

Technical Memorandum

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Subject: **Scenario Framework, Modeling Approach, and Results – VMT & Mode Share Target Setting**

LA22-3333

Introduction

In response to Board Motion 2021-0769 (December 2, 2021), the Los Angeles County Metropolitan Transportation Authority (Metro) launched a project to establish targets for future vehicle miles traveled (VMT) and mode share in Los Angeles County.¹ To guide Metro's target setting effort, a modeling-based approach was used to test packages of plans, policies, and programs – "scenarios" – that would result in different VMT and mode share outcomes. The main goal of this study is to identify the Metro actions and external partnerships that could advance its alignment with aspirational state and regional environmental sustainability, public health, and quality of life goals.

This memo describes the rationale underlying the scenarios and the methodology for each scenario tested in the model (i.e., the scenario framework and scenario components). The memo begins by describing the scenario framework and then follows by providing details on the scenario components.

An earlier memo entitled *Metro VMT and Mode Share Target Setting Background Review* (dated 02/22/2023) provides additional project background and summarizes the VMT and mode share targets already set by Metro and other peer agencies.

¹ Metro, December 2, 2021. Motion 2021-0769, Agenda Number 45. Retrieved from: <http://metro.legistar1.com/metro/attachments/52ec9a4f-66f0-4fbe-830e-43cd39cea93b.pdf>



Scenario Framework

The main goal of this study is to evaluate the Metro actions and external partnerships that could advance its alignment with aspirational state and regional environmental sustainability, public health, and quality of life goals. Previous to this study, Metro and the Southern California Association of Governments (SCAG) have undertaken various modeling efforts in order to inform key guiding documents, such as Metro's Long Range Transportation Plan (LRTP) and SCAG's Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS).

This study builds on, but differs from, those efforts in important ways. Unlike the RTP/SCS, which is developed at the regional scale, and unlike the LRTP, which does not have a core goal of VMT and GHG reduction, this study's primary goal is to explore the effects of implementing plans, policies, and programs at the county scale to build an understanding of how VMT reduction and non-auto mode share could be maximized. Metro is among the first transit agencies in the country to embark on this type of study which is anticipated to result in adopted VMT and mode share targets for the agency.

To perform this exploration, three scenarios were developed on top of one "No Project" scenario. Each scenario has a horizon year of 2045, which aligns with the SCAG 2020 RTP travel demand model. The scenarios are:

- **Scenario 0 (S0) – No Project:** describes what the VMT and mode share outcomes would be if the population and employment grew to 2045 as forecasted, but no transportation system changes were implemented past what will be complete by 2025.
- **Scenario 1 (S1) – Adopted & Ambitious Plans:** replicates most of what was tested in Metro's 2020 Long Range Transportation Plan (LRTP), which includes adopted plans as well as more ambitious plans.
- **Scenario 2 (S2) – Expanded & Fiscally Unconstrained:** a fiscally unconstrained scenario wherein more funding is available, within reason, to enhance the levers tested in S1.
- **Scenario 3 (S3) – Multi-Jurisdictional Coordination:** includes further enhancements to S2, while also adding levers that are fully within local control (e.g., local land use policy).

Scenarios are built on policy and programmatic levers that influence VMT and mode share. Each scenario builds upon the VMT reduction levers of the previous scenario by increasing their degree of implementation, or by adding new levers. The progression from S1 to S3 also reflects the level of authority that Metro possesses to implement the associated levers independent of partnerships. While all scenarios require some level of partnership, S1 contains levers that Metro has well-established authority to implement, while S3 includes levers that are the jurisdiction of partner agencies (e.g., local municipalities), hence its title, "Multi-jurisdictional Coordination."



Development of the Scenario Framework

This study is exploratory in nature and seeks to build an understanding of the relationship between VMT reduction outcomes as a result of plans, policies, and projects that are within Metro’s control, compared to those that require full inter-jurisdictional partnership to implement.

The results of this study will inform the determination of VMT and mode share targets. This project does not attempt a detailed alternatives analysis as would be conducted for an environmental impact assessment, nor does it replace any of Metro’s ongoing planning efforts.

To develop the scenario framework, a list of policy, project, and programmatic levers that influence VMT and mode share was organized along a spectrum of Metro control and presented to stakeholders for feedback. Sixteen high-level levers were identified within three “control” categories: “Metro owns and decides”, “Requires right-of-way (ROW) partnership”, and “Metro influences through funding and policy”. The project team gathered feedback from internal and external stakeholders to inform the organization of these levers across these categories. In some instances, the levers do not fit perfectly into the control spectrum; nevertheless, the concept is useful to develop a logical progression from one scenario to the next. **Table 1** shows the levers in order of decreasing control from “Metro owns and decides” to “Metro influences through funding/policy”. Darker colors within the same row indicate an enhancement in the elements of that lever from the previous scenario.



Table 1. Scenario Framework Summary

		Lever	S1	S2	S3
More Direct Control		Transit Service	Light Green	Medium Green	Dark Green
		Transit Pass Programs	Light Green	Medium Green	Dark Green
		Regional TDM Program	Light Green	Medium Green	Dark Green
		Joint Development	Light Green	Light Green	Light Green
		Metro Parking	White	White	Light Green
Requires Partnership		Transit Infrastructure	Light Green	Medium Green	Dark Green
		Regional Active Transportation	Light Green	Medium Green	Dark Green
		ExpressLanes	Light Green	Medium Green	Dark Green
		Complete Streets & Highways Program	Light Green	Medium Green	Dark Green
		Congestion Pricing	White	Light Green	Light Green
Influence through Funding & Policy		VMT Fee	White	White	Light Green
		Local Active Transportation	White	White	Light Green
		Local Telecommuting Programs	White	White	Light Green
		Local TDM Programs	White	White	Light Green
		Local Parking Costs	White	White	Light Green
		Local Land Use Policy	White	White	Light Green

This framework was presented and workshopped through six stakeholder meetings (two internal stakeholder meetings across Metro departments, two external stakeholder meetings with staff from various local government agencies, Metro’s Sustainability Council, and one focused meeting with Metro’s LRTP team). The project team incorporated the feedback provided, which resulted in adjusting, adding, or removing some levers. Additionally, some elements that were initially described together were separated. For example, “road pricing policies” was divided into cordon- and corridor-based pricing (“Congestion Pricing”) and a per-mile VMT Fee as separate line items to indicate a different level of Metro control between the two.

Modeling Approach

This analysis uses the SCAG 2020 RTP activity-based model (ABM), which is the adopted regional model for the six-county SCAG area. The transportation planning industry is transitioning to more widespread adoption and use of ABMs from trip-based models (TBM). Relative to TBMs, which are based primarily on balancing land use trip generation rates at the regional level, ABMs provide improved accuracy and enhanced granularity in modeling everyday travel behavior by simulating



chained multi-modal trips in service of defined individual and household activities (e.g., work, school, recreation, food, entertainment). This allows for more detailed estimation of VMT at a household and employer level, as well as a more accurate estimation of mode share.

The following types of projects and programs were analyzed using the SCAG ABM for each of the scenarios described later in this memo:

- Roadway and highway projects
- Transit infrastructure and service projects (e.g., Measure M, Metro NextGen Bus Plan)
- Cordon-zone and corridor-based congestion pricing; VMT fee
- Land use, population, and employment changes (e.g., Metro Joint Development)
- Regional travel demand management (TDM) parameters and work from home

Regional ABMs such as the SCAG ABM are less sensitive to certain types of projects, plans, and policies such as active transportation and first/last mile improvements. In order to capture the VMT reduction and mode shift potential of these levers, off-model calculations were developed based on guidance provided in the California Air Pollution Control Officers Association's (CAPCOA) *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity*, and other published research.²

The **inputs** for each scenario were developed by the project team and informed by focused conversations with the Metro divisions that would be responsible for implementing the policies, plans, and projects. Through these conversations, the team determined the specific projects and policies that would be aligned with each scenario: "S1 – Adopted and Ambitious," "S2 – Expanded and Unconstrained," or "S3 – Multi-Jurisdictional Partnership." The **outputs** from each scenario were summarized in two ways, which reflect two different approaches to quantifying VMT:

- Home-based VMT (a.k.a. "residential") – Sum of all VMT by residents of households living within the County, including the full length of trips that start in or end outside LA County
- Origin-Destination (OD) VMT – Sum of VMT from all trips that start or end in LA County regardless of the residential location of the person making the trip

Each of these metrics reflect a different way of thinking about VMT. Home-based VMT (**Figure 1**) includes all mileage driven by LA County residents, but omits VMT from trips taken by non-LA County residents. OD VMT (**Figure 2**) accounts for more of the vehicles that use LA County roadways. While these two metrics capture different kinds of VMT, both adhere to recent guidance from the Governor's Office of Planning and Research (OPR) on implementation of SB 743.

