. For people who are students, as the name implies. (Note that students who virtually attend schools located out-of-state are also considered to be home schooled, since StateFocus only has an inventory of educational institutions within Colorado.)
- Regular school location choice. For students who are not home-schooled, where is their regular school.
- Auto availability choice. For each household, how many automobiles do they own or have available.
- Daily activity pattern choice. Out of a set of seven activity categories, which activities will each person choose to do in the day. The seven activity categories - which also define travel purposes - are as follows:
  - Work and work-related activities, including volunteering, attending business meetings and training, and interviewing for jobs.
  - Schooling, at all levels from pre-school to professional, vocational or graduate studies.
  - Escorting other family members to their activities.
  - Personal business activities such as banking, getting legal advice, receiving medical care, and hair or beauty styling.
  - Shopping, whether for frequently purchased items such as groceries, or for less-frequently purchased items such as furniture or electronics.
  - Meals away from home, typically purchased from a restaurant or similar establishment.
  - Social and recreational activities, which includes visiting family members and friends, attending religious services, participating in civic activities, exercising, viewing professional sports, going to a concert, and seeing a play or movie in a theater.

- Exact number of tours choice. For each activity category in the person’s day, how many tours (round trips) will the person make for that activity.
- Work tour destination type choice. For workers who have a regular workplace location, are they going there to work, or to some other place.
- Work-based subtour choice. For workers who work out of the home, how many tours (round trips) will the person make from and returning to the workplace, and for what purpose(es)?
- Tour primary destination choice. For all tours whose destination isn’t already known, select the location.
- Tour main mode choice. The primary mode for the tour (round trip). The StateFocus model considers the following modes:
  - Single-occupant driver
  - Two-person carpool, regardless of whether the person is driving or a passenger
  - Three- or more-person carpool or vanpool
  - Taking transit by driving or getting dropped off at a park-and-ride lot or perhaps an informal location.
  - Taking transit while only walking or rolling (in a wheelchair, scooter or bike) to and from the origin and destination, and between transit vehicles.
  - Walking, including people who use a wheelchair or other mobility device.
  - Biking. Faster micromobility modes such as electric scooters would also be included in this mode.
  - Using a school bus, which is only available for school tours.
- Tour time of day choice. The time that the tour starts, paired with the time the tour ends.
- Intermediate stop generation choice. How many (and for what purpose) other stops are on the tour (besides the main stop at the tour destination and its purpose.)
- Intermediate stop location choice. The destination location for each intermediate stop.
- Trip mode choice. Will the trip use the primary mode for the tour, or which other mode will it use.
- Trip time of day choice. The time of day at which the person arrives at each stop on the tour.

## Appendix B.3 - Modeling Induced Demand

Induced demand typically is viewed as having six components. CDOT’s ABM handles five of these “endogenously”, meaning internally to the model. Endogenous

components interact with one another naturally in the model, as a person considers all of the corresponding choice dimensions as he or she reacts to changes in the transportation environment. The six components or choice dimensions are described below, together with how a common change in a road network (adding freeway lanes) might affect them:

- Change of route: added lanes to a congested freeway can cause traffic to divert from parallel roads, increasing volume on the freeway.
- Change of destination: improved travel times can cause drivers to select more distant destinations, increasing overall system miles driven.
- Change of daily activity pattern. Reduced congestion due to freeway expansion can cause people to make trips they would not have made under more congested conditions.
- Change of mode. Reduced congestion can cause people to divert from transit to automobile trips.
- Change of time of day. Drivers avoiding peak periods due to congestion may shift back into peak periods if congestion is reduced.
- Change of development pattern. Over the medium-to-long term, adding capacity to a freeway corridor can attract additional development to the corridor, reducing or eliminating any initial reduction in congestion in the corridor due to the capacity expansion.

Note that CDOT's ABM does not model changes in development pattern endogenously. However, the model can be used to examine the effects of land use scenarios (with the planners and modelers developing different possible development pattern futures, and inputting them to the model to test their effects.)

## **Appendix B.4 - Modeling Inputs and Outputs**

Each time CDOT updates a plan such as the current 2027-2036 10-Year Plan, the Planning Standard requires CDOT to use its travel demand model, StateFocus, to compare the proposed updated plan to the baseline plan in effect when the legislation was adopted, the CDOT 2019 10-Year Plan. Each plan contains a program of improvements over time, and the Planning Standard requires CDOT to evaluate both plans at each compliance horizon year that remains in the future. For this evaluation, those future years are 2030, 2040 and 2050.

Travel model inputs can be generally classified into three categories: (1) socioeconomic forecasts, (2) descriptions of the transportation network and (3) parameters representing various elements of travel behavior. While model forecasts have already been created for the baseline CDOT 2019 10-Year Plan, the adoption of the current 2027-2036 10-Year Plan may likely trigger a need to make new forecasts

of the Baseline CDOT 2019 10-Year Plan should any of the following circumstances apply:

- New socioeconomic forecasts are available that are substantially different from the ones previously used. DOLA updates their socioeconomic forecasts every year, and through the Statewide Model Coordination Group (SMCG), Colorado transportation planning agencies committed to using DOLA forecasts from no older than four years ago.
- More detailed or revised information about a transportation improvement in either plan may become available as that project proceeds through the environmental clearance, design and construction phases. For example, in a distant horizon year, a new roadway may be modeled with a generic or “most likely” alignment. Over time, more details may become available for any number of reasons - to avoid an environmental or cultural resource, to respond to stakeholder desires, or to take advantage of opportunities to optimize the project cost, for example. Similarly, station planning or scheduling efforts for a proposed transit service may allow anticipated service characteristics to be known with greater clarity. The new information may allow the project to be better represented in the model.
- Additional or more recent data may allow CDOT modeling staff to select parameters that more faithfully represent the current understanding of travel behavior. For example, when the CDOT 2019 10-Year Plan was adopted, news of the COVID-19 pandemic was beginning to emerge. The stay-at-home orders issued in 2020 resulted in a departure from past commuting and shopping behavior. Transportation practitioners wondered whether behaviors developed during the pandemic would continue after better medical treatments became available, or whether - and to what extent - people might return to pre-pandemic behaviors.

For GHG analysis, the primary travel model outputs of interest are the forecasted volume, VMT and travel speed at the link level. (Link VMT is calculated as the link volume multiplied by its distance. Travel speed is calculated by a volume-delay function used in the traffic assignment step.) Other model outputs include a trip roster (a list of all trips with information such as mode, origin, destination, purpose, departure time, arrival time), modal origin-destination matrices, transit ridership by stop and route, and potentially station-to-station matrices on specific routes (often for proposed services).

## Description of Baseline Networks

The baseline model network reflects the full build-out of all Regionally Significant projects in the CDOT 2019 10-Year Plan as adopted by the Commission in April 2020.

### 2030 Baseline Network

In the non-MPO area, there are four Regionally Significant projects included in the horizon year 2030 baseline network representing the CDOT 2019 10-Year Plan:

1. [I-70 auxiliary lanes on the west side of Vail Pass](#),
2. [US 40 Fraser Safety Improvements](#),
3. [I-70 westbound auxiliary lane from Bakerville to the Eisenhower-Johnson Memorial Tunnel](#),
4. [I-70 reconstruction around Floyd Hill](#), and
5. [US 160 at Elmore's Corner east of Durango](#).

### Changes in 2030 Baseline Network from the 2022 plan

While the Baseline networks always represent the CDOT 2019 10-Year Plan, the following refinements were made to the 2030 baseline network coded previously from the 10-Year Plan GHG Transportation report adopted in September 2022 (called “the 2022 Plan” going forward) to more faithfully model the 2030 baseline network for this current 2027-2036 10-Year Plan GHG Transportation Report:

- Realigning [CO 82/Grand Ave in Glenwood Springs](#) to match new bridge configuration and updated distance. (This edit also shortened the length of RFTA's Ride Glenwood route.)
- Reflecting the opening of the [Lawson Hill Park & Ride](#) just outside Mountain Village, the diversion on the Durango-Grand Junction Outrider route to serve downtown Telluride was dropped. The SMART Lawson Hill route was coded to provide comparable access to downtown Telluride.
- Adjusting centroid connectors and stops on the [Maroon Bells shuttle that RFTA operates in cooperation with the Forest Service](#) to better reflect existing connectivity.
- Correcting a routing error on the southwest-bound [Alamosa-Pueblo Outrider](#) in Cañon City.
- Adding over 50 nodes as park & ride lots, primarily informal lots and locations used for drop-off and pick-up (“Kiss & Ride”) to better reflect transit use patterns in the non-MPO areas. About 14 park & ride lots were re-coded to different nodes to better represent their location. [Table B-1](#) describes the affected park & ride lots in the non-MPO area.

- Adding Amtrak long-distance services (*California Zephyr* and *Southwest Chief*).

**Table B-1. Non-MPO locations where park & ride coding was added to allow drop-off & pick up**

Park & Ride name or location	Locality	Routes Served
Glenwood Springs Amtrak Station	Glenwood Springs	<i>California Zephyr</i>
Granby Amtrak Station	Granby	<i>California Zephyr</i>
Fort Morgan Amtrak Station	Fort Morgan	<i>California Zephyr</i>
Trinidad Amtrak Station	Trinidad	<i>Southwest Chief</i>
Adams State University	Alamosa	Alamosa-Pueblo Outrider
Mountaineer Square	Mount Crested Butte (CB)	(CB-DUS Outrider, incorrectly), Gunnison Valley RTA
Four-Way Stop	Crested Butte	Crested Butte-Denver Outrider, Gunnison Valley RTA
CO 135 & Brush Creek Rd	South Crested Butte	(CB Outrider), Gunnison Valley RTA
Almont	Almont	(CB Outrider), Gunnison Valley RTA
Tall Texan	Gunnison	(CB Outrider), Gunnison Valley RTA
US 50 & Colorado St (hotel)	Gunnison	Crested Butte-Denver Outrider
Main St & Railroad St	Buena Vista	Crested Butte-Denver Outrider
Stockbridge Transit Center	Steamboat Springs	Craig-Denver Outrider
US 40	Parshall	Craig-Denver Outrider
US 40	Empire	Craig-Denver Outrider
US 160 & Sligo St	Cortez	Durango-Grand Junction Outrider
CO 145 & 4th St	Dolores	Durango-Grand Junction Outrider

<b>Park &amp; Ride name or location</b>	<b>Locality</b>	<b>Routes Served</b>
Lawson Hill	Mountain Village	Durango-Grand Junction Outrider
CO 52 & I-76	Hudson	Sterling-Denver Outrider
Market St & I-76	Keenesburg	Sterling-Denver Outrider
Weld County Road (CR) 73 & I-76	Roggen	Sterling-Denver Outrider
CDOT Rest Area, US 6 & I-76	Wiggins	Sterling-Denver Outrider, Sterling-Greeley Outrider
Morgan Community College	Fort Morgan	Sterling-Denver Outrider, Sterling-Greeley Outrider
US 36 & Turner St	Brush	Sterling-Denver Outrider, Sterling-Greeley Outrider
US 6	Merino	Sterling-Denver Outrider, Sterling-Greeley Outrider
Logan County Courthouse	Sterling	Sterling-Denver Outrider, Sterling-Greeley Outrider
US 34 & Weld CR 53	Kersey	Sterling-Greeley Outrider
Elm St & Ash St (railroad museum)	Trinidad	Trinidad-Pueblo Outrider
Main St & San Antonio Ave	Aguilar	Trinidad-Pueblo Outrider
Main St & 5th St	Walsenburg	Trinidad-Pueblo Outrider
CO 165	Colorado City	Trinidad-Pueblo Outrider
Eagle County Maintenance	Gypsum	Core Valley
US 6 & CO 131	Wolcott	Core Valley
Freedom Park	Edwards	Core Hwy 6, Valley
US 24 Forest Service	Minturn, Dowd Junction	Core Hwy 6, Leadville & Minturn
US 24 & Spruce St	Leadville	Core Leadville

