Los Angeles County
Metropolitan Transportation Authority

Metro Transit Coalition to Reduce Climate Pollution
for the 2028 Olympics and Beyond

FY24 Environmental Protection Agency's Climate Pollution Reduction Grants (CPRG) Program: Implementation Grants General Competition

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Technical Appendix

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This Technical Appendix provides the methodology and assumptions used to develop estimated greenhouse gas (GHG) emission reductions for the Measures proposed under this Climate Pollution Reduction Grants (CPRG) Application for the Metro Transit Coalition (Coalition). It includes calculation assumptions for the projects listed under Measure T2: Decarbonized Passenger Transport, Measure T5: Expand the Active Transportation Network, and Measure T6: Expand the Transit Network and Increase Ridership. This Technical Appendix is organized by Measure, and specific inputs and assumptions are described for each of the projects. This appendix uses the latest available information and references relevant models and/or tools used to guide the inputs, methodologies, and assumptions.

Measure T2: Decarbonize Passenger Transport

For the analysis of Measure T2, an approach was applied to all three projects: Los Angeles County Metropolitan Transportation Authority (LA Metro) Divisions 7 and 18 Charging Infrastructure, Sylmar Bus Yard Charging Infrastructure, and El Sol Shuttle Zero-Emission Bus (ZEB) Conversion. Each project consists of either the installation of electric vehicle (EV) charging infrastructure, or the conversion of buses fueled by compressed natural gas (CNG) to ZEB vehicles. The same methods and tools were used to evaluate the reduction in GHG emissions, and an explanation is provided in the following sections titled "GHG Reduction Estimate Method" and "Models/Tools Used." Specific details of the assumptions for each of the projects are also described.

GHG Reduction Estimate Method: The analysis evaluates the tailpipe emissions of the CNG-fueled buses and the grid emissions of the ZEB vehicles based on the average number of vehicle-miles traveled (VMT) per vehicle per year for revenue and deadhead service to arrive at the annual GHG emission reduction estimate for Measure T2. The average VMT per vehicle is based on the corresponding transit agency's (e.g., LA Metro) average VMT per vehicle for directly operated local bus service extracted from the 2022 Metrics table from the National Transit Database (NTD) administered by the Federal Transit Administration (FTA).[1] The fuel efficiency of the CNG-fueled buses and the ZEB vehicles were extracted from a comparison technical study of CNG-fueled and ZEB transit vehicles published by the National Renewable Energy Laboratory.[2] The calculation of the GHG emissions from the consumption of CNG and grid electricity is based on the emissions factors published by the U.S. Environmental Protection Agency (EPA) in the February 2024 update of the "Emissions Factors for Greenhouse Gas Inventories."[3] The emissions of methane (CH_4)and nitrous oxide (N_2O) are converted into carbon dioxide equivalent (CO_2e) using the 100-year global warming potential published in the "Emissions Factors for Greenhouse Gas Inventories."

Models/Tools Used: The analysis was completed using a spreadsheet-based model compliant with the U.S. Department of Transportation's (USDOT) *Benefit-Cost Analysis Guidance for Discretionary Grant Programs* published in December 2023.[4] As a result, the spreadsheet-based model is compliant with the latest guidance provided by the Office of Management and Budget (OMB) defining the practices in measuring cost-effectiveness and the valuation of social and environmental costs for federal agencies. As such, the model is inclusive of the emissions factors for CNG and grid electricity published by EPA, the fuel efficiency of CNG and ZEB bus vehicles published by the National Renewable Energy Laboratory, and the fuel conversion factors from the U.S. Department of Energy.[5,6,7]

