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2014 Short Range Transportation Plan

TECHNICAL DOCUMENT



Metro

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*On the cover:
Construction continues on Metro's Expo Line extension.*

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The newly-refurbished El Monte Transit Center greets the day.

The 2014 Short Range Transportation Plan (Plan) Technical Document is a companion document to the Los Angeles County Metropolitan Transportation Authority's 2014 Short Range Transportation Plan.

The 2014 Short Range Transportation Plan (Plan), available under separate cover, lays out an action plan for funding and implementing Los Angeles County transportation programs and projects over the ten-year period from Fiscal Year (FY) 2014 through FY 2024. This document, the 2014 Short Range Transportation Plan Technical Document (Technical Document), provides additional information regarding various technical components of the Plan, including sustainability, financial modeling and assumptions, travel demand modeling and assumptions, and performance analysis.

Plan Overview

Metro is responsible for planning and programming in Los Angeles County, in accordance with California Government Code Section 130051. In October 2011, the Board directed Metro staff to prepare a Plan to lay out a realistic framework for the transportation needs and challenges that Los Angeles County will face in the short term to 2024. The Plan is a key element of Metro's planning process, serving to implement the near-term strategies of Metro's Long Range Transportation Plan (LRTP), adopted by the Metro Board in October 2009.

The Plan focuses on the various pieces of Los Angeles County's transportation system, identifying which projects and programs can be put into place within existing financial sources in the near term. The following highlights what the Plan will do:

- > Establish a coordinated blueprint for transportation
- > Keep our existing system in a State of Good Repair
- > Grow LA County greener
- > Respond to our financial challenges
- > Measure the benefits

Sustainability

The legislature has implemented policies designed to promote sustainability in the state. Legislation such as AB 32 (Global Warming Solutions Act) and SB 375 (Sustainable Communities Strategy and Climate Change Protection Act) are designed to reduce greenhouse gas emissions. Metro has implemented sustainability measures designed to ensure compliance with these state policies. Further information regarding this is found in the Sustainability chapter.

Community Outreach, Environmental Justice, and Title VI Analysis

In developing the Plan, Metro coordinated with a wide range of interests. Metro conducted community outreach meetings for the Plan at locations throughout the County,

and provided an opportunity for public review through a comment period from April 2014 through June 18, 2014. Metro also coordinated with its transportation partners, including the subregional agencies, the Southern California Association of Governments (SCAG), Caltrans, Metrolink, and municipal and local transit operators. Finally, Metro regularly consulted with the Metro Technical Advisory Committee and its subcommittees.

Metro complied with federal environmental justice and Title VI requirements to include transit-dependent and minority communities in its community outreach and to analyze the benefits and impacts of the Plan on the transit-dependent and minority communities. Metro met these programs through the following: 1) through many community meetings on the Plan; 2) through coordination with nine subregions comprising local elected officials and staff; 3) through media awareness of the Plan; 4) through presentations on the Plan to the Metro Board; 5) through the 30-day public review period; and 6) through demographic analysis of the Plan's recommendations, in particular looking at performance measures for mobility and transit access. Extensive community involvement also occurs on major transportation projects at the project-level and through planning and environmental review activities. The Plan performed well in meeting the needs of transit dependent and minority communities. In fact, the analysis indicates that transit services are available at a higher service level in these communities than in the County at large. Further information regarding this analysis is found in the Travel Demand Model chapter.

Relationship to Other Plans

The Plan identifies how Metro is advancing toward the long-term goals outlined in the LRTP for the ten-year window from FY 2014 through FY 2024. The projects recommended for funding in the Plan were initially proposed in the LRTP and are also included in SCAG's 2012 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS).

Technical Document Contents

This document includes the following sections, as described below:

- > **Chapter 1 – Introduction**
- > **Chapter 2 – Sustainability**
This chapter takes a look at how Metro is addressing sustainability issues.
- > **Chapter 3 – Financial Model and Assumptions**
This chapter describes the financial model and analysis that supports the Plan.
- > **Chapter 4 – Travel Demand Model and Assumptions**
This chapter describes the travel demand model and assumptions used to assess the performance of the Plan.

Sustainability

The projects and programs included in this Plan reflect Metro's continued commitment to sustainability in both its capacities as a major business and employer as well as the leading transportation planning and funding agency in the county. At the broadest level, this commitment to sustainability challenges us to meet the needs of the present without compromising the ability of future generations to meet their own needs.

Under the leadership of the Ad Hoc Sustainability Committee, the agency has generally focused its response to this challenge through policies and programs in two primary areas:

- > Countywide Planning and Programming and
- > Agencywide Facilities and Operations.

This chapter focuses on the progress and actions that are currently being undertaken in these areas.



COUNTYWIDE PLANNING AND PROGRAMMING

Meeting Regulations and Developing Strategies

Climate change regulations, adopted at the state level, mandate statewide greenhouse gas reductions. Assembly Bill (AB) 32 sets greenhouse gas reduction goals and Senate Bill (SB) 375 establishes a process at the regional level where land use, housing and transportation must be integrated in a Sustainable Communities Strategy (SCS) to reduce greenhouse gas emissions from passenger vehicles. The greenhouse gas reduction target established for our region is 8% per capita by 2020 and 13% per capita by 2035. In 2012, the Metro Board adopted a resolution and Joint Work Program committing to work together with SCAG to implement the 2012 Regional Transportation Plan/ Sustainable Communities Strategy (RTP/SCS). The Joint Work Program has 11 initiatives including the development of the First/Last Mile Strategic Plan, as well as cooperation on planning Transit Oriented Development, electric vehicle implementation, and open space conservation among other areas. Progress and major milestones to date include the adoption of the First/Last Mile Strategic Plan and the completion of the Plug-In Electric Vehicle Readiness Plan. Metro and SCAG continue to make significant progress on other items such as the development of a Countywide Safe Routes to School Strategy. These initiatives will support our efforts to improve regional accessibility, while also meeting greenhouse gas reduction and public health goals.

SCAG determines greenhouse gas emission reductions associated with the RTP/SCS through a methodology subject to approval by the California Air Resources Board. The methodology accounts for the combined effect of transportation and land use strategies in reducing emissions from passenger vehicle usage. The SCS focuses on strategies that will reduce vehicle miles traveled such as transit expansion, coordinated land use, pricing, Transportation Demand Management (TDM) and others. Emissions benefits for the 2012 RTP/SCS were calculated through a variety of modeling techniques, notably a trip-based regional transportation demand model and an emissions model (EMFAC). The RTP/SCS successfully achieves and exceeds our greenhouse gas emission reduction targets set by the Air Resources Board by achieving a 9% reduction by 2020 and 16% reduction by 2035 compared to the 2005 level on a per capita basis.

By offering alternative transportation modes, Metro is working toward meeting these new state mandates through significant reductions in greenhouse gas emissions. All in all, Metro is leading the way to a greener tomorrow by investing the majority of funds (87%) in transit, carpool lanes, ridesharing programs, bikeways, and pedestrian linkages.

Metro is proactively pursuing the development of active transportation strategies (e.g., First/Last Mile Strategic Plan and Safe Routes to Schools) that will improve regional accessibility, while also meeting greenhouse gas reduction and public health goals.

FIGURE 2.1

Principles and Priorities

Connect People and Places



Access. Better integrate land-use and transportation planning to reduce trip lengths and increase travel choices.



Prosperity. Reduce transportation costs for residents and provide the mobility necessary to increase economic competitiveness.



Green Modes. Promote clean mobility options to reduce criteria pollutants, greenhouse gas emissions, and dependence on foreign oil.

Create Community Value



Healthy Neighborhoods. Improve public health through traffic safety, reduced exposure to pollutants, and design and infrastructure for active transportation.



Community Development. Design and build transportation facilities that promote infill development, build community identity, and support social and economic activity.



Urban Greening. Enhance and restore natural systems to mitigate the impacts of transportation projects on communities and wildlife, and ecosystems.

Conserve Resources



Context Sensitivity. Build upon the unique strengths of Los Angeles County's communities through strategies that match local and regional context and support investment in existing communities.



System Productivity. Increase the efficiency and ensure the long-term viability of the multimodal transportation system.



Environmental Stewardship. Plan and support transportation improvements that minimize material and resource use through conservation, re-use, re-cycling, and re-purposing.



= Principle that highlights the social dimension of sustainability.



= Principle that highlights the economic dimension of sustainability.



= Principle that highlights the environmental dimension of sustainability.

Planning a Sustainable Transportation System

Through collaboration with the Southern California Association of Governments (SCAG), subregional agencies and cities on the Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) and development of the Countywide Sustainability Planning Policy (CSPP), Metro is providing the leadership and a framework for advancing sustainability across the county in the context of transportation planning.

The CSPP led to the development of a joint Metro/SCAG First/Last Mile Strategic Plan. The First/Last Mile Strategic Plan seeks to increase ridership and improve customer safety through a series of infrastructure and technological innovations in and around Metro Rail, Metro Bus, Metrolink, and municipal bus line stations. The First/Last

Mile Strategic Plan embodies the three overarching CSPP principles of Connect (improving station access; reducing transportation costs; promoting green modes), Create (enhancing community development; urban greening and public health) and Conserve (context sensitive solutions; making the transit system more productive and promoting green modes).

Principles and Priorities

Metro’s Countywide Sustainability Planning Policy seeks to better define and articulate Metro’s role in achieving a sustainable transportation system through principles and priorities. It aims to facilitate greater coordination and collaboration across transportation modes, planning disciplines, and government agencies. The principles align with the areas of responsibility within which Metro’s planning practices can influence sustainability outcomes—as a regional mobility provider (Connect), a project manager (Create), and a steward of public funds (Conserve). Three priorities are associated with each principle that highlight key social, economic and environmental dimensions of sustainability to be advanced through the transportation planning process (Figure 2.1).

Plan Performance

To integrate the sustainable principles and practices into planning activities, the Countywide Planning Policy promotes the use of performance metrics to assess the sustainability benefits of plans and projects. Consistent with this policy, the following section uses a set of evolving sustainability performance metrics and project examples to report on the impact of the Plan on Metro’s sustainability priorities.

These metrics compare a No Build scenario with a 2024 scenario in which the Plan has been implemented. The 2024 scenario assumes implementation of the 2012-2035 RTP/SCS, which includes land use changes and pricing strategies that will complement Metro’s assumptions made in the Plan. The RTP/SCS overlays a growth forecast, which compiles local land-use data, with the transportation network to achieve a per capita reduction in greenhouse gas emissions from passenger vehicle-use. The performance metrics track countywide outcomes, influenced by Metro’s activities as well as factors beyond the agency’s direct control. While the majority of the priorities have associated quantitative metrics, due to data limitations, some of the priorities highlight innovative programs and future endeavors that provide more of a qualitative assessment.

The performance metrics, except where noted otherwise, are derived from the Rapid Fire Model used in SCAG’s 2012 RTP/SCS.

Connect

Access – By better integrating land use and transportation planning, Vehicle Miles Traveled (VMT) and trip lengths will be reduced and greater transportation options will be made available. Additionally, annual transit boardings will increase with further investments in transit, bicycle

and pedestrian infrastructure, providing greater mobility options to county residents.

| | VMT ¹ | Annual Boardings ² |
|-----------------|------------------|-------------------------------|
| NO BUILD | 21,201 mi per HH | 703,547,000 |
| 2024 | 18,463 mi per HH | 737,477,000 |

Prosperity – The plan will increase economic competitiveness by linking jobs to the county rail network and providing for improved mobility of the region’s workforce. New and improved transportation infrastructure and an expanded network of alternative transportation modes will help to reduce household transportation costs including fuel use and automotive expenditures.

| | Jobs Accessible via Rail ³ | Household Costs ¹ |
|-----------------|---------------------------------------|------------------------------|
| NO BUILD | 855,000 jobs | \$12,924 per HH |
| 2024 | 1,352,400 jobs | \$11,900 per HH |

Green Modes – By investing in cleaner mobility options such as walking, biking, transit, and carpooling, criteria pollutant emissions and GHG emissions associated with fuel combustion will be reduced. The Plan will also reduce our region’s dependence on foreign oil by advancing and supporting green modes that rely less on traditional fuel sources.

| | Criteria Pollutants ¹ | GHG Emissions ¹ | Fuel Consumption ¹ |
|-----------------|----------------------------------|----------------------------|-------------------------------|
| NO BUILD | 192,195 tons | 24.3 MMT | 3,037 mil gal |
| 2024 | 150,303 tons | 21.3 MMT | 2,657 mil gal |

Create

Healthy Neighborhoods – Through traffic safety improvements and design for walking and bike, public health will benefit by reducing the number of annual health incidences and decreasing overall health costs for LA County.

| | Annual Health Incidences ¹ | Health Costs ¹ |
|-----------------|---------------------------------------|---------------------------|
| NO BUILD | 179,090 | \$3.14B |
| 2035 | 134,752 | \$2.37B |

Community Development – The RTP/SCS promotes infill development while maintaining and enhancing community identity and supporting social and economic activity. Fewer square miles will be consumed, open space will be preserved and infrastructure costs will fall. Land consumption will decline substantially and infrastructure costs (including local roads, water supply, and parks) will decrease. At Metro, the Transit-Oriented Development (TOD) Grant Program advances community development by supporting local regulatory changes that spur targeted investments near transit.

| | Land Consumption ¹ | Infrastructure Costs ¹ |
|-----------------|-------------------------------|-----------------------------------|
| NO BUILD | 133 sq mi | \$4,526M |
| 2024 | 79 sq mi | \$4,849M |

¹Data for VMT, Household Costs, Criteria Pollutants, GHG Emissions, Fuel Consumption, Annual Health Incidences, Health Costs, Land Consumption and Infrastructure Costs are outputs of the Rapid Fire Model used in SCAG's 2012 RTP/SCS.

²Data for Annual Boardings are outputs of Metro's Travel Demand Model.

³Data for Jobs Accessible via Rail derived from maps developed by Reconnecting America in 2011 as part of the Los Angeles Equity Mapping Project.

Urban Greening – As part of ongoing internal and external efforts, Metro will be promoting urban greening by planning for transportation improvements that mitigate impacts on local communities while advancing efforts to preserve and enhance the natural environment. On a regional scale, Metro will be working with SCAG to create an Open Space Conservation Strategy and at the county level, Metro will be developing an Urban Greening Plan to optimize environmental systems, enhance placemaking, and build a sense of community at our stations.

As part of the 2012 RTP/SCS, SCAG recommended creating an Open Space Conservation Strategy to optimize the use of transportation mitigation funds for land conservation and habitat preservation. Metro will be participating in the development of this Strategy to ensure that the impacts of future transportation projects appropriately enhance and restore natural systems.

Conserve

Context Sensitivity – The Plan moves forward strategies that match local and regional context and support investments in existing communities. Through our Countywide Sustainability Policy, Metro has established an Accessibility Index that groups locations by accessibility characteristics to help define implementation needs and potential strategies for advancing sustainability priorities among communities. This approach recognizes that “one-size fits all” solutions are not appropriate in a county as large and diverse as Los Angeles.

The Eastside Access Program is a Measure R funded project with a \$30 million allocation. Using urban design tools including art, lighting and landscaping, multi-modal linkages from the Metro Gold Line Eastside stations to the surrounding neighborhoods will be created. The project aims to strengthen neighborhood identity, pedestrian/bicycle activity and wayfinding.

System Productivity – The Plan will increase the efficiency and ensure the long-term viability in technology and innovative programs that enhance the regional transportation system and optimize the use of existing and planned facilities. Such programs include signal synchronization, transit priority systems, ExpressLanes, Freeway Service Patrol, and Transportation Demand Management.

Metro ExpressLanes is a pilot, one-year demonstration program to develop a package of solutions to improve traffic flow and provide enhanced travel options on the 10 and 110 freeways. The program includes introducing congestion pricing by converting High Occupancy Vehicle (HOV) lanes to High Occupancy Toll (HOT) lanes; improving transit service; upgrading transit facilities; and improving parking in downtown Los Angeles.

Environmental Stewardship – Minimizing material and resource use through conservation, re-use, recycling and re-purposing is an essential component of making transportation projects and improvements more sustainable. Metro has already incorporated environmental stewardship into many of the programs it supports, manages, and funds. For example, nearly two thirds of all projects funded through Measure R Local Return have included green design features and/or implemented SCS strategies.

Metro recently received a grant to develop an Urban Greening Plan that serves as an inter-agency blueprint for strategic investment of resources based on environmental and social needs across the transit system. As part of this plan, a Greening Toolkit will be created to address the environmental challenges of station areas including parking lots to reduce water and air pollutants and mitigate the impacts of climate change.

Next Steps

Metro will continue to advance sustainability through the execution of the Countywide Sustainability Planning Policy and its associated implementation activities. Metro will monitor and track regional performance and work with partners throughout the county to identify opportunities and strategies to create a more sustainable transportation system. Under the direction and leadership of the Ad Hoc Sustainability Committee, Metro will report regularly on local and regional government actions, programming and planning efforts, as well as interagency initiatives that showcase the impact and effectiveness of the Countywide Sustainability Planning Policy.

Countywide Planning objectives include:

- > Advance and more thoroughly integrate sustainability principles into Metro's plans and programs to enhance the quality, efficiency and effectiveness of agency investments.
- > Integrate a monitoring and evaluation process that will track countywide performance outcomes and be reported to the Metro Board on an annual basis.
- > Provide regional leadership for the implementation of the RTP/SCS to meet federal/state requirements and increase regional competitiveness for federal/state/private transportation funds.
- > Identify and implement pilot projects that further Metro's approach to sustainability in external activities and internal projects and practice.
- > Expand outreach and sustainability communications and programmatic initiatives to increase visibility and build community support.
- > Pursue Federal, State and local funding opportunities to advance the sustainability principles outlined in the RTP/SCS, LRTP and CSPP.

AGENCYWIDE FACILITIES AND OPERATIONS

The Need for Agency Sustainability

Metro is an essential part of the solution to achieving sustainability at the regional level in Los Angeles. Transit is a core component to a sustainable region; it enables a variety of improved efficiencies in goods distribution, people movement, infrastructure, natural resource consumption, and fuel consumption. Metro is improving and expanding transit options for the region that will create opportunities for millions of people to make more sustainable transportation choices. However, providing more services also means that Metro uses more resources—and that's why Agency Sustainability, or sustainability within Metro, is so important. As we expand our system and services through planned transit lines, new TODs and the further integration of active modes of transportation into our system, we're simultaneously working to improve our efficiency when it comes to fuel, water, energy, and waste; Metro is doing more with less and improving its operational capacity everyday.

Metro has adopted aggressive policies related to energy consumption, water conservation, construction activities, green building, and climate change management (www.metro.net/ecsd). While a majority of agency sustainability strategies are voluntary, they help Metro address the need to comply with various state and federal policies including AB 32: Global Warming Solutions Act, the California Environmental Quality Act (CEQA) and SB 375 among others.

Guiding Policies

Several policies adopted over the last few years have outlined the path forward for agency sustainability. The Metro Sustainability Implementation Plan (MSIP), adopted by the Board in June 2008, provides general guidelines for both short-term and long-term sustainability project development. As part of the MSIP, Metro publishes an annual report on environmental sustainability performance. The first report, written in 2009, establishes an agency-wide baseline for a number of indicator areas including ridership, fuel use, electricity consumption, water use, greenhouse gas and other emissions, and waste. Each year, Metro releases a new Energy and Resource Report (formerly known as the Sustainability Report) to track the agency's efforts relating to operational sustainability. The MSIP is undergoing revisions and is slated for an update in FY15.

The Environmental Policy, adopted in April 2009, reinforces the agency's commitment to provide multi-modal public transit services in a manner that both protects and enhances the environment and community that they serve. The Environmental Policy outlines Metro's commitment to planning and constructing projects, operating and maintaining facilities and vehicles, and procuring products and services consistent with state and federal laws and regulations in a manner that protects human health and the environment, while still prioritizing the efficient delivery of quality public transit services.

Facilities and Operations

A primary consideration of Metro's operations are the agency's facilities—the maintenance yards, administrative offices, and wayside facilities. These are the support system for the agency's transportation services, and are also responsible for a significant portion of the agency's resource consumption. Each of these facilities has a specific role within the transit network and most are responsible for carrying out tasks unique to that facility. To help manage and track the operations and safety of this wide range of facilities, Metro has embraced the adoption of an agency-wide Environmental Management System (EMS)—a series of best practices and procedures that seek to reduce Metro's impact on the environment, and to seek continual improvement to its environmental performance. In addition to environmental compliance, Metro's EMS has also assumed the overarching role of managing Metro's energy, water, waste and recycling, and climate and resiliency initiatives to streamline our efforts. EMS is currently employed at eight of Metro's divisions, with six divisions already certified to the International Standards Organization (ISO) 14001:2004 standard for upholding an exemplary EMS program. The EMS program has continued to prove effective in reducing division operating costs, employee risks, and environmental liabilities. All Metro facilities are slated to be enrolled in the EMS program by 2016.

The agency is also taking steps to reduce resource consumption as directed by additional strategies such as those contained in the Sustainability and Energy Policy (2007), Water Action Plan (2010), Energy Conservation and Management Plan (2011), and Renewable Energy Policy (2011). These policies have led to actions that have resulted in significant environmental benefits and agency cost savings. The Metro Headquarters building achieved Leadership in Energy and Environmental Design (LEED) Existing Building Operations and Management (EB O&M) certification in 2011. This has resulted in water savings of 48%, energy savings of 6% and a reduction in harmful chemicals used on-site for cleaning and other activities.

A total of six Metro buildings and facilities has already been certified by the United States Green Building Council (USGBC) as meeting the requirements for LEED Certified or higher. Metro has made a commitment to build future facilities over 10,000 square feet to LEED Silver standards. The agency is also undergoing an aggressive campaign to conduct energy audits at existing facilities and upgrade building energy systems to increase operating efficiency.

In addition to facility energy projects, Metro is planning, developing, and implementing projects to reduce water consumption. These water conservation projects include: 1) installing recycled water for irrigation along a portion of the Metro Orange Line, which is estimated to reduce potable water usage by 12 million gallons per year; 2) incorporating a cistern in the new Division 13 Bus Maintenance Facility to capture and use storm water for irrigation and bus washing (an estimated 2.8 million gallon reduction in potable water use); and 3) providing a water

recycling system to clean discharged water for reuse in the Division 9 Steam Bay (an estimated 2.0 million reduction in potable water use). Metro is also exploring pilot projects to install Linear Kinetic Cell (LKC) water conditioning systems for the bus wash final rinse at Bus Divisions 5 and 18 to eliminate the potable water waste associated with reverse osmosis water systems. The LKC system is estimated to conserve 3.8 million gallons and 6.1 million gallons at Division 2 and 18, respectively.