<b>Park &amp; Ride name or location</b>	<b>Locality</b>	<b>Routes Served</b>
US 160 & CO 149	South Fork	Mountain Valley Transit
US 160 & CO 112	Del Norte	Mountain Valley Transit
US 160 & Jefferson St (Chamber of Commerce)	Monte Vista	Mountain Valley Transit
CO 112 & Broadway	Center	Mountain Valley Transit
Visitor Center	Estes Park	The Peak (multiple)
US 34 Workshire Lodge	Estes Park	The Peak Red
Old Hwy 66 & Elk Meadow Lodge	Estes Park	The Peak Brown
US 6 & 7th St (Firehouse)	Silt	RFTA Hogback
US 6 & Castle Valley Blvd	New Castle	RFTA Hogback
SoCoCAA Office	Ignacio	Road Runner Transit
CO 172 & DRO Airport	Durango	Road Runner Transit
US 160 & CO 172 Elmore's Corner	Durango	Road Runner Transit
Mercury Dr	Durango	Road Runner Transit
Copper Mountain	Copper Mountain	Summit Stage Copper Mountain
CO 9/Main & 2nd	Alma	Summit Stage Park County Commuter
CO 9 & McCullough Gulch	Blue River	Summit Stage Blue River & Park County Commuter
Breckenridge Station	Breckenridge	Summit Stage (multiple)
River Run	Keystone	Summit Stage Keystone-Dillon- Silverthorne
US 6 & Lake Dillon Dr/Evergreen Rd	Dillon	Summit Stage Keystone-Dillon- Silverthorne
Silverthorne Station	Silverthorne	Summit Stage (multiple)

Park & Ride name or location	Locality	Routes Served
CO 9 & 13th St	Silverthorne	Summit Stage Silverthorne Loop
CO 144 & I-76	Log Lane Village	Proposed NECALG Morgan County route
US 6	Hillrose	Proposed NECALG Morgan County route

Source: CDOT compilation of multiple operator schedules

## 2045 Baseline Network

The 2045 Baseline network considered some additional stops in the non-MPO area as informal P&R locations - where a transit passenger could get dropped off or picked up by a friend or family member - to allow more precise modeling of the CDOT 2019 10-Year Plan with the current version of CDOT StateFocus, 1.84. No highway construction projects were anticipated between the 2030 and 2045 horizon years of the earlier plan. Similarly, no new or expanded transit services were modeled. As with the 2030 Baseline Network, some additional transit stops were coded to allow drive-access. These additional stops (beyond those already coded in the 2030 Baseline Network) and the transit operator serving them are as follows:

- CO 17 & Hooper - Mountain Valley Transit
- CO 17 & Mosca - Mountain Valley Transit
- US 160 & US 550 Grandview Interchange - Pagosa Outrider & SoCoCAA RRT
- CO 172 east of Oxford - SoCoCAA Road Runner Transit
- CO 172 & Southern Ute Health Center - SoCoCAA Road Runner Transit
- CO 172 & CR 509 - SoCoCAA Road Runner Transit
- US 285 & Villa Grove - Mountain Valley Transit
- US 285 east of Saguache - Mountain Valley Transit
- Crested Butte South - Gunnison Valley RTA
- US 6 & Elk Lot Beaver Creek - Core Transit
- CO 9 & Blue River Road - Summit Stage
- CO 9 & Breckenridge Peak 9 Lot - Summit Stage
- CO 9 & Swan Mountain Road - Summit Stage
- US 24 near Red Cliff - Core Transit

Additionally, some stops were moved: Dolores, Durango-La Plata County airport (DRO) airport, US 550 & South Montrose Target, CO 82 & Cattle Creek (from CO 133), CO 82 & Old Snowmass, US 50 & Gunnison Travel Lodge, US 40 & Stockbridge Transportation

Center, I-25 Business in Walsenburg, Brush, Estes Park visitor center, Telluride (to the Lawson Hill P&R) and Delta (to Confluence Park). Finally, the Outrider bus stop at Montrose Regional Airport (MTJ) was removed to reflect current operations.

## Changes in 2045 Baseline Network from 2022 plan

The refinements made to the 2030 baseline network were also applied to the 2045 baseline network. The other changes (from the 2030 Baseline Network) listed above generally followed the 2045 baseline network from the 2022 plan.

## Description of Action or Compliance Networks

Action or compliance networks reflect new capital projects or transportation services added to the compliance plan since the 2022 adoption of the Standard. Throughout this appendix, the term “compliance” is used as a shortcut for the CDOT 2027-2036 10-Year Plan which is proposed for adoption by the Transportation Commission of Colorado in spring of 2026.

### 2030 Compliance Network

The 2030 Compliance network does not include any regionally-significant highway capacity projects in the Non-MPO area beyond those already in the baseline network. However, the 2030 Compliance network has more transit routes than the 2030 baseline. Some notable transit routes in the 2030 Compliance network, which are not in the 2030 Baseline network, are as follows:

- [Colorado Blvd BRT](#) = Colorado Stn (Evans/I-25/Buchtel) to 40th & Colorado Stn
- [Federal Blvd BRT](#) = two patterns:
  - Englewood Stn to Westminster Stn (71st, B Line)
  - Federal & Evans Transfer Center to Wagon Rd PnR
- Modifications to existing RTD local routes to support the new BRT services
- [Joint Rail](#) between DUS and Fort Collins South Transit Center, with three round trips/day, eight stations
- [Mountain Rail](#) Short = an enhanced version of Amtrak’s current *Winter Park Express* - two round trips/day (seven day/week) DUS-Granby, six stations
- New North Pueblo [mobility hub](#) at I-25 Exit 108 Purcell Blvd

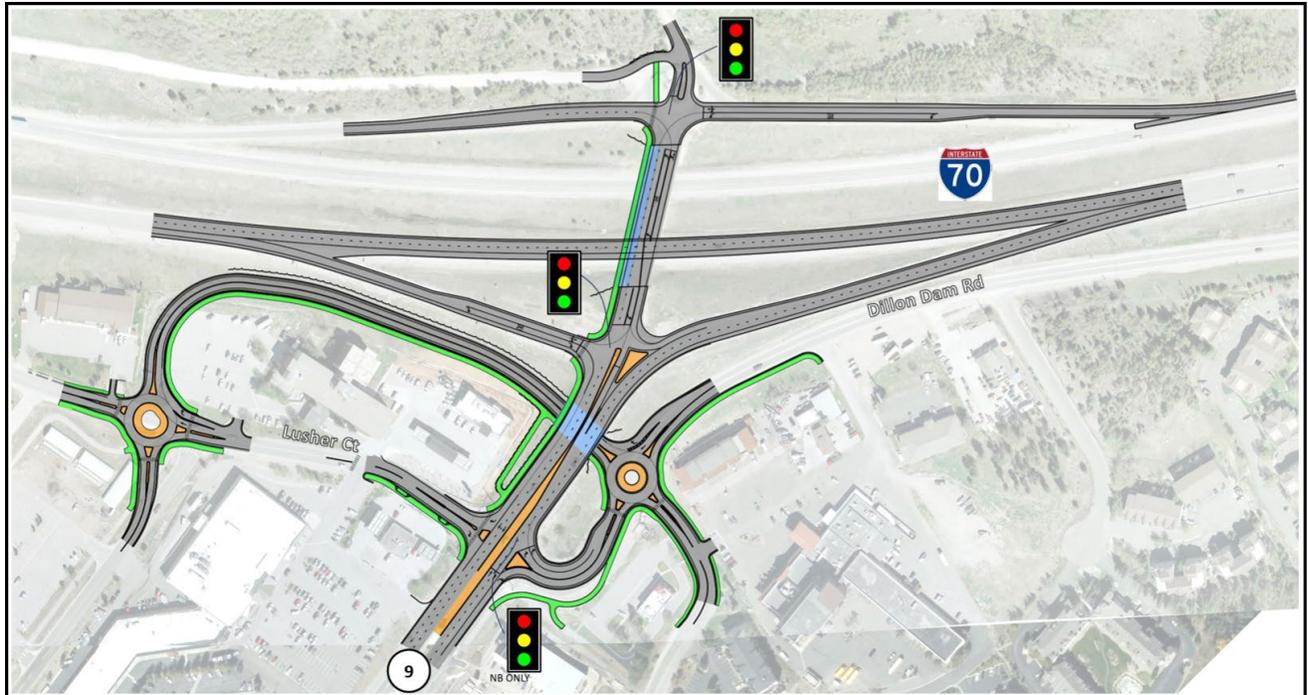
The 2030 compliance network also added existing services such as

- All Points Transit Montrose, Olathe, Delta Express & OurWay routes,
- Core Transit’s Minturn-Vail route,
- The SMART system (except for the Rico & Lawson Hill-Mountain Village routes)
- SST Main Line,

- Summit Stage X-Flyer to Arapahoe Basin

Finally, several Summit Stage routes serving Frisco Station were modified to reflect the CO 9 signal at Lusher Ct/Dillon Dam Rd being converted to right-in-right-out (RIRO) access only, as shown by the schematic in [Figure B-2](#). This model coding modification included adding link detail for Meadow Dr, Ten Mile Dr, Ten Mile Rd and a proposed frontage road underpass.

Figure B-2: Proposed underpass and frontage road at I-70 Exit 203 with CO 9 in Frisco



Source: [CDOT](#)

## Changes in 2030 Compliance Network from 2022 plan

Compared to the 2030 Compliance network from the 2022 plan, the current 2030 Compliance network makes the following changes:

- Adds Joint Rail between DUS and Fort Collins South Transit Center
- Adds Mountain Rail (expanded Winter Park Express) between DUS and Granby
- Updates [Bustang West Line](#) and [Durango-Grand Junction Outrider](#) routing between downtown transit center and Grand Junction Regional (GJT) Airport.
- [Bustang South Line](#) reflects more detail for Monument P&R, closes the Tejon P&R for security concerns, and adds the Pikes Peak State College - Centennial Campus stop as a new transfer center.
- [Bustang North Line](#) is re-coded to serve a median Berthoud mobility hub.
- Adds a Bustang/Outrider stop in North Pueblo at I-25 & Purcell Blvd

- Updates the [Sterling-Denver Outrider](#) route according to published changes in stops and routing: the route uses DEN Airport instead of RTD's Peoria Station. It no longer stops at Lochbuie, Hudson, Roggen, Log Lane Village or Hillrose.
- Updates the [Sterling-Greeley Outrider](#) route according to published changes in stops and routing: The route no longer stops at Log Lane Village or Hillrose.
- Provides more detailed coding around Frisco Station (Bustang, Pegasus, Summit Stage) to reflect the proposed underpass near I-70 Exit 203, described earlier.
- Enforces the Summit Stage policy of not allowing travel within Lake County or within Park County along the respective commuter routes.
- A Swan Mountain Road closure means the X-Flyer Breckenridge-Silverthorne and Frisco-Arapahoe Basin routes have to detour.
- Provides a more detailed routing of Core Transit's Valley Route in Gypsum.
- Adds the Core Transit Minturn-Vail route as a short-turn variant of the Leadville-Vail route pattern.
- Updates the Core Transit fare policy of free travel within most of Eagle County, except \$3 for trips starting or ending in Gypsum, which voted not to become part of the RTA. Trips to Leadville and Lake County remain at \$7.
- Changed RTD Colfax Lynx BRT guideway from peak period only to 24-hours within Denver.
- More detailed modeling of RTD Federal Blvd BRT and Colorado Blvd BRT.

## 2045 Compliance Network

Relative to the 2045 baseline network, the 2045 compliance network represents:

- All 2030 Compliance network elements above
- Expansion of Joint Rail to [FRPR](#) with 10 round trips per day. Two patterns use Pueblo or Colorado Springs as the southern terminus.
  - Modification of Mountain Metro Zeb Free Downtown Shuttle to better serve America the Beautiful Station
- Expansion to Mountain Rail:
  - Add one round trip per day between DUS and Craig
  - Add three round trips per day on a Yampa Valley Local route (Craig to Oak Creek)
- Relocation of Outrider and Mountain Valley Transit stops to use the proposed Poncha Springs Crossroads Transit Center
- More detailed coding of [Bustang North Line](#) to reflect the time-of-day patterns in use on the I-25 Central (reversible) Express Lanes

## Changes in 2045 Compliance Network from 2022 plan

Elements of the current 2045 compliance network that weren't included in the 2022 GHG Transportation Report modeling include:

- RTD BRT-related changes (including feeder routes) described above for 2030
- Amtrak, FRPR (12 stations from Pueblo to Fort Collins, inclusive) and Mountain Rail (13 stations from Craig to DUS, inclusive)
- Core Transit's Minturn-Vail route
- All Points Transit's regional routes (Montrose, Olathe, Delta [MOD] Express and OurWay [serving Montrose, Ridgway and Ouray])
- Mountain Metro Zeb Free Downtown Shuttle modified to serve America the Beautiful Station
- SMART routes (excluding Rico and Lawson Hill-Mountain Village)
- Steamboat Springs Transit's Main Line
- Summit Stage's X-Flyer to Arapahoe Basin
- Mountain Express Transit in Pagosa Springs identified an Aspen Springs Park & Ride lot for the 2045 horizon, but CDOT was not able to verify the location or anticipated service changes within the constraints of the travel modeling schedule.