1 Federal Transit Administration, "2022 Metrics: Los Angeles County Transportation Authority", National Transit Database, https://www.transit.dot.gov/ntd/data-product/2022-metrics
2 Leslie Eudy, Robert Prohaska, Kenneth Kelly, and Matthew Post, "Foothill Transit Battery Electric Bus Demonstration Results", National Renewable Energy Laboratory, January 2016, https://www.nrel.gov/docs/fy16osti/65274.pdf
3 U.S. Environmental Protection Agency, "Emissions Factors for Greenhouse Gas Inventories", February 2024, https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf
4 U.S. Department of Transportation, "Benefit-Cost Analysis Guidance for Discretionary Grant Programs", December 2023, https://www.transportation.gov/sites/dot.gov/files/2023-12/Benefit%20Cost%20Analysis%20Guidance%202024%20Update.pdf
5 U.S. Environmental Protection Agency, "Emissions Factors for Greenhouse Gas Inventories", February 2024, https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf
6 California Air Resources Board, EMFAC2017 Web Database (v1.0.2), https://arb.ca.gov/emfac/2017/
7 U.S. Department of Energy, "Gasoline and Diesel Gallon Equivalency Methodology", Alternative Fuels Data Center, https://afdc.energy.gov/fuels/equivalency_methodology.html.

LA METRO DIVISION 7 AND 18 CHARGING INFRASTRUCTURE

Measure Implementation Assumptions: To be fully implemented by 2028, with an operational life of at least 25 years, the total budgeted capital cost for the installation of all charging infrastructure at Division 7 and 18 is $361 million. The analysis evaluates the benefits from the CPRG request amount of $201 million. The reductions in GHG emissions related to the charging infrastructure funded solely by the CPRG funding, represents 30% of the buses in Division 18 and 80% of the buses in Division 7. A lifecycle analysis of the proposed improvements has not yet been completed, but the annual operations and maintenance costs are assumed to be around $1 million.

GHG Reduction Estimate Assumptions: The analysis measures the reduction in GHG emissions based on the average VMT per vehicle per year and the emissions rates for CNG-fueled buses and ZEB vehicles. The analysis assumed an average of 45,700 VMT per vehicle, which was calculated from the total revenue and deadhead VMT in 2022 by LA Metro's directly operated local bus service divided by the 1,421 vehicles operated in maximum service. The total annual VMT are estimated to be 9.4 million, based on the 30% of 221 buses in Division 18 and 80% of the 173 buses in Division 7 expected to be affected by the project. The emissions factors for CO_2, CH_4, and N_2O for the CNG-fueled buses represent the tailpipe emissions for the vehicles, while the emissions factors for the ZEB vehicles represent the emissions profile of the California and Mexico Western Electricity Coordinating Council (CAMX WECC) utility electrical grid, adjusted for transmission and distribution loss.

Reference Case Scenario (GHG Emissions or Activity Level): The analysis estimates the GHG emissions with and without the project from the base year of 2023 through 2050. As a reference scenario, a "business as usual" (BAU) GHG emission was developed based on a baseline assumption. The assumptions of the reference case scenario include the continued use of CNG-fueled buses passenger service at current operating levels within Divisions 7 and 18: 394 buses operating at 45,700 VMT per vehicle per year.

Measure-Specific Activity Data: Assuming an average of 45,700 VMT per vehicle per year, which adds up to 9.4 million VMT annually; the level of service is expected to remain constant through 2050. Based on the fuel efficiency of the CNG-fueled buses of 4.04 miles per gasoline gallon equivalent (GGE) and ratio of about 124 standard cubic feet (SCF) per GGE, the annual consumption of CNG is calculated to be approximately 286,129,000 SCF. Based on the emissions factors published by EPA, this volume of CNG results in the release of 16,309 metric tons of CO_2e. Based on the energy efficiency of the ZEB vehicles of 2.15 kilowatt-hours (kWh) per mile, the annual consumption of CNG is calculated to be approximately 20,123,000 kWh, or 20,113 megawatt-hours (MWh); accounting for a 5% loss in transmission and distribution, a total of 21,171 MWh is generated for the ZEB vehicles. Using the emissions profile for the CAMX (WECC California) grid subregion published by EPA, this volume of electricity results in the release of 10,086 metric tons of CO_2e.

