

California Air Resources Board

Greenhouse Gas Quantification Methodology for the California State Transportation Agency Transit and Intercity Rail Capital Program

Greenhouse Gas Reduction Fund FY 2016-17



Note:

ARB is accepting public comments on the draft FY 2016-17 quantification methodology through **January 26, 2016** via GGRFProgram@arb.ca.gov. This quantification methodology is subject to change pending final 2016 TIRCP Guidelines. It is anticipated that the final guidelines and quantification methodology will be released on February 4, 2016.

ARB may develop a calculator tool for applicants to quantify the proposed project greenhouse gas emission reductions in accordance with this Quantification Methodology.

DRAFT
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Section A. Introduction

The California Air Resources Board (ARB) is responsible for providing the quantification methodology to estimate greenhouse gas (GHG) emission reductions from projects receiving monies from the Greenhouse Gas Reduction Fund (GGRF). For the California State Transportation Agency's (CalSTA) Transit and Intercity Rail Capital Program (TIRCP), ARB staff developed this GHG emission reduction quantification methodology to be used by grant applicants to estimate proposed project GHG emission reductions for the 2016 TIRCP Guidelines. ARB staff will periodically review each quantification methodology to evaluate its effectiveness and update methodologies to make them more robust, user-friendly, and appropriate to the projects being quantified.

This methodology uses calculations to estimate the reduction in vehicle miles traveled (VMT) and associated reduction in GHG emissions based on specific transportation characteristics of the proposed TIRCP projects. These calculations are based on the "Methods to Find the Cost-Effectiveness of Funding Air Quality Projects for Evaluating Motor Vehicle Registration Fee Projects and Congestion Mitigation and Air Quality Improvement Projects" (CMAQ Methods) and ARB-developed GHG emission factors.

Methodology Development

ARB staff followed a set of principles to guide the development of the quantification methodology. These principles ensure that the methodology for TIRCP projects will:

- Apply at the project-level;
- Align with the project types proposed for funding;
- Provide uniform methodologies that can be applied statewide, and be accessible by all applicants;
- Support the analysis of GHG emission reductions from the proposed projects;
- Use existing and proven methods; and
- Use project-level data when available and verified by CalSTA for estimated ridership increases and corresponding VMT reductions.

The methodology fits these objectives, and provides a uniform approach to quantify GHG emission reductions in metric tons of carbon dioxide equivalent (MTCO_{2e}).

Tools

The CMAQ Methods are a set of equations for evaluating the cost-effectiveness of certain types of transportation projects. The CMAQ Methods were developed by ARB and Caltrans and are used statewide by transportation agencies to evaluate criteria pollutant emission reductions from transportation projects competing for State motor vehicle fee and federal CMAQ funding.

GHG emission reductions used in this methodology are calculated based on well-to-wheels (WTW) emission factors, fuel energy density values, and fuel economy values. Emission factors were developed through ARB's Low Carbon Fuel Standard (LCFS) Program, fuel energy density values were developed through the California-modified Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (CA-GREET 2.0), and fuel economy values were developed from ARB's Mobile Source Emission Factor Model (EMFAC 2014). The WTW method accounts for the emissions produced from the production and distribution of the different fuel types, including hydrogen and electricity, as well as any associated exhaust emissions. The description of the derivation of the emission factors is included in Appendix A - F.

Updates

ARB updated the quantification methodology for FY 2014-15 to enhance the analysis and provide additional clarity. The major changes include:

- Emission factors now include upstream GHG emission sources. This WTW approach quantifies the emissions resulting from the production and distribution of the different fuel types, including hydrogen and electricity, and any associated exhaust emissions. This approach is consistent with other GGRF programs and ARB's Low Carbon Fuel Standard (LCFS) Program.
- Lookup tables for the emission factors based on EMFAC 2014 and a WTW approach with a description of the derivation of the emission factors.
- Methods to calculate reductions from ferry transit, shuttle and vanpool services as well as displaced fuel resulting from reduced VMT and idling.
- Information from the approved ARB Funding Guidelines for Agencies Administering California Climate Investments (Funding Guidelines) on reporting after a project is selected for funding (see Section D for details).
- Additional definitions and clarity to the text based on lessons learned.

TIRCP Project Types

TIRCP will fund capital improvements that will modernize California’s intercity, commuter, and urban rail (train) systems, bus, ferry, shuttle bus and vanpool transit systems to reduce GHG emissions; improve/expand transit service and increase ridership; integrate existing bus and rail operations with each other and with high-speed rail; and improve safety.

For GHG quantification purposes, eligible TIRCP projects fall into the four project types described in Table 1 below. Some projects may include more than one project component, such as those that provide operational improvements that reduce travel time (generating ridership gains) and also deploy new, lower-emitting vehicles that replace current vehicles.

Table 1: Description of TIRCP Project Types

Project Types	Description
New/Expanded Service	Expansion of transit (e.g., rail (train), bus, ferry, shuttle and vanpool) service through new service or additional routes.
System and Efficiency Improvements that Result in Increased Ridership	Any system or efficiency improvements that result in increased ridership for existing routes, including projects that increase service levels, reliability, or decrease travel times.
Cleaner Vehicles/Technology/Fuels	Use of cleaner vehicles, technologies, or fuels that result in GHG emission reductions.
Displaced Fuel	Any system or efficiency improvements that result in displaced fuel from existing transit services, including projects that reduce transit VMT and idling.

GHG Emission Reductions Quantification Approach

The metric used to assess the effectiveness of the project to reduce GHG emissions per dollar of GGRF funds will be reported by the applicant as:

$$\frac{\text{Total Project GHG Reductions in Metric Tons of CO}_2\text{e}}{\text{Total GGRF Funds Requested (\$)}}$$

GGRF Funds Requested is the dollar amount requested through TIRCP and total GGRF funds requested from any other GGRF programs to which the applicant has or may apply. Section B describes the process for estimating the GHG emission reductions for proposed TIRCP projects in FY 2016-17. Additional documentation and reporting requirements are provided in sections C and D.

Requirements for program implementation and reporting are subject to change, based on future revisions that apply to the program (e.g., legislation, updates to ARB's Funding Guidelines, etc.). Implementing agencies/grantees should note that additional reporting may be required for some types of projects, or be modified based on the evolving needs of the program. For example, the requirements and methods of data collection are still under development for "Phase 2" reporting and will be published at a later date.

Technical Assistance

ARB staff will review the quantification portions of the TIRCP project applications to ensure that the methods described in this document were properly applied to estimate the GHG emission reductions for the proposed project. Applicants should use the following resources for additional questions and comments:

- Questions on this quantification document should be sent to GGRFProgram@arb.ca.gov.
- For more information on ARB's efforts to support implementation of GGRF investments, see: www.arb.ca.gov/auctionproceeds.
- Questions not related to this quantification document but pertaining to the TIRCP should be sent to TIRCPcomments@dot.ca.gov.

