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Evaluation of Existing Transportation Demand Management Calculators

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16. Abstract

The Colorado Department of Transportation (CDOT) supports the use of Transportation Demand Management (TDM) strategies to reduce greenhouse gas emissions (GHG) and maximize transportation investments implemented at the state and local levels. This report represents initial research that will inform potential development of a CDOT TDM Calculator. Specifically, this research identifies existing TDM calculators and determines if any existing calculators meet CDOT's goal of developing a calculator that estimates the vehicle miles traveled (VMT) reduction benefits of implementing TDM strategies.

We concluded that there is no existing TDM calculator that meets CDOT's needs. Therefore, the report also provides recommendations for CDOT's development of their own TDM calculator. To supplement the evaluation of existing calculators and recommendations, the project team interviewed state and local planning agencies that have existing TDM calculators or would potentially use a CDOT TDM calculator.

Implementation (Optional)

The report concludes by recommending development of a CDOT TDM Calculator

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Evaluation of Existing Transportation Demand Management Calculators

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Executive Summary

The Colorado Department of Transportation (CDOT) supports the use of Transportation Demand Management (TDM) strategies to reduce greenhouse gas emissions (GHG) and maximize transportation investments implemented at the state and local levels. This report represents initial research that will inform potential development of a CDOT TDM Calculator. Specifically, this research identifies existing TDM calculators and determines if any existing calculators meet CDOT's goal of developing a calculator that estimates the vehicle miles traveled (VMT) reduction benefits of implementing TDM strategies.

This report concluded that there is no existing TDM calculator that meets CDOT's needs. Therefore, the report also provides recommendations for CDOT's development of their own TDM calculator. To supplement the evaluation of existing calculators and recommendations, the project team interviewed state and local planning agencies that have existing TDM calculators or would potentially use a CDOT TDM calculator. The report concludes by recommending development of a CDOT TDM Calculator. .

Research Approach

Research completed for this report will inform CDOT's decision-making for development of a TDM calculator by identifying the most effective existing TDM calculators and highlighting the most relevant features of the most effective existing TDM calculators in use today.

The report identifies 16 existing TDM calculators, summarizes the methodology used to evaluate the existing calculators, lists key features of the top existing calculators, and provides recommendations for developing a CDOT TDM calculator. Identifying key calculator features provides CDOT with a framework for developing their own TDM calculator. Adapting the VMT reduction analysis approach used in existing calculators, many of which focus on land use development, to a transportation infrastructure context will be a challenging process. Specifically, 9 of the 16 calculators focus on VMT reduction related to TDM measures associated with land use development projects. Other calculators analyze transportation through high-level GHG reduction estimates, air quality improvements, cost-benefit ratios, or the induced demand from highway expansion. While a CDOT calculator could draw on the features, functions, and methodologies of these existing tools, estimating VMT reduction for TDM measures associated with transportation infrastructure projects represents a unique use case not addressed by existing calculators. To supplement this existing calculator evaluation, the project team also conducted in-depth interviews with agencies that have developed their own TDM calculators and with Colorado stakeholders that would potentially use a CDOT TDM calculator. Finally, the report provides

recommendations for key TDM calculator features, and it discusses key elements that should be considered for development of a CDOT TDM calculator.

Implementation Recommendations: Development of a CDOT TDM Calculator

Developing a custom TDM calculator that meets this use case would support state and CDOT goals, such as supporting VMT quantification, and providing a project rationale to stakeholders and community members. In addition, the calculator could augment existing TDM analysis, strengthen grant applications, and provide CDOT staff with a more accurate way to collect and report on TDM strategies. Given these benefits, CDOT's Office of Innovative Mobility (OIM) now plans to develop a custom web-based TDM calculator. The recommendations and next steps from this report will form the framework for development of this TDM calculator.

Chapter 1. Report Introduction

CDOT aims to support implementation of TDM strategies that reduce GHG emissions and maximize transportation investments. Several states, most notably California, have taken this approach a step further and developed TDM calculators to better understand the impacts of various TDM strategies on local and regional VMT and/or GHG emissions. These calculators use different land-use and/or transportation improvement scenarios to estimate VMT and/or GHG emissions before and after various TDM strategies. VMT reduction (and the associated GHG emissions reduction benefits) help accomplish a variety of Colorado's policy goals:

- CDOT Vision 2035's goals to increase multimodal travel.
- PD 14.0's performance goal to sustainably increase transportation choice.
- CDOT's Greenhouse Gas Pollution Reduction Planning Standard to reduce GHG emissions from the transportation sector, improve air quality, and provide more travel options for Coloradans.
- Colorado House Bill (HB) 19-1261: Establishes statewide GHG reduction goals, and Senate Bill (SB) 19-016 that accelerated these goals.
- Colorado SB21-260 – CDOT's Transit Connection Study: Creates new sources of dedicated funding and new state enterprises to preserve, improve, and expand existing transportation infrastructure; develop the modernized infrastructure needed to support the widespread adoption of electric motor vehicles; and mitigate environmental and health impacts of transportation system use.
- HB24-1313 – Housing in Transit-Oriented Communities: Requires a transit-oriented community to meet its housing opportunity goal. A housing opportunity goal is a zoning capacity goal based on an average zoned housing density of 40 dwelling units per acre multiplied by the number of acres of transit-related areas within a transit-oriented community.
- HB24-1304 – Parking Minimum Requirements: Prohibits a municipality that is within a metropolitan planning organization (MPO) or a county that has unincorporated areas within an MPO (local government) from enacting or enforcing minimum parking requirements for developments built within specific land uses.
- SB24-032: Establishes a committee to evaluate the feasibility of a statewide transit pass.

- SB24-230 – Oil and Gas Production Fees: Requires the Clean Transit Enterprise to impose a production fee for clean transit to be paid quarterly by every producer of oil and gas in the state.

This research will enhance CDOT's TDM calculator development goals by identifying the most effective existing TDM calculators and highlighting relevant features of the most effective existing TDM calculators in use today. Ultimately, a CDOT calculator would be used to calculate TDM-related vehicle trip reductions for promoting multimodal transportation improvements, transit service and amenity improvements, and programmatic TDM measures. Quantifying the VMT reduction related to these and other project types would provide CDOT and partners with a needed resource to communicate project benefits to key stakeholders and community members, understand project return on investment (ROI), evaluate grant proposals, and address other project planning needs.

At project onset, the CDOT project team assembled a multiagency and multidisciplinary Study Panel to provide feedback and valuable insight into the progress and direction of this research project. The project team, led by Felsburg Holt & Ullevig (FHU), met with the Study Panel multiple times to summarize research progress and provided interim draft reports for the Study Panel to review. Study Panel members include:

- Thomas Joyce – CDOT Office of Innovative Mobility (OIM), Research Project Manager
- Jim Eshelman – Denver Regional Council of Governments (DRCOG), Research Program Manager
- John Marcantonio – CDOT OIM, Mobility Services Project Manager
- Clark Rider – University of Colorado – Boulder, Sustainable Transportation Specialist
- Bryan Roeder – CDOT Office of Applied Research, Environmental, Sustainability, State Transportation Innovation Council Incentive (STIC), Technology Transfer, Planning Coordinator
- Sabrina Williams – CDOT, Greenhouse Gas Program Modeler

Chapter 2. Research Context

2.1. Vehicle Miles Traveled

As defined by the Federal Highway Administration (FHWA), VMT indicates the number of miles traveled by automobiles on a roadway segment over a period and calculated by multiplying the number of automobiles on a roadway segment during a time period by segment length. For example, a 5-mile roadway segment with 5,000 daily trips would have a daily VMT of 25,000 (FHWA 2014). Although VMT can be used to calculate individual segments, it is commonly used to calculate the overall usage of an entire roadway network (Caltrans 2020).

Level of Service (LOS), a measurement of traffic congestion level, has historically been used in transportation planning to assess the impact of development projects on traffic congestion of roadway segments or corridors. LOS analysis typically leads to recommendations to widen roads, leading to higher vehicle speeds, additional safety issues for all roadway users, and negative environmental impacts associated with increased VMT. More recently, California has been leading the push away from LOS in favor of VMT as a more significant measure of environmental impact from development projects. As of July 1, 2020, in California, Senate Bill 743 (SB 743) mandates the use of VMT as the principal indicator under the California Environment Quality Act[1] (CEQA) in place of LOS to address GHG emissions. (Association of Bay Area Governments 2020). This requirement has led to the development of TDM calculators by municipalities across California. Other states and municipalities have either developed TDM calculators or are exploring how they can best develop TDM calculators for their own need. This context in which CDOT OIM has decided to undertake this research.

2.2. Transportation Demand Management

FHWA defines Transportation Demand Management as a set of strategies for maximizing travel choices to shift or reduce the demand for travel in congested conditions. These strategies can vary but generally involve providing travelers with choices for work location, travel route, travel time, and/or travel mode (FHWA 2023). Frequently used TDM strategies include a bike-share program for a residential complex, a

[1] In June 2025, the California state legislature began rolling back certain provisions of CEQA to remove the Environmental Impact Report (EIR) requirement from many housing development projects. As of 7/1/25, it is unclear if the SB 743 VMT provisions have been removed from CEQA or associated impact reports. Any potential SB 743 will be discussed with local agency stakeholders during later phases of this project. Source: *The New York Times:* California Rolls Back Its Landmark Environmental Law (7/1/25).

free transit pass program for an office building, limits on parking access at residential buildings, and carpool and ridesharing programs.

2.3. The Connection Between VMT and TDM

Ultimately, the goal of TDM is to lessen the demand on roadways by providing transportation choices for travelers. These choices may include transit, biking, walking, flexible work schedules, carpooling, ridesharing, or telecommuting. Many of these choices involve non-automobile modes of travel or a reduction of single occupancy auto trips. These transportation choices will reduce VMT in most cases, and thereby GHG emissions, noise pollution, automobile crashes, roadway maintenance costs, and other metrics associated with automobile travel. Because roads cannot be infinitely widened, and automobile travel does not serve every member of the community equally, it makes sense to employ TDM strategies that can result in predictable and measurable decreases in VMT.

2.4. Policies Guiding Project Research

2.4.1. CDOT Policy Directive (PD) 1601 (2021)

CDOT PD 1601 requires TDM strategies for most interchange proposals or major interchange reconfiguration proposals. The goal of TDM strategies is to result in a 3 percent or greater decrease in Average Daily Traffic (ADT) on the interchange ramps for the preferred alternative in Metropolitan Planning Organization (MPO) boundary areas and 1 percent or greater ADT reduction for the preferred alternative outside the MPO boundary areas starting from the opening day of the new interchange. These requirements apply only to Type 1 and Type 2 interchange proposals as defined in the 2021 policy directive (CDOT 2021).

2.4.2. CDOT Policy Directive 14.0 (2024)

CDOT PD 14.0 provides general guidelines and goals for creating and carrying out Colorado's Statewide Transportation Policy Plan for 2050. The Department's strategic 10-year transportation plan will be guided by the strategies specified in this directive through a collaborative, public process (CDOT 2023). The Colorado Statewide Transportation Plan focuses on three key themes: advancing transportation safety, fixing the roads, and sustainably increasing transportation choices. The goal of sustainably increasing transportation choices offers substitutes for single occupancy vehicle trips that expand options and lessen VMT and GHG emission. PD 14.0 sets the goal of 1 percent annual reduction in VMT,

increasing the share of work commutes using multimodal transportation options, restoring bus service, and increasing unlinked passenger trips (CDOT 2023).

2.4.3. Colorado Greenhouse Gas Pollution Reduction Roadmap 2.0 (2024)

The roadmap aims to provide guidance on reducing GHG emissions and a 50 percent reduction in emissions by 2030. The roadmap also highlights the benefits of using active transportation such as walking, bicycling, and public transport toward reducing GHG emissions. The Near-Term Actions (NTAs) promote walkable neighborhoods and increasing transit access, statewide transit service, and transit ridership. This roadmap also provides guidance on mode shift that reduces VMT (Colorado Energy Office 2024).

2.4.4. Colorado Transportation Vision 2035 (2024)

According to Colorado Transportation Vision 2035, Colorado aims to have a transportation system that reduces GHG emissions, promotes safe travel, and reduces congestion. Vision 2035 also provides suggestions on mode shift goals through expansion of transit, compact land use, and walkable communities. The Vision stresses the importance of investing in active transportation infrastructure such as walking, biking and micromobility services and in providing “first- and last-mile” connectivity for transit users. The vision predicts the mode shift could lead to a 5 percent to 6 percent reduction in total VMT and GHG emissions from the transportation sector in 2050 (CDOT 2024).

2.5. Non-Colorado Policies Relevant to TDM Calculators

2.5.1. California Senate Bill 743 (SB 743) (2013)

According to SB 743 section 1 (a), the California legislature signaled its commitment to encouraging transportation and land use planning decisions that reduce VMT and contribute to GHG emissions reduction. This legislation also mentioned the limitation of using LOS or similar measures of traffic congestion because such measures cannot consider the impact on the environment and suggested using VMT or related measures for assessing transportation impact (California State 2013).

Chapter 3. Identification of Existing TDM Calculators

Initial research was informed by feedback received from the CDOT team during project scoping and the initial project kickoff meeting held in March 2025. CDOT wanted the research team to identify TDM calculators or models that specifically calculate VMT reduction for various TDM strategies. CDOT also requested that the calculators identified be publicly accessible or open-source calculators developed and used within the United States. Additional relevant search criteria included calculators available in common formats such as Excel, PDF, or online, and the calculators could be developed by public agencies, consultants, academic institutions, or nonprofits.

Deliverables for this project task include the development of a list of existing TDM calculators being used today, an evaluation of the top five TDM calculators, and this report summarizing the findings of this research and next steps.

3.1. Summary of Identified Calculators

After filtering the criteria listed in the previous section, the research team identified 16 calculators from 7 different states, along with one developed for use in all US states. Of the 16 calculators identified, 9 were from various jurisdictions in California, with the remainder coming from Colorado, Georgia, Massachusetts, Minnesota, North Carolina, and Tennessee.

The identified calculators were sometimes developed in-house by the agency or agencies intending to use the calculator, and others were also developed in conjunction with the user agency by nonprofit organizations, consultants, or academic institutions.

Examples include the Los Angeles Department of Transportation (LADOT) web calculator created by LADOT and the non-profit Hack For LA, the Bay Area Air Quality Management District (BAAQMD) TDM calculator created in conjunction with the consulting firm Fehr & Peers, and the California Induced Travel Calculator developed by researchers at the National Center for Sustainable Transportation at University of California, Davis.

3.2. Calculator Focus Areas and Use Cases

TDM calculators identified for this report fall into two focus areas: calculators used for land use projects and calculators used for transportation projects. Calculators for land use projects focus on the additional VMT impacts associated with new development, such as office buildings or apartment buildings, and how TDM measures may help mitigate these impacts. Calculators for transportation projects typically

focus on VMT impacts associated with new transportation infrastructure, such as proposed highway or roadway widening, interchange or intersection modifications, corridor planning, or other proposed transportation infrastructure projects. **Figure 1** shows the focus areas, types of calculations, and TDM elements identified in the calculators.

Tool Focus Area

- Transportation infrastructure projects
- Development review for land use projects

Tool Calculations

- VMT reduction
- GHG emissions reduction
- Compliance with local requirements by providing a project score
- Induced VMT from highway projects

TDM Elements

- Estimated VMT reduction from implementing specific TDM measures
- A score for implementing specific TDM measures
- Development of a Cost-Benefit Ratio (project costs vs. TDM associated benefits)

Figure 1. The Focus Areas, Tool Calculations, and TDM Elements for the Identified TDM Calculators

The calculators include 11 Excel calculators, 5 web calculators, and 1 interactive PDF. Of the 17 calculators, 8 are transportation infrastructure focused and 9 are land-use project focused. **Table 1** identifies the full list of 17 TDM calculators identified for this project.[2]

Table 1. The List of Identified TDM Calculators

TDM Calculator Name	Agency	Tool Focus Area
City of San Diego Mobility Evaluation Tool (MET)	City of San Diego (CA)	Development review for land use projects
LADOT TDM Calculator	Los Angeles Department of Transportation (CA)	Development review for land use projects
SF Planning TDM Tool	San Francisco Planning (CA)	Development review for land use projects
Alameda County VMT Reduction Estimator Tool	Alameda County Transportation Commission (CTC) (CA)	Development review for land use projects

[2] Some of these calculators contain the word "Tool" in their title rather than "Calculator." To ensure consistency, the term calculator will be used throughout other than for the official title.

TDM Calculator Name	Agency	Tool Focus Area
Sonoma County Vehicle Miles Traveled Mitigation and Reduction Calculator	Sonoma County Transportation Authority (CA)	Development review for land use projects
Denver TDM Plan Compliance Spreadsheet	Denver Departments of Transportation and Infrastructure and Community Planning and Development (CO)	Development review for land use projects
Los Angeles VMT Calculator	City of Los Angeles Department of Transportation (LADOT) (CA)	Development review for land use projects
Congestion Mitigation and Air Quality (CMAQ) Calculator Tool	Atlanta Regional Commission (ARC) (GA)	Transportation infrastructure projects
RMI Smarter MODES VMT Reduction Calculator	Rocky Mountain Institute (RMI) – Think tank (calculator for all states) (Nationwide)	Transportation infrastructure projects
Carbon Emission Calculator (CET) with TDM Strategies	Minnesota Department of Transportation (MnDOT) (MN)	Transportation infrastructure projects
Bay Area Air Quality Management District (BAAQMDX) TDM VMT Reduction Tool	BAAQMD (CA)	Development review for land use projects
TDM ROI Calculator and TRIMMS Model	Tennessee DOT (promoting calculators by Mobility Lab and CUTR) (TN)	Transportation infrastructure projects
CMAQ Emissions Calculator Toolkit (for TDM Projects)	Massachusetts Department of Transportation (MassDOT) (MA)	Transportation infrastructure projects
California Induced Travel Calculator	National Center for Sustainable Transportation (CA)	Transportation infrastructure projects
City of Goleta VMT Analysis Tool	City of Goleta (CA)	Transportation infrastructure projects
NCDOT VMT Reduction Toolkit	North Carolina Department of Transportation (NCDOT) (NC)	Transportation infrastructure projects
Project Impact Assessment (PIA) Tool for VMT Analysis	Tahoe Regional Planning Agency (TRPA)	Development review for land use projects

Chapter 4. Developing TDM Calculator Evaluation Criteria

To evaluate the TDM calculators identified in the earlier step, a set of 7 criteria was developed to score the calculators. Each criterion was scored on the following 1-5 scale. **Scoring Scale: 1 = Poor, 2 = Marginal, 3 = Acceptable, 4 = Good, 5 = Excellent. Max Score = 35**

Criteria include **Interface, Format, Directions, Methodology, Validity, Versatility,** and **Outputs.** Criteria were initially informed by the scope of the project, which called for the evaluation of calculator methodology, assumptions, and accuracy. During the project kickoff meeting, biweekly meetings, and the initial Study Panel meeting, other suggestions shared with the project team were factored into the scoring criteria. Based on the feedback in these meetings, detailed scoring rubrics were developed for the **Interface, Methodology, and Validity** criteria. The detailed scoring rubrics provide additional detail beyond the 1-5 scale to aid in scoring the calculators.

