COLORADO DEPARTMENT OF TRANSPORTATION	X POLICY DIRECTIVE □ PROCEDURAL DIRECTIVE	
Subject **Greenhouse Gas Mitigation Measures**		**1610.0**
Effective **6/16/22**	**Supersedes** **5/19/22**	**Originating Office** **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 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 in the Rule). For this reason, the GHG reductions achieved by GHG Mitigation Measures must be real, additional, quantifiable, and verifiable. GHG Mitigation Measures 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 GHG 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 GHG 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 GHG 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 and recommended 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 GHG 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 GHG Mitigation Measure contained in Appendix A of this Policy.

1. Proposing and Approving New GHG Mitigation Measures

a. 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

b. 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 GHG 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 Commission notes that there is a risk of disapproval under this scenario due to the Commission 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 GHG Mitigation 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 GHG 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 F. Stockinger III

Herman Stockinger
Transportation Commission Secretary

6-16-2022

Date of Approval

APPENDIX A.

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

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now-2025[3]	Points/ Metric 2026-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Pedestrian/Bicycle							
Bike lane/facility[4] - core urban[5]	Miles of two-way facility built between baseline plan year 1 and evaluation year[6]	30	26	21	12	6	2.0 – separated / protected lane or bike boulevard
Bike lane/facility - urban			14	11	7	3	
Bike lane/facility – suburban			4	4	2	1	

[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-2025: 2025; 2026-2030: 2030; 2031-2040: 2040; and 2041-2050: 2050.

[4] "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.

[5] For all strategies in this Appendix, "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. If there is evidence to show that a census tract or block group's population density will grow (e.g. shift from rural to suburban), agencies may claim a different density for a project.

[6] "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-2025[3]**	**Points/ Metric 2026-2030**	**Points/ Metric 2031-2040**	**Points/ Metric 2041-2050**	**Additional Multipliers**
Bike lane/facility – rural	Miles of two-way facility built between baseline plan year 1 and evaluation year	30	1	1	1	1	1.5 – within mixed-use district or ½ mi of transit station or school
Sidewalk/pedestrian facility - core urban			28	23	13	6	1.5 – within mixed-use district or ½ mi of transit station or school
Sidewalk/ pedestrian facility - urban			9	7	4	2	
Sidewalk/ pedestrian facility - suburban			1	1	1	1	
Sidewalk/ pedestrian facility – rural			1	1	1	1	
Shared-use path[7] - core urban			84	69	40	19	1.5 – within mixed-use district or ½ mi of transit station or school
Shared-use path - urban			39	32	18	9	
Shared-use path – suburban			10	8	5	2	
Shared-use path – rural			2	2	1	1	

[7] 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.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now-2025[3]	Points/ Metric 2026-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
"Complete Streets"[8] reconstruction - core urban	Miles of two-way facility built between baseline plan year 1 and evaluation year	30	54	44	26	12	2.0 – separated / protected lane or bike boulevard 1.5 – within mixed-use district or ½ mi of transit station or school
"Complete Streets" reconstruction - urban			22	18	11	5	
"Complete Streets" reconstruction - suburban			5	4	2	1	
Bikeshare	Per 100 vehicles in service in evaluation year	1	18	15	9	4	
Scooter share			18	14	8	4	
Transit							
New/increased fixed-route transit service[9] -electric	Per 1,000 additional vehicle revenue-hours[10] in evaluation year	1	31	25	15	7	
New/increased fixed-route transit service -electric/diesel fleet average			10	20	15	7	

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

[9] 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.

[10] Expressing service expansion in vehicle-hours captures a wide range of specific actions including adding route-miles, reducing headways, and extending

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now-2025[3]	Points/ Metric 2026-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
New/increased fixed-route transit service - intercity[11] fleet average bus	Per 1,000 vehicle revenue-miles	1	2	2	1	1	
New/increased fixed-route transit service - intercity electric bus			3	3	1	1	
Waive transit fares 25%	Per million annual trips current ridership base		69	57	33	16	
Waive transit fares 50%			139	115	67	32	
Waive transit fares 100%			277	229	133	63	
Implement bus priority treatments[12]	Per 1,000 vehicle revenue-miles per weekday of affected service in evaluation year	30	37	26	13	6	

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.

