

Greenhouse Gas Modeling Process

DRAFT as of 10/19/21

Introduction/contents

This document describes the procedural steps by which entities regulated by CDOT's Greenhouse Gas Transportation Planning Standard shall run models to demonstrate that "applicable planning documents" (the plans to which the rule applies) meet the rule's requirements. To provide flexibility concerning technical methods of how these requirements will be met (e.g., the ability to adapt these methods due to changes and improvements in travel models, new data, updates to state or federal regulations, etc.), details of these methods have not been included in the rule, but instead are provided in this companion document.

This companion document therefore describes:

- The cooperative process through which CDOT and the MPOs will work together to ensure that technical tools and resources are available to and established at CDOT and in each MPO to meet the requirements described in 8.02.4 and 8.02.5
- The modeling process required by Oct 1, 2022
- The modeling process required after Oct 1, 2022

Rule elements guiding the content of this document

Planning requirements in the rule are broadly described in section 8.02.4:

- By Oct 1, 2022, CDOT, DRCOG and NFRMPO shall update their plans and meet the requirements shown in Table 1.
- After Oct 1, 2022, CDOT and MPOs must meet Table 1 requirements for "each applicable planning document."

Rule section 8.02.5 describes the contents of a report that MPOs shall provide to demonstrate compliance with these requirements for the applicable plans and plan updates, including:

- Emissions analysis showing compliance
- Identification and documentation of the models (travel and air quality) used to determine GHG emissions
- Mitigation action plan

Modeling process elements

- Cooperative Process:
 - o Summary: travel demand forecasting is a diverse and rapidly evolving field. Likewise, efforts are proceeding around the world to evaluate the effects on GHG emissions of transportation projects and programs. Both trends are generating rapid progress/change in tools and techniques. Much the same can be said of air pollutant emissions modeling. However, a GHG emissions reduction program, such as that undertaken as a result of Colorado HB19-1261 and the subsequent GHG Roadmap,

requires an effectively consistent approach across the state and among the various entities regulated under these initiatives. It also is important that this approach adapt over time to take advantages of advances in the modeling field. It therefore is necessary that the entities participating in this process in Colorado develop and conduct an on-going process of cooperative decision-making in developing this modeling approach and maintaining it through time.

- CDOT will establish a Statewide Model Coordination Group (SMCG), composed of CDOT, CDPHE, all MPOs.
- The SMCG will be convened by no later than December 15, 2021, and meet thereafter at least quarterly, with additional meetings as necessary to discuss modeling issues at the request of group members. Immediately after being convened, the SMCG will advise CDOT in the development of key guidance documents, including:
 - **1-GHG Modeling Guidelines Technical Memo.** To provide guidance in the development of this outline and associated documentation, CDOT, advised by the SMCG, will provide a modeling guidelines technical memo, that describes required practices in modeling that will satisfy the process described here. This memo will, where available, make reference to national modeling standards already in existence, and will add to those standards where necessary. The guidelines memo will include (but not be limited to) elements such as:
 - Types of models approved for use (e.g., EPA-approved air quality models; travel models appropriate to the area and purpose for which they are used, such as activity-based models versus trip-based models, etc.)
 - Model calibration and validation guidelines
 - Description of the relationship between GHG/VMT estimation of projects/programs and the model components/variables needed to estimate them.
 - Appropriate sensitivity to induced demand.
 - Standard data sources to be used for model estimation/calibration/validation/inputs.
 - Standards for model maintenance and update scheduling.
 - Agreed-upon depiction in the MOVES model of travel model and mitigation measure outcomes and measures, and other necessary assumption (such as EV market penetration).
 - **2- Technical Documentation Outline.** Rule section 8.02.5.2 requires “Identification and documentation of the MPO Model or the Statewide Travel Model and the Approved Air Quality Model used to determine GHG emissions in MMT of CO₂e.” The SMCG will advise CDOT on development (and update as necessary) of a detailed outline describing the necessary contents of the documentation required in rule section 8.02.5.2. This document will describe each model used for GHG estimation, addressing all elements in the GHG Modeling Guidelines Technical Memo, describing how the model satisfies the requirements in that memo. Entities maintaining and operating the models used for GHG emissions modeling will then develop documentation of their

models according to the outline. Elements in this outline will include, but are not limited to:

- Technical description of the structure of the model (e.g., choice model components, model parameter sets, traffic assignment methods, etc.)
 - Model inputs and outputs
 - Calibration process and outcomes
 - validation process and outcomes.
- Rule section 8.02.3 states that “By April 1, 2022, CDOT shall establish an ongoing administrative process, through a public process, for selecting, measuring, confirming, and verifying GHG Mitigation Measures...” In support of complying with this section, CDOT will establish a GHG Mitigation Measures Advisory Group (Mitigation Group), composed of (LIST HERE). This group may be a new group, or may consist of an existing group tasked with this role.
 - This group will, by April 2022, develop an initial list of mitigation strategies, together with associated GHG reductions that can be used in the year 2022 as part of the transportation plans covered by the rule.
 - This group will be a permanent, on-going group, as CDOT expects that the list of mitigation measures and associated GHG reductions will change over time:
 - Reductions may be re-calculated
 - New tools to calculate reductions may become available, resulting in new reduction estimates.
 - New measures may be proposed and evaluated
 - At times measures may go off the list

Modeling Process Overview

- The modeling process required by Oct 1, 2022;
 - Summary. The purpose of the planning rule is to reduce GHG emissions compared to those produced under current planning. The modeling process therefore begins by estimating GHG emissions under current planning assumptions (plans adopted as of December 31st, 2021), then requires regulated entities to develop a modified plan, calculate its GHG emissions, and compare the GHG reduction (relative to current planning assumptions) to the reduction amount required in the rule. These two analyses are conducted with the inclusion of current estimates of EV market penetration in future years, so that estimated GHG reductions take into account how much “dirty vehicle” VMT remains on the road in those future years, since it is that pool of VMT that generates the GHG left in any given year that can be reduced by new planning assumptions. Model development and GHG model runs by all regulated entities will be conducted, confirmed and approved through a cooperative, interagency process.
 - Baseline model scenario development:
 - For applicable plans, per the rule text, to be run by CDOT if MPOs request or by MPOs otherwise, run the selected/applicable model for the plan as adopted by December 31st, 2021.

- Provide model outputs to APCD, which will run MOVES (or to CDOT, if it develops the capability to run MOVES, and if the SMCG agrees to CDOT taking on this role.)
 - Note: if the travel model is run by CDOT, CDOT will work with the MPO to ensure the statewide model networks and land use are updated to match the current MPO model.
 - Note: a baseline travel model is required so that it is available to support the “reduction level” runs described below. “No-action” GHG levels (that is, GHG levels assuming no modification of the 2021 plan, and no increase in EV market penetration) are provided in Table 1 for informational purposes only.
 - GHG reduction level analysis
 - MPO/CDOT develop a modified plan, with changes to the baseline plan intended to reduce GHG sufficient to meet the standards of the rule
 - MPO/CDOT conduct travel model run with this modified plan, including the projects/programs/strategies proposed to reduce GHG emissions. Provide to APCD (or CDOT), which will conduct two MOVES runs:
 - One run using the above baseline travel model run, but including the best-estimate EV market penetration; and
 - One with the modified plan travel model run, and the same EV penetration assumptions as above.
 - The “GHG reduction level” will be the difference between the above two runs.
 - If the MOVES results for “baseline travel model run” with EV assumptions minus the MOVES results for “modified plan travel model run” with EV assumptions is greater than or equal to the reduction level in the rule, as shown in Table 1 below, for that MPO or CDOT, for the given scenario year, then the GHG plan meets the standard. If the GHG plan does not meet the standard for one or more scenario years, then:
 - If the MPO has used their own model, and feels that the statewide model has greater sensitivity to the GHG reduction strategies, CDOT will re-run that scenario and re-calculate the reduction level; and/or
 - The MPO or CDOT will consider changes to the RTP / 10-Year plan (e.g. removing regionally significant projects or including GHG-reducing modifications to these projects) again running using their own model or having CDOT run the scenario using its model.
 - The above sequence will be run for all required model years (2025, 2030, 2040, 2050).