Once the initial list of scoring criteria was developed, it was shared with the project Study Panel who provided comments. Study Panel comments suggested that a detailed scoring rubric also be added for the **Versatility** criteria. The following subsections identify the full list of scoring criteria and discuss the detailed scoring rubrics.

4.1. TDM Calculator Scoring Criteria

***Interface:** Is the interface intuitive to maneuver and use?

***Methodology:** If there is a separate methodology, is it clear and easy to understand for a wide audience?

***Validity:** Is it robust enough to use as an in-depth calculator for TDM benefits as opposed to a more surface level analysis? Can local jurisdictions and grant recipients use this to officially calculate TDM measure impacts?

***Versatility:** Can this calculator be used in urban, suburban, or rural settings?

Format: Is the format readily accessible to most/all users? If it is a website, does it work on all browsers? If it is a table, does it require macros?

Directions: Are there directions in the calculator and are they clear and easy to follow?

Outputs: Are outputs in a ready-to-use form, or do they consist of raw data that needs to be processed?

***Criteria with additional detailed scoring rubric identified below**

4.2. Detailed Scoring Rubrics

Table 2 identifies the detailed scoring rubric for **Interface**.

Table 2. Scoring Rubric – Interface

Score	Description
5	● The interface is very intuitive with minimal to no learning curve. ● Users can complete tasks confidently without help. ● No directions or documentation are needed for first-time users.
4	● The interface is intuitive with some guidance. ● Most users can navigate and use the calculator without guidance. ● Basic directions or brief training may be needed to complete tasks.
3	● The interface is usable after some trial-and-error or exploration. ● Some labels, layouts, or structure may confuse new users. ● Users may make minor mistakes initially. ● Some training or documentation is recommended for efficient use.
2	● The interface is confusing and unintuitive for many users. ● Directions may be unclear, or workflows might feel clunky. ● Even with experience, users need guidance or documentation. ● Errors are common.
1	● The interface is difficult to use, even for experienced users. ● Users are unable to complete tasks without extensive support. ● There is a high instance of input errors or misinterpretation. ● The interface creates significant difficulty and frustration.

Table 3 identifies the detailed scoring rubric for **Methodology**.

Table 3. Scoring Rubric – Methodology

Score	Description
5	● Well-justified including rationale and relevant citations. ● Provides a clear and replicable process for analysis. ● All assumptions and formulas are clearly presented. ● Inputs and outputs are logically aligned.
4	● The methodology is sound and mostly transparent. ● The process is mostly clear and replicable. ● Some assumptions or formulas may lack clear documentation.
3	● The calculator uses a functional but basic or narrow approach. ● Some assumptions are unclear or outdated. ● Additional documentation is needed.
2	● The underlying logic is questionable, outdated, or not well-explained. ● Critical assumptions are missing or undocumented. ● Output may seem inconsistent with inputs.
1	● Calculations appear arbitrary or opaque. ● There is no explanation of how results are derived. ● Calculator results in misleading or unusable insights.

Table 4 identifies the detailed scoring rubric for **Validity**.

Table 4. Scoring Rubric – Validity

Score	Description
5	● Results are aligned with real-world data, expert expectations, and/or validated benchmarks. ● It has undergone formal validation (e.g., pilot testing, case study comparison). ● Outputs can be used for planning, reporting, or policy decisions.
4	● The outputs are generally accurate and reliable. ● Validation occurred informally or through partial testing. ● Results are suitable for decision-making, though caveats may apply.
3	● The calculator produces reasonable estimates but may be inaccurate in certain contexts. ● Lacks comprehensive validation. ● Exhibits inconsistencies under certain input combinations. ● Users may need to cross-check results with external data sources.
2	● Results often deviate from known or expected outcomes. ● Flaws in logic; does not reflect local or real-world nuances. ● Without extra validation, the calculator cannot be used for decision-making.
1	● The calculator consistently produces incorrect results. ● No evidence of validation exists. ● Results are not fit for practical use.

Table 5 identifies the detailed scoring rubric for **Versatility**.

Table 5. Scoring Rubric – Versatility

Score	Description
5	**Context (Urban, Suburban, Rural):** Flexible across all major location contexts. **Land Use Patterns:** The calculator accounts for diverse land use patterns. **Transportation infrastructure types/modes:** The calculator accounts for almost all potential transit/transportation infrastructure elements. **Assumptions/Approach:** Users can adjust settings or inputs to reflect a wide range of geographic and policy contexts.
4	**Context (Urban, Suburban, Rural):** Works well in most contexts and allows for customization. **Land Use Patterns:** The calculator accounts for most land use patterns but may lack some nuance. **Transportation infrastructure types/modes:** The calculator accounts for major transit/transportation infrastructure elements. **Assumptions/Approach:** May assume certain conditions (e.g., baseline transit access, minimum population density) that do not apply for all contexts (urban, suburban, rural).
3	**Context (Urban, Suburban, Rural):** The calculator is only designed for use in urban or suburban settings. **Land Use Patterns:** The calculator accounts for a limited range of land use patterns. **Transportation infrastructure types/modes:** The calculator accounts for some transit/transportation infrastructure elements and may be limited in low-transit areas. **Assumptions/Approach:** The calculator may be limited, and some outputs may not be meaningful outside its target use case.
2	**Context (Urban, Suburban, Rural):** The calculator is designed with a narrow context in mind. **Land Use Patterns:** The calculator accounts for a small range of land use patterns and performs poorly when applied to other settings. **Transportation infrastructure types/modes:** The calculator relies on specific transit availability or specific commuting patterns that make it ineffective in a range of areas. **Assumptions/Approach:** Built-in assumptions about density, transit, or other factors due to the limited context make the calculator inflexible.
1	**Context (Urban, Suburban, Rural):** The calculator is designed to be used only in a specific context. **Land Use Patterns:** The calculator only works for specific land use patterns (e.g., more dense land uses typically seen in large cities). **Transportation infrastructure types/modes:** The calculator has little flexibility for considering different transportation infrastructure types or modes. **Assumptions/Approach:** Users cannot adjust settings or inputs to reflect a wide range of geographic and policy contexts.

4.3. Calculator Evaluation Spreadsheet

The evaluation spreadsheet contains rows for each calculator being scored, columns for each scoring criterion, a column for the total summed score, and a column for a narrative to explain each score. Within each cell for the 7 scoring criteria scores, comments have been attached to providing context behind each score. Additionally, a tab with detailed scoring rubrics was added as a reference. To review the complete scoring spreadsheet, refer to **Appendix A**.

4.4. Scoring Methodology

The scoring consists of a 1-5 score for each of the 7 scoring criteria and a total summed score out of a maximum score of 35. **Table 6** shows a simplified version of the scoring table.

Table 6. Example TDM Calculator Evaluation Score

Interface	Format	Directions	Methodology	Validity	Versatility	Outputs	Total
4	3	5	3	3	2	3	**23**

4.5. Calculator Characteristics Filter

In addition to the 1-5 criteria scores, a "calculator characteristics" section was added to the scoring sheet to further filter the calculators based on different characteristics. These filters allow the project team and anyone reviewing these scores to compare calculators with similar characteristics. **Table 7** presents a simplified example.

Table 7. Example TDM Calculator Characteristics

What is the Calculator's Focus Area?		Scale of Focus		What does the Calculator Analyze?				How is TDM Factored into the Calculator?		
Transportation Infrastructure Projects	Development Review for Land Use Projects	Project/Site Level	Broader Scope	VMT Reduction	GHG Emissions Reduction	Compliance with Local TDM Requirements	Induced VMT from Highway Projects	Estimated VMT Reduction (%) from Implementing Specific TDM Measures	A Score is Produced for Implementing Specific TDM Measures	Development of a Cost-Benefit Ratio
X		X		X				X		

4.6. Identifying Key Elements from Lower Scoring Calculators

Although summing the scores into a total is an effective method for finding the most effective overall calculator on average, the project team acknowledges that the overall score could miss a high score in one criterion for a lower scoring calculator. No single calculator had every feature CDOT was looking for in a calculator, and the future version of the ideal TDM calculator would most likely incorporate elements from the top 5 scoring calculators, as well as select elements from lower scoring calculators. **Section 5.6, Individual Features from Other TDM Calculators**, provides a review of this analysis.

Chapter 5. Evaluation of Top Scoring TDM Calculators

After establishing evaluation criteria, the project team evaluated and scored all TDM calculators. This section provides an overview and scoring details for the top five overall scoring calculators:

1. City of San Diego - Mobility Evaluation Tool (MET)
2. Los Angeles (CA) TDM Calculator
3. City and County of San Francisco – Planning TDM Tool
4. Alameda County – VMT Reduction Estimator Tool
5. Sonoma County – Vehicle Miles Traveled Mitigation and Reduction Calculator

This section includes an overview of calculator characteristics, a summary of how each calculator is used, and a detailed discussion of calculator evaluation and scoring. Calculator evaluation is based on the scoring rubric developed by the project team to evaluate existing TDM calculators (**Appendix A** includes the full rubric). The scoring table also includes pros and cons for each calculator to provide additional context for why a calculator received a specific score. Any key calculator elements that align with CDOT's TDM calculator development goals are called out in the "CDOT Considerations" section of the table.

5.1. Calculator #1: City of San Diego Mobility Evaluation Tool (SD MET)

Lead Agency for Calculator Development: The City of San Diego (CA) Sustainability and Mobility Department

5.1.1. Calculator Overview

Table 8. Calculator Characteristics: SD MET

Calculator Characteristic Categories	Calculator Characteristics
Calculator Focus Area	• Development review for land use projects
Scale of Focus	• Project/site level scale
Quantitative Elements Analyzed	• VMT reduction • Compliance with local TDM requirements
How is TDM Factored In?	• A score is produced for implementing specific TDM measures

The SD MET is a web-based application that generates a formal report for development projects that applicants can submit during development reviews. The San Diego Sustainability and Mobility Department built this calculator to ensure that proposed developments comply with the city's Complete Communities: Mobility Choices regulations and accomplish the VMT reduction goals of the city's Climate Action Plan. The calculator produces a numerical score for a developer's proposed TDM measures that will be implemented as part of a new development. The calculator considers 32 potential TDM measures related to land use, trip reduction, parking and/or pricing management, neighborhood design, transit, and zero emission vehicles. Within the calculator, these measures are organized into several categories that focus on community members traveling to or from the development: pedestrian supportive measures, bike supportive measures, transit supportive measures, and other measures. This approach helps ensure that new projects are walkable, bikeable, and/or near transit, with the goal of reducing VMT at both the project and regional levels. In addition to providing a project score, the calculator also estimates potential VMT reductions broken out by all proposed project land uses. SD MET, developed with support from a Caltrans Sustainable Transportation Planning Grant, was released for public use in 2023.

5.1.2. Analysis Process

Users start by selecting the proposed development parcel(s) on a web map. In addition to parcel shapefiles, other map layers include Census Tract and Traffic Analysis Zone (TAZ) boundaries, relevant Census Tract boundary layers, and data layers from various city of San Diego plans. Next, development inputs are entered, including the number of residential units; square footage for residential, commercial, retail, and industrial uses; and number of parking spaces.

This information is then combined with proposed VMT reduction measures to calculate if these measures score high enough to satisfy San Diego's VMT reduction policies. The VMT potential reduction measures are sourced from the Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity (2021 CAPCOA GHG Handbook). This Handbook focuses on GHG emission reduction from reduced VMT, but developing VMT reduction percentages based on various measures is a major part of the methodology. Generally, the Handbook assumes that VMT decreases if any of the following occurs: (1) vehicle ownership declines, (2) vehicle trips are reduced, (3) vehicle trip lengths are reduced, or (4) any combination of these three variables. VMT percentage decrease estimates for each measure are calculated using academic research and other

reports to inform the VMT reduction assumptions. **Figure 2** shows an example of this for increases in intersection density.

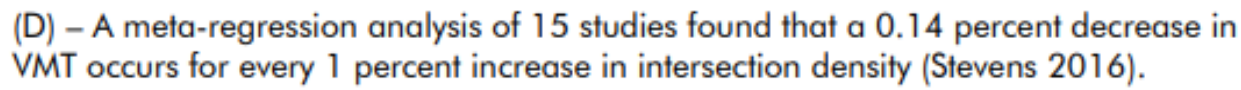


Figure 2. Example Formula from the CAPCOA Handbook (2021)

In total, VMT reductions are quantified for 32 TDM measures. The Handbook produced VMT decrease calculations for each measure, and all VMT decrease assumptions include detailed information on how the VMT decrease was calculated.

This input data is used to inform VMT reduction calculations in the SD MET calculator. Per city development regulations, new developments require a certain number of VMT reduction points. Major calculator input categories used to calculate these points include:

- Pedestrian supportive measures (infrastructure and amenity improvements to increase pedestrian safety and accessibility in proximity to the development)
- Bike supportive measures (infrastructure and amenity improvements to increase cyclist safety and accessibility in proximity to the development)
- Transit supportive measures (improved transit stop amenities—either higher cost or lower cost)
- Other supportive measures (examples include on-site micromobility options, dedicated carshare vehicle spaces, installation of traffic calming measures, and other options).

The calculator asks users to detail the specific number of each VMT reduction measure included in the proposed development. A point value is then produced for every VMT reduction measure included in the development (an example for pedestrian supportive measures is shown on **Figure 3**). The scores for all VMT reduction measures are then added into a total VMT reduction score.

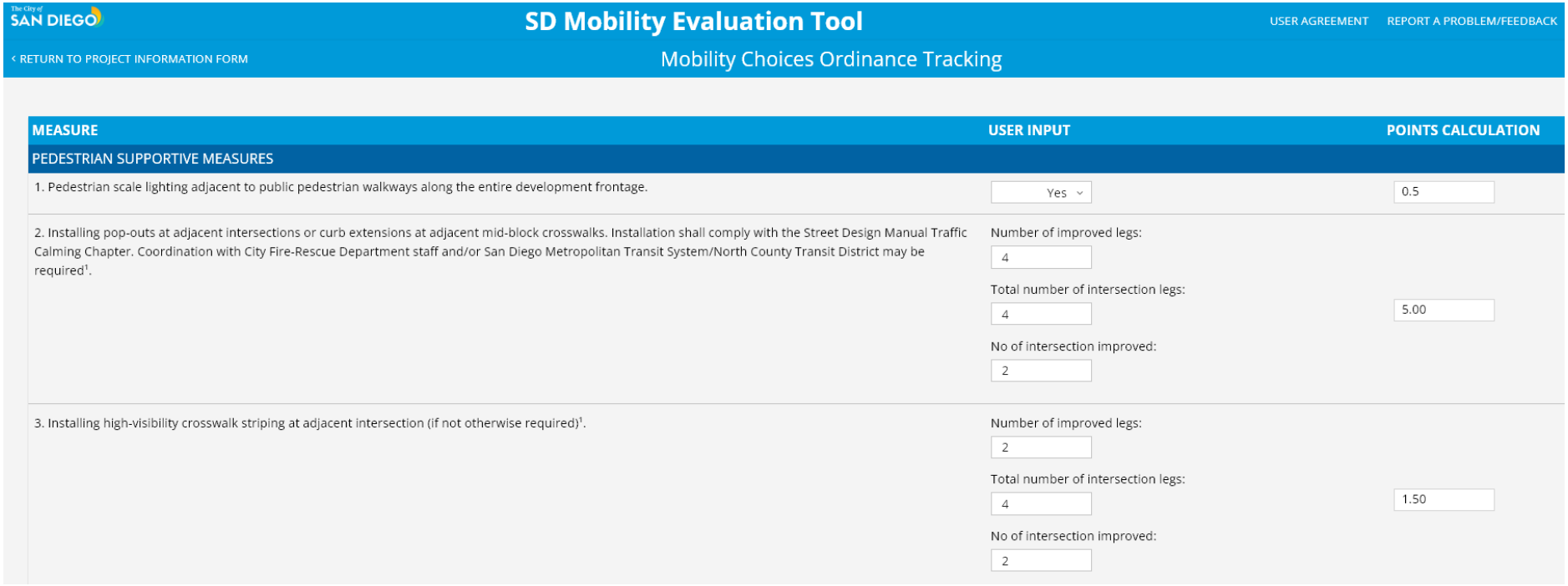
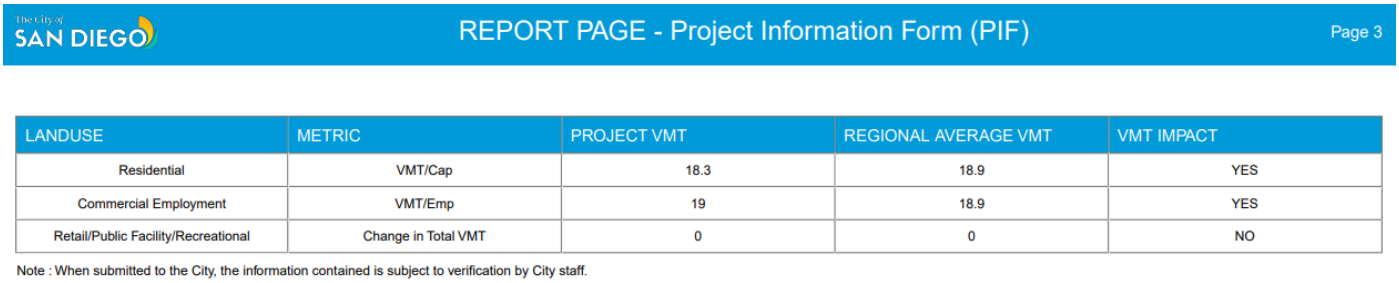


Figure 3. Screenshot: Potential VMT Reduction Measures

The calculator output is a PDF summarizing all user inputs and selected VMT reduction measures. Any VMT reduction related to the project is shown as the difference between the regional average VMT per capita and the project estimated VMT per capita (see **Figure 4** for an example). The San Diego Council of Governments (SANDAG) Regional Travel Demand Model is used to determine regional average VMT. If a CDOT TDM calculator aims to compare project VMT to regional average VMT, each Colorado MPO or Transportation Planning Organization/Region (TPR) would need to include regional average VMT projections from either the Colorado Statewide Model or models from each MPO.