Section B. Quantification Methodology

This methodology estimates the GHG emission reductions of a proposed TIRCP project based on estimated ridership increases and corresponding passenger vehicle VMT reductions, as well as the use of cleaner vehicles or displaced fuel. Applicants must use this quantification methodology to estimate the total GHG emission reductions from the proposed project as defined in this methodology.

The following is a summary of the steps TIRCP applicants will follow to estimate and report the GHG emission reductions for a proposed project. Detailed instructions for each step are provided on subsequent pages. An example project showing how to use this quantification methodology is included in Appendix G.

Step 1. Determine the Project Type(s) and Method(s) needed for the proposed project (Table 2)



Step 2. Calculate Annual GHG reductions for Year 1 and Year F by project type



Step 3. Calculate the Total GHG Emission Reductions by project type



Step 4. Calculate the Total Project GHG Emission Reductions

Note: Steps 2 and 3 will need to be repeated for projects with multiple project types.

Step 1: Determine the Project Type(s) and Method(s) needed for the Project

Applicants should select the appropriate Methods according to the proposed project type(s) included in their project from Table 2. Applicants may have more than one project type and can use multiple methods to quantify the GHG emission reductions from the different components.

Table 2: TIRCP Methods

Project Type and Method	Method Section Reference
New/Expanded Service	
<i>GHG Emission Reductions = GHG Emissions of Displaced Autos – GHG Emissions of New/Expanded Service Vehicle</i>	Step 2.A
System and Efficiency Improvements that Result in Increased Ridership	
<i>GHG Emission Reductions = GHG Emissions of Displaced Autos</i>	Step 2.B
Cleaner Vehicles/Technology/Fuels	
<i>GHG Emission Reductions = GHG Emissions of Old Service Vehicle – GHG Emissions of New Service Vehicle</i>	Step 2.C
Displaced Fuel	
<i>GHG Emission Reductions = GHG Emissions of Displaced Fuel</i>	Step 2.D

Step 2: Calculate Annual GHG Reductions for Year 1 and Year F

Methods for estimating the GHG emission reductions by project type are provided in the subsections below. Applicants must determine the Year 1 and Year F by project type and apply each applicable method for Year 1 and Year F. Year 1 refers to the first operational year of the project type and Year F refers to the final year, calculated as “Year 1 + Useful Life.” Useful life is the number of years the project is expected to provide net GHG benefits. For new service projects, the useful life is the number of years the service is funded under the proposed project.¹

A. New/Expanded Service

GHG Emission Reductions from New/Expanded Service are calculated as:

$$\begin{aligned} \text{GHG Emission Reductions} = \\ \text{GHG Emissions of Displaced Autos} \\ - \text{GHG Emissions of New/Expanded Service Vehicle} \end{aligned}$$

GHG Emissions of Displaced Autos

The first step in quantifying the GHG emissions of displaced autos is estimating the annual auto VMT reduced in miles per year from the proposed project. An applicant may use existing project-level methods² if verified by CalSTA to estimate annual VMT reductions. Alternatively, the applicant may use the CMAQ Method provided here to estimate the auto VMT reductions from the proposed project. Documented project specific data for the input variables, such as system average trip length for the applicable transit mode reported to the National Transit Database (NTD) or developed from a recent, statistically valid survey, should be used where available.

The applicant must provide detailed supporting documentation for the variables used. ARB has developed recommended default values³ for certain service types that may be used if project specific data does not exist. Caltrans has developed recommended values for applicants to use for the length of the average auto trip reduced, by agency or statewide, by mode using 2013 NTD data included in Appendix H. The GHG Emissions of Displaced Autos is quantified using the equation below, which should be applied for Year 1 and Year F.

$$\begin{aligned} \text{AutoVMT} &= \text{Annual Auto VMT Reduced in miles per year} \\ &= [(D) * (R) * (A)] * [(L) - (AA) * (LL)] \end{aligned}$$

¹ Funding may include GGRF and other enforceable committed funds.

² Applicant specified methods are subject to CalSTA verification. The applicant must provide supporting documentation demonstrating how the annual auto VMT reduction values were derived.

³ “Methods to Find the Cost-Effectiveness of Funding Air Quality Projects for Evaluating Motor Vehicle Registration Fee Projects and Congestion Mitigation and Air Quality Improvement Projects”

Where:

Factor	Description	Default Values			
		Train or Ferry ⁴	Bus	Shuttle	Vanpool
D	Days of operation per year of new service	User-defined	260 (weekday service) 365 (daily service)	260 (weekday service) 365 (daily service)	260 (weekday service) 365 (daily service)
R	Daily unlinked trip ridership of new service	Average daily ridership expected based on project data. For example, one bus rider commuting round trip per day is two bus trips per day. Ridership should be calculated as average ridership per day of service, so that D*R is equal to annual ridership expected from the project.			
A	Adjustment factor to account for transit dependency	User-defined	0.5 (local bus) 0.83 (long distance commuter)	0.83	0.83
L	Length (miles) of average auto trip reduced	Lookup by agency by mode from Table H-1. If no data exist by agency, use statewide average by mode from Table H-2.			
AA	Adjustment factor to account for auto trips used to access new service	User-defined	0.1 (local bus) 0.8 (long distance commuter)	0.75	0.75
LL	Length (miles) of average trip for auto access to transit	User-defined	2 (local bus) 5 (long distance commuter)	5	5

$$GHG \text{ Emissions of Displaced Autos} = \frac{[(AutoVMT) * (AVEF)]}{1,000,000}$$

Where:

AVEF = Auto Vehicle Emission Factor (in gCO₂e per mile)*

* See Appendix A.

⁴ Default values for new Train or Ferry services are not available due to high variability. Applicants must provide these values and document how the values were derived.

GHG Emissions of New/Expanded Service Vehicle

Applicants should use the appropriate equation for the New/Expanded Service, below. The equation must be used twice, once for Year 1 and once for Year F.

$$\text{Train} = \frac{[(\text{TrainF}) * (\text{TEF})]}{1,000,000} \text{ or } \frac{[(\text{TVMT}) * (\text{TDEF})]}{1,000,000}$$

$$\text{Bus} = \frac{[(\text{BVMT}) * (\text{BEF})]}{1,000,000}$$

$$\text{Ferry} = \frac{[(\text{FerryF}) * (\text{FEF})]}{1,000,000}$$

$$\text{Shuttle or Vanpool} = \frac{[(\text{SVMT}) * (\text{SVEF})]}{1,000,000}$$

Where:

- TrainF** = Annual units of fuel estimated for train service based on project data
- TEF** = Train Emission Factor (in gCO₂e per unit of fuel) from Table B-1
- TVMT** = Annual VMT of the train service based on project data
- TDEF** = Train Default Emission Factor (in gCO₂e per mile) from Table B-1
- BVMT** = Annual VMT of the bus in service based on project data
- BEF** = Bus Emission Factor (in gCO₂e per mile)*
- FerryF** = Annual units of fuel estimated for ferry service based on project data
- FEF** = Ferry Emission Factor (in gCO₂e per unit of fuel) from Table E-1
- SVVMT** = Annual VMT of the shuttle or vanpool in service based on project data
- SVEF** = Shuttle or Vanpool Emission Factor (in gCO₂e per mile)*

*See Appendix C for buses and Appendix D for shuttle and vanpools.