Table 1: GHG Transportation Planning Reduction Levels in MMT of CO₂e

Regional Areas	2025 No Action Projections (MMT)	2025 Reduction Level (MMT)	2030 No Action Projections (MMT)	2030 Reduction Level (MMT)	2040 No Action Projections (MMT)	2040 Reduction Level (MMT)	2050 No Action Projections (MMT)	2050 Reduction Level (MMT)
DRCOG	14.9	0.27	11.8	0.82	10.9	0.63	12.8	0.37
NFRMPO	2.3	0.04	1.8	0.12	1.9	0.11	2.2	0.07
PPACG	2.7	N/A	2.2	0.15	2.0	0.12	2.3	0.07
GVMPO	0.38	N/A	0.30	0.02	0.30	0.02	0.36	0.01
PACOG	0.50	N/A	0.40	0.03	0.30	0.02	0.4	0.01
CDOT/Non-MPO	6.7	0.12	5.3	0.36	5.2	0.30	6.1	0.17
TOTAL	27.4	0.43	21.8	1.5	20.6	1.2	24.2	0.7

* Estimate as of October, 2021

- The modeling process required after Oct 1, 2022
 - o Summary: Data and models that are used to estimate GHG emissions regularly change over time, as modelers and analysts work to improve those tools. The process of updating transportation plans and GHG reduction estimates in future years therefore must take these improvements into account. In addition, as the purpose of the planning rule is to require reductions in GHG emissions as compared to those produced by current planning, MPOs and CDOT will in future years have to retain their depiction of their current plans (those in force as of December 31st, 2021), and compare future plans to that plan to demonstrate compliance with GHG emissions reduction required in the rule. Use of updated models, and retention and use of the model depiction of the plans in force as of December 31st, 2021, constitute the difference between the required model process by Oct 1, 2022 and that required after that date. The process below notes those differences where needed. Model development and GHG model runs by all regulated entities will be conducted, confirmed and approved through a cooperative, interagency process.
 - o If the MPO/CDOT has updated its model since adopting its current RTP / 10 – year plan, and that model has been approved by the SMCG, the new model shall be used for all the

analysis described under this section. This step constitutes a difference from the process to be followed prior to October 1st, 2022.

- Baseline model scenario development:
 - For applicable plans, per the rule text, to be run by CDOT if MPOs request, by MPOs otherwise, run the selected/applicable plan as adopted in 2021 using the new/currently approved model:
 - Provide model outputs to APCD (or CDOT), which will run MOVES
 - Note: if travel model is run by CDOT, CDOT will work with the MPO to ensure the statewide model networks and land use are updated to match the current MPO model.
 - Note: a baseline travel model is required so that it is available to support the “reduction level” runs described below. “No-action” GHG levels (that is, GHG levels assuming no modification of the 2021 plan, and no increase in EV market penetration) are provided in Table 1 for informational purposes only.
- GHG reduction level analysis
 - For the updated plan to be analyzed, MPO/CDOT conduct travel model run with this updated plan. Provide to APCD or CDOT, which will conduct two MOVES runs:
 - One run using the above baseline travel model run (the plan in force as of December 31st, 2021), but including the best-estimate EV market penetration (this step constitutes a difference from the process to be followed prior to October 1st, 2022, as it requires comparison to a plan that may no longer be currently in force); and
 - One with the updated plan travel model run, and the same EV penetration assumptions as above.
 - The “GHG reduction level” will be the difference between the above two runs.
 - If the MOVES results for “baseline travel model run” with EV assumptions minus the MOVES results for “updated plan travel model run” with EV assumptions is greater than or equal to the reduction level in the rule for that MPO or CDOT, for the given scenario year, then the GHG plan passes. If the GHG plan does not pass, then:
 - If the MPO has used their own model, and feels that the statewide model has greater sensitivity to the GHG reduction strategies, CDOT will re-run that scenario and re-calculate the reduction level; and/or
 - Re-form the RTP / 10-Year plan, removing regionally significant projects that they think will produce GHG emission increases and replacing them with regionally significant projects that they think will reduce them, again running using their own model or having CDOT run the scenario using its model.
- The above sequence will be run for all required model years (2025, 2030, 2040, 2050).