Transportation Greenhouse Gas Report

July 20, 2022

Summary

The Colorado Department of Transportation's Regulation Governing Statewide Transportation Planning Process and Transportation Planning Regions (2 CCR 601-22, known as the Greenhouse Gas Planning Standard), adopted in December 2021, requires the DRCOG region to reduce surface transportation greenhouse gas emissions through the transportation planning process. **Through impactful changes to the 2050 Regional Transportation Plan (RTP) and a commitment to further action through a Mitigation Action Plan, the DRCOG region meets the rule's GHG emission reduction requirements for all staging years defined by the rule.**

The regulation (2 CCR 601-22, Section 8.02.6) establishes GHG emission reduction levels from an established baseline for four analysis years: 2025, 2030, 2040, and 2050. For the DRCOG region, baseline GHG values are established based on the defined transportation investments and planning assumptions identified in the 2050 Regional Transportation Plan adopted in April 2021. The target GHG emissions are determined by subtracting the Rule's GHG emission reduction levels from the total baseline emissions for each analysis year.

DRCOG meets the state GHG Rule emission reduction levels through a combination of several strategies and concepts, summarized as follows:

- Programmatic investment evaluation:
    - The adopted 2050 RTP includes over $1.34 billion in transportation investments associated with GHG emission reduction benefits not previously reflected in the travel model. The model has been updated to reflect these important investments.
- Project and program investment changes:
    - Reinvest funds from select roadway capacity projects to focus on multimodal elements and reduce the amount of increased roadway capacity;
    - Accelerate multiple bus rapid transit projects; and
    - Reallocate $900 million within the 2050 RTP's financial plan towards additional and accelerated regional complete streets and other multimodal programmatic investments.
- Updates based on observed data:
    - Minor geographic adjustments to the household growth forecasts based on observed residential construction occurring at higher densities than originally forecast; and
    - Updated work-from-home rates to reflect changes in behavior due to technological advancements, transportation demand management efforts, and the effects of the COVID-19 pandemic.
- Mitigation Action Plan:
    - A Mitigation Action Plan has been developed using the methods and processes in the Colorado Transportation Commission's Policy Directive 1610 (PD1610). The Mitigation Action Plan includes project types from Table 1 of PD1610 focused on parking management and rezoning in specific geographies (e.g., around rapid transit stations, vacant and underutilized land), as well as local adoption of complete streets ordinances and project implementation, and local adoption of multimodal design criteria/standards.

As shown in Table 1, DRCOG meets or exceeds the required GHG Reduction Levels in each staging year through these actions, demonstrating compliance with the GHG Planning Standard.

Table 1

GHG Emission Reduction Results (MMT per year)	2025	2030	2040	2050
2050 RTP Update Modeling (Network updates, programmatic funding, and observed data)	0.68	0.68	0.57	0.35
Additional programmatic transportation investments (Active transportation, complete street retrofits, signal timing, and CDOT Bustang)	N/A	0.07	0.05	0.03
Mitigation Action Plan (Commitment to further action in Appendix A)	0.02	0.10	0.12	0.08
Total GHG Reductions:	**0.70**	**0.83**	**0.72**	**0.46**
Reduction Level Requirement from GHG Rule Table 1 (2 CCR 601-22, Section 8.02.6)	**0.27**	**0.82**	**0.63**	**0.37**
Reduction Level Achieved	**Yes**	**Yes**	**Yes**	**Yes**

Purpose

The purpose of this report is to document DRCOG's process for complying with Colorado's greenhouse gas Transportation Planning Standard ("GHG Planning Standard"). The 2050 RTP was amended September 21, 2022, to meet the October 1, 2022 deadline specified in Colorado Revised Statutes §43-4-1103 and the Code of Colorado Regulations (2 CCR 601-22, Section 8.02.5.1)[1]. The analysis documented in this report demonstrates that the amended 2050 RTP complies with the regulation's requirements.

The demonstration is based on analysis conducted using the DRCOG's UrbanSim land use model and Focus travel demand model, and the Environmental Protection Agency's MOtor Vehicle Emission Simulator (MOVES) air quality model. GHG reductions that could not be sufficiently modeled, such as signal timing and additional multimodal corridor enhancements, were calculated off-model using methodologies defined by the Colorado Transportation Commission's Policy Directive 1610. Additionally, the DRCOG Board has adopted a Mitigation Action Plan (Appendix A) to meet the reduction levels of the regulation.