B. System and Efficiency Improvements that Result in Increased Ridership

GHG Emission Reductions = GHG Emissions of Displaced Autos

GHG Emissions of Displaced Autos

The first step in quantifying the GHG emissions of displaced autos is determining the annual auto VMT reduced in miles per year that occur from the proposed project. An applicant may use existing project-level methods⁵ if verified by CalSTA to estimate annual VMT reductions. Alternatively, the applicant may use the CMAQ Method provided here to estimate the auto VMT reductions from the proposed project. Documented project specific data for the input variables, such as system average trip length for the applicable transit mode reported to NTD or developed from a recent, statistically valid survey, should be used where available.

The applicant must provide detailed supporting documentation for variables used. ARB has developed recommended default values⁶ for certain service types that may be used if project specific data does not exist. Caltrans has developed recommended values for applicants to use for the length of the average auto trip reduced, by agency or statewide, by mode using 2013 NTD data included in Appendix H. The GHG Emissions of Displaced Autos is quantified using the equation below, which should be applied for Year 1 and Year F.

$$\begin{aligned} \mathbf{AutoVMT} &= \text{Annual Auto VMT Reduced in miles per year} \\ &= [(D) * (R) * (A)] * [(L) - (AA) * (LL)] \end{aligned}$$

⁵ Applicant specified methods are subject to CalSTA verification. The applicant must provide supporting documentation demonstrating how the annual auto VMT reduction values were derived.

⁶ “Methods to Find the Cost-Effectiveness of Funding Air Quality Projects for Evaluating Motor Vehicle Registration Fee Projects and Congestion Mitigation and Air Quality Improvement Projects”

Where:

Factor	Description	Default Values			
		Train or Ferry ⁷	Bus	Shuttle	Vanpool
D	Days of operation per year	User-defined	260 (weekday service) 365 (daily service)	260 (weekday service) 365 (daily service)	260 (weekday service) 365 (daily service)
R	Daily unlinked trip ridership	Average increase in daily ridership expected based on project data.			
A	Adjustment factor to account for transit dependency	User-defined	0.5 (local bus) 0.83 (long distance commuter)	0.83	0.83
L	Length (miles) of average auto trip reduced	Lookup by agency by mode from Table H-1. If no data exist by agency, use statewide average by mode from Table H-2.			
AA	Adjustment factor to account for auto trips used to access new service	User-defined	0.1 (local bus) 0.8 (long distance commuter)	0.75	0.75
LL	Length (miles) of average trip for auto access to transit	User-defined	2 (local bus) 5 (long distance commuter)	5	5

$$GHG \text{ Emissions of Displaced Autos} = \frac{[(AutoVMT) * (AVEF)]}{1,000,000}$$

Where:

AVEF = Auto Vehicle Emission Factor (in gCO₂e per mile)*

* See Appendix A.

⁷ Default values for Train or Ferry services are not available due to high variability. Applicants must provide these values and document how the values were derived.

C. Cleaner Vehicles/Technology/Fuels

GHG Emission Reductions =

GHG Emissions of Old Service Vehicle – GHG Emissions of New Service Vehicle

GHG Emissions of Old or New Service Vehicle

Applicants should use the appropriate equation for both the Old and New Service, below. The equation must be used twice, once for Year 1 and once for Year F.

$$\text{Train} = \frac{[(\text{TrainF}) * (\text{TEF}_{\text{new}})]}{1,000,000} \text{ or } \frac{[(\text{TVMT}) * (\text{TDEF})]}{1,000,000}$$

$$\text{Bus} = \frac{[(\text{BVMT}) * (\text{BEF})]}{1,000,000}$$

$$\text{Ferry} = \frac{[(\text{FerryF}) * (\text{FEF})]}{1,000,000}$$

$$\text{Shuttle or Vanpool} = \frac{[(\text{SVMT}) * (\text{SVEF})]}{1,000,000}$$

Where:

- TrainF** = Annual units of fuel estimated for train service based on project data
- TEF_{new}** = New Train Emission Factor (in gCO₂e per unit of fuel) from Table B-1
- TVMT** = Annual VMT of the train service based on project data
- TDEF** = Train Default Emission Factor (in gCO₂e per mile) from Table B-1
- BVMT** = Annual VMT of the bus in service based on project data
- BEF** = Bus Emission Factor (in gCO₂e per mile)*
- FerryF** = Annual units of fuel estimated for ferry service based on project data
- FEF** = Ferry Emission Factor (in gCO₂e per unit of fuel) from Table E-1
- SVVMT** = Annual VMT of the shuttle or vanpool in service based on project data
- SVEF** = Shuttle or Vanpool Emission Factor (in gCO₂e per mile)*

* See Appendix C for buses and Appendix D for shuttle and vanpools.

D. Displaced Fuel

*GHG Emission Reductions = GHG Emissions of Displaced Fuel*⁸

GHG Emissions of Displaced Fuel

The applicant must provide supporting documentation demonstrating how the annual fuel values were derived. The equation must be used twice, once for Year 1 and once for Year F.

$$\text{GHG of Displaced Fuel} = \frac{[(\text{Fuel}) * (\text{FuelEF})]}{1,000,000}$$

Where:

Fuel = Annual units of fuel displaced based on project data

Fuel EF = Fuel-Specific Carbon Content (in gCO₂e per unit of fuel) from Table F-1

⁸ The applicant must provide supporting documentation demonstrating how the annual fuel amounts were derived.

Step 3: Calculate the Project Type Total Emission Reductions

For each project type and method, the applicant must calculate the Total Emission Reductions over the Useful Life (UL):

$$\text{Project Type Total Emission Reductions} = \left(\frac{\text{Yr1 GHG Emission Reductions} + \text{YrF GHG Emission Reductions}}{2} \right) * UL$$

Where:

- UL** = The number of years the project is expected to provided net GHG benefits. For new service projects, the useful life is the number of years the service is funded under the proposed project.⁹
Use: 10 years for advance technologies (i.e., electric, hydrogen fuel cell buses); for others, use Federal Transit Administration guidance available here www.fta.dot.gov/documents/C_5010_1D_Finalpub.pdf.

⁹ Funding may include GGRF and other enforceable committed funds.

Step 4: Calculate the Total Project GHG Emission Reductions

If the project consists of more than one project type, applicants must sum the GHG reductions by project type to obtain the Total Project GHG Emission Reductions:

Total Project GHG Emission Reductions

*= Project Type GHG Reductions (from New or Expanded Service)
or Project Type GHG Reductions (from System and Efficiency Improvements)
+ Project Type GHG Reductions (from Cleaner Vehicles/Technology/Fuels)
+ Project Type GHG Reductions (from Displaced Fuel)*

Section C. Documentation

Applicants must report the Net GHG Benefits and provide documentation of the calculations and inputs used. The Net GHG Benefits are equal to the Total Project GHG Emission Reductions estimated in Step 4.