SYLMAR BUS YARD CHARGING INFRASTRUCTURE

Measure Implementation Assumptions: Fully implemented by 2028, with an operational life of at least 25 years, the budgeted capital cost of the project is $28 million. While a comprehensive lifecycle analysis of the proposed improvements has not yet been completed, the annual operations and maintenance costs (O&M) are assumed to be $100,000.

GHG Reduction Estimate Assumptions: The analysis measures the reduction in GHG emissions based on the average VMT per vehicle per year and the emissions rates for CNG-fueled buses and ZEB vehicles. Assuming an average of 46,200 VMT per vehicle, based on the total revenue and deadhead VMT in 2022 by LADOT's bus service divided by the 171 vehicles operated in maximum service. Annual VMT are estimated to be 4.2 million, based on 90 buses expected to be affected by the project. The emissions factors for CO_2, CH_4, and N_2O for the CNG-fueled buses represent the tailpipe emissions, while the factors for the ZEB

vehicles represent the emissions profile of the CAMX (WECC California) utility electrical grid, adjusted for transmission and distribution loss.

Reference Case Scenario (GHG Emissions or Activity Level): The analysis estimates the GHG emissions with and without the project from the base year of 2023 through 2050. The assumptions of the reference case scenario include the continued use of CNG-fueled buses to provide passenger service at current operating levels within the LADOT service area: a total of 90 buses operating at 46,200 VMT per vehicle per year.

Measure-Specific Activity Data: The analysis assumes an average of 46,200 VMT per vehicle per year (based on the NTD administered by FTA), which adds up to 4.2 million VMT annually; the level of service is expected to remain constant through 2050. Based on the fuel efficiency of the CNG-fueled buses of 4.04 miles per GGE and ratio of about 124 SCF per GGE, the annual consumption of CNG is calculated to be approximately 127,181,000 SCF. Based on the emissions factors published by EPA, this volume of CNG results in the release of 7,249 metric tons of CO_2e. Based on the energy efficiency of the ZEB vehicles of 2.15 kWh per mile, the annual consumption of CNG is calculated to be approximately 8,940,000 kWh, or 8,940 MWh; accounting for a 5% loss in transmission and distribution, a total of 9,410 MWh is generated for the ZEB vehicles. Based on the emissions profile for the CAMX (WECC California) grid subregion published by EPA, this volume of electricity results in the release of 4,483 metric tons of CO_2e.

EL SOL SHUTTLE ZERO-EMISSION BUS CONVERSION

Measure Implementation Assumptions: The project is expected to be fully implemented by 2028 with an operational life of at least 25 years. The budgeted capital cost of the project is $6 million. While a comprehensive lifecycle analysis of the proposed improvements has not yet been completed, the annual operations and maintenance costs are estimated to be $30,000.

GHG Reduction Estimate Assumptions: The analysis measures the reduction in GHG emissions based on the average VMT per vehicle per year and the emission rates for CNG-fueled buses and ZEB vehicles. Assuming an average of 32,400 VMT per vehicle, which was calculated from the total revenue and deadhead VMT in 2022 by LA County's bus service divided by the seven vehicles operated in maximum service. Annual VMT are estimated to be 0.2 million based on the number of transit vehicles expected to be affected by the project. The emissions factors for CO_2, CH_4, and N_2O for the CNG-fueled buses represented the tailpipe emissions for the vehicles, while the emissions factors for the ZEB vehicles represent the profile of the CAMX (WECC California) utility electrical grid, adjusted for transmission and distribution loss.

Reference Case Scenario (GHG Emissions or Activity Level): The analysis projects the GHG emissions with and without the project from the base year of 2023 through 2050. The assumptions of the reference case scenario include the continued use of CNG-fueled transit vehicles to provide passenger service at current operating levels within the El Sol Shuttle service area: a total of seven buses operating at 32,400 VMT per vehicle per year.