The City of SAN DIEGO — REPORT PAGE - Project Information Form (PIF) — Page 3

LANDUSE	METRIC	PROJECT VMT	REGIONAL AVERAGE VMT	VMT IMPACT
Residential	VMT/Cap	18.3	18.9	YES
Commercial Employment	VMT/Emp	19	18.9	YES
Retail/Public Facility/Recreational	Change in Total VMT	0	0	NO

Note : When submitted to the City, the information contained is subject to verification by City staff.

Figure 4. Screenshot: Report Page

5.1.3. Calculator Evaluation and Scoring

Scoring Scale (see the full scoring rubric for more details about each evaluation criteria):

1 = Poor, 2 = Marginal, 3 = Acceptable, 4 = Good, 5 = Excellent

Table 9. SD MET Calculator Evaluation and Scoring

Evaluation Criteria	Score	Pros	Cons
Interface: Is the interface intuitive to get around and use?	5	The SD MET calculator combines an interactive webmap with other interactive steps to allow users to add details about the TDM multimodal components related to a project. These components show an output score in real-time. The calculator also allows navigation forward and backwards between steps without losing any input information. **CDOT Considerations:** A similar interface could be used to estimate VMT reductions associated with infrastructure projects.	N/A

Evaluation Criteria	Score	Pros	Cons
Format: Is the format readily accessible to most/all users?	5	All of the information requested is readily available from development plans, and developers can clearly understand what additional multimodal elements will help raise the score. **CDOT Considerations:** Ensure that any user inputs in the calculator ask only for information that is readily available from the project team. Another benefit to this calculator is its ability to display TDM scores in real time based on different measures that are selected. CDOT should consider a similar approach so that calculator users can understand how different TDM measures impact VMT.	N/A
Directions: Are there directions in the calculator, and are they clear and easy to follow?	5	Directions are provided at several levels of detail, including: (1) A pop-up within the calculator that includes basic directions; (2) a 15-minute YouTube video that walks users through each step of using the calculator; (3) a Quick Start Guide; and (4) a detailed User Guide that includes information on calculator methodology. The calculator also includes a link to provide calculator feedback or report a problem. **CDOT Considerations:** Instructions that range in level of detail (embedded website instructions, YouTube video, one-pager, full user guide, etc.) can help different users access the level of instruction required for their needs.	N/A

Evaluation Criteria	Score	Pros	Cons
Methodology: If there is a separate methodology, is it clear and easy enough to understand to a wide audience?	4	The calculator uses a rigorous and defensible VMT reduction methodology based on the 2021 CAPCOA GHG Handbook. **CDOT Considerations:** The VMT reduction research and methodologies used for development of the CAPCOA Handbook (or a similar approach) could be used for development of a CDOT calculator. CDOT should leverage the forthcoming Western States CAPCOA Handbook, which will have Colorado-specific formulas for Colorado Metropolitan Planning Organizations (MPOs), but not for rural or resort towns.	The 2021 CAPCOA Handbook derives some of its VMT reduction calculations from outdated sources (some studies are 10-15 years old at this point). There is a new 2024 version of the Handbook, but it will likely be time consuming to update the SD MET calculator with assumptions from the 2024 Handbook. SD MET does not estimate VMT reductions from transportation infrastructure projects.
Validity: Is the calculator robust enough to use as an official calculator, or does it not measure impacts in an in-depth manner?	5	The calculator's methodology allows for in-depth and defensible VMT reduction projections. **CDOT Considerations:** San Diego has been using this calculator for several years now and should have some anecdotal data available about how well the calculator has been working. In the next step of this research, the project team will attempt to interview San Diego staff to learn more about this.	N/A
Versatility: Can this calculator be used in urban, suburban, or rural settings?	3	This calculator is directly linked to San Diego's evaluation criteria for VMT reduction, so it can be used to calculate TDM impacts based on San Diego's defined criteria. **CDOT Considerations:** The webmap includes boundaries that allow only a selection of parcels or project areas within designated analysis areas. For CDOT, this could include all of Colorado or just specific sub-areas.	This calculator is specific to a large urban area and would have limited application in most Colorado towns outside of the DRCOG region. Similar to the drawbacks mentioned previously in the Methodology section, the calculator focuses on site development project evaluation, and there is no option to evaluate transportation infrastructure projects.

Evaluation Criteria	Score	Pros	Cons
Outputs: Are outputs in a ready-to-use form or do they consist of raw data that needs to be processed?	5	The calculator output is a short PDF summary report that includes all project details, VMT reduction measures, and VMT reduction results. The PDF is formatted for easy review by city staff. **CDOT Considerations:** Clearly defining the outputs needed by CDOT for project evaluation will ensure that all outputs are included in any summary report that is developed.	The portion of the output showing the parcel map is zoomed in too far to see the full parcel and surrounding area.

5.1.4. Key Takeaways

The SD MET calculator includes several features that CDOT could draw on for its own TDM calculator development. First, both the calculator's instructions and web application interface are extremely user friendly and can be easily navigated by new users. In addition, CDOT can draw on the calculator's comprehensive list of TDM measures and interactive scoring feature that allows users to see the potential impact of TDM measures in real time. The calculator also uses a defensive and rigorous methodology based on academic research conducted for development of the CAPCOA Handbook. CDOT could leverage a similar approach to identify VMT reduction assumptions by using the soon-to-be published Western States CAPCOA Handbook, which primarily has applicability to Colorado MPOs. The biggest challenge for producing a similar calculator that meets CDOT's needs is adapting the analysis process to understand VMT reduction associated with transportation projects rather than proposed developments. In addition, the calculator would need to address different contexts across all of Colorado.

5.2. Calculator #2: Los Angeles (CA) Transportation Demand Management (TDM) Calculator

Lead Agencies for Calculator Development: The City of Los Angeles Department of Transportation (LADOT); Los Angeles Department of City Planning (LACP)

5.2.1. Calculator Overview

Table 10. Calculator Characteristics: LA TDM Calculator

Calculator Characteristic Categories	Calculator Characteristics
Calculator Focus Area	• Development review for land use projects
Scale of Focus	• Project/site level scale
Quantitative Elements Analyzed	• Compliance with local TDM requirements
How is TDM Factored In?	• A score is produced for implementing specific TDM measures

LA's TDM calculator was created to help simplify the development and implementation of the proposed updates to the city's TDM regulations. The TDM calculator helps communicate the compliance requirements of the city's TDM program to multiple stakeholders, including developers of real estate projects, residents, and transportation planning practitioners. The TDM program applies to new development projects that meet specific criteria. The calculator includes more than 40 TDM strategies that users can select. Hack for LA, in collaboration with LADOT and LACP, created the TDM calculator. Hack for LA is a California non-profit organization that builds digital products and programs.

5.2.2. Analysis Process

The web calculator first provides a checklist of required information (**Figure 5**), which is helpful for understanding what data will be needed to work through the calculator. The initial screen also creates a login that allows users to save projects and revisit them later.

Once in the calculator, users begin by entering the project name, address, and Assessor's Identification Number (AIN). Unlike most other web calculators, there is no map from which users can select the project site location, and users must access a separate webpage to look up their AIN.

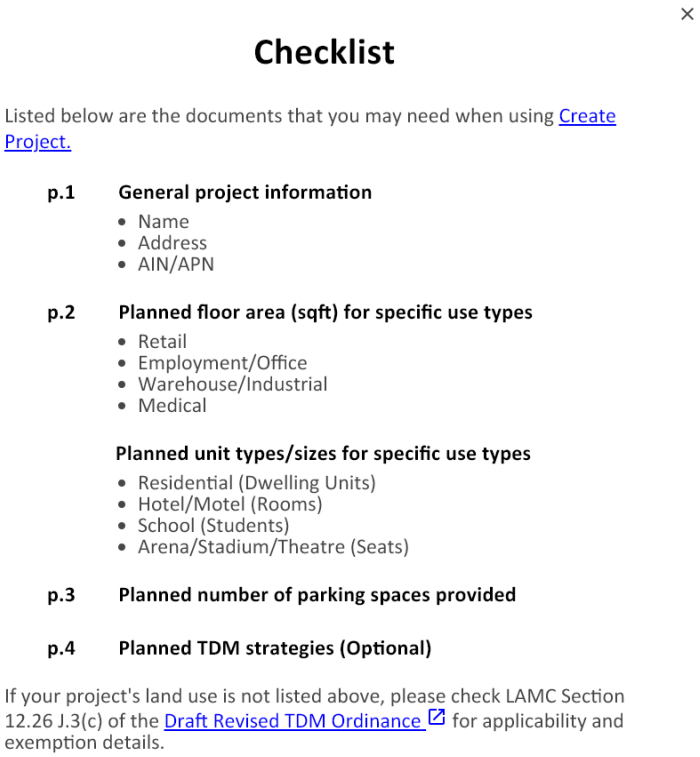


Figure 5. Screenshot: Required Input Data

Next, users determine their "Project Level" by entering the number of units and/or square footage for the development. Three project levels are defined within LA's TDM Program Guidelines. The city assigns a project level based on project size and use activity, which is reflective of the project's transportation demand related to the project's scope of activities. Based on the assigned project level, the development must reach a certain number of target points. Each potential TDM strategy is assigned a point value, and a developer meets their required target points by identifying TDM strategies that they will implement.

The calculator includes more than 40 TDM strategies from which users can choose, and users are shown a comparison of possible points vs. points earned (an example is shown on **Figure 6**), along with a summary of all points earned toward the target (**Figure 7**).

Figure 6. Screenshot: Example TDM Measures

Figure 7. Screenshot: Earned Points vs. Target Points

Major categories of possible TDM strategies include affordable housing, bicycle facilities, car sharing, childcare, high occupancy vehicles, information (e.g., transit schedules), mixed use development, mobility investment, parking, telecommuting, transit access, transportation management organization membership, and other user-defined strategies. Each strategy is assigned a point value based on its effectiveness at reducing VMT and how it advances the city's policy goals. Each strategy is backed by academic research, detailed in the TDM Program Guidelines, about how each measure changes travel behavior.

The calculator provides a concise summary of the project information, TDM strategies selected, and number of points earned. This summary can also be exported as a PDF.

5.2.3. Calculator Evaluation and Scoring

Scoring Scale (see the full scoring rubric for more details about each evaluation criteria):

1 = Poor, 2 = Marginal, 3 = Acceptable, 4 = Good, 5 = Excellent

Table 11. LA TDM Calculator Evaluation and Scoring

Evaluation Criteria	Score	Pros	Cons
Interface: Is the interface intuitive to get around and use?	3	The LA TDM calculator has a high-quality interface that has a simple way of displaying earned points vs. target points, along with the selected TDM strategies (as shown previously on **Figure 7**). **CDOT Considerations:** Including interactive scoring and live updates that show the project score in relation to the target score makes the calculator more engaging and allows users to experiment with different possible TDM strategies.	The major issue is that the project information page lacks embedded webmap. Instead, users must paste in the address and then use another map application to identify the project ID number from the city. **CDOT Considerations:** If possible, embed all relevant maps into the calculator rather than linking them to a separate webpage.
Format: Is the format readily accessible to most/all users?	5	The LA TDM calculator is clearly organized and has different steps to determine the project's required target points and the points earned through potential TDM measures. To increase accessibility, the calculator also includes a login function that allows users to save projects and come back to access them later. Other top scoring web-based calculators do not include this feature. **CDOT Considerations:** Include an optional login page that allows users to create an account and save their progress.	N/A

Evaluation Criteria	Score	Pros	Cons
Directions: Are there directions in the calculator and are they clear and easy to follow?	5	The LA TDM calculator's FAQ section is helpful for answering common questions that may arise; it is easier to understand than reading a user guide. For users that want more information, a fact sheet and informational videos are also included with the calculator, along with links to LA's overall TDM program guidelines **CDOT Considerations:** An FAQ webpage can help users quickly answer their questions. Additional questions can also be added into the FAQ over time.	N/A
Methodology: If there is a separate methodology, is it clear and easy enough to understand to a wide audience?	4	Each TDM strategy's assigned point value is based on its effectiveness at reducing VMT and how it advances the city's policy goals. Each strategy is backed by academic research on how the measure changes travel behavior.	The calculator's user guide states that much of the academic research that informs TDM measure scoring is from the 2010 CAPCOA Handbook. This approach would also have to be adopted for transportation infrastructure projects.
Validity: Is the calculator robust enough to use as an official calculator, or does it not measure impacts in an in-depth manner?	5	The calculator is robust enough to clearly address the TDM evaluation goals detailed in LA's TDM Program Guidelines. These guidelines are currently being used as part of the city's development review process to measure TDM impacts.	N/A

Evaluation Criteria	Score	Pros	Cons
Versatility: Can this calculator be used in urban, suburban, or rural settings?	3	The LA TDM calculator focuses on TDM measures that are best suited for the dense, urban environment of Los Angeles.	This calculator is specific to a large urban area and would have limited application in most Colorado towns outside of the DRCOG region. Since LA's TDM regulations do not apply to smaller developments, this calculator is relevant to only large developments (typically in urban areas). **CDOT Considerations:** Ensure that a CDOT calculator is calibrated to meet VMT reduction goals for multiple contexts across Colorado.
Outputs: Are outputs in a ready-to-use form or do they consist of raw data that needs to be processed?	5	Both a webpage and a PDF provide a concise summary with project information, selected TDM strategies, and number of points earned. **CDOT Considerations:** Consider the types of exports that will best serve calculator users and reviewers. As demonstrated with this calculator, a webpage output and PDF output are the two most common options.	N/A

5.2.4. Key Takeaways

The LA TDM calculator is another strong example of a web-based interface that CDOT could consider for its own TDM calculator development. However, CDOT should avoid an application that does not have an embedded map. Requiring users to access a separate webmap and copy over information, rather than having this information auto-populated, is not a user-friendly process. The calculator's interactive scoring features are engaging and allow users to consider a range of TDM strategies and receive feedback in real time about how each strategy impacts their score. Allowing users to create an account and save their work is a unique feature among other web-based calculators; this feature allows users to iteratively update their proposed TDM strategies without having to start over from scratch. Finally, the calculator's combination of a webpage output and a PDF export provides flexibility to users.

5.3. Calculator #3: City and County of San Francisco Transportation Demand Management Tool (TDM Calculator)

Lead Agency for Calculator Development: City and County of San Francisco Planning Department

5.3.1. Calculator Overview

Table 12. Calculator Characteristics: San Francisco TDM Management Tool

Calculator Characteristic Categories	Calculator Characteristics
Calculator Focus Area	• Development review for land use projects
Scale of Focus	• Project/site level scale
Quantitative Elements Analyzed	• VMT reduction • Compliance with local TDM requirements
How is TDM Factored In?	• A score is produced for implementing specific TDM measures

The San Francisco Planning Department created the TDM Tool to help planners, developers, and other stakeholders calculate TDM Plan point targets for a specific project. San Francisco's TDM program, originally adopted in 2016, applies to almost all types of new development and large changes of use. The city's end goal is more sustainable transportation options for a building's tenants, employees, residents, and visitors. In addition to receiving a TDM score, users can also leverage the calculator to explore various TDM options and develop a TDM plan based on the calculator's scoring of potential TDM measures. The calculator was created as part of the city's Shift initiative, which aims to encourage mode shift, and the most recent version of the calculator has been used since 2021.

5.3.2. Analysis Process

Users start by locating their project parcel on a webmap. Once a parcel is selected, the calculator auto-populates record numbers, block number, and transportation analysis zone (TAZ) for where the project is located. Next, users select the land use categories for the project and enter project characteristics, as shown on **Figure 8**.

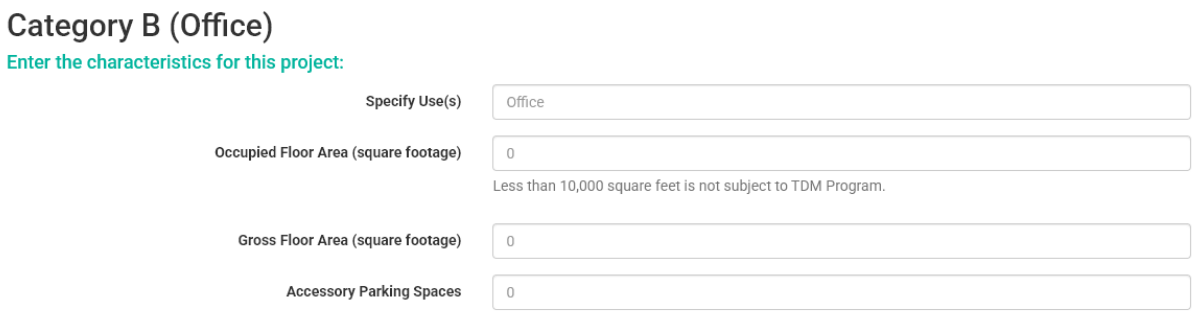


Figure 8. Screenshot: Input of Project Characteristics

After entering the project characteristics, users select potential TDM measures that are scored against target points. Twenty possible TDM measures are broken into the following categories:

- Parking
- Active Transportation
- Carshare
- Delivery
- Family (on-site childcare)
- High Occupancy Vehicles
- Communications and Information
- Land Use

All of the steps above take place on a single page, making it easy for users to review their whole project before exporting the results into a simple PDF that summarizes the project points and TDM measures compared to the target points.