[11] Intercity transit services that cross multiple regional and metropolitan areas, e.g. CDOT's Bustang. Intercity buses have a more efficient driving cycle due to use of the highway.

[12] 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.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now-2025[3]	Points/ Metric 2026-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
New/increased demand-response bus service	Per 1,000 new vehicle revenue hours	1	1	6	5	2	
Transportation Demand Management							
Trip Reduction program[13] - voluntary	Per 1,000 covered employees	1	108	89	52	24	
Trip Reduction marketing	Per program $1,000 expenditure in evaluation year	1	2	2	1	1	
Employer sponsored vanpool	Per new vanpool in evaluation year	1	2	1	1	1	

[13] 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-2025[3]**	**Points/ Metric 2026-2030**	**Points/ Metric 2031-2040**	**Points/ Metric 2041-2050**	**Additional Multipliers**
Employer sponsored vanpool - electric	Per new vanpool in evaluation year	1	8	7	4	2	
Carshare program	# of cars provided in evaluation year		15	13	7	3	3.0 for EVs
Telework	Per 100 employees teleworking additional 1 day/week		25	20	12	6	
Broadband Expansion	Per 100 new households served	30	45	37	21	10	
Traffic Operations[14]							
Retime/optimize arterial signals	Per 10,000 AADT per signal optimized within five years prior to evaluation year	5	53	45	31	22	

[14] 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-2025[3]**	**Points/ Metric 2026-2030**	**Points/ Metric 2031-2040**	**Points/ Metric 2041-2050**	**Additional Multipliers**
Replace signalized intersection with roundabout	Per 10,000 AADT per roundabout	30	243	206	121	50	
Parking Management							
Reduce or eliminate commercial parking minimums and set maximum levels - Non-Central Business District, max 2.5 spaces/1,000 sq. ft.	Per 10,000 sq. ft. of gross floor area of commercial capacity in the area subject to the parking requirements between baseline plan year 1 and evaluation year	30	3	3	1	1-	
Reduce or eliminate commercial parking minimums and set maximum levels - Non-Central Business District, max 2.0 spaces/1,000 sq. ft.			8	7	4	2	
Reduce or eliminate commercial parking minimums and set maximum levels - Central Business District, max 1.5 spaces/1,000 sq. ft			5	4	2	1	

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now-2025[3]	Points/ Metric 2026-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Reduce or eliminate commercial parking minimums and set maximum levels - Central Business District, max 1.0 spaces/1,000 sq. ft	Per 10,000 sq. ft. of gross floor area of commercial capacity in the area subject to the parking requirements between baseline plan year 1 and evaluation year	30	10	8	5	2	
Eliminate residential parking minimums and set low maximum levels[15] - core urban	Per 1,000 DUs[16] that can be built in the area subject to the parking requirements between baseline plan year 1 and evaluation year	30	1,535	1,265	734	347	
Eliminate residential parking minimums and set low maximum levels – urban			1,603	1,321	766	362	
Eliminate residential parking minimums and set low maximum levels - suburban			1,841	1,517	880	416	

[15] Maximums: no more than 0.75 (1 bed/studio/efficiency), 1.0 (2 bed), and 1.25 (3+ bed).

[16] Dwelling units.

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now-2025[3]	Points/ Metric 2026-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Reduce or eliminate residential parking minimums and set moderate maximum levels[17] - core urban	Per 1,000 DUs[18] that can be built in the area subject to the parking requirements between baseline plan year 1 and evaluation year	30	767	632	367	173	
Reduce or eliminate residential parking minimums and set moderate maximum levels - urban			801	660	383	181	
Reduce or eliminate residential parking minimums and set moderate maximum levels - suburban			921	759	440	208	
Unbundle residential parking[19]	Per 1,000 parking spaces rented for at least $100 per month in evaluation year	1	179	147	85	40	
Additional tax or fee on public and/or private parking	Per 1,000 parking spaces per daily $1 fee in evaluation year		188	155	90	42	

[17] Maximums: no more than 1.0 (1 bed/studio/efficiency), 1.5 (2 bed), and 1.75 (3+ bed).