Measure-Specific Activity Data: Assuming an average of 32,400 VMT per vehicle per year, which adds up to 0.2 million VMT annually; the level of service is expected to remain constant through 2050. Based on the fuel efficiency of the CNG-fueled transit vehicles of 4.04 miles per GGE and ratio of about 124 SCF per GGE, the annual consumption of CNG is calculated to be approximately 6,938,400 SCF. Based on the emissions factors published by EPA, this volume of CNG results in the release of 395 metric tons of CO_2e. Based on the energy efficiency of the ZEB vehicles of 2.15 kWh per mile, the annual consumption of CNG is calculated to be approximately 487,700 kWh, or 488 MWh; accounting for a 5% loss in transmission and distribution, a total of 513 MWh is generated for the ZEB vehicles. Based on the emissions profile for the CAMX (WECC California) grid subregion published by EPA, this volume of electricity results in the release of 245 metric tons of CO_2e. Table 1 presents GHG emissions reduced for Measure T2.

Table 1. GHG emissions reduced for Measure T2

Project Name	Reduction in CO_2e Emissions (metric tons)			
	Average (2025-2030)	Average (2025-2050)	Cumulative (2025-2030)	Cumulative (2025-2050)
LA Metro Division 7 and 18 Charging Infrastructure	6,223	6,223	18,670	143,138
Sylmar Bus Yard Charging Infrastructure	2,766	2,766	8,299	63,623
El Sol Shuttle ZEB Conversion	151	151	453	3,471
Total	**9,140**	**9,140**	**27,422**	**210,232**

Measure T5: Expand the Active Transportation Network

GHG Reduction Estimate Method: The analysis estimates the number of current and future pedestrian and bicyclist trips in the project areas based on the methodology outlined in *NCHRP Report 552 Guidelines for Analysis of Investments in Bicycle Facilities.*[8] The methodology estimates the number of existing and induced adult and child cyclists and pedestrians around a new facility based on commute share and their relative distance from the facility. Using multipliers measuring the likelihood for a resident to use the facility, the percentage of existing and new pedestrian and bicyclist users from the local population can be derived based on their proximity to a new facility. Demographic and population data define the existing and induced users; the data are extracted from the American Community Survey (ACS) published by the Census Bureau at the census tract level.[9] The expected population of residents and their characteristics identified for the analysis are shown in Table 2.

Table 2. ACS Population data for Measure 5 projects

Project Name	Population	Commute Share		
		Bike	Walk	Transit
Long Beach Blvd First/Last Mile (FLM)	19,790	0.38%	7.18%	
Ocean Blvd FLM	77,965	0.85%	4.11%	
Garey Ave FLM	25,232			1.85%
Katella Ave FLM/Pedestrian Bridge	958,105			1.89%

Using the information, the analysis calculates the population density and commute share by mode within a buffer zone around the new facilities. The analysis discerns between the adult and child populations due to differences in their trip purposes (commute and recreational use), participation in activities, and the allocation of benefits to each population.

The buffer zone identifies the projects' catchment area for existing and induced users; bicycle users within 1 mile of the facility and pedestrians within 3/8 mile of the facility would be likely to use the new facility. Based on the average trip distance of 2.38 miles for bicyclists and 0.86 mile for pedestrians defined in the USDOT's *Benefit-Cost Analysis for Discretionary Grant Programs*, the utilization of the facility is estimated based on the location of the access points and the length of the facility. With these assumptions, the number of existing and induced trips and person-miles traveled in the project areas can be projected under current and future conditions through 2050.

[8] Krizek et al., "NCHRP Report 552: Guidelines for Analysis of Investments in Bicycle Facilities", 2006, Transportation Research Board, https://www.trb.org/Main/Blurbs/157244.aspx