5.3.3. Calculator Evaluation and Scoring

Scoring Scale (see the full scoring rubric for more details about each evaluation criteria):

1 = Poor, 2 = Marginal, 3 = Acceptable, 4 = Good, 5 = Excellent

Table 13. San Francisco TDM Management Tool Evaluation and Scoring

Evaluation Criteria	Score	Pros	Cons
Interface: Is the interface intuitive to get around and use?	4	The webmap interface and accompanying web calculator make this calculator easy to navigate. All calculator elements are on a single webpage that users scroll through. **CDOT Considerations:** Aim to have the calculator on a single webpage to simplify navigation and allow users to see all project information on a single page.	When scrolling up and down the page, it can be challenging to navigate past the map, which takes up the entire screen horizontally. This leads to accidentally zooming in and out on the map rather than scrolling up or down past the map easily. **CDOT Considerations:** A webmap is a critical calculator for identifying a project location and populating project information, but it needs to be located properly so that it does not negatively impact the user experience.
Format: Is the format readily accessible to most/all users?	5	The calculator has real-time scoring updates for each TDM measure added into the calculator. This helps users immediately understand how proposed TDM measures compare to the target score for their development. **CDOT Considerations**: Real-time scoring and comparison to target scores is a critical component to include as part of any potential CDOT calculator.	N/A

Evaluation Criteria	Score	Pros	Cons
Directions: Are there directions in the calculator and are they clear and easy to follow?	4	The calculator features a link to a brief (2-page) how-to guide. Within the calculator itself, there is also a "Quick Tour" option that provides interactive, step-by-step directions. The calculator also links to the webpage for San Francisco's TDM program, which details all TDM measures within the calculator. **CDOT Considerations:** Interactive directions similar to this calculator's "Quick Tour" feature are helpful for showing users how to use the calculator without having to open a separate instructions webpage or PDF.	The sub-categories for each TDM measure do not include specific details; instead, the only information provided is Option A, Option B, etc. Users must reference an appendix for the definition of each option. For new users, the links to the appendix are not intuitive and can be confusing because the directions are not on the webpage, and they are not highlighted obviously in the user guide. **CDOT Considerations:** Test the calculator with new users to ensure that all steps are intuitive and that no key directions are missing.
Methodology: If there is a separate methodology, is it clear and easy enough to understand to a wide audience?	4	The calculator clearly details how many potential points each TDM measure can receive and provides criteria for what requirements must be met to receive a higher score for each potential TDM measure.	The scoring criteria primarily rely on San Francisco's municipal code for point values rather than academic research or other similar sources. **CDOT Considerations:** Using a specific municipal code rather than measures informed by research is not practical for CDOT since a wide range of local stakeholders would use any calculator.
Validity: Is the calculator robust enough to use as an official calculator, or does it not measure impacts in an in-depth manner?	5	The calculator is robust enough to clearly address the TDM evaluation goals related to San Francisco's TDM Program Guidelines. It is currently used as part of the city's development review process to measure TDM impacts.	N/A

Evaluation Criteria	Score	Pros	Cons
Versatility: Can this calculator be used in urban, suburban, or rural settings?	3	Like other high scoring calculators, the calculator focuses on TDM measures that are best suited for the dense, urban environment of San Francisco.	This calculator is specific to a large urban area and would have limited application in most Colorado towns outside of the DRCOG region. Since San Francisco's TDM regulations do not apply to smaller developments, this calculator is relevant to only large developments (typically in urban areas). **CDOT Considerations:** Ensure that a CDOT calculator is calibrated to meet VMT reduction goals for multiple settings.
Outputs: Are outputs in a ready-to-use form or do they consist of raw data that needs to be processed?	4	The calculator provides a simple PDF output that summarizes project information, the total score and the target score, and potential TDM measures selected.	The PDF formatting is not as high quality as other top scoring calculators. It is just a PDF printout of the webpage itself rather than a well-organized summary. **CDOT Considerations:** Any output PDF should be cleanly formatted to allow for easy project evaluation.

5.3.4. Key Takeaways

A key feature of San Francisco's TDM Tool is the scrollable, single-page web interface that consolidates all calculator elements and steps onto one centralized page. This helps users easily understand all required inputs and streamline calculator usage. Like other web-based calculators, the project score updates in real time as the TDM measures are selected; this should be a baseline feature for any web-based calculator. The calculator's Quick Tour feature enables users to understand how to navigate the calculator without consulting an external how-to guide. In addition, all other relevant program information is embedded in a link at the top of the calculator, allowing for easy access. Finally, the calculator's output PDF formatting should be improved from a PDF printout of the webpage to one that would produce a more organized summary.

5.4. Calculator #4: The Alameda County Vehicle Miles Traveled Reduction Estimator Tool (Alameda County Calculator)

Lead Agency for Calculator Development: The Alameda County Transportation Commission

5.4.1. Calculator Overview

Table 14. Characteristics: Alameda County Calculator

Calculator Characteristic Categories	Calculator Characteristics
Calculator Focus Area	• Development review for land use projects
Scale of Focus	• Project/site level scale
Quantitative Elements Analyzed	• VMT reduction
How is TDM Factored In?	• The calculator provides an estimated VMT reduction (%) based on the implementation of specific TDM measures

The Alameda County Transportation Commission developed the Excel-based Alameda County Tool to assist member agencies with SB 743 requirements by evaluating transportation impacts of land use projects under CEQA. The Alameda County Tool estimates the percent reduction in VMT, at both the project site level and the community/city level, resulting from the application of different mobility management strategies. Modeled after the San Diego MET (the highest scoring calculator in the evaluation report), the calculator was refined to meet specific requirements for Alameda County, incorporates local travel demand model data, and includes six additional VMT reduction strategies beyond those identified in the San Diego MET. This calculator is the highest scoring Excel-based calculator evaluated for this report.

5.4.2. Analysis Process

Users first enter the project name, address, and project type (residential, commercial, etc.) into the Excel sheet. Users must also access a separate webmap to identify the project's TAZ number. Next, users select relevant “Mobility Management Strategies,” which are TDM strategies that can lead to VMT reduction. **Figure 9** shows a partial overview of the calculator’s input tab.

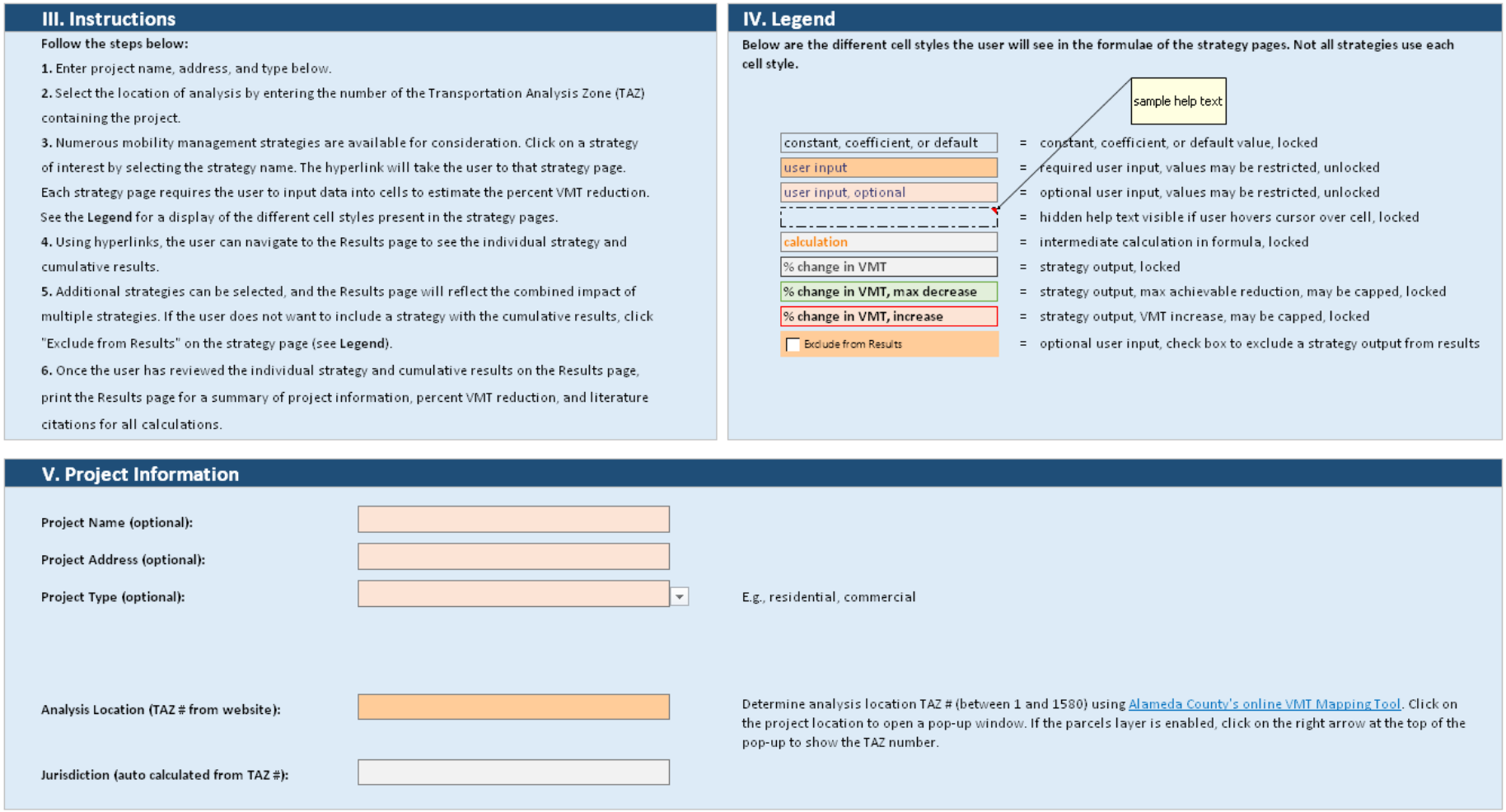


Figure 9. Screenshot: Calculator Input Tab

The calculator features 29 TDM strategies for VMT reduction broken out into the following categories:

- Employer Commute Programs
- Land Use Strategies
- Parking Management
- Neighborhood Enhancements
- Transit Strategies

Selecting a VMT reduction strategy from the input tab brings users to a separate tab for each strategy (an example is shown on **Figure 10**).

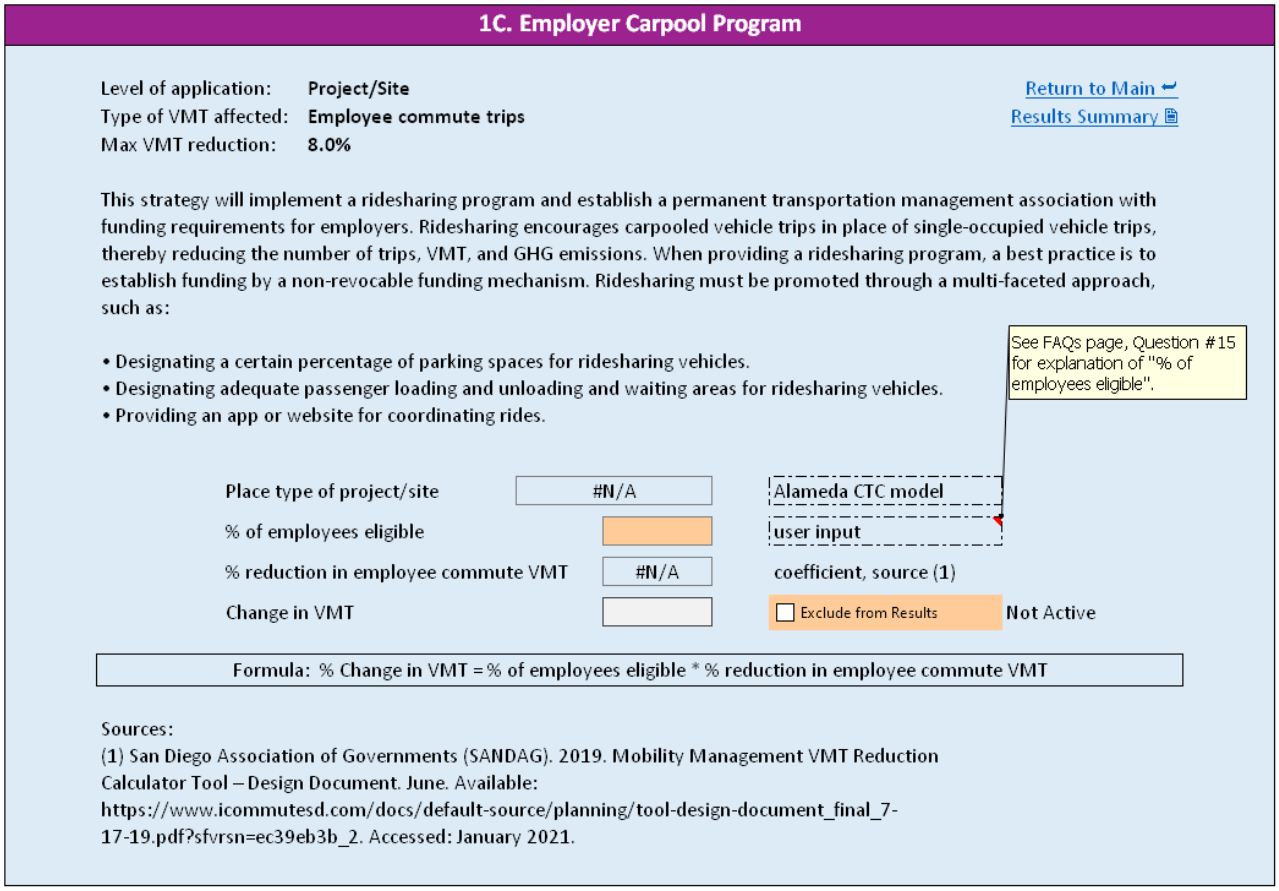


Figure 10. Screenshot: VMT Reduction Measures

Each VMT reduction strategy includes the maximum potential VMT reduction for the strategy and the estimated change in VMT based on the inputs provided. Each strategy also includes the formula for calculating VMT reduction and all sources used to develop these calculations. Overall, this calculator provides the most comprehensive methodology for calculating VMT reduction, and unlike the SD MET,

all assumptions and sourcing are included directly in the calculator. As inputs are added, the calculator produces a percentage change in VMT estimate in real time. The calculator's "Results" tab displays this VMT estimate for each identified TDM strategy and summarizes VMT changes at different scales: employee commute trips, project-generated trips, all neighborhood/city trips and trips on roadways with new bike facilities added. This feature is unique compared to other VMT calculators that typically calculate only VMT reduction at the project level. Users can export the calculator's Results page as a one-page PDF.

5.4.3. Calculator Evaluation and Scoring

Scoring Scale (see the full scoring rubric for more details about each evaluation criteria):

1 = Poor, 2 = Marginal, 3 = Acceptable, 4 = Good, 5 = Excellent

Table 15. Alameda County Calculator Evaluation and Scoring

Evaluation Criteria	Score	Pros	Cons
Interface: Is the interface intuitive to get around and use?	3	The calculator is easier to navigate than most other Excel-based calculators. However, web-based calculators are still easier to navigate overall.	Because the calculator includes an individual tab for each TDM measure, the Excel spreadsheet includes more than 30 tabs. At times, the calculator will also inadvertently jump between tabs if the user clicks a cell that is not a "User Input" cell. **CDOT Considerations:** If CDOT develops an Excel-based calculator, it should be consolidated into a limited number of tabs. If this is not possible, a webpage or application should be considered instead.

Evaluation Criteria	Score	Pros	Cons
Format: Is the format readily accessible to most/all users?	4	This is one of the few Excel calculators that do not require macros. Calculators that require macros will typically not work if a computer has security requirements that block macros. **CDOT Consideration:** A baseline requirement for any Excel calculator should be that it does not include macros since they typically do not work.	Many inputs are required for each TDM measure. Users may not have all required information without additional research. However, this is necessary since the calculator calculates VMT reduction using formulas. **CDOT Considerations:** A trade-off for calculating VMT reduction percentage is that many more user inputs are required. CDOT will need to consider the balance between input complexity and the level of detail that is produced.
Directions: Are there directions in the calculator and are they clear and easy to follow?	4	Instructions, FAQs, and sources are included directly in the Excel calculator, meaning that users do not have to switch between the calculator and a separate set of directions frequently. An accompanying webpage includes a demo video, user guidebook, and additional information on the methodology that informs this calculator.	Excel's formatting is limited for incorporating directions into each calculator's input page.
Methodology: If there is a separate methodology, is it clear and easy enough to understand to a wide audience?	5	This calculator provides the most comprehensive methodology for calculating VMT reduction. The VMT calculation formulas and all sources are included on each input tab. **CDOT Considerations:** Including VMT reduction formulas on each input tab provides a clear understanding of the VMT reduction methodology without having to reference a separate user guide.	N/A

Evaluation Criteria	Score	Pros	Cons
Validity: Is the calculator robust enough to use as an official calculator, or does it not measure impacts in an in-depth manner?	4	The calculator's detailed and rigorous methodology allows for in-depth measurement of VMT reduction.	Like other calculators, sourcing for all assumptions will have to be periodically reviewed and updated. If sourcing gets too outdated, then validity may be questioned.
Versatility: Can this calculator be used in urban, suburban, or rural settings?	4	The calculator can be used in any setting within Alameda County, CA. A similar calculator could likely be implemented elsewhere if a different traffic model was used. The calculator's ability to calculate VMT impacts at different scales (employee commute trips, project-generated trips, all neighborhood/city trips, and trips on roadways with new bike facilities added) is not a common feature (the SD MET calculator also calculates project-level VMT and regional VMT). **CDOT Considerations:** This calculator can provide detailed calculations for a single county, but expanding the analysis to municipalities statewide may be more challenging. CDOT will need to consider how many different traffic model inputs, parcel data shapefiles, etc. may be required to implement a similar calculator on a statewide scale.	This tool has different scales of analysis (employee commute trips, project-generated trips, all neighborhood/city trips, and trips on roadways with new bike facilities added). This tool's functionality is limited to a single county.

Evaluation Criteria	Score	Pros	Cons
Outputs: Are outputs in a ready-to-use form or do they consist of raw data that needs to be processed?	4	The Excel calculator's Results tab is a single page and can be printed as a PDF. **CDOT Considerations:** A simple Results tab formatted for export is important for any Excel-based calculator.	The output formatting is not as polished as outputs from web-based calculators.

5.4.4. Key Takeaways

Compared to other Excel-based calculators, the Alameda County Tool is relatively easy to navigate, and there are no macro errors when using the calculator. Each TDM measure is located on a separate tab; this approach can help organize individual TDM measures but also leads to a large spreadsheet that is challenging to navigate. The Alameda County Tool provides basic instructions, FAQs, and data sources directly within Excel, and the calculator's supporting webpage provides a comprehensive guidebook, methodology overview, and demo video. This balanced approach should be considered a best practice for Excel-based calculators. Finally, the Alameda County Tool provides a comprehensive methodology for calculating VMT reduction. The calculator includes all formulas and sourcing within each TDM input tab. CDOT should consider a similar approach when developing a methodology for its potential calculator.

5.5. Calculator #5: Sonoma County Vehicle Miles Traveled Reduction Calculator (SCTA VMT Reduction Calculator)

Lead Agency for Calculator Development: Sonoma County Transportation Authority (SCTA)

5.5.1. Calculator Overview

Table 16. Calculator Characteristics: SCTA VMT Reduction Calculator

Calculator Characteristic Categories	Calculator Characteristics
Calculator Focus Area	• Development review for land use projects
Scale of Focus	• Project/site level scale
Quantitative Elements Analyzed	• VMT reduction
How is TDM Factored In?	• The calculator provides an estimated VMT reduction (%) based on the implementation of specific TDM measures

The SCTA VMT Reduction Calculator was developed by the same team as the Alameda County Calculator, and it also shares many key characteristics with the Alameda County Calculator. Both calculators are based on the SD MET methodology and are both Excel-based calculators that share the same general template. This evaluation scored both calculators similarly, but there are also some key differences between the two calculators. There are also some limitations to the SCTA VMT Reduction Calculator that made it score slightly lower than the Alameda County Calculator. Overall, this is an example of how nearby municipalities can collaborate and iterate on calculator development. This report section will not discuss the similar evaluation processes completed by both calculators; instead, it will focus on the differences between the two calculators.