## Modeling Assumptions

### DOLA socioeconomic forecasts (county control totals)

Changes in socioeconomic forecasts from the 2022 plan to the current 10-Year Plan are shown in Tables [B-2](#) and [B-3](#). The current socioeconomic forecasts typically reflect a more modest growth projection because of the COVID-19 pandemic limiting growth during its duration.

**Table B-2. Summary of model socioeconomic inputs and outputs for 2030 and 2040 GHG compliance runs**

Socioeconomic data	2030 forecast in 2022 report	Current 2030 forecast	2040 forecast in 2022 report	Current 2040 forecast
Population	6,974,465	6,467,694	7,813,938	7,080,765
Households	2,950,775	2,702,130	3,295,546	2,968,835
Employment	3,995,831	3,963,747	4,307,732	4,215,674

Socioeconomic data	2030 forecast in 2022 report	Current 2030 forecast	2040 forecast in 2022 report	Current 2040 forecast
Number of workers who work at home - baseline	259,652	187,101	288,056	203,996
Number of workers who work at home - action	915,712	671,172	1,014,893	729,010

Source: CDOT, DOLA

**Table B-3. Summary of model socioeconomic inputs and outputs for 2050 GHG compliance runs**

Socioeconomic data	2050 forecast in 2022 report	Current 2050 forecast
Population	8,653,410	7,693,837
Households	3,640,316	3,235,539
Employment	4,619,632	4,467,602
Number of workers who work at home - baseline	316,460	220,890
Number of workers who work at home - action	1,114,073	786,848

Source: CDOT, DOLA

### **Travel behavior assumptions: work from home, bike speed, perceived walking speed**

Changes in behavioral assumptions for travel modeling for the future baseline and compliance scenarios are summarized in [Table B-4](#). Specific assumptions related to e-bike adoption and average bike speed for compliance forecasts, interpolated for five year increments, are summarized in [Table B-5](#).

Table B-4. Summary of travel behavior parameter changes by forecast scenario

Parameter type	2030 & 2045 baseline assumptions	2030 compliance assumptions	2045 compliance assumptions
Gender-specific active mode biases	Same as pre-pandemic base year	Half the value of the pre-pandemic base year	No bias
Lowest age for senior active mode biases for home-based work & other tour mode choice	50, same as pre-pandemic base year	62.5	75
Senior-specific active mode biases for home-based other tour mode choice	Same as pre-pandemic base year	Same as pre-pandemic base year for walk, half for bike	Same as pre-pandemic base year
Lowest age for older adult walk bias in trip mode choice	35, same as pre-pandemic base year	55	75
Older adult walk bias in trip mode choice	Same as pre-pandemic base year	Same as pre-pandemic base year	Same as pre-pandemic base year
Highest age for youth & young adult active mode biases for home-based other tour mode choice	20, same as pre-pandemic base year	20, same as pre-pandemic base year	20, same as pre-pandemic base year
Youth & young adult specific active mode biases for home-based other tour mode choice	Same as pre-pandemic base year	Half the value of the pre-pandemic base year	No bias

Parameter type	2030 & 2045 baseline assumptions	2030 compliance assumptions	2045 compliance assumptions
Rural area type bike bias for school trips	Same as pre-pandemic base year	Eleven-twelfths the value of the pre-pandemic base year	Five-sixths the value of the pre-pandemic base year
Actual bike speed (mph - average of traditional and electric bikes)	12	13	14
Perceived walking speed (mph)	3	5	5

Source: CDOT StateFocus model

Table B-5. Relationship between e-bike adoption and average bicycle speed by year

Forecast Year	Percent of bicycles that are e-bikes	Average bicycle speed (mph)
2015 (calibration)	0%	12
2030	25%	13
2040 (interpolated)	41.67%	13.67
2045	50%	14
2050 (extrapolated)	58.33%	14.33

Source: CDOT

**Post-processing of distance-based weights on transit trips**

While making refinements to StateFocus as part of the FRPR Service Development Plan, the CDOT modeling unit and consultant staff noticed that StateFocus appears to under-predict long-distance transit trips. One limitation of the current StateFocus version is that it was estimated from 2009-2010 Front Range Travel Counts survey data. At that time, the only intercity transit service in Colorado with sizable ridership was the Front Range Express or FREX, which traveled between the Colorado Springs and Denver metro areas (about 70 miles).

The study team determined that a post-processing step after the activity-based components and before transit assignment (of the last speed feedback iteration) would be the most effective means of adjusting the transit trip length distribution. Transit trips of over 100 miles between origin and destination would be weighted up, while shorter trips were weighted down so that the statewide total number of transit trips would remain roughly constant. The final weights are shown in Table B-6. Note that transit trips to DEN Airport - which are not forecasted by activity-based components - remain unweighted.

Table B-6. Transit trip weights by trip distance

Transit trip distance (miles)	Weight for transit trips to DEN Airport	Weight for all other transit trips
0.000 to 69.999	1.0	0.833
70.000 to 99.999	1.0	0.950
100.000 to 149.999	1.0	2.000
150.000 to 249.999	1.0	1.500
250.000 or more	1.0	1.200

Source: CDOT

## Statewide Forecast Outputs

Tables [B-7](#) and [B-8](#) show key model inputs and outputs for the model scenarios run in support of GHG analysis under the Standard, for the statewide model area, which includes the Non-MPO Areas, the latter being the area for which CDOT is responsible under the Standard. (For statistics specific to only the Non-MPO Area, please see [appendix section B.6](#) and Tables [B-11](#) and [B-12](#))

Table B-7. Summary of model inputs and outputs for 2030 and 2040 GHG compliance runs

Baseline and GHG Action Modeling Inputs & Outputs	2030 Baseline	2030 Action	2040 Baseline	2040 Action
Lane miles by roadway type				
Interstate	5,264	5,265	5,349	5,344

<b>Baseline and GHG Action Modeling Inputs &amp; Outputs</b>	<b>2030 Baseline</b>	<b>2030 Action</b>	<b>2040 Baseline</b>	<b>2040 Action</b>
Expressway	1,878	1,877	1,931	1,926
Principal arterial	11,963	11,973	12,186	12,181
Minor arterial	12,318	12,319	12,599	12,598
Collector & others	52,535	52,556	53,858	53,867
<b>Total lane miles</b>	<b>83,958</b>	<b>84,000</b>	<b>85,922</b>	<b>85,915</b>
Vehicle & transit data for a typical weekday				
Vehicle miles traveled (VMT)	170,733,534	155,788,468	186,428,854	169,634,853
VMT per capita	26.40	24.09	26.33	23.96
Person miles traveled (PMT) in autos	209,221,943	192,221,541	228,884,343	209,619,296
Average vehicle speed (mph)	35.47	36.82	34.63	36.15
Vehicle hours traveled (VHT)	4,813,152	4,231,193	5,383,356	4,692,920
Vehicle hours of delay (VHD)	580,473	381,349	736,432	482,414
Transit boardings	498,193	457,400	543,186	494,621
Weekday VMT by roadway type				
Interstate	52,333,920	48,353,911	56,153,576	51,926,038
Expressway	13,941,579	12,778,158	15,978,212	14,571,005
Principal arterial	51,047,145	46,565,544	55,472,839	50,366,698
Minor arterial	20,845,502	18,800,958	23,172,007	20,842,802
Collector & others	32,565,387	29,289,898	35,652,218	31,928,310

<b>Baseline and GHG Action Modeling Inputs &amp; Outputs</b>	<b>2030 Baseline</b>	<b>2030 Action</b>	<b>2040 Baseline</b>	<b>2040 Action</b>
Weekday Trip mode share				
Single occupant vehicle	13,906,618	12,805,996	15,254,906	13,977,514
Shared ride trip	9,565,072	8,967,301	10,623,100	9,839,466
School bus	605,008	559,762	630,460	581,984
Bicycle	433,116	477,521	470,812	663,931
Walk	1,449,853	2,422,692	1,631,143	2,794,984
Transit	368,992	335,119	397,435	357,374
<b>Total weekday person trips</b>	<b>26,328,658</b>	<b>25,568,392</b>	<b>29,007,856</b>	<b>28,215,253</b>

Source: CDOT

Note: Calculations were made with more decimal places shown in the table. Totals may not add because of rounding. Values for 2040 were interpolated between 2030 and 2045 model forecasts.

**Table B-8. Summary of model inputs and outputs for 2050 GHG compliance runs**

<b>Baseline and GHG Action Modeling Inputs &amp; Outputs</b>	<b>2050 Baseline</b>	<b>2050 Action</b>
Lane miles by roadway type		
Interstate	5,433	5,424
Expressway	1,983	1,964
Principal arterial	12,408	12,389
Minor arterial	12,879	12,876
Collector & others	55,182	55,177
<b>Total lane miles</b>	<b>87,886</b>	<b>87,831</b>
Vehicle & transit data for a typical weekday		

Baseline and GHG Action Modeling Inputs & Outputs	2050 Baseline	2050 Action
Vehicle miles traveled (VMT)	202,124,174	183,481,237
VMT per capita	26.27	23.85
PMT in autos	248,546,742	227,017,051
Average vehicle speed (mph)	33.95	35.60
Vehicle hours traveled (VHT)	5,953,560	5,154,646
Vehicle hours of delay (VHD)	892,391	583,480
Transit boardings	588,180	531,841
Weekday VMT by roadway type		
Interstate	59,973,232	55,498,166
Expressway	18,014,846	16,363,851
Principal arterial	59,898,533	54,167,852
Minor arterial	25,498,513	22,884,646
Collector & others	38,739,048	34,566,722
Weekday Trip mode share		
Single occupant vehicle	16,603,194	15,149,031
Shared ride trip	11,681,129	10,711,631
School bus	655,912	604,206
Bicycle	508,508	850,341
Walk	1,812,433	3,167,277
Transit	425,878	379,629
Total weekday person trips	31,687,054	30,862,115

Source: CDOT

Note: Calculations were made with more decimal places shown in the table. Totals may not add because of rounding. Values for 2050 were extrapolated from 2030 and 2045 model forecasts.

## Appendix B.5 - Travel Model Calibration and Validation Process

When travel models are built, they go through a process of “estimation” (an economic modeling term), in which survey or other data are used to “estimate” the numerous relationships in the model between, for example, the likelihood of a particular travel mode being chosen given the characteristics of the person doing the choosing (for example, age, gender, employment status, etc.) and of the various modes available to that person (for example, cost, travel time, etc.) The model estimated in this way produces a variety of results, such as numbers of transit boardings, volumes on roads, and travel patterns between parts of the state (for example, total trips between the North Front Range Region and the Denver region), among many others.

After the model is initially built, it is subjected to a process of calibration and validation. In this process, rather than just assuming the model’s results are accurate, we check them against other sources of information by using the model to make a “forecast” of a base year for which we have additional information. These additional information are sometimes called “calibration targets.” These targets include:

- Automobile traffic counts. CDOT maintains an extensive program of acquiring such data, which are used for this purpose (and many other purposes).
- Transit boardings. CDOT obtains such data from numerous transit providers around the state.
- Travel pattern data. These data are available from a number of sources, including the US Census and private data vendors.
- Highway speed data. These data are primarily available today from private data vendors.

Models are estimated typically using survey data, which of course is taken in a particular year (in the CDOT model case, 2010.) A version of the complete model is built to depict that year (for example, the road and transit systems as they existed then, the number and geographic distribution of people and jobs in that year, etc.) The model is then run, producing the results discussed above. Those results are compared to counts taken in the year 2010. If the model’s results do not compare closely enough to the counts, adjustments are made to appropriate elements of the model in order to bring the results sufficiently close to the counts. This process is referred to as “calibration”.