[9] U.S. Census Bureau, "2023 American Community Survey", www.data.census.gov

Induced trips from those with access to a personal vehicle are assumed to represent avoided vehicle-trips, as users shift from driving to an alternative mode to complete their trip. For the FLM projects in the City of Long Beach, a segment of users are expected to walk or bike instead of drive. The induced users are estimated using the methodology outlined in NCHRP Report 552 Guidelines for Analysis of Investments in Bicycle Facilities. For the Garey Avenue FLM and Katella Avenue FLM/Pedestrian Bridge projects, the induced users are assumed to be users attracted to the improved connectivity to transit service and estimated based on the percentage of the population within one-half mile of the new facility currently using transit to commute. For the Katella Avenue FLM/Pedestrian Bridge, the induced users are assumed to represent 50% to 100% of existing transit users visiting or commuting to the area; these induced users are attracted by the improved connectivity and the regional rail/bus hub. For the South LA bike share project, a segment of the projected users of the new bike share stations are expected to shift from driving to completing their trip using the bike share vehicles, based on the system's average number of trips per station in 2023. The avoided VMT is based on the average travel distance per trip while traveling by walking, bicycling, or using transit, as appropriate.

Models/Tools Used: The analysis was completed using a spreadsheet-based model compliant with USDOT's *Benefit-Cost Analysis Guidance for Discretionary Grant Programs* published in December 2023.[10] This model is compliant with the latest guidance provided by the OMB defining the practices in measuring cost-effectiveness and the valuation of social and environmental costs for federal agencies. The model includes the emissions factors published by the California Air Resources Board (CARB) and the projected fuel efficiency of vehicles through 2050 published by the U.S. Energy Information Administration.[11],[12],[13]

Measure Implementation Assumptions: The projects are expected to be fully implemented by 2028 with an operational life of at least 25 years. The budgeted capital cost of all the projects is $64 million. While a comprehensive lifecycle analysis of the proposed improvements has not yet been completed, the annual O&M costs are estimated to be $0.3 million.

GHG Reduction Estimate Assumptions: The reduction in GHG emissions based on the average VMT per induced trip per year and the emissions rates for gasoline-powered personal vehicles. Depending on whether a project is likely to encourage users within the project area to shift from driving to walking, bicycling or using transit, the average VMT per trip varies. The average trip distance per walking and bicycling trip is based on USDOT's *Benefit-Cost Analysis Guidance for Discretionary Grant Programs*, while the average distance per transit trip is based on the agency-specific service data from the 2022 Metrics table from FTA's National Transit Database. The emissions factors for CO_2 and N_2O for the gasoline-fueled personal vehicles represent the tailpipe emissions of the vehicle-trips.

Reference Case Scenario (GHG Emissions or Activity Level): The analysis estimates the GHG emissions with and without the projects from the base year of 2023 through 2050. The assumptions of the reference case scenario include the continued use of personal vehicles to complete the percentage of trips that are expected to be induced by the projects to use an alternative mode.

[10] U.S. Department of Transportation, "Benefit-Cost Analysis Guidance for Discretionary Grant Programs", December 2023, https://www.transportation.gov/sites/dot.gov/files/2023-12/Benefit%20Cost%20Analysis%20Guidance%202024%20Update.pdf
[11] U.S. Environmental Protection Agency, "Emissions Factors for Greenhouse Gas Inventories", February 2024, https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf
[12] California Air Resources Board, EMFAC2017 Web Database (v1.0.2), https://arb.ca.gov/emfac/2017/
[13] U.S. Energy Information Administration, "Annual Energy Outlook 2023", https://www.eia.gov/outlooks/aeo/

Measure-Specific Activity Data: For each project, a projected number of annual existing and induced trips for which people will choose to walk, bicycle, use transit, or drive to complete their trip. The projected induced trips in the project area for each project and their related avoided VMT are calculated based on project-specific characteristics, including its length and the encouraged mode of transportation. The number of induced trips for the opening year and the 2050 forecast year and the total avoided VMT for each project are provided in Table 3.