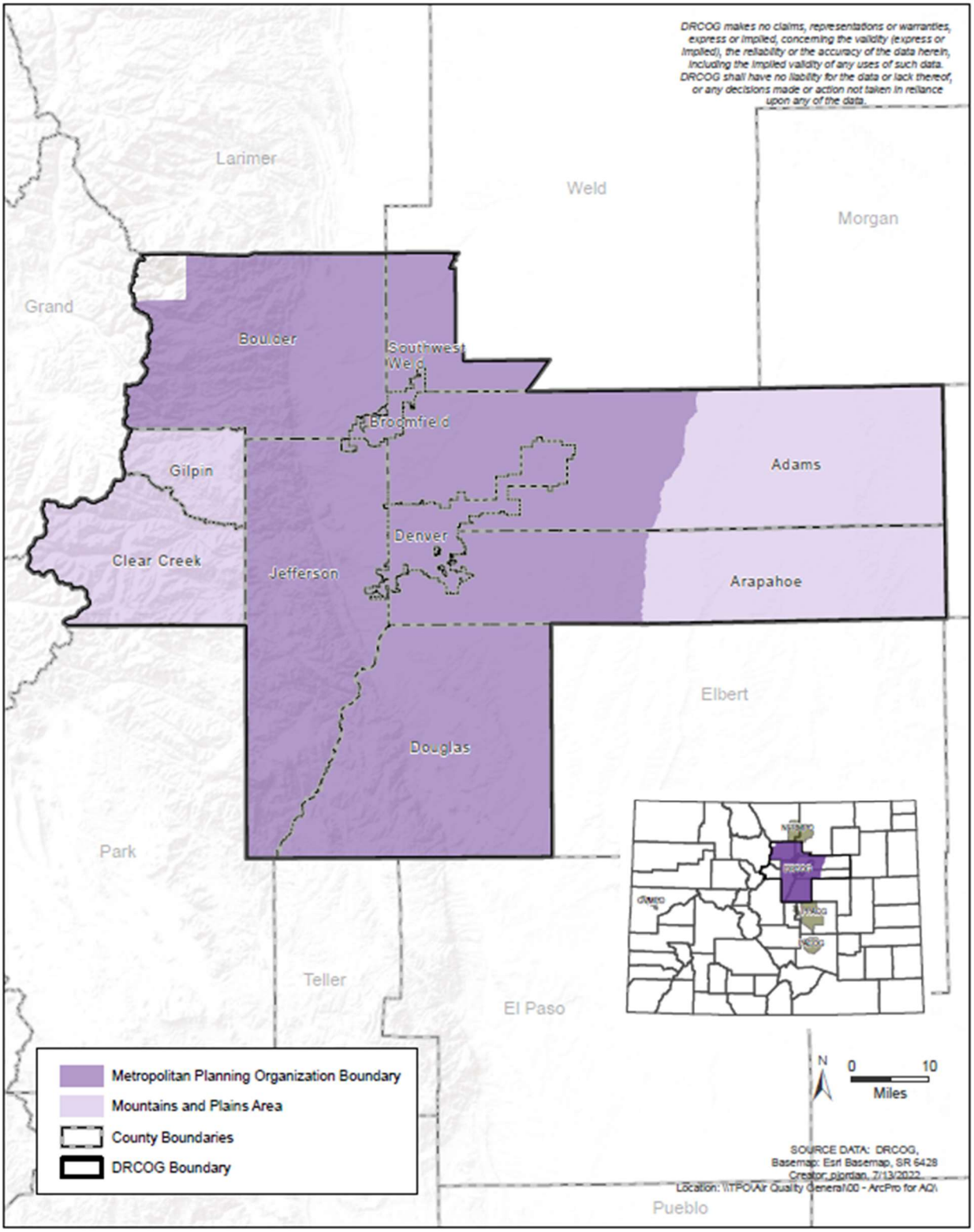
Background

Colorado SB21-260 ("Sustainability of the Transportation System") was enacted in June 2021. The bill directed the Colorado Department of Transportation to develop rules for the state and Colorado's five Metropolitan Planning Organizations (MPOs) to reduce surface transportation GHG emissions through transportation planning processes. Emission reductions due to vehicle technology, such as fuel efficiency and zero emission vehicles, are regulated in a separate process.