Well-developed models also are subjected to a process known as “validation”. This process is much the same as calibration, but is carried out for a different calendar year. In CDOT’s case, a version of the model was built depicting the year 2015 (again, road and transit systems for that year, people and jobs, etc.) The model is then run for this year, and again the results are compared to counts such as those described above. The point of doing model validation is to test whether the model, having been developed to do a good job of depicting reality in the calibration year (in this case the year 2010) can also do a good job with a different year (2015), when the region has changed (different development, different transportation networks, etc.) In this way, we test the model’s ability to correctly respond to those differences/changes through time.

CDOT’s travel modeling team has conducted extensive calibration/validation on the statewide model, most recently in the context of the FRPR project. Table B-9 below shows a summary of the highway portion of the 2015 calibration run. This table is just one of numerous tables that the StateFocus model can produce to evaluate many elements of the model’s results. The table shows how closely the model matches the counts, aggregated into each of the facility types in the model. The table also shows how much data was used in making these comparisons.

The table shows that industry-established calibration targets were not meant for the Interstate, minor arterial, and collector & others types. CDOT modeling staff were willing to accept these limitations in the highway calibration to give more focus to the transit calibration.

The Model Calibration and Validation Documentation Report is available through the [GHG Program Website](#).

**Table B-9. Difference between modeled auto volumes and counts by facility type**

Roadway type	Number of counts	Percent difference between model & counts	Target
Interstate	675	-13%	+/-7%
Expressway	202	-2%	+/-7%
Principal arterial	2,355	-4%	+/-10%
Minor arterial	2,056	-18%	+/-10%
Collector & others	2,136	-35%	+/-15%
Ramps	95	9%	N/A

Roadway type	Number of counts	Percent difference between model & counts	Target
Total (statewide)	7,546	-11%	+/-5%

Source: CDOT

Note: N/A = Not applicable, because no target for the percentage difference between modeled ramp volumes and counts has been established.

Table [B-10](#) shows the transit calibration results. The overall forecasted statewide boardings are close to the observed level - the model is three percent over. The forecasted RTD boardings are also three percent over, likely reflecting the fact that in 2015, RTD boardings represented roughly five-sixths of statewide boardings.

All versions of StateFocus to date have struggled to adequately predict ridership for the Roaring Fork Transportation Authority (RFTA), the top rural transit operator by ridership in the U.S., and the Colorado transit agency - rural or urban - with the most ridership after RTD. The StateFocus model also under-predicts autos on CO 82 between Glenwood Springs and Aspen. Both these results suggest that StateFocus under-predicts travel by all modes in the Roaring Fork Valley because it doesn't adequately capture travel by visitors and part-year residents. Neither of these groups are included in the synthetic population used by the activity-based components of StateFocus.

StateFocus also under-predicts ridership on the rural systems operated by Gunnison Valley RTA and Road Runner Transit (the latter overseen by the Southern Colorado Community Action Agency or SoCoCAA), likely for similar reasons it under-predicts for RFTA. The Gunnison Valley RTA serves a roughly 27-mile corridor between the City of Gunnison and Crested Butte, while RFTA's corridor is about 43 miles between Glenwood Springs and Aspen.

StateFocus comes within two percent of predicting overall Transfort ridership. While Transfort and Mountain Metro Transit (MMT) have similar levels of ridership, the StateFocus model over-predicts MMT ridership by 62 percent. While there are many dimensions to explore, one factor leading to the estimate might be that residents of the Mountain Metro service area are less inclined to use transit relative to the average Coloradan reflected by the model's parameters.

The Bustang core routes (South Line, North Line and West Line) were a particular focus of the calibration effort, which included adding a CSU student variable to mode choice calculations and reviewing the distribution of work trips by residents of

Larimer and Weld Counties. Overall, StateFocus comes reasonably close in forecasting the Bustang core system ridership, with an 8 percent under-estimate.

Note that transit systems where StateFocus has the greatest percent difference between forecasted volume and observed ridership tend to be those systems with lesser overall ridership. Such smaller systems would typically be a challenge to model, and even a high percentage difference for a lower-ridership system would mean a low absolute difference. That is, the absolute difference between modeled and observed ridership for Bustang (61 riders per weekday); Gunnison Valley RTA (117); Mountain Metro (6,788); RFTA Valley Local, Valley Express and Grand Hogback (1,718); Road Runner Transit (112) and Transfort (220) are each less than the absolute difference for RTD (9,893). CDOT has confidence in the transit ridership forecasts because of how closely the total ridership calibrates, and because for each system, the difference in ridership is a small absolute number, a small percentage or both.

CDOT is also working to improve its modeling capability to model non-MPO transit ridership in several ways. CDOT is in the process of developing a higher-resolution statewide zone scheme with greater detail in non-MPO communities such as Aspen, Durango, Glenwood Springs, Gunnison, Montrose, Steamboat Springs and Vail. CDOT also sponsored a statewide household travel survey, [Colorado Travel Counts](#), that collected responses between February 2024 and February 2025. That survey data is currently being processed and will allow CDOT to better model travel outside the Front Range MPO areas, on weekends, and during the winter and summer recreational peaks.

**Table B-10. Difference between modeled transit volumes and counts**

Transit system	2015 observed average weekday ridership	Percent difference between model & counts
Bustang (excludes Outrider)	813 (2018)	-8%
Gunnison Valley RTA	285 (2010)	-41%
Mountain Metro Transit	11,002	+62%
Roaring Fork Transportation Authority (Valley Local, Valley Express & Grand Hogback)	2,700	-64%
Regional Transportation District	364,135	+3%
Road Runner Transit	160	-70%

Transit system	2015 observed average weekday ridership	Percent difference between model & counts
Transfort	13,998	-2%
<b>Overall (where observed ridership is available)</b>	<b>393,093</b>	<b>+3%</b>

Source: CDOT, including compilation of observed ridership from individual transit systems

Notes: Bustang core routes are the North Line, South Line and West Line. Bustang service modeled is comparable to 2018 service levels, so its ridership is compared against observed 2018 ridership counts.

## Appendix B.6 - Extracting the non-MPO portion of statewide forecasts.

The emissions modeling process reflects emissions being allocated to agencies based on the location of the GHG emissions, which might be called “where the tires meet the pavement.” That is, emissions are not allocated based on the residence of the travelers in the vehicle, nor to the address where the vehicle is registered. Therefore, the VMT and emissions considered for the non-MPO area may include travel by residents of any of the five Colorado MPOs or even by out-of-state visitors. Similarly, travel by rural and small urban Colorado residents within the MPO areas is considered by the respective MPOs. The nature of travelers crossing through individual GHG compliance areas, such as between individual MPOs or between an MPO(s) and the non-MPO area make it necessary for CDOT to model statewide transportation behavior in order to accurately characterize this cross agency jurisdiction travel in Colorado.

To estimate CDOT’s portion of statewide travel and emissions, those quantities occurring within the five MPO areas needed to be excluded. TransCAD, the travel demand modeling software utilized by CDOT, possesses the functionality to split roadway links where they cross MPO boundaries, enabling these VMT and associated emissions calculations on these smaller sections of roadway links solely in the non-MPO area. MPOs use their own models to calculate VMT and emissions within their respective planning areas. This link-splitting process also allowed CDOT to exclude model links (“external stations”) that extended into neighboring states. The lengths of the split links are recalculated using an appropriate spatial software, such as TransCAD or ArcGIS Pro, in order to account for the adjusted VMT from the split links where roads cross a GHG compliance area boundary.

As part of this 2027-2036 10-Year Plan assessment, CDOT updated its GHG compliance

area boundaries based on minor refinements communicated by both the Pikes Peak Area Council of Governments (PPACG) and the Grand Valley Metropolitan Planning Organization (GVMPO). These changes to the MPO area boundaries were a result of (1) needing greater resolution than shown on letter size maps included with their board adoption packet, (2) reflecting existing agreements about the agency responsible for capital improvements and maintenance, and (3) preferring continuous roadway sections that conformed to Census geography.

The GVMPO boundary refinements included:

1. Including the portion of I-70 roughly between MP 16.76 and 17.33 within the GVMPO area, consistent with adjacent sections.
2. Including roughly 0.025 miles of L ½ Rd east of 16 ½ Rd within the GVMPO area, reflecting considerations of that intersection.
3. Including the portion of 17 ½ Rd north of the (Main Line) Grand Valley Canal to just north of Waters Ln in the GVMPO area.
4. Including the portion of 23 Rd north of the (Main Line) Grand Valley Canal to just north of I ½ Rd within the GVMPO area.
5. Including the portion of 24 Rd on either side of the Grand Valley Canal within the GVMPO area, so that a roadway structure (the bridge over the canal) is not split between agencies.
6. Including all of the I-70 alignment from 33 Rd (roughly Mile Post (MP) 37.04) to the Colorado River and US 6 half-diamond interchange (roughly MP 43.68) within the GVMPO area, since local traffic on that segment would be generated by developments within the MPO area.
7. Smoothing a concave area of the GVMPO boundary so that US 50 roughly between MP 42.23 and 43.44 are included in the MPO area, as are adjacent sections of the highway.
8. Converting a “stair-step” portion of the GVMPO boundary to a diagonal (Northwest-Southeast) line so that Desert Rd will remain in the MPO area once it enters from the south.

The refinements that PPACG made to their boundary include:

1. Excluding the portion of (El Paso & Pueblo) County Line Rd east of I-25 and the railroad from the PPACG area.
2. Excluding the portion of Rancho Colorado Blvd west of the I-25 SB ramps at Exit 119 from the PPACG area.
3. Including the portions of Midway Ranch Blvd immediately west of I-25 (functioning as a frontage road) within the PPACG boundary.
4. Including the portion of Old Stage Rd west of Transmitter Ln, and the segment of Gold Camp Rd descending from Old Stage Rd (including historic Tunnels 4 through 7) in the PPACG boundary.

5. Including the intersection of Gold Camp Rd and Bear Creek Rd within the PPACG boundary.
6. Including all of US 24 Business in Manitou Springs near Rainbow Falls, and its half-diamond interchange with mainline US 24, within the PPACG boundary.
7. Including the eastbound lanes of mainline US 24 roughly between MP 293.86 (Fountain Creek near Cascade) and MP 297.08 (US 24 Business interchange north of Manitou Springs) within the PPACG boundary, as the WB lanes are.
8. Including two lower sections of the Pikes Peak Toll Highway within El Paso County - one from Cascade to near Crystal Creek Reservoir and a second that crosses the reservoir's dam - within the PPACG boundary. (Portions of the toll highway that reenter El Paso County near the Pikes Peak summit remain in the non-MPO area.)
9. Including Teller CR 28/Edlowe Rd between CR 281 and US 24 within the PPACG boundary.
10. Excluding portions of University Dr west of Trout Creek from the PPACG area.
11. Likewise, excluding the portions of Teller CR 25/Trout Creek Rd that are west of Trout Creek from the PPACG area.
12. Including the section of Rampart Range Rd (Forest Rd 300) north of Loy Creek Rd to its branch just south of Carroll Lakes Rd and the Rampart Sled Hill within the PPACG boundary, while excluding the portion of Rampart Range Rd north of there.
13. Excluding Mt Herman Rd between its intersections with Sunburst Dr and Shiloh Pines Dr from the PPACG area.
14. Including County Line Rd/Palmer Divide Rd from the Town of Palmer Lake to Furrow Rd within the PPACG boundary and excluding all portions east of Furrow Rd, per maintenance agreements between Douglas and El Paso counties. (The section between Furrow Rd and the Douglas & Elbert county line is within the DRCOG area, while the section east of the county line is in the non-MPO area.)
15. Including Elbert Rd from Judge Orr Rd north to the El Paso & Elbert county line within the PPACG area.
16. Including Judge Orr Rd from Elbert Rd to Ellicott Highway within the PPACG boundary.
17. Including the portion of Ellicott Highway from Squirrel Creek Rd to Judge Orr Rd within the PPACG area.
18. Including the portion of Squirrel Creek Rd west of Ellicott Highway within the PPACG boundary.