² California Air Pollution Control Officers Association's (CAPCOA). (2021). "Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity." Retrieved from: <https://www.caleemod.com/handbook/index.html>



Figure 1. Home-based VMT



Figure 2. OD VMT





Scenario Details

This section summarizes each scenario, lists the levers included, and describes their associated components.

Baseline Year 2016

The baseline year scenario is based on the “off-the-shelf” 2016 base year scenario of the SCAG 2020 RTP model. This scenario reflects the LA County transportation network in early 2016, prior to the opening of the Gold Line Foothill Extension Phase 2A and Expo Line Phase 2 projects. The SCAG 2016 Model Validation Report covers SCAG’s process for validating this scenario based on extensive regional data and literature review.³ This scenario is used to estimate the VMT and mode share changes associated with each scenario.

Scenario 0 (So) – No Project

As stated previously, Scenario 0 is a “No Project” scenario for comparison only, that estimates how countywide VMT may trend in the future if Metro continues to offer current service levels but implements no additional plans and projects that are not already under construction. Scenario 0 combines the “off-the-shelf” 2025 scenario network of the SCAG 2020 RTP model with the 2045 horizon year scenario’s socio-economic/demographic (SED) inputs and regional travel behavior parameters, minus any TDM parameters for policies yet to be implemented such as pricing strategies. The SCAG model’s 2025 scenario represents a “near future” with the under-construction D Line Extension Phases 1 & 2, C/K Lines gap closure, A Line Foothill Extension Phase 2B, and LAX Automated People Mover fully operational, but Metro NextGen bus service patterns not fully implemented.

Scenario 1 (S1) – Adopted & Ambitious Plans

Scenario 1 includes projects that are planned, adopted, and on track to be funded. Much of what was adopted in the LRTP is included in S1; there are differences in how joint development projects, regional TDM programs, and a VMT fee were included.

Transit Service

- Component 1: Metro NextGen Bus Plan Transit First Scenario

³ SCAG (2020). 2016 Regional Travel Demand Model and Model Validation Report.
https://scag.ca.gov/sites/main/files/file-attachments/validationsummaryreport_20rtp_final_2020_05.pdf?1659028273



Transit service refers to projects that improve performance like speed and frequency. Transit infrastructure is separate lever in the scenario framework. Transit service was differentiated between transit infrastructure because Metro has greater control over service improvements, whereas infrastructure improvements require coordination with municipalities.

Metro's NextGen Bus Plan is an approved plan to improve the speed, frequency, reliability and accessibility of Metro's service to riders.⁴ The plan included three alternative scenarios: Scenario A – Reconnect, Scenario B – Transit First, and Scenario C – Future Funding. During internal meetings, Metro staff indicated that Scenario B – Transit First would be appropriate to include in S1 as it represents Metro's commitment via the NextGen Bus Plan. To represent Transit First improvements, Metro staff provided a list of corridors to receive bus-related infrastructure improvements. Bus speed improvement estimations indicated that speeds could increase by 30 percent as a result of these improvements. As such, buses that travel along these corridors were given a speed improvement of 30 percent.

Transit Pass Program

- Component 1: Fare-free transit for K-12 and university students [off-model]

S1 integrates a fare-free transit policy solely for K-12 and university students. This component is based on Metro's current GoPass for K-12 and Community College Students, which allows students at participating schools to ride Metro for free. This component is calculated using off-model procedures. For more details, see the Student Transit Pass section in the off-model chapter.

Regional Transportation Demand Management Program

- Component 1: SCAG ABM's TDM factor

Transportation demand management (TDM) programs are initiatives aimed at reducing reliance on single-occupancy vehicles and promoting more sustainable transportation options. These programs can involve a combination of strategies like marketing for public transportation, carpooling and ridesharing, biking and walking programs, flexible work arrangements, and incentivizes. At the end of 2022, the Metro Board of Directors approved a contract to develop a TDM Master Plan, this lever seeks to capture the benefits of the effort.⁵ By default, the SCAG ABM incorporates a TDM factor of 3.0545 percent. S1 assumes this default value.

⁴ Los Angeles County Metropolitan Transportation Authority (Metro) – Operations, Safety, and Customer Experience Committee. (2020). File #:2020-0617. Subject: NextGen Bus Plan. Retrieved from: <https://metro.legistar.com/LegislationDetail.aspx?ID=4665087&GUID=13E3E388-273A-4BEB-B76F-2764C25D7440&Options=ID%7cText%7c&Search=nextgen>

⁵ Los Angeles County Metropolitan Transportation Authority (Metro) – Planning and Programming Committee. (2022). File #: 2022-0465. Subject: Transportation Demand Management Master Plan and Program Contract. Retrieved from: <https://boardagendas.metro.net/board-report/2022-0465/>



Joint Development

- Component 1: 7,536 Metro Joint Development (JD) housing units

Metro owns several properties near transit and has adopted a Joint Development (JD) Policy. The JD policy is structured to build affordable housing near transit, which studies have shown would lead to an increase in transit riders. In 2021, Metro set a goal to complete 10,000 housing units by 2031.⁶ At the time of the analysis, 7,536 housing units in 21 sites (JD locations) had been identified – these housing units were added to the transportation model in the form of multi-family housing. To reflect these changes, an equivalent number of households within the region, outside of a half-mile from rail stations, and with a family gross-income of 50 percent below the Los Angeles area median income were shifted to JD locations.

Transit Infrastructure

- Component 1: Mobility Concept Plan (MCP)
- Component 2: Bus-only lanes built to date/planned

The MCP is a living project list developed by Metro to prioritize the mobility investments that serve the Los Angeles 2028 Olympic and Paralympic Games and to ensure a positive permanent legacy of the games. The Mobility Concept Plan includes both transit service and infrastructure projects. Various government offices will be involved in the planning and delivery of the MCP, though Metro is the lead mobility partner. Projects in the 2022 Prioritized MCP Project List were included in the model. These include fully funded projects, such as the G Line improvements, as well as unfunded and partially funded projects, such as bus-only lanes along several roadways.

Bus-only lanes built to date and those planned include corridors that are completely exclusive to buses, like the G (Orange) Line, as well as time-restricted corridors, like Grand Avenue and Olive Street bus priority lanes. To reflect the effects of the bus-only lanes, bus speeds on the corridors included were increased by 15 percent. If a bus-only lane aligned with a corridor in the NextGen Transit First scenario which received the 30 percent speed improvements in the model, bus speeds along such corridors were assigned a speed increase of 30 percent. If the project descriptions for planned bus-only lanes included lane removal, that was incorporated into the model. Decisions regarding the removal of automobile lanes or on-street parking were made on a case-by-case basis. The removal of on-street parking was prioritized over removal auto lanes where applicable.

⁶ Los Angeles Count Metropolitan Transportation Authority (Metro) – Operations, Safety, and Customer Experience Committee. (2020). File #:2021-0496. Subject: Joint Development Policy Goal. Retrieved from: file:///C:/Users/asarno/Downloads/Board%20Report-10.pdf



Regional Active Transportation

- Component 1: Active Transportation Strategic Plan (ATSP) related First/Last Mile (FLM) projects [off-model]

Metro staff provided a tiered list of projects that reflect their active transportation project priorities as they relate to their ATSP. The project list included First/Last Mile, Pedestrian, and Bicycle projects. Metro defines “active transportation” as any non-motorized mode of travel, including walking, bicycling, rolling, skating, or scootering. The ATSP serves as Metro’s overall strategy for funding and supporting implementation of active transportation infrastructure and programs in Los Angeles County. S1 includes all “tier one” FLM projects provided by Metro. This component is calculated using off-model procedures. For more details, see the First/Last Mile Station Improvements section in the off-model chapter. Note, Metro’s existing bikeshare system is assumed to be in place and contributing to the mode share of the 2016 base year. Scenarios 2 and 3 include an expansion of the bike share program.

ExpressLanes

- Component 1: LRTP changes for Measure M funded projects

S1 incorporates an increase in HOT3+ lanes (ExpressLanes) reflecting those that are included in Measure M. Two HOT3+ Express Lanes in each direction were coded into the I-105 corridor from I-405 to I-605.

Complete Streets & Highways Program

- Component 1: I-5 Corridor Improvement Project (I-605 to I-710)
- Component 2: Remove I-710 Expansion Project

Modifications were made to the portfolio of highway projects that is included in the SCAG ABM off-the-shelf model to reflect recent project and policy changes. The Measure M Expenditure Plan was cross-referenced with the projects included in the SCAG ABM off-the-shelf model and the I-5 Corridor Improvement project was added. The project adds one general purpose lane and one carpool lane in each direction, for a total of seven miles. When complete, there will be a total of five general purpose lanes and one carpool lane in each direction. Also, because the SCAG ABM was published in 2020, it included the I-710 South freeway expansion. Since the project has been cancelled, it was removed.