5.5.2. Analysis Process

The SCTA VMT Reduction Calculator follows the same analysis process as described for the Alameda County Calculator. Users input basic project information and then select potential TDM strategies from a list of 32 possible strategies (compared to the 29 available in the Alameda County Calculator). The list also includes the specific VMT types associated with each TDM strategy, which is helpful when understanding what TDM strategies impact the VMT reduction results (an example is shown on **Figure 11**).

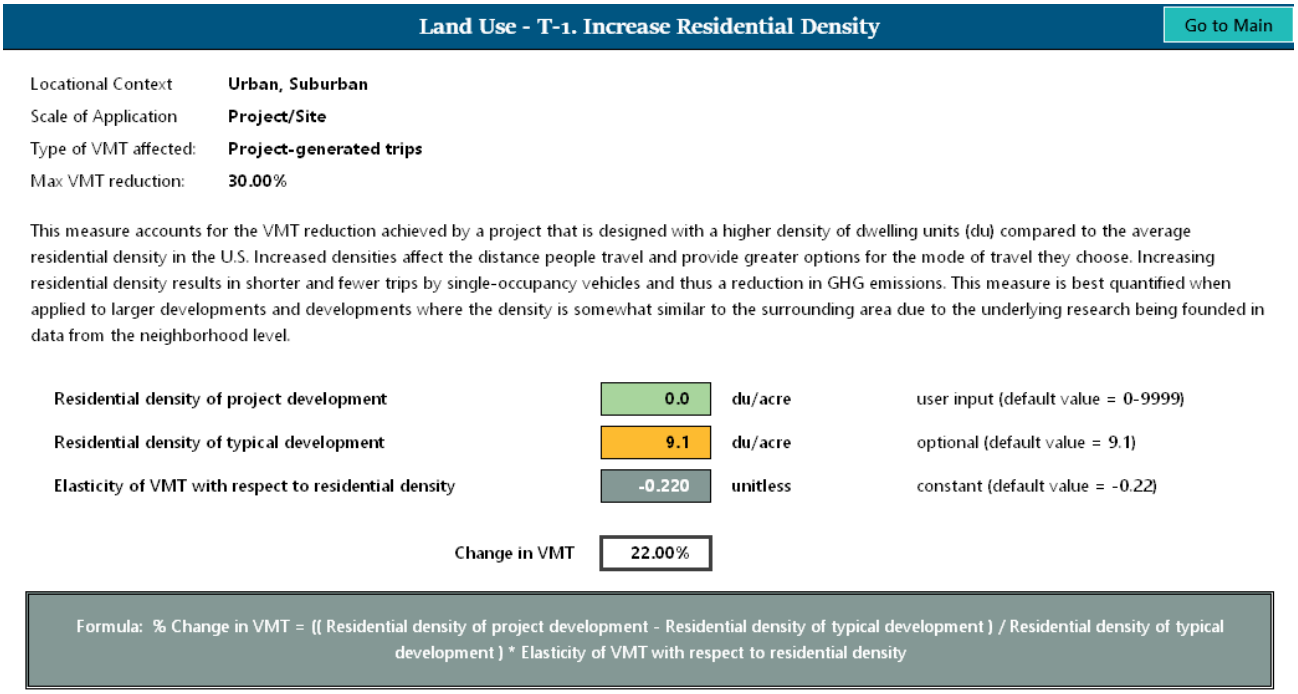
The following represent key TDM categories and VMT types:

- Land Use (VMT Type: Project-generated trips; all neighborhood/city trips)
- Trip Reduction Programs (Employee commute trips; project-generated trips)
- Parking or Road Pricing/Management (Project-generated trips; all neighborhood/city trips)
- Neighborhood Design (all household trips; all neighborhood/city trips; employee commute trips)
- Trip Reduction Programs (Household trips)
- Transit (All neighborhood/city trips)

TDM Strategy Available (strategies that can combine their reductions are the same color)			
TDM ID	Strategy Name	Strategy Type	VMT Type
T-1	Increase Residential Density	Land Use	Project-generated trips
T-2	Increase Job Density	Land Use	Project-generated trips
T-3	Provide Transit-Oriented Development	Land Use	Project-generated trips
T-4	Integrate Affordable and Below Market Rate Housing	Land Use	Project-generated trips
T-5	Implement Commute Trip Reduction Program (Voluntary)	Trip Reduction Programs	Employee commute trips
T-6	Implement Commute Trip Reduction Program (Mandatory Implementation and Monitoring)	Trip Reduction Programs	Employee commute trips
T-7	Implement Commute Trip Reduction Marketing	Trip Reduction Programs	Employee commute trips
T-8	Provide Ridesharing Program	Trip Reduction Programs	Employee commute trips
T-9-A	Implement Subsidized or Discounted Transit Program - All Trips	Trip Reduction Programs	Project-generated trips

Figure 11. Screenshot: Potential TDM Strategies

Similar to the Alameda County Calculator, each TDM strategy includes maximum potential VMT reduction and an estimated change in VMT based on implementation of these strategies. All VMT assumptions are also included on each TDM strategy tab (**Figure 12**). All results are summarized on a single tab that can be printed as a PDF.



Land Use - T-1. Increase Residential Density Go to Main

Locational Context	**Urban, Suburban**
Scale of Application	**Project/Site**
Type of VMT affected:	**Project-generated trips**
Max VMT reduction:	**30.00%**

This measure accounts for the VMT reduction achieved by a project that is designed with a higher density of dwelling units (du) compared to the average residential density in the U.S. Increased densities affect the distance people travel and provide greater options for the mode of travel they choose. Increasing residential density results in shorter and fewer trips by single-occupancy vehicles and thus a reduction in GHG emissions. This measure is best quantified when applied to larger developments and developments where the density is somewhat similar to the surrounding area due to the underlying research being founded in data from the neighborhood level.

Residential density of project development	0.0	du/acre	user input (default value = 0-9999)
Residential density of typical development	9.1	du/acre	optional (default value = 9.1)
Elasticity of VMT with respect to residential density	-0.220	unitless	constant (default value = -0.22)
Change in VMT	22.00%		

Formula: % Change in VMT = ((Residential density of project development - Residential density of typical development) / Residential density of typical development) * Elasticity of VMT with respect to residential density

Sources:

(1) Ewing, R., Bartholomew, K., Winkelman, S., Walters, J., Chen, D. 2007. Growing Cooler: The Evidence on Urban Development and Climate Change. October. Available: https://www.nrdc.org/sites/default/files/cit_07092401a.pdf. Accessed: January 2021.

(2) Stevens, M. 2016. Does Compact Development Make People Drive Less? Journal of the American Planning Association 83:1(7–18). DOI: 10.1080/01944363.2016.1240044. November. Available: https://www.researchgate.net/publication/309890412_Does_Compact_Development_Make_People_Drive_Less. Accessed: January 2021.

Figure 12. Screenshot: VMT Reduction Assumptions and Formulas

5.5.3. Calculator Evaluation and Scoring

Scoring Scale (see the full scoring rubric for more details about each evaluation criteria):

1 = Poor, 2 = Marginal, 3 = Acceptable, 4 = Good, 5 = Excellent

Table 17. SCTA VMT Reduction Calculator Evaluation and Scoring

Evaluation Criteria	Score	Pros	Cons
Interface: Is the interface intuitive to get around and use?	3	The SCTA VMT Reduction Calculator has a slightly better format than the Alameda County Calculator due to some different coloring and cell styling, but they are the same overall. **CDOT Considerations:** Most Excel calculators lack the high-quality formatting of web-based calculators, but the SCTA VMT Reduction Calculator's formatting is the best of any Excel calculator and could be used as a formatting template.	Since the calculator includes an individual tab for each TDM measure, the Excel spreadsheet includes more than 30 tabs. Each TDM measure tab has a link back to the "Main" tab, but the number of tabs still makes navigation challenging. **CDOT Considerations:** If CDOT develops an Excel-based calculator, it should be consolidated into a limited number of tabs. If this is not possible, a webpage or application should be considered instead.
Format: Is the format readily accessible to most/all users?	4	Including the VMT types associated with each TDM measure is helpful for users to understand how these measures are connected to the different VMT reduction categories summarized on the Results tab. **CDOT Considerations:** If VMT reduction is broken out into categories (project-generated trips, employee trips, all neighborhood/city trips, etc.), it is important to specify which TDM measures impact each category.	The calculator uses macros, which sometimes create usability challenges. If Windows' security functions block macros, then the calculator may not be usable. **CDOT Consideration:** An Excel calculator should avoid the use of macros, if possible.

Evaluation Criteria	Score	Pros	Cons
Directions: Are there directions in the calculator and are they clear and easy to follow?	4	The calculator's first tab (the "Introduction" tab) provides a clear overview of the calculator and answers frequently asked questions. This is a clearer approach than that used for the Alameda County Calculator, which does not include an Introduction tab. In addition, an accompanying webpage includes a demo video, user guidebook, and additional information on the methodology that informs this calculator. **CDOT Considerations:** Do not assume that users will read any overview materials outside the calculator itself; ensure there is an Introduction/Overview tab within the calculator itself.	Excel's formatting is limited for incorporating directions into each calculator's input page.
Methodology: If there is a separate methodology, is it clear and easy enough to understand to a wide audience?	5	The calculator uses the same comprehensive methodology as that of the SD MET and Alameda County calculators. This comprehensive methodology includes VMT calculation formulas and calculation sources. **CDOT Considerations:** Including VMT reduction formulas on each input tab provides a clear understanding of the VMT reduction methodology without having to reference a separate user guide.	N/A

Evaluation Criteria	Score	Pros	Cons
Validity: Is the calculator robust enough to use as an official calculator, or does it not measure impacts in an in-depth manner?	4	The calculator's detailed and rigorous methodology allows for in-depth measurement of VMT reduction.	Like other calculators, sourcing for all assumptions will have to be periodically reviewed and updated. If sourcing gets too outdated, then validity may be questioned. **CDOT Considerations:** Since San Diego, Alameda County, and SCTA all use similar sourcing, it would be helpful to understand how the municipalities coordinate on periodic updates to these calculators.
Versatility: Can this calculator be used in urban, suburban, or rural settings?	4	The calculator can be used in any setting within Sonoma County, CA. A similar calculator could be implemented elsewhere if a different traffic model was used. The calculator has the ability to calculate VMT impacts at different scales. Like the Alameda County calculator, the SCTA calculator estimates project-generated trips and employee commute trips at the project level. In addition, the calculator estimates community-wide trips for all trips, employee trips, and household trips. **CDOT Considerations:** This calculator has high applicability to CDOT's statewide analysis goals since it includes urban, suburban and rural contexts. Another beta version of this tool can be used to conduct VMT reduction analysis in eight US Census Core Based Statistical Areas across California. However, the analysis approach would still have to be modified significantly with Colorado datasets.	N/A

Evaluation Criteria	Score	Pros	Cons
Outputs: Are outputs in a ready-to-use form or do they consist of raw data that needs to be processed?	3	The Output tab includes much more detail than the Alameda County calculator. This is a useful summary to review all results in a single Excel tab.	When exporting this detailed summary as a PDF, the single page PDF export is too small to easily read. The calculator should format the output so that the summary is split into multiple pages when exported to PDF or printed.

5.5.4. Key Takeaways

The SCTA VMT Reduction Calculator's clear VMT reduction methodology, paired with information about how each TDM measure connects to VMT-specific categories, is more detailed than any other VMT calculator. CDOT should consider taking this approach as a potential calculator. The San Diego, Alameda County, and SCTA calculators all include slightly different TDM measures; CDOT can reference TDM measures from other calculators, but it should also consider strategies that are relevant to suburban and rural areas in addition to urban or urban edge areas. Finally, macros are a limitation of Excel-based calculators that can be addressed by developing a web-based calculator instead. Other web-based calculator benefits include higher quality formatting than Excel, and consolidation of TDM measures onto a single webpage instead of breaking them out into many tabs.

More broadly, all the top five scoring TDM calculators focus on development review for land use projects. There are several possible reasons for this. First, there is a clear need for development review calculators. Many cities and other local municipalities have implemented TDM plans, and as part of the development review process, they require analysis of how potential TDM measures will impact VMT related to the development. Some of these policies originate from the municipalities themselves, while others are designed to meet state statutes, such as California's SB 743. Municipalities also aim to streamline the development review process and make it less onerous for applicants by developing user-friendly VMT calculators. This is best accomplished by developing web tools rather than spreadsheets. Given the benefits of web tools identified through this project (interactive interfaces, real-time scoring, in-depth how-to resources, clear outputs, and other factors), these calculators scored higher. These calculators also scored high for using defensible methodologies that quantified VMT reduction related to potential TDM measures.

Second, TDM evaluation requirements for transportation infrastructure projects are less common than TDM evaluation requirements for land use development projects. Several states, including California

through its SB 743 ((California State 2013)), New York State through its 2010 Smart Growth Public Infrastructure Policy Act (New York Department of Transportation n.d.), and Massachusetts through its Environmental Review and GHG Policy Process (Massachusetts Environmental Policy Act 2007), have policies that require analysis of TDM measures, but the scope of these requirements are typically narrow, and this type of project happens much less frequently compared to development review. For example, California's SB 743 only requires identification of TDM measures to mitigate VMT increases for proposed highway expansion projects. Other state policies require DOTs or local agencies to consider transportation demand management, system management, and modal alternatives to address VMT increases and congestion before any highway expansion is even approved. States with well-established programs include Maine through its Sensible Transportation Policy Act (State of Maine 1991), Oregon through its 1991 Transportation Planning Rule and Highway Policy, and Washington State through its 1991 Commute Trip Reduction Law (Washington State Office of Financial Management 2025) and other state-level TDM requirements. The complexity of major transportation infrastructure projects also requires the use of regional travel models that are typically refined and customized for the project itself (Handy and Volker 2025). This more manual process is challenging to replicate in a calculator or tool. In addition, despite this refinement, these regional models can still have a high degree of uncertainty at the project level. Widespread TDM policy requirements for development review have led to the development and refinement of high-quality TDM calculators for this use case. The demand for transportation infrastructure VMT analysis is still evolving and requires a more complex evaluation process than the land use development use case. Key Elements from Other TDM Calculators.

5.6. Individual Features from Other TDM Calculators

In addition to the key features identified for the top scoring calculators, other calculators that scored lower overall have individual features that are important for CDOT to consider.

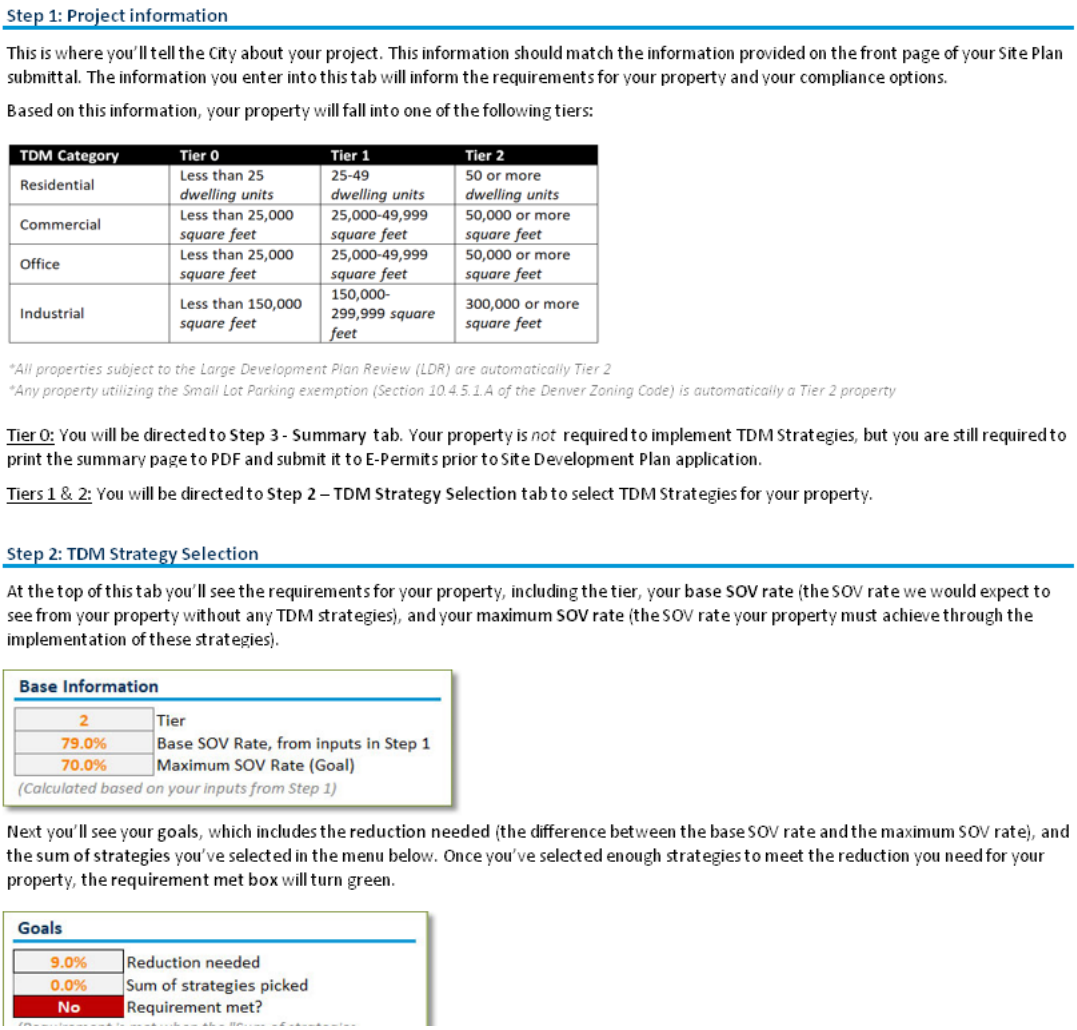
5.6.1. The Tahoe Regional Planning Agency Project Impact Assessment (PIA) Tool for VMT Analysis

Many of the identified calculators can be used in urban, suburban, and rural areas. However, these calculators do not have a methodology that can analyze the unique travel patterns associated with recreational mountain and resort travel, which is a key driver of VMT in Colorado. The project team searched for calculators that addressed VMT for these trip types and were only able to find the Tahoe PIA that addresses this context. The PIA is a land use calculator that analyzes VMT associated with tourist accommodations and other types of land use that tourists might visit, but the calculator only

calculates employee travel to and from these locations. Another calculator that attempts to measure these trip types in California is the TDM+ Calculator (beta version). This calculator was developed using the same format, approach, and methodology as the SCTA VMT Reduction Calculator (evaluated above), but it can be used in Core Based Statistical Areas statewide. This calculator can be used by more rural municipalities in California that may not have their own calculators. Unfortunately, this calculator combines both the mountainous areas and rural areas of California into a single analysis region that is almost larger than all other regions combined. This calculator is not likely to capture recreational mountain and resort trips because the Sierra/Northern California region is so broad and extends well beyond mountain and resort areas like Tahoe, Yosemite, and Mammoth Mountain. While this calculator's wider scale could be useful for certain types of Colorado municipalities, this generalized approach still does not analyze mountain and resort areas specifically and does not meet CDOT's needs.