Applicants are required to provide electronic documentation that is complete and sufficient to allow the calculations to be reviewed and replicated. Paper copies of supporting materials must be available upon request by CalSTA or ARB staff.

Documentation must include, at a minimum:

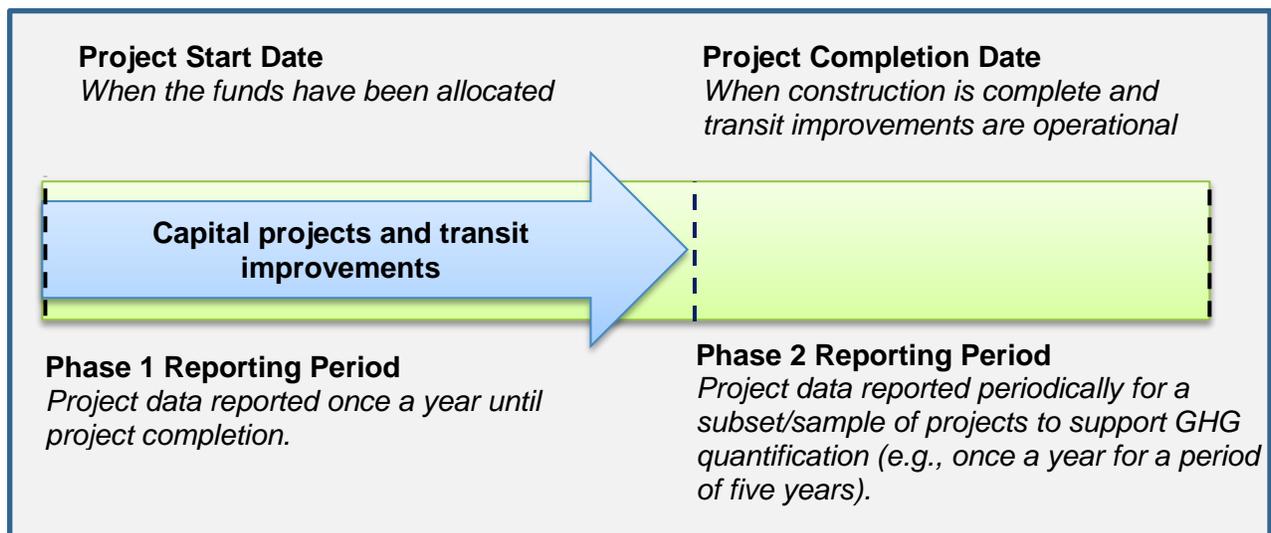
- Contact information for the person who can answer project specific questions from staff reviewers on the quantification calculations;
- Project description, including excerpts or specific references to the location in the main TIRCP application of the project information necessary to complete the applicable portions of the quantification methodology; and
- Project data support, including:
 - Documentation of the project data used to estimate ridership, project VMT, adjustment factors (A, L, AA, LL), vehicle data (useful life, fuel type, model year, etc.) and fuel savings;
 - References to public documents that are the source of the project data.
- Summary page with, at minimum, the following information:
 - The Project Types from Table 1 that are applicable;
 - GHG emission reductions for Yr 1, Yr F, and Total Net GHG Benefits;
 - GGRF funds requested for the project from TIRCP;
 - GGRF funds requested for the project from all GGRF-funded programs;
 - Total Net GHG Benefits per TIRCP GGRF funds requested;
 - Total Net GHG Benefits per Total GGRF funds requested.

Section D. Reporting after Funding Award

Accountability and transparency are essential elements for all projects funded by the GGRF. Each administering agency is required to track and report on the benefits of the California Climate Investments funded under their program(s) and each funding recipient has the obligation to provide the necessary data or access to data for their project to support reporting on project outcomes.

In 2015, ARB developed Funding Guidelines for Agencies Administering California Climate Investments (Funding Guidelines)¹⁰ using GGRF monies. These Funding Guidelines describe the reporting requirements and set the minimum project-level reporting requirements for projects funded. Volume III of the Funding Guidelines summarizes the major reporting components that CalSTA must report to ARB. Because much of this data comes directly from TIRCP projects, TIRCP funding recipients will need to provide project data to CalSTA to support these reporting requirements.

Table 3 and the figure below show the project phases and when reporting is required.



¹⁰ California Air Resources Board. Funding Guidelines for Agencies Administering California Climate Investments. December 21, 2015. <http://www.arb.ca.gov/cc/capandtrade/auctionproceeds/arb-funding-guidelines-for-ca-climate-investments.pdf>

Table 3: Quantification and Reporting By Project Phase

	Timeframe	Quantification Methodology Section
Project Selection	Covers the period from solicitation to selection of projects and funding awards.	All applicants use methods in this QM to estimate GHG reductions based on application data.
Phase 1	Covers the period from the beginning of the project until it becomes operational or the initial implementation is completed.	Funded projects use methods in this QM, as needed, to update GHG estimates based on project changes.
Phase 2	Starts after Phase 1 is complete and a project becomes operational.	GHG reductions achieved are quantified and reported for a subset of funded projects.

Phase 1 reporting is required for all TIRCP funding recipients during project implementation (e.g., initial construction). This quantification methodology provides guidance on how to estimate project benefits to satisfy Phase 1 reporting requirements. At a minimum, ARB expects that TIRCP funding recipients will report to CalSTA once a year during project construction (for projects with a capital component) or during implementation (for transit without a capital component) and once at the end of the project.

Phase 2 reporting is required for only a subset of TIRCP projects and is intended to document actual project benefits achieved after the project becomes operational. Phase 2 data collection and reporting will not be required for every project. CalSTA will be responsible for identifying the subset of individual projects that must complete Phase 2 reporting, identifying who will be responsible for collecting Phase 2 data, and for reporting the required information to ARB. ARB will work with CalSTA to address “Phase 2” procedures, including but not limited to:

- The timelines for Phase 2 reporting, i.e., when does Phase 2 reporting begin, how long will Phase 2 reporting be needed.
- As applicable, approaches for determining the subset of projects that need Phase 2 reporting (i.e., how many X projects out of Y total projects are required to have Phase 2 reporting).
- Methods for monitoring or measuring the necessary data to quantify and document achieved GHG reductions and other select project benefits.
- Data to be collected, including data field needed to support quantification of GHG emission benefits.
- Reporting requirements for transmitting the data to ARB or CalSTA for program transparency and use in reports.

Once the Phase 2 quantification method and data needs are determined, ARB will develop and post the final ARB approved Phase 2 methodology for use in Phase 2 reporting.