In line with Caltrans policies related to the implementation of Senate Bill (SB) 743, induced VMT related to new highway projects must be fully mitigated. At the time of analysis, Metro’s approach to mitigation was still unfolding, so for the purposes of this study, no additional mitigations were assumed.



Scenario 2 (S2) – Expanded & Fiscally Unconstrained

Scenario 2 assumes a fiscally unconstrained scenario that adds to, accelerates, and enhances projects, programs and policies tested in S1.

Transit Service [Enhanced from S1]

- Component 1: Metro NextGen Bus Plan Transit First Scenario
- Component 2: Metro NextGen Bus Plan Future Funding Scenario frequency changes

As mentioned previously, the NextGen Bus Plan included three alternative scenarios: Scenario A – Reconnect, Scenario B – Transit First, and Scenario C – Future Funding. In addition to the Transit First speed improvements applied in S1, bus frequencies along the corridors identified were increased by 34 percent. This increase was based on revenue service hour differences between the Transit First (7.0 million revenue service hours) and Future Funding scenarios (9.4 million revenue service hours).

Transit Pass Program [Enhanced from S1]

- Component 1: Expanded fare-free and subsidized fare programs on Metro services

The transit pass programs lever is enhanced from S1 to S2 to test the maximum expansion of free fare or subsidized pass programs on Metro services in LA County, including Metro buses, urban rail, BRT lines, and transfers to local bus operators (e.g., Santa Monica Big Blue Bus, Foothill transit, etc.). This policy excludes Metrolink riders and fares for rides taken fully on other (non-Metro) operators. The student travel pass off-model adjustment was removed from S1 to S2 given that the free fare and transfers program would apply to all riders including students.

Regional Transportation Demand Management Program [Enhanced from S1]

- Component 1: Increase the SCAG ABM TDM factor by 10%

The regional transportation demand management programs lever is enhanced from S1 to S2 by increasing the TDM factor by 10%. The S2 TDM factor is 3.35995 percent.

Joint Development

- Component 1: 7,536 Joint Development (JD) housing units

This lever is the same as in S1.

Transit Infrastructure [Enhanced from S1]

- Component 1: Mobility Concept Plan (MCP)
- Component 2: Bus-only lanes built to date/planned



- Component 3: Rail lines
- Component 4: Metro subregional strategic unfunded project lists

The MCP projects are the same as those in S1. The MCP is a living project list developed by Metro to prioritize the mobility investments that serve the Los Angeles 2028 Olympic and Paralympic Games and to ensure a positive permanent legacy of the games. The Mobility Concept Plan includes both transit service and infrastructure projects. Various government offices will be involved in the planning and delivery of the MCP, though Metro is the lead mobility partner. Projects in the 2022 Prioritized MCP Project List were included in the model. These include fully funded projects, such as the G Line improvements, as well as unfunded and partially funded projects, such as bus-only lanes along several roadways.

In addition to the bus-only lanes built to date/planned included in S1, additional transit corridors identified via research were added. Furthermore, rail line improvements (such as the B (Red) Line extension from NoHo to Hollywood Burbank Airport, G Line conversion to rail, and C & K Line extension to Norwalk Metrolink station) were added where Metro has indicated future implementation will occur.

The Metro subregional strategic unfunded projects were collected by Metro during the 2020 LRTP effort from subregional partners. All the projects were unfunded needs that include capital improvements that would improve mobility, reduce congestion, and serve a regional need. These lists were submitted by the subregional Councils of Governments. Modal categories include transit, active transportation and complete streets, highway improvements, and goods movement. Many projects on this list were duplicative of projects that were gathered from other sources, and some were specific enough to incorporate. Any non-duplicative project with enough specificity to be included in the model was added to this scenario.

Regional Active Transportation [Enhanced from S1]

- Component 1: ATSP FLM [off-model]
- Component 2: ATSP Bikeways [off-model]
- Component 4: Bikeshare expansion [off-model]

This lever is enhanced from S1 to S2 to include implementation of “tier one” ATSP bikeways, pedestrian facilities, and bikeshare expansion. The ATSP bikeways comes from the list provided by Metro described in Scenario 1. The bikeshare expansion simulates if bikeshare were to expand to TAZs which do not already have a bikeshare facility. All of the components in this lever were calculated using off-model procedures. For more details see each respective section in the off-model chapter.

ExpressLanes [Enhanced from S1]

- Component 1: Match the LRTP changes for all highway HOT3+ ExpressLanes



The ExpressLanes lever is enhanced from S1 to S2 to include all HOT3+ ExpressLanes projects included in the LRTP, regardless of Measure M funding.

Complete Streets & Highways Program [Enhanced from S1]

- Component 1: Include I-5 Corridor Improvement Project (I-605 to I-710)
- Component 2: Remove I-710 Expansion Project
- Component 3: Incorporate the I-405 Comprehensive Multimodal Corridor Plan (CMCP)

The first two components are the same in S2 as S1.

This lever is enhanced from S1 to S2 by including projects in the I-405 CMCP. The I-405 CMCP provides a guiding vision for addressing congestion and its impacts through an array of multimodal transportation solutions along the I-405 Corridor. The plan includes a project list. Some projects from this list were excluded based on Metro input, recent published staff reports, and other Metro board discussions.

Cordon- and Corridor-based Congestion Pricing [New lever in S2]

- Component 1: Test cordon/corridor pricing scenarios on a zone or corridor basis

Cordon and corridor pricing are road pricing concepts that would apply to drivers who use certain corridors or enter certain zones (as opposed to a per-mile fee). These concepts have been under consideration at Metro and elsewhere in California and across the country. For the purposes of the modeling conducted in this study, the concepts that are currently under investigation at Metro via the Traffic Reduction Study (TRS) were included in S2.

Scenario 3 (S3) – Multi-jurisdictional Coordination

Scenario 3 represents a scenario where Metro and local governments work together to prioritize sustainable transportation options and access to transit. To simulate this, five new local levers were added to this scenario.

Transit Service

- Component 1: Metro NextGen Bus Plan Transit First Scenario
- Component 2: Metro NextGen Bus Plan Future Funding Scenario frequency changes

This lever is the same as in S2.

Transit Pass Program [Enhanced from S2]

- Component 1: Expanded fare-free and subsidized fare programs on Metro services, Metrolink services, and Municipal transit operators



The transit pass programs lever is further enhanced from S2 to S3 to test the maximum expansion of free fare or subsidized pass programs on Metro services in LA County, as well as Metrolink services and Municipal transit operators.

Regional Transportation Demand Management Program

- Component 1: Increase the SCAG ABM TDM factor by 10%

This lever is the same as S2.

Joint Development

- Component 1: 7,536 Joint Development (JD) housing units

This lever is the same as in S1 and S2.

Metro Parking Costs [New lever in S3]

- Component 1: Drop Metro Park & Ride price relative to local parking costs

Metro owns several parking lots. This lever reduced the price for Metro parking lots and allowed Park & Ride to be free, creating an incentive within the model to shift from passenger vehicles to transit by making the total cost of transit, including park-and-ride costs, lower. This lever was not tested in S1 or S2 because this effect would be minimal without also increasing the parking costs of surrounding areas (non-Metro lots) and the overall cost of driving, both of which are included in S3 but not S1 or S2.

Transit Infrastructure

- Component 1: Mobility Concept Plan (MCP)
- Component 2: Bus-only lanes built to date/planned
- Component 3: Rail lines
- Component 4: Metro subregional strategic unfunded project list

This lever is the same as S2.

Regional Active Transportation [Enhanced from S2]

- Component 1: ATSP FLM [off-model]
- Component 2: ATSP Bikeways [off-model]
- Component 3: ATSP Pedestrian facilities [off-model]
- Component 4: Bikeshare expansion [off-model]

This lever is enhanced from S2 to S3 by including “tier two” and “tier three” ATSP bikeway projects. The ATSP bikeways component was calculated using off-model procedures. For more information, see the ATSP Corridors section of the off-model chapter.



ExpressLanes

- Component 1: Match the LRTP changes for all highway HOT3+ ExpressLanes

This lever is the same as S2.

Complete Streets & Highways Program

- Component 1: Include I-5 Corridor Improvement Project (I-605 to I-710)
- Component 2: Remove I-710 Expansion Project
- Component 3: Incorporate the I-405 Comprehensive Multimodal Corridor Plan (CMCP)

This lever is the same as S2.

Cordon- and Corridor-based Congestion Pricing

- Component 1: Test cordon/corridor pricing scenarios on a zone or corridor basis

This lever is the same as S2.

