California Air Resources Board

Quantification Methodology for Affordable Housing Programs

California Climate Investments

Note:
The California Air Resources Board (CARB) is accepting public comments on the Draft Affordable Housing Benefits Calculator Tool and the Draft Quantification Methodology for Affordable Housing Programs until September 18, 2026, via GGRFProgram@arb.ca.gov. The Draft Benefits Calculator Tool and Draft Quantification Methodology are subject to change pending public comment. The Final Affordable Housing Benefits Calculator Tool and Final Quantification Methodology for Affordable Housing Programs will be available on the California Climate Investments tools webpage.

DRAFT
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Section A. Introduction

California Climate Investments uses billions of Cap-and-Invest dollars to fund projects that reduce harmful emissions, protect public health, strengthen local economies, and support natural environments. With a strong focus on communities most impacted by pollution and limited access to resources, California Climate Investments helps build a more equitable and sustainable future—where all Californians can share in the benefits of climate action.

The California Air Resources Board (CARB) is responsible for providing guidance on estimating the GHG emissions reductions and co-benefits from projects receiving monies from the Greenhouse Gas Reduction Fund (GGRF). This guidance includes quantification methodologies, co-benefit assessment methodologies, and benefits calculator tools.

CARB developed the Affordable Housing Quantification Methodology to estimate the GHG emissions reductions and selected co-benefits of proposed affordable housing projects, and to track results of funded projects.

The Affordable Housing Benefits Calculator Tool automates methods described in this document. Projects receiving GGRF monies will use the Affordable Housing Benefits Calculator Tool to report the total project GHG emissions reductions and co-benefits and total project GHG emissions reductions per dollar of GGRF funds requested. The Affordable Housing Benefits Calculator Tool is available for download on the California Climate Investments tools webpage.

Using many of the same inputs required to estimate GHG emissions reductions, the Affordable Housing Benefits Calculator Tool estimates the following co-benefits from affordable housing projects:

- Diesel particulate matter (PM) emission reductions (lbs)
- NO_X emission reductions (lbs)
- $PM_{2.5}$ emission reductions (lbs)
- ROG emission reductions (lbs)
- Passenger auto vehicle miles traveled (VMT) reductions (miles)
- Fossil fuel use reductions (gallons)

All CARB co-benefit assessment methodologies are available on the California Climate Investments co-benefits webpage.

Methodology Development

CARB developed this Quantification Methodology consistent with the guiding principles of California Climate Investments, including ensuring transparency and accountability, per the California Climate Investments Funding Guidelines.

The implementing principles ensure that the methodology would:

- Apply at the project-level;
- Provide uniform methods to be applied statewide, and be accessible by all applicants;
- Use existing and proven tools and methods;
- Use project-level data, where available and appropriate; and
- Result in GHG emissions reductions estimates that are conservative and supported by empirical literature.

CARB funded a study to identify methods for estimating VMT and GHG emissions reductions for affordable housing projects. The study produced a new estimation approach, detailed in the final report *Assessing the Quantification Methodology for the Affordable Housing and Sustainable Communities Program* (Chatman et al., 2025), along with a database of metric-specific VMT variations at the block-group level. These tools were designed to provide accurate estimates using data that can be readily obtained for individual projects.

The Affordable Housing Benefits Quantification Methodology relies on emission factors that are obtained from the California Climate Investments Emission Factor Database. CARB staff have developed this database to increase transparency and continue to use the most up-to-date emission factors when estimating project benefits. The Database Documentation explains how emission factors used in CARB benefits calculator tools are developed and updated. This database is available on the California Climate Investments tools webpage.

In addition, CARB staff, in collaboration with the University of California, Berkeley, have developed assessment methodologies for the co-benefits listed above. CARB solicited public comment on their draft versions in Spring 2018 prior to posting the final methodologies. These co-benefit assessment methodologies are available on the California Climate Investments tools webpage.

Tools

The Affordable Housing Benefits Calculator Tool relies on project-specific outputs from the following tools:

- Census Geocoder: The Census Geocoder provides interactive and

programmatic access to users interested in matching addresses to geographic locations and entities containing those addresses. The Census Geocoder is used statewide, subject to regular updates to incorporate new information, free of charge, and publicly available to anyone with internet access. The Census Geocoder is used to identify the block group GEOID for projects estimating their project benefits through the Affordable Housing Benefits Calculator Tool. The Census Geocoder tool is available on the United States Census Bureau website. Instructions for obtaining and inputting the block group GEOID can be found in Affordable Housing Benefits Calculator Tool.

- Mapping platform: A mapping platform (such as Google Maps) must be used to measure the walking distance between the housing project and the nearest rail station. Common mapping platforms are used statewide, subject to regular updates to incorporate new information, free of charge, and publicly available to anyone with internet access.

Section B. Methods

The following section provides details on the methods supporting emissions reductions in the Affordable Housing Benefits Calculator Tool.

A. VMT Reductions from Affordable Housing Projects

This method accounts for the change in estimated vehicle miles traveled (VMT) expected from building an affordable housing project in a specific census block group relative to a regional average.