Working collaboratively, CDOT, DRCOG and NFRMPO identified areas for potential future refinements to their mutual boundaries. However, the plan adoption and regulatory compliance schedule did not allow the agencies to reach agreement - or

barely to begin such discussions - on boundary refinements, and so the calculations presented here are based on the pre-existing boundary delineations.

The travel model forecasts for the resulting non-MPO area are shown in Tables [B-11](#) and [B-12](#).

**Table B-11. Non-MPO portion of model inputs and outputs for 2030 and 2040 GHG compliance runs**

<b>Baseline and GHG Action Modeling Inputs &amp; Outputs</b>	<b>2030 Baseline</b>	<b>2030 Action</b>	<b>2040 Baseline</b>	<b>2040 Action</b>
Lane miles by agency				
DRCOG	18,598	18,604	20,295	20,268
GVMPO	2,668	2,668	2,692	2,692
NFRMPO	4,111	4,111	4,263	4,213
PACOG	1,521	1,522	1,536	1,538
PPACG	5,143	5,143	5,283	5,278
Non-MPO (CDOT)	51,848	51,855	51,877	51,884
<b>Total lane miles</b>	<b>83,958</b>	<b>84,000</b>	<b>85,922</b>	<b>85,915</b>
Non-MPO lane miles by roadway type				
Interstate	2,613	2,621	2,618	2,618
Expressway	446	446	457	453
Principal arterial	5,518	5,518	5,373	5,390
Minor arterial	7,067	7,067	7,202	7,200
Collector & others	36,202	36,202	36,226	36,223
Weekday Non-MPO VMT by roadway type				
Interstate	11,316,059	10,659,138	12,451,632	11,801,239
Expressway	1,443,392	1,344,383	1,762,750	1,613,085
Principal arterial	10,914,663	10,020,520	11,489,036	10,674,077

Baseline and GHG Action Modeling Inputs & Outputs	2030 Baseline	2030 Action	2040 Baseline	2040 Action
Minor arterial	4,863,880	4,425,839	5,426,272	4,962,695
Collector & others	11,847,164	10,706,394	12,645,901	11,490,073
<b>Total Weekday non-MPO VMT</b>	<b>40,385,157</b>	<b>37,156,273</b>	<b>43,775,591</b>	<b>40,541,169</b>
Non-MPO GHG emissions				
GHG emissions (MMT/year)	4.886	4.495	3.315	3.061

Source: CDOT

Note: Totals may not add because of rounding and because of the inclusion of out-of-state lane-mileage and VMT in the model area total.

**Table B-12. Non-MPO portion of model inputs and outputs for 2050 GHG compliance runs**

Baseline and GHG Action Modeling Inputs & Outputs	2050 Baseline	2050 Action
Lane miles by agency		
DRCOG	21,991	21,931
GVMPO	2,716	2,716
NFRMPO	4,314	4,314
PACOG	1,552	1,552
PPACG	5,423	5,413
Non-MPO (CDOT)	51,906	51,914
<b>Total lane miles</b>	<b>87,886</b>	<b>87,831</b>
Non-MPO lane miles by roadway type		
Interstate	2,624	2,614
Expressway	468	460

<b>Baseline and GHG Action Modeling Inputs &amp; Outputs</b>	<b>2050 Baseline</b>	<b>2050 Action</b>
Principal arterial	5,228	5,262
Minor arterial	7,336	7,333
Collector & others	36,250	36,244
Weekday Non-MPO VMT by roadway type		
Interstate	13,587,206	12,943,340
Expressway	2,082,108	1,881,788
Principal arterial	12,063,409	11,327,634
Minor arterial	5,988,664	5,499,551
Collector & others	13,444,637	12,273,751
<b>Total Weekday non-MPO VMT</b>	<b>47,166,025</b>	<b>43,926,065</b>
Non-MPO GHG emissions		
GHG emissions (MMT/year)	2.558	2.371

Source: CDOT

Note: Totals may not add because of rounding and because of the inclusion of out-of-state lane-mileage and VMT in the model area total.



## Appendix C - 2025 MOVES4 Modeling and Greenhouse Gas Emissions Calculation Methodology

**To:** Transportation Commission

**From:** Sabrina Williams - CDOT and Dale Wells - CDPHE

**Date:** December 22, 2025

**Subject:** CDOT Greenhouse Gas Transportation Planning Standard –  
2025 MOVES4 Modeling and Greenhouse Gas Emissions  
Calculations Methodology Documentation.

### Appendix C.1 - Introduction:

This document summarizes the methodology used to calculate greenhouse gas (GHG) emissions for demonstrating compliance with the CDOT Greenhouse Gas (GHG) Transportation Planning Standard (Standard). Previous GHG emissions calculations to support CDOT were conducted by the Air Pollution Control Division (APCD). This methodology represents a coordinated approach between CDOT and APCD's modeling teams to represent likely future on-road GHG emissions as accurately as possible. The approach was also agreed upon by the Statewide Model Coordination Group (SMCG). Several refinements and improvements were made compared to the previous methodology for calculating GHG emissions due to the availability of new models, data and assumptions. All data and files utilized in the GHG emissions analysis methodology were reviewed by an individual other than the person who developed the data and/or performed the modeling as documented throughout.

The process for calculating GHG emissions begins with generating emission rates using the EPA's Motor Vehicle Emissions Simulator Model (MOVES). The GHG emissions rates developed in MOVES are the same statewide and applied consistently between all agencies to calculate mass total GHG emissions for a compliance area. The emission rates are multiplied by the vehicle miles traveled (VMT) from the Travel Demand Model (travel model) at the link level for individual hours of the days based on the observed vehicle mix from CDOT's statewide Automated Traffic Recorder (ATR) station network within a Microsoft (MS) Access relational database. The result of querying the database is the predicted total mass emissions of GHGs for the roadways represented in the travel model for an average weekday. This requires a series of data analysis and post-processing steps

to correctly compile these three main parameters (emissions rates, travel behavior, vehicle mix) into compatible formats within the database.

In 2025 the three significant new considerations for how GHG emissions are calculated for the purposes of an agency demonstrating compliance with the Standard were adopted by consensus through the Statewide Model Coordination Group (SMCG). These considerations involve updates to (1) vehicle emissions rates, (2) vehicle mix assumptions, and (3) the number of vehicle classes considered.

Each step in the emissions calculation process results in standalone datasets (emissions rates, vehicle mix, travel modeling) that are created independently, but compiled in a manner that allows this data to interface with each other through relational database software (MS Access) that calculate total GHG mass emissions for a compliance agency. All data used in the emissions analysis developed by an individual (or agency) was then independently reviewed by another individual (or agency) for data validity and accuracy prior to incorporation into the final GHG emissions calculations methodology. In addition to the analysts and reviewers noted throughout, all SMCG member agencies were extended the opportunity to perform additional data review at each step in development of the emissions calculations, including contributing to the underlying framework that established the methodology and resultant procedures.

## **Appendix C.2 - Vehicle Emissions Rates**

**Performed by: Sabrina Williams-CDOT**

**Reviewed by: Dale Wells-CDOT**

New GHG Rates were required to incorporate the State Interagency Coordination Team (IACT) determination, as defined under 2 CCR 601-22 Section 1.44, May 5, 2025 that the CDOT Department of Accounting and Finance (DAF) projections on future EV adoption be used in the GHG emissions rates development. The previous GHG emissions rates were developed using asserted adoption curves of early, mid and late term EV adopters annually with individual forecasts for passenger vehicles and SUVs/light-duty trucks through 2050. CDOT DAF, as part of CDOT's 10-Year Plan development, created a forecast of expected revenue through the year 2050. As part of their revenue forecasting effort, DAF also generated a forecast of light-duty EV fleet growth in Colorado (since revenue from EVs is different from revenue from fossil-fueled vehicles). DAF's forecast estimated 950,000 light-duty EVs in Colorado in 2031, with an estimate of 95% of light-duty vehicles being EVs in 2050.

Separate EV adoption rates were initially developed for passenger cars and SUVs/light-duty trucks as at that time very few EV SUVs/light-duty trucks were available for purchase and it was unknown when additional electrified SUVs/light-duty trucks would be commercially available. Since the time the initial EV planning assumptions were used to develop the original GHG rates, numerous electrified SUV make and models are now

commercially available and auto manufacturers continue to release additional EV SUVs for sale. Furthermore, manufacturers have indicated that electrified light-duty trucks will become more broadly available in future years. The Colorado Energy Office (CEO) has completed numerous studies on likely future EV adoption for planning purposes such as EV charging infrastructure needs. These studies also project greater levels of electrification of these larger passenger vehicles within the next five years. Given that a significant percentage of passenger vehicles registered in the state are classified as SUVs and light-duty trucks, the earlier SUV/light-duty truck EV adoption rates was adjusted to reflect the quicker levels of EV adoption now expected. Therefore, in future years the rate of EV adoption is assumed to be the same between passenger cars and SUVs/light-duty trucks in developing the new GHG rates whereas previously they differed.

## Appendix C.3 - Vehicle Mix Assumptions

**Performed by: Juan Robles-CDOT**

**Reviewed by: Sabrina Williams-CDOT, Dale Wells-CDPHE**

### Overview

The vehicle mix represents the type (i.e. motorcycles, passenger cars, SUVs, vans, trucks, etc.) of vehicles operating on a roadway. The GHG emissions rates are highly variable by vehicle class and generally increase with the size of the vehicle. For example, passenger cars emit significantly less GHGs per vehicle mile traveled (VMT) than heavy-duty trucks. While travel demand models forecast total on-road travel behavior, including trips from commercial vehicles, no travel demand model in the state is calibrated for commercial travel accurately enough to properly assign the on-road vehicle mix. Therefore, the real-world observed vehicle mix used to calculate GHG emissions for the Standard is developed from traffic observations (counts) collected by CDOT's vehicle count stations.

Vehicle mix is assigned from ATR data using both continuous and short-duration counts stratified by hour of the day, the [13 Federal Highway Administration \(FHWA\) vehicle classifications](#) as well as roadway and urban or rural area type updated for more recently observed years. Each ATR station's counts were used in conjunction with VMT weighting for the roadway to develop a ratio of vehicle types by hour for all of the major roadway types in Colorado. The VMT-weighting of the counts is a refinement of the previous vehicle mix assignment that used unweighted (straight) counts in the previous emissions calculations. The VMT-weighting method was developed by CDOT and APCD in order to better reflect the vehicle mix outside the Front Range where the majority of ATR stations are located. Furthermore, for the 2025 vehicle mix used to calculate GHG emissions rates, post-pandemic (2023) vehicle classification counts were used. In the previous GHG emissions calculations methodology, pre-pandemic (2017-2019) vehicle classification counts were used. SMCG determined that an update to post-pandemic vehicle

classification counts should be made statewide to the emissions calculation methodology in order to more accurately reflect the vehicle mix that is currently present on roadways in the state as transportation behavior has altered since COVID due to factors including increased remote employment and land use changes.

### ATR Count Data Methodology

To assign the vehicle mix percentages by roadway functional category, a total of 316 statewide count stations that collect hourly classification data were used. Of these count locations, 75 of them are permanent traffic recorders (ATRs), and 241 were short-term counts for the years 2022 and 2023. The 13-bin FHWA hourly counts were then grouped into the five Highway Performance Monitoring System (HPMS) class groups used in MOVES to calculate emission rates (passenger vehicles [including SUVs and light-duty trucks], motorcycles, buses, single unit heavy-duty trucks and combination heavy-duty trucks)

To calculate the vehicle mix fractions or percentages for each functional class by individual hours, the VMT-weighted sum of all hourly volumes from each class was divided by the total number of counts for each class. This means that ATR stations have a larger weight than short-term count locations because there are many more hourly counts available from ATRs, and that count stations with higher volumes or VMT have a higher weight than stations with low volumes or VMT.

A simplified example would be if the number of total individual hourly volumes at an ATR station were 20,000 vehicles and 17,000 vehicles were observed to be passenger vehicles and 1,000 vehicles were single unit (SU) trucks. In this case, the percentage of passenger vehicles for that station in that individual hour is assigned to be 85% and the fraction of SU trucks would be 15%.

[Figure C-1](#) below shows percentages for the Urban Freeways and Expressways functional category with reliance on 11 ATRs. The average percentages for this class are shown in green and the percentages for each of the ATRs are below the green bar. Only the aggregated values for the entire area type and roadway functional classification are used to calculate emissions for the state, the individual data shown for each ATR station is used in the calculation of average vehicle mix percentages.