VMT Fee [New lever in S3]

- Component 1: Test a 20 cent VMT fee on a per-mile basis

The VMT Fee lever a 20 cent VMT fee per mile of vehicle travel on top of auto operating costs within the model. This concept is aligned with California initiatives such as action S6.2 in the Climate Action Plan for Transportation Infrastructure (CAPTI)⁷.

Local Active Transportation [New lever in S3]

- Component 1: Add active transportation projects from the Metro subregional strategic unfunded list [off-model]

The Metro subregional strategic unfunded projects list described in transit infrastructure lever in S2 included active transportation projects as well as transit projects. Effects from the active transportation projects in that list were calculated using off-model procedures. For more information, see the Local Active Transportation Projects section of the off-model chapter.

Local Transportation Demand Management (TDM) Program [New lever in S3]

- Component 1: Integrate the effect of local TDM programs on VMT [off-model]

⁷ CalSTA. (July 2021). Climate Action Plan for Transportation Infrastructure. Available at <https://calsta.ca.gov/-/media/calsta-media/documents/capti-july-2021-a11y.pdf>. Action S6.2 states "Convene a Roadway Pricing Working Group to Provide State Leadership and Support for Implementation of Local, Regional, or State Efforts."



This lever was calculated using off-model procedure. For more information, see the Local TDM Programs section of the off-model chapter. The inclusion of a local TDM program in addition to a regional TDM program (as captured in S1 and S2) reflects the potential for additional VMT reduction beyond what is possible through Metro's TDM activities, for example by passing a local ordinance that requires new developers to adopt TDM plans or existing employers to begin offering transit benefits to their employees.

Local Parking Costs [New lever in S3]

- Component 1: Increase countywide parking costs

There is evidence that suggests parking availability leads to more driving. This component simulates coordination across local jurisdictions to disincentivize driving by increasing the cost of parking by 10 percent across the county.

Local Land Use Policy [New lever in S3]

- Component 1: Transportation Oriented Development (TOD) using a prototypical land use mix (residential + retail/commercial) around all Metro rail and Metrolink stations
- Component 2: Reallocate housing away from less efficient growth areas

Transportation Oriented Development is "the creation of compact, walkable, pedestrian-oriented, mixed-use communities centered around high-quality train systems."⁸ To integrate TOD into the model, for any city that has a Metro Rail or Metrolink station, the future growth in households and jobs was reallocated to a "TOD zone". For cities without Metro rail or Metrolink stations, no change was applied to the future growth. TOD land use mix reflected mixed-use with a balance of residential, retail, and commercial.

For the purpose of this analysis, "TOD zones" are defined as TAZs located within a radius of ½ mile of the Metro rail and Metrolink stations in the LA County. There are 56 cities with TOD zones in the model, which includes a total of 1,537 TOD TAZs. A total of 229,614 multi-family households and 246,498 jobs were relocated from non-TOD TAZs to TOD TAZs within their respective city, representing six percent of future households and five percent of future jobs, countywide.

⁸ Transit Oriented Development Institute. Retrieved from: <http://www.tod.org/>



Off-Model Methodologies

This section summarizes the off-model approaches used in the LA Metro VMT and Mode Share Target Setting modeling effort. The measures requiring off-model calculations are listed below and described in additional detail in the corresponding sections.

- ATSP First/Last Mile Station Improvements
- Student Transit Pass
- Bikeshare Expansion
- ATSP Bicycle Corridors
- Local Pedestrian Improvements
- Local TDM Programs

ATSP First/Last Mile Station Improvements (All Scenarios)

The VMT reduction potential of first/last mile (FLM) improvements was estimated using the equation below for each scenario. This approach was applied to TAZs within a half mile of priority locations for FLM improvements, aligned with the transit station walkshed. FLM improvements typically include a package of improvements that make it easier to use transit – such as wayfinding, crossing improvements, bike parking and bike access improvements – but do not change the nearby land use or the transit service available at the station. The priority locations for FLM improvements were provided by Metro. **Table 2** provides a description of each parameter.

$$A = \frac{B * C}{D} * E$$

Table 2: First/Last Mile Station Improvements VMT Reduction Calculation Parameters

Parameter	Value
A Total daily VMT reduction	--
B First/last mile (FLM) factor	3%
C Total daily transit trips	TAZ dependent, scenario dependent
D Total daily person trips in vehicles	TAZ dependent, scenario dependent
E Total daily VMT	TAZ dependent, scenario dependent

To estimate total daily VMT reduction from FLM improvements, the VMT reduction was calculated for each TAZ in LA County within a half mile of a priority location for FLM improvement and then summed. This process was performed once in terms of home-based VMT and once in terms of OD VMT for each scenario. Scenario 1 considered Tier 1 FLM priority locations, which are likely to



receive funding through the Metro Active Transportation (MAT) Program, while the remaining scenarios included Tier 1, 2, and 3 locations, reflecting expanded funding for FLM improvements.

The FLM factor, 3%, was multiplied by total daily transit trips in each relevant TAZ to estimate the increase in daily transit trips from FLM station improvements.⁹ The estimated increase in transit trips was divided by the total person trips in vehicles in each relevant TAZ to determine the percent reduction in vehicle person trips, which was assumed to be equal to the percent reduction in VMT. The percent reduction in VMT was multiplied by the total daily VMT in each relevant TAZ to estimate the daily VMT reduction of FLM improvements. The total daily transit trips, person trips in vehicles, home-based VMT, and OD VMT in TAZs within a half mile of FLM locations were obtained from the SCAG ABM results for all Scenarios in this study.

Student Transit Pass (Scenario 1)

The VMT reduction potential of the student transit pass subsidy was estimated by adapting research findings from the 2021 CAPCOA reference manual on the VMT reduction potential associated with transit pass subsidies (Measure T-9). The equation below was employed to estimate the VMT reduction potential of a student transit pass subsidy. **Table 3** provides a description of each parameter.

$$A = \left(\left(\frac{C}{B} \right) * E \right) * D * F * G$$

Table 3: Student Transit Pass VMT Reduction Calculation Parameters

Parameter	Value
A Total daily VMT reduction	--
B Average transit fare without subsidy	\$1.75
C Subsidy amount	\$1.75
D Transit mode share of all K-12 & college student trips	TAZ dependent
E Elasticity of transit boardings with respect to transit fare price	0.43
F Percent of transit trips that would otherwise be made in a vehicle	K-12: 50% University: 20% ¹⁰
G Total student generated daily VMT	TAZ dependent

⁹ The UTA FLM Strategies Study estimated that transit ridership would increase up to 3% if a comprehensive program of first/last mile solutions were to be implemented. Reference: Utah Transit Authority (UTA). (2015). "First/Last Mile Strategies Study." Retrieved from: https://www2.rideuta.com/-/media/Files/About-UTA/Tiger-VIII/UTAFirst_LastMileFINALCOMP1.hrashx?la=en

¹⁰ The University factor differs from the K-12 factor based on data provided by Metro's UPass program. Reference: Fehr & Peers. (2021). "VMT Mitigation Program Pilot Project." Retrieved from: <https://scag.ca.gov/sites/main/files/file-attachments/ladot-vmt-mitigation-program-report.pdf?1643075394>



To calculate the total daily school purpose VMT reduction from a student transit pass subsidy, the school purpose VMT reduction was calculated for each TAZ in LA County and then summed. This process was performed for Scenario 1 only as transit is assumed to be free in all subsequent scenarios. First, the subsidy amount as a percentage of the transit fare without subsidy was multiplied by the elasticity of transit boardings with respect to transit fare price; in this case the subsidy was equal to 100 percent of the transit fare.¹¹ For each TAZ in LA County, the product of this first step was multiplied by the transit mode share of all student trips in the TAZ, the percent of transit trips that would otherwise be made in a vehicle, and the total student generated daily VMT in the TAZ.¹² Student generated daily VMT is the VMT from all school-purpose trips attracted by K-12 schools or colleges/universities. The daily school purpose VMT reduction was calculated separately for K-12 students and college students in each TAZ because parameters D, F, and G differed for these two populations. The daily school purpose VMT reduction for K-12 and college students was summed to get the total daily VMT reduction from a student transit pass subsidy in each TAZ. The total daily OD VMT reduction from this measure was estimated by multiplying the total daily school purpose VMT reduction by two.

Bikeshare Expansion (Scenarios 2-3)

The VMT reduction potential of expanding the bikeshare program was estimated by adapting research findings from the 2021 CAPCOA reference manual on the VMT reduction potential associated with implementing a bikeshare program (Measure T-22A). The equation below was employed to estimate the VMT reduction potential of expanding the bikeshare program. **Table 4** provides a description of each parameter.

$$A = \frac{(C - B) * D * E * F}{G * H} * I$$

¹¹ The elasticity variable is based on an academic study (Taylor et al. 2008) of transit use in 265 urbanized areas in the U.S., which found a 0.43 percent increase in transit boardings occurs for every 1 percent decrease in transit fare price.