[18] Dwelling units.

[19] 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-2025[3]	Points/ Metric 2026-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Land Use							
Increase residential density	Per acre rezoned from <10 units/acre to at least 15-25 units/acre meeting "smart growth" criteria	30	27	22	13	6	
Increase job density	Per acre rezoned from <0.5 FAR to at least 1.0 FAR meeting "smart growth" criteria	30	22	18	11	5	
Mixed-use Transit-Oriented Development (TOD) - 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	30	60	49	28	13	

Project Type	Metric	Project Lifetime (Years)[1]	Points/ Metric[2] Now-2025[3]	Points/ Metric 2026-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Mixed-use TOD - moderate intensity	Per acres of area rezoned for mixed-use TOD accommodating at least 15 residential units/acre and 100 jobs/acre, within ½ miles of high-frequency bus transit or fixed guideway station	30	49	40	23	11	
MD/HD[20]							
Replace diesel transit buses with battery-electric buses	Number of new vehicles introduced between baseline plan year 1and evaluation year	12	92	85	-	-	
Replace diesel transit buses with hybrid diesel-electric buses			15	14	-	-	
Replace diesel transit buses with RNG bus			37	34	-	-	

[20] 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-2025[3]	Points/ Metric 2026-2030	Points/ Metric 2031-2040	Points/ Metric 2041-2050	Additional Multipliers
Replace diesel school buses with electric buses	Number of new vehicles introduced between baseline plan year 1and evaluation year	12	12	11	10	10	
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 baseline plan year 1 r 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)	341	281	163	77	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	327	798	81,556	New users: Transportation Investment Strategy Tool documentation, Table 4.11
Sidewalk/ pedestrian facility - urban	174	247	25,243	Displaced auto miles: New users * C1 * B1 * D
Sidewalk/ pedestrian facility - suburban	55	13	1,329	
Sidewalk/ pedestrian facility – rural	11	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	(25.8)	(21.2)	(12.3)	(5.8)	= Displaced auto miles * A / 1000000
	Bike lane/facility - urban	(13.7)	(11.3)	(6.6)	(3.1)	
	Bike lane/facility – suburban	(4.3)	(3.5)	(2.1)	(1.0)	
	Bike lane/facility – rural	(0.9)	(0.7)	(0.4)	(0.2)	
	Sidewalk/ pedestrian facility - core urban	(27.8)	(22.9)	(13.3)	(6.3)	
	Sidewalk/ pedestrian facility - urban	(8.6)	(7.1)	(4.1)	(1.9)	
	Sidewalk/ pedestrian facility - suburban	(0.5)	(0.4)	(0.2)	(0.1)	
	Sidewalk/ pedestrian facility – rural	(0.1)	(0.1)	(0.0)	(0.0)	
	Shared-use path - core urban	(84.0)	(69.2)	(40.1)	(19.0)	
	Shared-use path - urban	(38.6)	(31.8)	(18.4)	(8.7)	

	Shared-use path – suburban	(9.8)	(8.1)	(4.7)	(2.2)	
	Shared-use path – rural	(1.9)	(1.6)	(0.9)	(0.4)	
	"Complete Streets" reconstruction - core urban	(53.6)	(44.1)	(25.6)	(12.1)	
	"Complete Streets" reconstruction - urban	(22.3)	(18.4)	(10.7)	(5.0)	
	"Complete Streets" reconstruction – suburban	(4.7)	(3.9)	(2.3)	(1.1)	
	Change in tons CO2 per 100 new shared vehicles (annual):	**2025**	**2030**	**2040**	**2050**	**Source/Calculation**
	Shared bike	(18.1)	(14.9)	(8.7)	(4.1)	= Displaced auto miles * A / 1000000
	Scooter	(17.5)	(14.4)	(8.4)	(4.0)	
	Points per new facility-mile:	**2025**	**2030**	**2040**	**2050**	
	Bike lane/facility - core urban	26	21	12	6	Providing a minimum of 1 point, with the expectation to improve these values as more Colorado specific data becomes available.
	Bike lane/facility - urban	14	11	7	3	
	Bike lane/facility – suburban	4	4	2	1	
	Bike lane/facility – rural	1	1	1	1	
	Sidewalk/ pedestrian facility - core urban	28	23	13	6	

