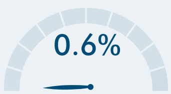
# T-27. Implement Transit-Supportive Roadway Treatments


## GHG Mitigation Potential




Up to 0.6% of GHG emissions from vehicle travel in the plan/community

## Co-Benefits (icon key on pg. 34)

## Climate Resilience

Implementing transit-supportive roadway treatments improves the reliability of the transportation network and allows redundancy to exist even if an extreme event disrupts part of the system. It could also incentivize more people to use transit, resulting in less traffic and better allowing emergency responders to access a hazard site during an extreme weather event. Furthermore, emergency responders can use queue jumps and dedicated bus lanes when needed.

## Health and Equity Considerations

Transit facilities can have conflicts with cyclists. Consider appropriate treatments to minimize conflicts. Improved transit investments should be equitably distributed prioritizing areas with transit deficiencies in underserved communities.

## Measure Description

This measure will implement transit-supportive treatments on the transit routes serving the plan/community. Transit-supportive treatments incorporate a mix of roadway infrastructure improvements and/or traffic signal modifications to improve transit travel times and reliability. This results in a mode shift from single occupancy vehicles to transit, which reduces VMT and the associated GHG emissions.

## Subsector

Transit

## Locational Context

Urban, suburban

## Scale of Application

Plan/Community

## Implementation Requirements

Treatments can include transit signal priority, bus-only signal phases, queue jumps, curb extensions to speed passenger loading, and dedicated bus lanes.

## Cost Considerations

Costs and savings of transit-supportive roadway treatments vary depending on the strategy pursued, ranging from low-cost route optimization changes to high-cost infrastructure projects (e.g., bus-only lanes). Reducing route cycle time without significantly increasing the number of transit vehicles can result in net cost savings for the transit system. Dedicated transit infrastructure will improve transit reliability and increase ridership. This supplements existing transit income streams for municipalities. Increased ridership similarly reduces vehicle use, which has cost benefits for both commuters and municipalities.

## Expanded Mitigation Options

This measure could be paired with other Transit subsector strategies (Measure T-25 and Measure T-29) for increased reductions.

## GHG Reduction Formula

$$A = -1 \times \frac{B \times C \times D \times E \times G}{F}$$

## GHG Calculation Variables

| ID | Variable | Value | Unit | Source |
|---|---|---|---|---|
| **Output** | | | | |
| A | Percent reduction in GHG emissions from vehicle travel in plan/community | 0–0.6 | % | calculated |
| **User Inputs** | | | | |
| B | Percent of plan/community transit routes that receive treatments | 0–100 | % | user input |
| **Constants, Assumptions, and Available Defaults** | | | | |
| C | Percent change in transit travel time due to treatments | -10 | % | TRB 2007 |
| D | Elasticity of transit ridership with respect to transit travel time | -0.4 | unitless | TRB 2007 |
| E | Transit mode share in plan/community | Table T-3.1 | % | FHWA 2017a |
| F | Vehicle mode share in plan/community | Table T-3.1 | % | FHWA 2017a |
| G | Statewide mode shift factor | 57.8 | % | FHWA 2017b |

Further explanation of key variables:

- (C) – A literature review of studies from the U.S. and United Kingdom indicates that the travel time savings associated with one type of transit-supportive roadway treatment—transit signal prioritization—typically ranged from 8 to 12 percent (TRB 2007). To account for the likelihood that a user would implement multiple transit-supportive treatments, the midpoint of this range is used for the measure formula. Use of the midpoint is still conservative given the additional travel time savings associated with other transit-supportive treatments. If the user can provide a project-specific value based on the suite of their treatments, then the user should replace this default in the GHG reduction formula.
- (E and F) – Ideally, the user will calculate transit and auto mode shares for a plan/community at the city scale (or larger). Potential data sources include the California Household Travel Survey (preferred) or local survey efforts. If the user is not able to provide a project-specific value using one of these data sources, they have the option to input the mode shares for transit and vehicles for one of the six most populated CBSAs in California, as presented in Table T-3.1 in Appendix C. It is likely for areas outside of the area covered by the listed CBSAs to have vehicle mode shares higher and transit mode shares lower than the values provided in the table.

- (G) – Mode shift factor is an adjustment to reflect the reduction in vehicle trips associated with a reduction in person trips as some vehicles carry more than one person. It is calculated as (1/average vehicle occupancy) (FHWA 2017b).

## GHG Calculation Caps or Maximums

*Measure Maximum*

($A_{max}$) For projects that use default CBSA data from Table T-3.1 and ($C_{max}$), the maximum percent reduction in GHG emissions (A) is 0.6 percent. This maximum scenario is presented in the below example quantification.

($C_{max}$) The percent reduction in transit travel time is capped at 20 percent, which is based on the values reported in a literature review of studies from the U.S. and United Kingdom (TRB 2007).

*Subsector Maximum*

($\sum A_{max_{T\text{-}25 \text{ through } T\text{-}29}} \leq 15\%$) This measure is in the Transit subsector. This subcategory includes Measures T-25 through T-29. The VMT reduction from the combined implementation of all measures within this subsector is capped at 15 percent.

*Mutually Exclusive Measures*

If the user selects Measure T-28, *Provide Bus Rapid Transit*, and converts all transit routes in the plan/community to BRT, then the user cannot also take credit for this measure or Measure T-26, *Increase Transit Service Frequency*. This is because Measure T-28 accounts for the VMT reduction associated with increased transit frequency and decreased transit travel time as well as the additional BRT-specific bonus. To combine the GHG reductions from Measure T-28 with Measure T-27 and/or Measure T-26 would be considered double counting. However, where BRT is proposed on less than all of the existing bus routes in the plan/community area, this measure and/or Measure T-26 could be applied to the remaining bus routes, and the measure reductions could be combined with Measure T-28 to determine the emissions reduction at the larger plan/community scale.

## Example GHG Reduction Quantification

The user reduces plan/community GHGs by implementing transit-supportive roadway treatments that decrease transit travel time, thereby encouraging a mode shift from vehicles to transit and reducing VMT. In this example, the project is in San Francisco-Oakland-Hayward CBSA where the transit and vehicle mode shares would be 11.38 percent and 86.96 percent, respectively (E and G). Assuming the maximum decrease in transit travel time of 20 percent ($C_{max}$) and implementation for all transit routes (100 percent) in the plan/community (B), the user would reduce plan/community GHG emissions from VMT by 0.6 percent.

$$A = -1 \times \frac{100\% \times -20\% \times -0.4 \times 11.38\% \times 57.8\%}{86.96\%} = -0.6\%$$

## Quantified Co-Benefits

*Improved Local 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* above for further discussion.

*Energy and Fuel Savings*

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

*VMT Reductions*

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

### Sources


- Federal Highway Administration (FHWA). 2017a. *National Household Travel Survey–2017 Table Designer*. Travel Day PMT by TRPTRANS by HH_CBSA. Available: https://nhts.ornl.gov/. Accessed: January 2021.
- Federal Highway Administration (FHWA). 2017b. *National Household Travel Survey–2017 Table Designer*. Average Vehicle Occupancy by HHSTFIPS. Available: https://nhts.ornl.gov/. Accessed: January 2021.
- Transportation Research Board (TRB). 2007. *Transit Cooperative Research Program Report 118: Bus Rapid Transit Practitioner's Guide*. Available: https://nacto.org/docs/usdg/tcrp118brt_practitioners_kittleson.pdf. Accessed: January 2021.