The Colorado Department of Transportation's Regulation Governing Statewide Transportation Planning Process and Transportation Planning Regions (2 CCR 601-22), adopted December 2021, established reduction levels of annual GHG in million metric tons for four future analysis years: 2025, 2030, 2040, and 2050. The rule applies to the MPO area within DRCOG which includes all, or portions of, eight counties as shown in **Figure 1**. This report presents the modeled total GHG emissions of future surface transportation associated with the 2022 Updated 2050 Regional Transportation Plan within the MPO area of DRCOG.

[1] Colorado Department of Transportation, "Rules Governing Statewide Transportation Planning Process and Transportation Planning Regions: 2 CCR 601-22", Accessed on 6/14/2022 from https://www.codot.gov/programs/environmental/greenhousegas/assets/5-2-ccr-601-22_final_clean.pdf.

Figure 1. The DRCOG Region



DRCOG's Role

The Denver Regional Council of Governments is a planning organization where local governments collaborate to establish guidelines, set policy, and allocate funding in the areas of transportation and personal mobility, growth and development, and aging and disability resources. The Denver region is a dynamic region of 3.4 million people and 58 communities anchoring Colorado's Front Range. Consistently rated one of the best places to live in the country, the region will add a million more people and half a million more jobs by 2050.

The DRCOG region includes Adams, Arapahoe, Boulder, Clear Creek, Douglas, Gilpin and Jefferson counties, the City and County of Denver, the City and County of Broomfield and southwest Weld County. DRCOG is also the federally designated Metropolitan Planning Organization (MPO) for the Denver region, meaning DRCOG leads multimodal transportation planning activities in cooperation with CDOT, RTD, and other stakeholders.

For over 25 years, the Denver Regional Council of Governments has been actively involved in efforts to reduce the amount of motor fuel burned, vehicle miles traveled, and associated greenhouse gas emissions. This task is made challenging due to the region's growth . However, DRCOG remains strongly committed to efforts to reduce GHG emissions and has invested significant funding towards those efforts for many years.

DRCOG's Planning Documents

DRCOG, in conjunction with its direct MPO partners CDOT and RTD, prepares and routinely updates three key planning documents:

Metro Vision

In addition to its role as an MPO, DRCOG serves as a regional planning commission (RPC) under Colorado statutes. Metro Vision fulfils DRCOG's duty as an RPC to make and adopt a plan for the physical development of the region. As such, it reflects the long-range vision for the Denver region, establishing a set of shared outcomes and objectives that provide guidance and a framework for regional and local planning priorities, including the region's shared multimodal transportation planning priorities. While providing guidance and numerous example initiatives for regional and local implementation, Metro Vision acknowledges the unique characteristics and contributions of the region's 58 local governments.

To monitor progress towards Metro Vision outcomes the DRCOG incorporated VMT and GHG reduction targets, along with several other performance measures, into the plan – first in 2011 and again in the 2017 update. DRCOG continues to monitor and make progress towards these targets with strategic initiatives to achieve the shared outcome.

2050 Metro Vision Regional Transportation Plan (2050 RTP)

The 2050 RTP helps DRCOG and its many partners implement the shared aspirational vision of Metro Vision by identifying specific project and program investment priorities for the region's multimodal transportation system and its operations. It identifies six priorities: multimodal mobility, safety, air quality, regional transit, freight, and active transportation. The RTP identifies investments and regionally significant projects expected to be funded with "reasonably expected" future revenues, looking forward 30 years into the future. The 2050 RTP balances planning for an additional million residents in the region while also maintaining the current transportation system and expanding travel options.

Transportation Improvement Program

The TIP is a 4-year program of specific state and federally funded projects and programs to be implemented by CDOT, RTD, local governments, DRCOG, and other partner agencies. The process to evaluate projects selected to receive

DRCOG-administered funds has always included criteria associated with the reduction of VMT and GHG emissions. This includes application questions on air quality reduction, improving multimodal mobility and connectivity, expanding transit, increasing safety, and reducing congestion delays.

Historically, DRCOG allocations have gone towards the following project types that work towards reducing VMT and GHG emissions:

- Active Transportation Projects- new and upgraded facilities
- Transit funding- including capital purchases, new and expanded service operations, BRT infrastructure, and passenger facilities.
- Grants for station area, transit-oriented development, and urban center planning
- Direct funding to support air quality improvement programs through the Regional Air Quality Council
- Congestion management initiatives, including:
    - DRCOG's Way to Go Program
    - TDM Partnerships and non-infrastructure projects
    - Transportation operations- traffic signal system upgrades, signal corridor retiming, ITS infrastructure
    - Car, van, and school pool programs
    - One of the nation's largest Bike to Work Day programs
- Roadway operational improvement projects

It should be noted DRCOG administers a small percentage of total transportation funds within the region used to build, operate and maintain the region's transportation system. Over 95% of funding is administered by CDOT, RTD, toll authorities, and local governments.

