COLORADO
Department of
Transportation

DATE: May 12, 2022

TO: STAC

FROM: Rebecca White, Director, Division of Transportation Development
Theresa Takushi, Greenhouse Gas Program Specialist
Herman Stockinger, Deputy Director

SUBJECT: **GHG Mitigation Measures Policy Directive**

Purpose

This memo provides an update on the development of the GHG Mitigation Measures Policy Directive (PD 1610) which is provided on the May Transportation Commission agenda for adoption.

Background

The GHG Rule requires that "...CDOT in consultation with the MPOs shall establish an ongoing administrative process and guidelines, through a public process, for selecting, measuring, confirming, verifying, and reporting GHG Mitigation Measures" (Section 8.02.4).

This month, CDOT staff will present an updated Draft GHG Mitigation Measures Policy Directive including updates to Appendix A with specific GHG Mitigation measures. The Transportation Commission will be asked to consider the PD for approval at the May Commission meeting.

Details

Staff sought input from the Metropolitan Planning Organizations, the State Interagency Consultation Team, and other stakeholders and provided for a 45-day review by the Air Pollution Control Division as required in the Rule.

Following the March and April Transportation Commission workshops, and with specific guidance from the Ad Hoc Committee, CDOT staff is now bringing forward the final Draft Policy Directive which includes both a broader framework and guidance as well as an Appendix listing specific GHG Mitigation Measures, their scores, and the calculation methodology behind the scores. The calculation methodology outlined is based on the state of the practice and cites the best thinking and information on this work available nationwide. The scores associated with each GHG Mitigation Measure are based on actual GHG reductions, where 1 point is equivalent to 1 ton of CO2 reduced.

The main sections of the Draft Policy Directive include:

1. Process for Establishing GHG Mitigation Measures
2. Broad overview of scoring approach for GHG Mitigation Measures
3. Mitigation Action Plan Requirements
4. Mitigation Action Plan Status Report
5. Appendix - Approved GHG Mitigation Measures

Next Steps

Development of this Policy Directive is a critical component of implementing the GHG Rule. By October 1, 2022, CDOT, DRCOG and NFRMPO must update their plans pursuant to the requirements of the rule and demonstrate compliance with the GHG reduction levels. Each agency must submit a GHG Transportation Report to the Commission, demonstrating the emissions analysis for their regions and, if necessary, a Mitigation Action Plan which details mitigation measures used to help them meet their reduction levels.

Attachments

- Slide presentation
- Draft GHG Policy Directive including Appendix A (GHG Mitigation Measures)

COLORADO
Department of Transportation

GHG Pollution Standard for Transportation Planning:
Policy Directive 1610.0

May, 2022

GHG Mitigations Background

- GHG mitigation strategies are a key concept within the GHG Rule providing another pathway toward meeting the GHG reduction levels in the Rule.
- GHG Mitigation Measures are those that can't be effectively modeled YET or are too small to be captured.
- At March's Transportation Commission meeting it was decided that all of this detailed work would live in a single Policy Directive to be adopted by the Commission.
- This Policy has been drafted as Policy Directive 1610.0.

Structure of Proposed Final PD 1610.0

Narrative

A. Overall Process for Establishing GHG Mitigation Measures
B. Process for Scoring Approved Mitigation Measures
C. GHG Mitigation Action Plan Requirements
D. GHG Mitigation Measure Status Report

Appendix A

Table 1: Measures and points/metric in each compliance year

Tables 2-8: Point estimate calculation methodologies for each category

Table 9: Sources

Mitigation Categories - and some examples

Bike/Ped

- Build new bike lanes and sidewalks
- “Complete Streets” reconstruction

Transit

- New/expanded bus service
- Reduce transit fares

MD/HD Electrification

- Rebates/incentives for depot charging

Travel Demand Management

- Telework
- Commute Trip Reduction programs

Operations

-Retime/optimize arterial signals

-Roundabouts

Parking Management

-Additional fee on parking

-Unbundle residential parking

Land Use

-Increase residential density

-Increase job density

Stakeholder Involvement

- Staff has been following the process outlined in the Rule in developing this PD as well as engaging broadly with stakeholders in the same spirit that guided the Rule's development.

- Interagency Consultation Team (MPOs, CEO, CDPHE, CDOT and local representatives)
  - Established in Rule
  - Consulted regularly throughout PD development
  - Will be asked on 5/16 to provide a recommendation to the Commission on the PD

- Review by the Air Pollution Control Division
  - 45-day review period per Rule
  - Drafts and updates provided to Division beginning on 3/24
  - On 5/4 staff received a formal response letter from APCD with requested changes and clarifications

- Other stakeholder engagement
  - Weekly meetings with CDPHE/APCD and CEO
  - Presentations and conversations with STAC, MPO committees, non-profits, etc
  - Internal meetings with CDOT regions and divisions

Stakeholder Input

APCD Comments

- More specificity around timeline for determining effectiveness of measures
  - Evaluation of GHG effectiveness against predicted achievement required by end of 2026
- Include more info/definitions within tables on specific measures and methodology
  - Accepted
- Ensure measures are “tracked” over time
  - Additional detailed requirements for Mitigation Action Plan (Table 2)
- Demonstrate additionality (measures don’t double count reductions)
  - New language added to Table 2 defining how additionality is determined (in reference to GHG Roadmap)

Stakeholder Input

IACT

- Flexibility to use measures not contemplated in "Appendix A" of PD
  - Mitigation Measures outside Appendix A may be included in a Mitigation Action Plan if verified as outlined in a new section (provision will be revisited in one year to see if necessary and beneficial)
- Take credit for independent local measures
  - Local, independent measures can be included IF listed within Appendix A and is considered additional if it is not currently listed as a specific and quantified action in the GHG Roadmap
- Allow for local and program specific info to be included in methodology
  - Provided as easy-to-use tool in transit
  - Also created process to substitute specific local data for the inputs and parameters that form the basis of the calculation methodologies of the strategies in Appendix A
- Ability to have minor changes made to Appendix A without TC approval
  - Not accepted, all changes constitute an amendment
- Maximize number of measures
  - ~Approx 50 included

Stakeholder Input

- Other Input
  - Remove light duty electrification measures
    - Accepted
  - Require some connection to local measures and geographic nexus between mitigation and projects
    - For future discussion; difficult given long-term nature of plans
  - Include minimum standards for bike lanes
    - Consider for next update
  - Set timeline for including methods to prioritize localized benefits to DICs
    - Resolution commits to amendment by end of 2022
  - Inclusion of induced demand when assigning scores to operational measures
    - Included for signal timing, roundabouts have no data to show travel time savings
  - Clean construction measures need further review
    - Removed for current version; will be developed with CDOT staff

Status & Next Steps

The PD reflects substantial effort and stakeholdering over the last several months and staff believes it is ready for TC review and adoption.

Commission adoption this month provides certainty for the three agencies required to comply with the Rule by October 1, 2022.

- By October 1,2022, CDOT, DRCOG and NFRMPO must update their plans pursuant to the requirements of the rule and demonstrate compliance with the GHG reduction levels.
- Each agency must submit a GHG Transportation Report to the Commission, demonstrating the emissions analysis for their regions and, if necessary, a Mitigation Action Plan which details mitigation measures used to help them meet their reduction levels.

Status & Next Steps

Because this work is without precedent, staff anticipates that a series of amendments will be needed over the coming months and years as we receive better information and experience implementing the PD. This effort could be seen as a series of “phases”:

Phase I - May 2022 - PD adopted by TC establishing overall guidance, structure and a detailed and quantified list of approx 50 measures.

- Possible small amendments in June if necessary

Phase 2 - December 2022 - PD amended to include:

- Equity scoring/considerations
- New measures identified by agencies or through research
- Modifications/error corrections

Phase 3 - 2023 - Amendments based on implementation experience

Phase 4 - 2024/2025 - Amendments based on PACOG/PPACG/GVMPO input

Phase 6 - 2026/2027 - Amendments based on evaluation of real-world effectiveness

Questions?

DRAFT
May 11, 2022

COLORADO DEPARTMENT OF TRANSPORTATION	X POLICY DIRECTIVE □ PROCEDURAL DIRECTIVE
Subject **Greenhouse Gas Mitigation Measures**	**1610.0**

Effective	Supersedes	Originating Office
5/01/22	**New**	**Division of Transportation Development**

I. PURPOSE

The purpose of this Policy Directive is to fulfill the requirements of the Rules Governing Statewide Transportation Planning Process and Transportation Planning Regions (the Rule), which directs the Colorado Department of Transportation (CDOT), in consultation with the Metropolitan Planning Organizations (MPOs), to establish an ongoing administrative process and guidelines for selecting, measuring, confirming, verifying, and reporting Greenhouse Gas (GHG) Mitigation Measures. CDOT and MPOs may use GHG Mitigation Measures in order to assist them in meeting the Regional GHG Planning Reduction Levels in 2 CCR 601-22. This Policy Directive sets forth the intent and principles of GHG mitigations and the process for establishing, tracking, and verifying mitigation measures. It further establishes the quantification methodology and the associated GHG reductions/scores for each measure.

II. AUTHORITY

Transportation Commission pursuant to § 43-1-106 (8)(a), C.R.S.
§ 43-1-128, C.R.S.
2 CCR 601-22, Rules Governing Statewide Transportation Planning Process and Transportation Planning Regions (the "Rule").

III. APPLICABILITY

This Policy Directive shall apply to all CDOT Divisions, Regions, Branches, and Offices as well as to the state's current five MPOs: Denver Regional Council of Governments (DRCOG), North Front Range Metropolitan Planning Organization (NFRMPO), Pikes Peak Area Council of Governments (PPACG), Grand Valley Metropolitan Planning Organization (GVMPO), and

Pueblo Area Council of Governments (PACOG), as well as any MPOs created during the lifetime of the Rule.