These targeted efficiency measures have not only reduced resource consumption, but also lowered facility expenses. Our green building efforts complement the alternatively fueled fleet we operate. Since 1993 Metro has only added buses to its fleet that run on alternative, clean air fuels. The last diesel bus was retired from service in 2011, and Metro is now proud to operate a fleet of over 2,000 compressed natural gas buses. These buses have helped the agency reduce GHG emissions by 16%, and criteria air pollutants by 93% from 1990 to 2010.

Metro's renewable energy portfolio currently includes approximately 2.5 megawatts of solar photovoltaic energy at six facilities. Coupled with ongoing energy efficiency retrofits, these renewable energy projects are reducing Metro's demand for mostly coal-based power.

Metro is exploring other renewable energy sources through grants received from the Federal Transit Administration and the South Coast Air Quality Management District. Flywheel technology will be used at the Red Line/Purple Line MacArthur Park Station as energy storage. The same technology will be used as a voltage regulator at the Gold Line, near Avenue 31. Metro is reviewing other ideas to expand its renewable energy capabilities and options.

Our Board has approved in 2013 our Biomethane Implementation Plan. This plan outlines options for Metro to use biomethane in its fleet while further reducing Metro's carbon footprint. Biomethane is a natural gas that originates from dairy waste, wastewater treatment plant processing, and landfill material decomposition. As such, biomethane is classified as a renewable fuel. As technologies improve, Metro will continue to assess options to further reduce our emissions.

Construction

Metro has recently been focusing efforts on increasing the sustainability of our construction activities as we deliver major Measure R funded capital projects that keep the region moving. The Construction Demolition Debris Recycling and Reuse Policy (2007) ensures consideration be given to recyclable and recycled products in the selection of construction materials used for Metro or Metro-funded capital projects, like rail lines, bus and rail maintenance facilities or TODs. The policy also requires Metro to verify that materials are disposed at, or diverted to, licensed or permitted facilities. Metro's Green Construction Policy, adopted in 2011, addresses emissions associated with construction activities, by requiring that construction equipment used on Metro projects meet emissions

requirements that meet or exceed current air quality standards. Best Management Practices outlined in the policy provide additional specifications for construction equipment to ensure that emissions and traffic congestion caused by construction activities are minimized.

Climate Change Management

Climate change is an increasingly important issue, and Metro is in a position to impact the volume of greenhouse gas emissions (GHG) in the Los Angeles region. The agency is moving quickly to reduce direct greenhouse gas emissions and prepare for increased weather impacts. The Greenhouse Gas Emissions Cost Effectiveness Study, completed in 2010, analyzes a variety of short- and long-term options for GHG reduction at the agency. This study has been a key document aiding in the development of the agency-wide Climate Action and Adaptation Plan (CAAP). The completed CAAP is the agency's guiding document for GHG reduction actions and climate adaptation. It provides the necessary foundation as we move forward and begin to transition from climate adaptation planning to physical adaptive measures to make our transit system more sustainable and resilient.

Metro has partnered with the FTA in an exploratory effort for implementing climate adaptation. Metro's climate adaptation pilot program provides a series of steps for how climate adaptation planning can be integrated into Metro's EMS. The pilot also provides a more generalized tool kit for other transportation agencies to adopt if they choose to utilize an EMS to approach climate adaptation.

Next Steps

When it comes to sustainability, Metro is an industry leader. The policies we have developed and the projects we have implemented allow us to do more for transit users with less, and we are always looking to new technologies and exploring new ideas to further these efforts.

Current studies and projects underway include assessing different methods to reduce energy consumption used for rail propulsion, and exploratory efforts to harvest wind in subway tunnels for energy. We are quantifying and valuing our carbon emissions in all of our operations as well as the derived benefits of our system from vehicle miles traveled, congestion reduction, and land use to produce carbon credits that will be tradeable in the California and similar markets. We are expanding our EMS to create more efficiency in the way we operate our systems. We are incorporating electric vehicle charging stations initially at our outlying stations to encourage electric vehicle owners to use our expanding transit network. We are also producing design requirements and guidelines to incorporate sustainability into new projects from the onset.

As Metro expands its facilities and services over the next few years by providing more options for transit riders, we will seek to reduce our environmental impact while simultaneously providing social value to our stakeholders, an avenue to further grow local and regional economic activity, and a mutually beneficial transportation experience where our riders are part of the solution.

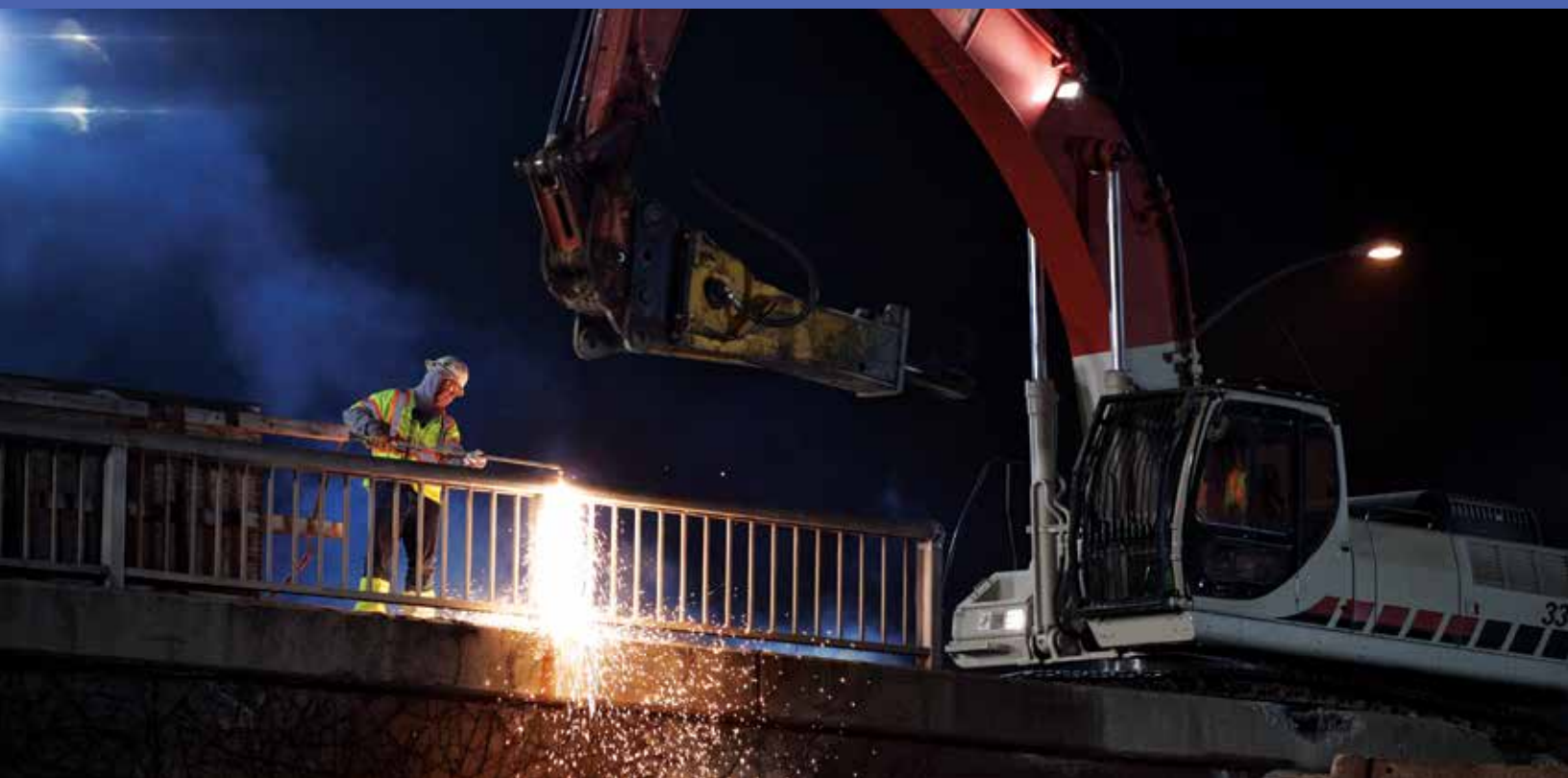
Financial Model and Assumptions

The Plan financial forecast provides a fiscally sound baseline for decision-making and is a key strategic financial planning element of Metro's LRTP. The Plan financial forecast seeks to maximize resources by leveraging state and federal funds and minimizing the amount and cost of Metro borrowing. This strategy supports Metro's state and federal legislative advocacy program by providing a focus for those efforts and a common plan for our delegations.

The Plan includes a multi-modal, publicly funded capital and operating program estimated at \$88.2 billion through FY 2024. The forecast reflects the best available estimate of revenues (sources) and costs (uses) and is constrained to the financial resources that can reasonably be expected to be available. The forecast assumes continuation of state and federal formula funds and assumes the need for state and federal

discretionary funds. It allocates available resources to priorities established by the Board, reflecting Board and voter-adopted sequencing to ensure consistency with Measure R and the LRTP.

Los Angeles County voters entrusted Metro with three half-cent sales tax initiatives – Proposition A (in 1980), Proposition C (in 1990), and Measure R (in 2008). While this trust forms a majority of Metro's ten-year financial forecast, Federal and State revenues are also important elements of our financial picture. On the strength of our voter commitments, Metro sought and secured a new, low cost federal loan program called America Fast Forward. This program is already accelerating improvements to our rail transit system. Next, shoring up the Federal Highway Trust Fund and the State Highway Account are both critical to meeting the state of good repair needs on our legacy transportation systems.



MAJOR REVENUE ASSUMPTIONS

Revenues come from many federal and state grants, and local taxes, as well as from passenger fares, advertising, real estate rentals, and other miscellaneous sources.

Local Sales Tax Revenues

Sales Tax Revenues

State and local sales taxes account for 48 percent of forecasted revenues (excluding Measure R Highway Program Strategy Funds) through FY 2024. Growth is based on the July 2013 University of California at Los Angeles (UCLA) Anderson Forecast. The average sales tax growth rate is 4.19 percent through FY 2024. The actual percentage growth varies each year to capture fluctuations in the economic market as the independent forecast depicts. The sales tax projection is based on FY 2012 audited values of \$648.7 million for Proposition A, \$648.8 million for Proposition C, and \$645.0 million for Measure R.

Proposition A*

A half-cent sales tax, passed by Los Angeles County voters in 1980, is to be used to improve public transit throughout Los Angeles County. A portion of the revenues is returned to local jurisdictions, based on population, for use in public transit projects. Revenues, after 5 percent administration, are divided as follows:

| | |
|---|-----|
| Local Return (direct to cities and county) | 25% |
| Rail development and operations | 35% |
| Discretionary (bus operations only per Metro Board policy) | 40% |

All Proposition A 40 percent discretionary funds are used for bus operations in accordance with established formulas. Proposition A local return revenues are spent on bus operations expenditures that are based on the Short Range Transit Plans of the local municipal operators and plans of the cities.

Proposition C*

A half-cent sales tax, passed by Los Angeles County voters in 1990, is to be used for public transit purposes in Los Angeles County. Revenues, after 1.5 percent administration, are divided as follows:

| | |
|---|-----|
| Rail and bus security | 5% |
| Commuter rail/transit centers/park and ride lots | 10% |
| Transit-related street, state highway, and rail right-of-way improvements | 25% |
| Local return (direct to cities and county) | 20% |
| Discretionary | 40% |

The 40 percent discretionary funds are assumed split among rail capital and operations and bus capital and operations. Allocations between bus and rail capital and operating requirements shift over time as capital projects are built and operations begin. These funds are also used for planned replacement and rehabilitation of capital items including buses, facilities, and rail vehicles.

An allocation to Municipal Operators for bus expansion to offset Metro’s usage of Proposition C 40 percent was

directed by the Metro Board of Directors. This Municipal Operators Service Improvement Program (MOSIP) is assigned Proposition C 40 percent discretionary funds of \$21.4 million in FY 2014 and escalates annually at 3 percent. Further allocations are also given to regional operators for Foothill Transit mitigation, transit service expansion and discretionary base restructuring.

Most of the Proposition C 25 percent transit-related highway funds are programmed for transit-related highway projects such as carpool or high occupancy vehicle (HOV) lanes. These funds are also eligible for portions of transit projects that are on a state highway or freeway and for public mass transit improvements to railroad rights of way.

The Proposition C 10 percent funds are used for Metrolink commuter rail operations and capital, debt service, and regional park-and-ride capital facilities and transit centers through the Call for Projects. Metrolink operations receives 65-70 percent of the Proposition C 10 percent funds directly through the annual budgetary process.

*Propositions A and C cannot be used for underground improvements of services, such as transit or highway tunneling.

Measure R

A half-cent sales tax effective July 1, 2009, passed by Los Angeles County voters in 2008, is used for projects and programs as specified in the Measure R Expenditure Plan. Revenues, after 1.5 percent administration, are divided as follows:

| | |
|---|-----|
| Specified New Rail and/or Bus Rapid Transit Capital | 35% |
| Metrolink Capital Improvements within LA County | 3% |
| Metro Rail Capital System Improvements | 2% |
| Specified Highway Capital Improvements | 20% |
| Local Return | 15% |
| Rail Operations | 5% |
| Bus Operations | 20% |

In January 2011, the Metro Board of Directors approved a Unified Cost Management Process and Policy for Measure R Projects which requires a step-by-step evaluation of project costs against possible resources to address project shortfalls. Shortfalls that cannot be addressed at the project level by value engineering or other measures, such as changes in the scope of the project, will be subject to a stepwise evaluation process which will require the Metro Board to review and consider approval of project cost estimates against funding resources at key milestone points throughout the environmental, design, and construction phases of Measure R transit and highway projects. Measure R funds allocated to each project shall not exceed the Measure R amount shown on the Measure R Expenditure Plan.

In May 2011, the Metro Board approved a Fiscal Responsibility Policy for Measure R Capital Project Contingency Funds which establishes guidelines for the use of the Measure R Transit and Highway Capital Project Contingency line items on the Measure R Expenditure Plan. The goal of the policy is to ensure that all Measure R capital projects can be completed as scheduled in the adopted

L RTP. The uses of the Measure R Transit and Highway Contingency lines items are described in the Measure R Ordinance. The Contingency line items may be used for Measure R debt service (excluding principal) but such debt service may not exceed the levels forecasted to be necessary in the 2009 L RTP. The policy was amended in April 2012 to stipulate that it applies to net bond interest costs after adding Measure R interest earnings and exempting the 2010 bonds that pre-dated the policy.

Transportation Development Act (TDA Article 4)

Revenues are derived from one-quarter cent of the 7.25 percent statewide base retail sales tax. The funds are apportioned to each county by the State Board of Equalization according to the amount of tax collected in the county. Each year, the actual funds are allocated according to the Metro Formula Allocation Procedure (FAP), but generally Metro receives approximately 74 percent and the Municipal Operators and non-Metro operators receive 26 percent. TDA Article 4 funds are available for bus and rail capital and operations.

Other Local Revenues

Metro Fare Revenues

Planned Metro action to change the transit fare structure is an important assumption in the efforts to continue the improved bus service that Metro has developed. The changed fare structure will pair user benefits with fares paid, resulting in a fair and efficient allocation of passenger revenues. The passenger fare forecast is adjusted in FY 2015 and reflects changes in the cash fares, monthly passes and other fare media based on customer usage data and review of selected fare media sources. Fare recovery is adjusted annually based in part on the Consumer Price Index (CPI) for Southern California, estimated changes in ridership, opening of new transit projects and corridors, and revised fare media projections. Fare restructurings are assumed in FY 2015 and every two years starting in FY 2018. The adopted 2009 L RTP states that fare recovery would be adjusted to reflect cost increases associated with operations through the planning period. The same assumption applies to the Plan.

The current baseline farebox recovery ratio of 26 percent comes from the FY 2014 Metro budget. The Plan assumes that the recovery ratio will rise to 32 percent by FY 2022 and remain in the 30-33 percent range thereafter. If this does not occur, it will impact Metro's ability to fund projects and/or operate service assumed in this plan. Maintaining the fare recovery ratio between 30 and 33 percent will require a combination of strategies such as reducing unproductive service, achieving operating efficiencies, reducing costs, and increasing operating revenues.

Municipal Operators Fare Revenues

Passenger fare revenues for the Municipal Operators are based on projections in their Short Range Transit Plans and 2011 National Transit Database reports. The farebox recovery ratio for the Plan period is approximately 26.2 percent. For FY 2014 and beyond, fare revenues are

escalated by inflation as approved by the Bus Operations Subcommittee (BOS) during review of these assumptions as part of the L RTP.

Metrolink Fare Revenues

Passenger fare revenues are based on SCRR's FY 2014 budget and the percentage of passenger boardings taking place in Los Angeles County. Fare revenues for fiscal years 2015 and 2016 are escalated by 3.5 percent per year and thereafter by CPI.

Lease Revenues

Metro may lease property and equipment receiving payments as the financial market dictates. These funds become general revenues and are used to fund agency operations in most instances. While these are limited in scope, they can offer offsets to supplement and increase existing funding sources. Much of this funding emanates from the innovative financial marketing of Metro assets. Such items as cross border leases and funds held as reserves and later released are the primary source of these funds.

Local Agency Funds (City of Los Angeles and other cities)

These funds represent each affected city's contribution of 3 percent of the cost of Metro rail lines as contemplated in the Measure R Expenditure Plan. Over the Plan period, these contributions total \$323.8 million and are reflected in the forecast on an annual basis.

State Repayment of Capital Project Loans

Metro established the State Repayment of Capital Project Loans (fund 3562) to account for capital reimbursements from the State for advances that Metro made in lieu of capital project funding that the State could not provide on the originally programmed schedule. The adopted L RTP assumed that these funds must be used for capital purposes only and are allocated at the discretion of the Metro Board. In the Plan period, \$90.8 million of these funds are assumed used for major transit projects.

In April 2012, the Metro Board amended the Fiscal Year 2011 Budget Policy to Reimburse Funding Sources Used as Advance Funding to Accelerate Measure R Projects. The amendment permits reimbursement at the end of the Measure R scheduled funding period for each project. The amendment also permits the planned use of the funds reimbursed to the State Repayment of Capital Program Loans fund for subsequent project segments included in the L RTP, but requires that such planned uses be brought to the Metro Board for specific approval when a life-of-project budget including such funds is adopted.

Bonds/Financing Mechanisms

Propositions A and C and Measure R Bonds

Senior lien bonds have a senior claim on a Metro pledged revenue source that is superior to the claim of any other bonds or debt. The Plan assumes that senior lien bonds will be issued as needed to support bus, rail and highway capital requirements. Bonds are projected for issuance each year they are needed to meet capital requirements.

The financial forecast assumes bond payments based on an issuance interest rate initially at 4.0 percent, then increasing to 4.5 percent in FY 2016. Bond issuances, assumed in the forecast, do not substitute for specific Board action required to issue bonds.

Capital Grant Receipt Revenue Bonds

Capital Grant Receipt Revenue Bonds of \$1,039.6 million are assumed in anticipation of receipt of \$1,250 million of FTA Section 5309 New Starts funds for the Westside Purple Line Extension, Section 1. Because the appropriation schedule of \$65 million in FY 2014, \$100 million from FY 2015 to FY 2025, and \$85 million in FY 2026 is not consistent with the project's cash flow requirements during the construction period, Metro will issue a total of \$1,039.6 million in Capital Grant Receipt Revenue Bonds between FY 2014 and FY 2023. Financing charges for the bonds will total \$162.6 million assuming a 3.5 percent interest rate.

State Revenues

Regional Improvement Program (RIP) Funds

The State Transportation Improvement Program (STIP) is a five-year state-regional program, adopted every two even years, of capital improvements on and off the State Highway System that increase the capacity of the transportation system. The STIP is funded from the State Highway Account (SHA), the primary funds of which are the 18 cents per gallon state gasoline tax and Federal (primarily STP) funds. The STIP is divided into a 75 percent Regional Improvement Program (RIP) and a 25 percent Interregional Improvement Program. The 75 percent RIP share allows Metro to select projects for funding upon approval by the California Transportation Commission (CTC). Revenues anticipated through the RIP program are programmed by the Metro Board for capital improvements to highway, bus, rail, fixed guideway and other capital projects. Metro programs RIP funds to specific projects through either the Call for Projects or the County Transportation Improvement Programming (CTIP) processes. The financial forecast reflects Metro's projects in Caltrans' Adopted 2012 State Transportation Improvement Program.

State Transit Assistance (STA)

Funds are used for bus and rail operations and capital throughout the plan period. Metro's regional allocation is based on Los Angeles County's shares of population and transit operator revenue compared to the rest of the state. The 50 percent population portion of STA is used for Metro rail operations and the 50 percent operator revenue share is used for Metro and Municipal Operators bus capital and operating needs. Previously funded from 50 percent of the State Public Transportation Account, effective July 1, 2011, it is funded from 75 percent of the 6.5 percent diesel fuel sales tax. Per the provisions of this State's "Fuel Tax Swap", the STA program now relies upon actual consumption of diesel fuel rather than an annual budget appropriation. Consequently, actual allocations, which are paid quarterly by the State, will likely fluctuate and the actual annual total may be more or less than the estimate made at the beginning of a fiscal year.

Proposition 1A

In November 2008, California voters approved the Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century to authorize \$9.95 billion in State general obligation bond funds to initiate construction of a high-speed passenger rail system. This proposition provides \$950 million for capital improvements to intercity rail lines, commuter rail lines, and urban rail systems that provide direct connectivity to the high-speed train system and its facilities, or that are part of the construction of the high-speed train system. The connectivity portion has two categories: Intercity Rail Program (\$190 million statewide) and Commuter and Urban Rail Program (\$760 million statewide) allocated to eligible recipients based on a defined formula. Los Angeles County's \$178 million share of the Commuter and Urban Rail Program is included in the financial forecast with \$114.9 million for the Regional Connector and \$63.5 million for Metrolink.

Proposition 1B

In November 2006, California voters approved the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006 to authorize \$19.925 billion of state general obligation bonds for specified capital purposes. Bond categories are discretionary or are allocated by formula and each category has specific formulas and/or guidelines. Funding for categories must be included in the annual State Budget. Such appropriations may vary each year and are expected for six to ten years. The Plan includes remaining expenditures of \$556 million from the Public Transportation Modernization, Improvement, and Service Enhancement Account (PTMISEA) category, \$388.3 million from the Corridor Mobility Improvement Account (CMIA) category, \$100.3 million from the State-Local Partnership Program (SLPP) category, and \$105.4 million from the Transit System Safety and Security category.

Excise Tax Replacement for Proposition 42 Funds

In 2010, Proposition 42 gasoline sales taxes were eliminated and swapped with a new excise tax on gas of which 44 percent is allocated to local jurisdictions for local roads.

State Gas Tax Subventions to Cities

These revenues reflect 6.46 cents per gallon of the State gas tax which is paid directly by the State Controller to the cities in Los Angeles County for local streets and roads. No growth is assumed as the gas tax is not indexed to inflation and revenues tend to remain flat.