**Figure C-1. Example illustrating calculation of vehicle mix percentages as a weighted average of count data from multiple locations**

Sta_ID	Rural_Urban	Func_Class	Average VMT	M-cycles	Pass_veh	Buses	SU	Combo
	<b>Urban</b>	<b>(2) Freeway &amp; Expr</b>	<b>109,926</b>	<b>0.17%</b>	<b>97.37%</b>	<b>0.13%</b>	<b>1.25%</b>	<b>1.09%</b>
000003	Urban	(2) Freeway & Expr	134,451	0.19%	97.38%	0.06%	1.12%	1.25%
000004	Urban	(2) Freeway & Expr	168,873	0.07%	98.27%	0.29%	0.76%	0.61%
000503	Urban	(2) Freeway & Expr	57,247	0.10%	98.96%	0.07%	0.50%	0.37%
000504	Urban	(2) Freeway & Expr	246,762	0.18%	97.05%	0.23%	1.53%	1.02%
000506	Urban	(2) Freeway & Expr	91,498	0.13%	97.97%	0.10%	1.24%	0.56%
100331	Urban	(2) Freeway & Expr	131,878	0.20%	98.27%	0.20%	0.85%	0.48%
103608	Urban	(2) Freeway & Expr	104,847	0.11%	98.44%	0.09%	0.72%	0.64%
103684	Urban	(2) Freeway & Expr	81,433	0.12%	89.91%	0.25%	3.38%	6.34%
103712	Urban	(2) Freeway & Expr	11,012	0.10%	89.71%	0.11%	3.29%	6.78%
105548	Urban	(2) Freeway & Expr	164,048	0.19%	97.45%	0.07%	1.22%	1.08%
107556	Urban	(2) Freeway & Expr	121,040	0.13%	96.99%	0.10%	1.77%	1.02%

Of the seven roadway functional categories:

- (1) Interstate
- (2) Freeway & Expressway
- (3) Other Principal Arterial
- (4) Minor Arterial
- (5) Major Collector
- (6) Minor Collector
- (7) Local

CDOT does not collect classification data on Minor Collectors, Ramps or Local roads that would permit the calculation of accurate mix percentages for these roadways. Thus, there is no vehicle classification count data available at a statewide level for these roads. However, travel models must account for vehicle travel for all road types in the state to accurately predict passenger trips and associated VMT whose emissions need to be accounted for. CDOT and APCD determined the most suitable approach for assigning the vehicle mix on these access roads for the purposes of calculating GHG emissions was to assign the same vehicle mix as the most similar roadway functional classification for which vehicle classification was available. In this case, functional classes six and seven would use the rates from Major Collectors.

The result is a compiled table of the observed individual hourly vehicle mix by HPMS category for the seven roadway functional classifications that are represented in the travel modeling for a GHG compliance area.

The vehicle mix is applied to the travel model run data in the MS Access database that calculates the mass total emissions and is not considered directly within the MOVES modeling to develop the GHG emissions rates as discussed later in the documentation of the GHG emissions analysis methodology.

## Appendix C.4 - Vehicle Classes Considered

**Performed by: Mobility Analysis Section-CDOT**

**Reviewed by: Sabrina Williams-CDOT, Juan Robles-CDOT**

The original GHG rates developed in MOVES for use in prior analyses to demonstrate compliance with the standard had unique rates for six HPMS vehicle categories: motorcycle, passenger cars, passenger trucks, buses, single unit heavy trucks, and combination heavy trucks. These GHG emissions rates by HPMS category are applied to the travel model data in the MS Access database in conjunction with the observed vehicle mix fractions (observed vehicle classification counts) to calculate total mass GHG emissions for a compliance area. However, Division of Transportation Development Mobility Analysis Section staff realized that because vehicle classification counts are recorded by the number of axles and length of a given vehicle, the CDOT count network often records SUVs and light-duty trucks as passenger cars. Furthermore, in MOVES the type of vehicles are not grouped by the body style of a vehicle, rather by similar characteristics of the engines and associated emissions profiles. This results in many vehicles that are commonly thought of as passenger vehicles, such as wagons and crossovers, being considered to be passenger trucks in the MOVES model.

To more accurately account for the number of larger passenger vehicles and to minimize the discrepancy between the CDOT count network's data collection mechanism and the MOVES model vehicle source types, a refinement was made to the number of vehicle classes considered in the GHG emissions calculations to combine passenger cars and SUVs/light-duty trucks to reflect total passenger vehicles. This was performed by aggregating the observed vehicle classification counts to a new HPMS25 vehicle category representing all passenger vehicles instead of differentiating between passenger cars and SUVs/light-duty trucks. This resulted in reducing the number of HPMS classes considered in the MOVES model to develop the updated GHG emissions rates from six to five categories of vehicles: motorcycles, passenger vehicles, buses, single-unit heavy trucks, and combination heavy trucks.

The refinements to the number of vehicle classes considered results in an increased representation of SUVs/light-duty trucks and their associated GHG emissions in the state that more accurately depicts present real-world observed conditions. Furthermore, the

approach of representing all passenger vehicles as a single HPMS category is now consistent with the manner in which CDOT reports HPMS data for the state.

## Appendix C.5 - MOVES4 GHG Emissions Rates

Performed by: Sabrina Williams, CDOT

Reviewed by: Dale Wells, APCD-CDPHE

### Overview

Incorporating the DAF future EV planning assumptions required new emissions rates to be developed in MOVES. Emissions rates were generated using the MOVES version 4.1.2 (MOVES4). Previously MOVES version 3.0.1 (MOVES3) was used to generate the original GHG emissions rates. The change in GHG emissions rates specific to changing to model versions is minimal due to the previous and continued high levels of EV/ZEV adoption assumed in future years, which is discussed in later sections. For more information about GHG modeling using MOVES, see the [Using MOVES for Estimating State and Local Inventories of On-road Greenhouse Gas Emissions and Energy Consumption](#) guidance document. The MOVES4 Run Specifications used to generate the GHG emissions rates may also be found in later sections.

### MOVES4 Run Specifications

The run specification (RunSpec) parameters outlined below were used to calculate GHG emission rates with MOVES. CDOT performed the MOVES4 modeling to develop the new GHG emissions rates and model results and inputs were reviewed and verified by APCD for accuracy. The MOVES modeling methodology is largely consistent with APCD's previous process to calculate GHG emissions except where noted.

The three modeled years: 2030, 2040, and 2050, used the same run specifications except for where specified (e.g., the year being modeled). Each of the three modeled years has five related run specifications to separate the emission rates by vehicle type, as described in the On-road Vehicles section, i.e., five MOVES runs per compliance year. This denotes a change from the previous GHG emissions rates that were generated using six model runs to represent vehicle types by aggregating passenger cars with SUVs and light-duty trucks into a single MOVES run. When used for modeling compliance with the Standard the GHG emissions rates are applied identically between an agency(s) baseline plan and compliance plan demonstrations, e.g., there is no emissions benefit given to a compliance demonstration for future EV/ZEV adoption. If an MPO or CDOT were to develop a project in a long-range transportation plan specific to switching vehicle types or vehicle fuel types in a future year, this will be revisited by SMCG for consideration on how to best represent these types of planning actions.

### Scale

The "Scale" parameters define the model type (on-road or non-road), domain/scale, and calculation type.

## Model Type

On-road was the model type selected. This estimates emissions from motorcycles, cars, buses, and trucks that operate on roads.

Non-road/off-network emissions were not included. These emissions are from equipment used in applications such as recreation, construction, lawn and garden, agriculture, mining, etc. and are outside of the scope of this analysis.

## Domain/Scale

MOVES allows users to analyze mobile emissions at various scales: National, County, and Project. While the County scale is necessary to meet statutory and regulatory requirements for State Implementation Plans (SIPs) and transportation conformity, either the County or National scale can be used for GHG inventories at the federal level. EPA recommends using the County scale for GHG analysis.

The County scale allows the user to enter locally-specific data through the County Data Manager whereas under the National Scale only MOVES default values are used. Providing local data significantly improves the precision of the modeling results and allows the MOVES users to better evaluate future planning scenarios. Therefore, the County Scale was used.

County Scale in MOVES can be used to model a single county, or a larger representative group of counties such as a nonattainment area or entire state that share common emissions characteristics such as fuel types and blends, emissions testing programs, vehicle age and other considerations. For this modeling, Adams County was used as the representative county on MOVES to develop the statewide GHG emissions rates. All non-default inputs in MOVES4 used in the County Data Manager are representative of the most currently available statewide vehicle data compiled by APCD for EPA's National Emissions Inventory (NEI) Reporting, with the exception of future EV/ZEV adoptions rates at the direction of IACT.

## Calculation Type

MOVES has two calculation types - Inventory (total emissions in units of mass) or Emissions Rates (emissions per unit of distance for running emissions or per vehicle for starts and hotelling emissions) in a look-up table format that must be post-processed to produce an inventory. Either may be used to develop emissions estimates for GHGs.

The Emission Rates calculation type was used. Emissions Rates calculation type requires more post-processing; however, this also allows for a consolidated set of GHG emissions rates that can be used statewide by any GHG compliance agency with minimal emissions modeling required from an MPO. Furthermore, this method provides for not needing to rerun MOVES if there is a change to an agency's travel model.

## Time Span

The “Time Span” parameters define the years, months, days, and hours that emissions are calculated.

When Emission Rates is specified in the RunSpec, users may choose to approach the selection of options in the Time Spans Panel differently than when running MOVES in Inventory mode. For example, when modeling running emission rates, instead of entering a diurnal temperature profile for 24 hours, users can enter a range of 24 temperatures in increments that represent the temperatures over a period of time. By selecting more than one month and using a different set of incremental temperatures for each month, users could create a table of running emission rates by all the possible temperatures over an entire season or year.

When using Emission Rates instead of Inventory, the time aggregation level is automatically set to Hour and no other selections are available. Pre-aggregating time does not make sense when using Emission Rates and would produce emission rates that are not meaningful. However, the year, month, and day must still be specified and will affect the emission rates calculated.

The time span parameters specified in the following subsections were also used because the travel model outputs represent an average weekday. These daily emissions are then translated into annual emissions in the final step of the emissions calculation process.

### Years

The County scale in MOVES allows only a single calendar year in a RunSpec. Users who want to model multiple calendar years using the County scale will need to create multiple RunSpecs, with local data specific to each calendar year, and run MOVES multiple times.

The years used were 2030, 2040, and 2050. Emission rates for each of these years were calculated separately. This accounts for information such as a changing age distribution of vehicles, fleet turnover and their corresponding fuel types and fuel efficiencies.

### Months

MOVES allows users to calculate emissions for any or all months of the year. If the user has selected the Emission Rates option, the Month can be used to input groups of temperatures as a shortcut for generating rate tables for use in creating inventories for large geographic areas.

The months used were January and July to match the previous modeling by APCD. These represent winter and summer months and generally the extremes in annual weather conditions. This accounts for changes in fuel efficiency between warm and cold temperatures throughout the year. The arithmetic averages of emission rates from January and July were used for the final emissions inventory to represent an annual average GHG emissions rate.

## Days

Weekdays and weekend days can be modeled separately in MOVES. MOVES provides the option of supplying different speed and VMT information for weekdays and weekend days to allow the calculation of separate emissions estimates by type of day.

The days used were weekdays to match the TDM output data. These represented the emission rates for an average weekday. The results are annualized in one of the final steps for calculating the GHG emissions to approximate a full year.

## Hours

The hours used were all 24 hours of the day (i.e., clock hours ending at 1:00 AM, 2:00 AM, 3:00 AM, etc.). These represent the emission rates for individual hours of a day. This accounts for changes in fuel efficiency between warm and cold temperatures throughout the day.

## Geographic Bounds

The “Geographic Bounds” parameter defines the county(s) used. For a county-scale run, only one county can be selected per RunSpec. The county used was Adams County, Colorado; however, any county in Colorado could have been selected as the MOVES modeling defined input parameters such as the vehicle age used to estimate emission rates using statewide data.

## On-Road Vehicles

MOVES describes vehicles by a combination of vehicle characteristics (e.g., passenger car, passenger truck, light commercial truck, etc.) and the fuel that the vehicle is capable of using (gasoline, diesel, etc.). This is required to specify the vehicle types included in the MOVES run.