IV. BACKGROUND

The broad purpose of this Policy Directive is to help achieve the objectives of the Rule, which is intended to reduce greenhouse gas (GHG) emissions from the transportation sector. Specifically, the Policy Directive fulfills the following requirement within 2 CCR 601-22, Section 8.02.4:

> "By May 1, 2022, CDOT in consultation with the MPOs shall establish an ongoing administrative process and guidelines, through a public process, for selecting, measuring, confirming, verifying, and reporting GHG Mitigation Measures. CDOT and MPOs may incorporate one or more GHG Mitigation Measures into their plans in order to assist in meeting the Regional GHG Planning Reduction Levels in Table 1. Such a process and guidelines shall include, but not be limited to, how CDOT and MPOs shall determine the relative benefits and impacts of GHG Mitigation Measures, and measure and prioritize localized benefits to communities and Disproportionately Impacted Communities in particular. The mitigation credit awarded to a specific solution shall consider both regional and community benefits."

GHG Mitigation Measures are an important, but voluntary, component of the Rule as they provide an additional option to demonstrate compliance with the GHG Reduction Levels (Table 1). For this reason, the GHG reductions achieved by Mitigation Measures must be real, additional, quantifiable, and verifiable. GHG Mitigation Measure will be considered additional if it is not currently listed as a specific and quantified action in the GHG Roadmap or captured in an agency's model. The Mitigation Measures included in this Policy Directive--and the scores or reduction levels assigned to these measures--are based on the best available research, calculation methodology and forecasting tools available nationwide.

It also is important to understand how Mitigation Measures relate to transportation plans ("Applicable Planning Documents" in the Rule), which include a range of projects-- from roadway expansions to new transit and bike lanes. The Rule requires CDOT and MPOs to model "at a minimum… Regionally Significant Projects" to demonstrate compliance. The words "at a minimum" give the flexibility to model projects that are <u>not</u> Regionally Significant. This approach has the benefit of providing a full analysis of all the projects within a plan and, further, of realizing the benefits of a model to capture the interrelationships of these strategies across the transportation network. However, not all projects can be accurately modeled yet. This is either because they are too small to be detected within a model (e.g. a segment of bike lane)

or are beyond the current overall capability of an agency's model. Thus, this Policy largely focuses on GHG Mitigation Measures that cannot yet be accurately quantified within CDOT or an MPO's travel demand modeling runs. The Commission recognizes that this dynamic will change over time. As models continue to improve, transportation system elements currently treated as mitigation measures may be incorporated into the models which may require amendments to this Policy.

V. DEFINITIONS

The defined terms in this Policy Directive have the same meaning as in the Rule except as explicitly set forth herein. Some definitions are repeated here for convenience.

"Applicable Planning Document", as stated in the Rule (1.02), are MPO Fiscally Constrained Regional Transportation Plan (RTP), Transportation Improvement Program (TIP) for MPOs in Non-Attainment Areas, CDOT's 10-Year Plan and Four-Year Prioritized Plan in Non-MPO areas, and amendments to the MPO RTPs and CDOT's 10-Year Plan and Four-Year Prioritized Plan in Non-MPO areas that include the addition of Regionally Significant Projects.

"Disproportionately Impacted Communities", as stated in the Rule (1.11), is defined in § 24-38.5-302(3), C.R.S. as a community that is in a census block group, as determined in accordance with the most recent United States Decennial Census where the proportion of households that are low income is greater than forty percent (40%), the proportion of households that identify as minority is greater than forty percent (40%), or the proportion of households that are housing cost-burdened is greater than forty percent (40%).

"Greenhouse Gas (GHG)", as stated in the Rule (1.16), are pollutants that are anthropogenic (man-made) emissions of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, nitrogen trifluoride, and sulfur hexafluoride

"Greenhouse Gas (GHG) Mitigation Measures", as stated in the Rule (1.18) or "Mitigation Measures", are non-Regionally Significant Project strategies that reduce transportation GHG pollution and help meet the GHG Reduction Levels.

"Greenhouse Gas (GHG) Reduction Level", as stated in the Rule (1.17), is the amount of the GHG expressed as CO2e reduced that CDOT and MPOs must attain through transportation planning.

"GHG Transportation Report" is the report that is required to be submitted as part of the Rule which shows compliance toward meeting the reductions levels.

"Metropolitan Planning Organization" or "MPO", as stated in the Rule (1.28), is an organization designated by agreement among the units of general purpose local governments and the Governor, charged to develop the Regional Transportation Plans (RTPs) and programs in a Metropolitan Planning Area pursuant to 23 U.S.C. § 134. Colorado currently includes five designated MPOs: DRCOG, PPACG, PACOG, GVMPO and NFRMPO.

"Mitigation Action Plan" (MAP) is an element of the GHG Transportation Report that specifies which GHG Mitigation Measures shall be implemented that help achieve the GHG Reduction Levels.

"Off-Model" means tools are better suited to use independent of the travel model, including calculation methodology in order to quantify or estimate the effects of GHG reductions.

"Policy Directive" is a document adopted by the Transportation Commission that specifies organizational and Commission goals and policies and is used to help implement the Rule.

"Regionally Significant Project", as stated in the Rule (1.42), is a transportation project that is on a facility which serves regional transportation needs (such as access to and from the area outside of the region, major activity centers in the region, major planned developments such as new retail malls, sports complexes, etc., or transportation terminals as well as most terminals themselves) and would normally be included in the modeling of a metropolitan area's transportation network or state transportation network, including at a minimum all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel. Modifications of this definition shall be allowed if approved by the State Interagency Consultation Team. If the MPOs have received approval from the Environmental Protection Agency (EPA) to use a different definition of regionally significant project as defined in 40 C.F.R. § 93.101, the State Interagency Consultation Team will accept the modified definition. Necessary specificity for MPO Models or the Statewide Travel Model will be approved by the State Interagency Consultation Team. The Transportation Commission may issue guidance for implementation of this definition based on population density or other defined factors from time to time.

"State Interagency Consultation Team" (IACT), as stated in the Rule (1.44), consists of the Division Director or the Division Director's designee, the Colorado Department of Public Health and Environment (CDPHE) Director of Air Pollution Control Division or the Director's designee, the Director of each MPO or their designee, and the Colorado Energy Office Director

or Director's designee. The Division Director may appoint additional member(s) from outside of these organizations. The State Interagency Consultation Team works collaboratively and consults appropriately to approve modifications to Regionally Significant definitions, to address classification of projects as Regionally Significant, and to consult on issues that may arise regarding modeling assumptions and projects that reduce GHG emissions.

VI. POLICY

The Transportation Commission adopts the processes and priorities stated herein to guide the development of GHG Mitigation Measures, the approval of new GHG Mitigation Measures, the elements of a Mitigation Action Plan and GHG Mitigation Measure Status Report, and the analysis of the efficacy of GHG Mitigation Measures. Due to the evolving nature of evaluation techniques it is expected that this Policy may be reviewed and amended in the early months and years of its adoption.

A. Overall Process for Establishing GHG Mitigation Measures

This Policy Directive includes a list of approved GHG Mitigation Measures (Appendix A) that have been reviewed, vetted, and scored by the Department's subject matter experts, reviewed by the Interagency Consultation Team, and provided to the Air Pollution Control Division as required by the Rule, Section 8.04.2.

This Policy recognizes the need to balance appropriate analytical rigor around the expected reductions of GHG Mitigation Measures with encouraging new ideas and adapting to advancements in measurement methodologies. Further, the Commission recognizes that in the early compliance period for the Rule, MPOs may identify valid and quantifiable mitigation measures that are not contemplated in Appendix A. Thus, this Policy provides two pathways for including mitigation measures in a MAP: 1) Using an approved measure listed in Appendix A or 2) Proposing a new measure so long as the process outlined below for validating and reviewing a measure is followed.

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 Mitigation Action Plan if it is a Mitigation Measure contained in Appendix A of this Policy.

1. Proposing and Approving New GHG Mitigation Measures

i. Inclusion in Appendix A:

Any individual or organization may nominate a new GHG Mitigation Measure for review and potential approval. CDOT shall develop an online form on CDOT's website to receive these nominations. Staff, in consultation with the Transportation Commission, reserves the discretion to prioritize newly nominated GHG Mitigation Measures based on the information available and the effort required to assess.

Additionally, CDOT staff will establish a regular process of inventorying best practices from around the country with a focus on identifying a range of effective GHG Mitigation Measures for urban, suburban, and rural contexts throughout the state. Staff shall engage CDOT's Environmental Justice branch in this process to help ensure that GHG Mitigation Measures and policy updates are regularly adapted to, and developed with, input from Disproportionately Impacted Communities.

In order to be included in Appendix A as an approved GHG Mitigation Measure, all new measures must follow the process outlined below:

- Assessment by CDOT GHG Program staff according to the framework listed in Table 1. The individual or group submitting the new measure shall be expected to provide, to the extent possible, this information and data upon submission of a proposed GHG Mitigation Measure.
- Review and recommendation by the Interagency Consultation Team.
- Confirmation and verification by the Air Pollution Control Division (APCD) (as required by 8.04.2).
- Approval by the Transportation Commission for incorporation into Appendix A.

Table 1: Framework for Submitting New GHG Mitigation Measures

New GHG Mitigation Measure Submission Components	**Description of New GHG Mitigation Measure**
Strategy Description	Describe the overall strategy, including: ● The nexus with the transportation sector ● Description of what the strategy achieves or implements ● Description of how the strategy reduces CO2e emissions ● If possible, identification of how the strategy is not already reflected--or cannot be accurately measured by-- land use and travel modeling tools, thus warranting an off-model estimate of CO2e emission reductions ● Description of additionality. A GHG Mitigation Measure will be considered additional if it is not currently listed as a specific and quantified action in the GHG Roadmap or captured in an agency's modeling.
Quantification Methodology	Describe the methodology for quantifying CO2e emissions reductions from the strategy, including: ● Empirical evidence supported by verifiable data sources ● Clearly document all assumptions, sources of data, and calculations
Challenges and Constraints	● Potential challenges and constraints with quantifying and implementing strategy

ii. Including a Mitigation Measure in a MAP not included in Appendix A.
If a GHG Mitigation Measure is not included in Appendix A, but submitted as part of a MAP, such measures must include the information in Table 1 and follow the process outlined below. CDOT staff shall work expeditiously to review new mitigation measures and support each submittal through this process.