Modeling GHG Emissions

Three models are used in combination to estimate GHG emissions from surface transportation activity in the Denver Region: UrbanSim (land use), Focus (travel), and MOVES (emissions). DRCOG, the Colorado Department of Public Health and Environment, and CDOT have entered into a Modeling Intergovernmental Agreement that outlines each agency's responsibilities for the execution of models used for the GHG emissions analyses which can be found as **Appendix F.**

UrbanSim Model

To understand how demands on the transportation system will change between now and 2050, DRCOG must forecast how growth and development will affect the distribution of households and jobs throughout the region. The State Demography Office in the Colorado Department of Local Affairs forecasts future population, household and job levels at the state and county-level. DRCOG uses the county-level growth forecast from the State Demographer and applies a predictive model, the UrbanSim block model, to simulate household and employment location choices with real estate market dynamics and within natural and regulatory constraints.

DRCOG relies on extensive feedback from local partners on preliminary model results to improve model inputs before finalizing household and employment forecasts across 2,804 Transportation Analysis Zones within the Denver region. With forecasts available for each Transportation Analysis Zone, DRCOG and its partners can model future travel demand between zones to anticipate the effects on the transportation network and vehicle emissions, as well as mobility and accessibility for people and freight. More details about the UrbanSim Model can be found in Appendix C.

DRCOG Regional Travel Demand Model

DRCOG's activity-based travel demand model, Focus, uses socioeconomic outputs from the UrbanSim model along with numerous travel, demographic, and human decision-making factors to represent an average weekday of travel within

the Denver region. Focus is calibrated to data obtained from regional and national travel surveys, along with several other data sources, to replicate the 15.3 million person-trips made every weekday on the regional transportation system. The model replicates the planned transportation system and land use attributes to generate trips across travel modes and assigns applicable trips to the roadway and transit network. The Focus model is calibrated to match real world observations of traffic volumes, transit boardings, and numerous other travel, demographic, and trip mode data metrics.

The key use of the Focus Model is to forecast future travel metrics based on changes to the Denver region's population, employment, and transportation system. Appendix B shows some of the key travel model outputs for both the baseline and compliance model runs. Appendix C provides more detailed information about the Focus Model.

MOVES Emissions Model

The Focus model does not calculate GHG emissions. The US Environmental Protection Agency created the Motor Vehicle Emission Simulator (MOVES) model to estimate transportation emissions for various pollutants from surface transportation, including GHGs. To calculate GHG emissions for the Denver MPO area, region-specific inputs to the MOVES model are developed and maintained by the Colorado Department of Public Health (CDPHE).

Key inputs to the MOVES model to calculate GHG emissions include:

- Traffic volumes and speeds by time of day from the Focus travel model
- Number, type, and age of vehicles in the regional vehicle fleet
- Vehicle fleet mix by roadway type
- Meteorological conditions
- Fuel economy of vehicles (miles per gallon)
- Increase of electric and other non-internal combustion engine motor vehicles

Further documentation of the MOVES model is provided in Appendix D.

GHG Emissions Analysis Process and Results

Setting the Baseline

To establish the GHG emission baseline, DRCOG followed the guidance found in 2 CCR 601-22, Section 1.04 which defines the baseline as: "For each MPO area and for the Non-MPO areas of the state, for each of the model years 2025, 2030, 2040, and 2050: the GHG emissions, in million metric tons (MMT), produced by the most recently adopted model for that area… as of the effective date of this rule."

For DRCOG, the "most recently adopted model" is the 2050 RTP adopted in April 2021. As adopted, the 2050 RTP identifies the regionally significant transportation investments through the year 2050 along with other planning assumptions, such as demographic data, land use information, travel costs and travel time changes. The final baseline values, shown in Table 2, were derived from running the most current version of the UrbanSim, Focus, and MOVES models, with the network and land use planning assumptions as adopted in April 2021 for the 2050 RTP.

Table 2. DRCOG GHG Baseline by Analysis Year (MMT)

	2025	2030	2040	2050
GHG Baseline (RTP Adopted April 2021)	10.50	9.23	6.22	3.70

Reduction Requirement from GHG Rule Table 1	0.27	0.82	0.63	0.37

The large decrease in baseline GHG emissions over time is due to the CDOT's estimates for large increases in the share of electric vehicles into the overall fleet.