Appendix A. Auto Vehicle Emission Factor Lookup Tables

Look up the county and year (Yr1 and YrF) to find the appropriate emission factors. Auto Vehicle Emission Factor Lookup Tables can be downloaded at: http://www.arb.ca.gov/cc/capandtrade/auctionproceeds/ef_avef_final.pdf

For example, if a proposed project in Sacramento County will start in 2018 and has a project life of 20 years, the appropriate emission factors would be:

Yr 1 (2018): 505 g CO₂e/mi and

Yr F (2018+20 = 2038): 313 g CO₂e/mi.

Auto Vehicle Emission Factors

Passenger (auto) vehicle emission factors (**AVEF**) were derived using the following steps:

1. Emissions by county for each calendar year from 2016 through 2050 were downloaded from EMFAC 2014 with the following parameters:
 - a. Annual average
 - b. EMFAC2011 vehicle categories LDA, LDT1, LDT2, and MDV
 - c. Aggregated model year
 - d. Aggregated speed
 - e. Gasoline fuel
2. The auto fuel consumption rate (**AFCR**, in gallons of gasoline per mile) was calculated using the total gallons of gasoline used by each vehicle category divided by the total mileage by vehicle category by county and year, using the following equation:

$$AFCR = \frac{(Fuel_Consumption_{LDA} + Fuel_Consumption_{LDT1} + Fuel_Consumption_{LDT2} + Fuel_Consumption_{MDV}) * 1,000}{VMT_{LDA} + VMT_{LDT1} + VMT_{LDT2} + VMT_{MDV}}$$

Where:

Fuel_Consumption: the total fuel consumption for the vehicle type, in 1,000 gallons per day, from EMFAC 2014, and

VMT: is the total vehicle miles traveled for the vehicle type, in miles per day, from EMFAC 2014.

3. The auto vehicle emission factors (**AVEF**, in grams of CO₂e per mile) were calculated for each year and county by multiplying the auto fuel consumption rate by the WTW carbon content factor for gasoline, which is 11,460.09 g CO₂e per gallon (Table B-1), using the following equation:

$$AVEF = 11,460.09 * AFCR$$

Appendix B. Train Emission Factor Lookup Table

Emissions for trains require project-specific information on the estimated quantity and type of fuel used annually, which are used with the appropriate carbon content factor (in gCO₂e per unit of fuel) from Table B-1 to convert fuel to GHG emissions. Emission Factors are calculated using fuel type megajoule (MJ) per unit of fuel and the fuel type Energy Densities (grams of CO₂e per MJ). When converting from diesel fuel usage to other fuel types use the New Train Emission Factor (**TEF_{new}**).

Alternatively, the applicant may use the ARB provided train default emission factors here to estimate GHG emission reductions, if fuel specific data is unknown or cannot be documented, of the proposed project.

TEF_{new} and ARB (**TDEF**) defaults were calculated using the diesel fuel usage of the baseline train as a basis for the emission factors. This method assumes that a new fuel type will have the same energy requirements as a diesel counterpart and allow all submitted applications to be compared on a level playing field.

Table B-1. Train Emission Factors

Train Fuel Type	TEF	TEF _{new} (Diesel Equivalent gCO ₂ e)	TDEF (gCO ₂ e/mi)
CNG	78 gCO ₂ e/scf	11,782	21,596
Diesel		13,818 gCO ₂ e/gal	25,136
Electric (Heavy Rail)	379 gCO ₂ e/KWh	3,047	5,592
Electric (Light Rail)		4,285	7,795
Electric (Trolley Bus, Cable Car, Street Car)		4,562	8,298
Hydrogen Fuel Cell	12,678 gCO ₂ e/kg	7,477	13,602
Hydrogen Fuel Cell (SB 1505)	10,466 gCO ₂ e/kg	6,173	11,229
LNG	6,824 gCO ₂ e/gal	12,935	23,529
Renewable Diesel	4,510 gCO ₂ e/gal	4,677	8,508

Train Emission Factors (TEF_{new}, TDF)

Train emission factors were derived using the following process.

1. A Train Consumption Rate (TCR, in gallons of diesel per mile) was calculated using the total gallons of diesel fuel used by 130 trains across the State in 2010 divided by the total mileage of those trains using the following equation:

$$TCR_{diesel} = \frac{Fuel\ Consumption}{VMT}$$

2. The diesel emission factor was developed using data as described in (a) below. Emission factors for other fuel types convert the diesel new service fuel consumption rate to the appropriate fuel type as described in (b).
 - a. Diesel: the new train emission factor (**TDEF**, in grams of CO₂e per mile) was obtained by multiplying the train fuel consumption rate (**TCR**, in gallons per mile) by the WTW carbon content factor for diesel (13,818.14 g CO₂e per gallon) using the following equation:

$$TDEF = 13,818.14 * TCR$$

- b. Non-Diesel: For fuel types other than diesel, staff converted the diesel fuel consumption rate (**TCR**) from Step 2 to the equivalent new service emission factor (**TEF**, in grams of CO₂e per mile) using the following equation:

$$TEF_{new_fuel} = TCR_{diesel} * ED_{diesel} * \left(\frac{1}{ED_{new_fuel}} \right) * \left(\frac{1}{EER} \right) * CC_{new_fuel}$$

Where:

TCR_{diesel} = Train Consumption Rate for diesel (gallons per mile)

ED_{diesel} = 134.47 MJ per gallon, from Table F-1

ED_{new fuel} = Energy density of the new fuel type (MJ per unit of new fuel), from Table F-1

EER = Energy Economy Ratio (unitless), from Table F-1

CC_{new fuel} = Carbon Content of the new fuel type (grams of CO₂e per unit of new fuel), from Table F-1

Appendix C. Bus Emission Factor Lookup Tables

Look up calendar year and the model year of the bus being added, according to fuel type, for the emission factor for Yr 1. Look up calendar year and the same model year and fuel type, for the emission factor for Yr F. Bus Emission Factor Lookup Tables can be downloaded at:

http://www.arb.ca.gov/cc/capandtrade/auctionproceeds/ef_bus_final.pdf

For example, if the project will purchase new CNG buses in 2017 for a project start year of 2017 and project end year of 2024, the bus emission factors would be:

Yr 1 (2017): 2,197 g CO₂e/mi and

Yr F (2024): 2,198 g CO₂e/mi.

