TRANSPORTATION SYSTEM

HIGHWAYS & ARTERIALS

SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS

2016–2040 RTPSCS

APPENDIX

ADOPTED | APRIL 2016

2016 2040 RTP SCS

APPENDIX

TRANSPORTATION SYSTEM | HIGHWAYS & ARTERIALS

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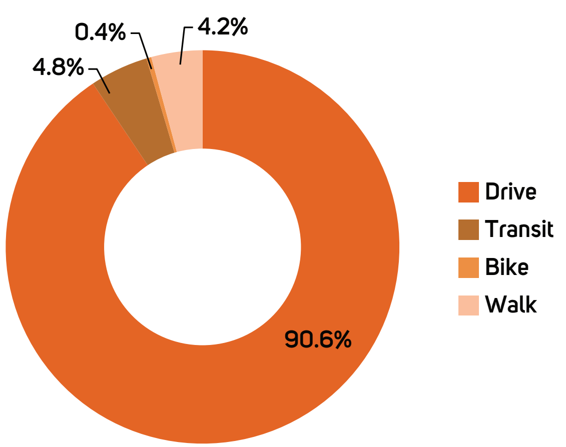
HIGHWAYS & ARTERIALS

INTRODUCTION

Southern California's highway and arterial system functions as the backbone of our overall transportation network and facilitates the movement of people and goods throughout our region. Our region's highway and arterial system covers 70,000 lane miles and serves more than 66 million trips per day. Within the SCAG region alone, 90 percent of all commute trips are auto trips that rely on the highway and local streets and roads[1] (see **FIGURE 1**). In addition to automobiles and freight trucks, our roadways serve other modes, including public transit and active transportation (i.e. walking and bicycling). Our roadways are critical for meeting our mobility needs and are essential to the economic vitality of our region.

Yet, as travelers throughout the SCAG region well know, our roadways face serious challenges. Funding constraints have led to the deferment of critical maintenance and preservation investments. As a result, the condition of our roadway pavement as well as our bridges is deteriorating. At the same time, traffic congestion on our highways and arterial system continues to worsen on a day-to-day basis. This is not just an inconvenience for commuters, but has negative impacts on our region's air quality and our overall well-being. The 2016 Regional Transportation Plan/Sustainable Communities Strategy (2016 RTP/SCS) addresses these challenges and advances an integrated system management approach as a means towards improving mobility throughout the region.

FIGURE 1 Commute Mode



Source: SCAG Regional Travel Demand Model

The foundation of the 2016 RTP/SCS is based upon a "fix-it-first" philosophy that aims to preserve our existing infrastructure assets. SCAG works with partner agencies to encourage preserving our existing system, which has cost us so much to build and is critical for helping us maintain the overall viability of our region. Our second priority is to maximize the productivity of our existing system by relying on smart land use decisions and implementing transportation demand management (TDM) and transportation system management (TSM) strategies. These priorities have become elevated in recent years as resource constraints and environmental concerns have made expanding our system more difficult. Rather, as the regional planning agency, we encourage implementing agencies to prioritize the strategic expansion of roadways, with the intention of closing critical gaps within the existing network. The remainder of this Appendix summarizes the 2016 RTP/SCS's investments and strategies for highways and arterials in the SCAG region.

GUIDING PRINCIPLES

As a region, we are guided by a system management approach, which is depicted in **FIGURE 2**, the System Management Pyramid. The foundation of this approach is system monitoring and evaluation, which allows us to have a clear understanding of how our system currently operates prior to developing solutions to improve safety, reliability and mobility on our roadways.

Our next priority is to protect our existing investments by maintaining and preserving our transportation infrastructure in a state of good repair in order to achieve the maximum productivity of our system.