- Assessment by CDOT GHG Program staff according to the framework listed in Table 1.
- Review and approval by the Interagency Consultation Team.
- Confirmation and verification by the Air Pollution Control Division (APCD) (as required by 8.04.2).

The Commission shall revisit this provision by May, 2023 to determine its necessity and effectiveness based on the experience of the initial compliance period (i.e. October 2022 deadline).

B. Process for Scoring Approved GHG Mitigation Measure

Approved GHG Mitigation Measures will be scored and the scores included in Appendix A. The scoring is related to the ability of a GHG Mitigation Measure to reduce GHG emissions relative to a certain metric (e.g. per mile of bike lane). It also provides a way to distinguish and value the location and context of Mitigation Measures.

The scores are based on the following factors:

1. Metric (e.g. per mile of bike lane)
2. Points/metric
3. Additional multipliers
4. Adjustment for effectiveness over time, and
5. A total expected lifetime of each measure

C. GHG Mitigation Action Plan

Subsection 8.02.6.3 of the Rule states as follows: "If (GHG) Mitigation Measure(s) are needed to count toward the GHG Reduction Levels in Table 1, the MPO or CDOT may submit a Mitigation Action Plan that identifies GHG Mitigation Measures, if any, needed to meet the GHG Reduction Levels within Table 1". The Transportation Commission will evaluate Mitigation Action Plans and determine their sufficiency to assure that the Plan meets the GHG Reduction Levels needed for compliance.

The following information must be included in a Mitigation Action Plan:

a. GHG Emissions Reductions: Summary of emissions analysis from GHG Transportation Report, including the estimated gap to achieve the GHG Reduction Levels specified for each horizon year.
b. GHG Mitigation Measure Summary/Description: Each measure shall include the following details as listed in Table 2.

Table 2: Description for Each Mitigation Measure

Component	**Description of information to be submitted with application.**
Measure Description	A description of the measure, including scale, location, and how it would affect travel activities expected to result in GHG reductions.
Timing	Anticipated start date, completion date, and dates of any other key milestones.

GHG Reductions	If using the points as set up in Appendix A, record the GHG reductions and associated technical data in each year of the project's lifetime. If agencies would like to substitute specific local data for the inputs or parameters that form the basis of the calculation methodologies of the strategies in Appendix A, document the GHG reductions and associated technical data. Agencies shall work with CDOT technical staff to verify the new technical data inputs. If using a GHG Mitigation Measure that is not included in Appendix A, document the GHG reductions and associated technical data listed in Table 1 used to calculate the GHG emissions reductions of the strategy. The TC notes that there is a risk of disapproval under this scenario due to the TC reviewing without the benefit of being pre-approved through the Appendix A process.
Co-benefits	Quantification, where possible, of specific co-benefits including reduction of co-pollutants (PM2.5, NOx, etc.) as well as travel impacts (changes to VMT, pedestrian/bike use, transit ridership, etc. as applicable), for each relevant compliance year in the project's lifetime.
Benefits to Disproportionately Impacted Communities	A description of the benefits to Disproportionately Impacted Communities and stakeholder engagement conducted with those communities. Include an accounting of the amount of mitigation dollars directly spent in--or designed to serve--Disproportionately Impacted Communities as a subset of total dollars.
Measure Origin and History	Include a description of the origin of the measure, including, where applicable, the role of the MPO or CDOT. Description must explain how the Measure is additional per the guidance provided above. A GHG Mitigation Measure will be considered additional if it is not currently listed as a specific and quantified action in the GHG Roadmap or captured in an agency's modeling. 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 Mitigation Action Plan if it is a Mitigation Measure contained in Appendix A of this Policy. If a project was specifically identified in a previous fiscally constrained plan as of January 30, 2022 , it is not eligible as a GHG Mitigation Measure in a new plan UNLESS the new GHG Mitigation Measure is funded from a pool of non-specific projects (and not otherwise modeled in a previous plan), in which case it may be used as a GHG Mitigation Measure in the new plan.
Funding/ Resources/ Partnerships	Funding source(s), including if those funds are confirmed if any partnerships have been made or in-kind/matches are included.
Other Info As Needed	Any other relevant information that may be needed for thorough review of the proposed GHG Mitigation Measure.

D. GHG Mitigation Measure Status Reports and Follow-Up Analysis.

1. Submitting a GHG Mitigation Measure Status Report.

Following the approval of a GHG Mitigation Action Plan, CDOT and the MPOs are required to submit an annual status report for each GHG Mitigation Measure to the Transportation Commission starting on April 1 of each calendar year subsequent to the approval of the MAP The following information shall be included in each status report (as outlined in the Rule):

- The implementation timelines;
- The current status
- For measures that are in progress or completed, quantification of the annual benefit of such measures
- For measures that are delayed, canceled, or substituted, an explanation of why that decision was made and, how these measures or the equivalent will be achieved
- For measures located in a Disproportionately Impacted Community that are delayed, canceled, or substituted, an explanation of why that decision was made and, how these measures or the equivalent will still be achieved in Disproportionately Impacted Communities

If an agency fails to implement or find a substitute for a delayed or canceled GHG Mitigation Measure, the Commission will need to consider whether an Applicable Planning Document is in compliance, as per subsection 8.02.6.4 of the Rule. The Commission shall consider failure to submit reports and any analysis therein in subsequent review of future plans presented for consideration.

2. Analyzing the Efficacy of GHG Mitigation Measures.

CDOT shall create a process to evaluate the effectiveness of implemented GHG Mitigation Measures against predicted achievement of those measures by no later than the end of 2026 and annually thereafter if needed. Such analysis shall be provided to the Interagency Consultation Team for their review and consideration as to whether this information merits a change to the score applied to relevant measure(s). The

Commission shall incorporate subsequent review and revisions into this Policy Directive. Further, CDOT and MPOs shall conduct ongoing review in advance of the next plan update in order to better understand how GHG Mitigation Measures are being developed and implemented.

V. IMPLEMENTATION PLAN

This Policy Directive shall be effective immediately upon approval by the Transportation Commission.

The Office of Policy and Government Relations shall post this Policy Directive on CDOT's intranet as well as on public announcements.

VI. REVIEW DATE

This Directive shall be reviewed by January, 2023, following the adoption of various transportation plans in 2022.

_____ _____

Herman Stockinger
Transportation Commission Secretary

Date of Approval

APPENDIX A.

Table of Contents

Table 1. GHG Mitigation Measures and their points/metric in each compliance year.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now - 2024[3]	Points/ Metric 2025-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Pedestrian/Bicycle							
Bike lane/facility - core urban[4]	Miles of two way facility built between plan year 1 and evaluation year	30	23	19	9	3	2.0 – separated / protected lane or bike boulevard 1.5 – within mixed-use district or ½ mi of transit station or school
Bike lane/facility - urban			12	10	5	2	
Bike lane/facility – suburban			4	3	1	1	
Bike lane/facility – rural			1	1	1	1	
Sidewalk/pedestrian facility - core urban			25	21	10	4	1.5 – within mixed-use district or ½ mi of transit station or school

[1] Lifetime Effectiveness of GHG Mitigation Measures: The table lists the number of years after implementation or expenditure for which a strategy remains effective. Some infrastructure projects have long lasting effects, while other programs must be annually reinstated e.g., transit operations and parking pricing. For those programs that must be annually reinstated, agencies may take credit for as many years as the applicable planning document commits to funding said program. An agency may take credit for the GHG reductions of a given project over its lifetime effectiveness.

[2] 1 point corresponds to 1 metric ton of CO2 reduced. Agencies may take partial credit for any of these measures, i.e. if an agency builds half a mile of bike lane in an urban area, it may take half the points (6 points).

[3] Year of emissions factor basis for points: now-2024: 2025; 2025-2030: 2030; 2031-2040: 2040; and 2041-2050: 2050.

[4] For pedestrian and bicycle facilities,"core urban" corresponds to census tract or block group population density of greater than 10,000, "urban" to density between 4,000 and 10,000 persons per square mile; "suburban" to density between 500 and 4,000 persons per square mile; and "rural" to density of less than 500 persons per square mile. "Sharrows" are not considered bike facilities in this application; however, a bike boulevard (low-volume street that includes pavement markings, signage, and traffic calming measures) is considered a bike facility. A "mixed-use district" is a street along which both residential and commercial (including retail) uses are permitted by zoning and where multiple non-residential uses (including retail) are present or planned.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now - 2024[3]	Points/ Metric 2025-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Sidewalk/ pedestrian facility - urban			8	6	3	1	
Sidewalk/ pedestrian facility - suburban			1	1	1	1	
Sidewalk/ pedestrian facility – rural			1	1	1	1	
Shared-use path[5] - core urban			75	63	29	11	
Shared-use path - urban			34	29	13	5	
Shared-use path – suburban			9	7	3	1	
Shared-use path – rural		30	2	1	1	1	
"Complete Streets"[6] reconstruction - core urban			48	40	19	7	2.0 – separated / protected lane or bike boulevard vs. bike lane
"Complete Streets" reconstruction - urban			20	17	8	3	1.5 – within mixed-use district or ½ mi of transit station or school

[5] A shared use path is a facility that is physically separated from motorized vehicular traffic by an open space or barrier, either within the highway right-of-way or within an independent right of way, and with minimal cross flow by motor vehicles. Shared use paths should have a minimum width of 8' for two way traffic, while 10 - 12' is desired.

[6] Reconstruct streets to include or enhance bicycle and pedestrian facilities as well as transit priority treatments if appropriate.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now - 2024[3]	Points/ Metric 2025-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
"Complete Streets" reconstruction - suburban			4	4	1	1	
Bikeshare	Per 100 vehicles in service in evaluation year	2	16	14	6	2	
Scooter share			16	13	6	2	
Transit							
New/increased fixed-route transit service[7] -electric	Per 1,000 additional vehicle revenue-hours[8] in evaluation year[9]	1	27	23	11	4	
New/increased fixed-route transit service -electric/diesel fleet average			7	18	11	4	
Reduce transit fares 25%	Per million annual trips current ridership base		62	52	24	9	
Reduce transit fares 50%			124	104	49	19	

[7] Some new transit projects may yield higher GHG reductions if the agency supplies local specific data. CDOT and the MPOs may use the "Transit GHG Mitigation Measure User Input Tool" found on the CDOT GHG webpage as an alternative to the points in this table when evaluating the GHG reductions impact of new or expanded transit services.