Federal Revenues

Moving Ahead for Progress in the 21st Century (MAP-21) Funding

All federal funding for highway, transit and transportation programs authorized in the MAP-21 legislation which expires in September, 2014, is assumed to continue. The amounts assumed vary annually based on the guaranteed levels in the MAP-21 legislation or a specified percentage of the national authorization. Based on these assumptions, approximately \$9.0 billion in federal funds is projected to be available through FY 2024. However, most of this money

is not discretionary but restricted for highway or transit capital. Certain federal funding programs can be transferred between transit and highway capital usage. This flexible funding is assumed to be used by Metro to assist transit capital. Only limited funding from federal sources is available for operating uses.

Federal Flexible Funding Categories

The Surface Transportation Program (STP) and the Congestion Mitigation and Air Quality Improvement Program (CMAQ) allow for funds to be exchanged between highway and transit modes (often called flexible funds). Portions of these funds have been assumed in the financial forecast to be flexed to transit capital and transit operating needs in accordance with the published federal regulations, for either bus purchases or for the first three years of new operating transit segments. Generally Metro Board policy directs usage of CMAQ for the first three years of operations for all new rail lines.

Surface Transportation Program (STP)

STP funds are flexible but appropriated by Congress for highway improvements. Eligible uses include transit capital projects, Transportation Demand Management (TDM), and improvements to highways and arterial roads. Approximately half of the STP allocation to the State goes to the State of California Highway Account with the remainder divided by formula to the regions [Regional Surface Transportation Improvement Program (RSTP)] in accordance with Section 182.6 of the State Streets and Highway Code. RSTP funding is used primarily for Access Services paratransit. Metro allocates a portion of the STP funds (designated as STP-L) on a per capita basis to the County of Los Angeles and to the 88 jurisdictions in the County.

Congestion Mitigation and Air Quality Improvement Program (CMAQ)

The CMAQ program is designed to fund projects that contribute to attainment of national ambient air quality standards. CMAQ funds cannot be used to construct facilities providing additional capacity for single-occupancy vehicles. The CMAQ program funding has been adjusted downward in FY 2019 and again in FY 2020 to reflect improvements in air quality standards in Los Angeles County. Metro Board of Directors action will be required through the Call for Projects and TIP programming processes to program funds to specific projects. It is assumed that new transit corridors will receive CMAQ funding for the first three years of operation. Los Angeles County's share of CMAQ funds could be reduced if other air quality attainment areas throughout the country are allowed to be at higher levels.

Active Transportation

Active transportation is considered to be all methods of travel that are human-powered, the most common modes being walking and bicycling and is recognized as a low-cost, non-polluting alternative to driving that incorporates physical activity into daily life and can help to create healthier and more sustainable communities. While \$500 million is specifically available in the bikeway and pedestrian components of the Call for Projects it's

important to note that up to \$1 billion is available for active transportation through a variety of programs over the life of the Plan. The opportunity also exists for Active Transportation projects to compete in various other modes of the Call for Projects including Regional Surface Transportation Improvements (RSTI), TDM, and Signal Synchronization. Up to \$287 million is available from state and regional sources through the state/regional active transportation program. Additionally, cities have approximately \$11 billion available at their discretion through local sources (Propositions A and C, STP-L, and State Gas Tax subventions) for providing transportation needs which include active transportation.

We are also working with local governments to adopt local land use regulations supportive of Transit Oriented Development (TOD). The TOD planning grants increase access to, and improve utilization of public transit while reducing greenhouse gas emissions and supporting sustainable development policies.

Federal Transit Administration (FTA) Section 5307 Urbanized Area Formula

Federal regulations allow Section 5307 funds to be used for preventive maintenance costs as well as capital costs. Funding is assumed at the guaranteed level of MAP-21 as determined by the federal formula and Southern California Association of Governments (SCAG) implementing formulas. This funding source was decreased slightly this year and into the future based on the 2010 Census results which factor into the formulas. The financial forecast reflects this funding decrease. The annual amount is assumed to increase by 1.4 percent after MAP-21 expires in September 2014. The forecast assumes that these funds will be allocated to all eligible bus operators by formula for identified capital projects, pursuant to the current Metro Capital Allocation Procedure [84 percent allocation prescribed by formula and 16 percent discretionary]. For forecasting purposes, an average of the last five years is used to determine the split between the Municipal Operators and Metro. The actual allocation of the 16 percent discretionary funds will occur annually and may vary from the financial forecast.

Metro is using its share of these flexible funds for eligible bus and rail preventive maintenance costs in the operating budget. Approximately ten percent of the Metro bus operation preventive maintenance is forecasted for funding using this source through FY 2024. The financial forecast assumes the continued usage by Metro of Section 5307 funds for preventive maintenance purposes that appear in Metro's operating budget. The Municipal Operators allocate their share of the Section 5307 formula funds for capital facilities and purchasing replacement buses on a 12-year cycle. Municipal Operators are planning the purchase of new vehicles in addition to capital facilities as part of their expansion program. The capital expansion program also provides for alternative fueling facilities in the event the Municipal Operators convert from diesel fuel to cleaner burning fuels. Several operators have initiated this conversion. Implementation of the new buses and facilities will occur incrementally over the Plan period.

FTA Section 5309 New Starts

These funds are for major fixed guideway capital investment competitive grants. The funding comes from the United States General Fund and the Federal Mass Transit Account of the Federal Highway Trust Fund, which is generated from two cents of the 18.4-cent federal excise tax on gasoline. The FTA awards multi-year Full Funding Grant Agreements (FFGA) to specific projects and Congress allocates Section 5309 New Starts Funds generally following the annual payment schedule in the FFGA. In 2014, Metro received FTA FFGAs for \$669.9 million in Federal New Starts funds for the Regional Connector and \$1.25 billion for the Westside Purple Line Extension, Section 1. The forecast assumes that the Regional Connector and Westside Purple Line Extension, Section 1 projects each receive \$65 million in FY 2014 and \$100 million per year thereafter until each project's New Starts funding total is reached. The Plan assumes an additional \$100 million New Starts funding per year for the Westside Purple Line Extension, Section 2 from FY 2020 through FY 2024.

FTA Section 5337 State of Good Repair

Section 5337 State of Good Repair funds are used in the financial forecast for rail rehabilitation and other minor rail state of good repair capital expenses. The amount assumed annually reflects the guaranteed level in MAP-21 and eligible route-miles that become seven years old during the forecasting period. After the expiration of MAP-21, the program is estimated to expand at 1.4 percent annually. Some additional miles will be included annually as Metrolink and Metro Gold and Expo Lines' service miles become eligible for the funding category and are applied to the federal formula. The forecast assumes this added revenue based on current formulas.

Measure R Highway Program Strategy Funds

As Measure R will fund only about 25 percent of the Measure R highway project cost, the Plan assumes that \$12.9 billion of additional non-Measure R funds will be leveraged to support the Measure R highway program. This includes user tolls and new federal and state funds. If the assumed new revenues are not secured, projects may be delayed until full funding is secured.

No New Revenue Sources

Other than the Measure R Highway Strategy funds, no new revenue sources are assumed to be available over and above the local, state, and federal revenue sources that are currently obtainable or identified by law to become available. The financial forecast assumes that Metro will maintain the historical growth level of funding provided by current revenue sources, except in specific fund sources such as fares. If projected levels of funding are not maintained, projects and programs will be reduced or delayed accordingly unless comparable cost savings measures or alternative revenues are implemented.

MAJOR EXPENDITURE ASSUMPTIONS

Most of Metro's available revenues are committed to maintaining and operating the transportation system, and the projects and programs already approved by the Metro Board (FY 2014-2024). Through FY 2024, \$27 billion,

36 percent of total commitments (excluding those funded with Measure R Highway Program Strategy Funds), is projected for countywide bus and rail operations. The high priority capital projects are the Exposition Transit Corridor Phase II, Gold Line Foothill Extension Phase 2A, East San Fernando Valley Transit Corridors, Crenshaw/LAX Transit Corridor, Regional Connector, Westside Purple Line Extension, Section 1, and the state of good repair program. Through FY 2024, \$12.9 billion will be spent on these projects, other rapid transit corridors, and Metrolink capital.

The share of highway and multimodal programs funded through Metro (which does not include the additional amount provided directly by Caltrans, Los Angeles County, and local cities) is projected at \$10.2 billion. Sales tax revenues returned directly to local governments account for \$5.8 billion and Debt Service totals \$6.7 billion. A more detailed breakdown is shown in Figure J of the Plan, Phasing of Forecasted Funds.

The financial forecast includes estimates developed and submitted to the Federal Transit Administration (FTA) for Full Funding Grant Agreement applications for the Regional Connector and Westside Purple Line Extension, Section 1 projects.

Metro will program billions of dollars in funds over the Plan period. In addition, Metro administers the local sales tax initiatives receiving the collected funds from the State of California. By having such programming and management of funds authority, it is not uncommon for large fund balances to be available in Metro accounts. Balances, however, are not to be confused with those funds actually available to Metro for bus and rail capital and operations. For example, balances in Metro accounts such as Proposition C 25 percent, Transit-Related Highway funds, are awaiting disbursement to sponsors from prior years' Call for Projects. Other accounts may have balances wherein the funds can only be used for specific purposes such as security (Proposition C 5 percent), or commuter rail, transit centers, and park-and-ride lots (Proposition C 10 percent).

It is important to note that the delivery and implementation of all projects and programs are dependent on the availability of local, state, and federal revenues at the projected levels. Major changes in local, state, or federal policies, or unanticipated shifts in the state/national economy would impact the implementation of the proposed projects and programs.

The financial forecast forms the fiscal basis of the Plan through FY 2024. The financial forecast is a tool used to evaluate the fiscal capacity of Metro to implement the Plan. The assumptions do not replace Metro Board action or policies. These assumptions, financial policies and the financial forecast itself will be updated periodically to reflect separate, specific Metro actions. All the financial policies, assumptions and financial forecast are intended as management tools to assist in evaluating the impacts of contemplated actions involving transportation programs

or projects on the overall financial capacity of Metro as the regional transportation planning agency for Los Angeles County.

The following are some of the major expenditure assumptions:

New Buses and Added Service

By the end of the Plan, it is forecasted that an additional 88,400 revenue service hours will be added to base Metro bus service compared to FY 2014 levels. The additional service will be added toward the end of the Plan to accommodate expected ridership increases due to population growth. Funding for the added service is included and is based on existing marginal costing approaches used for added bus service in the financial forecast. An annual average purchase of 200 new Metro replacement buses is assumed in the Plan. When averaging the Metro replacement buses with the Municipal Operators' fleet, a countywide bus fleet with an average age of 6 years is established.

Opening of Six Transit Corridors

The financial forecast assumes that six transit corridors will be completely constructed by FY 2024 and will operate daily. The five corridors are as follows:

| | |
|--|---------------|
| Gold Line Foothill Extension Phase 2A | opens 11/2016 |
| Exposition Transit Corridor Phase II | opens 12/2016 |
| East San Fernando Valley Transit Corridors | opens 6/2018 |
| Crenshaw/LAX Transit Corridor | opens 4/2019 |
| Regional Connector | opens 5/2021 |
| Westside Purple Line Extension, Section 1 | opens 5/2024 |

Current Federal Funding Programs Continue

The forecast assumes the implementation of MAP-21 at the guaranteed transit funding levels. Highway formula funds are assumed to be available at the level estimated by Caltrans. If federal funds do not occur at the estimated levels, planned highway, rail, automated bus guideway and Call for Projects capital projects may be delayed accordingly unless comparable project cost savings measures are implemented. In the event federal funds increase, projects and services will be brought on-line in accordance with the available revenue.

Leveraging State and Federal Funds

The forecast assumes that local funds are bonded for capital needs if necessary to match state and federal funds consistent with the project and program priorities established by the Metro Board of Directors.

Use of Long Term Debt

The forecast assumes that senior lien bonds will be issued each year as necessary to fund major capital projects. It is further assumed that such bonding will be in conformance with the Metro debt policy adopted in October 1998 and subsequently amended annually with the most recent occurring in March 2013. Debt service on the bonds is assumed paid annually with Propositions A and C and Measure R cash revenues. Actual bond issuances must be analyzed separately from the financial forecast assumptions and approved by separate Metro Board action.

In May 2011, the Metro Board approved a Fiscal Responsibility Policy for Measure R Capital Project Contingency Funds which establishes guidelines for the use of the Measure R Transit and Highway Capital Project Contingency line items on the Measure R Expenditure Plan. Any Measure R Contingency funds used for Measure R debt service (excluding principal) may not exceed the levels forecasted to be necessary in the 2009 LRTP. The policy was amended in April 2012 to stipulate that it applies to net bond interest costs after adding Measure R interest earnings and exempting the 2010 bonds that pre-dated the policy.

Operating and Capital Inflation

Based upon the August 2013 annual economic forecast for Los Angeles County from the UCLA Anderson Forecast, the average CPI inflation rate is estimated to be 2.04 percent. The financial forecast applies the annual inflation rate from the forecast to various operating cost items. The capital inflation rate is estimated to be 3.0 percent. The financial forecast applies the annual inflation rate to various capital cost items. In the Call for Projects application review process, all projects are escalated annually by 3 percent.

BUS PROGRAM ASSUMPTIONS

Bus Capital

Transit Operators – The financial forecast covers funding for clean fuels, vehicle replacement schedule, facilities and support equipment, and bus bonds as described below.

Clean Fuels – Air Quality Management District (AQMD) requirements are met by:

- > converting vehicles and facilities to clean fuels (e.g., alternative fuel vehicles);
- > increasing transit service so that work trips on transit as a percentage of all regional trips increases by the year 2019 (year compliance is achieved for air quality in the South Coast Air Basin); and
- > local bus operators (Municipal Operators) currently using diesel fuel have been programmed to receive funds for converting fueling facilities and transitioning buses to cleaner burning fuels in the event such decisions are made. Such funding emanates from the Section 5307 funds allocated to the Municipal Operators and the new bus expansion allocation to the Municipal operators enacted by the Metro Board.

Vehicle Replacement Schedule – Vehicle replacement is based on the following retirement schedule:

- > Transit Buses (35, 40 foot and Articulated) Metro 13 years
Metro/Municipal Operators fleets Muni 12 years
average 6+ years old
- > Heavy-Duty Smaller Buses 10 years
- > Dial-A-Ride Vehicles
(light-duty, mid-sized buses, approx. 5 years
25-35 feet long)
(light-duty, small buses, cutaways, or 4 years
modified vans less than 25 feet in length)

Vehicle Costs – Based on Metro’s recent procurements of compressed natural gas buses, the price in 2014 was \$554,000 per standard 40-foot bus (includes extra parts from plant assembly, sales tax and labor force account of Metro expenses) and is escalated annually by CPI after FY 2014. The financial forecast assumes the same price for Metro and Municipal Operators for bus purchases. Municipal Operators purchase buses separately using criteria unique to their own needs and standards and the actual price may vary from the forecast assumptions. It is assumed that 200 buses will be purchased annually to replace the basic active bus fleet of Metro. The Municipal Operators plan on purchasing approximately 100 buses annually, some of which may be articulated buses. The actual number may vary on a year to year basis based on actual purchases but as a planning average provides for the optimum efficient delivery of new buses and allows for equally spreading the age of the basic bus fleet over time. A decision has not been made on the technology of future bus procurements.

Facilities and Support Equipment – The financial forecast assumes that costs for bus capital projects are based on the existing capital program, new projects expected to be approved, state of good repair needs and any expansion needs. Funding for a new Bus Division has been assumed in FY 2020 through 2023. The financial forecast includes the adopted Metro Capital Program costs through FY 2018. These cost projections include expenditures for: bus maintenance overhaul and rehabilitation, CNG fueling facilities, bus maintenance facilities improvements, non-revenue vehicles and communications support. The Municipal Operators’ Plan costs have been extrapolated from the capital facilities and bus purchase assessment completed previously for the LRTP.

Bus Capital Bonds – The forecast assumes that bonds will be issued as needed to support bus capital requirements if compliance with the Metro debt policy can be achieved. The forecast assumes bond payments based on a 4.0 percent interest rate in FY 2014, which will increase to 4.5 percent in FY 2016 and thereafter. The debt incurred is paid over periods of up to 30 years depending on asset life cycles.

Bus State of Good Repair (Rehabilitation and Replacement) – Projected rehabilitation and replacement costs are based on a State of Good Repair study undertaken in response to a request from the Metro Board of Directors and a national policy effort on the part of the Federal Transit Administration to improve industry practices by carefully studying rehabilitation and replacement needs and identifying their anticipated costs and funding. The study identified state of good repair needs and costs for the existing system out to 2040. The financial forecast incorporates the anticipated funding for both Metro bus and rail modes. More than half of the nearly \$4.8 Billion for State of Good Repair will be spent on the Metro Bus system. The bus rehabilitation and replacement costs through 2024 are:

| Metro Bus | Amount |
|-------------------------------------|----------------------|
| Replacement Bus Acquisition | \$1.4 billion |
| Bus Vehicle State of Good Repair | \$524 million |
| Bus Facilities State of Good Repair | \$608 million |
| Total Cost | \$2.5 billion |

Bus Operations

Metro Bus Operations – The financial forecast assumes the following for Metro bus operations:

- > Operating and maintenance cost projections are extrapolated off of the current budget and modified by Metro Operations’ projections of service levels in the Plan time period.
- > Hourly service costs grow slightly faster than inflation to mimic recent past experience.
- > TDA Article 4, Proposition A, and STA will continue to be allocated through the FAP in future years.
- > Metro will continue to operate high capacity buses for an extended period of time. As Metro continues to develop and implement its Light and Heavy Rail systems, some of the service currently operated by high capacity buses will shift to complementary rail service and the total number of high capacity buses in Metro’s fleet will adjust over time. However, Metro will continue to use high capacity buses to meet the service demands of our customers.

Municipal Operators – Operations and maintenance costs were based on projections in their Short Range Transit Plans and 2011 National Transit Database reports. These cost estimates are used as the basis for future years’ cost projections and escalated at CPI. The forecast assumes TDA Article 4, Proposition A, and STA funds will continue to be allocated via the FAP. Proposition C 40 percent for expansion buses has likewise been assumed for the entire planning period. Municipal transit operators receiving formula funding include:

- > Antelope Valley Transit Authority
- > Arcadia
- > Claremont
- > Commerce Municipal Bus Lines
- > Culver City Municipal Bus Lines
- > Foothill Transit
- > Gardena Municipal Bus Lines
- > La Mirada Transit
- > Long Beach Transit
- > Los Angeles Department of Transportation (LADOT)
- > Montebello Municipal Bus Lines
- > Norwalk Transit
- > Redondo Beach
- > Santa Clarita Transit
- > Santa Monica Municipal Bus Lines
- > Torrance Transit

Expansion Services – A new transit corridor and Metro Rapid line in the East San Fernando Valley is included in the Measure R transit program and funded in the Plan. It is assumed that Transportation System Management (TSM) program and other techniques to ensure rapid movement of buses along the highways will occur as technology improvements and funding emerge in years ahead. Funds for overall system upgrades are provided.

Access Services – The forecast assumes the continued usage of Regional Surface Transportation Program (RSTP) funds programmed for Access Services as the countywide paratransit provider. Allocating RSTP funds for Access Services allows Metro to make Proposition C 40 percent Discretionary funds available for other uses.

RAIL PROGRAM ASSUMPTIONS

Rail Capital

Rail Projects Capital Cost Estimates – Costs, including rail cars, which have been approved by the Metro Board, are based on the adopted FY 2014 budget. Costs for rail projects with no existing Board-approved life-of-project budgets are based on Metro's cost estimation guidelines from the Metro Construction Division and specialized consultants. The cost estimation process considers factors such as the projected construction cost in current dollars, construction start date, construction duration and timing, and escalation based on experience with past and current projects. The following five rail projects will be completed in the Plan period:

Expo Phase II
Gold Line Foothill Extension Phase 2A
Crenshaw/LAX
Regional Connector
Westside Purple Line Extension Section 1

- > Exposition Light Rail Transit Project Phase II to Santa Monica (assumed to open FY 2016) – This light rail line will extend Phase I approximately 6.9 miles from Culver City to Santa Monica. The Exposition Metro Line Construction Authority is constructing Phase II with funding from Metro and Metro will operate and maintain the line. The capital cost is \$1,511.2 million.
- > Gold Line Foothill Extension Phase 2A (assumed to open FY 2016) – This light rail line will extend the Metro Gold Line approximately 11.3 miles from Pasadena east to Azusa/ Glendora. The project is being built by the Metro Gold Line Foothill Extension Construction Authority with funding from Metro and Metro will operate and maintain the line. The capital cost is \$851.1 million.
- > Crenshaw/LAX Transit Corridor (assumed to open FY 2019) – This light rail line is approximately 8.5 miles with seven stations, one of which will be aerial. From a northern terminus at the Exposition/Crenshaw station, the alignment will follow Crenshaw Blvd south to the South Bay Metro Green Line Extension and then follow the South Bay Metro Green Line Extension to a connection at the Metro Green Line Aviation/LAX station. The capital cost is \$2,058.0 million.

- > Regional Connector (assumed to open in 2021) – This 1.8-mile light rail line will create a transit link between the Metro Gold and Blue lines through downtown Los Angeles and also will connect the Metro Expo Line and Metro Gold Line Eastside Extension. By providing continuous through-service between these lines, the Regional Connector Transit Corridor will improve access to both local and regional destinations and help create a true transportation network for the region. The cost is \$1,399.5 million.
- > Westside Purple Line Extension, Section 1 (assumed to open in 2024) – This heavy rail line will extend the Metro Purple Line 3.9 miles from Wilshire/Western to La Cienega and will add three stations. The cost is \$2,485.7 million.

Light Rail Vehicles – The light rail car procurement consists of a \$342.35 million base order of 78 cars and \$396.65 million for two options for 97 vehicles. The base order cars are for the Gold Line Foothill Extension and the Exposition Phase I and Phase II projects and are funded with state and local funds. The option cars are for replacements and the Crenshaw/LAX project and are funded with Measure R 35 percent, Proposition A 35 percent, and federal funds.

Future Rail Vehicle Procurement – As part of the State of Good Repair program, approximately 35 additional light rail cars are forecasted to be purchased from FY 2021 through FY 2024 for a total of \$149 million. Sixteen additional Metro Red Line heavy rail cars are forecast for purchase in FY 2016 through FY 2018.

High Speed Rail – Proposition 1A, the Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century, approved by California voters in November 2008, provides \$9 billion in bonding capacity to build a high-speed train network from San Francisco to San Diego. The California High-Speed Rail Authority has identified Union Station as one of the major stops for the new high-speed rail line. The Plan assumes \$225 million through FY 2024 for the high speed rail line. Proposition 1A funds assumed include \$63.5 million for Metrolink and \$114.9 million used for the Regional Connector.

Planning for Future Transit Projects – \$71.1 million for short-term planning is included for FY 2014-21.