Moving up the System Management Pyramid are TDM, smart land use and value pricing strategies, which aim to reduce travel demand on our roadways. More specifically, these strategies aim to reduce the number of single occupancy vehicle (SOV) trips on our roadways so that we can lessen congestion and improve the overall efficiency and productivity of our system. Examples of TDM strategies include:

- Increase carpooling and vanpooling;
- Increase use of transit, bicycling and walking;
- Redistribution of vehicle trips from peak demand periods to non-peak periods by shifting work times/day/locations;
- Incentivize carpooling, transit, biking, walking and flexible work schedules;
- Telecommuting;
- First/last mile connections; and
- Mileage-Based User Fees.

Smart land use approaches aim to better integrate land use and transportation, and to provide an opportunity to increase development densities as a means to improve the jobs/housing balance. By improving the connection between jobs and housing, daily auto commute trips can be reduced and opportunities for using alternative modes of transportation can increase (i.e. walking, biking and transit). Finally, value pricing strategies, which are essentially a form of TDM, aim to incorporate pricing as part of the highway network in the form of express lanes to better use existing capacity. Express lanes that are appropriately priced can improve overall throughput within the system. In addition, revenues generated from the express lanes can be used to deliver and/or improve upon existing complementary transit service, thereby further reducing vehicular demand.

Moving up the System Management Pyramid is the intelligent transportation systems (ITS) approach, which is based in part on technological advancements aimed to provide innovative services to travelers to make better informed travel decisions. As a result, greater efficiencies can be achieved throughout the transportation network. Users of the transportation network can better leverage their travel options. The use of TSM strategies relies heavily on ITS technologies to increase traffic flow and reduce congestion. Examples of TSM strategies include:

FIGURE 2 System Management Pyramid

- Enhanced incident management;
- Advanced ramp metering;
- Traffic signal synchronization;
- Advanced traveler information;
- Improved data collection;
- Universal Transit Fare Cards (Smart Cards); and
- Transit Automatic Vehicle Location (AVL).

For more information regarding TDM and TSM strategies, please refer to the Congestion Management Appendix.

The top of the System Management Pyramid includes system completion and expansion. System completion and expansion should be considered only when all other options have been exhausted. However, SCAG recognizes that because critical gaps and congestion chokepoints still exist within our system, improvements beyond TSM and TDM strategies still have to be considered. The overarching guiding principles embodied in this System Management Pyramid and approved by SCAG's Transportation Committee are as follows:

- Protect and preserve what we have first, supporting a "fix-it-first" philosophy, including the consideration of life cycle costs beyond construction;
- Support new funding for system preservation;
- Focus on achieving maximum productivity through strategic investments in system management and demand management;
- Focus on adding capacity primarily (but not exclusively) to:
  - Close gaps in the system;
  - Improve access where needed;
- Support policies and system improvements that will encourage seamless operation of our roadway network from the user's perspective;
- Develop any new roadway capacity project with consideration and incorporation of congestion management strategies, including demand management measures, operational improvements, transit and ITS, where feasible;
- Focus on addressing non-recurring congestion with new technology; and
- Support complete streets opportunities where feasible and practical.

SYSTEM PRESERVATION

DETERIORATING INFRASTRUCTURE

As previously mentioned, system preservation continues to be a challenge for our highways and local arterials. Part of the challenge is ensuring that life cycle costs (i.e. maintenance and preservation expenses) are considered and planned for when infrastructure projects are being developed. Because our roadway infrastructure represents hundreds of billions in investments, it is important that our assets are preserved and maintained. Making sure our previous investments will continue to serve future residents is a priority for SCAG and its partner agencies. Due to significant funding constraints, the condition of our roadways has deteriorated over the years. **FIGURES 3 AND 4** represent the condition of our highways. The region has more than 2,750 distressed lane miles, and more than 17 percent of all our lane miles are distressed. **FIGURE 5** summarizes the conditions of our region's bridges. More than 2,200 of our bridges (out of almost 8,100) have fallen into an unacceptable state of disrepair.