[8] Expressing service expansion in vehicle-hours captures a wide range of specific actions including adding route-miles, reducing headways, and extending service hours or days. Ridership elasticities are available to relate to overall service metrics, but will be less available for more specific actions. Data to support ridership response to other improvements (e.g., bus stops and other amenities) will be less available.

[9] "Evaluation year" is the year for which projected GHG mitigation is being compared against a target, i.e., 2025, 2030, 2040, 2050.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now - 2024[3]	Points/ Metric 2025-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Free fares			247	208	97	37	
Implement bus priority treatments[10]	Per 1,000 vehicle revenue-miles per weekday of affected service in evaluation year	30	34	24	10	4	
Transportation Demand Management							
Trip Reduction program[11] - voluntary	Per 1,000 covered employees	1	96	81	38	14	
Trip Reduction marketing	Per program $1,000 expenditure in evaluation year		2	2	1	1	

[10] Infrastructure and/or operational improvements to reduce run times and improve reliability. These may include transit signal priority, queue jump lanes, exclusive bus lanes, bulb-outs, and/or other treatments. Bus priority treatments will need to meet minimum standards, e.g., anticipated >+10% travel time reduction on high-frequency (<=20 min headway) routes.

[11] Minimum requirements for such programs include staff dedicated to performing outreach to employers to promote and provide information on travel options for employees; resources for employers to communicate travel options to employees (e.g., websites, flyers, social media, trip planning tools, model telework policies, vanpool support); guaranteed ride home program; ride matching platform; incentives for participation (e.g., prizes, recognition); and support for measuring and tracking performance (e.g., participation in alternative mode use) via apps or surveys.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now - 2024[3]	Points/ Metric 2025-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Employer sponsored vanpool	per new vanpool in evaluation year		1	1	1	1	
Employer sponsored vanpool - electric	per new vanpool in evaluation year		7	6	3	1	
Carshare program	# of cars provided in evaluation year		14	12	5	2	3.0 for EVs
Telework	Per 100 employees teleworking additional 1 day/week	1	22	18	9	3	
Broadband Expansion	Per 100 new households served	30	40	34	16	6	
Traffic Operations[12]							
Retime/optimize arterial signals	Per 10,000 AADT per signal optimized within five years prior to evaluation year	5	55	47	28	19	

[12] The Rule requires that any operational GHG Mitigation Measure take into consideration induced demand. Table 6 in the Appendix demonstrates how the points for retiming/optimizing arterial signals were calculated with an induced demand factor. At this time, there is no conclusive evidence that roundabouts offer any travel time savings to drivers, thus induced demand is not a factor in this strategy.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now - 2024[3]	Points/ Metric 2025-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Replace signalized intersection with roundabout	Per 10,000 AADT per roundabout	30	243	208	106	37	
Parking Management							
Eliminate residential parking minimums and set low maximum levels[13] - core urban	per 1,000 DUs that can be built in rezoned area between current year and evaluation year	30	1,364	1,150	534	205	
Eliminate residential parking minimums and set low maximum levels - urban			1,425	1,201	558	214	
Eliminate residential parking minimums and set low maximum levels - suburban			1,637	1,380	641	246	
Reduce or eliminate residential parking minimums and set moderate maximum levels[14] - core urban			682	575	267	103	
Reduce or eliminate residential parking minimums and set moderate maximum levels - urban			712	601	279	107	

[13] Maximums: no more than 0.75 (1 bed/studio/efficiency), 1.0 (2 bed), and 1.25 (3+ bed).
[14] Maximums: no more than1.0 (1 bed/studio/efficiency), 1.5 (2 bed), and 1.75 (3+ bed).

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now - 2024[3]	Points/ Metric 2025-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Reduce or eliminate residential parking minimums and set moderate maximum levels - suburban			818	690	321	123	
Unbundle residential parking[15]	per 1,000 parking spaces rented for at least $100 per month in evaluation year	1	160	134	62	25	
Additional tax or fee on public and/or private parking	Per 1,000 parking spaces per daily $1 fee in evaluation year	1	167	141	65	25	
Land Use							
Increase residential density	Per acre rezoned from <10 units/acre to at least 15-25 units/acre meeting "smart growth" criteria	30	24	20	9	4	
Increase job density	Per acre rezoned from <0.5 FAR to at least 1.0	30	20	16	8	3	

[15] This measure unbundles a residential project's parking costs from property costs, requiring those who wish to purchase parking spaces to do so at an additional cost. Unbundling may not be available to all residential developments, depending on funding sources.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now - 2024[3]	Points/ Metric 2025-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
	FAR meeting "smart growth" criteria						
Mixed-use Transit-Oriented Development	Per acre of area rezoned for mixed-use TOD accommodating at least 25 residential units/acre and 150 jobs/acre, within 1/2 mile of fixed-guideway transit station	30	53	45	21	8	
MD/HD[16]							
Replace diesel transit buses with battery-electric buses	Number of new vehicles introduced between current year and evaluation year [5]	12	92	85	-	-	
Replace diesel transit buses with hybrid diesel-electric buses			15	14	-	-	
Replace diesel transit buses with RNG bus			37	34	-	-	
Replace diesel school buses with electric buses			12	11	10	10	

[16] Strategies in this category will need to be recalibrated or reconsidered if an overlapping regulation is passed at the state level, such as the Advanced Clean Trucking rule.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now - 2024[3]	Points/ Metric 2025-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Build medium duty truck charger	Number of chargers		19	17	15	15	
Build heavy duty truck charger			32	30	27	27	
Replace medium duty truck	Number of new electric trucks / trucks introduced between current year and evaluation year		19	17	15	15	
Replace heavy duty truck			32	30	27	27	
Support hydrogen refueling infrastructure	Number of refueling stations	30	45	250	420	420	Use 2040 values if hydrogen is produced from renewables
Clean Construction							
Strategies in this category will be added in 2023.							

Legend for Calculation Methodologies Table

output (points)
future years copied from base year
User input

Table 2. GHG Point Estimate Calculation Methodologies - Pedestrian and Bicycle Strategies

PEDESTRIAN AND BICYCLE STRATEGIES						
		Value				
Ref	**Parameter**	**2025**	**2030**	**2040**	**2050**	**Source/Calculation**
Parameters Common Across Strategies						
A	grams CO2 per vehicle-mile (auto)	303	256	119	46	CDOT (2021) - high EV scenario
Prior drive mode share of new bikers/walkers						
B1	Owned bikes	60%				Transportation Investment Strategy Tool, Table A.4
B2	Shared bikes and scooters	40%				Buehler et al (2019), Mobility Lab (2019), NABSA (2020), Ramboll (2020), MacArthur et al (2018)
B3	Walkers	40%				
Average trip length (mi)						
C1	Bike	2.3				2009 National Household Travel Survey
C2	Walk	0.7				2009 National Household Travel Survey
C3	Shared bike	1.4				PBOT (2020) and NABSA (2020)
C4	Scooter	1.1				PBOT (2020) and NABSA (2020)
D	Annualization factor	365				

Per New Facility-Mile:	New Bicyclists (Daily)	New Walkers (Daily)	Displaced Auto Miles/yr	
Bike lane/facility - core urban	150		75,555	New users: Transportation Investment Strategy Tool documentation, Table A.4
Bike lane/facility - urban	80		40,296	Displaced auto miles: New users * C1 * B1 * D
Bike lane/facility – suburban	25		12,593	
Bike lane/facility – rural	5		2,519	
Sidewalk/ pedestrian facility - core urban		798	81,556	New users: Transportation Investment Strategy Tool documentation, Table 4.11
Sidewalk/ pedestrian facility - urban		247	25,243	Displaced auto miles: New users * C1 * B1 * D
Sidewalk/ pedestrian facility - suburban		13	1,329	
Sidewalk/ pedestrian facility – rural		2	204	
Shared-use path - core urban	327	798	246,266	New bicyclists: Transportation Investment Strategy Tool documentation, Table A.4
Shared-use path - urban	174	247	113,089	New walkers: Same as sidewalk/pedestrian facility
Shared-use path – suburban	55	13	28,780	Displaced auto miles: New users * C1 * B1 * D
Shared-use path – rural	11	2	5,695	
"Complete Streets" reconstruction - core urban	150	798	157,111	= Sum of value for bike lane + pedestrian improvements
"Complete Streets" reconstruction - urban	80	247	65,539	
"Complete Streets" reconstruction – suburban	25	13	13,921	

Per New Shared Vehicle:	Trips per Day	Annual Person-Miles	Displaced Auto Miles		
Shared bike	2.6	1329	531		Trips per day: PBOT (2020) and NABSA (2020)
Scooter	3.2	1285	514		Annual person-miles: Trips per day * [C3 or C4]* 365
					Displaced auto miles: Annual person-miles * B2

Change in tons CO2 per new facility-mile (annual):	2025	2030	2040	2050	
Bike lane/facility - core urban	(22.9)	(19.3)	(9.0)	(3.5)	= Displaced auto miles * A / 1000000
Bike lane/facility - urban	(12.2)	(10.3)	(4.8)	(1.9)	
Bike lane/facility – suburban	(3.8)	(3.2)	(1.5)	(0.6)	
Bike lane/facility – rural	(0.8)	(0.6)	(0.3)	(0.1)	
Sidewalk/ pedestrian facility - core urban	(24.7)	(20.9)	(9.7)	(3.8)	
Sidewalk/ pedestrian facility - urban	(7.6)	(6.5)	(3.0)	(1.2)	
Sidewalk/ pedestrian facility - suburban	(0.4)	(0.3)	(0.2)	(0.1)	
Sidewalk/ pedestrian facility – rural	(0.1)	(0.1)	(0.0)	(0.0)	
Shared-use path - core urban	(74.6)	(63.0)	(29.3)	(11.3)	
Shared-use path - urban	(34.3)	(29.0)	(13.5)	(5.2)	
Shared-use path – suburban	(8.7)	(7.4)	(3.4)	(1.3)	
Shared-use path – rural	(1.7)	(1.5)	(0.7)	(0.3)	
“Complete Streets” reconstruction - core urban	(47.6)	(40.2)	(18.7)	(7.2)	