5.6.2. The Denver TDM Plan Compliance Calculator

The Denver TDM Plan Compliance Calculator has the most concise and clear directions of any other calculator that was reviewed. Rather than detailing key steps in a separate user guide, the first tab of the spreadsheet provides an overview of project tiers, TDM strategy selection, and development of a summary output. Users can quickly scroll through this tab in just a few minutes, and then they are ready to fill out the calculator. **Figure 13** shows an excerpt from the calculator instructions.



Step 1: Project information

This is where you'll tell the City about your project. This information should match the information provided on the front page of your Site Plan submittal. The information you enter into this tab will inform the requirements for your property and your compliance options.

Based on this information, your property will fall into one of the following tiers:

TDM Category	Tier 0	Tier 1	Tier 2
Residential	Less than 25 *dwelling units*	25-49 *dwelling units*	50 or more *dwelling units*
Commercial	Less than 25,000 *square feet*	25,000-49,999 *square feet*	50,000 or more *square feet*
Office	Less than 25,000 *square feet*	25,000-49,999 *square feet*	50,000 or more *square feet*
Industrial	Less than 150,000 *square feet*	150,000-299,999 *square feet*	300,000 or more *square feet*

**All properties subject to the Large Development Plan Review (LDR) are automatically Tier 2*
**Any property utilizing the Small Lot Parking exemption (Section 10.4.5.1.A of the Denver Zoning Code) is automatically a Tier 2 property*

Tier 0: You will be directed to Step 3 - Summary tab. Your property is *not* required to implement TDM Strategies, but you are still required to print the summary page to PDF and submit it to E-Permits prior to Site Development Plan application.

Tiers 1 & 2: You will be directed to Step 2 – TDM Strategy Selection tab to select TDM Strategies for your property.

Step 2: TDM Strategy Selection

At the top of this tab you'll see the requirements for your property, including the tier, your base SOV rate (the SOV rate we would expect to see from your property without any TDM strategies), and your maximum SOV rate (the SOV rate your property must achieve through the implementation of these strategies).

Base Information

2	Tier
79.0%	Base SOV Rate, from inputs in Step 1
70.0%	Maximum SOV Rate (Goal)

(Calculated based on your inputs from Step 1)

Next you'll see your goals, which includes the reduction needed (the difference between the base SOV rate and the maximum SOV rate), and the sum of strategies you've selected in the menu below. Once you've selected enough strategies to meet the reduction you need for your property, the requirement met box will turn green.

Goals

9.0%	Reduction needed
0.0%	Sum of strategies picked
No	Requirement met?

Figure 13. Screenshot: Project Information and TDM Strategy Selection

This calculator also provides both Excel-based and web-based options to allow users to choose which they prefer to complete. Because this is a simpler TDM strategy identification calculator, this approach may be infeasible for a more complex TDM calculator.

5.6.3. Los Angeles VMT Calculator

Note: This is a different calculator than the LA TDM Calculator reviewed in ***Section 5.2****.* The format for this VMT reduction calculator is the most user-friendly of any other Excel-based calculator that was reviewed. It includes a dashboard-like display with high quality formatting and an embedded map (**Figure 14**).

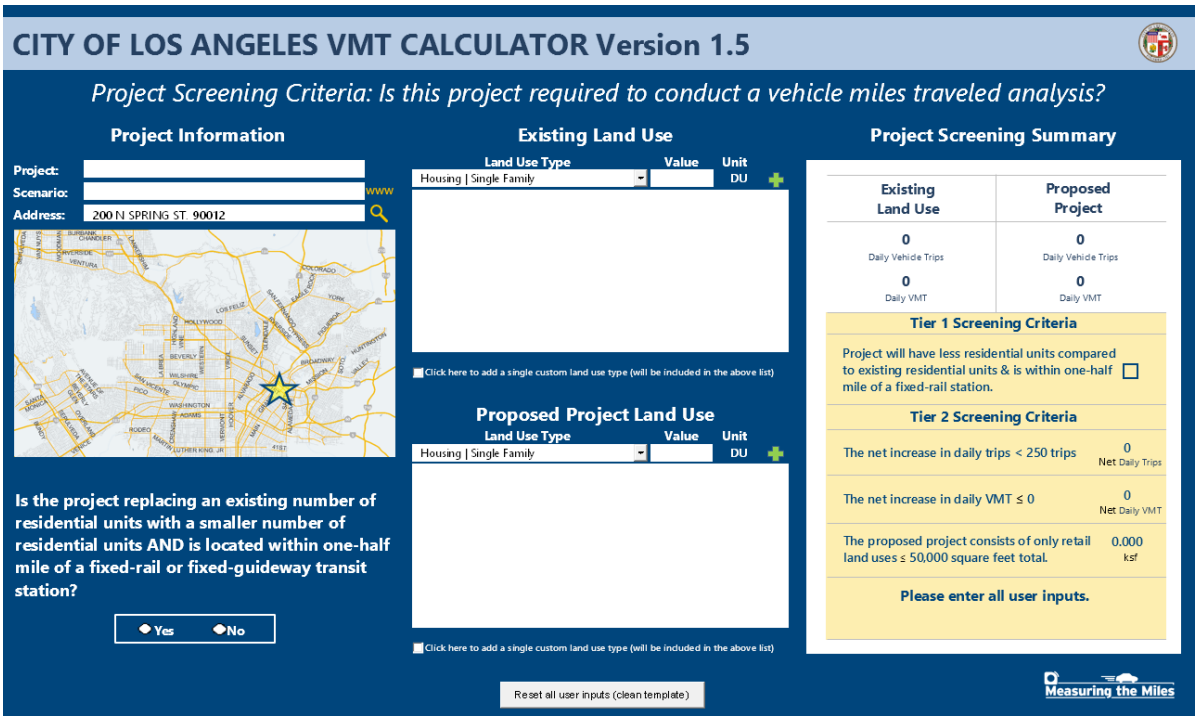


Figure 14. Screenshot: Dashboard Display

While visually appealing, it is likely more cost effective to develop a similar web-based calculator that is more versatile than an Excel calculator. The calculator's complexity can also lead to formatting issues, as shown on **Figure 15**, where the TDM Strategies dropdown menus overlap with each other.

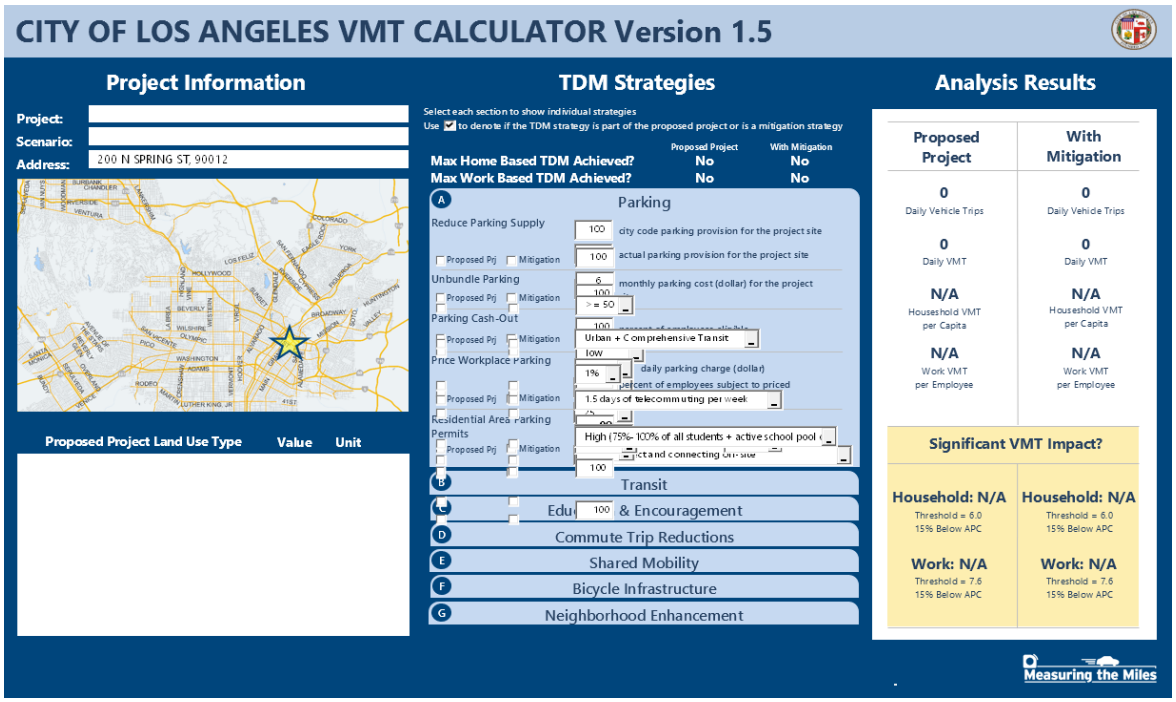


Figure 15. Screenshot: Formatting Issues with the Dashboard Display

5.6.4. Rocky Mountain Institute (RMI) Smarter MODES VMT Reduction Calculator

The RMI calculator quantifies GHG emission reductions, cost savings, and road safety increases (avoided crashes with serious injuries or fatalities) resulting from reduced VMT partnered with electric vehicle adoption. Because improvements are projected over time, the summary output includes line graphs that show temporal improvements (**Figure 16**). Any temporal information in the CDOT calculator could be displayed similarly.

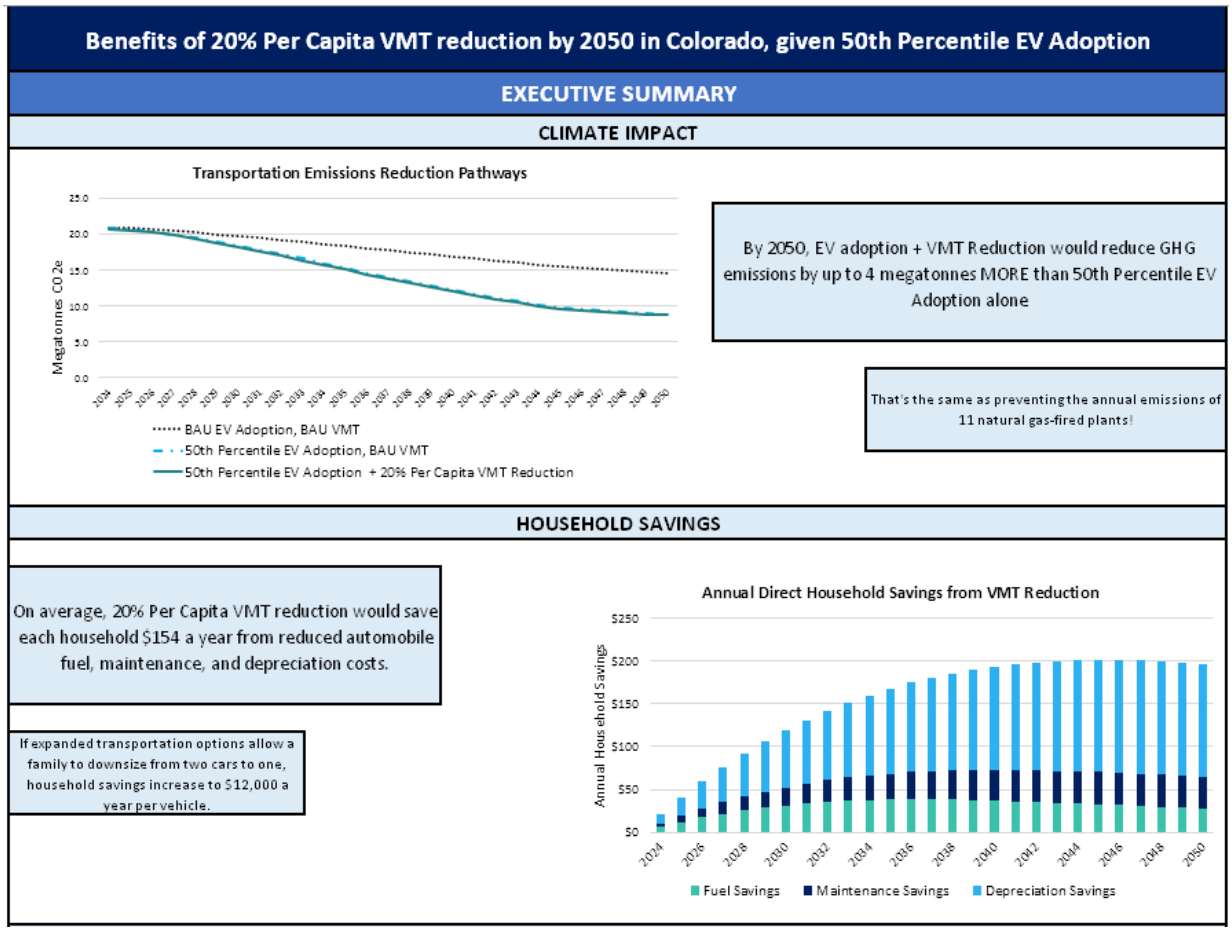


Figure 16. Screenshot: Output Graphs from the RMI Calculator

Road safety increases and household savings measures in the RMI calculator are not found in other VMT calculators. These measures are not typically associated with VMT, but they could be additional data points that local agencies could use to justify their projects. Road safety increases can be calculated using existing crash data and modeled future crash data that projects potential crash reductions after the proposed infrastructure project is completed. Household savings data, as shown on **Figure 16**, could also be calculated using VMT reduction projections from a CDOT calculator. This is another example of a measure that could be used to justify a project beyond VMT reduction alone. While the output

formatting and analysis measures in this calculator are useful for CDOT, this calculator uses a methodology and approach that have not produced accurate results for CDOT in the past.[3]

5.6.5. The Mobility Lab - TDM Return On Investment Calculator

The Mobility Lab calculator uses a benefit-cost analysis approach, which is unique compared to other calculators. Specifically, the calculator was developed to help users calculate vehicle trips and VMT reduced by their TDM programs and to calculate benefit-cost ratios or ROI. This approach helps quantify the results of TDM programs.

[3] This feedback was provided by members of CDOT's Greenhouse Gas Program team.

Chapter 6. Stakeholder Engagement Summary

6.1. Overview

This chapter summarizes findings from in-depth interviews with agencies that have experience with developing and using TDM calculators. In addition, the project team solicited feedback from local Colorado jurisdictions, TPRs, MPOs, and CDOT stakeholders through additional in-depth interviews. The project team conducted these interviews to better understand lessons learned from past TDM calculator users and to gain insight into how and why potential future users plan on using a TDM calculator in their work. The project team interviewed 10 agencies and one consulting firm with previous TDM calculator experience:

- City of San Diego
- Alameda County Transportation Commission
- Sonoma County Transportation Authority
- City and County of Denver
- Minnesota Department of Transportation
- City of Lost Angeles Department of Transportation
- Rocky Mountain Institute
- Atlanta Regional Commission
- San Francisco Planning Department
- Federal Highway Administration
- Transportation consulting firm with experience developing several TDM calculators

Using the in-depth interview questions detailed in **Appendix B**, the project team asked the 10 agencies to identify their main goals for developing a TDM calculator; the methodology they used; how much time and budget they used to develop the calculator; the primary user base; what (if any) methods they had for tracking the effectiveness of TDM strategies after implementation; any lessons learned through the process of developing and using a calculator; and their maintenance and update schedule. The project team asked the consulting firm similar questions from the perspective of calculator development.

The second group of interviews focused on Colorado stakeholders that would potentially use a CDOT TDM calculator. The project team interviewed 17 Colorado stakeholders, including:

- CDOT Greenhouse Gas Team
- CDOT Office of Information Technology
- Colorado Department of Local Affairs (DOLA)
- Colorado's five metropolitan organizations: (DRCOG), North Front Range MPO (NFRMPO), Pikes Peak Area Council of Governments (PPACG), Pueblo Area Council of Governments (PPACG), and Grand Valley MPO (GVMPO)
- Colorado Transportation Planning Organizations: Intermountain, Southwest, Upper Front Range
- Local municipalities: Denver, Fort Collins, Grand Junction, Greeley, and Pueblo
- Transportation Management Associations and Transportation Management Organizations: Transportation Solutions, Commuting Solutions

The project team asked these stakeholders to identify use cases for which a calculator could be used, preferences for data input and methodology, preferred formats for data outputs, desired features, which format (Excel vs. web-based) they prefer for the calculator, which TDM strategies they most want to see in the calculator, and how a calculator could benefit their projects. The in-depth interview questionnaire is available in **Appendix C**. Additionally, the project team interviewed DOLA about the calculator they developed to assist with the Strong Communities Grant Program.

6.2. Interview Summaries: Agencies with Existing TDM Calculators

For the agency stakeholder interviews, the project team developed a standard set of questions to determine the factors agencies considered when developing a calculator and to determine basic information such as cost/timeframe for developing a calculator, lessons learned, and primary user base. The following subsections summarize the most common themes and key points across all agencies resulting from the agency interviews.

6.2.1 Discussion Area 1: Goals for Calculator Development

Across agencies, the main goals for developing TDM calculators centered on meeting new policy and regulatory mandates (especially California's SB 743), providing a consistent and streamlined approach to estimating VMT reduction, and offering accessible tools for local governments and developers. Many agencies wanted to replace expensive or lengthy modeling with a more flexible and easier to use tool.

Agencies also wanted a tool that could be used by non-technical staff or developers with minimal training and a tool that produced defensible results. A few agencies also noted the intent to help smaller jurisdictions or nonprofits that lack the resources for advanced modeling.

Quotes

"We wanted to create a tool that was accessible and reduced barriers and also made it easier for the city to review." – **LADOT (07/30/2025 interview)**

"The TDM program gave developers flexibility to pick and choose between different measures." – **SF Planning (08/24/2025 Interview)**

"We wanted to be able to generate reliable emissions estimates and to assist agencies who didn't have a big budget to do in depth modeling." – **FHWA (07/29/2025 Interview)**

Outliers

In addition to general summaries of the most common themes, the process revealed the following unique outlier statements for discussion areas.

City of San Diego: Focused on developer compliance under CEQA and designed their tool to provide fast, regulatory-grade VMT estimates. Most other agencies emphasized public usability, not regulatory streamlining.

Sonoma County Transportation Authority: Framed their tool as an educational instrument for understanding long-term VMT and GHG trends rather than immediate permitting. This broader "awareness and behavior change" goal was not really echoed elsewhere.