Bus Emission Factors (BEF)

The bus emission factors were derived using the following steps:

1. The statewide emissions each calendar year from 2016 through 2050 were downloaded from EMFAC 2014 with the following parameters:
 - a. Annual average
 - b. EMFAC2011 vehicle categories UBUS
 - c. All model years
 - d. Aggregated speed
 - e. Diesel fuel
2. The bus fuel consumption rate (**BFCR**, in gallons of diesel per mile) was calculated using the total gallons of diesel fuel used by model year divided by the total mileage by model year, using the following equation:

$$BFCR_{diesel} = \frac{Fuel_Consumption_{(UBUS)} * 1,000}{VMT_{(UBUS)}}$$

3. Diesel emission factors were developed using data as described in (a) below. Emission factors for other fuel types convert the diesel bus fuel consumption rate to the appropriate fuel type as described in (b).
 - a. Diesel: the bus emission factor (**BEF**, in grams of CO₂e per mile) for each calendar year and model year were obtained by multiplying the bus fuel consumption rate (**BCR**, in gallons per mile) by the WTW carbon content factor for diesel (13,818.14 g CO₂e per gallon) using the following equation:

$$BEF = 13,818.14 * BCR$$

- b. Non-Diesel: For fuel types other than diesel, staff converted the diesel bus fuel consumption rate (**BFCR_{diesel}**) from Step 2 to the equivalent service vehicle emission factor (**BEF_{new_fuel}**, in grams of CO₂e per mile) using the following equation:

$$BEF_{new_fuel} = BFCR_{diesel} * ED_{diesel} * \left(\frac{1}{ED_{new_fuel}} \right) * \left(\frac{1}{EER} \right) * CC_{new_fuel}$$

Where:

BFCR_{diesel}	= Bus Fuel Consumption Rate for diesel, from Step 2 (gallons per mile)
ED_{diesel}	= 134.47 MJ per gallon, from Table F-1
ED_{new_fuel}	= Energy density of the new fuel type (MJ per unit of new fuel), from Table F-1
EER	= Energy Economy Ratio (unitless), from Table F-1
CC_{new_fuel}	= Carbon Content of the new fuel type (grams of CO ₂ e per unit of new fuel), from Table F-1

Appendix D. Shuttle and Vanpool Emission Factor Lookup Tables

Look up calendar year and the model year of the shuttle or vanpool being added, according to fuel type, for the emission factor for Yr 1. Look up calendar year and the same model year and fuel type, for the emission factor for Yr F. Shuttle or Vanpool Emission Factor Lookup Tables can be downloaded at:

www.arb.ca.gov/cc/capandtrade/auctionproceeds/ef_ldh_busshuttle_final.pdf

For example, if the project will operate a 2017 CNG shuttle for a project start year of 2017 and project end year of 2024, the emission factors would be:

Yr 1 (2017): 600 g CO₂e/mi and

Yr F (2024): 603 g CO₂e/mi.

Shuttle or Vanpool Emission Factors (SVEF)

The emission factors were derived using the following steps:

1. The statewide emissions each calendar year from 2016 through 2050 were downloaded from EMFAC 2014 with the following parameters:
 - a. Annual average
 - b. EMFAC2011 vehicle categories LDH1
 - c. All model years
 - d. Aggregated speed
 - e. Diesel fuel
2. The fuel consumption rate (**FCR**, in gallons of diesel per mile) was calculated using the total gallons of diesel fuel used by model year divided by the total mileage by model year, using the following equation:

$$FCR_{diesel} = \frac{Fuel_Consumption_{(LDH1)} * 1,000}{VMT_{(LDH1)}}$$

3. Diesel emission factors were developed using data as described in (a) below. Emission factors for other fuel types convert the diesel fuel consumption rate to the appropriate fuel type as described in (b).
 - a. Diesel: the emission factor (**SVEF**, in grams of CO₂e per mile) for each calendar year and model year were obtained by multiplying the fuel consumption rate (**FCR**, in gallons per mile) by the WTW carbon content factor for diesel (13,818.14 g CO₂e per gallon) using the following equation:

$$SVEF = 13,818.14 * FCR$$

- b. Non-Diesel: For fuel types other than diesel, staff converted the diesel bus fuel consumption rate (**FCR_{diesel}**) from Step 2 to the equivalent service vehicle emission factor (**SVEF_{new_fuel}**, in grams of CO₂e per mile) using the following equation:

$$SVEF_{new_fuel} = FCR_{diesel} * ED_{diesel} * \left(\frac{1}{ED_{new_fuel}} \right) * \left(\frac{1}{EER} \right) * CC_{new_fuel}$$

Where:

FCR_{diesel} = Fuel Consumption Rate for diesel, from Step 2 (gallons per mile)

ED_{diesel} = 134.47 MJ per gallon, from Table F-1

ED_{new_fuel} = Energy density of the new fuel type (MJ per unit of new fuel), from Table F-1

EER = Energy Economy Ratio (unitless), from Table F-1

CC_{new_fuel} = Carbon Content of the new fuel type (grams of CO₂e per unit of new fuel), from Table F-1

Appendix E. Ferry Emission Factor Lookup Table

Due to the high variability in ferries, standardized emission factors are not available for new/expanded ferry service. Emissions for ferries require project-specific information for the estimated quantity and type of fuel used annually, which are used with the appropriate carbon content factor from Table E-1 to convert fuel to GHG emissions. The same emission factor will be used for both Year 1 and Year F, according to fuel type, in Table E-1. Emission Factors are calculated using fuel type megajoule (MJ) per unit of fuel and the fuel type Energy Densities (grams of CO₂e per MJ).

Table E-1. Ferry Emission Factors

Fuel Type (units)	FEF (gCO₂e/unit of fuel)
CNG (scf)	78
Diesel (gal)	13,818
Electric/BEV or PHEV (KWh)	379
Hydrogen Fuel Cell (kg)	12,678
Hydrogen Fuel Cell (SB 1505) (kg)	10,466
LNG (gal)	6,824

Appendix F. Fuel-Specific Factors Lookup Table

Table F-1. Fuel-Specific Factors

Fuels (units)	Energy Density	Carbon Content gCO ₂ e/unit*	EER Values Relative to Diesel
CNG (scf)	0.98 (MJ/scf)	77.88 (gCO ₂ e/scf)	0.9
Diesel (gal)	134.47 (MJ/gal)	13,818.14 (gCO ₂ e/gal)	1.0
Electric (KWh)	3.6 (MJ/KWh)	378.58 (gCO ₂ e/KWh)	Electricity/BEV, or PHEV Bus: 4.2
			Heavy Rail: 4.6
			Light Rail: 3.3
			Trolley Bus, Cable Car, Street Car: 3.1
Gas (gal)	115.63 (MJ/gal)	11,460.09 (gCO ₂ e/gal)	0.9
Hydrogen (kg)	120.00 (MJ/kg)	12,678.00 (gCO ₂ e/kg)	1.9
Hydrogen SB 1505 compliant (kg)		10,466.4 (gCO ₂ e/kg)	
LNG (gal)	78.83 (MJ/gal)	6,824.31 (gCO ₂ e/gal)	0.9
Renewable Diesel (gal)	129.65 (MJ/gal)	4,509.75 (gCO ₂ e/gal)	1.0

*Calculated using fuel type megajoule (MJ) per unit of fuel from Table III-2 (see Staff Report) and Energy Densities of LCFS Fuels and Blendstocks¹¹ and the fuel type grams of CO₂e per MJ from CA-GREET 1.8b versus 2.0 CI Comparison Table.¹²

¹¹ [Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Re-Adoption of the Low Carbon Fuel Standard, December 2014](#)

¹² [Direct values \(without energy efficiency ratio adjustments\). Source: California Air Resources Board, CA-GREET 1.8b versus 2.0 CI Comparison Table, April 1, 2015](#)

Appendix G. Example New/Expanded Service Project [FORTHCOMING]

Appendix H. Length of Average Auto Trip Reduced Lookup Tables

Caltrans developed these recommended values for applicants to use for the length of the average auto trip reduced, by agency or statewide, by mode using data from the 2013 NTD. These values were calculated by dividing passenger miles traveled by unlinked passenger trips. For additional information on the tables please contact Caltrans at TIRCPcomments@dot.ca.gov.

