T-55. Infill Development

GHG Mitigation Potential

30%

Up to 30% of GHG emissions from project/site residential VMT

Co-Benefits (icon key on pg. 34)

Climate Resilience

Infill development increases density, which can put people closer to resources they may need to access during an extreme weather event. Infill development can also shorten commutes, decreasing the amount of time people are on the road and exposed to hazards, such as extreme heat or flooding. Screening and management of climate risks should still be considered, especially if infill occurs in a hazardous area, to preserve the benefits of density without introducing new risks.

Health and Equity Considerations

Living in compact areas with greater accessibility provides residents with health benefits, such as better access to health-promoting goods and services and more opportunities to be physically active.

Measure Description

This measure accounts for the VMT reduction achieved by infill housing development programs that allow residents to live closer to downtown areas where there is greater access to jobs and activities. Residents living at infill development projects typically do not need to travel as far to access essential destinations. This leads to lower VMT and associated GHG emissions compared to similar projects located farther from a downtown area. An example implementation of this measure is Sacramento Area Council of Government's Green Means Go program (SACOG 2021a, 2021b).

Subsector

Land Use

Locational Context

Urban, suburban

Scale of Application

Project/Site

Implementation Requirements

To ensure that the development would only proceed with implementation of this measure, the applicable projects would have to be commercial or industrial lots that are rezoned as high-density residential or mixed-use. GHG reductions from this measure cannot be credited unless the project site is currently a commercial or industrial lot that is being rezoned into either high-density residential or mixed-use.

Cost Considerations

Depending on the location, siting housing projects in infill locations can increase housing and development costs. However, the costs of providing public services, such as health care, education, policing, and transit, are generally lower in more dense areas where things are in closer proximity. Infrastructure for water and electricity also operates more efficiently when the service and transmission area is reduced. Local governments may provide approval streamlining benefits or financial incentives for infill residential projects.

Expanded Mitigation Options

Pair with Measure T-2, *Increase Job Density*, to promote further densification and yield increased co-benefits from a highly walkable and bikeable area, including VMT reductions, improved public health, and social equity.

GHG Reduction Formula

$$A = \frac{-B+C}{C} \times D$$

GHG Calculation Variables

ID	Parameter	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from project VMT in study area	0–30.0	%	calculated
User Inputs				
B	Distance to downtown for proposed project	[ ]	miles	user input
C	Distance to downtown of conventional development	[ ]	miles	user input
Constants, Assumptions, and Available Defaults				
D	Elasticity of VMT with respect to distance to downtown	-0.22	unitless	Ewing et al. 2010; Stevens 2016

Further explanation of key variables:

- (B) – For polycentric metros such as the San Francisco-Oakland-Berkeley metropolitan statistical area (MSA), the downtown area used to measure the distance needs to represent the closest of the relevant polycentric cities. For example, for a development in San Leandro, downtown Oakland would be the relevant downtown.
- (C) – This variable needs to be estimated for each region or metropolitan planning organization (MPO) where the measure will be applied because it differs greatly based on geographic context. Using geographic information system tools, this distance can be measured using the Census Centers of Population data for each block group to estimate the average distance to the appropriate downtown within a region weighted by population. For example, applying this technique to the San Francisco-Oakland-Berkeley MSA for the dual centroids of Oakland and San Francisco yields a population-weighted average distance of 21.6 kilometers, or 13.4 miles.
- (D) – An analysis of three studies in which disaggregate travel data were used found that a 0.22 percent decrease in VMT occurs for every 1 percent decrease in distance to downtown (Ewing et al. 2010).

GHG Calculation Caps or Maximums

Measure Maximum

(A_{max}) The percent reduction in GHG emissions (A) is capped at 30 percent. The purpose for the 30 percent cap is to limit the influence of any single built environmental factor (such as density). Projects that implement multiple land use strategies (e.g., density, design, diversity) will show more of a reduction than relying on improvements from a single built environment factor.

Subsector Maximum

$(\sum A_{max_{T\text{-}1\ through\ T\text{-}4,\ \ T\text{-}55}} \leq 65\%)$ This measure is in the Land Use subsector. This subcategory includes Measures T-1 through T-4 and T-55. The VMT reduction from the combined implementation of all measures within this subsector is capped at 65 percent. This measure could not be used in conjunction with Measures T-1, *Increase Residential Density*, or T-3, *Transit-Oriented Development*, due to correlation between distance to downtown and the other measures.

Example GHG Reduction Quantification

The user reduces VMT by rezoning areas near the downtown area to allow for a new mixed-use development. Areas that were undeveloped but already zoned as mixed-use can still achieve reductions, but such reductions can only be attributed to the developer and not to an MPO or city. This requirement ensures the benefits are not counted for projects that could have happened without the rezoning process. In this example, the projects would be located 5 miles from downtown (B) in a metro area where the population-weighted average distance to downtown is 25 miles (C). This would reduce GHG emissions from the project's VMT by 17.6 percent.

$$A = \frac{\textbf{-5 mi+25 mi}}{\textbf{25 mi}} \times \text{-}0.22 = \text{-}17.6\%$$

Quantified Co-Benefits

Successful implementation of this measure could achieve improved air quality, energy and fuel savings, VMT reductions, enhanced pedestrian or traffic safety, improved public health and enhanced energy security. This section defines the methods for quantifying improved air quality, energy and fuel savings, and VMT reductions.

Improved Air Quality

The percent reduction in GHG emissions (A) would be the same as the percent reduction in NO_X, CO, NO_2, SO_2, and PM. Reductions in ROG emissions can be calculated by multiplying the percent reduction in GHG emissions (A) by an adjustment factor of 87 percent. See *Adjusting VMT Reductions to Emission Reductions* for further discussion.

Energy and Fuel Savings

The percent reduction in vehicle fuel consumption achieved by the measure would be the same as the percent reduction in GHG emissions (A).

VMT Reductions

The percent reduction in VMT achieved by the measure would be the same as the percent reduction in GHG emissions (A).

Sources

- Ewing, R., and R. Cervero. 2010. Travel and the Built Environment: A Meta-Analysis. Journal of the American Planning Association 76(3):265–294. Available: https://doi.org/10.1080/01944361003766766. Accessed: December 2023.
- Sacramento Area Council of Governments (SACOG). 2021a. Greens Means Go Fact Sheet. Available: https://www.sacog.org/sites/main/files/file-attachments/gmg_fact_sheet_2021.pdf?1635458873. Accessed: August 2023.
- Sacramento Area Council of Governments (SACOG). 2021b. Criteria for Establishing Green Means Go "Green Zones". Available: https://www.sacog.org/sites/main/files/file-attachments/framework_for_establishing_green_zones_0.pdf?1650668241. Accessed: August 2023.
- 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: http://dx.doi.org/10.1080/01944363.2016.1240044. Accessed: September 2023.