"Complete Streets" reconstruction - urban	(19.9)	(16.8)	(7.8)	(3.0)	
"Complete Streets" reconstruction – suburban	(4.2)	(3.6)	(1.7)	(0.6)	
Change in tons CO2 per 100 new shared vehicles (annual):	**2025**	**2030**	**2040**	**2050**	**Source/Calculation**
Shared bike	(16.1)	(13.6)	(6.3)	(2.4)	= Displaced auto miles * A / 1000000
Scooter	(15.6)	(13.2)	(6.1)	(2.4)	
Points per new facility-mile:	**2025**	**2030**	**2040**	**2050**	
Bike lane/facility - core urban	23	19	9	3	Providing a minimum of 1 point, with the expectation to improve these values as more Colorado specific data becomes available.
Bike lane/facility - urban	12	10	5	2	
Bike lane/facility – suburban	4	3	1	1	
Bike lane/facility – rural	1	1	1	1	
Sidewalk/ pedestrian facility - core urban	25	21	10	4	
Sidewalk/ pedestrian facility - urban	8	6	3	1	
Sidewalk/ pedestrian facility - suburban	1	1	1	1	
Sidewalk/ pedestrian facility – rural	1	1	1	1	
Shared-use path - core urban	75	63	29	11	
Shared-use path - urban	34	29	13	5	
Shared-use path – suburban	9	7	3	1	
Shared-use path – rural	2	1	1	1	

	"Complete Streets" reconstruction - core urban	48	40	19	7
	"Complete Streets" reconstruction - urban	20	17	8	3
	"Complete Streets" reconstruction – suburban	4	4	2	1
	Points per 100 new shared vehicles:	**2025**	**2030**	**2040**	**2050**
	Shared bike	16	14	6	2
	Scooter	16	13	6	2

Table 3. GHG Point Estimate Calculation Methodologies - Transit Strategies

TRANSIT STRATEGIES						
		Value				
Ref	**Parameter**	**2025**	**2030**	**2040**	**2050**	**Metric; Source/Calculation**
Parameters Common Across Strategies						
	Vehicle revenue-miles per revenue-hour					
A1	Fixed-route bus	13.0	13.0	13.0	13.0	NTD (2019), Colorado agencies
A2	Demand-response bus	13.7	13.7	13.7	13.7	NTD (2019), Colorado agencies
	Passenger-miles per vehicle-mile					
B1	Fixed-route bus	11.5	11.5	11.5	11.5	NTD (2019), Colorado agencies - Rapid Bus (RB) service
B2	Demand-response bus	3.5	3.5	3.5	3.5	NTD (2019), Colorado agencies
	grams CO2 per vehicle-mile					
C1	Fixed-route bus	1,555	399	-	-	CDOT (2021) - high bus electrification (100% electric by 2033)
C2	Demand-response bus	619	159	-	-	2019 based on medium truck MPG from AEO, future years adjusted proportional to fixed-route bus

C3	Auto	303	256	119	46	CDOT (2021) - high bus electrification
	grams CO2 per vehicle-hour					
C4	Fixed-route bus	3,966	1,018	-	-	CS (2021), scaled by g/mi from CBA analysis for future years
D	Prior drive mode share of new riders	60%	60%	60%	60%	CS (2021)
	Average trip length (mi) - unlinked					
F1	Fixed-route bus	4.5	4.5	4.5	4.5	FHWA CMAQ Calculator Toolkit
F2	Demand-response bus	4.5	4.59	4.5	4.5	Assumed same as fixed-route
G	Annualization factor	300	300	300	300	
	New/increased fixed-route bus service - urban/suburban					**1,000 new vehicle revenue-hours**
	Tons CO2 per new VRH					
	Displaced auto	(27.2)	(23.0)	(10.7)	(4.1)	= 1000 * A1 * B1 * C3 * D / 1000000
	New bus (fleet average)	20.2	5.2	-	-	= 1000 * C1 * A1 * / 1000000
	New bus (electric)	-	-	-	-	
	Net (fleet average bus)	(7.0)	(17.8)	(10.7)	(4.1)	= new bus + displaced auto
	Net (electric bus)	(27.2)	(23.0)	(10.7)	(4.1)	
	Points per new 1,000 VRH (fleet average bus)	7	18	11	4	
	Points per new 1,000 VRH (electric bus)	27	23	11	4	
	New/increased demand-response bus service - urban/suburban					**1,000 new vehicle revenue-hours**
	Tons CO2 per new VRH					Calculation from above data:
	New bus	8.5	2.2	-	-	= C2 * A2 / 1000

	Displaced auto	(8.7)	(7.4)	(3.4)	(1.3)	= A1 * B1 * C3 * D / 1000
	Net	(0.2)	(5.2)	(3.4)	(1.3)	= new bus + displaced auto
	Points per new 1,000 VRH	-	5	3	1	
	Reduce transit fares					**1 million base annual trips**
	Fare elasticity	-0.3	-0.3	-0.3	-0.3	TCRP Report 95, Chapter 12; CAPCOA (2021)
	Effects per million annual trip base @ 100% fare reduction (annual)					
	New trips	300,000	300,000	300,000	300,000	= 1000 * -(fare elasticity)
	Change in auto VMT	(813,600)	(813,600)	(813,600)	(813,600)	= new riders * F1 * D
	Change in tons CO2	(246.6)	(207.9)	(96.6)	(37.1)	= change in auto VMT * C3 / 1000000
	Points per million trips - free fares	247	208	97	37	
	Points per million trips - 50% fare reduction	124	104	49	19	
	Points per million trips - 25% fare reduction	62	52	24	9	
	Implement bus priority treatments					**Affected 1,000 VRM per weekday**
	Bus travel time elasticity	-0.4	-0.4	-0.4	-0.4	TCRP Report 95, Chapter 12
	Typical travel time change (%)	-10%	-10%	-10%	-10%	CAPCOA (2021)
	Effects per 1,000 affected VRM (annual)					
	New bus passenger-miles	138,000	138,000	138,000	138,000	= B1 * elasticity * travel time change * G * 1000
	Change in auto VMT	(82,800)	(82,800)	(82,800)	(82,800)	= new passenger-mi * D
	Change in auto emissions (t CO2)	(25)	(21)	(10)	(4)	= change in auto VMT * C3 / 1000000
	Change in bus idle emissions (t	(9)	(2)	-	-	

	CO2)					
	Change in tons CO2	(34)	(24)	(10)	(4)	
	Points per 1,000 affected weekday VRM	34	24	10	4	
	User-input method for new transit service					
	Planned new annual vehicle revenue-miles					Agency service plan
	Anticipated new ridership (annual unlinked trips)					Agency estimate based on survey, model, or similar service
	Anticipated share of new riders who previously drove or used a taxi/TNC					Agency estimate based on rider surveys or local mode shares. Use 60% if no local data available.
	Average unlinked trip length of new riders (mi)					Agency estimate based on rider surveys, models, or data. Use 4.52 if no local data available.
	Transit vehicle size					Agency service plan
	Transit vehicle technology					Agency service plan
	Average load factor for new service	13.6	13.6	13.6	13.6	= new riders * trip length / new revenue-miles
	Change in annual auto VMT	(1,464,480)	(1,610,928)	(1,772,021)	(1,949,223)	= new riders * trip length * prior drive mode share
	Change in annual tons CO2					
	Displaced auto	(444)	(412)	(211)	(90)	= change in auto VMT * C3 / 1000000
	New bus service	280	79	-	-	= 1000 * C1 * A1 * / 1000000
	Net change	(164)	(333)	(211)	(90)	= new bus + displaced auto
	Points	164	333	211	90	

Table 4. GHG Point Estimate Calculation Methodologies - Parking Management Strategies

PARKING STRATEGIES						
		Value				
Ref	**Parameter**	**2025**	**2030**	**2040**	**2050**	**Metric; Source/Calculation**
	Parameters Common Across Strategies					
A	grams CO2 per vehicle-mile (auto)	303	256	119	46	CDOT (2021) - high EV scenario
B	Average trip length (mi) - all purposes	10.5				FHWA (2018), Table 6b
C	Annualization factor	300				
	Annual miles driven					
D1	Per vehicle	10,450				CDOT (2021)
D2	Per household	19,642				FHWA (2018), based on 2017 NHTS
D3	Per worker (commuting)	6,400				2017 NHTS work trip length * 2 * 250
	Additional Fee on Parking					Per 1,000 covered spaces per daily dollar fee
	Elasticity of driving w/r/t fuel price	-0.12				Small and van Dender (2007)
	Price of gasoline ($/gal)	$ 3.11				AEO 2022 Reference case for 2021
	Average mpg	23.8				AEO 2020 Reference Case, Table 7
	$1 parking fee equivalent cost per mile	$ 0.10				$1.00 / B
	$1 parking fee equivalent cost per gallon	$ 2.27				= Cost per mile * miles per gallon
	Leakage factor (destination change)	0%				Placeholder for people to shift trip destination rather than paying fee. No good research.
	% VMT change for affected trips	-9%				= Fee cost per gallon / gas cost per gallon * elasticity
	Trips per covered space per day	2.0				Assumes 1 round trip to a workplace or home. For short-term parking, fee is prorated.
	Change in annual VMT per space per $	(551)	(551)	(551)	(551)	