¹² The transit mode share of student trips by TAZ and the student generated daily VMT by TAZ were obtained from the SCAG 2020 TRIP Activity-Based Travel Demand Model. The percent transit trips that would otherwise be made in a vehicle was based on CAPCOA estimates for K-12 students and more recent internal research on university students.



Table 4: Bikeshare Expansion VMT Reduction Calculation Parameters

	Parameter	Value
A	Total daily VMT reduction	--
B	Percent of service population in plan/community with access to bikeshare system without measure	TAZ dependent
C	Percent of service population in plan/community with access to bikeshare system with measure	TAZ dependent, scenario dependent
D	Daily bikeshare trips per person	0.021
E	Vehicle to bikeshare substitution rate	19.6%
F	Bikeshare average one-way trip length	1.4 miles
G	Daily vehicle trips per person	TAZ dependent, scenario dependent
H	Average one-way vehicle trip length	TAZ dependent, scenario dependent
I	Total daily passenger VMT	TAZ dependent, scenario dependent

To calculate total daily home-based VMT reduction from a bikeshare expansion, the estimated percent VMT reduction in each TAZ in LA County was multiplied by the daily home-based VMT in each TAZ and then summed. This approach relied on Tier 2 TAZs, which align to Census Block Groups. This process was performed for Scenarios 2 and 3. Scenario 1 is presumed to have the effects of the current extent of the bikeshare system already reflected in the bicycle mode share within the model.

Each TAZ was assessed to determine if it had access to the bikeshare system under the current system’s zones. All residents and employees in each TAZ were considered to have access to the existing bikeshare system if the TAZ was located within an eighth of a mile of an existing bikeshare station. TAZs that did not have access to an existing bikeshare station but had a higher-than-average bicycle mode share relative to the County average—1.84% in Scenarios 2, 2.05% in Scenario 3—were assigned a new bikeshare station. These parameters utilized data from Metro Bike Share and Scenarios 2 and 3 model results. For each TAZ with new access under each Scenario, the service population was multiplied by daily bikeshare trips per person, a vehicle to bikeshare substitution rate, and the average one-way bikeshare trip length to arrive at the new daily bikeshare miles traveled per person that shifted from vehicle miles.¹³ This value was divided by daily vehicle miles traveled per person (daily vehicle trips multiplied by average one-way vehicle trip length) to estimate the percent reduction in VMT from this measure in a given TAZ.

¹³ Parameters D, E, and F were based on the recommended values in the CAPCOA “Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity,” which draws from academic studies of bikeshare in the U.S., with a heavy focus on the San Francisco Bay Area.



The final step was to multiply the percent reduction in VMT from this measure by the daily home-based VMT in each TAZ. The daily vehicle trips per person, average one-way vehicle trip length, and daily home-based VMT were obtained from the model results for Scenarios 2 and 3.

To calculate total daily OD VMT reduction from a bikeshare expansion, instead of multiplying the percent VMT reduction in each TAZ in LA County by the total daily VMT in the TAZ and summing the outputs, the average of the estimated percent VMT reduction in each TAZ in LA County was multiplied by the OD VMT in LA County because OD VMT was not available at the Tier 2 TAZ level. The percent VMT reduction in each TAZ was calculated using the method described above. This process was performed for Scenarios 2 and 3. The daily vehicle trips per person, average one-way vehicle trip length, and daily OD VMT were obtained from the model results for Scenarios 2 and 3.

ATSP Bicycle Corridors (All Scenarios)

The VMT reduction potential of expanding bikeways was estimated by adapting research findings from the 2021 CAPCOA reference manual on the VMT reduction potential associated with expanding a bikeway network (Measure T-20). The expanded bikeway network included facilities provided by Metro designated as Tier 1, 2, and 3 priority bikeways in the draft Active Transportation Strategic Plan (ATSP) and via the South Bay Local Travel Network (LTN). The equation below was employed to estimate the VMT reduction potential of expanding the bikeway network in LA County. **Table 5** provides a description of each parameter.

$$A = \frac{\left(\frac{C - B}{B}\right) * D * F * H}{E * G} * I$$

Table 5: ATSP Corridor VMT Reduction Calculation Parameters

	Parameter	Value
A	Total daily VMT reduction	--
B	Existing bikeway miles in plan/community	1,873 miles
C	Bikeway miles in plan/community with measure	Scenario dependent
D	Bicycle mode share in plan/community	Scenario dependent
E	Vehicle mode share in plan/community	Scenario dependent
F	Average one-way bicycle trip length in plan/community	1.7 miles
G	Average one-way vehicle trip length in plan/community	Scenario dependent
H	Elasticity of bike commuters with respect to bikeway miles per 10,000 population	0.25
I	Total daily VMT	Scenario dependent



To estimate total daily VMT reduction from bikeway expansion in LA County, the VMT reduction percent was calculated at the county level and then multiplied by total daily VMT in LA County. This process was performed once in terms of home-based VMT and once in terms of OD VMT for each scenario.

Scenario 1 included Tier 1 ATSP corridors, which are the likeliest to be funded and implemented through existing MAT funding. Scenario 2 included Tier 1 and Tier 2 ATSP corridors, reflecting expanded funding. Scenario 3 included Tiers 1-3 ATSP corridors as well as the South Bay LTN, reflecting expanded funding and strong local partnership.

The sum of the existing bikeway miles in LA County was subtracted from the sum of bikeway miles in LA County following the implementation of the ATSP corridors, and LTN where applicable, then divided by the existing bikeway miles in LA County to determine the percent increase in bikeway miles from the measure. The percent increase in bikeway miles was multiplied by bicycle mode share, average one-way bicycle trip length, and the elasticity of bike commuters with respect to bikeway miles per 10,000 population to arrive at new bicycle miles traveled as a share of all trips with the measure.¹⁴ This value was divided by daily vehicle miles traveled as a share of all trips (vehicle mode share multiplied by average one-way vehicle trip length) to estimate the percent reduction in VMT from this measure in the county. The percent VMT reduction was multiplied by daily VMT in LA County to estimate the VMT reduction potential from this measure. The daily bicycle mode share, vehicle mode share, average one-way vehicle trip length, LA County daily home-based VMT, and LA County daily OD VMT were obtained from the model results for all scenarios.

Local Pedestrian Improvements (Scenario 3)

To estimate the VMT impact of pedestrian intersection improvements, an adapted version of CARB Congestion Mitigation and Air Quality (CMAQ) method was used. The pedestrian improvements identified were primarily intersections included in the City of Los Angeles' Mobility Plan 2035 Pedestrian Enhanced Districts (PED), some of which overlapped with the ATSP pedestrian zones. A handful of projects were also identified in Metro's Subregional Strategic Unfunded Project List. The CMAQ-based equation is shown below. **Table 6** provides a description of each parameter.

$$A = B * C * D * E * F * G * H * I$$

¹⁴ The average one-way bicycle trip length is based on 2017 National Households Travel Survey data for the Los Angeles-Long Beach-Anaheim Core-Based Statistical Area. The elasticity of bike commuters with respect to bikeway miles per 10,000 population is based on an academic study (Pucher & Buehler 2011) of the 100 largest U.S. cities, which found a 0.25 percent increase in commute cycling occurs for every 1 percent increase in bike lane distance.



Table 6: Pedestrian Improvements VMT Reduction Calculation Parameters

	Parameter	Value
A	Total annual VMT reduction	--
B	Days of use per year	0.91
C	Average daily pedestrian count	1,009.5
D	Growth factor (expected increase in pedestrian count)	0.65
E	Automobile substitution rate	0.1
F	Carpool factor	1.42
G	Trip type factor	0.646
H	Walking trip length	0.3
I	Number of pedestrian facility improvements	3,214

The days of use per year was sourced from CAPCOA (Table T-19.4) – the parameter accounts for days with poor weather conditions when pedestrian facilities are less likely to be used. The average daily pedestrian count was derived from a sample of LADOT pedestrian count volumes. The sample was representative of AM and PM peak hour counts in three different zone classifications (residential, commercial, and industrial) in eight different geographical groups based on community plan areas, for a total of 48 counts. To arrive at an estimated daily count, a 20 percent factor was applied to the average peak hour count. The growth factor applied is the CARB default value for an expected increase in pedestrian counts due to the improvement. The automobile substitution rate is the CARB default value for the expected rate of pedestrians who switch from driving due to the improvement. The carpool factor is the average vehicle occupancy rate sourced from the SCAG model. The trip type factor is a CARB variable that accounts for recreational walking trips that are not likely to replace automobile trips. The walking trip length is the average walking trip length found in the California Household Travel Survey. And lastly, as mentioned previously, the number of pedestrian facility improvements largely consisted of intersections identified in the City of Los Angeles’ Mobility Plan 2035 Pedestrian Enhanced Districts (PED), and some additional projects were also found in Metro’s Subregional Strategic Unfunded Project List.