Table 3. Annual induced person-trips and avoided VMT for 2028 and 2050

Project Name	Annual Induced Person-Trips		Avoided VMT	
	2028	2050	2028	2050
Long Beach Blvd FLM	347,658	289,509	457,267	380,785
Ocean Blvd FLM	669,627	705,720	75,427	79,493
Garey Ave FLM	144,109	117,510	177,945	145,100
Katella Ave FLM/Pedestrian Bridge	243,148	243,148	1,083,576	1,083,576
Long Beach Blvd FLM	110,278	110,278	325,060	325,060
Total	**1,514,820**	**1,466,165**	**2,119,275**	**2,014,014**

The projected travel speed of the VMT is based on the characteristics of the project areas and the mode of transportation used by existing and induced users. For walking and bicycling trips, the average travel speed in the project area is assumed to be on neighborhood arterial roadways, usually limited to 25 miles per hour (mph). For transit trips, the average travel speed is assumed to be a combination of urban arterial and highway speeds, usually averaging 40 mph. The projected travel speed affects the tailpipe emissions, based on engine efficiency, so traveling at higher speeds tends to emit higher tailpipe emissions per VMT. Table 4 presents GHG emissions reduced for Measure T5.

Table 4. GHG emissions reduced for Measure T5

Project Name	Reduction in CO_2e Emissions (metric tons)			
	Average (2025-2030)	Average (2025-2050)	Cumulative (2025-2030)	Cumulative (2025-2050)
Long Beach Blvd FLM	205	162	616	3,736
Ocean Blvd FLM	154	135	462	3,097
Garey Ave FLM	80	63	239	1,440
Katella Ave FLM/Pedestrian Bridge	354	302	2,200	8,085
South LA Bike Share	147	126	441	2,891
Total	**941**	**787**	**3,958**	**19,249**

Measure T6: Expand the Transit Network and Increase Ridership

TRANSIT PRIORITY ENHANCEMENTS

The analysis evaluates the impact of residents within the bus corridors becoming more attracted to transit with improvements in service reliability and travel time. Based on ridership projections with these improvements, a percentage of ridership growth is expected from persons shifting their trips from personal vehicles to transit. The induced ridership is dependent on the expected total ridership extracted from the 2022 Metrics table from the NTD for the corresponding transit agencies (e.g., LA Metro Next Gen Tier 1, Orange County Transportation Authority [OCTA] Harbor Boulevard Rapid Service), the accessibility to a vehicle, and the percentage of the base ridership in the corridor affected by the project. The induced trips with access to a personal vehicle are assumed to represent avoided vehicle-trips, as users shift from driving to transit to complete their trip. The avoided VMT is based on the average travel distance per trip, as appropriate for each project.

Models/Tools Used: A spreadsheet-based model compliant with USDOT's *Benefit-Cost Analysis Guidance for Discretionary Grant Programs* published in December 2023[14] and guidance provided by the OMB defining the practices in measuring cost-effectiveness and the valuation of social and environmental costs for federal agencies was used. The model includes the emissions factors for gasoline published by the CARB and the projected fuel efficiency of vehicles through 2050 published by the U.S. Energy Information Administration.[15,16,17]

Measure Implementation Assumptions: Assuming full implementation by 2028 with an operational life of at least 25 years, the budgeted capital cost of the transit priority projects are $65.4 million. While a comprehensive lifecycle analysis of the proposed improvements has not yet been completed, the annual operations and maintenance costs are estimated to be $0.3 million.

GHG Reduction Estimate Assumptions: The analysis measures the reduction in GHG emissions based on the average VMT per induced trip per year and the emissions rates for gasoline-powered personal vehicles. Depending on whether a project is likely to encourage users within the project area to shift from driving to using transit and the average length per passenger trip for the service agency, the average VMT per trip varies. The average distance per transit trip is based on the agency-specific service data from the 2022 Metrics table from FTA's NTD; an additional quarter mile is assumed from the origin to the transit stop and from the transit stop to the destination to account for FLM connections.[18] The emissions factors for CO_2 and N_2O for the gasoline-fueled personal vehicles represent the tailpipe emissions of the vehicle-trips.

Reference Case Scenario (GHG Emissions or Activity Level): The analysis estimates the GHG emissions with and without the projects from the base year of 2023 through 2050. The assumptions of the reference case scenario include the continued use of personal vehicles to complete the percentage of trips that are expected to be induced by the projects to use transit.