	Sidewalk/ pedestrian facility - urban	9	7	4	2	
	Sidewalk/ pedestrian facility - suburban	1	1	1	1	
	Sidewalk/ pedestrian facility – rural	1	1	1	1	
	Shared-use path - core urban	84	69	40	19	
	Shared-use path - urban	39	32	18	9	
	Shared-use path – suburban	10	8	5	2	
	Shared-use path – rural	2	2	1	1	
	"Complete Streets" reconstruction - core urban	54	44	26	12	
	"Complete Streets" reconstruction - urban	22	18	11	5	
	"Complete Streets" reconstruction – suburban	5	4	2	1	
	Points per 100 new shared vehicles:	**2025**	**2030**	**2040**	**2050**	
	Shared bike	22	15	9	4	
	Scooter	21	14	8	4	

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				NTD (2019), Colorado agencies
A2	Demand-response bus	13.7				NTD (2019), Colorado agencies
	Passenger-miles per vehicle-mile					
B1	Fixed-route bus	11.5				NTD (2019), Colorado agencies - Rapid Bus (RB) service
B2	Demand-response bus	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	341	281	163	77	CDOT (2021) - high EV scenario
C4	Intercity bus	778	200	-	-	CDOT (2021) - high bus electrification
	grams CO2 per vehicle-hour					
D	Fixed-route bus	3,966	1,018	-	-	CS (2021), scaled by g/mi from CBA analysis for future years
D1	Prior drive mode share of new riders	60%				CS (2021)
D2	Prior drive mode share of new riders (intercity)	80%				
	Average trip length (mi) - unlinked					
F1	Fixed-route bus	4.5				FHWA CMAQ Calculator Toolkit
F2	Demand-response bus	4.5				Assumed same as fixed-route

G	Annualization factor	300				
	New/increased fixed-route bus service					**1,000 new vehicle revenue-hours**
	Tons CO2 per new VRH					
	Displaced auto	(36.7)	(25.2)	(14.6)	(6.9)	= 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)	(16.5)	(200)	(14.6)	(6.9)	= new bus + displaced auto
	Net (electric bus)	(36.7)	(25.2)	(14.6)	(6.9)	
	Points per new 1,000 VRH (fleet average bus)	16	20	15	7	
	Points per new 1,000 VRH (electric bus)	37	25	15	7	
	New/increased fixed-route bus service - intercity					1,000 new vehicle revenue-miles
	Change in auto VMT	(9,200)	(9,200)	(9,200)	(9,200)	= 1000 * B1 * D2
	Tons CO2 per new VRM					
	Displaced auto	(3.1)	(2.6)	(1.5)	(0.7)	= 1000 * B1 * C3 * D / 1000000
	New bus (fleet average)	0.8	0.2	-	-	= 1000 * C4 / 1000000
	New bus (electric)	-	-	-	-	
	Net (fleet average bus)	(2.4)	(2.4)	(1.5)	(0.7)	= new bus + displaced auto
	Net (electric bus)	(3.1)	(2.6)	(1.5)	(0.7)	

	Points per 1,000 new VRM (fleet average bus)	2	2	1	-	
	Points per 1,000 new VRM (electric bus)	3	3	1	-	
	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	(9.8)	(8.1)	(4.7)	(2.2)	= A1 * B1 * C3 * D / 1000
	Net	(1.3)	(5.9)	(4.7)	(2.2)	= new bus + displaced auto
	Points per new 1,000 VRH	1	6	5	2	
	Reduce transit fares					**1 million base annual trips**
	Fare elasticity	-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	(277.4)	(228.6)	(132.6)	(62.6)	= change in auto VMT * C3 / 1000000
	Points per million trips - free fares	277	229	133	63	
	Points per million trips - 50% fare reduction	139	115	67	32	
	Points per million trips - 25% fare reduction	69	57	33	16	