Modeling the 2022 Updated 2050 RTP

To comply with the GHG rule and reduce future surface transportation GHG emissions, DRCOG committed to meaningful changes to planned regionally-significant transportation projects, analyzed the effects of programmatic investments, and reevaluated land use and travel parameters in light of more recent observed data. Through this process, DRCOG engaged the public and stakeholders to determine the changes.

Project and program investment changes

DRCOG, CDOT, and other project stakeholders have proposed modifications to select 2050 RTP projects (CDOT-directed funds and DRCOG-directed funds) to accomplish the following:

- Freeway managed lane projects: modify C-470 and Central I-25 projects to focus on safety, operational, transit, and other multimodal aspects and associated GHG benefits; redirect/finance CDOT funds to advance BRT corridors and fund additional regional multimodal programmatic investments as shown in Table 3.
- DRCOG-directed funded roadway projects: modify the scope of several projects to remove "6 laning" components and re-focus those projects on multimodal, safety, and complete streets investments as shown in Table 3.
- Bus Rapid Transit (BRT) network: advance four BRT corridors and complete five BRT corridors by 2030: East Colfax, East Colfax Extension, SH-119, Federal, and Colorado; advance Broadway/Lincoln BRT corridor from 2040-2050 to 2030-2039 as listed in Table 3.
- Additional Multimodal programmatic investments: re-allocate and finance $900 million made available through the specified project changes to fund additional multimodal programmatic investments ($500 million by 2030, $200 million more by 2040, $200 million more by 2050). A summary of the program investment changes is shown in Table 4.

These changes also incorporate sponsor-requested project-based amendments as part of DRCOG's routine call for amendments to the 2050 RTP.

Table 3. Proposed Project Modifications: Cycle Amendments and GHG Analysis

DRCOG 2050 Regional Transportation Plan
Proposed Project Modifications: Cycle Amendments & GHG Analysis

Last Revised: June 28, 2022

Project Name/Corridor	Location/Limits	Current 2050 RTP Project Description	Proposed Project Change/Description
I-70 Floyd Hill Eastbound	Floyd Hill to Veterans Memorial Tunnel	Eastbound interchange improvements with frontage road extension from Hidden Valley interchange to US 6 interchange	Process requested amendment. Move from 2030-2039 stage to 2020-2029 stage
I-70 Floyd Hill Westbound	Floyd Hill to Veterans Memorial Tunnel	Addition of a new express travel lane from the top of Floyd Hill to Veterans Memorial Tunnels, and eastbound auxillary lane from the bottom to top of Floyd Hill	Process requested amendment. Move from 2030-2039 stage to 2020-2029 stage
I-270	I-25/US 36 to I-70	New managed lanes	Process requested amendment. Move from 2030-2039 stage to 2020-2029 stage
C-470	Wadsworth to I-70	New managed lanes	Remove managed lanes component; complete interchange complex reconstruction and then reassess need for new managed lanes
	U.S. Route 285/Morrison/Quincy	Interchange complex reconstruction	
I-25 Central Buildout	Colfax Ave. to 20th St.	Ultimate buildout of corridor improvements	Re-scope corridor to focus on transit network improvements, safety, operations, multimodal mobility; community re-connections; advance I-25/Speer/23rd Ave. safety/operational improvements; advance safety & operations improvements, Santa Fe to Colfax
I-25 Valley Highway/Burnham Yard	Santa Fe Blvd. to Colfax Ave.	Managed lanes, includes right-of-way, Burnham Yard, Central Main Line relocation	
Broncos Pkwy./Easter/Dry Creek Corridor	Parker Rd. to Havana	Widening to 6 lanes, bridge widening and intersection improvements	Widen to 4 lanes; bridge, multimodal corridor and intersection improvements
Gun Club Rd.	State Hwy. 30 to 6th Ave.	Widen from 2 to 4/6 lanes, includes stream crossing upgrade at Coal Creek	Widen from 2 to 4 lanes, includes stream crossing upgrade at Coal Creek, multimodal corridor improvements; advance stage period
Gun Club Rd.	Quincy to Aurora Pkwy.	Widen from 2 to 6 lanes	Widen from 2 to 4 lanes, multimodal corridor improvements
Smoky Hill Rd.	Buckley Rd. to Picadilly St.	Widen from 4 to 6 lanes	Multimodal corridor improvements [Note: corridor remains at 4 lanes]; potentially advance stage period
State Hwy. 30	Airport Blvd. to Quincy Ave.	Widen from 2 to 6 lanes	Widen from 2 to 4 lanes, multimodal corridor improvements; potentially advance stage period
Lincoln Ave.	Oswego to Keystone	Widen 4 to 6 lanes	Multimodal corridor improvements [Note: corridor remains at 4 lanes]; potentially advance stage period
SH-66	Lyons to Longmont	Widen from 2 to 4 lanes (Hover St. to Main St.) and operational/safety improvements from Lyons to Longmont in alignment with PEL	Process requested amendment. Split project between the 2020-2029 (Hover to Main) and 2030-2039 (Lyons to Hover) stage periods
South Platte River Trail		Complete missing links and upgrade trail section	Process requested amendment. Split project cost between the 2020-2029 and 2030-2039 stage periods
Broadway/Lincoln BRT	Colfax to Highlands Ranch Pkwy.	Bus rapid transit service and supporting safety/multimodal improvements	Advance BRT implementation from 2040-2050 stage period to 2030-2039 stage period
Federal Blvd. BRT	120th to Santa Fe/Dartmouth	Bus rapid transit service and supporting safety/multimodal improvements	Process requested amendment. Advance BRT implementation from 2030-2039 stage period to 2020-2029 stage period
State Hwy. 119 BRT	Downtown Boulder to downtown Longmont	Bus rapid transit service and supporting safety/multimodal improvements	Process requested amendment. Advance BRT implementation from 2030-2039 stage period to 2020-2029 stage period
Colfax Ave. Ext. BRT	I-225 to E-470	Bus rapid transit service and supporting safety/multimodal improvements	Potentially advance stage period (currently 2040-2050 stage period)