Red/Purple Line System Improvements not included in the Purple Line Extension Project Budget – \$251.1 million of traction power and ventilation improvements on the Red and Purple lines and upgrades to the Division 20 maintenance facility will be needed to accommodate the Purple Line Extension. Funding sources assumed are Measure R 2 percent, Proposition A 35 percent, and Proposition C 40 percent.

Rail Yards – Two new maintenance facilities (Eastern Light Rail Yard and Southwestern Light Rail Yard) are included costing \$561.8 million funded partly by new rail projects and partly with Proposition A 35 percent and Measure R 2 percent.

Metrolink Commuter Rail – The Southern California Regional Rail Authority (SCRRA) is a Joint Powers Agency that plans, constructs, and operates Southern California’s commuter rail system. Metro funds a portion of the capital and operating costs for commuter rail lines and projects located within Los Angeles County, including:

- Los Angeles /San Bernardino & Los Angeles/Riverside
- Los Angeles /Oxnard
- Los Angeles /Santa Clarita /Palmdale /Lancaster
- Los Angeles /Oceanside & Fullerton/LAAPT
- Los Angeles /Riverside (Union Pacific)
- Shared maintenance facility

The current SCRRA system includes 512 unduplicated route miles, 186 of which are in Los Angeles County, and 55 stations, 26 of which are in Los Angeles County. The financial forecast assumes continued funding for the current commuter rail system. SCRRA staff has provided operating cost projections. Los Angeles County’s share of commuter rail costs is funded with Proposition C 10 percent revenues. The Metro funding assumptions in the Plan period for Metrolink are:

- > \$642.5 million for operating subsidy;
- > \$196.0 million for capital maintenance; and
- > \$292.8 million of Measure R 3 percent for capital improvements in Los Angeles County.

Rail State of Good Repair (Rehabilitation and Replacement) –

Projected rehabilitation and replacement costs are based on an internal State of Good Repair study undertaken in response to a request from the Metro Board of Directors and a national policy effort on the part of the Federal Transit Administration to improve industry practices by carefully studying rehabilitation and replacement needs and identifying their anticipated costs and funding. The study identified state of good repair needs and costs for the existing system out to 2040. The financial forecast incorporates the anticipated funding needs and adds in any expected state of good repair needs for new lines that open in the Plan time frame. The rail rehabilitation and replacement costs (and major asset types included in each category) through 2024 are:

| Metro Rail | Amount |
|--|---------------|
| Vehicle-related Rehabilitation/Replacement | \$1.2 billion |
| Rail Vehicle Spare and Replacement Parts | |
| Rail Vehicle Rebuilds | |
| Train Control | |
| Communications | |
| Rail Vehicle Acquisition | \$546 million |
| Replacement Light Rail Vehicles | |
| Replacement Heavy Rail Vehicles | |

| | |
|-----------------------------------|----------------------|
| Maintenance of Way and Facilities | \$567 million |
| Operating Divisions | |
| Passenger Stations | |
| Traction Power Substations | |
| Power Distribution Systems | |
| Bridges and Tunnels | |
| Track | |
| Rail Operations Center | |
| Total Cost | \$2.3 billion |

Rail capital state of good repair is funded with a combination of local TDA Article 4 revenues, Propositions A and C, including bond proceeds, and federal Section 5337 State of Good Repair funds.

Previous Rail Projects Which Require Rehabilitation and Replacement – Shown for Information Only

Metro Red Line Subway, Segment 1 (Opened in January 1993) –

This heavy rail subway line extends 4.4 miles with five stations through downtown Los Angeles, from Union Station/Gateway Transit Plaza to the Westlake/MacArthur Park station. Costs totaled \$1.4 billion.

Metro Red Line, Segment 2 (Opened in two phases in July 1996 and June 1999) –

Totaling 6.7 miles, this heavy rail subway segment consists of two rail corridors, the costs of which totaled \$1.8 billion:

- > Wilshire Corridor (now known as the Metro Purple Line)
Opened in July 1996, this corridor extends from the Westlake/MacArthur Park station northwest to Wilshire Boulevard and Vermont Avenue intersection, and west along Wilshire Boulevard, terminating at the Wilshire/Western station.
- > Vermont/Hollywood Corridor (the Metro Red Line)
Opened in June 1999, this corridor extends north from Wilshire/Vermont intersection along Vermont Avenue, turning west along Hollywood Boulevard to the Hollywood/Vine station.

Metro Red Line Segment 3, North Hollywood (Opened in June 2000) –

This heavy rail subway segment is 6.3-miles with three stations beginning just west of the Segment 2 Hollywood/Vine station and continuing west under Hollywood Boulevard to the Hollywood/Highland station and north under the Santa Monica mountains to the Universal City station, finally terminating in North Hollywood. The costs were \$1.3 billion.

Metro Green Line (Opened in November 1995) –

This light rail line extends 20 miles with 14 stations along the center of the 105 Freeway from Studebaker Road and the I-605 Freeway in Norwalk to Marine Ave. in Redondo Beach. The total cost was \$718 million.

Metro Blue Line (Opened in July 1990) –

This light rail line extends 22 miles, with 22 stations, from the Downtown Los Angeles station (Metro/7th Street station) to Long Beach. The construction cost was \$877 million. The Blue Line was expanded to three-car train lengths in 2002, funded through Metro’s annual budgetary process.

Metro Gold Line – Pasadena (Opened in July 2003) –

This light rail line extends 13.7 miles from Sierra Madre Villa in the City of Pasadena to Union Station in downtown Los Angeles and has 14 stations. State law created the “Pasadena Metro Blue (renamed “Gold Line”) Line Construction Authority” (PMBLCA) to construct the project. Metro funded the construction and Metro operates it. The cost was \$859 million.

Metro Gold Line – Eastside Extension (Opened in November 2009) –

This is a six-mile light rail transit project running from Union Station to the intersection of Pomona and Atlantic Boulevards in East Los Angeles. The line includes eight stations plus the main station at Union Station, which is also the station stop for the Pasadena Gold Line. The cost was \$898.8 million.

Exposition Light Rail Transit Project Phase I to Culver City (Opened in April 2012) –

This light rail line phase extends 8.6 miles from 7th and Flower streets in downtown Los Angeles to Venice Boulevard/Robertson Boulevard in Culver City and includes ten stations. State law created the “Exposition Metro Line Construction Authority” to construct the project. Metro funded the construction and Metro operates it. The cost was \$923.8 million.

Rail Operations

Rail operating cost projections are extrapolated off of the current budget and modified by Metro Operations’ projections of service levels in the Plan time period. Hourly service costs grow slightly faster than inflation to mimic recent past experience. The forecast is consistent with the methodology specified by the FTA for Alternatives Analysis studies. Staffing requirements, labor costs, and non-labor expenses are calculated based on the projected quantity of service supplied (e.g., peak vehicles, revenue vehicle service hours) and the physical size of the system (e.g., route-miles, number of stations). Operating costs for new lines are included as those lines enter revenue service. The Gold Line Foothill Extension (November 2016), Expo Line Phase II (December 2016), Crenshaw/LAX Line (April 2019), Regional Connector (May 2021) and Westside Purple Line Extension Section 1 (May 2024) lines are all scheduled to open to the public during the Plan time frame.

HIGHWAY, MULTIMODAL, AND CALL FOR PROJECTS

The highway/multimodal component of the forecast includes funding for projects such as carpool lanes and other highway and multimodal programs. Local funding sources (Proposition C 25 percent, Proposition C 10 percent, and Measure R 20 percent) are forecasted on a cash flow basis. State and federal funding sources are forecasted on a programming basis.

Environmental Enhancement & Mitigation (EEM)

The financial forecast assumes that Los Angeles County will receive \$0.7 million annually from the non-Active Transportation Program portion for eligible projects. Caltrans administers the program.

Freeway Carpool Lanes [High Occupancy Vehicle Lanes (HOV)]

Funding for these projects totals \$3.0 billion through 2024. Funding sources consist of Proposition C 25 percent, Measure R 20 percent, State Proposition 1B funds, State STIP and SHOPP funds, CMAQ, and RSTP funds. Unidentified additional funding of \$4.48 billion is necessary during the Plan period for the I-710 South.

Freeway Gap Closures, Interchanges, and Arterial Widening

Funding for these projects totals \$1.6 billion through FY 2024. Funding sources consist of Proposition C 25 percent, Measure R 20 percent, and STIP RIP funds. Unidentified additional funding of \$6.8 billion is necessary during the Plan period for the High Desert Corridor, the SR-710 North Extension, and the I-605 Hot Spot Interchanges.

Freeway Service Patrol

Continued funding for this program is assumed funded with Proposition C 25 percent, State Highway Account Funds, and HOV violation funds. The Proposition C 25 percent funding is assumed to grow annually by CPI.

Freeway Traffic Systems Management (TSM) & Traffic Operations System (TOS)

The financial forecast assumes Caltrans will continue providing the operating costs for these measures.

Regional Integration of Intelligent Transportation System (RIITS)

This program aims to efficiently utilize advanced technologies in Southern California’s transportation systems. The financial forecast assumes \$1.7 million of Proposition C 25 percent funds beginning in FY 2014, escalating by CPI thereafter. No Federal funds are assumed.

Local Streets and Roads

Estimated State Gas Tax subventions and excise tax replacement for Proposition 42 funds of \$4.78 billion are assumed received by the County and the cities in Los Angeles County through FY 2024.

Operations, Caltrans

Estimated State Highway Account funds of \$1.9 billion are assumed for highway operations and maintenance by Caltrans District 7.

Retrofit Soundwalls

The Retrofit Soundwalls program encompasses freeways previously constructed without necessary soundwalls. This program and its \$2.4 billion backlog of projects has been a Metro responsibility since Senate Bill 45 took effect in 1998. The program has two phases: three priorities in Phase I and unprioritized Phase II. Completion of Phase I for a total of \$186.9 million is assumed funded with Proposition C 25 percent funds. Phase II, for soundwalls on freeways without carpool lanes and therefore not eligible for Proposition C 25 percent, is funded with Measure R 20 percent funds for \$96 million during the Plan period. Unidentified additional funding of \$530 million is necessary during the Plan period.

Rideshare/Vanpool Program

Since FY 2003, Metro has directly operated countywide rideshare services with over 100,000 registrants currently. In May 2007, the Vanpool Program was added, providing lease and fare incentives to new and existing vanpools. Proposition C 25 percent funding of \$147.4 million is assumed in the Plan period.

Service Authority for Freeway Emergencies (SAFE)

A separate legal entity that is housed within Metro, SAFE operates call boxes along the freeways, the #399 Mobile Call Box program, and the 511 Traveler Information System. It is funded by a \$1 surcharge on each of the seven million registered vehicles in the County. Cost estimates and assumptions are based on the SAFE Ten-Year Financial Plan and include capital requirements and operations and maintenance expenses. An increase in the number of registered vehicles in the county would be the only mechanism, other than legislation, to increase revenues.

State Highway Operation and Protection Program (SHOPP) – Freeway Rehabilitation

Every four years, Caltrans prepares a SHOPP plan that identifies needed projects for maintenance and safety repairs. Caltrans administers this program and allocates funding throughout California as-needed. An estimated amount allocated to Los Angeles County is assumed for reference and comparison to other counties.

Traffic Congestion Relief Program (TCRP)

In 2008, the CTC adopted an Allocation Plan which gives priority to Tier 1 projects and allocates funding to Tier 2 projects on a first-come, first-served basis. Tier 1 includes projects with approved Letters of No Prejudice which Metro received for certain projects that allowed Metro to advance its own local funds to maintain project schedules and be reimbursed later by the State. The financial forecast assumes that all approved Letters of No Prejudice are reimbursed and all remaining unallocated highway projects are allocated by FY 2017.

Freeway Incident Management

The forecast assumes continued funding for the Freeway Incident Management program, known as Freeway Service Patrol (FSP) and Major Incident Response Program. This program is funded through Proposition C 25 percent, State Highway Account Funds, and HOV violation funds. The program is assumed to grow at CPI annually.

MULTIMODAL PROGRAM ASSUMPTIONS

Alameda Corridor East

This project is included in the Plan for \$806.4 million of which \$477 million is from Metro Proposition C 25 percent and Measure R 20 percent. The project is located in the San Gabriel Valley to install railroad grade separations to reduce traffic congestion after completion of the Alameda Transportation Corridor.

Call For Projects

The Call for Projects is Metro's process every two odd years for allocating discretionary regional capital funds to local jurisdictions, transit operators, and other public agencies for regionally significant, non-freeway, multimodal transportation projects in six modes. After completion of a competitive, merit-based evaluation, projects are selected and approved by the Metro Board of Directors. Approved projects are awarded funding (i.e. programmed) for specific year(s), with a time limit to expend the funds of 3-4 or more years depending on the situation. Accordingly, expenditures can occur beyond the years in which the funds were programmed.

Funding is projected for completion of projects from Calls prior to the 2013 Call. For the 2013 and future Calls, \$1,581 million regional funding is assumed, beginning in FY 2015. Each mode's share will be determined through the Call process. Funding sources are Proposition C 25 percent, Proposition C 10 percent, STIP RIP, CMAQ, and RSTP funds. Also, recipients must provide matching funds which are not included in the forecast, as they are assumed funded from cities' Local Return funds.

The program is divided into multimodal categories. As part of the application review process, all projects are escalated annually by 3 percent.

Call For Projects Multimodal Categories

Regional Bikeways and Pedestrian Improvements – Funding sources are CMAQ, RIP STIP funds, local agency matching funds, and TDA Article 3 funds.

Regional Surface Transportation Improvements (RSTI) and Goods Movement – Generally arterial street projects. Funding sources are Proposition C 25 percent, local agency matching funds, RIP STIP funds, and RSTP.

Signal Synchronization and Bus Speed Improvements – Funding sources are Proposition C 25 percent, local agency matching funds, CMAQ funds, and RIP STIP Funds.

Transit Capital (Park and Ride Facilities/Transit Centers) – Funding sources are primarily Proposition C 10 percent, local matching funds, and CMAQ.

Transportation Demand Management (TDM) – Funding sources consist of CMAQ, RSTP, and local agency matching funds.

Travel Demand Model and Assumptions

The development of the 2014 Plan was preceded by a rigorous assessment of the analytical tools, assumptions and performance criteria that would be employed in the evaluation of the Plan. The primary analysis tool is the Metro Travel Demand Simulation Model.

This chapter provides a technical summary of the travel demand modeling process and performance measure analyses conducted as part of the 2014 Plan effort.



MODEL STRUCTURE

The Metro Travel Demand Simulation Model uses the traditional four-step process generally employed by travel forecasting modelers throughout the United States. The four steps are trip generation, trip distribution, mode choice, and network assignment. Figure 4.1 is a conceptual representation of the four-step modeling process. The implementation of the travel demand modeling process is achieved through a series of 17 computer simulation modules. Figure 4.2 is a flowchart that illustrates the process.

Each module has been calibrated from observed data, typically from a sample of household interviews from which detailed demographic and travel characteristics are collected through written questionnaires. The current Metro Travel Demand Simulation Model is the Year 2014 Model that was developed for the 2014 Plan. The 2014 Model is the latest and most sophisticated evolution of the Metro Model originally developed in the early 1970s.

The trip generation component of the Metro Model is primarily based on the 1967, 1976, 1991, and 2000 home interview surveys for the Los Angeles metropolitan area that were conducted by the California Department of Transportation (Caltrans) and the Southern California Association of Governments (SCAG). The trip distribution and mode choice modules were updated using the 2000 and 2010 Census, the Year 2000 Post-Census Regional Travel Survey, the 2001 on-board surveys on light-rail, heavy-rail and bus patrons, the 2002 on-board survey of commuter-rail patrons, and the 2006/7 survey of Orange Line and Rapid Bus patrons.

The 2014 Model was validated for its ability to replicate 2013/4 travel patterns and conditions using the survey data from which it was calibrated as well as transit ridership statistics. The model performed within standard limits for all components including average trip length, mode shares, and comparisons of transit boardings.

For the 2014 Plan, the 2004 Model has been updated to reflect 2014 as the base year and 2024 as the forecast year. The process includes updating the input socioeconomic data and the modification of highway and transit networks for the years 2014 and 2024.

The Metro modeling area is identical to the SCAG modeling area which encompasses six counties, namely Los Angeles, Orange, Riverside, San Bernardino, Ventura, and Imperial counties. It is illustrated in Figure 4.3A. The area is represented by a total of 3,720 transportation analysis zones (TAZs), of which 3,010 are in the internal modeling area, 40 represent cordons, and 670 are transit station zones. 2,261 TAZs are located in Los Angeles County and illustrated in Figure 4.3B. They are aggregated into nine subregions and are also illustrated in Figure 4.3B.