	Implement bus priority treatments					**Affected 1,000 VRM per weekday**
	Bus travel time elasticity	-0.4				TCRP Report 95, Chapter 12
	Typical travel time change (%)	-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)	(28)	(23)	(13)	(6)	= change in auto VMT * C3 / 1000000
	Change in bus idle emissions (t CO2)	(9)	(2)	-	-	
	Change in tons CO2	(37)	(26)	(13)	(6)	
	Points per 1,000 affected weekday VRM	37	26	13	6	
	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	-	-	-	-	= new riders * trip length / new revenue-miles

	service					
	Change in annual auto VMT					= new riders * trip length * prior drive mode share
	Change in annual tons CO2					
	Displaced auto	-	-	-	-	= change in auto VMT * C3 / 1000000
	New bus service	-	-	-	-	= 1000 * C1 * A1 * / 1000000
	Net change	-	-	-	-	= new bus + displaced auto
	Points	-	-	-	-	

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)	341	281	163	77	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)				
	Change in annual tons CO2 per 100 spaces per $	(187.9)	154.8	89.8	42.4)	= Change in VMT * 1000 * A / 1000000
	Points per 1,000 spaces per $ daily fee	188	155	90	42	
	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)				= D1 * percent reduction
	Change in annual tons CO2 per 1,000 space per $	(178.7)	(147.3)	(85.4)	(40.4)	= Change in VMT * 1000 * A / 1000000
	Points per 1,000 spaces per $100 monthly cost	179	147	85	40	

	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	(1,535)	(1,265)	(734)	(347)	
	Urban	(1,603)	(1,321)	(766)	(362)	
	Suburban	(1,841)	(1,517)	(880)	(416)	
	Points per 1,000 DU					
	Urban core	1,535	1,265	734	347	
	Urban	1,603	1,321	766	362	
	Suburban	1,841	1,517	880	416	

	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	(767)	(632)	(367)	(173)	
	Urban	(801)	(660)	(383)	(181)	
	Suburban	(921)	(759)	(440)	(208)	
	Points per 1,000 DU					
	Urban core	767	632	367	173	
	Urban	801	660	383	181	
	Suburban	921	759	440	208	
	Reduce or eliminate minimum and set maximum levels (commercial)					**Per 10,000 sq. ft. gross floor area of commercial capacity**
	Square feet per worker	300				Average for multiple employment categories; see CAPCOA (2021), p. 74
	Workers per 10,000 sq. ft.	33				= 10,000 / sq. ft. per worker
	% change in auto mode share per 0.1 space parking reduction per 1,000 sq. ft.	-1.4%				Estimates based on Morrall & Bolger (1996) and Lund, Cervero, & Willson (2004)
	Annual VMT change per 0.1 space reduction	(2,987)				= % change in auto mode share * workers per 10,000 sq. ft. * D3

	Baseline parking level (spaces per 1,000 sq. ft. general office or commercial) for existing mode share (no reduction)					
	Non-CBD area	2.8				Institute of Transportation Engineers, as cited in TCRP Report 95 Chapter 18
	CBD area	2.0				Estimate
	% change in auto mode share vs. baseline for maximum parking ratio for general office or commercial floor area:					= (Baseline parking ratio - new parking ratio) * % change in auto mode share per 0.1 space reduction * 10
	Non-CBD, max 2.5 spaces/1,000 sq. ft.	-4.2%				
	Non-CBD, max 2.0 spaces/1,000 sq. ft.	-11.2%				
	CBD, max 1.5 spaces/1,000 sq. ft.	-7.0%				
	CBD, max 1.0 spaces/1,000 sq. ft.	-14.0%				
	Annual VMT change per 10,000 sq. ft. revised parking ratios:					= % change in auto mode share * workers per 10,000 sq. ft. * D3
	Non-CBD, max 2.5 spaces/1,000 sq. ft.	(8,960)				
	Non-CBD, max 2.0 spaces/1,000 sq. ft.	(23,893)				
	CBD, max 1.5 spaces/1,000 sq. ft.	(14,933)				
	CBD, max 1.0 spaces/1,000 sq. ft.	(29,867)				
	Change in annual tons CO2					= Change in VMT * A / 1000000
	Non-CBD, max 2.5 spaces/1,000 sq. ft.	(3.1)	(2.5)	(1.5)	(0.7)	
	Non-CBD, max 2.0 spaces/1,000 sq. ft.	(8.1)	(6.7)	(3.9)	(1.8)	