Representation of Adopted 2050 RTP Programmatic Funding

As adopted in April 2021, DRCOG's fiscally constrained 2050 RTP contains over $15 billion in regional programmatic funding. These investments are shown as lump sums across various programs and individual projects are not yet identified in these programs. Programmatic funding categories include transit investments, active transportation, safety/Vision Zero, transportation demand management, and ITS investments, all of which are key strategic investments to improve the region's multimodal transportation system, improve air quality and reduce GHG emissions.

DRCOG staff evaluated the programmatic RTP funding, which was not yet reflected in the travel model, and determined there were approximately $1.34 billion dollars of investment associated with GHG emission reductions. Based on this information and in coordination with CDOT and North Front Range MPO travel modelers, DRCOG staff developed a method to reflect these investments in the travel model. **Appendix D** provides more detailed information about the RTP funding and the modeling process for GHG emissions analysis, including the research and CDOT guidance that supports these changes.

Updates reflecting new observed data

DRCOG compiles point-level housing data from a variety of local and proprietary sources. When the 2050 RTP was adopted in 2021, the most recent observation available was 2018. This was the same for point-level employment data licensed from the Colorado Department of Labor and Employment and subject to additional processing and cleaning at DRCOG. DRCOG staff use this data as a supplementary UrbanSim model input applied during the scheduled development step. DRCOG was able to incorporate housing and employment data through 2020, along with preliminary data from proprietary housing datasets to update those observations into 2022. DRCOG staff also incorporated insights from these same proprietary housing datasets to include anticipated housing construction through 2028. To accommodate these observations of more multifamily housing in more dense locations and counties, DRCOG staff had to make several adjustments to the previous county forecasts.

Additionally, factors influencing work-from-home rates were updated to reflect observed changes in behavior due to technological advancements, transportation demand management efforts from DRCOG and DRCOG's partners, and the effects of the COVID-19 pandemic. Further description of the model updates can be found in Appendix D.

Emission Results

Table 5 shows the modeling results for the 2022 Amendments to the 2050 RTP with the GHG emission reductions from the baseline. Only in 2025 do the modeling results meet the GHG reduction levels on their own. Because the modeling of the 2022 Updated 2050 RTP did not achieve the Rule's reduction levels, DRCOG incorporated additional transportation investments that were evaluated using "off model" calculations to achieve further emission reductions.