The variable VMT_{BG} represents the expected daily vehicle miles driven per person in a block group based on the built environment characteristics of that block group. The built environment characteristics used to predict vehicle miles driven include:

- Road congestion
- Street density
- Bus stop density
- Retail density
- Jobs accessibility by car
- Jobs accessibility by transit

VMT_{BG} pulls from a database of values developed as part of the CARB-sponsored study *Assessing the Quantification Methodology for the Affordable Housing and Sustainable Communities Program* (Chatman et al., 2025). The methodology used to derive the values in the database is described in the final report of the study. The database is available in the "VMT Estimates" tab of the Affordable Housing Quantification Benefits Calculator Tool.

Equation [1]: Project level VMT Reduction

Equation 1 applies a parking factor to VMT_{BG}. The percent reduction of parking applied depends on the ratio of parking supplied to dwelling units. Equation 1 also adds a VMT reduction if the project is within 0.25 miles of a rail station

$$VMT_{PC} = VMT_{BG} * PF + \begin{cases} VMT_{\mathrm{RA}}, & if\ project \text{ is within 0.25 miles of rail station} \\ 0, & otherwise \end{cases}$$

Table 1. Variables of Equation 1: Project level VMT

Variable	Variable Definition	Units
VMT_{PC}	Project-level VMT	Miles/capita/day
VMT_{BG}	Block group VMT	Miles/capita/day

PF	Parking factor based on parking spaces supplied per dwelling unit	Unitless
VMT_{RA}	VMT reduction of ~4 miles applied if project is within 0.25 miles walking path to a rail station	Miles/capita/day

Table 2. Parking factors

Parking rate	Parking Factor
No parking spaces	50%
0.5 spaces/unit	23%
More than 0.5 but less than 1 space per unit	10%
One or more spaces per unit	No parking-based VMT reductions

Parking factors were determined using findings from recent research on parking constraints and travel behavior (Currans et al., 2022; Millard-Ball et al., 2020).

Equation [2]: Project VMT change relative to the region

Equation 2 compares the project-level VMT from Equation 1 to a regional VMT. The regional VMT is calculated by averaging the VMT_{BG} of every block group in the defined region.

$$VMT_{CT} = VMT_{PC} - \frac{\sum_{i=1}^{n_b} VMT_{BGi}}{n_b}$$

Table 3. Variables for equation 2: Project VMT compared to a regional counterfactual

Variable	Variable Definition	Units
VMT_{CT}	Project VMT reductions compared to a regional counterfactual	Miles/capita/day
VMT_{PC}	Project-level VMT from equation 1	Miles/capita/day
BG	Block groups	NA
n_b	Number of block groups in a defined region	NA

Equation [3]: Annual VMT change for entire project

Equation 3 calculates the annual VMT reduction for the project by taking the per capita/day VMT reduction from Equation 2 and multiplying it by the number of occupants expected to live in the housing project and days of the year.

$$VMT_A = VMT_{CT} * EO * 365 \text{ days}$$

Table 4. Variables for equation 3: Annual VMT change for entire project

Variable	Variable Definition	Units
VMT_A	Total VMT change for entire project for one year	Miles
VMT_{CT}	Project VMT compared to regional average from equation 3	Miles/capita/day
EO	Total number of people expected to live in housing project	# of People

B. Total Emissions Reductions from Affordable Housing Projects

Finally, the VMT impact of the project's location and parking provision is multiplied by CARB emission factors to estimate the project's emissions reductions for GHG, $PM_{2.5}$, NO_X, ROG, and Diesel PM. These emission factors are obtained from the California Climate Investments Emission Factor database.

Equation [4]: Emissions Reductions

$$Emissions\ Reductions = (Annual\ VMT * EF_{yr1} + Annual\ VMT * EF_{yrF})/2 * QP * U^{-1}$$

Table 5. Variables for equation 4: Emissions Reductions

Variable	Variable Definition	Units
VMT_A	Total VMT reductions for entire project for one year	Miles
EF_{yr1}	County-specific auto vehicle emission factor for first year of project life	g/mile
EF_{yrF}	County-specific auto vehicle emission factor for final year of project life	g/mile
QP	Quantification Period	years
U	Unit conversion factor (1,000,000 for grams to metric tons; 453.59 for grams to pounds)	g/MT or g/lb

A 30-year quantification period was determined by the typical CEQA 20- or 30-year expectations for mitigation lifespan, which is based on the standard 30-year economic life of a project and is the standard horizon applied by air districts to amortize short-term construction emissions and to calculate total operational GHG emissions over the life of a project.

Section C. References

The following references were used in the development of the Affordable Housing Quantification Methodology and the Benefits Calculator Tool.

California Air Resources Board. (2024). *California Climate Investments Quantification Methodology Emission Factor Database*. https://www.caclimateinvestments.ca.gov/tools

Chatman, D. G., Rodynansky, S., Boarnet, M., Comandon, A., Snyder, B., Patel, K., & Atkins, J. (2025). *Assessing the quantification methodology for the Affordable Housing and Sustainable Communities Program*. Institute of Transportation Studies, University of California, Berkeley. https://escholarship.org/uc/item/99j4s0bp

Currans, K. M., Abou-Zeid, G., McCahill, C., Iroz-Elardo, N., Clifton, K. J., Handy, S., & Pineda, I. (2022). Households with constrained off-street parking drive fewer miles. *Transportation*, 1–26. https://doi.org/10.1007/s11116-022-10306-8

Millard-Ball, A., West, J., Rezaei, N., & Desai, G. (2020). *How the built environment affects car ownership and travel: Evidence from San Francisco housing lotteries*. University of California Institute of Transportation Studies. https://doi.org/10.7922/G2319T55