FIGURE 4.1
Travel Demand Modeling Process

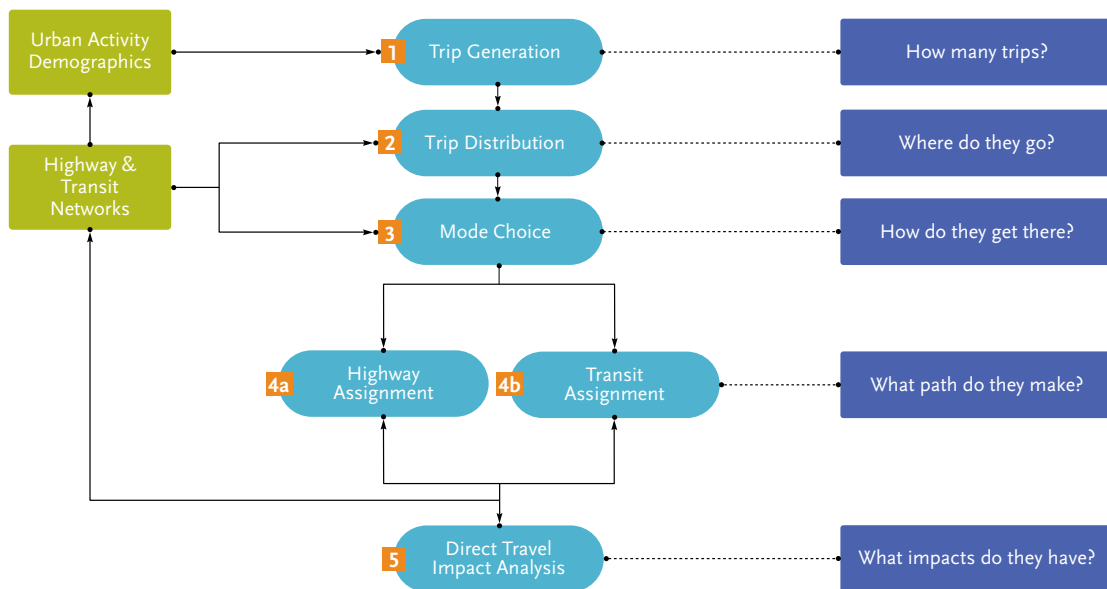


FIGURE 4.2

Metro Short Range Transportation Plan Base Year (2014) Model Flowchart

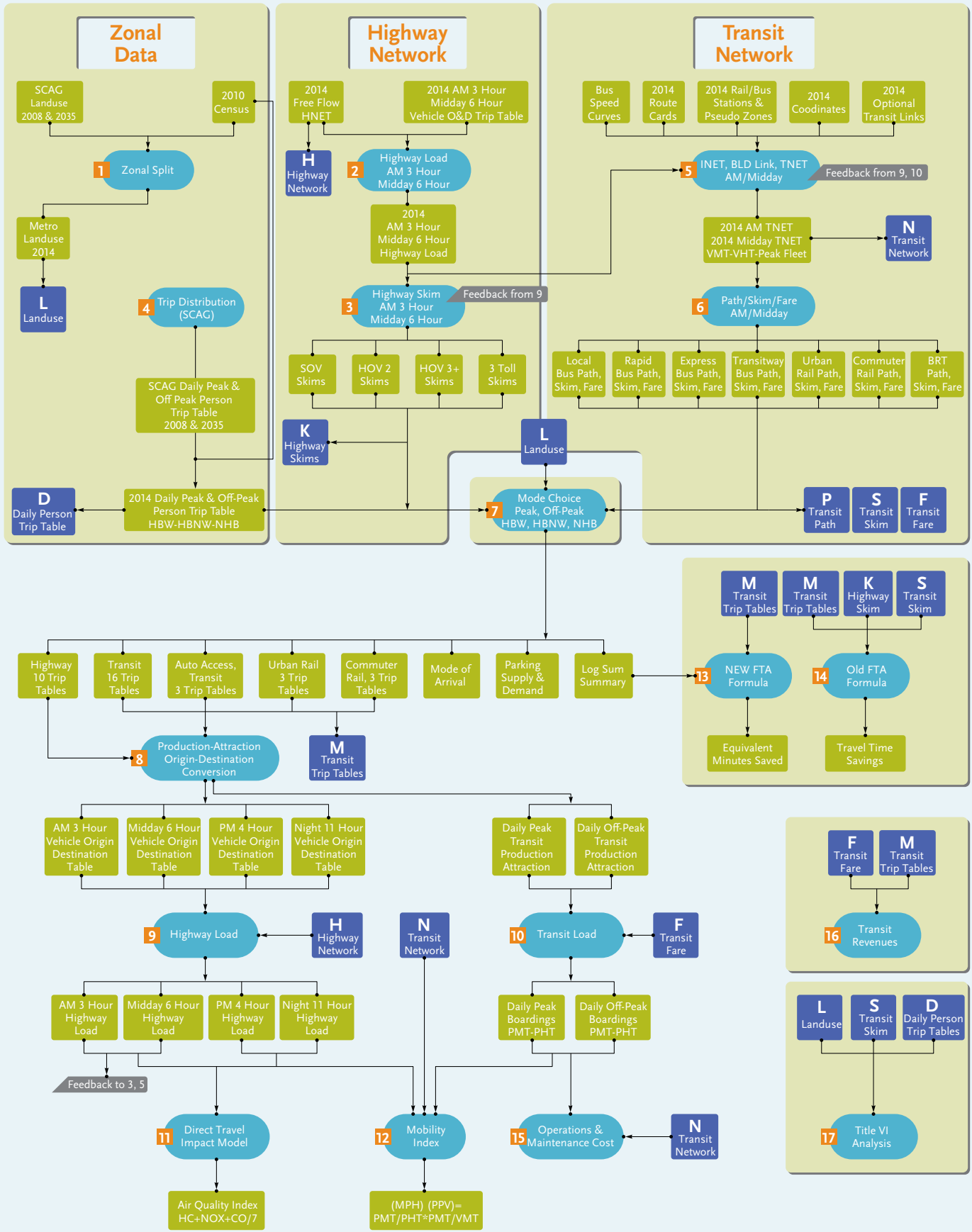


FIGURE 4.3A

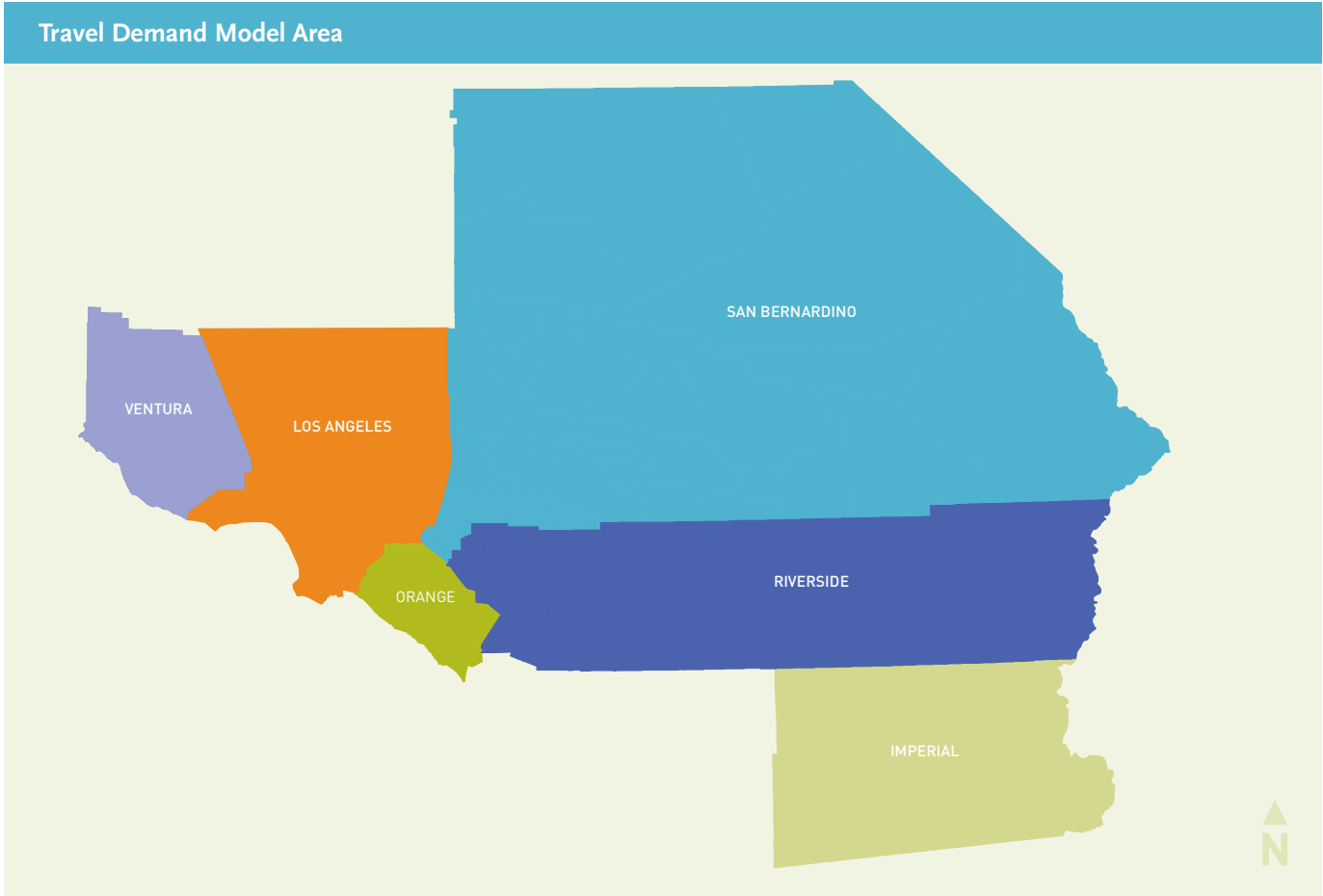
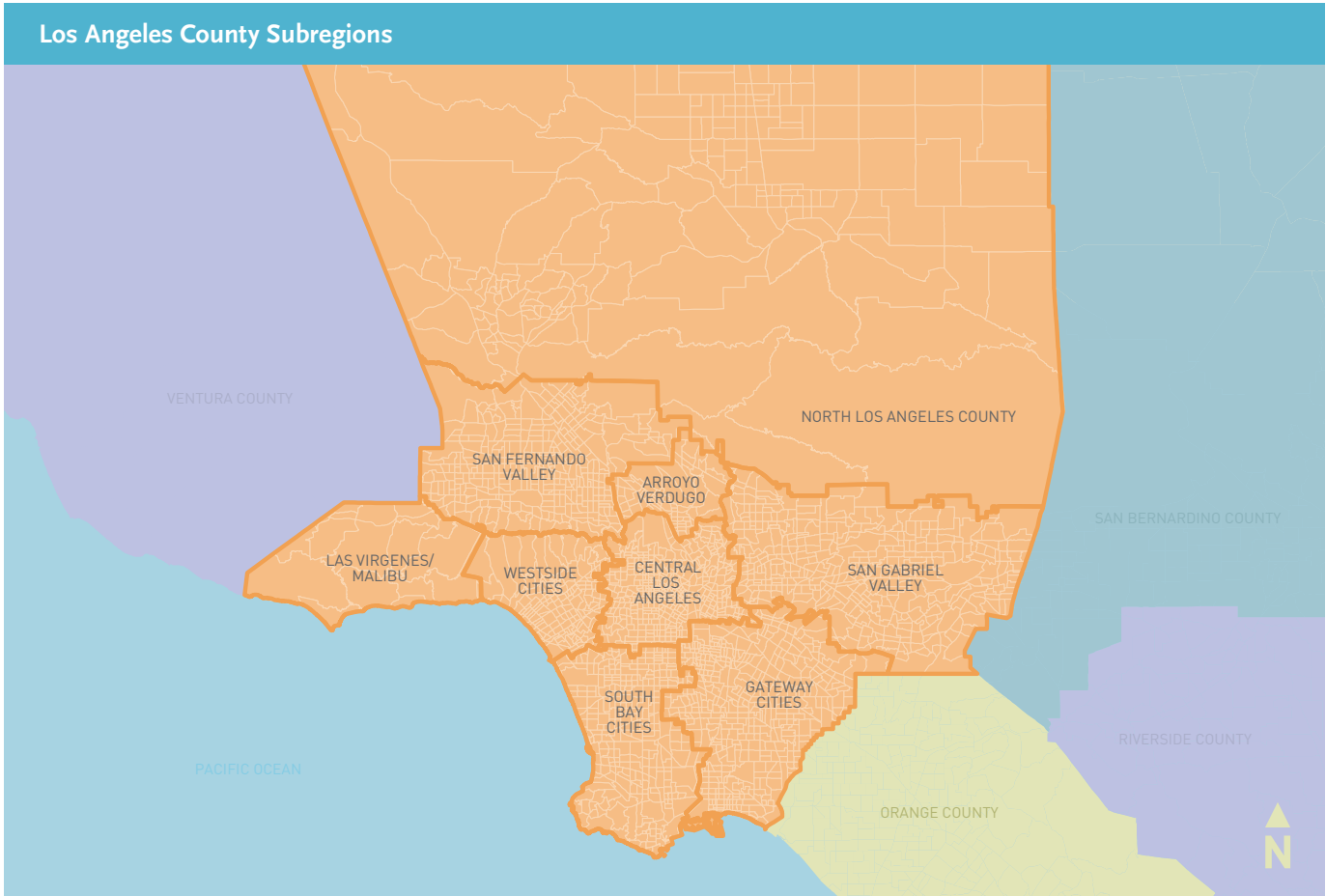


FIGURE 4.3B



MODEL ASSUMPTIONS

Each input to the Metro Model is a representation of the characteristics of the trip, the trip maker or the transportation system. This information is usually employed at the census tract level, but may include some distributions of characteristics within the census tract. All inputs for the 2014 validation used empirical data compiled from a variety of sources as described in Figure 4.4.

Projections for the planning horizon year 2014 were obtained from many of the same sources. The model then uses its econometric and behavioral formulations to project travel response and transportation system impacts under a variety of transportation system environments and conditions. However, there are several major assumptions that either reflect a continuation of existing trends or fall into the policy arena. If the future varies from these assumptions, the projected future year results will likely be different from those projected by the model. These assumptions are:

- > The growth and distribution in population, employment, income, and vehicle ownership will occur in accordance with the projection adopted by SCAG in 2012;
- > The per-mile vehicle operating cost will not change in constant dollars (i.e., changes in fuel prices and fuel economy offset one another but rise with inflation);
- > The May 2011 transit fare structure was fully implemented and the regular inflationary adjustments will be made;
- > Parking costs will rise with inflation and the location and application of parking costs will not change significantly from today (that is, the location of free versus pay parking and employer subsidies);

- > The need or distribution of travel will not change dramatically due to a major movement to a round-the-clock business day or a major displacement of work trips by telecommuting; and,
- > The current highway and transit levels-of-service will not change dramatically from today (except for planned system improvements and the projected congestion effects) due to potential large scale Intelligent Transportation System implementation.

Three model runs were conducted for the 2014 Plan. These include:

1. 2014 Base Year;
2. No Build (2024) – the 2024 demand on the base condition (2014), assuming implementation of no further projects; and
3. 2014 Plan (2024) – the 2024 demand on the transportation system adopted in this Plan.

Figures 4.5 and 4.6 summarize and illustrate the highway and transit projects that comprise the 2014 Plan. Several of the highway and transit projects in the 2014 Plan have or will have opened by the 2014 base year model and are noted as such in Figures 4.5A and 4.6A. Each run assumes all of the projects from the previous runs.

FIGURE 4.4

| Model Validation Data | | | |
|----------------------------|---|--|---|
| MODEL COMPONENT | INPUT DATA | DATA SOURCE | OUTPUT DATA |
| Urban Activity | General Plans, Population, Employment, Licensed Drivers | Municipalities, Census Bureau, Bureau of Labor Statistics, Dept. of Economic Development | Population, Employment, household demographic data by Zone |
| Highway & Transit Networks | Highway facilities, Transit services | Caltrans, Municipalities, Transit Operators | Zone-to-zone travel time and cost by time period |
| Trip Generation | Population, employment, household demographics | Southern California Association of Governments | Trip productions and attractions by zone |
| Trip Distribution | Trip productions and attractions by Zone & Zone-to-zone travel time | Southern California Association of Governments | Zone-to-zone trip volumes by purpose |
| Mode Choice | Zone-to-zone trip volumes, Zone-to-zone travel time, Zone demographic data, Parking costs, Fuel/auto operating costs, Transit fares | Trip Distribution Model, Transportation Networks, Urban Activity Model, Parking Posted Rate, Surveys Transit Operators | Zone-to-zone trips by purpose and mode of travel |
| Network Assignment | Transportation Networks, Zone-to-zone trips by purpose and mode | Transportation Networks, Mode Choice Model | Volumes on highway facilities and patronage on transit services |

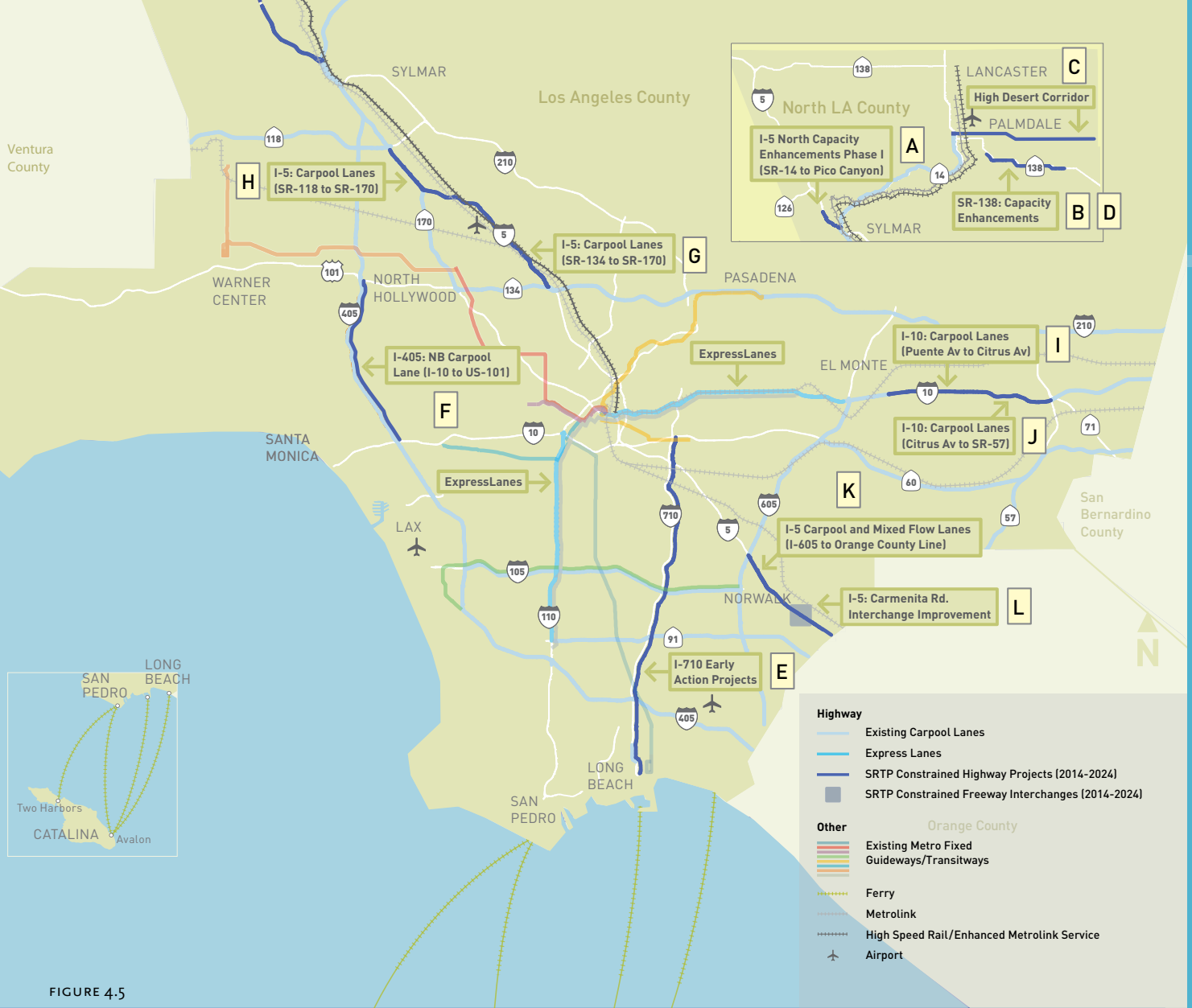


FIGURE 4.5

2014 Plan – Highway Projects Map

FIGURE 4.5A

2014 Plan – Highway Projects List

| MAP LABEL | PROJECT TYPE | DESCRIPTION/LIMITS |
|-----------|---------------------------------------|--|
| A | Freeway Improvements and Gap Closures | I-5 North Capacity Enhancements: Phase I from SR-14 to Pico Canyon |
| B | Freeway Improvements and Gap Closures | SR-138 Widening |
| C | Freeway Improvements and Gap Closures | High Desert Corridor |
| D | Freeway Improvements and Gap Closures | SR-138 Capacity Enhancements |
| E | Freeway Improvements and Gap Closures | I-710 Early Action Projects |
| F | Carpool Lanes | I-405 NB Carpool Lanes: I-10 to US-101 |
| G | Carpool Lanes | I-5 Carpool Lanes: SR-170 to SR-134 |
| H | Carpool Lanes | I-5 Carpool Lanes: SR-118 to SR-170 |
| I | Carpool Lanes | I-10 Carpool Lanes: Puente Av to Citrus Av |
| J | Carpool Lanes | I-10 Carpool Lanes: Citrus Av to SR-57 |
| K | Carpool Lanes | I-5 Carpool & Mixed-Flow Lanes: I-605 to Orange County Line |
| L | Freeway Interchanges | I-5/Carmenita Rd Interchange Improvement I-405, I-110, I-105 and SR-91 Ramp and Interchange Improvements in South Bay* I-605 Corridor “Hot Spot” Interchanges in Gateway Cities* |

*Level of detail not included in Regional Model



FIGURE 4.6

2014 Plan – Transit Projects Map

FIGURE 4.6A

2014 Plan – Transit Projects List

| MAP LABEL | PROJECT TYPE | DESCRIPTION/LIMITS |
|-----------|--------------------|--|
| A | Light Rail Transit | Exposition LRT Phase II: Culver City to Santa Monica |
| B | Light Rail Transit | Metro Gold Line Foothill LRT Extension Phase 2A |
| C | Transit Corridor | East San Fernando Valley Transit Corridors |
| D | Light Rail Transit | Crenshaw/LAX Transit Corridor (LRT) |
| E | Light Rail Transit | Regional Connector |
| F | Subway | Westside Purple Line Extension |
| G | Regional Rail | Los Angeles/Palmdale Corridor (Enhanced Metrolink Service) |

MODEL INPUTS

The basic inputs to a travel demand simulation model include socioeconomic data and the transportation networks (both highway and transit). This section describes the socioeconomic data and the network information used in the Model for the 2014 Plan.

Socioeconomic Forecast

The socioeconomic input data to the Metro model are consistent with the SCAG forecast. The latest official forecast released by SCAG is the “2012 RTP” version, used to develop the 2012 Regional Transportation Plan adopted by the Regional Council. Population and employment are the main socioeconomic input to a travel demand model. The socioeconomic forecasts were developed by interpolating from the adopted 2008 and 2035 data sets at the zonal level. These forecasts are consistent with the SCAG forecast.

Population Forecasts

The analysis of population growth was conducted regionally by county and at the subregional level for Los Angeles County. Figure 4.7A shows that Los Angeles County’s population is expected to grow by 8 percent from 9.8 million in 2014 to 10.5 million in 2024. The region’s population is expected to grow by 11 percent during that period, from 17.7 million in 2014 to 19.7 million in 2024. Los Angeles County’s share of the regional population is estimated to decrease from 55.1 percent in 2014 to 53.5 percent in 2024.

Figure 4.7B depicts population growth in the subregions in Los Angeles County. In 2014, the Gateway Cities was the most populous subregion with 2 million residents. In 2024, the Gateway Cities is expected to be the most populous subregion with 2.1 million residents. North Los Angeles County is expected to experience the most population growth, growing by 159,000, or 24 percent.

Employment Forecasts

Figure 4.8A shows that Los Angeles County’s employment is expected to grow by 5 percent from 4.3 million in 2014 to 4.6 million in 2024. The region’s employment is expected to grow by 10 percent during that period, from 7.7 million in 2014 to 8.5 million in 2024. Los Angeles County’s share of the regional employment is estimated to decrease from 56.5 percent in 2014 to 54.0 percent in 2024.

Figure 4.8B depicts employment growth in the subregions in Los Angeles County. In 2014, Central Los Angeles had the most jobs, 751,000. In 2024, Central Los Angeles is expected to continue to have the most employment with 790,000 jobs. North Los Angeles County is expected to experience the most employment growth, growing by 21 percent.

FIGURE 4.7A

Population Growth by County (2014-2024)

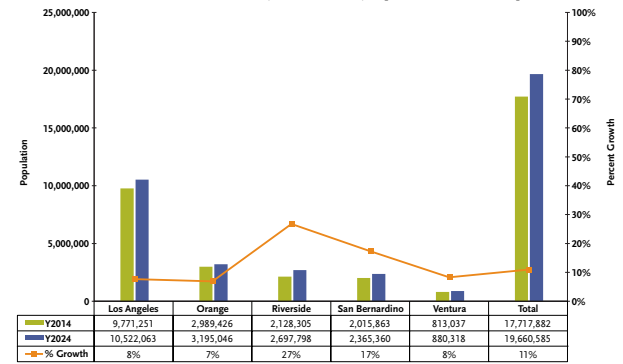


FIGURE 4.7B

Population Growth by Subregion (2014-2024)

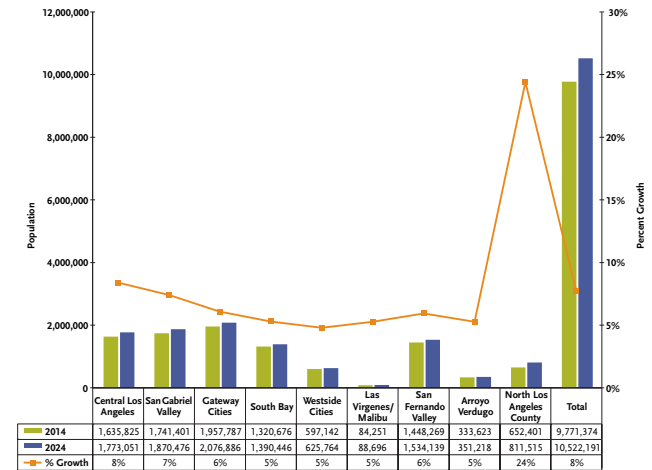


FIGURE 4.8A

Employment Growth by County (2014-2024)

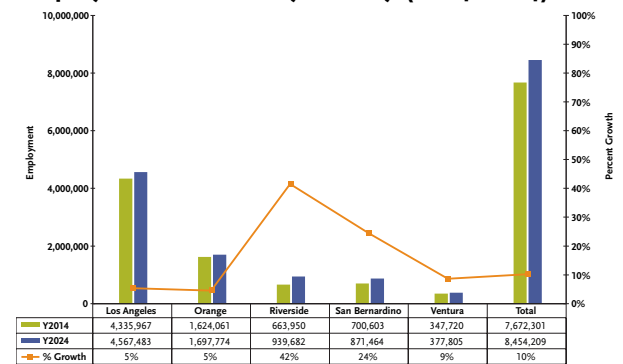
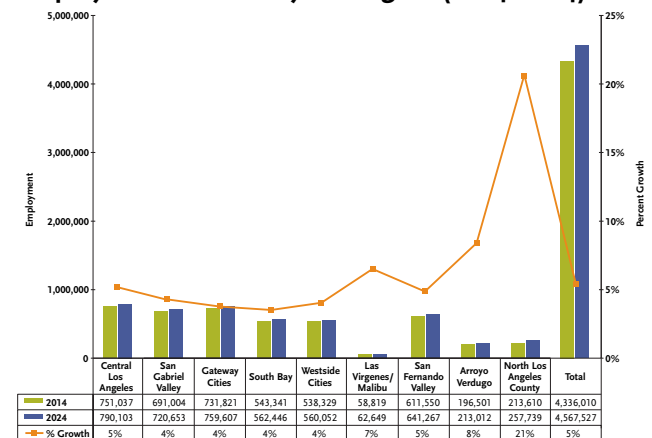


FIGURE 4.8B

Employment Growth by Subregion (2014-2024)



Transportation Networks

The transportation networks in the 2014 Model were updated from representing 2004 conditions to 2014 conditions. Networks representing year 2024 with 2014 Plan improvements were also developed.

2014 Base Year Conditions

Figure 4.9 depicts the highway links included in the computer network file representing the year 2014 highway network. The network consists of 20,971 nodes and 66,257 links. They cover all freeways as well as major, primary and secondary arterials within the five-county modeling area.