6.2.2. Discussion Area 2: TDM Calculator Methodology

Most agencies adapted or built on existing frameworks rather than starting from scratch. The SANDAG methodology and CAPCOA guidance were frequently cited as baselines, modified with local data for defensibility. Many calculators incorporated VMT modeling, mode shift assumptions, or formulas drawn from regional or federal datasets such as FHWA's CMAQ calculator. Several agencies stressed the importance of user-friendliness and started with spreadsheet-based tools before migrating to web apps for broader access. Some agencies mentioned challenges with calibration—ensuring the tool reflected local land-use and travel behavior differences. In some cases, agencies developed point-based systems or tiered frameworks linking TDM measures to VMT reduction scores. DOLA wanted to use readily available databases in their methodology.

Quotes

"Used the SANDAG tool as the methodology... The simplicity and user-friendliness of the SANDAG model were key decision points..." **- Alameda County Transportation Commission (CTC) (07/22/2025 Interview)**

"Methodology was a mix of formulas from CAPCOA, internal modeling data, and some info from a consultant... Tried to use as much local data and conditions so we could defend the mitigations..." **- Sonoma County Transportation Authority (07/22/2025 Interview)**

"Want to transition away from Excel sheets. Mac users have difficulty accessing it and they want to develop a web version" **- LADOT (07/30/2025 Interview)**

Outliers

City and County of Denver: Introduced a tier-based approach that determines a project's VMT impact category (size, location, parking).

Sonoma County: Emphasized defensibility in court ("San Diego has been hit with lawsuits").

6.2.3. Discussion Area 3: Development Costs and Timeline

Cost to develop tools varied widely from about $50,000 for more simple calculators to $500,000 for web-based tools. Many tools began as Excel-based calculators because they were less expensive and easier to develop. Tool development timeframes ranged from six months to two years, depending on complexity, available funding, and need for the tool. Some agencies relied on grants or pooled local contributions for funding. Transitioning to web-based platforms cost more and required more careful internal IT coordination to ensure that the tools were accessible to IT staff for maintenance and updates. Staff involvement was typically limited, with consultants doing most of the heavy lifting. For the most part, maintenance and upgrades required a budget in addition to the initial fee.

Outliers

Sonoma County: Identified staff time variability and partial funding from local jurisdictions, which highlighted a collaborative funding structure uncommon in others.

FHWA: Mentioned developing an Excel-to-web migration costing $500,000 and involving IT coordination issues. No other agency gave as much detail.

6.2.4. Discussion Area 4: TDM Calculator Users

Users mainly included developers, consultants, and agency reviewers. To find potential users, outreach involved working groups, ITE meetings, and some limited public engagement, but most tools were not heavily marketed beyond professional audiences. Feedback from users was mostly positive, emphasizing transparency and time savings, but adoption remained low in regions with minimal development activity or where developers could avoid using the tool. A few agencies expanded use cases to include advocates or academic institutions, and some tools were cited in public communications such as press releases and policy op-eds. Agencies also investigated integrating with internal databases to track project performance.

Quotes

"There was an outreach effort as part of the consultant's fee, but the calculator was mostly geared towards developers." **- City of San Diego (07/17/2025 Interview)**

"We formed a working group; they looked at the SANDAG model and had feedback as we were developing our own with local data..." **- Alameda County Transportation Commission (CTC) (07/22/2025 Interview)**

Outliers

San Diego: Conducted targeted outreach through business associations and ITE meetings, showing unusually strong proactive engagement.

Sonoma County: Reported that developers avoid using the tool because most development occurs in VMT-efficient zones. This insight into geographic bias in tool relevance was not discussed elsewhere.

6.2.5. Discussion Area 5: Implementation Tracking

Few agencies had methods for post-implementation tracking. Most reported having limited or no follow-up studies to compare predicted results to actual outcomes. When tracking did occur, it focused on high-level VMT trends or specific case studies. Agencies mentioned problems such as delays between project completion and occupancy, lack of staff resources, and difficulty in obtaining trip data. Some showed interest in future monitoring through surveys or integrated databases. Overall, agencies recognized the need for better evaluation methods but accepted current calculators as primarily planning-level tools. Many agencies noted the importance of user feedback and peer review to catch calculation errors and improve assumptions over time.

Quotes

"Things are difficult in the rural areas... Big gap in knowledge when it comes to the VMT impacts of visitors..." **- Sonoma County Transportation Authority (07/22/2025 Interview)**

"Monitoring component has not started yet... Part of it is surveys of employees, visitors and residents..." **- City and County of Denver (07/24/2025 Interview)**

Outliers

City and County of Denver: Noted they plan to use employee and visitor surveys once developments are occupied.

Sonoma County: Identified visitor or tourism-generated VMT in rural areas as a critical blind spot.

6.2.6. Discussion Area 6: Lessons Learned by Agencies

Agencies repeated the need to keep the tool simple, transparent, and easy to maintain. Overly-complex calculators discouraged adoption. Some common themes included involving stakeholders early, defining metrics and priorities clearly, and managing consultant relationships closely to avoid scope creep. Agencies recommended using existing data sources where possible and building flexibility for updates. Many learned that server migration and internal IT coordination, software integration, and cross-agency coordination can take a lot of time. Simpler prototypes often helped build internal and political support. A key takeaway was that usability outweighs sophistication. Tools should be accessible to planners and developers alike. Some agencies also expressed a desire for statewide or regional harmonization to avoid duplicative local tools.

Quotes

"An easy-to-use and easy-to-understand tool is a key selling point..." **- Alameda County Transportation Commission (CTC) (07/22/2025 Interview)**

"The exercise of having the tool has been useful... Developers want certainty and a streamlined process..." **- Sonoma County Transportation Authority (07/22/2025 Interview)**

Outliers

San Diego: Had to rebuild their tool due to hosting/server issues, which significantly delayed rollout.

City and County of Denver: Deliberately kept the tool simple and avoided over-integration with other datasets.

Sonoma County: Suggested the tool itself helped facilitate policy dialogue and awareness, treating it as a "conversation starter" instead of merely a technical instrument.

6.2.7. Discussion Area 7: Tool Updates and Maintenance

Many agencies conduct minor updates, including minor bug fixes annually and major overhauls every few years to align with regional transportation plans. Updates typically focus on refining assumptions based on user feedback, improving usability, or transitioning to web-based platforms. Maintenance budgets are small but recurring. Consultants often handle maintenance. A few agencies expressed a desire to make outputs more interactive and exportable while maintaining simplicity. DOLA added that they opted for an Excel tool to ensure the longevity of the tool and to avoid future expenses due to web subscriptions or web maintenance programs.

Quotes

"Always making small updates to the tool, larger updates every 4 years to match TMP. Budget about $5k per year for updates..." **- City of San Diego (07/17/2025 Interview)**

Outliers

City and County of Denver: Mentioned creating a parking calculator add-on and referencing King County's Multi-Family Parking Calculator.

San Diego: Maintains regular updates tied to the Transportation Master Plan (TMP) cycle.

6.3. Stakeholder Interviews: Local Colorado Jurisdictions, TPRs, and MPOs

After the initial interviews with agencies using already developed TDM calculators, the project team conducted separate interviews with local Colorado jurisdictions, TPRs, and MPOs that potentially may be users of a future statewide TDM calculator. The questions for these interviews focused on specific use cases, data inputs and methodology, output preferences, desired features, desired TDM strategies, and potential project benefits.

6.3.1. Discussion Area 1: TDM Calculator Use Cases

Stakeholders envision using a TDM calculator to support grant applications, corridor studies, air quality planning, and regional long-range plans. MPOs such as DRCOG and NFRMPO noted that a standardized calculator could streamline project evaluations for CMAQ and other funding programs. Stakeholders also identified opportunities for use in congestion management, emissions analysis, and local planning

support, especially for smaller jurisdictions without modeling staff. Specific features mentioned included flexibility to serve urban, small-urban, and rural contexts, as travel behavior and data availability differ significantly across regions. Some expressed that a TDM calculator could help make the case for non-infrastructure projects and justify the benefits of TDM measures to elected officials. The CDOT GHG team noted that PD 1610 has default scores for different strategies, but a calculator would allow greater flexibility for unique projects and the ability to account for unique differences between different projects when evaluating emissions factors.

Quotes

"We sometimes help jurisdictions with grant applications, so that could be something they're interested in… Could tie into active transportation and long-range transportation plans as well." **- PPACG (08/14/2025 Interview)**

"For some of the set-aside projects, we're asking applicants to estimate what the VMTR would be… If we had an established calculator in place, it would be very helpful. For CMAQ, we need to understand emission impacts." **– DRCOG (08/18/2025 Interview)**

Outliers

Fort Collins: Mentioned integration with "Go Amigo," their local rideshare and incentive platform.

NFRMPO: Suggested the calculator's output could feed directly into TDM project scoring and call-for-projects processes.

6.3.2. Discussion Area 2: Data Inputs and Methodology

Most interviewees agreed that data transparency and flexibility are essential. Most MPOs and local agencies already collect GIS, survey, and demographic datasets, but data gaps remain for carshare, micromobility, and smaller communities. Stakeholders favored a balance between methodology/transparency and usability. The consensus was to show enough of the methodology to maintain credibility but not so much that it overwhelms users. Including options for rural vs. urban settings and allowing different project types (e.g., infrastructure vs. programmatic measures) are important. Some expressed that assumptions should be documented, defensible and could be potentially validated by an expert review process. Others noted that TDM is not an exact science and that starting simple and improving over time is preferable to waiting for perfection.

Quotes

"The calculator display can probably be a simplified version as long as the methodology backup is available. Our team will want to see the background data and how the scoring comes about; they will be very skeptical otherwise." **- PPACG (08/14/2025 Interview)**

Outliers

Weld County / Upper Front Range TPR: Wanted the tool to offer different detail levels for staff vs. communities ("I'd want inputs, communities just want outputs").

DRCOG: Highlighted post-COVID multimodal data relevance.

PACOG: Noted staff capacity constraints and a desire for tools that can allow for cross-jurisdictional collaboration and harmony.

Commuting Solutions: Proposed expert-validated transparency, where subject matter expert would peer-review the assumptions and outputs.

6.3.3. Discussion Area 3: Output Preferences

For TDM calculator outputs, there was a clear consensus that percentage reductions in VMT, emissions, or trips are far more defensible and useful than points-based systems. Percentages are easier to communicate to decision-makers and more relevant for regulatory and funding contexts, like air quality conformity or Clean Air Act reporting. Points were viewed as confusing unless they are clearly linked to percentage conversions.

Quotes

"Percentage makes a lot of sense from a statistical background. There are some certain numbers that must be hit for air quality regulations (specifically for DRCOG and North Front Range)." **- PPACG (08/14/2025 Interview)**

"Vehicle trips and emissions reduction are must-haves. The TDM set-aside program is VMT reduction and vehicle trips — outputs should match what's being requested in final project reports." **– DRCOG (08/18/2025 Interview)**

"When showing elected officials, it's better to have straightforward percentage reductions." **– PACOG (08/19/2025 Interview)**

Outliers

NFRMPO: Questioned reconciling different stakeholder priorities (e.g., trip reduction vs. emissions reduction).

Commuting Solutions: Insisted "points don't mean anything" and called for percentages with rigorous conversions.

6.3.4. Discussion Area 4: TDM Calculator Features

Many stakeholders agreed that the tool should go beyond VMT and include features such as vehicle trip reductions, crash/safety benefits, GHG reductions, and travel cost savings. These metrics help connect TDM to tangible outcomes such as Vision Zero, public health, and economic benefits, to name a few. Some noted that crash reduction is very effective at justifying infrastructure investments, while cost savings and emission reductions resonate for grant reporting and outreach. Some respondents envisioned two versions of the tool: a simplified version for the public and a detailed one for agencies applying for or reporting on grants. This could be accomplished by adding a filter that provides both a high-level summary of calculator results and a deeper dive with more information about calculator scores and analysis. The need for periodic updates and pilot testing with real projects was mentioned as well.

Quotes

"Vehicle trips are important; so are cost savings. Cost savings in particular would be useful to our board of directors." **- PPACG (08/14/2025 Interview)**

"Congestion reduction and community health would be good measures to consider." **– PACOG (08/19/2025 Interview)**

"Vehicle trips, types of trips, and visually ready outputs that can be easily shared in a PowerPoint are top priorities." **- Fort Collins (08/20/2025 Interview)**

Outliers

PACOG: Highlighted community health impacts as a measurable outcome.

6.3.5. Discussion Area 5: Tool Format and Instructions

Most respondents preferred a web-based tool for accessibility, version control, and downloadable results. Excel-based tools are good for transparency, as users can inspect formulas and document assumptions. Stakeholders wanted clear, concise instructions including YouTube demos, FAQs, and one-page summaries as opposed to lengthy instruction manuals. Pop-up guidance and interactive help features were also suggested. Accessibility, specifically ADA/Section 508 compliance, and ease of navigation were identified as key design priorities. The CDOT GHG team specifically noted the importance of users being able to access formulas and input their own data if needed.

Quotes

"Potentially a web-based tool, but having all of the data points in a spreadsheet is useful. The major concern with a web tool is who would host it; accessibility is also a key consideration (508 compliance)." **– PPACG (08/14/2025 Interview)**

"FHWA tools are almost all Excel; they can be complex. A web-based tool where we could send a link would be very useful." **– DRCOG (08/18/2025 Interview)**

Outliers

DRCOG: Suggested YouTube-based training paired with downloadable Excel models.

NFRMPO: Warned that web-based tools risk less transparency compared to Excel.

PACOG: Suggested both web and Excel tools available simultaneously.

6.3.6. Discussion Area 6: TDM Strategies

High-priority strategies included active transportation-related strategies, transit-related strategies, and shared mobility and micromobility strategies. Many participants emphasized the need to quantify programmatic investments such as marketing, outreach, and commuter programs instead of just infrastructure improvements. It was noted that regional differences affect feasibility and what works in Denver may not work in rural counties or small towns. Some stakeholders also encouraged consideration of school transportation, carpooling, and cost-reduction measures that make sustainable travel more practical.

Quotes

"Thinking about school busing: if we had more options to pick kids up in buses, then it would make a huge difference in having parents not have to drop kids off at school individually" **– Mesa County (08/20/2025 Interview)**

"Active transportation is good; electric and shared mobility; transit. In addition to infrastructure, don't forget the programmatic investments in TDM — these are so nebulous to calculate." **– DRCOG (08/18/2025 Interview)**

"Carpooling, cost tradeoffs between selecting SOV travel versus other ways. Transit measures would be our top priority overall." **– PACOG (08/19/2025 Interview)**

Outliers

DRCOG: Stressed including programmatic campaigns (social media, education, commuter outreach), not just physical infrastructure.

PACOG: Mentioned school busing options and the parental trip-reduction benefits of centralized pickup.

6.3.7. Discussion Area 7: Project Benefits

Stakeholders agreed that a Colorado-specific TDM calculator would be highly beneficial. Many were encouraged by the prospect of a tool for standardizing methodologies, supporting grant applications, and strengthening the credibility of TDM investments. Respondents envisioned the calculator being integrated into MPO project scoring, state and local grant processes, and GHG reduction reporting. Smaller jurisdictions stressed that usability and resource constraints must be considered so that the tool doesn't disadvantage less-resourced areas. Multiple stakeholders expressed interest in pilot testing the tool. Overall, a statewide, transparent, well maintained TDM calculator would fill a major gap and help quantify the value of TDM strategies across Colorado. The CDOT GHG team added that a calculator would be beneficial to have applicants estimate GHG reduction for potential projects and for the GHG team to report GHG emissions reduction from TDM measures.

Quotes

"There would be benefit if CDOT developed a Colorado-specific calculator that each area can tailor to best suit their communities… Comparing statewide data to the local area would also be helpful." **- PPACG (08/14/2025 Interview)**

"It would be great to have a more standardized approach for any set-asides — helping local governments with CMAQ and project benefit analysis. We could all benefit in Colorado with a standard TDM calculator approach." **– DRCOG (08/18/2025 Interview)**

Outliers

Commuting Solutions: Proposed using the tool for cost-effectiveness evaluation to prioritize investments.

PACOG: Raised the issue that smaller MPOs might be disadvantaged if calculators are too urban-centric.

DRCOG: Connected tool usefulness to national standardization of VMTR reporting.

Commuting Solutions: Offered to pilot the tool with CDOT Region 4.

6.4. CDOT Office of Information Technology (OIT) Coordination Process

The project team met with the CDOT OIT in August of 2025 to discuss what the coordination process will look like when working with the OIT on developing a TDM calculator. The main takeaways from this discussion are summarized below.

Overall Process Coordination

- OIT should be involved early during the drafting of the initial scope of work.
- Communication between the OIM and OIT is necessary to ensure that the tool does not become dormant and that new technologies and software updates are implemented.
- Hosting the calculator on a CDOT website would involve coordination with CDOT's communications team and would not need any special approval unless new software is needed to develop the website.
- ArcGIS online (AGOL) tools are difficult to transfer from a consultant account to the CDOT side, so a temporary CDOT account would be created if an AGOL tool is developed.
- If using an ArcGIS Online tool that runs analysis on the fly, there could be expenses due to the usage of credits.
- For other web-based (non-AGOL) tools in the past, consulting teams have developed the tool on their servers and transferred to CDOT servers later.

Tool Maintenance

- A long-term maintenance plan is key, and a budget will need to be developed for consultant maintenance if it is necessary.
- OIT has a small budget for GIS accessibility/3rd party testing.
- OIM would not need an additional budget for in-house hosting and maintenance from the OIT.

User Access

- OIT would prefer a single sign-on system for users instead of a registration/login process because a login might decrease interest in the tool.
- ArcGIS logins would have to be managed if the tool is not open to the public. CDOT usually covers the cost for MPOs, TPRs, and local municipalities, but it would be best practice to create one login per organization to limit the number of logins.
- Furthermore, according to CDOT's conversations with a consulting firm that regularly develops similar online web tools using the ArcGIS platform, adding user accounts and authentication would roughly double the development effort. Specifically, adding standalone user management turns what could otherwise be a front-end-only app into a security- and data-bearing system that increases development time and resources significantly.

Chapter 7. CDOT Calculator Recommendations and PD 1601 Considerations

7.1. Recommended Components of a CDOT VMT Reduction Calculator

To inform CDOT's TDM calculator development, key calculator features and approaches identified in Chapter 5 and insights from stakeholder interviews in Chapter 6 have been synthesized into a list of recommended CDOT TDM Calculator components below in **Table 18**.