	Change in annual tons CO2 per 100 spaces per $	(167.0)	(141.1)	(65.6)	(25.3)	= Change in VMT * 1000 * A / 1000000
	Points per 1,000 spaces per $ daily fee	167	141	66	25	
	Unbundle Residential Parking					Per 1,000 covered spaces @ $100/mo
	Annual parking cost per space	$ 1,200				= $100 * 12
	Annual vehicle cost	$ 9,666				AAA (2021)
	Elasticity of vehicle ownership with respect to total vehicle cost	(0.4)				Litman (2021)
	Adjustment factor from vehicle ownership to VMT	1.01				FHWA (2017), as cited in CAPCOA (2021)
	Percent reduction in miles per vehicle	-5.0%				= (parking cost) / (vehicle cost) * elasticity * adjustment factor
	Change in annual VMT per space per $100/mo	(524)	(524)	(524)	(524)	= D1 * percent reduction
	Change in annual tons CO2 per 1,000 space per $	(158.8)	(134.2)	(62.4)	(24.1)	= Change in VMT * 1000 * A / 1000000
	Points per 1,000 spaces per $100 monthly cost	159	134	62	24	
	Eliminate minimum and set low maximum levels (residential)					Per 1,000 dwelling unit (DU)
	Change in annual VMT per DU for a 1-space reduction					
	Urban core	(4,500)				CS analysis using sample projects from the King County (WA) Right Size Parking Calculator (https://rightsizeparking.org/)

	Urban	(4,700)				assuming that typical parking is 2+ space/unit for 2+ bedroom
	Suburban	(5,400)				
	Change in annual tons CO2 per 1,000 DU					= Change in VMT * 1000 * A / 1000000
	Urban core	(1,364)	(1,150)	(534)	(205)	
	Urban	(1,425)	(1,201)	(558)	(214)	
	Suburban	(1,637)	(1,380)	(641)	(246)	
	Points per 1,000 DU					
	Urban core	1,364	1,150	534	205	
	Urban	1,425	1,201	558	214	
	Suburban	1,638	1,380	641	246	
	Eliminate minimum and set moderate maximum levels (residential)					Per 1,000 dwelling unit (DU)
	Change in annual VMT per DU for a 1-space reduction					
	Urban core	(2,250)				CS analysis using sample projects from the King County (WA) Right Size Parking Calculator (https://rightsizeparking.org/)
	Urban	(2,350)				assuming that typical parking is 2+ space/unit for 2+ bedroom
	Suburban	(2,700)				
	Change in annual tons CO2 per 1,000 DU					= Change in VMT * 1000 * A / 1000000
	Urban core	(682)	(575)	(267)	(103)	

	Urban	(712)	(601)	(279)	(107)	
	Suburban	(818)	(690)	(321)	(123)	
	Points per 1,000 DU					
	Urban core	682	575	267	103	
	Urban	712	601	279	107	
	Suburban	818	690	321	123	

Table 5. GHG Point Estimate Calculation Methodologies - Travel Demand Management Strategies

TRAVEL DEMAND MANAGEMENT STRATEGIES						
		Value				
Ref	**Parameter**	**2025**	**2030**	**2040**	**2050**	**Metric; Source/Calculation**
	Parameters Common Across Strategies					
	grams CO2 per vehicle-mile					
A1	Auto	303	256	119	46	CDOT (2021) - high EV scenario
A2	Vanpool	758	639	250	38	Base year assumed 10 mpg, future year efficiency/electrification adjustments proportional to auto
	Average work trip length (mi)					
B1	Auto	12.7	12.7	12.7	12.7	FHWA (2018), Table 26
B2	Vanpool	25	25	25	25	TCRP Report 95, Chapter 5. Typical average length is close to 25 miles (p. 5-13, Table 5-5)
C	Annualization factor	250	250	250	250	TCRP Report 95, Chapter 5, Table 5-6

Trip Reduction Program - Voluntary					**Per Program $1,000**
Change in annual VMT per program $	-100				MWCOG (2009), as analyzed by CS for Colorado DOT (2010) and updated 2022
Change in annual tons CO2 per $1,000	-30.3	-25.6	-11.9	-4.6	= Change in VMT * 1000 * A1 / 1000000
Points per program $1,000	30	26	12	5	
Trip Reduction Program - Marketing					**Per Program $1,000**
Annual VMT reduced per program $	7	7	7	7	MWCOG (2009), as analyzed by CS for Colorado DOT (2010) and updated 2022
Change in annual tons CO2 per $	-2.1	-1.8	-0.8	-0.3	= Change in VMT * 1000 * A1 / 1000000
Points per program $1,000	2	2	1	-	
Employer Sponsored Vanpool					**Per New Vanpool**
Average vanpool occupancy	5.8	5.8	5.8	5.8	CDOT (2019), total participants / total vans
Prior drive mode share of new vanpoolers	65%	65%	65%	65%	TCRP Report 95, Chapter 5, p. 5-34. Total prior auto drivers, counting in carpool drivers, are in the 45 to over 65% range
Vanpool circuity factor	1.2	1.2	1.2	1.2	Estimate
Annual VMT change per new vanpool					
Auto	-23,563	-23,563	-23,563	-23,563	= occupancy * prior drive mode share * B1 * C
Vanpool	7,500	7,500	7,500	7,500	= circuity factor * B1 * C
Change in annual tons CO2 per new vanpool					

	Auto	-7.1	-6.0	-2.8	-1.1	= Change in auto VMT * A1 / 1000000
	Vanpool	5.7	4.8	1.9	0.3	= Change in vanpool VMT * A2 / 1000000
	Net	-1.5	-1.2	-0.9	-0.8	= Sum of auto and vanpool change
	Points per new vanpool	1	1	1	1	
	Carshare					**Per # cars provided**
	Households served per car	15				Litman (2018) - typically 10-20 members per vehicle
	Annual VMT reduction per HH served	3,000				Litman (2018) - carshare HHs are typically lower mileage HHs who reduce travel 50% (6,000 to 3,000 annual miles)
	Change in annual CO2 per car (tons)	-14	-12	-5	-2	
	Points per new carshare vehicle	14	12	5	2	

Table 6. GHG Point Estimate Calculation Methodologies - Traffic Operation Strategies

PARKING STRATEGIES						
		Value				
Ref	**Parameter**	**2025**	**2030**	**2040**	**2050**	**Metric; Source/Calculation**
	Parameters Common Across Strategies					
	grams CO2 per vehicle-mile (auto)	303	256	119	46	CDOT (2021) - high EV scenario
	grams CO2 per vehicle-mile (heavy truck)	1,307	1,199	1,074	1,074	Based on AEO forecast mpg (no electrification)
	CO2 fraction from heavy vehicles (2019)	21%				National average based on AEO data

	kg CO2 per hour of delay (all traffic)	3.5	2.9	1.7	1.0	2019 based on TTI (2021), future years adjusted by relative efficiency improvement of autos and heavy trucks
	Retime/optimize arterial signals					**Per 10,000 AADT per signal**
	Sample corridor length (mi)	1.0				Assumption
	Signals per mile	2.0				Assumption
	Baseline corridor travel speed (mph)	20.0				Assumption
	Corridor travel time change (%)	-12%				USDOT (2010), p. 4-24: travel time reductions of 8-25% possible for preset signals, or 8-41% for actuated signals
	New corridor travel speed (mph)	22.7				Calculation
	Average daily arterial traffic volume at signal	10,000				Assumption
	Change in travel time per vehicle (hours)	-0.006				Calculation
	Daily total delay reduction (hours)	(60)				Calculation
	Induced travel elasticity (% change in VMT with respect to % change in travel time)	-0.3				[U.K.] Highways Agency (1997), recommended value of -0.20 to -0.33 for "urban areas with low modal competition, or interurban"; Barr (2000), -0.3 to -0.5
	New volume	10,360				= Volume + [Volume * % travel time change * elasticity]
	Annual change in tons CO2 per signal					
	From delay reduction	(76.7)	(63.5)	(37.0)	(22.4)	= Delay reduction * CO2/hour * 365 / 1000
	From VMT increase	19.9	16.8	7.8	3.0	= Volume change * miles/signal * g/mi [auto] * 365 / 1000000
	Net CO2 change	(56.7)	(46.7)	(29.2)	(19.4)	
	Points per signal per 10,000 AADT	57	47	29	19	

	Roundabout					**Per 10,000 AADT per roundabout**
	CO2 change, kg/vehicle	(0.07)				Calculated from data in Hu et al (2014), adjusted for ratio of 2025 to 2012 emissions based on AEO data
	Annual vehicles	3,650,000				= 10,000 * 365
	CO2 change, tons/year/10,000 AADT	(243)	(200)	(102)	(34)	= Vehicles * kg/vehicle / 1000
	Points per roundabout per 10,000 AADT	243	200	102	34	

Table 7. GHG Point Estimate Calculation Methodologies - Land Use Strategies

LAND USE STRATEGIES						
		Value				
Ref	**Parameter**	**2025**	**2030**	**2040**	**2050**	**Metric; Source/Calculation**
	Parameters Common Across Strategies					
A	grams CO2 per vehicle-mile (auto)	303	256	119	46	CDOT (2021) - high EV scenario
B	Average trip length (mi) - all purposes	10.5				2017 NHTS Trends, Table 6b
C	Annualization factor	300				
	Annual miles driven					
D1	Per vehicle	10,450				CDOT (2021)
D2	Per household	19,642				FHWA (2018), based on 2017 NHTS
D3	Per worker (commuting)	6,400				2017 NHTS work trip length * 2 * 250
	Increase Residential Density					Per acre rezoned from <10 units/acre to at least 15-25 units/acre meeting "smart growth" criteria
	Elasticity of VMT with respect to residential density	(0.22)				Stevens (2016), as cited in CAPCOA (2021)