The “On-road Vehicles” parameter defines the source types (i.e., vehicle types) and their fuels (gasoline, diesel, electricity, etc.). All combinations of vehicle types and fuels available in MOVES4 were used to calculate the emission rates; except that no EV/ZEVs are assumed for buses or commercial vehicles. The process for assigning what vehicle types are represented in the model run has been refined from the previous method that used separate MOVES runs to represent passenger cars vs. SUVs and light-duty trucks. The MOVES model runs used in the GHG rates update now match the MOVES HPMS types defined in the model that aggregates all passenger vehicles into a single category (HPMS=25).

[Table C-1](#) illustrates the HPMS categories.

**Table C-1. Composition of vehicle types used for MOVES emissions modeling**

MOVES Vehicle Source Type	HPMS Name	HPMS (Current)	HPMS (Previous)
Motorcycle	Motorcycles	10	10
Passenger Car	Light-Duty Vehicles	25	20
Passenger Truck	Light-Duty Vehicles	25	30
Light-Commercial Truck	Light-Duty Vehicles	25	30
Other Buses	Buses	40	40
Transit Bus	Buses	40	40
School Bus	Buses	40	40
Refuse Truck	Single Unit Trucks	50	50
Single Unit Short-Haul Truck	Single Unit Trucks	50	50
Single Unit Long-Haul Truck	Single Unit Trucks	50	50
Motor Home	Single Unit Trucks	50	50
Combination Short-Haul Truck	Combination Trucks	60	60
Combination Long-Haul Truck	Combination Trucks	60	60

## Road Type

The Road Type in MOVES is used to define the types of roads that are included in the run. There are four categories of road types in MOVES used to represent onroad emissions and they are separated between urban vs. rural and ramp-controlled (Interstates) vs. non ramp-controlled (local roads). Assignment of the correct road type when calculating emissions is important because in MOVES the vehicle drive cycles assumed in the model are variable by road type, e.g., MOVES assumed more stop and go traffic on local roads associated with intersection controls than interstates, as well as area type, e.g., MOVES assumes a greater level of congestion on local roads in urban areas than rural areas. MOVES also has an option for Off-Network road types which would be associated with vehicle emissions not occurring in traffic, e.g., idling vehicles at a large transit station. All road types were selected in MOVES. The Off-Network road type must be selected for MOVES to execute in Emissions Rate mode, but was not used in the emissions calculations as they are not on-road emissions.

## Pollutants and Processes

The Pollutants and Processes Panel allows users to select from various pollutants, types of energy consumption, and associated processes of interest. In MOVES, a pollutant refers to particular types of pollutants or precursors of a pollutant but also includes energy consumption choices. Processes refer to the vehicle mechanism by which emissions are released, such as running exhaust or start exhaust. Users should select all relevant processes associated with a particular pollutant to account for all emissions of that pollutant. Generally, for this project, that includes running emissions, e.g. emissions processes associated with vehicle start-ups, extended idling and refueling occur on Off-Network road types in MOVES.

The CO<sub>2</sub> Equivalent pollutant is the sum of the global warming potential of Carbon Dioxide (CO<sub>2</sub>) and all other greenhouse gases expressed as a unit CO<sub>2</sub> Equivalents. (CO<sub>2</sub>e) is the pollutant of interest in MOVES as it accounts for all greenhouse gas emissions considered in MOVES. MOVES requires several other prerequisite pollutants for CO<sub>2</sub>e, e.g., methane; whose individual global warming potentials are calculated within the model and appropriately summed with CO<sub>2</sub> and reported as CO<sub>2</sub>e.

## General Output

The General Output parameters define the output database, units, and activity.

### Output Database

Results from the five related HPMS RunSpecs for a given analysis year (2030, 2040, 2050) can be stored together in a single output database for convenience, or separate databases can be created for each run. The RunSpecs must have the same units and aggregation or MOVES will not execute. A different output database is required for each year and varying MOVES RunSpec. A consistent and informative naming convention for the output database assists in file housekeeping. Five output databases were used for each year modeled representing a single HPMS category for that year. Each output database contained results for the modeled year and vehicle HPMS category.

### Units

Users can select from any of the mass unit selection options but should generally choose a unit whose magnitude is appropriate for the parameters being analyzed.

The units selected in the MOVES RunSpecs are grams for mass, joules for energy, and miles for distance.

### Activity

MOVES allows the user to select multiple activity output options. As Emissions Rates were selected MOVES automatically reports emissions in mass units per distance traveled (grams/VMT) for each month and hour selected in the MOVES Time Spans panel for each Road Type selected in MOVES.

## Output Emissions Detail

This panel allows the users to make selections that will additionally disaggregate the data beyond what is automatically reported by MOVES. Certain selections are automatically made by MOVES based on the RunSpec definition and cannot be unselected.

No optional details were selected in this panel as the outputs automatically reported by MOVES for these RunSpecs contain sufficient detail for calculating GHG emissions in this manner.

## Input Database (Formerly the County Data Manager)

The previous panels in MOVES defined the RunSpec and the format of the output data. The next step is to create the input database where files with local data are imported.

The RunSpec parameters selected in the other panels in MOVES define the file structure and required data for the input database and constrain all files imported into MOVES to this structure or errors are generated and the model will not execute. Therefore, it is recommended that the MOVES user make this Input Database the last panel used in the MOVES graphical user interface (GUI) as any alterations to the RunSpec can result in needing to recreate its settings.

One input database was created for each model year for each vehicle HPMS category; a total of 15 MOVES model runs. Data is imported into the input database for each MOVES run, as specified below.

## Age Distribution

The Age Distribution in MOVES represents the distribution of the age of each vehicle type in MOVES from 0-30 years old (vehicles whose model years are 31 years and older). The age distribution is a critical input in MOVES as this directly assigns the specific vehicle model years and vehicle characteristics, e.g., fuel types and associated emissions rates. MOVES allows the user to import locally specific data as was performed in this analysis. APCD develops locally specific age distributions from all vehicles registered in the state every three years for the EPA's National Emissions Inventory (NEI) reporting at the county and statewide level, as well as for the Denver Metro/North Front Range 8-hr Ozone Nonattainment Area. For this analysis, the statewide age distribution for the 2024 NEI reporting was imported into MOVES4 except for long-haul commercial vehicles. National default values were used for long-haul commercial vehicles as a significant portion of these vehicles in the state are registered elsewhere in the country.

## Average Speed Distribution

Vehicle tailpipe emissions rates are highly affected by the speed the vehicle is traveling. At lower speeds associated with congestion emissions rates are higher and rates decrease until vehicles are traveling at speeds of approximately 55 miles per hour (mph) where at that point emissions rates begin to increase again. MOVES requires an Average Speed

Distribution be imported to perform a model run. This distribution is an important input in Inventory Mode as it represents the detailed information concerning the on-road speeds of vehicles and related emissions rates by road type, hour of the day, day of the week, and month of the year. In Emissions Rates mode, however, the average speed distribution is not used and for this analysis national default values were used.

## Fuel

The fuels data in MOVES assigns the specific fuel formulations, including chemical properties, for all petroleum vehicles as well as the fuel types for each vehicle type by model year including representation of EV/ZEVs in the model through the Alternative Vehicles Fuels and Technologies (AVFT) file. For the GHG analysis, default fuel values were used with the exception of the AVFT data.

The AVFT file specifies the fraction of each fuel used by a vehicle type, e.g., gas, diesel, ethanol and electricity, for vehicle model years 1960-2060. It is important to specify these fractions by model year as this provides a more accurate estimate of the fuel economy standards and emissions improvements associated with fleet turnover as older higher emitting vehicles are retired and replaced with lower emitting vehicles than assuming an average fuel mix for an entire vehicle type in MOVES.

In a MOVES run, vehicle data is only considered for the same vehicle model year as the analysis year selected in the RunSpec and the previous 30 vehicle model years, i.e., the fuel mix considered in a specific run is assigned from the Age Distribution in MOVES.

Although EV/ZEVs have zero GHG emissions, these vehicles do have emissions of other pollutants, such as particulate matter, and should be represented within MOVES. Therefore, future EV/ZEV planning assumptions are directly considered within MOVES and there is no “zeroing” out of EV/ZEV VMT, because that VMT corresponds to a GHG tailpipe emissions rate of zero. For this analysis the AVFT file used the same motor vehicle registration data for the 2024 NEI as the Age Distribution through vehicle model year 2024 after which the DAF EV planning assumptions for light-duty vehicles were incorporated to represent future EV adoption levels. MOVES4 contains default values for future EV adoption for commercial vehicles; however, this data was not used in the model and no EV/ZEVs were considered for commercial vehicles.

## Meteorology

Vehicle emissions rates can vary by temperature and humidity, particularly for criteria pollutants and mobile source air toxics. However, GHG emissions from vehicles relate to atmospheric conditions solely based on a driver’s comfort and their likely usage of air conditioning in a vehicle and resultant impacts to fuel economy. The default values for Meteorology in MOVES represent actual climate data for all individual counties in the nation as collected from the National Climate Data Center. MOVES default data for Adams County, Colorado was used for the months of January and July in the analysis, which is consistent with the RunSpec.

## Road Type Distribution

MOVES does not have default data for the Road Type Distribution and it must be created and imported by the user. In Emissions Rates the Road Type Distribution data in a MOVES run does not impact the results and is not an important file in the analysis, but must be present and correctly compiled for the model to run. A Road Type Distribution file was provided by APCD imported in MOVES for the analysis.

## Source Type Population

MOVES requires the Source Type Population file to be present in MOVES and there is no national default data available in MOVES. However, this file does not change the results in Emissions Rates as this data is used for calculating vehicle emissions associated with off-network activity, e.g., extended periods of idling at a truckstop or a large number of vehicles congregating at a transit station. As these vehicle emissions are not truly occurring “on-road” they are not accounted for in the analysis or present in the Emissions Rates output files. The Source Type Population was provided by APCD from the 2024 NEI and used in the analysis.

## Vehicle Type VMT

The Vehicle Type VMT is required to run MOVES and is very important if Inventory is selected in the RunSpec. However, in Emissions Rates mode this data does not change the results; moreover, a single vehicle classification is considered in this analysis so the VMT considered in MOVES does not vary by vehicle category. Default Vehicle Type VMT data was imported in MOVES for all runs with the exception of the annual HPMS file that was provided by APCD from the 2024 NEI in order for MOVES to run.

## Inspection and Maintenance Program

The Denver Metro/North Front Range Ozone Nonattainment Area has a vehicle inspection and maintenance (I/M); i.e., emissions testing program as an emissions reduction strategy in the state implementation plan (SIP) for all or a portion of these nine counties in the state. However, in MOVES there is no GHG tailpipe emissions benefit associated with I/M programs as emissions control devices such as catalytic converters and diesel particulate filters do not reduce emissions of GHGs. In MOVES there is a slight methane credit given to I/M programs associated with evaporative emissions; however, these emissions reductions are insignificant compared to net GHG emissions that are dominated by tailpipe exhaust. The check box for “No I/M Program” was selected since there is not a statewide I/M program and accounting for the minimal GHG emissions credit within the ozone nonattainment area would result in no meaningful change to the results.

## MOVES Output Data and Post-processing

### Output Database (HeidiSQL)

After MOVES has successfully completed a model run the results are stored in the output database that was created in the RunSpec. The MOVES install package includes HeidiSQL

which is an open source database software and results are automatically stored here as well as the data that was imported into the input database for that RunSpec.

The main output file of interest in MOVES for this analysis is the “Rate Per Distance” table. The file associated with each MOVES run contains the emissions rates for the HPMS category being analyzed for the months, road types and pollutants specified in the RunSpec for every individual hour of the day by speed bin. This table was queried in HeidiSQL to select only emissions of CO<sub>2</sub>eq as that is the pollutant of interest in the analysis and those results were exported from the HeidiSQL as a .csv file for each MOVES run.