A summary of the 2014 highway network by facility type for each subregion is provided in Figure 4.10. Countywide, a total of 21,700 lane-miles of roadway are represented in the network. Among them, 5,100 lane-miles, or 23 percent are freeway.

2014 transit service was coded in the computer network to reflect the conditions expected to exist at that time. In Los Angeles County, this included approximately 451,000 vehicle-miles of bus service, 16,000 vehicle-miles of Metro Rail service, and about 9,000 vehicle-miles of commuter rail service in the region.

2024 Future Year Conditions

The 2014 Plan includes highway and transit improvement projects listed in Figures 4.5A and 4.6A. These projects are assumed to be completed by 2024. The 2014 Base Year highway network and transit network were modified to reflect the completion of these projects. A 2024 Acceleration network was coded to represent an accelerated completion of Measure R projects.

The highway projects included in the 2014 Plan will add 110 lane-miles of freeways and 130 lane-miles of new/upgraded arterials. Combined, they represent a 2.1 percent increase in freeway lane-miles and 0.8 percent increase in arterial lane-miles in Los Angeles County.

In addition, the 2014 Plan will add substantial transit infrastructure to the network.

The 2024 transit service was coded in the computer network to reflect the future planned transit network. In Los Angeles County, this included approximately 454,000 vehicle-miles of bus service, 28,000 vehicle-miles of Metro Rail service, and 9,100 vehicle-miles of commuter rail service in the region. These increases over 2014 represent additional lines as well as increased service on existing lines.

MODEL OUTPUTS

The basic outputs from a travel demand simulation model include trip productions and attractions, trip tables between TAZs, trip tables by mode, and trip assignments. This section describes the outputs of the Model for the 2014 Plan.

Trip Generation

Trip generation is the process of estimating how many daily person trips are generated by households within each TAZ. SCAG's trip generation model generates trips for the following thirteen (13) purposes:

1. Home-Based Work Direct – Low-Income
2. Home-Based Work Direct – Middle-Income
3. Home-Based Work Direct – High-Income
4. Home-Based Work Strategic – Low-Income
5. Home-Based Work Strategic – Middle-Income
6. Home-Based Work Strategic – High-Income
7. Home-Based School
8. Home-Based University
9. Home-Based Shop
10. Home-Based Social/Recreation
11. Home-Based Other
12. Work-Based Other
13. Other-Based Other

Using the population and employment estimates for 2014 and 2024 as input, SCAG's trip production model and trip attraction model are used to estimate the trips produced from and trips attracted to each TAZ.

Trip Productions

The results of trip production are summarized in Figure 4.11A. Figure 4.11A shows that productions in Los Angeles County are expected to grow by 6 percent, from 34.9 million in 2014 to 37.0 million in 2024. Riverside County is expected to experience the highest growth at 30 percent. Figure 4.11B illustrates the growth by subregions in Los Angeles County. North County is expected to experience the highest growth in trip productions at 21.2 percent and 488,000 trips. Central Los Angeles has the second largest growth at 6.9 percent and 386,000 trips.

Trip Attractions

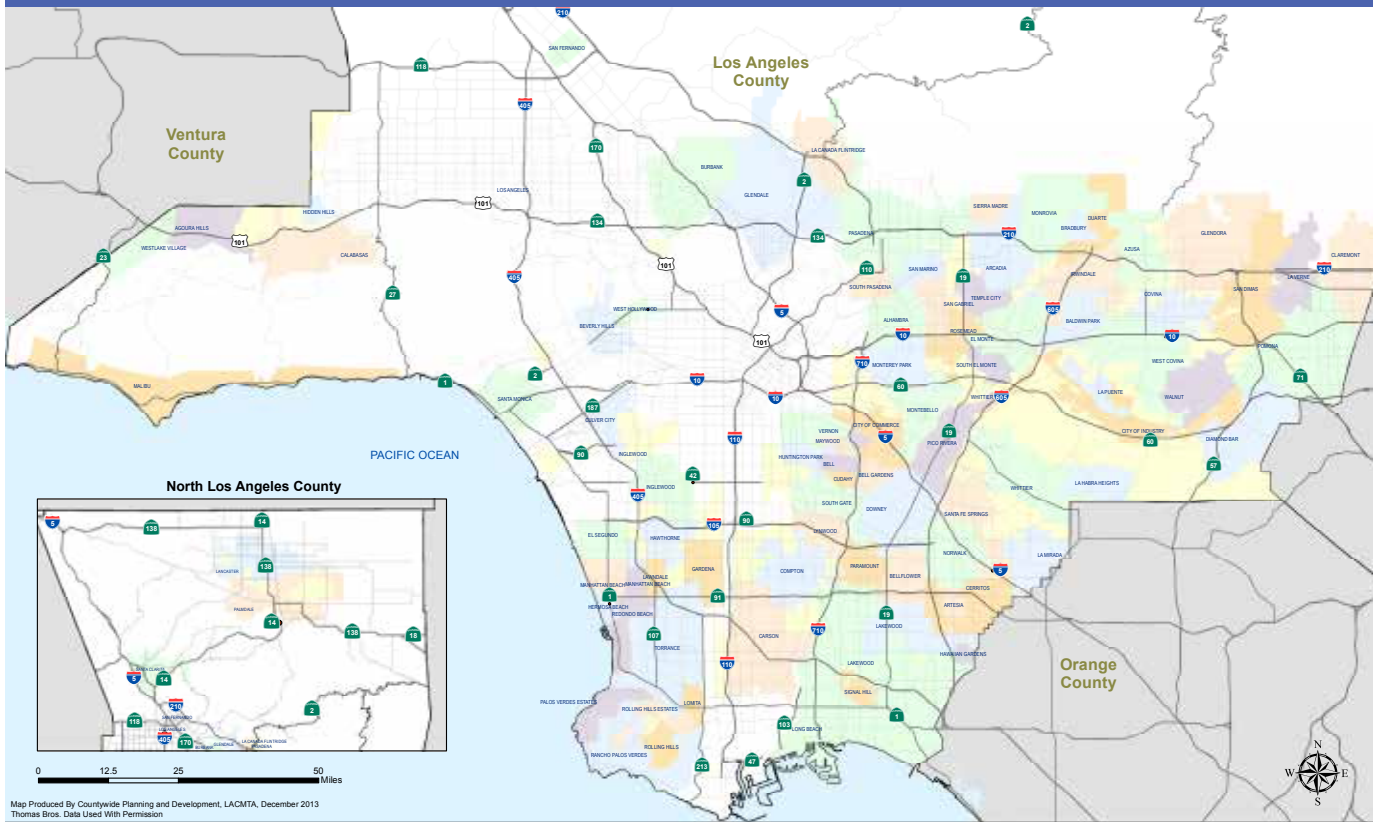
The results of trip attraction are summarized in Figure 4.12A. Figure 4.12A shows that Los Angeles County is expected to be the largest trip attractor in the region in 2024, with 37.3 million trips, a growth of 6 percent over 2014. Riverside County is expected to experience the highest growth at 31 percent. Figure 4.12B illustrates the growth by subregions in Los Angeles County. North County is expected to experience the highest growth in trip attractions, at 20.5 percent and 440,000 trips. Central Los Angeles has the second largest growth at 6.5 percent and 385,000 trips.

Trip Distribution

Trip distribution is the process where person trip productions (for each TAZ) are linked to specific attraction TAZs, thereby creating a "trip table" of trip interchanges between TAZs. The SCAG trip distribution model created trip tables for 2008 and 2035. Those trip tables were interpolated to create the 2014 and 2024 trip tables.

FIGURE 4.9

2014 Highway Network



Map Produced by Countywide Planning and Development, LACMTA, December 2013
Thomas Bros. Data Used With Permission

FIGURE 4.10

Summary of Highway Lane-Miles by Facility Type and Subregion in Los Angeles County (2014 and 2024)

| Subregion | 2014 | | | 2024 | | |
|---------------------|--------------|---------------|---------------|--------------|---------------|---------------|
| | Freeway | Arterial | Total | Freeway | Arterial | Total |
| Arroyo Verdugo | 185 | 452 | 637 | 195 | 452 | 647 |
| Central Los Angeles | 628 | 1,963 | 2,591 | 645 | 1,963 | 2,608 |
| Gateway Cities | 799 | 2,966 | 3,765 | 813 | 2,966 | 3,779 |
| Las Virgenes/Malibu | 94 | 273 | 366 | 94 | 273 | 366 |
| North LA County | 724 | 2,673 | 3,396 | 741 | 2,801 | 3,542 |
| San Fernando Valley | 790 | 2,333 | 3,123 | 815 | 2,333 | 3,148 |
| San Gabriel Valley | 1,144 | 2,749 | 3,894 | 1,165 | 2,749 | 3,914 |
| South Bay Cities | 507 | 2,238 | 2,745 | 507 | 2,238 | 2,745 |
| Westside | 216 | 927 | 1,143 | 237 | 927 | 1,165 |
| Total | 5,087 | 16,573 | 21,660 | 5,212 | 16,701 | 21,913 |

| County | 2014 | | | 2024 | | |
|----------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | Freeway | Arterial | Total | Freeway | Arterial | Total |
| Los Angeles | 5,101 | 16,693 | 21,794 | 5,211 | 16,821 | 22,032 |
| Orange | 1,772 | 4,711 | 6,483 | 1,779 | 4,711 | 6,490 |
| Riverside | 2,060 | 4,719 | 6,779 | 2,060 | 4,779 | 6,839 |
| San Bernardino | 2,611 | 6,533 | 9,144 | 2,611 | 6,533 | 9,144 |
| Ventura | 501 | 1,749 | 2,250 | 501 | 1,749 | 2,250 |
| Imperial | 419 | 960 | 1,379 | 419 | 960 | 1,379 |
| Total | 12,465 | 35,365 | 47,830 | 12,581 | 35,553 | 48,134 |

FIGURE 4.11A

Total Daily Trip Production by County (2014-2024)

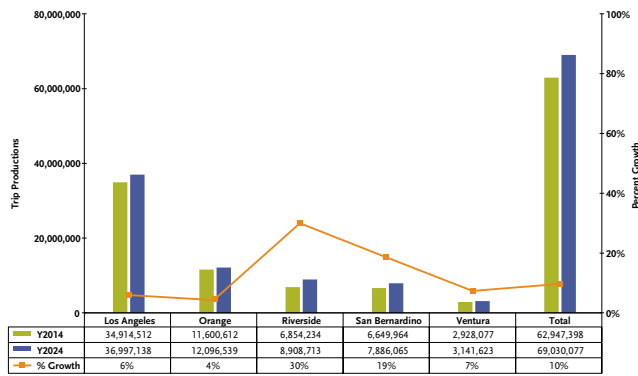


FIGURE 4.11B

Total Daily Trip Production by Subregion (2014-2024)

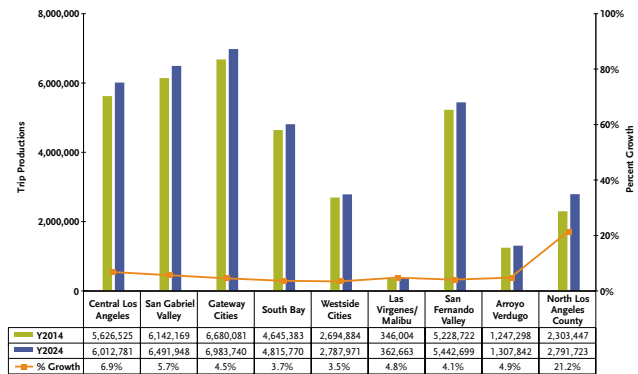


FIGURE 4.12A

Total Daily Trip Attraction by County (2014-2024)

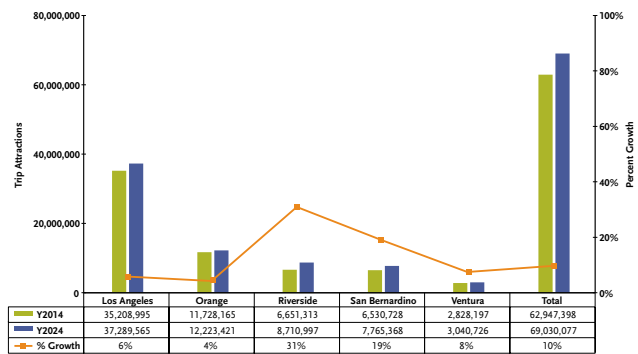
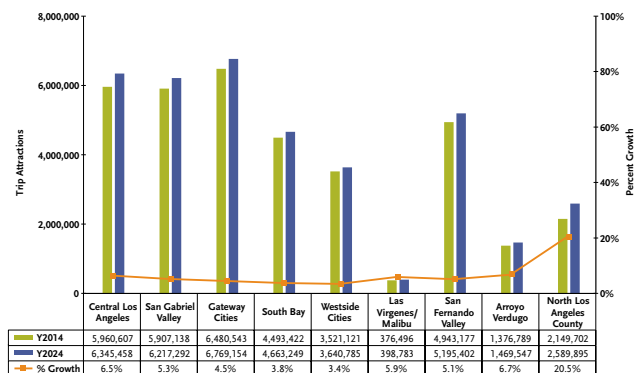


FIGURE 4.12B

Total Daily Trip Attraction by Subregion (2014-2024)



Home-Based Work Travel Patterns In Years 2014 & 2024

Figure 4.13A summarizes the trip production travel patterns for 2014 daily peak period home-based work trips in each subregion of Los Angeles County. The large pie in the lower left corner of the Figure shows the number of home-based work trips produced by each subregion. The Gateway Cities subregion produces the largest number of home-based work trips – 800,700. The San Gabriel Valley subregion produces the next highest number at 792,400.

Figure 4.13A also displays the home-based work trip production activity within each subregion, as represented by the smaller pies. The largest interaction within each subregion occurs intra-subregion; that is, the largest percentage of home-based work trips within each subregion stays internal to that subregion. For the Gateway Cities subregion, the second highest interaction occurs with trips destined outside Los Angeles County (at 17 percent), followed by trips with the South Bay Cities and Central LA, both at 11 percent.

Figure 4.13B summarizes the trip production travel patterns for 2024 daily peak period home-based work trips, produced in each subregion of Los Angeles County. The San Gabriel Valley is expected to produce the largest number of home-based work trips – 839,100. The Gateway Cities subregion is expected to produce the second largest number of home-based work trips – 835,600. The largest interaction within each subregion occurs intra-subregion. For the San Gabriel Valley, the second highest interaction occurs with trips destined to the Central Los Angeles subregion (14 percent), followed by trips destined outside Los Angeles County (13 percent).

Figure 4.14A summarizes the daily peak period home-based work trip attractions within each subregion in year 2014. The Central Los Angeles subregion attracts the largest number of home-based work trips in the County (799,800), followed by the Gateway Cities subregion at 740,900 and San Gabriel Valley subregion at 690,700. Within Central Los Angeles, 14 percent of trips originate in the San Gabriel Valley subregion and 11 percent from the Gateway Cities subregion.

Figure 4.14B summarizes the daily peak period home-based work trip attractions within each subregion in year 2024. The Central Los Angeles subregion is expected to attract the largest number of home-based work trips in the County (841,700), followed closely by the Gateway Cities subregion at 769,400 and the San Gabriel Valley at 724,000.

For the Central Los Angeles subregion, the second highest interaction occurs with trips expected to originate in the San Gabriel Valley (14 percent), followed by trips attracted from the Gateway Cities subregion (11 percent).

FIGURE 4.13A

Peak Period Home to Work Trip Productions by Subregion (2014)

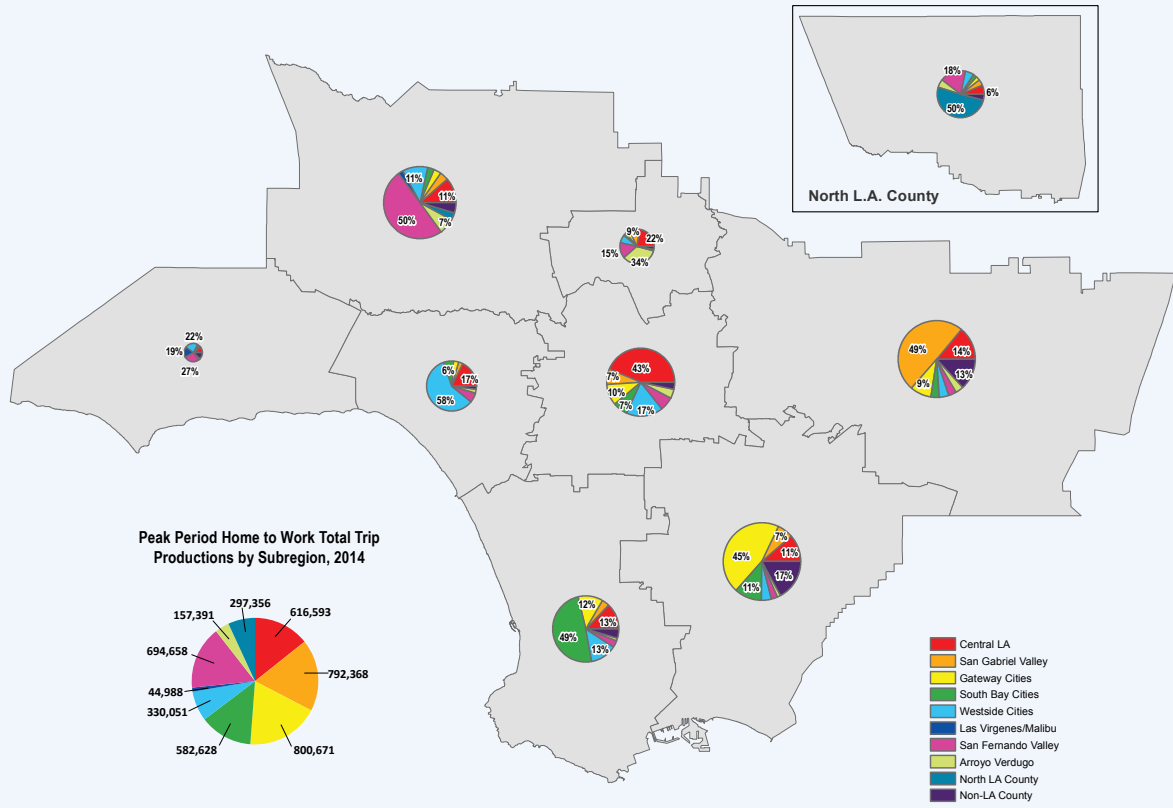


FIGURE 4.13B

Peak Period Home to Work Trip Productions by Subregion (2024)

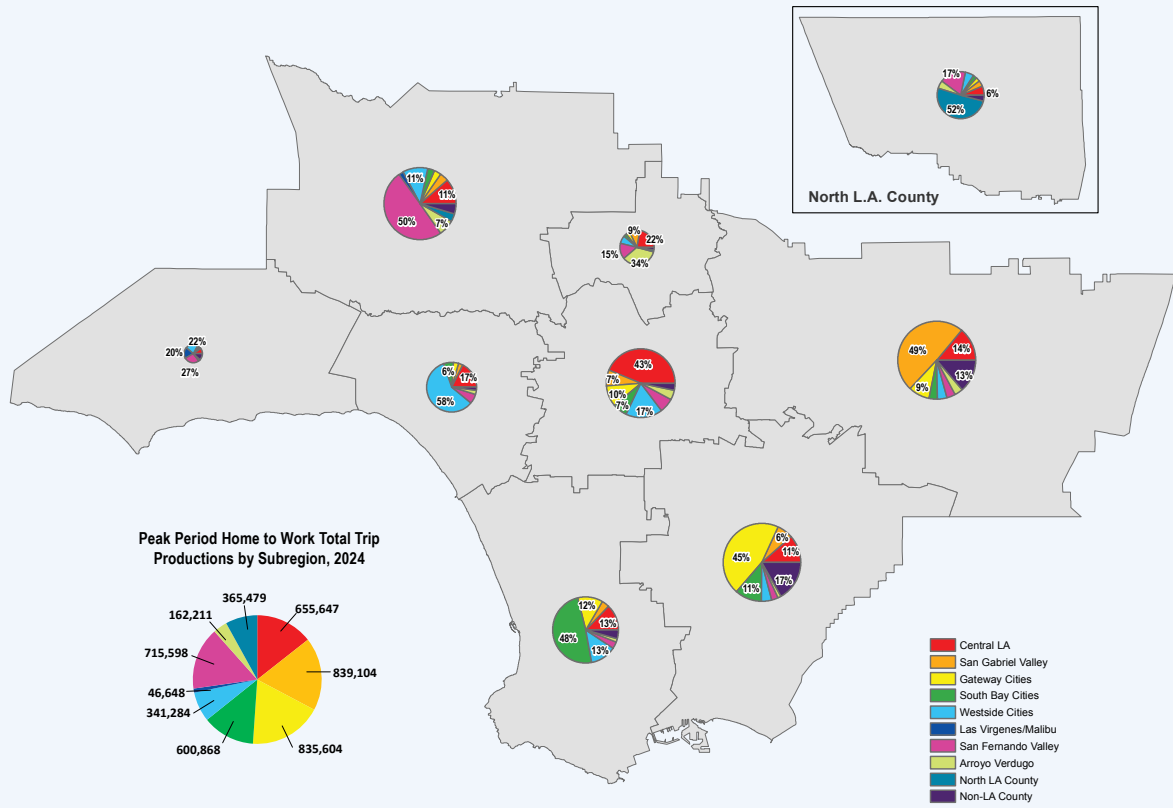


FIGURE 4.14A

Peak Period Home to Work Trip Attractions by Subregion (2014)