Local TDM Programs (Scenario 3)

The VMT reduction potential of local transportation demand management (TDM) programs was estimated by adapting research findings from the 2021 CAPCOA reference manual on the VMT reduction potential associated with implementing a voluntary commute trip reduction program (Measure T-5). The equation below was employed to estimate the VMT reduction potential of local TDM programs. **Table 7** provides a description of each parameter.

$$A = B * C * D$$



Table 7: Local TDM Program VMT Reduction Calculation Parameters

Parameter		Value
A	Total daily VMT reduction	--
B	Percent of employees eligible for program	Jurisdiction dependent
C	Percent reduction in commute VMT for eligible employees	4%
D	Total daily VMT (home-based commute)	Jurisdiction dependent, scenario dependent

To calculate total daily home-based commute VMT reduction from local TDM programs in LA County, the VMT reduction percent was calculated for each jurisdiction and multiplied by total daily home-based commute VMT in the jurisdiction and then summed. For each jurisdiction in LA County, the percentage of employees eligible for the TDM program (0% or 100%) was determined by whether the jurisdiction had a TDM plan in place. If the jurisdiction had not yet adopted a TDM plan, we assumed the percent of employees eligible for the TDM program was 100%. For each jurisdiction, the percentage of employees eligible for the TDM program was multiplied by 4 percent, which is the estimated percent by which employer-based trip reduction programs reduce total commute VMT for employees at participating work sites.¹⁵ This produced the percent VMT reduction from local TDM programs in a jurisdiction, which was then multiplied by daily home-based commute VMT in the jurisdiction. Daily commute VMT for each jurisdiction was obtained from the model results for Scenario 3. The total daily OD VMT reduction from this measure was estimated by multiplying the total daily home-based commute VMT reduction by two.

¹⁵ Four percent represents the low end of the range cited in a policy brief (Boarnet et al. 2014) summarizing results of employer-based trip reduction studies. The policy brief found reduction potential ranged from 4 to 6 percent, but to be conservative, this calculation relies on the low end.



Results

The levers and components presented in this memo (i.e., the scenario framework), and their results via the model computation and off-model adjustments are summarized below.

Table 8 reports VMT results in terms of home-based VMT, reflecting the travel patterns of all residents within Los Angeles County, as well as Origin-Destination (OD) VMT, reflecting travel patterns of all residents and employees within Los Angeles County.

Table 8: VMT Results

		2016	S1 (2045)	S2 (2045)	S3 (2045)
	Population	10,107,130	11,668,802	11,668,802	11,668,802
	Employees	4,740,590	5,379,122	5,379,122	5,379,122
Home-Based VMT	Model VMT	206,998,482	202,257,954	200,907,691	176,581,152
	Off-Model Adjustments	-	-105,992	-226,319	-2,663,184
	Total VMT	206,998,482	202,151,962	200,681,372	173,917,968
	Per Capita (Pop)	20.5	17.3	17.2	14.9
	<i>Change (Miles)</i>	-	-3.2	-3.3	-5.6
	<i>Change (Percent)</i>	-	-15.4%	-16.0%	-27.2%
Origin-Destination VMT	Model VMT	441,839,540	445,109,686	441,129,952	393,622,643
	Off-Model Adjustments	-	-248,424	-711,125	-5,723,266
	Total VMT	441,839,540	444,861,262	440,418,827	387,899,377
	Per Capita (Pop + Emp)	29.8	26.1	25.8	22.8
	<i>Change (Miles)</i>	-	-3.7	-3.9	-7.0
	<i>Change (Percent)</i>	-	-12.3%	-13.2%	-23.5%

The results of the modeling show that the difference in VMT reduction between S1 and S2 is marginal. This indicates that the majority of VMT reduction from Metro-controlled actions may already be realized with the implementation of the agency's ambitious programs and policies that have already been adopted (S1). The *additional* VMT reductions available as a result of S2's service enhancements, free/subsidized Metro service, and a cordon- and corridor-based congestion pricing concept are relatively marginal compared to the reductions available between 2016 and S1 (2045).



Larger differences emerge between S1/S2 and S3. Adding elements like free/subsidized fares on *all* transit including Metrolink and municipal operators, a per-mile VMT fee that applies to *all* trips rather than only cordons or corridors, and a shift in land use to bring people and jobs closer to transit together produce a greater reduction than is available from the levers tested in S2.

Table 9 reports mode share in terms of auto modes (including single occupancy and high occupancy vehicles) and non-auto modes.

Table 9: Mode Share Results

		2016	S1 (2045)	S2 (2045)	S3 (2045)
Auto Modes	Single-Occupancy Vehicle	42.1%	40.2%	39.3%	35.9%
	<i>Change (percentage points)</i>	-	-1.9%	-2.8%	-6.2%
	<i>Change (percent)</i>	-	-4.5%	-6.7%	-14.8%
	High-Occupancy Vehicle	45.3%	42.6%	42.0%	40.8%
	<i>Change (percentage points)</i>	-	-2.8%	-3.3%	-4.5%
	<i>Change (percent)</i>	-	-6.1%	-7.3%	-10.0%
Non-Auto Modes	Transit	2.6%	5.3%	6.9%	9.5%
	<i>Change (percentage points)</i>	-	2.7%	4.3%	6.9%
	<i>Change (percent)</i>	-	103.9%	166.9%	264.5%
	Walk	7.0%	8.1%	8.1%	9.6%
	<i>Change (percentage points)</i>	-	1.1%	1.1%	2.7%
	<i>Change (percent)</i>	-	16.1%	15.8%	38.4%
	Bike	1.2%	2.2%	2.1%	2.4%
	<i>Change (percentage points)</i>	-	1.0%	0.9%	1.3%
	<i>Change (percent)</i>	-	86.6%	79.8%	107.6%
	Taxi	0.7%	0.7%	0.7%	0.8%
	<i>Change (percentage points)</i>	-	0.0%	0.0%	0.1%
	<i>Change (percent)</i>	-	-1.1%	-4.6%	12.2%
	School Bus	1.1%	0.9%	0.9%	1.0%
	<i>Change (percentage points)</i>	-	-0.2%	-0.2%	-0.1%
	<i>Change (percent)</i>	-	-16.6%	-18.4%	-10.0%
Total Non-Auto Modes		12.6%	17.2%	18.7%	23.3%
<i>Change (percentage points)</i>		-	4.6%	6.1%	10.8%
<i>Change (percent)</i>		-	37.0%	48.8%	85.9%

Appendix

This appendix includes a full list of the projects that were included in each modeled scenario.

Rail Projects

#	Project	Source	S1	S2	S3
1	Westside Purple Line Extension Section 1	Fully Funded Projects to Be Completed By 2028 Games	Included	Included	Included
2	Westside Purple Line Extension Section 2	Fully Funded Projects to Be Completed By 2028 Games	Included	Included	Included
3	Westside Purple Line Extension Section 3	Metro Measure M Project List, Fully Funded Projects to Be Completed By 2028 Games	Included	Included	Included
4	Foothill Gold Line Extension Phase 2B (Montclair)	2022 Prioritized MCP Project List	Included	Included	Included
5	East SF Valley Transit Corridor Project	Metro Measure M Project List	Included	Included	Included
6	West Santa Ana Transit Corridor LRT	Metro Measure M Project List	Included	Included	Included
7	Crenshaw/LAX Track Enhancement Program	Metro Measure M Project List	Included	Included	Included
8	Green Line Extension to Crenshaw Blvd in Torrance	Metro Measure M Project List	Included	Included	Included
9	Gold Line Eastside Extension to Greenwood	Metro Measure M Project List	Included	Included	Included
10	Airport Metro Connector	Metro Measure M Project List, Fully Funded Projects to Be Completed By 2028 Games	Included	Included	Included
11	Antelope Valley Line Improvements	Fully Funded Projects to Be Completed By 2028 Games	Included	Included	Included
12	Vermont Rapid Transit Corridor upgrade to HRT from Wilshire to Exposition.	Metro, SCAG 2020 RTP/SCS	Not included	Included	Included
13	Extend C and K Line to Norwalk Metrolink Station. Add an Amtrak station at Norwalk, same station as the C-Line Norwalk station.	Metro team's direction after reviewing the Rail Integration Study	Not included	Included	Included
14	Metro B (Red) Line Extension: NoHo to Hollywood Burbank Airport	Subregional Strategic Unfunded Projects	Not included	Included	Included