Table 5. GHG Emission Results (MMT per year)	**2025**	**2030**	**2040**	**2050**
GHG Baseline (RTP Adopted April 2021)	10.50	9.23	6.22	3.70
2022 Updated 2050 RTP	9.82	8.55	5.65	3.35
GHG Reduction from 2022 Updated 2050 RTP Modeling:	**0.68**	**0.68**	**0.57**	**0.35**

Additional Programmatic Investment

In addition to modeling the GHG reductions associated with the programmatic (non-project specific) investments in the 2050 RTP as adopted, DRCOG also worked with CDOT to re-allocate $900 million in the 2050 RTP's fiscally constrained financial plan towards additional programmatic investments to help meet the GHG reduction levels for each analysis year, especially for 2030. Additionally, $190 million in 2050 RTP-adopted programmatic funding remained from the representation of programmatic funding in the Focus model described above and was also included in this analysis, for a total of $1.09 billion

Because the GHG technical analysis indicated particular difficulty with attaining the 2030 reduction levels, the $1.09 billion in programmatic funding was allocated as follows:

the 2030 analysis year reduction levels Accordingly, the additional $900 million was apportioned as follows:

- 2030: $605,000,000
- 2040: 242,000,000
- 2050: 242,000,000

The first step was to compare the programmatic categories in Table 3.1 of the adopted 2050 RTP with the mitigation measures in PD 1610 since the GHG reduction calculations for each type of programmatic investment used PD 1610's scoring and calculation methodologies. Based on this comparison, the following PD 1610 measures were used to represent the additional programmatic investment:

- Signal timing
- CDOT Bustang expansion within DRCOG MPO area
- Bicycle/pedestrian facility (primarily urban and suburban)
- Sidewalk/pedestrian facility (urban, suburban)
- Shared-use path (urban, suburban, and rural)

- Complete streets retrofits (urban, suburban)

Each programmatic investment category is described below.

Additional Signal Timing

Since 1989, DRCOG has been working with CDOT and local governments to coordinate traffic signals across jurisdictional boundaries on major roadways in the region. DRCOG has a proven record and the resources to continue to reduce traffic congestion and improve air quality through signal timing coordination plan development support.

The 2022 Updated 2050 RTP increases investments in the Regional Traffic Operations Program above this baseline to retime and optimize an additional 50 signals per year beginning in 2025. Calculations for GHG emission reductions associated with this effort were made using the method described in PD1610. GHG emission reductions are calculated per 10,000 Average Annual Daily Traffic (AADT) per signal optimized within five years prior to evaluation year. The emission reduction value declines over time due to increasing electric vehicles in the fleet and the calculations include an induced demand factor.

Table 7 shows the calculated GHG emission reduction for 2030, 2040, and 2050 based on 250 signals (50 per year) optimized during the five years preceding the analysis year and with an average AADT per signal of 45,000.

Table 6. GHG Emission Results (MMT per year)	2025	2030	2040	2050
GHG Emission Reductions from Additional Signal Timing	N/A	0.05	0.03	0.02

CDOT Bustang Expansion within DRCOG MPO Area

CDOT indicated to DRCOG that as part of its own GHG Rule compliance, it intends to expand Bustang service over time, including within the DRCOG MPO area. According to CDOT, its approach apportions the daily bus vehicle revenue miles (VRM) of the Bustang expansion within each MPO boundary, as well as by route, since different patterns of weekday and weekend service for the routes will require different annualization factors. The West Line and the Outrider Routes have the same schedule 7 days a week - suggesting that 365 is a reasonable annualization factor. The South Line to Denver Union Station and North Line have 1/3 the number of round trips on weekends compared to week days (52 weeks * 5 weekdays = 260 days, plus 1/3 weighing to 52 weekends -> 104/3 - 34.67, so 260+34.67 = 204.67 as an annualization factor). The Colorado Springs to DTC route only operates on weekdays, so a 260 annualization factor is most appropriate.

Table 7. GHG Emission Results (MMT per year)	2025	2030	2040	2050
GHG Emission Reductions from Increased Bustang Service within DRCOG MPO Area	N/A	0.003	0.001	0.001

Bicycle and Pedestrian Facilities and Complete Streets Retrofits

DRCOG staff analyzed its Regional Active Transportation Plan in terms of the Plan's envisioned regional network buildout, such as for the Regional Active Transportation Network as well as proposed on-street facilities. DRCOG staff also reviewed its Complete Streets Toolkit and deployed its complete streets GIS prioritization tool developed under guidance from the federal Bipartisan Infrastructure Law to estimate the potential for complete street retrofits throughout the region for each analysis year. Using PD 1610's methodology, the mileage associated with each

investment is multiplied by a point factor ranging from 1.0 to 3.5 to estimate the total points for each category. Each point equals one metric ton of GHG reduction.