CBD, max 1.5 spaces/1,000 sq. ft.	(5.1)	(4.2)	(2.4)	(1.1)	
CBD, max 1.0 spaces/1,000 sq. ft.	(10.2)	(8.4)	(4.9)	(2.3)	
Points per 10,000 sq. ft. gross floor area of commercial capacity:					
Non-CBD, max 2.5 spaces/1,000 sq. ft.	3	3	1	1	
Non-CBD, max 2.0 spaces/1,000 sq. ft.	8	7	4	2	
CBD, max 1.5 spaces/1,000 sq. ft.	5	4	2	1	
CBD, max 1.0 spaces/1,000 sq. ft.	10	8	5	2	

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	341	281	163	77	CDOT (2021) - high EV scenario
A2	Vanpool	758	703	366	90	Base year assumed 10 mpg, future year efficiency/electrification adjustments proportional to auto
	Average work trip length (mi)					

B1	Auto	12.7				FHWA (2018), Table 26
B2	Vanpool	25				TCRP Report 95, Chapter 5. Typical average length is close to 25 miles (p. 5-13, Table 5-5)
C	Annualization factor	250				TCRP Report 95, Chapter 5, Table 5-6
	Trip Reduction Program - Voluntary					**Per Program $1,000**
	% change in work trip VMT for covered employees	-5%				USDOT (2010), p. 5-75, 5% reduction in SOV mode share; Boarnet (2014) as cited in CAPCOA (2021), 4-6% VMT reduction
	VMT change per 1,000 covered employees (annual)	(317,500)	(317,500)	(317,500)	(317,500)	= % VMT Change * B1 * 2 * C * 1000
	Change in annual tons CO2 per $	(108.3)	(89.2)	(51.8)	(24.4)	= Change in VMT * A1 / 1000000
	Points per 1,000 covered employees	108	89	52	24	
	Trip Reduction Program - Marketing					**Per Program $1,000**
	Annual VMT reduced per program $	7				MWCOG (2009), as analyzed by CS for Colorado DOT (2010) and updated 2022
	Change in annual tons CO2 per $	(2)	(2)	(1)	(1)	= Change in VMT * 1000 * A1 / 1000000
	Points per program $1,000	2	2	1	1	

	Employer Sponsored Vanpool					**Per New Vanpool**
	Average vanpool occupancy	5.8				CDOT (2019), total participants / total vans
	Prior drive mode share of new vanpoolers	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				Estimate
	Annual VMT change per new vanpool					
	Auto	(23,563)				= occupancy * prior drive mode share * B1 * C
	Vanpool	7,500				= circuity factor * B1 * C
	Change in annual tons CO2 per new vanpool					
	Auto	(8.0)	`(6.6)	(3.8)	(1.8)	= Change in auto VMT * A1 / 1000000
	Vanpool, fleet average	6.4	5.3	2.7.9	0.7	= Change in vanpool VMT * A2 / 1000000
	Vanpool, electric	-	-	-	-	= Change in vanpool VMT *A3 / 1000000
	Net, fleet average vanpool	(1.6)	(1.4)	(1.1)	(1.1)	= Sum of auto and vanpool change
	Net, electric vanpool	(8.0)	(6.6)	(3.8)	(1.8)	= Sum of auto and vanpool change
	Points per new vanpool (fleet average)	2	1	1	1	= Sum of auto and vanpool change
	Points per new vanpool (electric)	8	7	4	2	
	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)	(15)	(13)	(7)	(3)	
	Points per new carshare vehicle	15	13	7	3	
	Telework					**Per 100 employees teleworking additional 1 day/week**
	Daily work trip VMT change per new teleworker	-25.4				= B1 * 2
	Rebound effect (additional non-work travel as % of reduced work travel)	41%				"Overall rebound effect" for a telecommuter on a telecommuter day, based on analysis of 2012-2013 California Household Travel Survey (CS, 2019)
	Annual VMT change per 100 new teleworkers per additional day per week	(719)				= Daily VMT change * (1 - rebound effect) * 48 weeks/year
	Change in annual CO2 per 100 new teleworkers per additional day per week (tons)	(25)	(20)	(12)	(6)	= Change in VMT * A1 * 100 / 1000000
	Points per 100 new teleworkers per additional day per week	25	20	12	6	