	Change in annual VMT per residential unit	(4,321)				= D2 * elasticity * 100% density increase (assumes typical density 9 units/ac per CAPCOA is doubled to 18 units/ac)
	Change in annual CO2 (tons) per rezoned acre	-23.6	-19.9	-9.3	-3.6	= Change in VMT/unit * A * 18 / 1000000
	Points per rezoned acre	24	20	9	4	
	Increase Job Density					Per acre rezoned from <0.5 FAR to at least 1.0 FAR meeting "smart growth" criteria
	Elasticity of VMT with respect to job density	(0.07)				Stevens (2016), as cited in CAPCOA (2021)
	Square feet of building space per employee	300				CAPCOA (2021)
	Employees per acre at 1.0 FAR	145				43,560 / square feet/employee
	Annual work trip VMT per employee					
	Baseline	6,350				= TDM-B1 * TDM-C * 2
	Change from rezoning	(445)				= Baseline VMT * elasticity * 100% density increase
	Change in annual CO2 (tons) per rezoned acre	-19.6	-16.5	-7.7	-3.0	= Change in VMT/employee * employees/acre * A / 1000000
	Points per rezoned acre	20	17	8	3	
	Mixed-use Transit-Oriented Development (higher intensity)					Per acre of area rezoned for mixed-use TOD accommodating at least 25 residential units/acre and 150 jobs/acre, within 1/2 mile of fixed-guideway transit station
	Change in annual VMT per rezoned acre	(174,706)				= Change in VMT/unit * 25 + change in VMT/employee * 150
	Change in annual CO2 (tons) per rezoned	-52.9	-44.7	-20.8	-8.0	= Change in VMT/acre * A / 1000000

	acre					
	Points per rezoned acre	53	45	21	8	
	Mixed-use Transit-Oriented Development (moderate intensity)					Per acre of area rezoned for mixed-use TOD accommodating at least 15 residential units/acre and 100 jobs/acre, within 1/2 mile of high-frequency bus transit or fixed-guideway station
	Change in annual VMT per rezoned acre	(109,269)				= Change in VMT/unit * 15 + change in VMT/employee * 100
	Change in annual CO2 (tons) per rezoned acre	-43.1	-36.4	-16.9	-6.5	= Combined effect for increasing residential density + increasing job density
	Points per rezoned acre	43	36	17	7	

Table 8. GHG Point Estimate Calculation Methodologies - MD/HD Strategies

ELECTRIFICATION & ZEV STRATEGIES						
		Value				
Ref	**Parameter**	**2025**	**2030**	**2040**	**2050**	**Metric; Source/Calculation**
	grams CO2 per vehicle-mile					
	Auto - gas	326	303	277	266	CDOT (2021)
	Auto - electric	-	-	-	-	Excluding electricity sector emissions
	Transit bus - diesel	2,945	2,698	2,405	2,347	CDOT (2021)
	Transit bus - hybrid-electric	2,454	2,248	2,004	1,956	20% efficiency improvement
	Transit bus - RNG	1,774	1,626	1,449	1,414	Calculated based on 0.60 ratio of CNG to diesel direct CO2 emissions per unit energy
	Transit bus - electric	-	-	-	-	Excluding electricity sector emissions
	School bus - diesel	1,243	1,150	1,007	1,007	AFDC school bus mpg for 2017, future year adjustments for Federal MHDV rule, 10.15 kg CO2/gal
	School bus - electric	-	-	-	-	Excluding electricity sector emissions

	Medium truck - diesel	1,011	936	809	809	AEO medium truck mpg for base year, future year adjustments for Federal MHDV rule, 10.15 kg CO2/gal
	Medium truck - electric	-	-	-	-	Excluding electricity sector emissions
	Heavy truck - diesel	1,286	1,199	1,074	1,074	AEO heavy truck mpg for base year, future year adjustments for Federal MHDV rule, 10.15 kg CO2/gal
	Heavy truck - electric	-	-	-	-	Excluding electricity sector emissions
	Heavy truck - H2 fuel cell	-	-	-	-	Excluding electricity sector emissions
	Miles per vehicle per year					
	Auto	10,450				CDOT (2021)
	Transit bus	31,396				CDOT (2021)
	School bus	9,939				U.S. EPA (2016): 9,939 mi/year, from the 1997 School Bus Fleet Fact Book
	Medium truck	18,387				Computed from Argonne National Lab - VISION model (2019) data
	Heavy truck (electric)	25,185				69 miles per day for class 7 delivery truck (Gao et al. 2017) - local food delivery
	Heavy truck (H2 FC)	41,628				Argonne VISION model, computed average for Class 7/8 truck
	CO2 change per vehicle (tons/year)					
	Auto electric	(3.4)	(3.2)	(2.9)	(2.8)	= miles per year * (g/mi[electric] - g/mi[gas])
	Transit bus hybrid	(15.4)	(14.1)	(12.6)	(12.3)	= miles per year * (g/mi[hybrid] - g/mi[diesel])
	Transit bus CNG	(36.8)	(33.7)	(30.0)	(29.3)	= miles per year * (g/mi[CNG] - g/mi[diesel])
	Transit bus all-electric	(92.5)	(84.7)	(75.5)	(73.7)	= miles per year * (g/mi[electric] - g/mi[diesel])
	School bus electric	(12.4)	(11.4)	(10.0)	(10.0)	= miles per year * (g/mi[electric] - g/mi[diesel])
	Medium truck electric	(18.6)	(17.2)	(14.9)	(14.9)	= miles per year * (g/mi[electric] - g/mi[diesel])
	Heavy truck electric	(32.4)	(30.2)	(27.0)	(27.0)	= miles per year * (g/mi[electric] - g/mi[diesel])

	Points per new vehicle					Per vehicle replacing a diesel vehicle
	Auto electric	3	3	3	3	
	Transit bus hybrid	15	14	13	12	
	Transit bus CNG	37	34	30	29	
	Transit bus all-electric	92	85	76	74	
	School bus electric	12	11	10	10	
	Medium truck electric	19	17	15	15	
	Heavy truck electric	32	30	27	27	
	Hydrogen Refueling Stations					Per station
	Utilization rate	10%	30%	30%	30%	RMI (2020): 10% in 5-year term, 30% long-term for DCFC, assumed same for H2
	Time to refuel (hrs)	0.17	0.17	0.17	0.17	
	Daily service time (hrs)	16	16	16	16	RMI (2020): most DCFC demand between 6 am and 10 pm, assumed same for H2
	Number of vehicles served per station per day	9.6	28.8	28.8	28.8	= Service time / time to refuel * utilization rate
	H2 % renewable (vs. natural gas)	10%	40%	100%	100%	Assumption
	H2 carbon intensity, g CO2/MJ					
	Compressed, central NG reform	115.6	115.6	115.6	115.6	CARB (2015) value of 152.5 life-cycle, deflated based on ratio of direct to life-cycle for diesel
	Compressed, on-site renewable	62.1	62.1	62.1	62.1	CARB (2015) value of 62.1 life-cycle, deflated based on ratio of direct to life-cycle for diesel
	Weighted average	110.3	94.2	62.1	62.1	Calculated
	H2 carbon intensity, g CO2/GDE	14,994	12,811	8,446	8,446	= g CO2/MJ * 136 MJ/GDE [GDE = gallon diesel equivalent]
	Heavy truck diesel mi/gallon	6.8	7.5	8.4	8.5	AEO, 2019 Reference Case
	H2/diesel energy efficiency ratio (EER)	2.0	2.0	2.0	2.0	GREET model, v.2020

	Heavy truck H2 g CO2/mi	1,103	854	503	497	= g CO2/GDE / mi/gal / EER
	CO2 change (tons/year):					
	per H2 truck served	(4.6)	(8.7)	(14.4)	(14.5)	= Miles/year/vehicle * g/mile / 1000000
	per H2 station	(44.4)	(250.2)	(414.4)	(418.7)	= CO2 change/truck * trucks/charger
	Points per new station	44	250	414	419	

Table 8. GHG Point Estimate Calculation Methodologies - Sources

Short Name	Citation	Web Link
AAA (2021)	AAA (2021). Your Driving Costs.	https://newsroom.aaa.com/wp-content/uploads/2021/08/2021-YDC-Brochure-Live.pdf
AEO	U.S. Department of Energy, Annual Energy Outlook Reference Case, 2019 or 2022	https://www.eia.gov/outlooks/aeo/
AFDC	Alternative Fuels Data Center	https://afdc.energy.gov/
Barr (2000)	Barr, L.C. (2000). "Testing for the significance of induced highway travel demand in metropolitan areas", Transportation Research Record: Journal of the Transportation Research Board, vol. 1706.	https://journals.sagepub.com/doi/10.3141/1706-01
Buehler (2012)	Buehler, R., and J. Pucher (2012). “Cycling to Work in 90 Large American Cities: New Evidence on the Role of Bike Paths and Lanes.” Transportation 39:409–432.	https://www.saferoutespartnership.org/resources/journal-article/cycling-work-90-large-american-cities
CAPCOA (2021)	California Air Pollution Control Officers Association (2021). Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity.	https://www.airquality.org/ClimateChange/Documents/Handbook%20Public%20Draft_2021-Aug.pdf
CARB (2015)	California Air Resources Board (2015). Staff Report: Calculating	https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/peerre

	Life Cycle Carbon Intensity Value of Transportation Fuels in California.	view/050515staffreport_ca-greet.pdf
CDOT (2019)	Colorado Department of Transportation (2019). Statewide Transportation Demand Management Plan. Phase 1 Report: Colorado Transportation Options. Prepared by Wilson & Company, Inc.	https://www.codot.gov/programs/innovativemobility/mobility-services/tdm/links.html
CDOT (2021)	Colorado DOT (2021). Cost-Benefit Analysis for Rules Governing Statewide Transportation Planning. August 31, 2021.	https://www.codot.gov/business/rules/documents/cdot-cost-benefit-analysis-for-ghg-rule-sept-2021.pdf
CS (2010)	Cambridge Systematics and Sprinkle Consulting (2010). Transportation Demand Management Project Evaluation and Funding Methods in the Denver Region. Prepared for Colorado DOT.	http://www3.drcog.org/documents/archive/_CODOT_TDM_COMPLETE%20-%20FINAL%202%2011%2010.pdf
CS (2019)	Cambridge Systematics (2019). "The Future of the Workplace: How Will Economic and Technological Changes Affect Work Travel and Emissions?" Presented to Southern California Association of Governments.	
CS (2021)	Cambridge Systematics (2021). Transportation Investment Strategy Tool Documentation, 2021. Prepared for Georgetown Climate Center.	https://www.georgetownclimate.org/files/report/GCC_Investment_Tool.pdf
FHWA (2018)	McGuckin, N. and A. Fucci (2018). Summary of Travel Trends: 2017 National Household Travel Survey. U.S. Department of Transportation, Federal Highway Administration, FHWA-PL-18-019.	https://nhts.ornl.gov/assets/2017_nhts_summary_travel_trends.pdf
Hu et al (2014)	Hu, W.; A.T. McCartt, J.S. Jermakian, S. Mandavilli (2014). Public Opinion, Traffic Performance, the Environment, and Safety After Construction of Double-Lane Roundabouts. Transportation Research Record no. 2402.	https://journals.sagepub.com/doi/abs/10.3141/2402-06