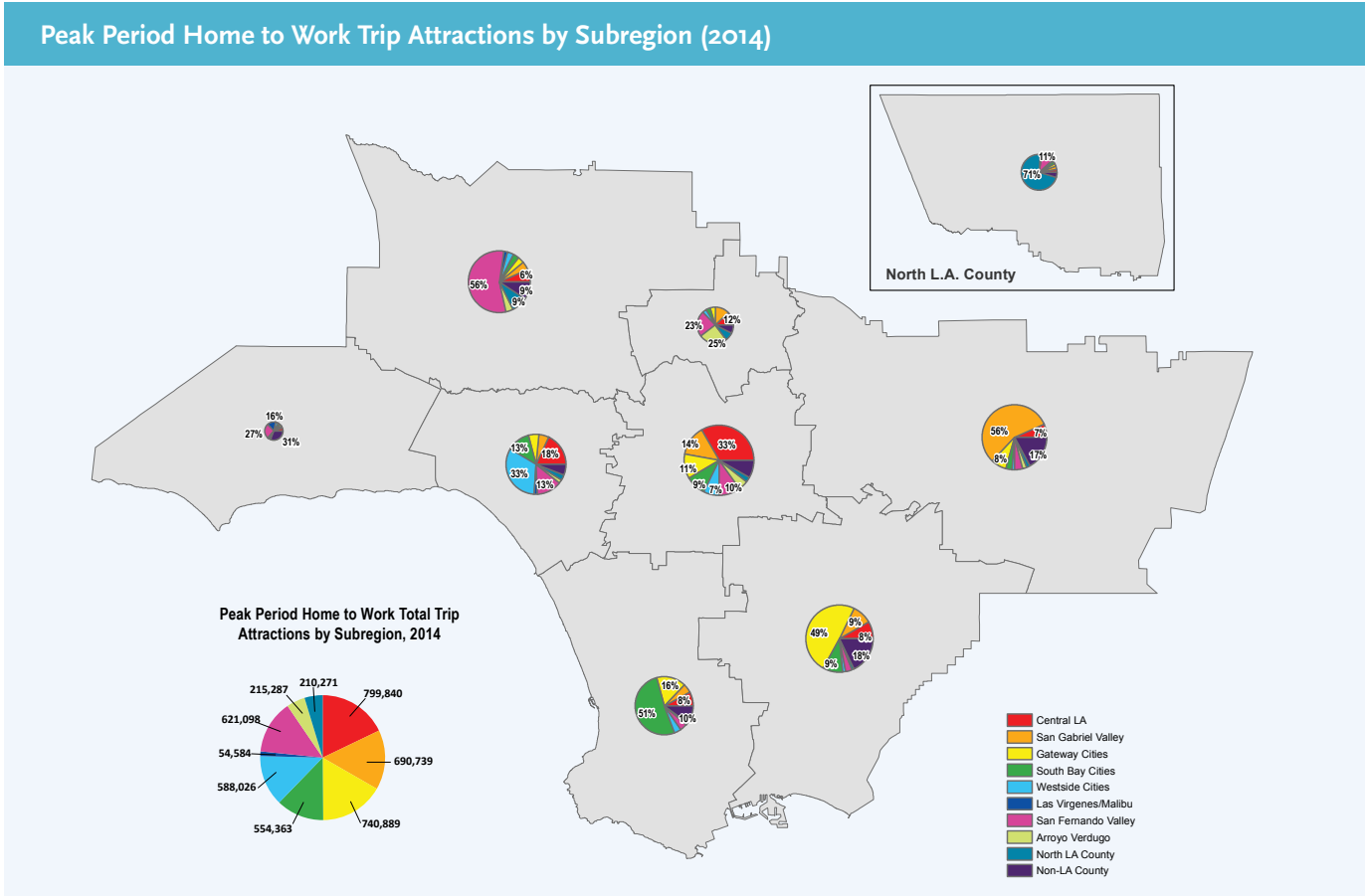
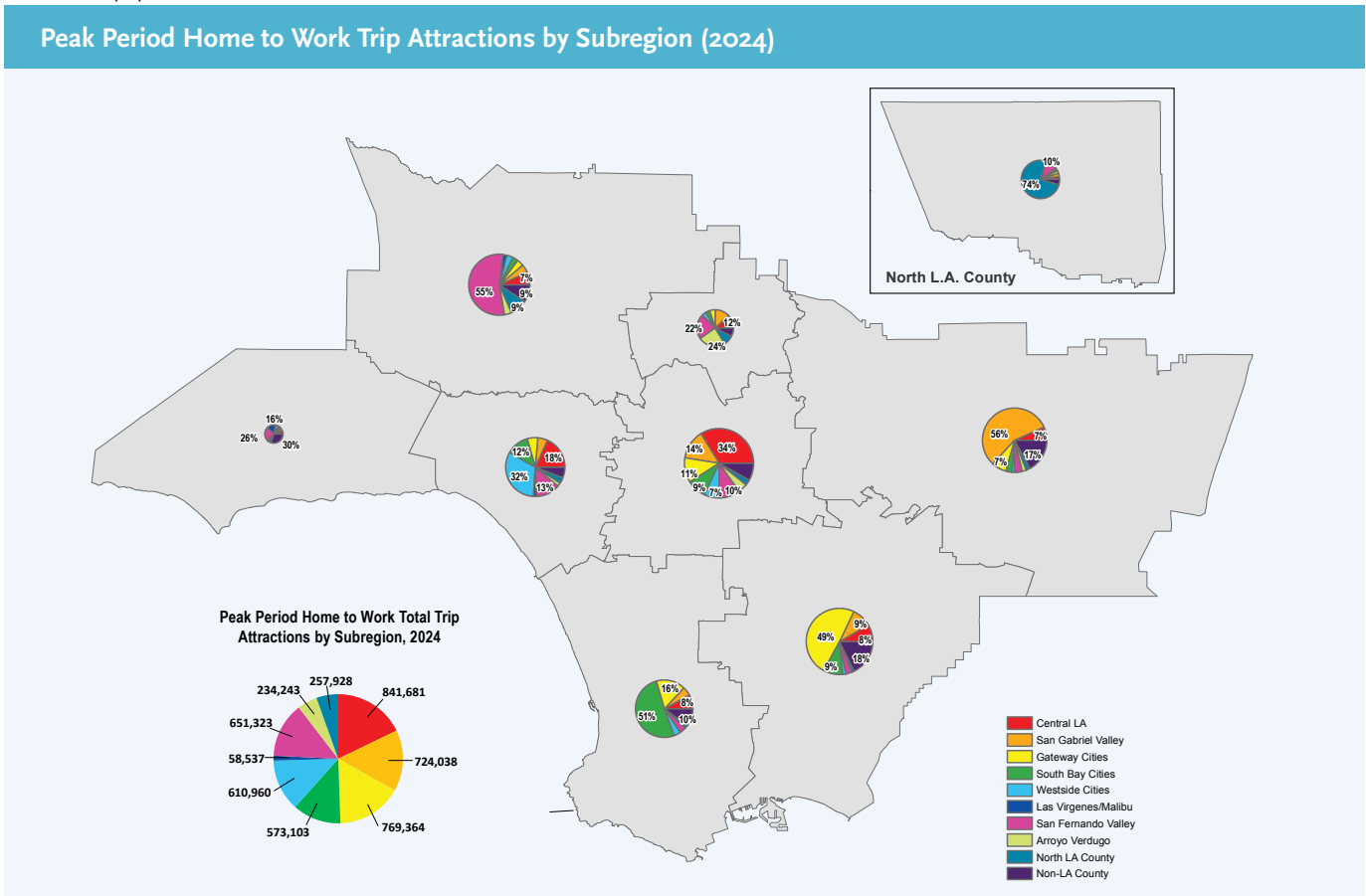


FIGURE 4.14B

Peak Period Home to Work Trip Attractions by Subregion (2024)



All Purposes Travel Patterns in Years 2014 & 2024

Figure 4.15A illustrates the total daily trip productions within each subregion for year 2014. The Gateway Cities subregion produces the highest number of total daily trips at 6.7 million, followed by the San Gabriel Valley subregion at 6.1 million. The largest interaction in each subregion occurs intra-subregion.

Within the Gateway Cities subregion, 10 percent of the trips are destined outside Los Angeles County, followed by 7 percent destined to the South Bay Cities and 7 percent destined to Central LA.

Figure 4.15B summarizes the trip production patterns for 2024 daily trips, in each subregion of Los Angeles County. The Gateway Cities subregion expected to produce the largest number of daily trips – 6,983,700. San Gabriel Valley is expected to produce the second largest number of daily trips – 6,491,900. For the Gateway Cities subregion, the second highest interaction occurs with trips destined outside Los Angeles County (10 percent), followed by trips destined to the Central Los Angeles subregion and South Bay Cities at 7 percent each.

Figure 4.16A illustrates the total daily trip attractions within each subregion for year 2014. The Gateway Cities subregion attracts the highest number of total daily trips, at 6.5 million, followed closely by the Central Los Angeles subregion at 6.0 million. Within the Gateway Cities subregion, the largest number of trips originates outside Los Angeles County (11 percent).

Figure 4.16B summarizes the daily trip attractions within each subregion in year 2024. The Gateway Cities subregion is expected to attract the largest number of home-based work trips in the County (6,769,200), followed closely by the Central Los Angeles subregion at 6,345,500 and the San Gabriel Valley at 6,217,200. For the Central Los Angeles subregion, the second and third highest interactions are with the San Gabriel Valley and Gateway Cities subregions, at 8 percent each.

Mode Choice

The mode choice process determines the share of person trips taking various modes of transportation. The modes in the Metro Travel Demand Model are automobiles and transit. The submodes under automobile include single-occupancy and high-occupancy vehicles (two-person carpools and three persons or more carpools) while the submodes under transit are bus (including local bus, rapid bus, express bus, and transitway bus) and rail (including urban rail and commuter rail).

Traffic Assignment

Traffic assignment is the process of loading vehicle trips onto a highway network and transit trips onto a transit network. This process produces traffic volumes and resulting congested speeds on each road segment represented in the highway network as well as passenger volumes on the transit network.

Metro uses a four time-period equilibrium highway assignment process. Separate vehicle trip tables are generated for the AM peak period, midday period, PM peak period, and night period. These trip tables are assigned to the appropriate highway network, using equilibrium assignment procedures. The assignment results were reviewed for reasonableness and minor adjustments were made when required.

System Performance Measures

Performance measures evaluate the highway and transit systems for the base year and future year. This analysis is intended to determine the effectiveness of transportation strategies and assist in the development of program and project recommendations.

The System measures assess the performance of the Plan as a whole and how the transportation system benefits from implementation of the Plan, as compared with the existing and No Build scenarios.

The system measures include:

- > **Speed** – a measure of mobility and how the Plan improvements impact the average speed of the highway system.
- > **Mobility Index** – a measure of system throughput that adjusts speed by factoring in the vehicle occupancy of automobiles and transit. The higher the index number, the more effective the transportation system in moving people.
- > **Title VI Analysis** – a series of measures required by federal Title VI that assesses the Plan's impact on mobility benefits for minority and transit-dependent communities.

FIGURE 4.15A

Daily Trip Productions by Subregion (2014)

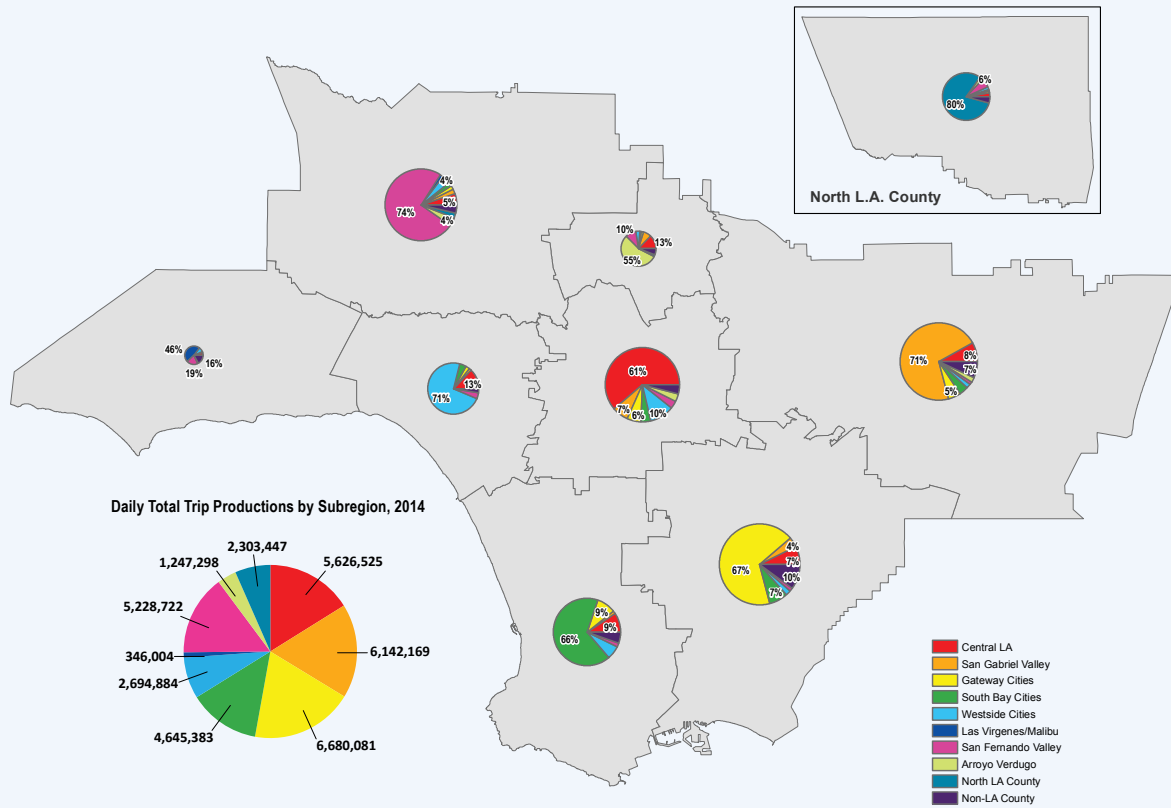


FIGURE 4.15B

Daily Trip Productions by Subregion (2024)

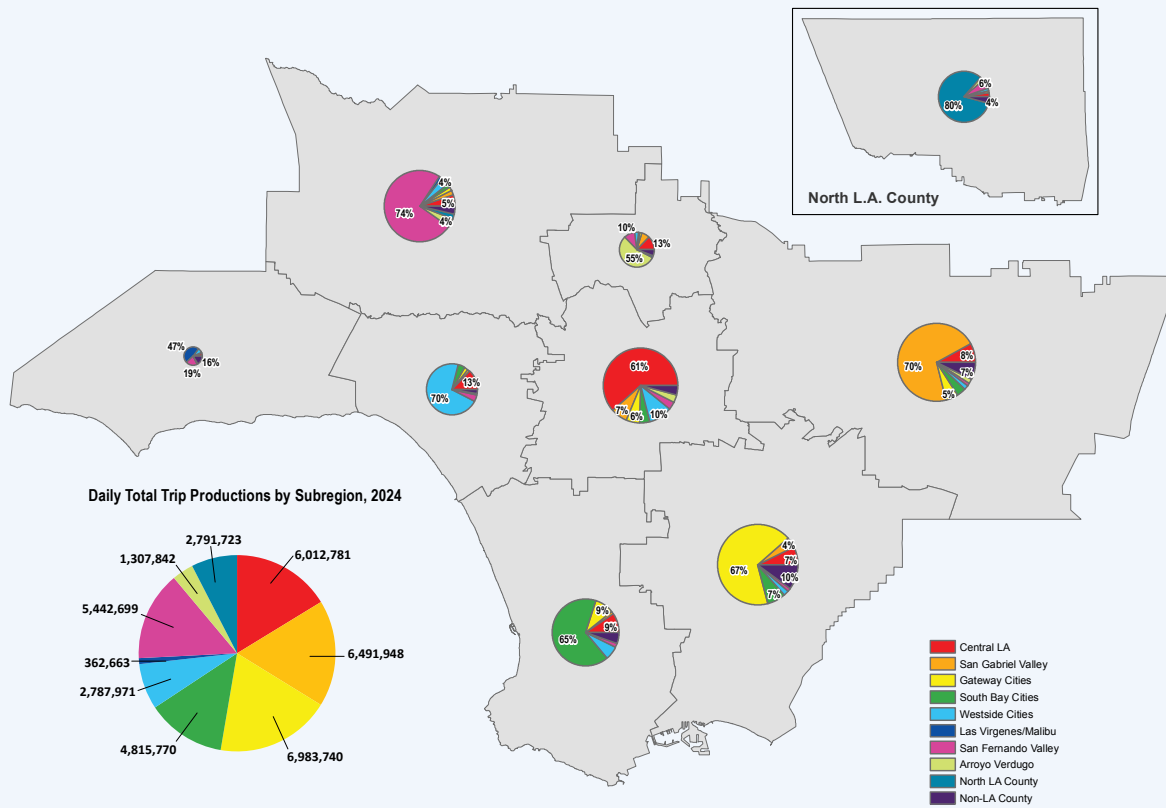


FIGURE 4.16A

Daily Trip Attractions by Subregion (2014)

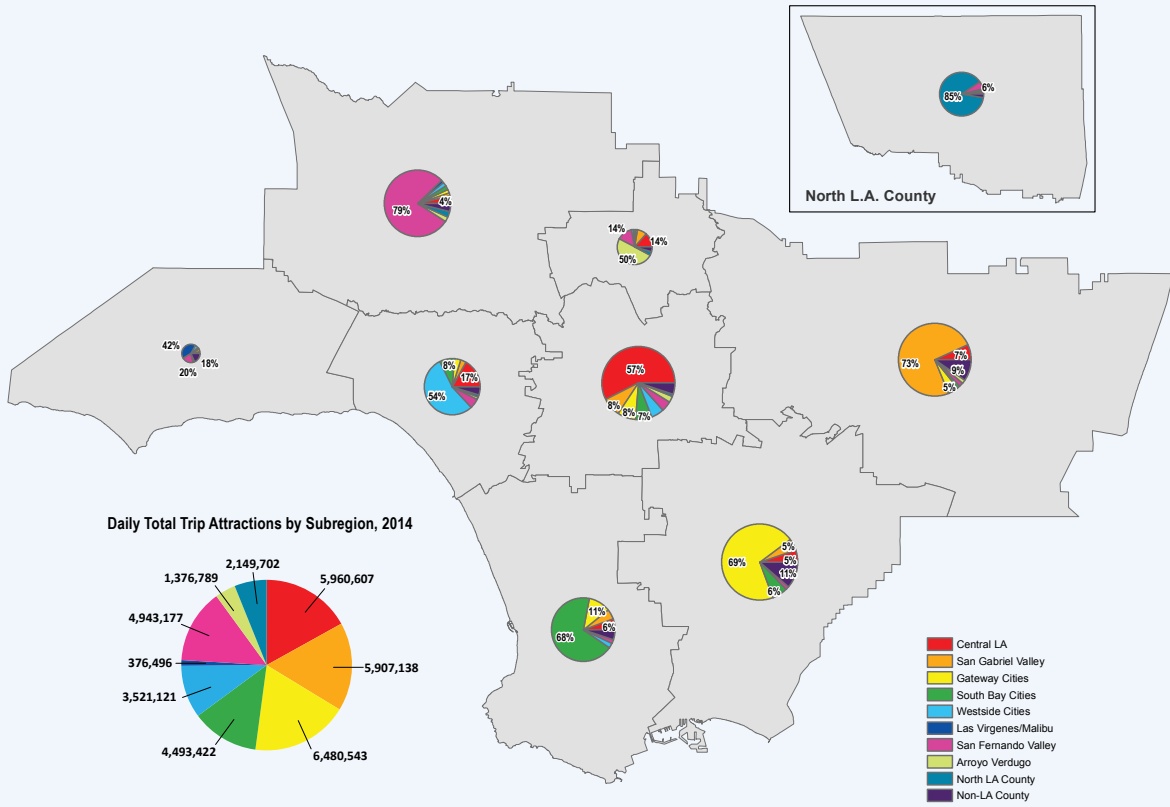
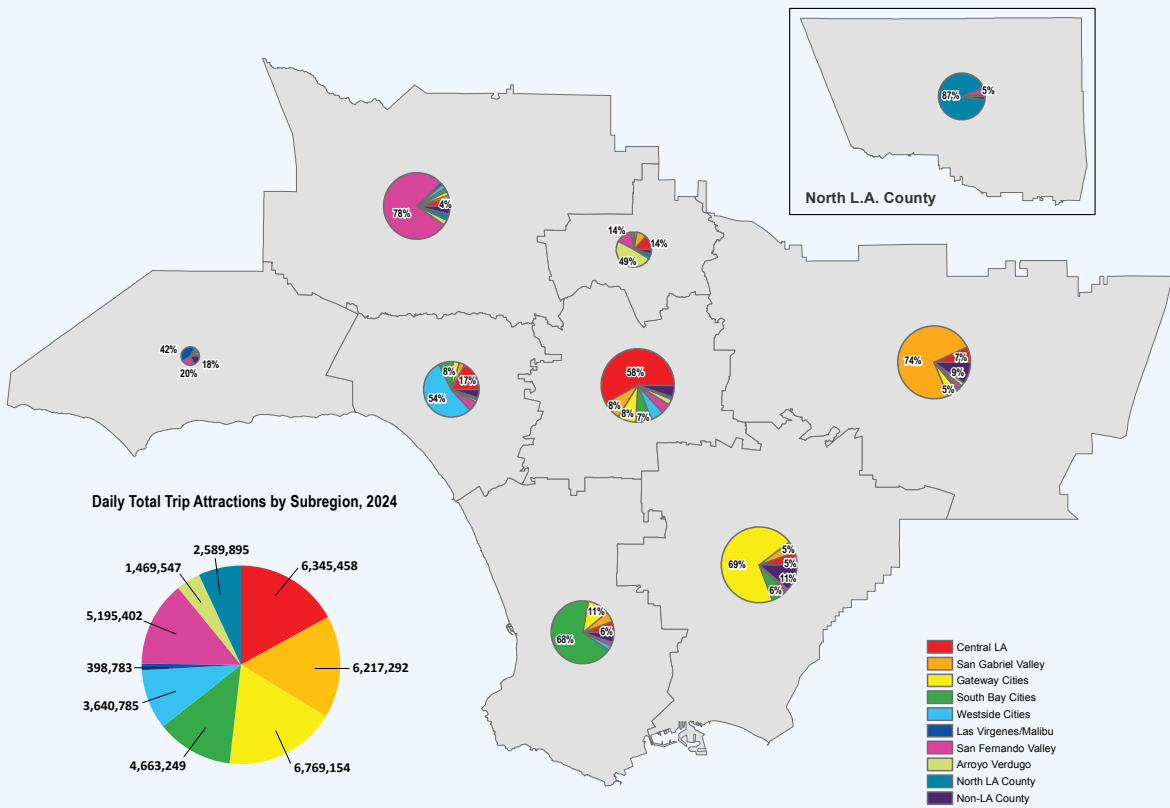


FIGURE 4.16B

Daily Trip Attractions by Subregion (2024)



AM Peak Period Speeds

Figure 4.17A compares the peak freeway and arterial speeds between the base year (2014) and two scenarios for the forecast year of 2024 (No Build and 2014 Plan). The AM peak period speeds on the freeways are expected to deteriorate from 27.8 MPH in 2014 to 25.6 MPH in the No Build Scenario and improve to 25.8 MPH with the 2014 Plan. Arterial speeds are expected to deteriorate from 23.9 MPH in 2014 to 22.4 MPH in the No Build scenario and improve to 22.6 MPH in the 2014 Plan.

Mobility Index

The mobility index is a performance measure of the throughput of a multimodal transportation system. It takes into consideration the volume of people moved and their travel speed. It is a function of both speed and vehicle occupancy and focuses on the movement of people rather than vehicles. The higher is the index, the faster the speeds and the higher the vehicle occupancies.