	Broadband					**Per 100 new households served**
	% VMT for "personal business"	32%				FHWA (2018), Table 6a
	Change in personal business VMT due to tele-travel	-10%				Assumption
	% VMT for work	29%				FHWA (2018), Table 6a
	Change in work travel due to work-from-home	-12%				Colorado DOT
	Annual household VMT change per new broadband service point	(1,317)				= [Land Use-D2] * (% VMT * VMT reduction for personal business + % VMT * VMT reduction for work)
	Change in annual CO2 per 100 new households served with broadband (tons)	(45)	(37)	(21)	(10)	= Change in VMT * A1 * 100 / 1000000
	Points per 100 new households served with broadband	45	37	21	10	

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

TRAFFIC OPERATION STRATEGIES						
		Value				
Ref	**Parameter**	**2025**	**2030**	**2040**	**2050**	**Metric; Source/Calculation**
	Parameters Common Across Strategies					
	grams CO2 per vehicle-mile (auto)	341	281	163	77	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	(75.7)	(68.2)	(44.2)	(27.8)	= Delay reduction * CO2/hour * 365 / 1000

	From VMT increase	22.4	18.5	10.7	5.1	= Volume change * miles/signal * g/mi [auto] * 365 / 1000000
	Net CO2 change	(53.3)	(45.4)	(31)	(21.5)	
	Points per signal per 10,000 AADT	53	45	32	22	
	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)	(206)	(121)	(50)	= Vehicles * kg/vehicle / 1000
	Points per roundabout per 10,000 AADT	243	206	121	50	

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)	341	281	163	77	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	-26.5	(21.9)	(12.7)	(6)	= Change in VMT/unit * A * 18 / 1000000
	Points per rezoned acre	27	22	13	6	
	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	-22	(18.1)	(10.5)	(5)	= Change in VMT/employee * employees/acre * A / 1000000
	Points per rezoned acre	22	18	11	5	

	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 acre	(-59.6)	(49.1)	(28.5)	(13.5)	= Change in VMT/acre * A / 1000000
	Points per rezoned acre	60	49	28	13	
	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	(48.5)	(-40)	(23.2)	(11)	= Combined effect for increasing residential density + increasing job density
	Points per rezoned acre	49	40	23	11	

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

MD/HD STRATEGIES						
		Value				
Ref	**Parameter**	**2025**	**2030**	**2040**	**2050**	**Metric; Source/Calculation**
	grams CO2 per vehicle-mile					
	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)					
	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
	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				
	Daily service time (hrs)	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				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				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				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 9. 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 Life Cycle Carbon Intensity Value of Transportation Fuels in California.	https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/peerreview/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.	https://journals.sagepub.com/doi/abs/10.3141/2402-06

	Transportation Research Record no. 2402.	
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/
Lund, Cervero, and Willson (2003)	Lund, H. M., Cervero, R., and Willson, R. W. (2004). Travel Characteristics of Transit-Oriented Development in California. Prepared by Project Team Members from Cal Poly Pomona, UC Berkeley, and San Francisco Bay Area Rapid Transit under a Caltrans "Statewide Planning Studies" Transportation Grant, Sacramento, CA. Cited in TCRP Report 95 Chapter 17.	
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/

Morrall and Bolger (1996)	Morrall, J., and Bolger, D. (1996). "The Relationship Between Downtown Parking Supply and Transit Use." ITE Journal Vol. 66, No. 2 (February, 1996).	
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
TCRP Report 95 Chapter 17	Evans, J., R. Pratt, A. Stryker, and J.R. Kuzmyak (2004). TCRP Report 95, Traveler Response to Transportation System Changes. Chapter 17: Transit-Oriented Development. Transportation Research Board, Washington, D.C.	https://www.trb.org/Publications/TCRPReport95.aspx
TCRP Report 95 Chapter 18	Kuzmyak, J.R., R. Weinberger, R. Pratt, and H. Levinson (2003). TCRP Report 95, Traveler Response to Transportation System Changes. Chapter 18: Parking Management and Supply. 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