Table 8. GHG Emission Results (MMT per year)	2025	2030	2040	2050
Bicycle/Pedestrian Facilities, Complete Street Retrofits	N/A	0.02	0.02	0.01

Considering all of the additional programmatic investments together, Table 9 shows the total estimated GHG reductions for each analysis year (in MMT). While the total reduction amounts are modest, they are an important component of the overall framework to demonstrate compliance with the GHG Rule. Perhaps even more importantly, the represent important needed investment in the region's multimodal transportation network.

Total Emission Reductions from Off Model Calculations

Table 9. GHG Emission Results (MMT per year)	2025	2030	2040	2050
GHG Emission Reductions from Additional Signal Timing	N/A	0.05	0.03	0.02
GHG Emission Reductions from Increased Bustang Service within DRCOG MPO Area	N/A	0.003	0.001	0.001
Pedestrian Facilities, Complete Street Retrofits	N/A	0.02	0.02	0.01
Total Additional Programmatic Investment GHG Reduction Calculations:	N/A	0.07	0.05	0.03

Mitigation Action Plan

To achieve additional emission reductions and meet the reduction requirements defined in the rule, DRCOG is pursuing a Mitigation Action Plan. The Mitigation Action Plan is detailed in Appendix A. DRCOG staff's commitment is to report annually on the progress of the measures listed in the Mitigation Action Plan, which include further commitments to land use planning efforts, complete streets standards, and other strategies to reduce GHG emissions from on-road transportation sources. A summary of the GHG reductions by staging period and strategy can be found in Table X.

		GHG Reduction - Metric Tons		
Measure		**2030**	**2040**	**2050**
Increase Residential Density from <10 units / acre to at least 15 to 25 units / acre		13,548	16,011	10,557
Increase Job Density from <0.5 FAR to at least 1.0 FAR		2,309	2,822	1,833
Mixed-Use TOD-higher intensity: Area rezoned for mixed-use TOD at least 25 units / acre and 150 jobs / acre		8,588	9,814	6,510
Mixed-Use TOD-moderate intensity: Area rezoned for mixed-use TOD at least 15 units / acre and 100 jobs / acre		18,397	21,157	14,455
Reduce or eliminate minimum requirements and set low maximum levels (residential)		37,750	43,795	29,573
Reduce or eliminate minimum requirements and set moderate maximum levels (residential)		18,332	21,281	14,347
Reduce or eliminate minimum requirements and set maximum levels (commercial)		4,373	3,940	3,511
Adopt local complete streets standards		369	243	44
Grand Total		**103,666**	**119,063**	**80,829**

Table 10. Reduction Through Mitigation Action Plan by Staging Year (MMT)

	2025	2030	2040	2050
GHG Reductions from Mitigation Action Plan (Commitment to further action in Appendix A)	N/A	0.10	0.12	0.08

Summary

DRCOG complies with the requirements of the rule for all staging periods through the revising the 2050 MVRTP and pursuing a Mitigation Action Plan. DRCOG will monitor changes in the region that would require a re-baselining in future years as well as the effectiveness of strategies. DRCOG will continue to demonstrate compliance with the rule in every RTP amendment cycle.

GHG Emission Reduction Results (MMT per year)	**2025**	**2030**	**2040**	**2050**
GHG Reduction from 2022 Updated 2050 RTP Modeling (Network updates, programmatic funding, and observed data)	0.68	0.68	0.57	0.35
Off Model GHG Reduction Calculations (Active transportation funds, signal timing, and Bustang)	0.06	0.05	0.03	0.02
GHG Reductions from Mitigation Action Plan (Commitment to further action in Appendix A)	0.02	0.10	0.12	0.08
Total GHG Reductions:	**0.76**	**0.83**	**0.72**	**0.46**

Reduction Requirement from GHG Rule Table 1 (2 CCR 601-22, Section 8.02.6)	**0.27**	**0.82**	**0.63**	**0.37**
Reduction Requirement Achieved	**Yes**	**Yes**	**Yes**	**Yes**

Public engagement

DRCOG conducted a 30-day public review period and held a public hearing on the amended 2050 RTP and accompanying air quality and greenhouse gas documents. Additionally, staff engaged with the Civic Advisory Group and presented to multiple groups.

For a full overview of the public engagement conducted during the amendment process, see Appendix C of the 2050 RTP.