Table 18: CDOT TDM Calculator Recommendations

Key Calculator Recommendations	Recommendation Details
Interface/Format: Develop an intuitive, easily navigated web-based interface including input measures that users can easily gather or calculate.	**Stakeholder Interview Feedback:** The user interface should be intuitive and should be just as easily used by both technical and non-technical users. The tool should minimize complexity when possible to ensure that it will be adopted and used. When a more complex tool is needed for grant and project evaluations, a simple public-facing version should also be available. Visually, the interface should be simple with the ability to hide or collapse more advanced elements. Fields should be pre-filled with state or US Census dataset information when possible and applicable to save time and effort. **Research Findings:** The calculator's interface should be web-based and interactive. Specifically, there should be a module on each page that shows a real-time comparison between the percent VMT reduction from potential TDM measures compared to the target reduction. The tool should be contained within a single webpage to ensure easy navigate among inputs, TDM strategies, and outputs. Users should be able to save their progress and return to the calculator as needed before finalizing their results. This will require a login feature and data hosting capabilities so users can access their saved projects. CDOT's Office of Information Technology (OIT) must be involved in these discussions to better understand feasibility and hosting costs. It is critical to coordinate with OIT early in the scoping process for development of a potential TDM to avoid issues with calculator development and hosting, which could require re-work. All input data entered by users should be readily available from their PD 1601 application or other relevant multimodal infrastructure design applications or plans. A web-based calculator will also help with updates and methodology changes, which can be completed in the background rather than having to release a new version of a spreadsheet. **Existing Reference Calculators:** ● San Diego Mobility Evaluation Tool (SD MET) ● Los Angeles TDM Calculator ● Los Angeles VMT Calculator ● City and County of San Francisco TDM Management Calculator ● Sonoma County VMT Reduction Calculator

Key Calculator Recommendations	Recommendation Details
Directions for Use: Directions should be available at multiple levels of detail, be well formatted, and easy to access.	**Stakeholder Interview Feedback:** Directions should be updated, and periodic webinars or recorded demos should be provided for new staff onboarding and training. The interface should use recognizable symbols such as the "i" (information) icon for tips about tool functionality, key terms, and assumptions. **Research Findings:** Links to directions should be within the web app at the top of the page. Directions should also be provided at several levels of detail: ● A pop-up on each page of the calculator that summarizes what users will do on that page. ● A narrated YouTube video that walks users through each step of the calculator. The video should be no longer than 15 to 20 minutes. ● A quick start guide with a walkthrough similar to the YouTube video. ● A detailed user guide with background information on local or state policies that influenced calculator development, how the calculator was developed, in-depth methodology information and sources, and details on any appendices (such as local TDM policies). A Frequently Asked Questions guide can also supplement these directions in an approachable way and should include common user questions. **Existing Reference Calculators:** ● San Diego Mobility Evaluation Tool (SD MET) ● Los Angeles TDM Calculator ● City and County of Denver TDM Plan Compliance Calculator ● City and County of San Francisco TDM Management Calculator ● Sonoma County VMT Reduction Calculator

Key Calculator Recommendations	Recommendation Details
Methodology: Develop a methodology that is easy for users to understand and provides sources for any assumptions or calculations used in the calculator.	**Stakeholder Interview Feedback:** A methodology appendix should be available if users prefer to take a more in-depth look at underlying definitions, data assumptions, data citations, and calculations being run within the tool. **Research Findings:** The calculator's VMT reduction methodology should be based on existing datasets. Specifically, the forthcoming Western States CAPCOA Handbook can calculate VMT reduction in Colorado's Metropolitan Planning Organization areas, which include DRCOG, Grand Valley MPO, North Front Range MPO, Pikes Peak Area Council of Governments, and Pueblo Area Council of Governments. Overall, the CAPCOA Handbook has limited applicability in Colorado's rural or resort towns because it does not address visitor traffic or non-commute recreational traffic (such as weekend ski travel on I-70). The Colorado Statewide Travel Model includes VMT analysis for visitor and non-commute recreational traffic, so it should be used for calculating VMT reduction in these geographic contexts. CDOT should revisit the sources and calculations at a pre-determined timeframe to ensure that the assumptions remain up to date. **Existing Reference Calculators:** ● San Diego Mobility Evaluation Tool (SD MET) ● Los Angeles TDM Calculator ● Sonoma County VMT Reduction Calculator
Validity: Develop a calculator that provides applicants with a clear understanding of how their proposed TDM measures meet CDOT requirements.	**Stakeholder Interview Feedback:** The tool should undergo periodic updates and calibration tied to real-world data to ensure validity and accuracy. This calibration could include surveys and observation of post-implementation conditions. Assumptions should be validated through external technical peer review when possible. **Research Findings:** To be considered valid for CDOT's needs, the calculator must first be robust enough to clearly address CDOT's specific VMT reduction requirements associated with TDM measures. Second, the calculator should rely only on inputs that can be easily collected from the project that is being evaluated, and it should use a defensible VMT calculation methodology. **Existing Reference Calculators:** ● San Diego Mobility Evaluation Tool (SD MET) ● Los Angeles TDM Calculator

Key Calculator Recommendations	Recommendation Details
Versatility: Develop a calculator that has assumptions that can be used in multiple contexts across Colorado.	**Stakeholder Interview Feedback:** The calculator should have the ability to evaluate both infrastructure and programmatic projects and TDM strategies. **Research Findings:** A CDOT calculator will be used in multiple contexts throughout the state. The methodology will need to consider research and assumptions that inform VMT reduction estimates for TDM measures related to both PD 1601 and other multimodal infrastructure projects in urban, suburban, rural, and resort town settings. The calculator's input must be tailored to these different contexts, and the user guide should explain differing methodologies or calculations between these contexts. **Existing Reference Calculators:** ● San Diego Mobility Evaluation Tool (SD MET) ● The Mobility Lab's TDM Return on Investment Calculator[4]
Outputs: The calculator's outputs should be tailored to the needs of reviewers without any additional analysis or data processing needed.	**Stakeholder Interview Feedback:** Output options should include visually compelling graphics ready for PowerPoints and emails for relaying results to decision-makers. Outputs for VMT reduction estimates should be provided in a percentage format as opposed to a proprietary points system. Outputs should also include monetary savings as a compelling metric for policymakers when possible. **Research Findings:** The output should be formatted to clearly show all inputs, potential TDM measures, and VMT reduction estimates. In addition, the calculator should include both a web-based output and a PDF or spreadsheet output that can be downloaded. **Existing Reference Calculators**: ● San Diego Mobility Evaluation Tool (SD MET) ● Los Angeles TDM Calculator ● Alameda County TDM Calculator
Other Considerations: Additional elements to consider from the other TDM calculators that were evaluated.	**Stakeholder Interview Feedback:** The tool should be 508 compliant to ensure accessibility for all users. **Research Findings:** Additional measures beyond VMT reduction that can help justify a transportation project. For example, crash reduction projections, household cost savings, emissions reductions, or other elements that can be derived from VMT data or other commonly available data sources. **Existing Reference Calculators:** ● RMI Smarter MODES VMT Reduction Calculator

[4] This tool's return on investment approach is a versatile approach for quantifying project benefits in different contexts.

7.2. Considerations for PD 1601 TDM Analysis

As discussed in Chapter 2, CDOT PD 1601 requires TDM strategies for most interchange proposals or major interchange reconfiguration proposals. Specifically, the goal of TDM strategies is to reduce interchange ramp ADT. Adapting the VMT reduction analysis approach used in the existing land use development calculators to PD 1601's transportation infrastructure context will be a challenging process. Major challenges include:

- PD 1601's TDM requirements currently focus on vehicle trip reduction as opposed to VMT reduction. All calculators identified through this study, as well as their associated methodologies, focus on other approaches for analyzing TDM measures (VMT reduction, GHG emissions reduction, and/or compliance, based on TDM measures) as opposed to vehicle trip reductions.[5]
- The scope of existing calculators' TDM measures is primarily limited to land use developments. This is a much different scope compared to understanding how potential TDM measures impact interchanges and interchange ramp traffic.
- As documented in the report, academic and policy research on reducing VMT through TDM strategies for land use development is widely available. However, developing a calculator with a defensible methodology for estimating vehicle trips or VMT reduction on interchange ramps will be challenging, as research on the impact of TDM measures in such a specific context is limited.
- Proposed TDM measures for interchange projects may provide VMT reduction at a broader scale, but in some cases, these measures may actually lead to additional vehicle trips on intersection ramps. For example, building a mobility hub is currently a strategy in CDOT's PD 1601 TDM toolkit. The TDM benefits of a mobility hub can reduce VMT and pollution by providing carpool lots, serving as hubs for regional or local transit, providing shared micromobility options, and/or providing electric vehicle charging. These benefits will attract community members, but vehicle trips on interchange ramps may increase if many community members drive to the mobility hub.

[5] It is possible to convert from VMT to AADT, but the trip length variable is challenging, as it can vary by mode, land use, trip purpose, or other considerations. For example, 10 vehicle miles traveled might be just one long auto trip in a rural area or 10+ short pedestrian/scooter trips in a dense urban area. VMT is typically used for larger scale analysis wide, whereas AADT is used for a single roadway segment or short corridor. A calculator that provides both metrics or allows a user to toggle back and forth between VMT and AADT could theoretically be developed. The calculator could potentially access average trip length data, or just make some broad assumptions based on the urban character of the area.

The 2025 Handy and Volker report examined similar challenges in the context of California's SB 743 requirement to identify TDM measures to mitigate VMT increases for proposed highway expansion projects. The purpose of the 2025 Handy and Volker report was to understand (1) how to quantify VMT reduction related to the implementation of TDM mitigation measures and (2) the effectiveness of travel demand forecasting models for estimating VMT changes based on mitigation factors such as implementing TDM measures.

As shown in **Figure 17**, the Handy and Volker report identified 45 potential TDM measures and evaluated how estimated reduction in VMT can be quantified for each measure. It also identified when a reduction in VMT cannot be easily quantified. In many of these cases, it is likely the mitigation measures will reduce VMT, but accurate quantification of the reduction is not possible.

The 2025 Handy and Volker report also examined the use of travel demand forecasting models to estimate the impacts of TDM measures. These models are typically regional in scale, and while they can be calibrated for the needs of specific projects, they have a high degree of uncertainty when analyzing VMT changes based on individual transportation projects. The report also found that Four-Step travel demand models struggle to incorporate TDM measures associated with multimodal travel and parking management specifically. Therefore, travel demand models will not produce reliable VMT reduction estimates for projects that include this type of TDM measure. In Colorado, the Grand Valley Metropolitan Planning Organization (MPO) and Pueblo Area Council of Governments use Four-Step travel models that have these issues, but activity-based models and dynamic traffic assignment models used in the other three MPO regions have less uncertainty with VMT estimates.

	Quantification Recommendation
Public transportation measures	
Transit service headways/frequency	Use effect size estimate or travel demand model
First/last mile connectivity	Do not quantify
Transit service coverage	Use effect-size approach or travel demand model
Transit-supportive roadway design	Do not quantify or use travel demand model
Transit fares	Use effect-size approach or travel demand model
Transit reliability	Do not quantify
Mobility hubs	Do not quantify
TNC/transit partnership	Do not quantify
Transit stop amenities	Do not quantify
Transit vehicle amenities	Use effect-size approach
Park-and-ride lots	Do not quantify
Marketing transit	Do not quantify
On-demand transit	Use effect-size approach
Commuter/regional rail	Use effect-size approach or travel demand model
Travel demand management measures	
Telecommuting	Use effect-size approach
Employer-based Commute Trip Reduction programs	Use effect-size approach
Transit pass subsidies	Use effect-size approach

	Quantification Recommendation
Ridesharing Programs	Use effect-size approach
Car-sharing programs	Do not quantify
Community-based travel planning	Use effect-size approach
Safe Routes to School and other school-based programs	Do not quantify
Broadband improvements	Do not quantify
Land use measures	
Transit-Oriented Development (TOD)	Use effect-size approach or travel demand model
Residential density	Use effect-size approach or travel demand model
Employment density	Use travel demand model or do not quantify
Affordable housing	Use effect-size approach
Land preservation as growth management	Use travel demand model or do not quantify
Land-use mix	Use travel demand model or do not quantify
Delivery Hubs	Do not quantify
Jobs/housing balance	Use travel demand model or do not quantify
Road management measures	
Congestion pricing	Use effect-size approach or travel demand model
Road diets/ complete streets	Do not quantify
Local network connectivity	Use effect-size approach or travel demand model
Traffic calming	Do not quantify
Curb management	Do not quantify
Active transportation measures	
Bicycle facilities	Use effect-size approach
Pedestrian facilities	Use CAPCOA approach
E-bike incentive programs	Use effect-size approach
Bike share and scooter share	Use effect-size approach
Parking management measures	
Parking workplace pricing	Use effect-size approach
Parking cash-out programs	Use effect-size approach
Pricing on-street parking	Use effect-size approach
Adaptive parking pricing	Do not quantify
Residential parking restrictions	Use effect-size approach
Unbundling parking costs	Do not quantify

Figure 17. Summary of Recommendations for Quantifying Mitigation Measures (Handy and Volker 2025)

7.3. Additional TDM Calculator Use Cases

In addition to PD 1601 TDM evaluation, there are other potential use cases for a CDOT TDM calculator. Development of this calculator could also help with project planning and justification for the following:

- Development of TDM plans developed by local municipalities or Transportation Management Associations/Transportation Management Organizations.
- Development of Metropolitan Planning Organization (MPO) plans and TPR plans for organizations MPOs other than the Denver Regional Council of Governments (DRCOG).
- CDOT 10-Year Vision Plan.
- Colorado Regional Transportation Plan analysis.
- Colorado Statewide Transit Plan analysis.
- Corridor planning
- Development of state-level grant applications for the Transportation Alternatives Program (TAP), Multimodal Transportation and Mitigation Options Fund (MMOF), Office of Innovative Mobility (OIM) Grants, Clean Transit Enterprise (CTE) Grants, Community Accelerated Mobility Program (CAMP), or other grants.

A calculator that addresses multiple use cases would be a valuable tool that can help local municipalities evaluate the effectiveness of TDM measures in multiple contexts.

Overall, many TDM calculators exist today, but none of them meet the specific needs of PD 1601 TDM analysis or the other potential use cases noted above. These existing calculators can inform development of a CDOT calculator, but the calculator's context and methodology will vary significantly from existing calculators.

Chapter 8 Next Steps: CDOT TDM Calculator Development

Using the recommendations developed in the previous chapter, the next recommended step is for CDOT OIM to develop a web-based TDM calculator. The user base for this future calculator will likely include internal CDOT stakeholders, local jurisdictions, staff from Colorado TPRs and MPOs, private developers, and the general public. The calculator should quantify the VMT reduction benefits of TDM measures during plan and project development, communicate project benefits/rationale to community members and decision-makers, augment existing TDM analysis (if any exists), and strengthen grant applications and reporting. The calculator should first be developed for analysis in urban areas before expanding capabilities to address suburban, rural, and resort town contexts. The calculator development process should also include a working group of CDOT and MPO stakeholders to provide input on calculator development and pilot test the calculator. Eventually, pilot testing should expand to include external stakeholders that are the calculator's target users. This goal of this iterative process is to develop a calculator that incorporates the feedback of multiple user groups to ensure usability and applicability to key user needs. As of November 2025, the CDOT project team is developing a project scope for this work. The recommended process for development of a CDOT TDM calculator is broadly identified below.

Key Stakeholder Identification and Collaboration: Develop a TDM Calculator Working Group that will be the core TDM calculator testing team. This Working Group should receive regular updates and provide feedback about the TDM calculator development process. The Working Group can include both internal CDOT stakeholders and at least one MPO. Potential CDOT stakeholders include CDOT OIM, CDOT OIT, CDOT modeling team, CDOT CHG team, and others as needed to advance calculator development.

TDM Calculator Methodology Development: Determine categories of TDM measures to be analyzed. Several calculators identified in this report provide a comprehensive list of TDM measures that can serve as a starting point for this analysis. Next, the project team should develop VMT reduction assumptions, calculation methodology, and calculator outputs for VMT reduction based on specific TDM measures. This information should be formalized into a methodology document.

Identify Specifications and Core Functional Requirements for a Web-Based TDM Calculator: Clearly document the calculator's purpose, target users, and process flow for using the calculator. The project team should also outline the calculator's main features, including an interactive map to identify project location, data input fields, background calculations based on the proposed methodology, and display of results/outputs.

Develop a Web-Based TDM Calculator: The previously identified requirements should be translated into discrete calculator development tasks. The TDM Calculator Working Group should review all newly developed calculator functionality and provide feedback. Based on this feedback, the project team should then deploy new versions of the in-progress calculator for review, testing, and feedback at several points throughout development. The final step of calculator development should produce a calculator that is ready for testing with external stakeholders primarily representing local jurisdictions in Colorado's MPO areas. The project team will provide more details about external stakeholder testing and expansion of calculator capabilities to meet the needs of Colorado's rural and resort towns as calculator development progresses.

Altogether, this report's evaluation of existing TDM calculators and in-depth interviews with a broad range of stakeholders led to clear recommendations for development of a CDOT TDM calculator. These recommendations will help inform CDOT's decision-making and completion of a phased, stakeholder-informed process for developing a TDM calculator.

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Appendix A. TDM Calculator Evaluation/Scoring Spreadsheet (Attached Separately)

Appendix B. In-Depth Interview Questionnaire: Agencies with Existing TDM Calculators

The questionnaire below helped guide discussions with local agencies that have developed and implemented TDM calculators.

- What were your primary goals of developing a calculator?
- How did you decide on which methodology to use?
- What did it cost to develop the calculator and how long did it take?
- How much agency staff time was required for calculator development?
- How did you get users to utilize the calculator? And what has been their feedback about using the tool?
- Does your agency track the results of implemented projects using TDM strategies? If so, how do the real-world results compare to the projected results from the calculator? Are there certain scenarios or use cases where the projected results were more or less accurate?
- What lessons did your agency learn through the process of developing and implementing this calculator? What advice would you give to another agency developing their own calculator?
- What successes and/or outcomes came about as a result of calculator implementation?
- Are you maintaining the tool and/or planning on any updates?

Appendix C. In-Depth Interview Questionnaire: Colorado Stakeholders

The questionnaire below helped guide discussions with Colorado stakeholders that would potentially use a CDOT TDM calculator.

TDM Calculator Use Cases

- Are there any planning processes, grants, or other use cases where your agency/ organization could use a TDM calculator?
- Can you think of any other potential use cases?

Data Inputs, Outputs and Methodology

- Typically, what sort of project-level data inputs do you have available?
- How much transparency/methodology would you like to see for the VMT reduction estimates?
- To meet your needs, how frequently would you want the methodology/ assumptions to be updated?
- What type of VMT reduction results are most beneficial?

TDM Calculator Features

- Beyond VMT, what other TDM-related benefits would you want the calculator to estimate?
- Do you prefer a web-based tool or an offline Excel-based tool?
- Which format(s) of calculator instructions are the most useful?
- What TDM calculator features would you find useful?
- What are some high priority TDM strategies that you would want to include in the calculator?

Potential Project Benefits

- Overall, would you find a TDM calculator useful in your current work? How would you integrate it into your processes?
- Based on this information, would it benefit your work if CDOT developed a Colorado-specific TDM calculator?