### **Post-Processing Emissions Rates by Speed and Month**

Emissions Rates mode in MOVES does not produce emissions rates associated with speed changes at the level of rates at individual integer speeds in miles per hour values. Rather MOVES aggregates emissions by speed into groups of 16 speed bins with each bin corresponding to a five mile per hour maximum and minimum range of vehicle speeds, e.g., 42.5 mph to 47.5 mph. This results in faster model run times and smaller output files, and could be appropriate in instances where only a qualitative analysis is needed. However, for the purposes of this quantitative analysis a greater level of granularity concerning emissions rates by speeds is needed for GHG emissions results precise enough for accurate comparison to the absolute standards associated with each compliance year.

Previously the emissions rates were post-processed to produce emissions rates in grams per mile at individual integer speeds through interpolation in an additional MS Access database that was separate from the database utilized to calculate total mass GHG emissions for a compliance area. In revising the analysis, the interpolation methodology to develop GHG emissions rates in individual integer mph values remains unchanged, but APCD has consolidated this step into the same MS Access database used by an agency to calculate the total GHG emissions for a compliance area. Average annual emissions rates were similarly generated from a straight average of the emissions rates from the representative months of January and July in MOVES output data in the MS Access database.

## **Appendix C.6 - Calculation of Mass GHG Emissions**

**Performed by: Dale Wells-ACPD**

**Reviewed by: Sabrina Williams-CDOT**

Total mass GHG emissions for a compliance area are calculated in MS Access databases for 2030, 2040 and 2050 that are developed by APCD and are unique for each MPO/non-MPO area based on the design and structure of each compliance agency’s travel modeling platform as well as the format the travel model runs data is provided.

Each database contains lookup tables for the GHG emissions rates and vehicle mix ratios that are consistent statewide, and the travel model run files specific to each individual

agency. There are additional tables in each database that appropriately assign each link a road type from MOVES based on the area type and roadway functional classification based on an agency's travel modeling metadata.

## Travel Model Data Considerations

Prior to calculating GHG emissions an agency must remove all links extending outside of their GHG compliance area that are represented in the travel model run. This is performed by a compliance agency splitting any sections of links that may go outside a compliance area in comparison to their boundary in appropriate spatial software, e.g., ESRI geographic information system (GIS) or TransCAD, so that only the portions of the link within a compliance area boundary are considered in the GHG emissions calculations for the agency. Following the splitting of links, the length of those split links must be recalculated. Whether this calculation is done automatically or manually depends on the particular software platform in use. Once the lengths of any split links are calculated, the VMT for the split links can be calculated by multiplying the recently-calculated link length by the predicted travel volumes.

GHG emissions rates are highly variable by vehicle speeds, and to a much lesser extent individual hours of the day based on temperature and use of cooling in the cab of the vehicle. Ideally, some form of dynamic traffic assignment would be used (such as the Simulation-Based Assignment of PTV VISUM) to estimate such within-day variation in travel speed. Static assignment of 24 individual hours would produce similar output data for GHG emissions calculations. Conversely, if an agency's travel model has less than 24 time periods, coordination is required between CDOT, APCD and individual MPOs on an agreed upon process for disaggregating travel model data with predicted vehicle volumes and speeds from time periods representing multiple hours to discrete individual hours. This is particularly important for agencies with a traffic assignment process that contains a single off-peak period representing 22 hours travel behavior in a day. In this instance simply dividing the predicted volumes on a link by the number of hours in the period is likely to greatly underestimate travel volumes during the AM and PM peak shoulders and midday hours, while overestimating travel volumes in nighttime hours. Furthermore, the use of the predicted speed for a link from a four-step model during an off-peak hours is likely to overestimate speeds during the AM and PM peak shoulders and midday hours which results in underestimating emissions during this time of day.

## Querying the Database

The MS Access databases developed by APCD each contain numerous queries that run in sequence. These queries assign the correct GHG emissions rates and vehicle mix ratios at the link level through a series of joins. The length of each link is multiplied by the predicted hourly volume to calculate the VMT for that hour that then is multiplied by the vehicle mix ratio and appropriate GHG emissions rate for that vehicle class to calculate the emissions. Emissions for the links are then summed together to calculate the final

database output which is daily GHG emissions in short-tonnes for each travel model scenario.

### **Calculation of Annual Emissions and Modeled Reductions**

The emissions in GHG short-tons/day from the MS Access database are extracted into spreadsheet workbooks, e.g., MS Excel, and annualized through multiplying the weekday emissions by 338 to get annual emissions. Standard unit conversions (one US short ton = 0.907185 metric tons) are applied to calculate the GHG emissions in million metric tons (MMT) per year for each agency's baseline and compliance travel model scenarios for 2030, 2040, and 2050. The modeled emissions reduction for each year is simply calculated by subtracting the compliance emissions from the baseline emissions. The modeled emissions reduction is then compared to the agency's reduction target for that compliance year to determine if compliance with the Standard has been demonstrated through modeling or if mitigation is required.



## Appendix D - CDOT/Non-MPO GHG Emissions Modeling Memorandum

**To:** Transportation Commission  
**From:** Sabrina Williams, GHG Program Modeler  
**Date:** December 29, 2025

**Subject:** Methodology for Assigning Individual Hourly Volumes and Speeds from CDOT's Travel Model in the GHG Emissions Database for the non-MPO area.

### Background:

The MOVES modeling conducted for the Standard generated greenhouse gas (GHG) emissions rates in grams of CO<sub>2</sub>eq/VMT for each individual hour of the day (24hrs) that is further disaggregated by speed, vehicle type, and road type. APCD uses the MOVES emissions rates in conjunction with a GHG compliance area's predicted total daily on-road travel activity for each compliance year within a database platform to calculate predicted total annual GHG emissions (million metric tonnes, MMT/yr) to verify whether an area can demonstrate compliance with GHG Rule for Transportation Planning.

To accurately calculate total daily and annual GHG emissions it is necessary for the GHG database to assign individual hourly volumes and speeds (24hrs/day) at the link level from the travel model's daily output. Most travel models for GHG compliance areas in Colorado do not use 24 time periods that facilitate this individual hourly assignment. Therefore, GHG compliance areas with fewer than 24 time periods need to develop a mutually agreed upon process for the assignment of individual hourly volumes and speeds within the GHG database that interacts with the travel model output to calculate GHG emissions. Each GHG compliance agency documents the agreed upon process for assigning individual hourly volumes and speeds from their travel model in the agency's GHG report.

## Methodology

Generally hourly count data used to validate the travel model can be also utilized to develop logical mathematical formulas that assign individual hourly volumes at the link level. Professional judgement is used to determine the appropriate speeds for these periods, also at the link level; often by comparing the hourly counts for the off-peak period to peak period counts to determine if peak period predicted speeds should be assigned at an individual link level during these hours. However, not all travel models in the state are validated with hourly counts, e.g., the CDOT model is validated with daily counts. Travel models validated with daily counts may have any number of time of day periods. The CDOT travel model has ten time of day periods, which range in duration from a half-hour a.m. early shoulder to a seven-and-a-half-hour overnight period. With more periods of shorter duration, simply dividing the predicted period volume by the number of hours in that period to calculate an hourly volume, and assigning the same predicted speed from the travel model at the individual link level can be a reasonable approximation. The process that CDOT uses to convert period volumes to hourly volumes is shown in [Table D-1](#). CDOT uses the period link speed for all relevant hours in that period.

**Table D-1. Conversion of CDOT travel modeling periods for GHG emissions calculation**

Hour ending at	Model period & description	Calculate hourly volume by dividing period volume by ...
1:00 a.m.	OP1 (11:00 p.m. to 6:30 a.m.)	7.0
2:00 a.m.	OP1 (11:00 p.m. to 6:30 a.m.)	7.0
3:00 a.m.	OP1 (11:00 p.m. to 6:30 a.m.)	7.0
4:00 a.m.	OP1 (11:00 p.m. to 6:30 a.m.)	7.0
5:00 a.m.	OP1 (11:00 p.m. to 6:30 a.m.)	7.0
6:00 a.m.	OP1 (11:00 p.m. to 6:30 a.m.)	7.0
7:00 a.m.	AM1 (6:30 to 7:00 a.m.)	1.0
8:00 a.m.	AM2 (7:00 to 8:00 a.m.)	1.0
9:00 a.m.	AM3 (8:00 to 9:00 a.m.)	1.0
10:00 a.m.	OP2 (9:00 to 11:30 a.m.)	2.5
11:00 a.m.	OP2 (9:00 to 11:30 a.m.)	2.5

Hour ending at	Model period & description	Calculate hourly volume by dividing period volume by ...
12:00 noon	OP2 (9:00 to 11:30 a.m.) & OP3 (11:30 a.m. to 3:00 p.m.)	OP2 / 5 + OP3 / 7
1:00 p.m.	OP3 (11:30 a.m. to 3:00 p.m.)	3.5
2:00 p.m.	OP3 (11:30 a.m. to 3:00 p.m.)	3.5
3:00 p.m.	OP3 (11:30 a.m. to 3:00 p.m.)	3.5
4:00 p.m.	PM1 (3:00 to 5:00 p.m.)	2.0
5:00 p.m.	PM1 (3:00 to 5:00 p.m.)	2.0
6:00 p.m.	PM2 (5:00 to 6:00 p.m.)	1.0
7:00 p.m.	PM3 (6:00 to 7:00 p.m.)	1.0
8:00 p.m.	OP4 (7:00 to 11:00 p.m.)	4.0
9:00 p.m.	OP4 (7:00 to 11:00 p.m.)	4.0
10:00 p.m.	OP4 (7:00 to 11:00 p.m.)	4.0
11:00 p.m.	OP4 (7:00 to 11:00 p.m.)	4.0
12:00 midnight	OP1 (11:00 p.m. to 6:30 a.m.)	7.0

Source: CDOT, CDPHE



**COLORADO**

**Department of Transportation**

Division of Transportation Development

## Appendix E - CDOT/Non-MPO Boundary Memorandum

**To:** Transportation Commission

**From:** Sabrina Williams, GHG Program Modeler

**Date:** December, 29 2025

**Subject:** Overview of Coordinated Modeling Approaches for Compliance with GHG Rule (2 CCR 601-22)

### Background

CDOT has completed its efforts to model Greenhouse Gas (GHG) emissions within the non-MPO boundary in order to comply with 2 CCR 601-22, referred to herein as the Standard. Throughout this process, CDOT coordinated closely with Colorado Air Pollution Control Division (APCD) as well as members of the Statewide Model Coordination Group (SMCG) on the most appropriate ways to proceed. After reaching agreement on the process for representing emissions in the non-MPO area, all MPOs were given opportunity to review and comment on this representation of travel and emissions as presented in CDOT's Updated Plan and GHG emissions analysis through an interagency review. This memorandum documents CDOT's interagency review period and comments received on the boundary file that spatially represents the non-MPO area as well as the appropriateness of any links that were required to be split at this boundary file for the purposes of performing GHG emissions calculations associated with the Updated Plan.

### Boundary File Representing the non-MPO Compliance Area

**Review Period:** October 8, 2025 to November 7, 2025

**Reviewing Agencies:** DRCOG, NFRMPO, PPACG, GVMPO, PACOG

CDOT provided all MPOs the boundary file developed by CDOT for spatially representing the non-MPO GHG compliance area, which comprised a representation of the MPO boundaries of each individual agency on a statewide scale. CDOT requested the MPOs to review and either propose revisions/modifications of the representation of their MPO boundary or provide concurrence. Although several agencies noted that the legal definition of their MPO boundary had changed, these

will not go into effect for the purposes of demonstrating compliance with the Standard for CDOT's Updated Plan. No agencies identified errors in representing their MPO boundary as legally defined for this Updated Plan. Therefore, CDOT used the boundary file initially developed for this Updated Plan without modifications as agreed upon between SMCG member GHG compliance agencies.

## **Splitting Links at the non-MPO Boundary**

**Review Period: December 5, 2025 to December 15, 2025**

**Reviewing Agencies: DRCOG, NFRMPO, PPACG, GVMPO, PACOG**

Following interagency review and approval of the representation of the non-MPO area for the purposes of calculating GHG emissions, CDOT split the roadway links from the travel model at locations where portions of roadways extended outside of the non-MPO area into an MPO boundary. CDOT provided the MPOs with the statewide roadway network with the split links at the approved non-MPO boundary file and requested agencies to review that all links crossing outside of the non-MPO boundary had been correctly split at their boundary. No agencies provided comments that a link crossing into their MPO boundary from the non-MPO area as represented in the CDOT travel model had been incorrectly split.