[14] U.S. Department of Transportation, "Benefit-Cost Analysis Guidance for Discretionary Grant Programs", December 2023, https://www.transportation.gov/sites/dot.gov/files/2023-12/Benefit%20Cost%20Analysis%20Guidance%202024%20Update.pdf
[15] U.S. Environmental Protection Agency, "Emissions Factors for Greenhouse Gas Inventories", February 2024, https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf
[16] California Air Resources Board, EMFAC2017 Web Database (v1.0.2), https://arb.ca.gov/emfac/2017/
[17] U.S. Energy Information Administration, "Annual Energy Outlook 2023", https://www.eia.gov/outlooks/aeo/
[18] Federal Transit Administration, "2022 Metrics: Los Angeles County Transportation Authority", National Transit Database, https://www.transit.dot.gov/ntd/data-product/2022-metrics

Measure-Specific Activity Data: The analysis assumes, for each project, a projected number of annual existing and induced trips in the project area for which people will choose to use transit or drive to complete their trip. The projected induced trips for each project and their related avoided VMT are calculated based on project-specific characteristics, including the density of passenger trips in the corridor, the average distance per passenger trip and the access to personal vehicles by transit users. Baseline annual growth in ridership was excluded from the analysis, so the population of existing ridership users is assumed to remain constant to ensure definition of the number of induced trips over the analysis period. Total avoided passenger VMT for the opening year and the 2050 forecast year are shown in Table 5.

Table 5. Avoided passenger VMT for transit priority enhancement projects

Project Name	Reduction in Passenger VMT		
	Annual Average (2025 to 2050)	Cumulative from 2025 to 2030	Cumulative from 2025 to 2050
Transit Priority Upgrades for NextGen Tier 1 Routes	50,783,366	152,350,098	1,168,017,416
Venice Blvd Improvements for Bus and Bike Enhancements (National to Arlington)	3,128,302	9,384,906	71,950,943
Atlantic Blvd/Garvey Ave and Holt Ave Bus Priority Lanes	7,465,297	22,395,891	171,701,834
Transit Priority Upgrades for OCTA Harbor Blvd Connected Bus	9,157,899	27,473,697	210,631,676
Total	**70,534,864**	**211,604,592**	**1,622,301,869**

METROLINK ANTELOPE VALLEY LINE INFRASTRUCTURE EXPANSIONS

GHG Reduction Estimate Method: A scenario planning model ridership over a 4-year time horizon (2023 to 2027), then extrapolated to 2028 to establish the 2028 Baseline and 2028 Service Growth Plan forecasts used in the calculation of benefits. As of June 30, 2023, Metrolink's ridership has recovered 50% of 2019 ridership, with only 85% of 2019 service restored. Based on the 2028 Baseline forecast, weekday ridership will return to 6.9 million annually, with 100% of 2019 levels of service in place by the year 2028. This represents a "business as usual" approach to service. The forecast is consistent with regionally supported plans of service growth in commuter rail and connecting local bus and rail transit, which produces 14.4 million annual weekday passengers in 2028. This ridership estimate year coincides with Metrolink's Antelope Valley Line (AVL) projects would begin operation. A conservative background rate of 0.02% was assumed between 2029 and 2053 for the quantification of benefits through 2050.

The ridership projection for the the AVL project was produced as part of Metrolink's ongoing Service Growth Development Plan (SGDP), as adjusted to reflect the portion of growth enabled by these projects. This adjustment was based on the increased trips between station pairs on the AVL supported by these projects, relative to the total trips in the SGDP model. The ridership increase is based on the assumption that these projects will enable hourly service along the AVL, extending four current short trips (between LA Union Station and Santa Clarita) to long trips (between LA Union Station and Lancaster), and adding five new long trips.