ITF (2020)	International Transport Forum (ITF). (2020). "Good to Go? Assessing the Environmental Performance of New Mobility."	https://www.itf-oecd.org/good-go-assessing-environmental-performance-new-mobility
King County (2022)	King County Multi-Family Residential Parking Calculator	https://rightsizeparking.org/
Litman (2018)	Litman, T. (2018). TDM Encyclopedia: Carsharing. Victoria Transport Policy Institute.	https://www.vtpi.org/tdm/
Litman (2021)	Litman, T. (2021). TDM Encyclopedia: Parking Requirement Impacts on Housing Affordability. Victoria Transport Policy Institute.	https://www.vtpi.org/tdm/
MacArthur (2018)	MacArthur, J., C. Cherry, M. Harpool and D. Scheppke. (2018). A North American Survey of Electric Bicycle Owners. NITC-RR-1041. Portland, OR: Transportation Research and Education Center (TREC). https://dx.doi.org/10.15760/ trec.197	https://pdxscholar.library.pdx.edu/trec_reports/161/
Mobility Lab (2019)	Mobility Lab, Arlington County Commuter Services (ACCS). (2019). Arlington County Shared Mobility (SMD) Pilot Evaluation Report.	https://mobilitylab.org/research-document/arlington-county-shared-mobility-devices-smd-pilot-evaluation-report/
MWCOG (2009)	LDA Consulting et al for Metro Washington Council of Governments (2009). Transportation Emission Reduction Analysis Report, FY 2006–2008.	https://www.mwcog.org/documents/2020/11/17/commuter-connections-transportation-emission-reduction-measure-term-analysis-report--carsharing-commuter-connections-commuting/
NABSA (2020)	North American Bikeshare Association (NABSA). (2020). 1st Annual Micromobility State of the Industry Report.	https://doi.org/10.7922/G2057D6B
NACTO (2018)	National Association of City Transportation Officials (NACTO). (2018). Shared Micromobility in the U.S.: 2018.	https://nacto.org/shared-micromobility-2018/
NTD (2019)	2019 National Transit Database (data analysis by Cambridge Systematics)	https://www.transit.dot.gov/ntd
PBOT (2020)	Portland Bureau of Transportation (2020). E-Scooter Findings Report.	https://www.portlandoregon.gov/transportation/article/709719

Ramboll (2020)	Ramboll. (2020). Achieving Sustainable Micro-mobility. <https://ramboll.com/-/media/files/rgr/documents/markets/transport/m/ramboll_micro-mobility_greenpaper_a4_0320_lowres_v.pdf?la=en>	
Rabi (2012)	Rabi, A. and A. de Nazelle (2012). "Benefits of Shift from Car to Active Transport." Transport Policy 19(1).	
RMI (2020)	Rocky Mountain Institute (2020). DCFC Rate Design Study. Prepared for Colorado Energy Office.	https://rmi.org/insight/dcfc-rate-design-study/
Small and van Dender (2007)	Small, K. and K. Van Dender (2007). Fuel Efficiency and Motor Vehicle Travel: The Declining Rebound Effect. The Energy Journal, 28:1.	
TCRP Report 95 Chapter 12	McCollom, B.E., and R. H. Pratt, et al (2004). TCRP Report 95, Traveler Response to Transportation System Changes. Chapter 12: Transit Pricing and Fares. Transportation Research Board, Washington, D.C.	https://www.trb.org/Publications/TCRPReport95.aspx
TCRP Report 95 Chapter 5	Evans, J.E., and R. H. Pratt, et al (2005). TCRP Report 95, Traveler Response to Transportation System Changes. Chapter 5: Vanpools and Buspools. Transportation Research Board, Washington, D.C.	https://www.trb.org/Publications/TCRPReport95.aspx
TTI (2021)	Texas A&M Transportation Institute (2021). Urban Mobility Report. As analyzed in Cambridge Systematics (2021).	https://mobility.tamu.edu/umr/
[U.K.] Highways Agency (1997)	[U.K.] Highways Agency (1997). Design Manual for Roads and Bridges, Volume 12, Section 2, Part 2: Induced Traffic Appraisal.	
U.S. EPA (2016)	U.S. Environmental Protection Agency (EPA) (2016). Population and Activity of On-road Vehicles in MOVES2014. EPA-420-R-16-003.	https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=OTAQ&dirEntryId=309336

USDOT (2010)	U.S. Department of Transportation (2010). Transportation's Role in Reducing U.S. Greenhouse Gas Emissions.	http://www.reconnectingamerica.org/assets/Uploads/DOTClimateChangeReport-April2010-Volume1and2.pdf
WSCTRB (2017)	Washington State Commute Trip Reduction Board (2017). 2017 Report to the Legislature.	https://app.leg.wa.gov/ReportsToTheLegislature/Home/GetPDF?fileName=2017CTR_Report_cc6e5f5a-b10f-44b7-8304-fd65ba28133f.pdf

Community Access Enterprise

Statewide Transportation Advisory Committee

May 13, 2022

Carrie Atiyeh

CAE Board Administrator and Senior Program Manager

Community Access Enterprise Creation

- Created by Colorado Legislature through Senate Bill (SB) 21-260 and housed within the Colorado Energy Office (CEO)

- Business purpose: support the widespread adoption of electric vehicles, including vehicles that originally were powered exclusively by internal combustion engines but have been converted into electric vehicles, in an equitable manner by:

  - Funding the construction of charging infrastructure throughout the state

  - Incentivizing the acquisition and use of electric motor vehicles and electric alternatives to motor vehicles in communities, including but not limited to disproportionately impacted communities, and by owners of older, less fuel efficient, and higher polluting vehicles

Community Access Enterprise Benefits

- Equitably reduce and mitigate the adverse environmental and health impacts of air pollution and greenhouse gas emissions produced by vehicles used to make retail deliveries to consumers in local communities

- Support adoption of electric vehicles and electric alternatives to motor vehicles at the community level including rural, urban and disproportionately impacted communities throughout the state

- Support charging infrastructure to reduce range anxiety and ensure electric vehicles are viable in all communities

- Incentivize and assist owners of older, less fuel efficient and higher polluting vehicles to replace with electric vehicles, encourage use of electric alternatives and public transit

Community Access Enterprise Board of Directors

- Reverend Eugene Downing - New Hope Baptist Church (3 year term) – Chair
- Sarah Meirose - Ford Motor Company (3 year term) - Vice Chair
- Ryan Hurst - Motiv Power Systems, Inc. (4 year term)
- Alice Laird - Clean Energy Economy for the Region (CLEER) (4 year term)
- Rebecca White - Colorado Department of Transportation
- Michael Ogletree - Colorado Department of Public Health and Environment
- Will Toor - Colorado Energy Office

Work to Date and Looking Ahead

- First board meeting in November 2021
  - Board meets the 2nd Thursday of each month, 10am-12noon
  - Meetings are open to the public and all agendas, presentations, and meeting recordings are on the enterprise website

- Fee rulemaking
- Development of Ten-Year Plan
- Development of online dashboard and annual reports to ensure transparency, accountability

Community Access Enterprise Funding

- Retail delivery fee as established by SB21-260
    - CAE retail delivery fee as allowed by legislation six and nine-tenths cent
    - Stakeholder engagement meetings in February 2022
    - Fee rulemaking public hearing March 10, 2022 - board voted unanimously to approve retail delivery fee at six and nine-tenths cent
- Anticipated funding $310M over 10 years
- Fee collection begins July 1, 2022 by Dept. of Revenue

Community Access Enterprise Opportunities

- Grant, loan or rebate programs to support:
    - Charging infrastructure in public, workplace, transportation network company, multifamily and other locations
    - Chargers for communities including but not limited to disproportionately impacted communities
    - Chargers for medium- and heavy-duty vehicles including refrigerated trailers
    - Infrastructure to support hydrogen fuel cell motor vehicles
    - Networks and plazas that offer fast charging
    - Inexpensive and accessible electric alternatives to motor vehicles (e-bikes and scooters)
    - Incentivize adoption of electric motor vehicles in communities including replacement of high-emitting vehicles
    - Incentives for Transportation Network Companies to increase access to overnight charging for drivers

Ten-Year Plan Development

- Cambridge Systematics selected as vendor to develop CAE Ten-Year Plan
- Five stakeholder meetings held in March 2022
- Plan required to be complete and posted no later than June 1, 2022
- The plan will outline how the enterprise will execute its business purpose during fiscal years 2022-2023 through 2031-2032 and estimate the amount of funding needed to implement the plan
- Flexibility vs recommended direction

Ten-Year Plan Recommendations

Existing Programs

- Charge Ahead Colorado
- Can Do Colorado (ebikes)
- DCFC (fast charging) corridors and plazas
- Research + technical support + stakeholder engagement

New Programs

- Community Accelerated Mobility Projects (CAMP)
- Vehicle Investment for Sustainable Transportation Access (VISTA - vehicle replacement)
- Service Panel Upgrade + Residential Resources (SPURR)
- Fleet Infrastructure Resources (FIR - medium-/heavy-duty charging infrastructure)
- Sustainable Hydrogen Investments for a New Economy (SHINE)

Questions?

Thank you!

https://energyoffice.colorado.gov/boards-commissions/community-access-enterprise