Table H-1. Length of Average Auto Trip Reduced by Agency by Mode

NTD ID	Agency	Mode*	Miles/Trip
9006	Santa Cruz Metropolitan Transit District	CB	31.7
9012	San Joaquin Regional Transit District	CB	46.0
9020	Santa Barbara Metropolitan Transit District	CB	40.3
9026	San Diego Metropolitan Transit System	CB	23.9
9031	Riverside Transit Agency	CB	13.2
9031	Riverside Transit Agency	CB	23.9
9036	Orange County Transportation Authority	CB	3.7
9036	Orange County Transportation Authority	CB	5.3
9041	Montebello Bus Lines	CB	10.4
9061	Yuba-Sutter Transit Authority	CB	41.0
9121	Antelope Valley Transit Authority	CB	63.3
9147	City of Los Angeles Department of Transportation	CB	16.7
9148	Victor Valley Transit Authority	CB	50.7
9149	City of Lompoc - Lompoc Transit	CB	51.7
9159	Western Contra Costa Transit Authority	CB	23.8
9164	Ventura Intercity Service Transit Authority	CB	11.5
9171	Santa Clarita Transit	CB	22.0
9196	Placer County Department of Public Works	CB	26.6
9196	Placer County Department of Public Works	CB	26.6
9205	City of Elk Grove	CB	20.0
9206	San Luis Obispo Regional Transit Authority	CB	24.5
9232	Solano County Transit	CB	8.8
9015	San Francisco Municipal Railway	CC	1.3
9030	North County Transit District	CR	27.5
9134	Peninsula Corridor Joint Powers Board dba: Caltrain	CR	21.8
9151	Southern California Regional Rail Authority dba: Metrolink	CR	34.6
9182	Altamont Corridor Express	CR	44.8
9004	Golden Empire Transit District	DR	7.4
9006	Santa Cruz Metropolitan Transit District	DR	6.4

*See Table H-2 for Mode type definition.

NTD ID	Agency	Mode*	Miles/ Trip
9007	Modesto Area Express	DR	6.8
9008	Santa Monica's Big Blue Bus	DR	2.6
9009	San Mateo County Transit District	DR	8.7
9012	San Joaquin Regional Transit District	DR	5.9
9013	Santa Clara Valley Transportation Authority	DR	11.2
9014	Alameda-Contra Costa Transit District	DR	10.2
9016	Golden Gate Bridge, Highway and Transportation District	DR	9.3
9017	City of Santa Rosa	DR	4.4
9019	Sacramento Regional Transit District	DR	4.1
9020	Santa Barbara Metropolitan Transit District	DR	5.7
9022	Norwalk Transit System	DR	2.9
9024	City of La Mirada Transit	DR	3.4
9026	San Diego Metropolitan Transit System	DR	9.3
9027	Fresno Area Express	DR	7.1
9029	Omnitrans	DR	11.1
9030	North County Transit District	DR	3.1
9031	Riverside Transit Agency	DR	11.8
9035	Gold Coast Transit	DR	7.9
9036	Orange County Transportation Authority	DR	10.6
9039	Culver City Municipal Bus Lines	DR	2.3
9042	City of Gardena Transportation Department	DR	3.7
9043	City of Commerce Municipal Buslines	DR	6.8
9044	City of Arcadia Transit	DR	3.2
9061	Yuba-Sutter Transit Authority	DR	4.3
9062	Monterey-Salinas Transit	DR	9.7
9078	Central Contra Costa Transit Authority	DR	9.4
9079	SunLine Transit Agency	DR	11.3
9086	City of Riverside Special Transportation	DR	10.3
9087	Santa Maria Area Transit	DR	5.5
9089	Sonoma County Transit	DR	11.3
9090	Yolo County Transportation District	DR	11.6
9091	City of Visalia - Visalia City Coach	DR	7.2
9092	City of Fairfield - Fairfield and Suisun Transit	DR	8.1
9093	Redding Area Bus Authority	DR	8.1
9144	Livermore / Amador Valley Transit Authority	DR	5.5
9147	City of Los Angeles Department of Transportation	DR	4.9
9148	Victor Valley Transit Authority	DR	11.9
9149	City of Lompoc - Lompoc Transit	DR	1.8
9157	Access Services	DR	13.1
9159	Western Contra Costa Transit Authority	DR	6.7

*See Table H-2 for Mode type definition.

NTD ID	Agency	Mode*	Miles/Trip
9162	The Eastern Contra Costa Transit Authority	DR	5.7
9164	Ventura Intercity Service Transit Authority	DR	4.0
9166	LACMTA - Small Operators	DR	3.6
9171	Santa Clarita Transit	DR	9.3
9173	Merced County Transit	DR	7.0
9175	City of Lodi - Transit Division	DR	2.5
9196	Placer County Department of Public Works	DR	3.9
9200	Kings County Area Public Transit Agency	DR	3.5
9201	City of Turlock	DR	6.9
9205	City of Elk Grove	DR	9.8
9206	San Luis Obispo Regional Transit Authority	DR	9.4
9208	Butte County Association of Governments	DR	3.8
9213	City of Petaluma	DR	3.6
9214	City of Redondo Beach - Beach Cities Transit	DR	3.4
9223	Paratransit, Inc.	DR	9.0
9224	Paratransit, Inc. CTSA	DR	15.1
9226	Imperial County Transportation Commission	DR	12.8
9232	Solano County Transit	DR	4.4
9244	City of Tulare	DR	3.0
9006	Santa Cruz Metropolitan Transit District	DT	5.8
9009	San Mateo County Transit District	DT	11.2
9010	Torrance Transit System	DT	5.7
9012	San Joaquin Regional Transit District	DT	6.4
9022	Norwalk Transit System	DT	3.9
9023	Long Beach Transit	DT	4.0
9030	North County Transit District	DT	8.5
9031	Riverside Transit Agency	DT	22.5
9036	Orange County Transportation Authority	DT	2.9
9039	Culver City Municipal Bus Lines	DT	2.6
9041	Montebello Bus Lines	DT	2.0
9121	Antelope Valley Transit Authority	DT	8.0
9147	City of Los Angeles Department of Transportation	DT	2.0
9166	LACMTA - Small Operators	DT	3.2
9173	Merced County Transit	DT	4.7
9196	Placer County Department of Public Works	DT	18.9
9223	Paratransit, Inc.	DT	7.8
9016	Golden Gate Bridge, Highway and Transportation District	FB	11.0
9225	SF Bay Area Water Emergency Transportation Authority	FB	17.0
9003	San Francisco Bay Area Rapid Transit District	HR	13.0
9154	LA County Metropolitan Transportation Authority dba: Metro	HR	4.8

*See Table H-2 for Mode type definition.