#	Project	Source	S1	S2	S3
15	Metro B/D (Red/Purple) Lines 6th Street/Arts District Station	Subregional Strategic Unfunded Projects	Not included	Included	Included
16	Metrolink River Park Station	Subregional Strategic Unfunded Projects	Not included	Included	Included
17	G-Line BRT upgrade to LRT	I405 CMCP List	Not included	Included	Included

2022 Prioritized MCP Project List (All Scenarios)

#	Project
1	G Line Improvements
2	NoHo to Pasadena BRT
3	North SFV Transit Corridor
4	I-105 ExpressLanes (Segment 1)
5	I-605 Hot Spots Projects
6	SR-91 Improvements
7	LA Union Station Forecourt and Esplanade Improvements
8	1-5 North County Enhancements
9	SR-57/SR-60 Interchange Improvements
10	Airport Metro Connector
11	Foothill Gold Line Extension Phase 2B (Pomona)
12	Regional Connector
13	Westside Purple Line Extension Section 1
14	Westside Purple Line Extension Section 2

#	Project
15	Westside Purple Line Extension Section 3
16	Antelope Valley Line Improvements
17	SR-57/SR-60 Interchange Improvements
18	Broadway Bus Only Lanes & TSP (NextGen Improvements)
19	Venice Blvd Bus Only Lanes & TSP (NextGen Improvements)
20	Vermont BRT
21	Inglewood (Century & Prairie) Bus Only Lanes
22	DTLA (extension of existing bus-only lanes)
23	Olympic Blvd Bus Only Lanes
24	Norwalk (Imperial Hwy) Bus Only Lanes
25	Inglewood Transit Connector
26	Foothill Gold Line Extension Phase 2B (Montclair)

Bus Only Lanes

#	Project	Status	Source	S1	S2	S3
1	Alvarado St Bus Priority Lanes Phase 1	Built	City of LA	Included	Included	Included
2	Alvarado St Bus Priority Lanes Phase 2	Planned	Metro	Included	Included	Included
3	Grand Av Bus Priority Lanes	Built	City of LA	Included	Included	Included
4	Olive St Bus Priority Lanes	Built	City of LA	Included	Included	Included
5	Wilshire Bl Bus Lanes	Built	City of LA	Included	Included	Included
6	Sunset/Chavez Bus Lanes	Built	City of LA	Included	Included	Included
7	Figueroa St Bus Lanes	Built	City of LA	Included	Included	Included
8	Flower St Bus Lanes	Built	City of LA	Included	Included	Included
9	Aliso St Bus Lanes	Built	City of LA	Included	Included	Included
10	5th St Bus Lanes	Built	City of LA	Included	Included	Included
11	6th St Bus Lanes	Built	City of LA	Included	Included	Included
12	Venice Bl Bus Lanes	Built	City of LA	Included	Included	Included
13	N Spring St Bus Lanes	Built	City of LA	Included	Included	Included
14	Alameda St Bus Lanes	Built	City of LA	Included	Included	Included
15	98 St Bus Lanes	Built	City of LA	Included	Included	Included
16	Culver Blvd Bus Lanes	Built	Fehr & Peers	Included	Included	Included
17	Santa Monica Blvd Bus Lanes	Built	Fehr & Peers	Included	Included	Included
18	Broadway Bus Lanes	Built	Fehr & Peers	Included	Included	Included
19	La Brea Av Bus Priority Lanes	Planned	Metro	Included	Included	Included
20	Florence Av Bus Priority Lanes	Planned	Metro	Included	Included	Included
21	Sepulveda Bl (Line 234) Bus Lanes	Planned	Metro	Included	Included	Included



#	Project	Status	Source	S1	S2	S3
22	North San Fernando Valley Transit Corridor	Planned	Metro	Included	Included	Included
23	San Gabriel Valley (SGV) Transit Corridor	Planned	Metro, SGVCOG	Not Included	Included	Included
24	Vermont Transit Corridor South Bay Extension	Planned	Metro	Not Included	Included	Included

Subregional Strategic Unfunded Projects List

#	Project	S1	S2	S3
1	Inglewood Transit Connector	Included	Included	Included
2	Downtown Burbank Olive Avenue Bridge BRT Station	Not Included	Included	Included
3	Metro B (Red) Line Extension: NoHo to Hollywood Burbank Airport	Not Included	Included	Included
4	The Old Road Safety and Capacity Enhancement - Segment 2	Not Included	Included	Included
5	I-605/Valley Blvd Interchange Improvement	Not Included	Included	Included
6	Glendale Streetcar System design and construction	Not Included	Included	Included
7	Metro B/D (Red/Purple) Lines 6th Street/Arts District Station	Not Included	Included	Included
8	Metrolink River Park Station	Not Included	Included	Included
9	Vermont Rapid Transit Corridor Upgrade to LRT or HRT	Not Included	Included	Included
10	Broadway Bus Lanes (2nd St to the bridge)	Not Included	Included	Included
11	Broadway BRT (Vernon to Cesar Chavez)	Not Included	Included	Included



I-405 Comprehensive Multimodal Corridor Plan (CMCP) Project List

#	Name (if applicable)	Reference ID	Short Description	S1	S2	S3
1	Inglewood Transit Connector	405CMCP_1301	The Inglewood Transit Connector Project is an approximately 1.6 mile fully elevated, automated transit system that will connect passengers from the Metro K Line's Downtown Inglewood Station to the City of Inglewood's new housing and employment centers and sports and entertainment venues including The Forum, SoFi Stadium and the Intuit Dome. The Project will complete the existing first/last mile gap and is scheduled to open in advance of the 2028 Olympic Games. Original Description This project is a new monorail system that connects the Crenshaw/LAX line to the Inglewood Entertainment District.	Included	Included	Included
2	(Not applicable)	405CMCP_0637	I-405 Expresslanes from I-105 to I-110 (segment is included in the Countywide ExpressLanes Strategic Plan Tier 1 project- I-405 from I-101 to Los Angeles/Orange County Line)	Not Included	Included	Included
3	(Not applicable)	405CMCP_0638	I-405 Expresslanes from I-110 TO LA/Orange County Line (segment is included in the Countywide ExpressLanes Strategic Plan Tier 1 project- I-405 from I-101 to Los Angeles/Orange County Line)	Not Included	Included	Included
4	(Not applicable)	405CMCP_0640	I-405 Expresslanes from I-10 to I-105 (segment is included in the Countywide ExpressLanes Strategic Plan Tier 1 project- I-405 from I-101 to Los Angeles/Orange County Line)	Not Included	Included	Included
5	I-110 ExpressLanes Ext South to I-405/ I-110 Interchange	405CMCP_0942	Extends the existing I-110 ExpressLanes southward one mile to the I-405 interchange while maintaining current general-purpose lanes	Not Included	Included	Included



#	Name (if applicable)	Reference ID	Short Description	S1	S2	S3
6	I-405/I-110 Int. HOV Connect Ramps & Interchange Improvements	405CMCP_0917	Route I-110/I-405 HOV/Express Direct Connector (Countywide ExpressLanes Strategic Plan Tier 1)	Not Included	Included	Included
7	HOV 3+ Policy Implementation	405CMCP_2063	Convert existing HOV lane occupancy to three or more persons per vehicle countywide	Not Included	Included	Included
8	(Not applicable)	405CMCP_0652	I-105/I-405: HOV connectors from I-105 westbound to northbound and southbound I-405	Not Included	Included	Included
9	(Not applicable)	405CMCP_0667	I-405 Add auxiliary lanes from SR-90 to I-105	Not Included	Included	Included
10	I-405 Aux	405CMCP_0897	Construct Aux lanes and widen connectors, in LA County, in Carson and Los Angeles, on I-405 from Main St separation to Normandie Ave separation	Not Included	Included	Included
11	I-405 Aux	405CMCP_0902	Construct Auxiliary lanes, in Los Angeles County, in Carson and Los Angeles, on Route 405 from I-110 connector to Wilmington Ave	Not Included	Included	Included
12	I-405 South Bay Curve Improvements	405CMCP_0943	Adds segments of auxiliary lanes in each direction to improve traffic flow at on/off ramps for ten miles from Florence Ave to I-110	Not Included	Included	Included
13	(Not applicable)	405CMCP_1039	Route 105: Westbound I-105 at Crenshaw Blvd onramp to Prairie/Hawthorne - add westbound transition lane	Not Included	Included	Included
14	(Not applicable)	405CMCP_1040	Route 105: Eastbound I-105 from Yukon to Crenshaw Blvd - Add EB Transitional Lane	Not Included	Included	Included
15	(Not applicable)	405CMCP_1142	Route 405: Northbound 405 from Hawthorne Blvd to Inglewood Ave - add transitional lane	Not Included	Included	Included
16	(Not applicable)	405CMCP_1144	Route 405: Northbound 405 from Inglewood Ave to Rosecrans Ave - add transitional lane	Not Included	Included	Included