Models/Tools Used: To quantify the GHG benefits a tool was used based on the California Climate Investments suite of Quantification Methodologies and Calculator Tools for estimating GHG emission reductions and co-benefits (reductions in VMT and criteria pollutants). The specific tool is also one required by the California State Transportation Agency (CalSTA) for Transit and Intercity Rail Capital Projects (TIRCP) program grant applications. Its parameters and assumptions are overseen by CARB, allowing for differences in rail ridership, locomotive tiers, alternative fuels including battery electric, fuel cells, etc., and system efficiencies, using strict state passenger car vehicle emission standards and assumptions about low- and no-carbon vehicle penetration in the auto fleets of the future. This makes the resulting GHG analyses robust and fairly conservative.

The calculation of the reduction in GHG emissions is based on reduction of auto VMT by users mode-shifting to the expanded passenger train service, the reduction in diesel fuel consumption by the diesel locomotives, and the increase in electricity consumption by the zero-emission locomotives.

Measure Implementation Assumptions: The analysis for the period 2025-2050 includes two components: new AVL service beginning in 2028 through the end of 2040, which would be provided by Metrolink's cleanest available Tier 4 locomotives using renewable diesel fuel; and the new service from 2041 through 2050, will be powered by zero-emission locomotives. This is based on an agency-planned conversion of Tier 4 diesel locomotives to zero-emissions operation, and "electric" was selected as the fuel type for years 2041 through 2050 for the future planned operating scenario.

GHG Reduction Estimate Assumptions: As a protected TIRCP spreadsheet model, access to the specific assumptions related to calculating the GHG emissions is restricted. An emissions rate is applied to the VMT by autos and the locomotives to calculate the fuel and electricity consumption and/or related emissions. The grant ask only funds about 60% of the scoped improvements, requiring a proportional adjustment to the total reduction in GHG emissions to determine the benefit attributable to the project.

Reference Case Scenario (GHG Emissions or Activity Level): In the analysis, the reference case scenario is defined as the operation of current levels of passenger service using the Tier 4 locomotives. The annual growth rate is applied to the ridership under the scenario with the project and without the project. Users are assumed to continue using their current mode of transportation to complete their future trips.

Measure-Specific Activity Data: The analysis evaluated the change in travel behavior by users shifting from completing their trip by personal vehicle to using the AVL passenger train service, resulting in a reduction of VMT. The summary of the reduction in passenger VMT using a personal vehicle is shown in Table 6.

Table 6. Avoided passenger VMT for Metrolink AVL

	Reduction in Passenger VMT		
	Annual Average (2025 to 2050)	Cumulative from 2025 to 2030	Cumulative from 2025 to 2050
Total	11,708,094	37,009,008	269,286,170

To account for the emissions related to the new train service, the additional trip distance traveled with the eight net new service miles were added and annualized for weekday operations, using an factor of 273.5 days per year. Train VMT are not expected to change over the life of the project. The net new ridership and the train VMT for the expanded AVL train service by milestone year are shown in Table 7.

Table 7. Baseline Scenario – AVL Line – Balboa Double Track Extension and Lancaster Terminal Improvements

TIRCP Model Input	Year 2028	Year 2030	Year 2040	Year 2041	Year 2050
Net New Ridership	322.260	338,993	352,147	352,225	352,376
Train VMT	272,850	272,850	272,850	272,850	272,850

Table 8. GHG emissions reduced for Measure T6

Project Name	Reduction in CO_2e Emissions (metric tons)			
	Average (2025-2030)	Average (2025-2050)	Cumulative (2025-2030)	Cumulative (2025-2050)
Transit Priority Upgrades for NextGen	28,309	24,034	84,926	552,781
Venice Blvd Improvements for Bus and Bike Enhancements (National to Arlington)	1,176	1,423	3,529	32,733
Atlantic Blvd/Garvey Ave & Holt Ave Bus Priority Lanes	2,807	3,396	8,420	78,113
Transit Priority Upgrades for OCTA Harbor Blvd Connected Bus	3,443	4,166	10,329	95,824
Metrolink Antelope Valley Line Infrastructure Expansion	1,346	1,322	4,039	30,400
Total	**37,081**	**34,341**	**111,243**	**789,851**