The formula is specified as:

$$\text{Throughput} = (\text{PMT}/\text{PHT}) \times (\text{PMT}/\text{VMT})$$

where

PMT = Person-Miles Traveled for automobile and transit modes

PHT = Person-Hours Traveled for automobile and transit modes and

VMT = Vehicle-Miles Traveled for automobile and transit modes.

Mathematically, the first half of this formula, PMT/PHT, can be expanded to represent the difference between the average person flow speed and a weighted variance of the speed between all link pairs. PMT/PHT is equal to the average person flow speed when the weighted variance is zero and all links have the same speed (meaning there is no variation in the speed). Since speed does not stay constant across the highway and transit networks, PMT/PHT is always lower than the average person flow speed.

Likewise, the second half of the formula, PMT/VMT, can be expanded to represent the difference between the average vehicle occupancy and a weighted variance of the vehicle occupancy of all link pairs. Since the occupancy does not vary much from one link to the next, the weighted occupancy variance is not a large number. Thus, PMT/VMT is similar to the average vehicle occupancy.

Figure 4.17B illustrates the mobility index in Los Angeles County. The mobility index in 2014 is 48.2, dropping to 46.6 in the No Build, and increasing to 47.1 for the 2014 Plan.

FIGURE 4.17A

AM Peak Period Speeds

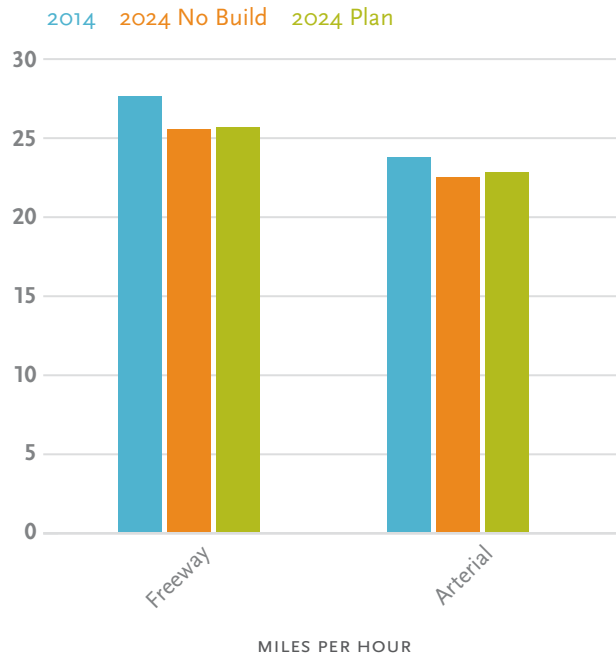
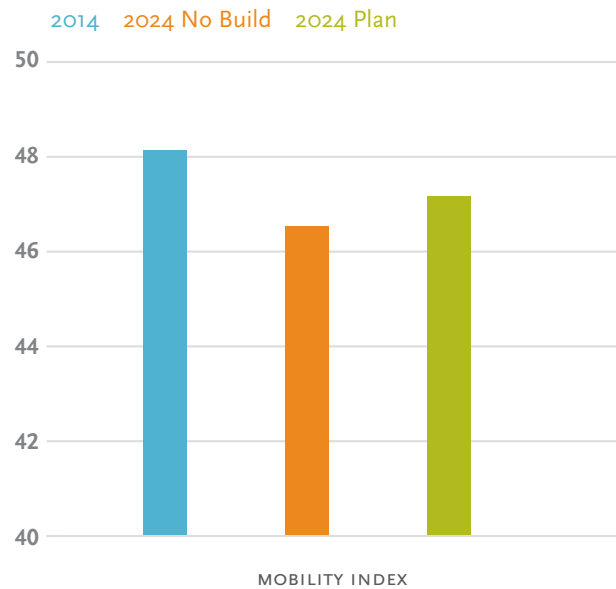


FIGURE 4.17B

Daily Mobility Index



Title VI Analysis

The Title VI analysis was performed to assess the transportation impacts on distinct socioeconomic groups in Los Angeles County. The transportation impacts analyzed include:

- > Job accessibility within 60 minutes via transit; and
- > Mode choice by income quintile.

The distinct socioeconomic groups include:

- > Transit dependent;
- > African American;
- > Hispanic; and
- > Asian/Pacific Islander.

Using information from the 2010 Census and 2010 American Community Survey 5-Year Estimates, a transportation analysis zone (TAZ) was designated as transit-dependent if it met one or more of the following criteria:

- > Zero-car ownership – 10 percent or more of the households do not own a car;
- > Low-income – 26.7 percent or more of the households have income of \$25,000 or less (in 2010 dollars); or
- > Senior citizens with medium-low-income – 11 percent or more of the households include individuals aged 65 or older, and median household income is less than \$53,762.

TAZs were also designated with a specific socioeconomic group, if its population exceeded the socioeconomic group’s average for Los Angeles County (e.g., a TAZ with ten percent of households comprised of African Americans would be deemed an African American TAZ since that exceeded the 8.3 percent of African Americans for Los Angeles County). Figure 4.18 summarizes the ethnic population of Los Angeles County, based on the 2010 Census. Hispanics, at 47.7 percent of the population, comprise the largest minority group in the County.

FIGURE 4.18

Ethnic Population Based on 2010 Census

| | POPULATION | PERCENT |
|------------------------|------------|---------|
| African American | 815,086 | 8.3% |
| Hispanic | 4,687,889 | 47.7% |
| Asian/Pacific Islander | 1,348,135 | 13.7% |
| Non-Minority | 2,728,321 | 27.8% |
| Other Race Alone | 44,253 | 0.5% |
| Two or More Races | 194,921 | 2.0% |
| Total | 9,818,605 | 100% |

In addition to transit-dependency and socioeconomic group, TAZs were also classified by household income quintiles. The quintiles represent:

- > Low income – less than \$37,500
- > Moderate income –\$37,501 to \$50,000
- > Medium income –\$50,001 to \$62,500
- > Above average income –\$62,501 to \$80,000
- > High income – greater than \$80,000

TAZs by income quintiles are illustrated in Figure 4.19.

Geographic Distribution of Socioeconomic Groups

Figures 4.20A, 4.20B, 4.21A, and 4.21B illustrate the distribution of transit dependent, African American, Hispanic, and Asian/Pacific Islander populations throughout Los Angeles County.

FIGURE 4.19

2010 Median Zonal Income in Quintiles

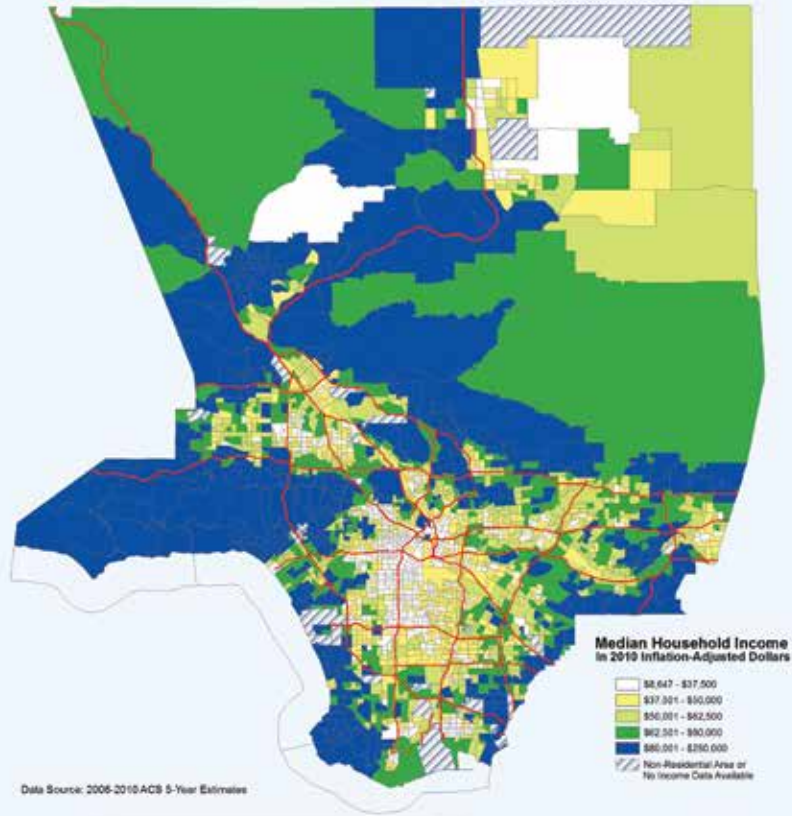


FIGURE 4.20A

Transit Dependent Population

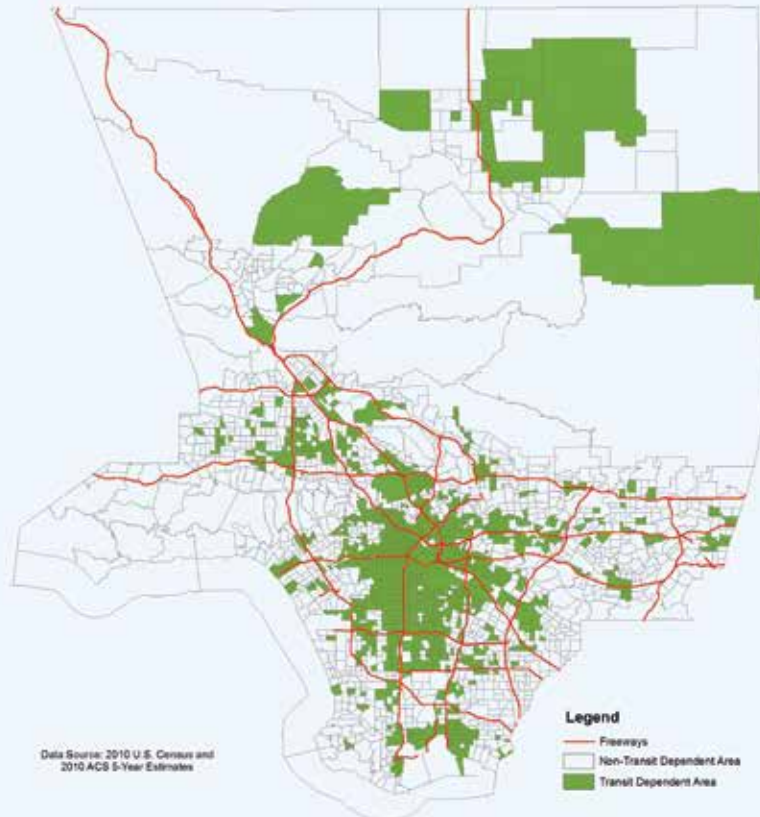


FIGURE 4.20B

African American Population

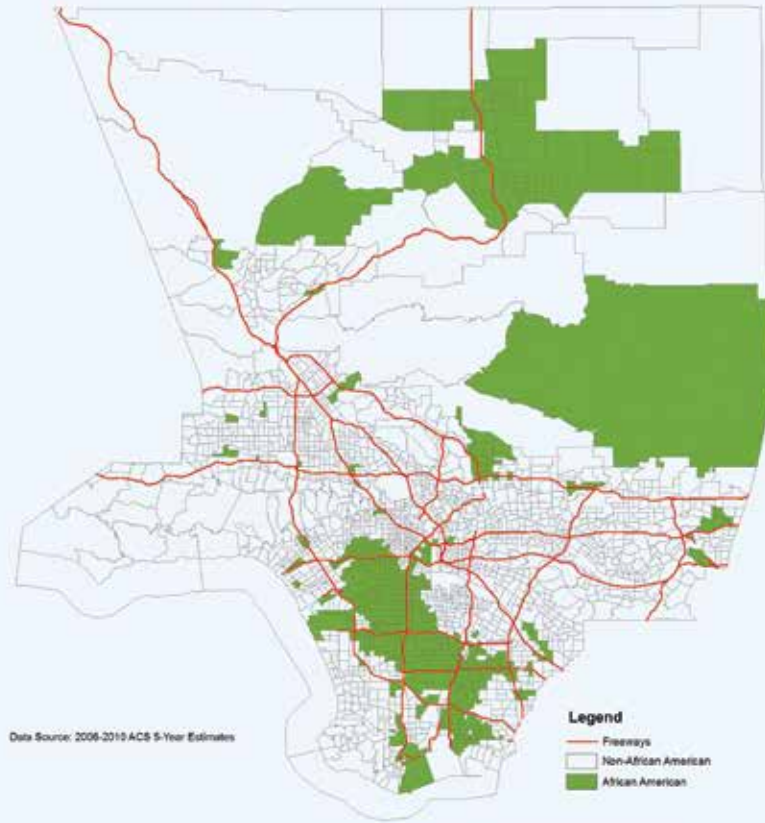
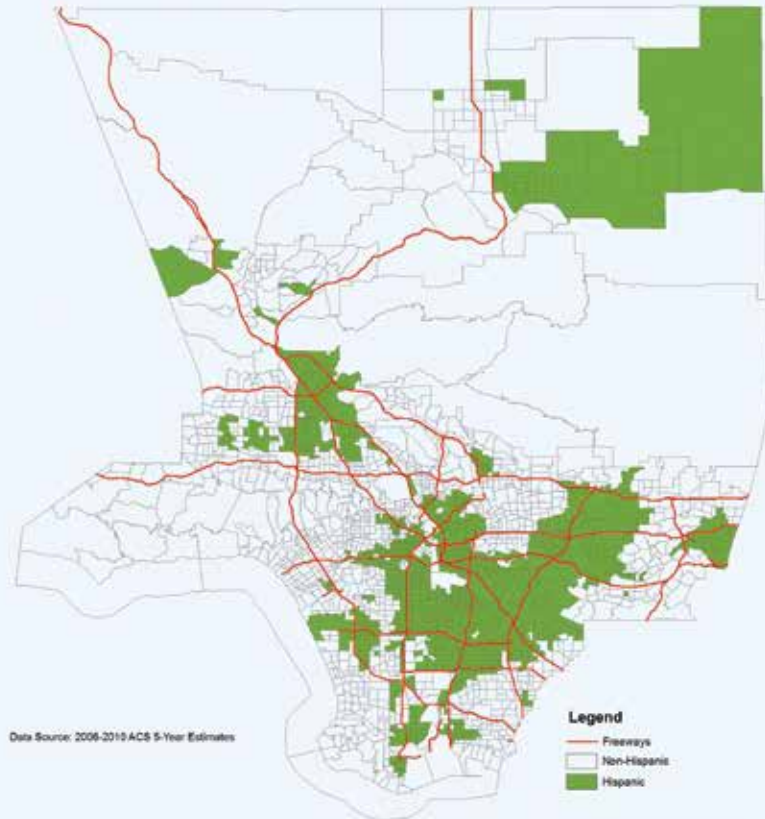


FIGURE 4.21A

Hispanic Population



Asian/Pacific Islander Population

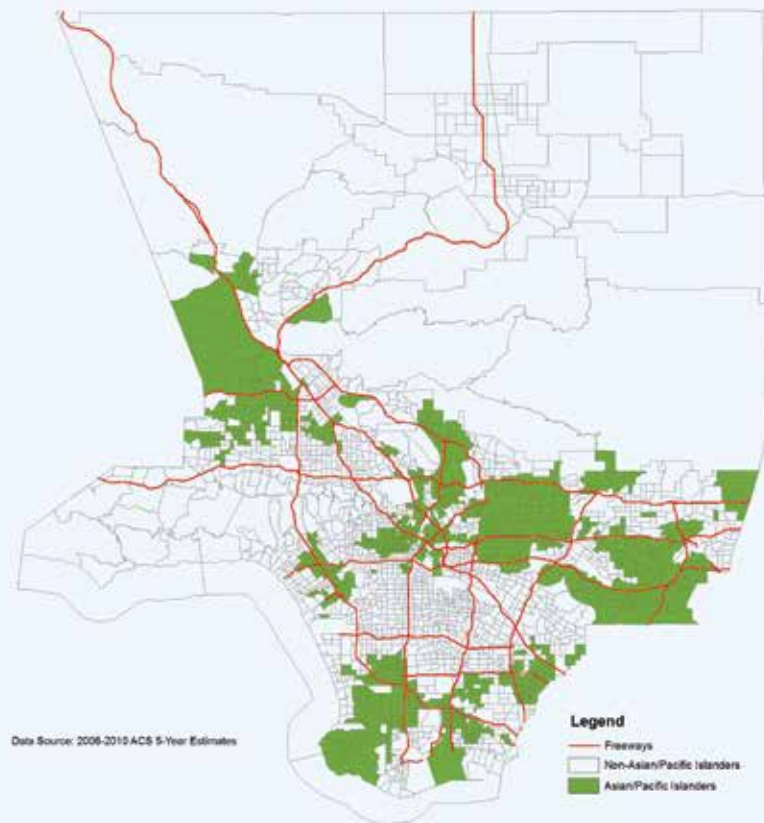
**Job Accessibility**

Figure 4.22A displays, by income quintile, the percentage of jobs that can be reached via transit in a sixty-minute period. Low-income TAZs are expected to benefit the most from transit accessibility as 51.3 percent of jobs can be reached via transit in the No Build scenario and 54.6 percent in the 2014 Plan scenario. All income quintiles are expected to see an improvement in transit accessibility with implementation of the 2014 Plan.

Figure 4.22B illustrates the job accessibility by population subgroup. The transit-dependent population is expected to benefit the most from the 2014 Plan with accessibility improving from 48.8 percent of the population to 51.5 percent. All other population subgroups are expected to see an improvement in transit accessibility as well.

Mode Choice

Figure 4.23A displays, by income quintile, the mode split of home-to-work trips. Transit usage is expected to be the heaviest for low-income households in the No Build scenario (22.5 percent), increasing to 23.5 percent in the 2014 Plan scenario. All other income quintiles are also expected to experience an increase in transit usage.

Figure 4.23B illustrates the mode choice by population subgroup. The transit-dependent population is expected to increase transit usage the most, increasing from 18.2 percent in the No Build scenario to 19.2 percent in the 2014 Plan. All other population subgroups are expected to see a modest improvement in transit usage.

FIGURE 4.22A
Job Accessibility by Income Quintile

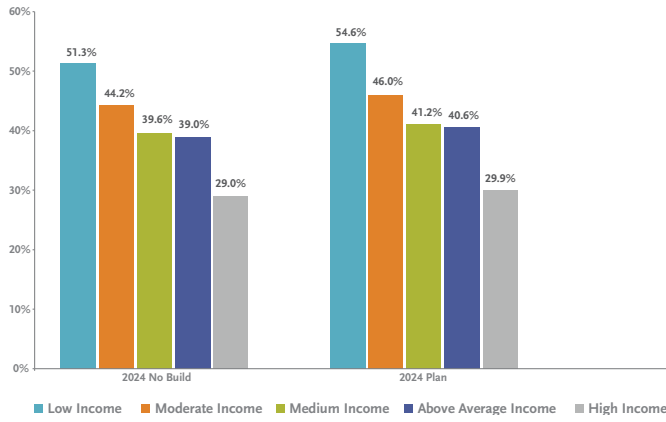


FIGURE 4.22B
Job Accessibility by Population Subgroup

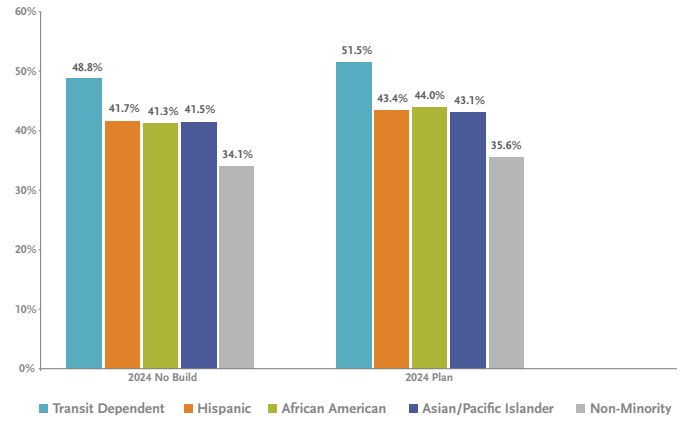


FIGURE 4.23A
Mode Choice by Income Quintile

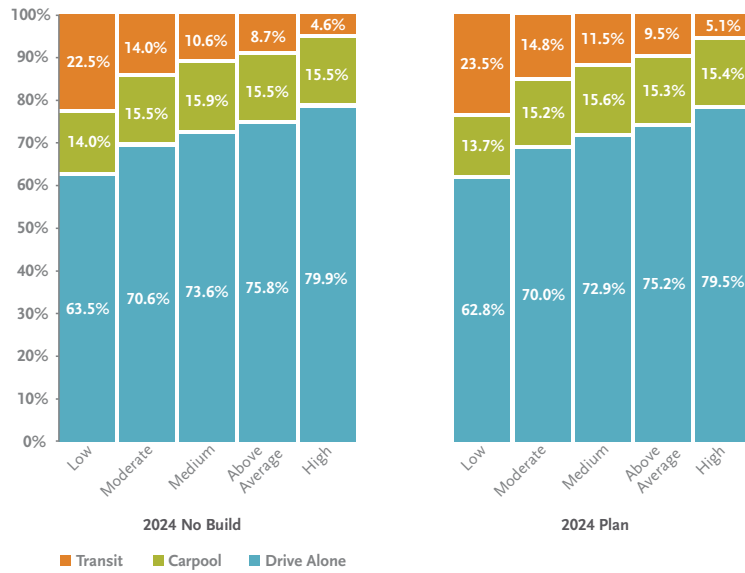
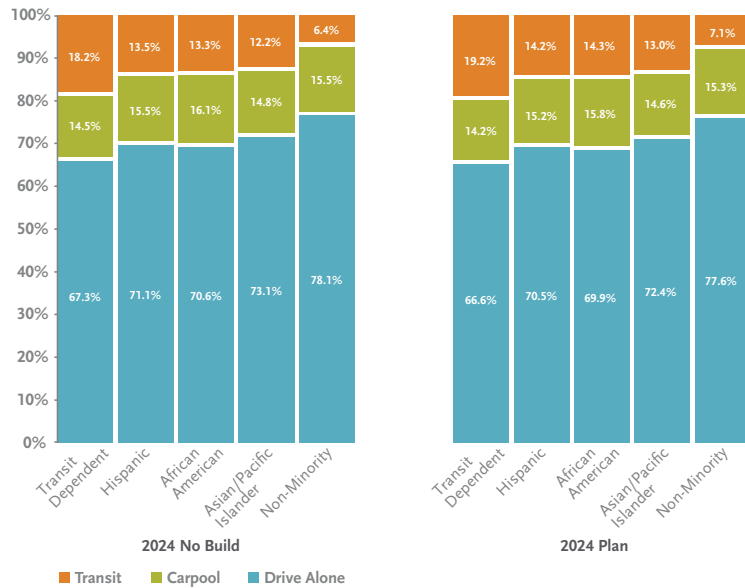


FIGURE 4.23B
Mode Choice by Population Subgroup



Los Angeles County
Metropolitan Transportation Authority
One Gateway Plaza
Los Angeles, CA 90012-2952