NTD ID	Agency	Mode*	Miles/Trip
9013	Santa Clara Valley Transportation Authority	LR	5.4
9015	San Francisco Municipal Railway	LR	2.9
9019	Sacramento Regional Transit District	LR	5.6
9026	San Diego Metropolitan Transit System	LR	5.8
9154	LA County Metropolitan Transportation Authority dba: Metro	LR	6.4
9004	Golden Empire Transit District	MB	3.3
9006	Santa Cruz Metropolitan Transit District	MB	4.8
9007	Modesto Area Express	MB	3.2
9008	Santa Monica's Big Blue Bus	MB	3.9
9009	San Mateo County Transit District	MB	4.1
9009	San Mateo County Transit District	MB	7.1
9010	Torrance Transit System	MB	4.3
9010	Torrance Transit System	MB	12.3
9012	San Joaquin Regional Transit District	MB	3.4
9012	San Joaquin Regional Transit District	MB	4.3
9013	Santa Clara Valley Transportation Authority	MB	5.1
9013	Santa Clara Valley Transportation Authority	MB	3.9
9014	Alameda-Contra Costa Transit District	MB	3.7
9015	San Francisco Municipal Railway	MB	2.3
9016	Golden Gate Bridge, Highway and Transportation District	MB	11.0
9016	Golden Gate Bridge, Highway and Transportation District	MB	18.0
9017	City of Santa Rosa	MB	2.8
9017	City of Santa Rosa	MB	4.3
9019	Sacramento Regional Transit District	MB	3.6
9020	Santa Barbara Metropolitan Transit District	MB	4.3
9022	Norwalk Transit System	MB	3.6
9023	Long Beach Transit	MB	3.1
9026	San Diego Metropolitan Transit System	MB	3.7
9026	San Diego Metropolitan Transit System	MB	3.2
9027	Fresno Area Express	MB	2.5
9029	Omnitrans	MB	4.8
9029	Omnitrans	MB	3.9
9030	North County Transit District	MB	4.8
9031	Riverside Transit Agency	MB	6.2
9031	Riverside Transit Agency	MB	6.8
9035	Gold Coast Transit	MB	4.2
9036	Orange County Transportation Authority	MB	3.7
9036	Orange County Transportation Authority	MB	5.3
9039	Culver City Municipal Bus Lines	MB	3.4
9041	Montebello Bus Lines	MB	3.3

*See Table H-2 for Mode type definition.

NTD ID	Agency	Mode*	Miles/ Trip
9041	Montebello Bus Lines	MB	3.3
9042	City of Gardena Transportation Department	MB	3.9
9043	City of Commerce Municipal Buslines	MB	3.4
9061	Yuba-Sutter Transit Authority	MB	1.2
9062	Monterey-Salinas Transit	MB	5.3
9062	Monterey-Salinas Transit	MB	4.5
9078	Central Contra Costa Transit Authority	MB	4.8
9079	SunLine Transit Agency	MB	6.6
9087	Santa Maria Area Transit	MB	6.8
9089	Sonoma County Transit	MB	9.3
9089	Sonoma County Transit	MB	9.3
9090	Yolo County Transportation District	MB	11.0
9091	City of Visalia - Visalia City Coach	MB	4.6
9092	City of Fairfield - Fairfield and Suisun Transit	MB	7.2
9093	Redding Area Bus Authority	MB	6.1
9119	Laguna Beach Municipal Transit	MB	1.8
9121	Antelope Valley Transit Authority	MB	13.1
9134	Peninsula Corridor Joint Powers Board dba: Caltrain	MB	3.3
9142	Unitrans - City of Davis/ASUCD	MB	2.2
9144	Livermore / Amador Valley Transit Authority	MB	4.9
9146	Foothill Transit	MB	7.5
9147	City of Los Angeles Department of Transportation	MB	1.4
9148	Victor Valley Transit Authority	MB	6.0
9149	City of Lompoc - Lompoc Transit	MB	6.8
9154	LA County Metropolitan Transportation Authority dba: Metro	MB	4.1
9154	LA County Metropolitan Transportation Authority dba: Metro	MB	3.7
9156	City of San Luis Obispo	MB	2.8
9159	Western Contra Costa Transit Authority	MB	6.2
9162	The Eastern Contra Costa Transit Authority	MB	6.9
9166	LACMTA - Small Operators	MB	2.4
9171	Santa Clarita Transit	MB	4.1
9173	Merced County Transit	MB	1.9
9175	City of Lodi - Transit Division	MB	2.8
9193	Chula Vista Transit	MB	3.7
9196	Placer County Department of Public Works	MB	8.3
9196	Placer County Department of Public Works	MB	5.3
9200	Kings County Area Public Transit Agency	MB	5.2
9201	City of Turlock	MB	3.5

*See Table H-2 for Mode type definition.

NTD ID	Agency	Mode*	Miles/ Trip
9205	City of Elk Grove	MB	8.0
9206	San Luis Obispo Regional Transit Authority	MB	14.1
9208	Butte County Association of Governments	MB	6.3
9211	Anaheim Transportation Network	MB	2.1
9213	City of Petaluma	MB	3.0
9214	City of Redondo Beach - Beach Cities Transit	MB	4.5
9226	Imperial County Transportation Commission	MB	16.4
9232	Solano County Transit	MB	4.5
9244	City of Tulare	MB	5.2
9154	LA County Metropolitan Transportation Authority dba: Metro	RB	6.3
9015	San Francisco Municipal Railway	SR	1.5
9015	San Francisco Municipal Railway	TB	1.5
9036	Orange County Transportation Authority	VP	36.1
9095	San Diego Association of Governments	VP	47.1
9148	Victor Valley Transit Authority	VP	51.3
9154	LA County Metropolitan Transportation Authority dba: Metro	VP	45.0
9196	Placer County Department of Public Works	VP	40.2
9230	California Vanpool Authority	VP	39.3
9030	North County Transit District	YR	9.1

*See Table H-2 for Mode type definition.

Table H-2. Length of Average Auto Trip Reduced Statewide by Mode

Mode Type		Miles/Trip
Commuter Bus	CB	26.6
Cable Car	CC	1.3
Commuter Rail	CR	32.2
Demand Response	DR	7.0
Demand Response Taxi	DT	7.1
Ferryboat	FB	14.0
Heavy Rail	HR	8.9
Light Rail	LR	5.2
Bus	MB	5.1
Bus Rapid Transit	RB	6.3
Streetcar Rail	SR	1.5
Trolley Bus	TB	1.5
Vanpool	VP	43.2
Hybrid Rail	YR	9.1