#	Name (if applicable)	Reference ID	Short Description	S1	S2	S3
17	I-110 Southbound Off-ramp to PCH	405CMCP_2040	I-110 southbound off-ramp to Pacific Coast Highway (PCH) by widening the mainline to add one auxiliary lane and widening the off-ramp to provide a two-lane exit	Not Included	Included	Included
18	North San Fernando Valley Transit Corridor	405CMCP_0928	The North San Fernando Valley Transit Corridor Project is a proposed enhanced bus network that would increase connectivity and provide high-quality bus service and transit infrastructure in North San Fernando Valley communities from Northridge on the west to North Hollywood on the east	Not Included	Included	Included
19	G Line (Orange) Conversion to Light Rail	405CMCP_0934	The G Line conversion of the 18-mile bus rapid transit line to light-rail service	Not Included	Included	Included
20	Atlantic BRT	405CMCP_2052	New BRT service along Atlantic consistent with Board-adopted standards and design guidelines, such as dedicated running ways and BRT stations	Not Included	Included	Included
21	Lincoln Blvd BRT	405CMCP_2053	New BRT service along Lincoln Blvd consistent with Board-adopted standards & design guidelines, such as dedicated running ways & BRT stations	Not Included	Included	Included
22	Arbor Vitae Bus Lane	405CMCP_2055	Add eastbound bus lane for dedicated route between I-405 and SoFi Stadium	Not Included	Included	Included
23	Hawthorne/La Brea Bus Lanes	405CMCP_2056	Add bus lanes on La Brea Avenue (from Market St. to Century Blvd), and on Hawthorne Boulevard (from Century Blvd. to Hawthorne/Lennox Station)	Not Included	Included	Included
24	Prairie Avenue Bus Lanes	405CMCP_2057	Add bus lanes on Prairie Avenue between the K Line and C Line	Not Included	Included	Included
25	Palos Verdes Drive West Corridor Expansion Project	405CMCP_2024	Palos Verdes Drive West Corridor Expansion Project	Not Included	Included	Included



#	Name (if applicable)	Reference ID	Short Description	S1	S2	S3
26	San Pedro Water Front Access/Harbor Boulevard Improvements	405CMCP_1263	Improves traffic operations on major arterial connecting San Pedro to I-110 and SR-47. as part of the San Pedro waterfront development project, Harbor Blvd will be restriped, and the median is removed/reconstructed as needed to provide three northbound through and southbound through lanes between the reconstructed Sampson Way/Harbor Blvd intersection and the westbound on ramp/front street intersection. This will result in the removal of parking and the bike lane on the northbound side. The parking and 5' bike lane on the southbound side, south of O'Farrell St will be preserved. North of O'Farrell St, the parking and the parking lane on the southbound side would need to be removed to accommodate the northbound dual left-turn lane.	Not Included	Included	Included
27	(Not applicable)	405CMCP_0664	I-405: Widen from 3 to 4 lanes through interchange at I-110	Not Included	Included	Included
28	I-5/I-405 Carpool Connector	405CMCP_0641	I-5/I-405 Carpool Lane Partial Connector (south to north)	Not Included	Included	Included
29	I-405 Aux	405CMCP_0898	Construct Aux Lane between Artesia Blvd and El Segundo Blvd	Not Included	Included	Included
30	I-710 Early Action	405CMCP_0911	Shoemaker bridge replacement	Not Included	Included	Included
31	Sepulveda Pass Transit Corridor (Ph 1 - ExpressLanes)	405CMCP_0938	I-405 ExpressLanes from US 101 to I-10 (Measure M funded/ segment is included in the Countywide ExpressLanes Strategic Plan Tier 1 project- I-405 from I-101 to Los Angeles/Orange County Line)	Not Included	Included	Included
32	Metrolink Antelope Valley Line 15 Service and Capital Improvements	405CMCP_1303	Increase Metrolink frequency and reliability in concert with the Antelope Valley Line Double Track capital improvements. Annual funding needed to implement 15-minute, bi-directional, all-day service on the Antelope Valley Line.	Not Included	Included	Included



#	Name (if applicable)	Reference ID	Short Description	S1	S2	S3
33	Alameda St (south) Widening from Anaheim St to Harry Bridges Blvd	405CMCP_2023	Alameda St (south) widening from Anaheim St to Harry Bridges Blvd	Not Included	Included	Included
34	Metrolink Antelope Valley Line	405CMCP_2029	Metrolink Antelope Valley Line	Not Included	Included	Included
35	C Line (Green) Extension to Torrance	405CMCP_2073	Extension of the light rail line from its current terminus at the Redondo Beach Station to the Torrance Transit Center	Not Included	Included	Included

ExpressLanes

#	Project	Source	S1	S2	S3
1	I-105 ExpressLanes from I-405 to I-605	Measure M	Included	Included	Included
2	I-110 ExpressLanes from Downtown LA (DTLA) to I-405	Metro LRTP	Not Included	Included	Included
3	I-10 ExpressLanes from DTLA to Los Angeles/San Bernardino (LA/SBD) Line	Metro LRTP	Not Included	Included	Included
4	I-405 ExpressLanes from I-101 and Los Angeles/Orange County (LA/OC) Line	Metro LRTP	Not Included	Included	Included
5	I-605 ExpressLanes from I-10 to Los Angeles/Orange County (LA/OC) Line	Metro LRTP	Not Included	Included	Included



Highway Project Changes Outside of the Subregional Strategic Unfunded Project List, I-405 CMCP, and Express Lanes (All Scenarios)

#	Project	Change	Source
1	I-710 Expansion	Removed	ASCE, EPA suspends California Interstate 710 project, 10/7/2021. Assessed in March 2024 on: https://www.asce.org/publications-and-news/civil-engineering-source/civil-engineering-magazine/article/2021/10/epa-suspends-california-interstate-710-project
2	Cordon pricing assumptions (Santa Monica and DTLA) from the SCAG off-the-shelf model.	Changed	Per Metro's direction, Traffic Reduction Study (TRS) was used in replacement of the SCAG's off-the-shelf assumption.
3	I-5 Corridor Improvements (I-605 to I-710)	Added	Measure M https://thesource.metro.net/2016/11/08/measure-m-project-descriptions/



Joint Development Sites, included in All Scenarios

Site	Site Name	Status	Buildable Sq Ft	Street Address	City	Zip	Total Units
1	Wilshire/ Crenshaw	Pipeline	60,000	675 Crenshaw Blvd	Los Angeles	90005	217
2	Florence Station	Pipeline	74,913	1720 E Florence Ave	Florence-Firestone Community	90001	167
3	Heritage Square Station	Pipeline	80,192	Cypress Park	Los Angeles	90065	157
4	Balboa/ Victory	Pipeline	517,130	16851 Victory Blvd	Los Angeles	91406	1,152
5	Glendora	Pipeline	283,146	410 S Vermont Ave	Glendora	91741	631
6	Fairview Heights	Pipeline	35,000	1119 E Redondo Blvd	Inglewood	90302	78
7	Artesia Station	Pipeline	87,120	1920 S Acacia Ave	Compton	90220	140
8	17th St/ SMC Station	Pipeline	182,041	1619 17th St	Santa Monica	90404	190
9	Sepulveda Station	Pipeline	557,706	6127 Sepulveda Blvd	Los Angeles	91411	533
10	Temple/Beaudry Bus Layover	Pipeline	57,250	1113 W Temple St	Los Angeles	90012	119
11	Canoga Park Station	Pipeline	60,000	6620 Canoga Ave	Los Angeles	91303	193
12	La Verne	Pipeline	184,210	1941 N White Ave	La Verne	91750	411
13	1940 CPE	Pipeline	30,016	1940 Century Park East	Los Angeles	90067	67
14	Pickle Works	Pipeline	88,105	1001 E 1st St	Los Angeles	90012	182
15	Pomona	Pipeline	156,816	205 W Santa Fe St	Pomona	91767	350
16	San Dimas	Pipeline	35,317	100 W Railway St	San Dimas	91773	79
17	Universal City/Studio City Station	Pipeline	468,270	3906 Willowcrest Ave North	Los Angeles	91604	842
18	103rd St/ Watts Towers Station	Pipeline	159,907	10305 Grandee Ave	Los Angeles	90002	73
19	El Segundo Station	Pipeline	67,291	2226 E El Segundo Blvd	El Segundo	90245	109
20	Wilshire/ La Brea	Pipeline	115,000	711 S La Brea Ave	Los Angeles	90036	1,659
21	Aviation/ Century Station	Pipeline	83,575	5601 W Century Blvd	Los Angeles	90045	187

Note: Total units **in bold** were estimated based on the average unit size available. Source: LA Metro, Raimi + Associates.