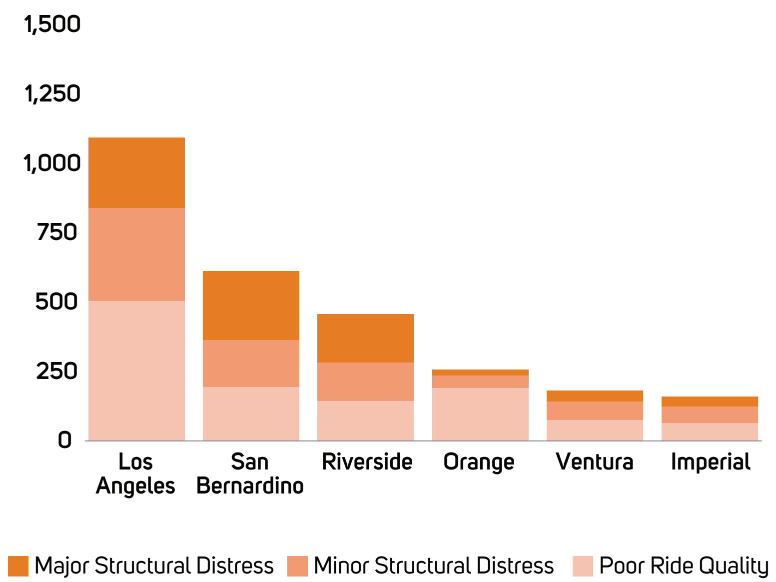
The compromised condition of our highways and bridges is due to years of underfunding our statewide preservation needs. **FIGURE 6** reflects how funding has diminished over the last 10 years (primarily due to fuel efficiency, in addition to the gas tax not being adjusted for inflation) while at the same time our aging highway infrastructure preservation needs have continued to grow (due to age and inflation). This growing gap will continue to expand if we do not address it soon. As shown in **FIGURE 7**, deferred maintenance leads to much costlier repairs in the future. Minor repairs to keep our roadways in a state of good repair cost on average $106,000 per highway lane mile, while major rehabilitation of a lane mile can cost an average of $842,000.

As shown in **FIGURES 8-10**, currently available funding is significantly below the region's needs. The figures show that funding commitments address less than half of highway operation and protection needs and less than a third of total local streets and roads preservation needs in the region. As part of the 2016 RTP/SCS, additional investments, assumed to be funded by reasonably available new revenue sources and innovative financing strategies included in the Plan, bring our region's roadways to a state of good repair.

LEVERAGING NEW AND EVOLVING TECHNOLOGIES FOR SYSTEM MANAGEMENT

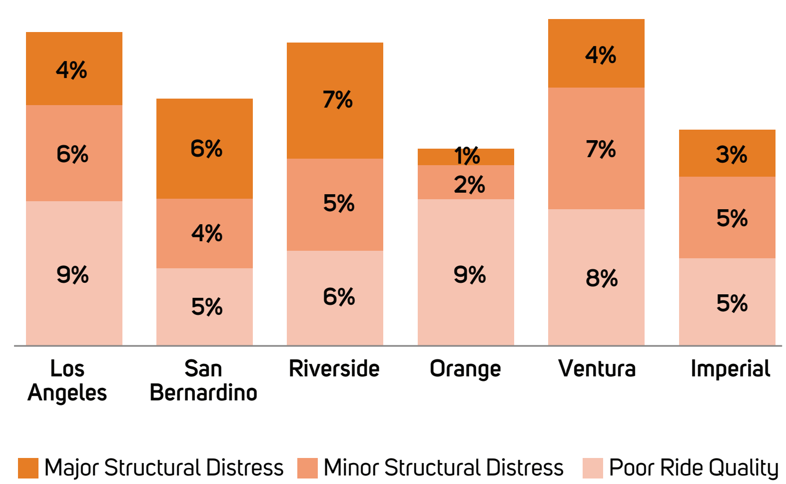
The 2016 RTP/SCS identifies a comprehensive set of strategies that work in concert to optimize the performance of the transportation system. The California Department of Transportation (Caltrans), SCAG, and county partners will continue to work together to improve the efficiency of our highways and arterials while leveraging advanced technologies.

FIGURE 3 Total State Highway System Distressed Lane Miles (2013)



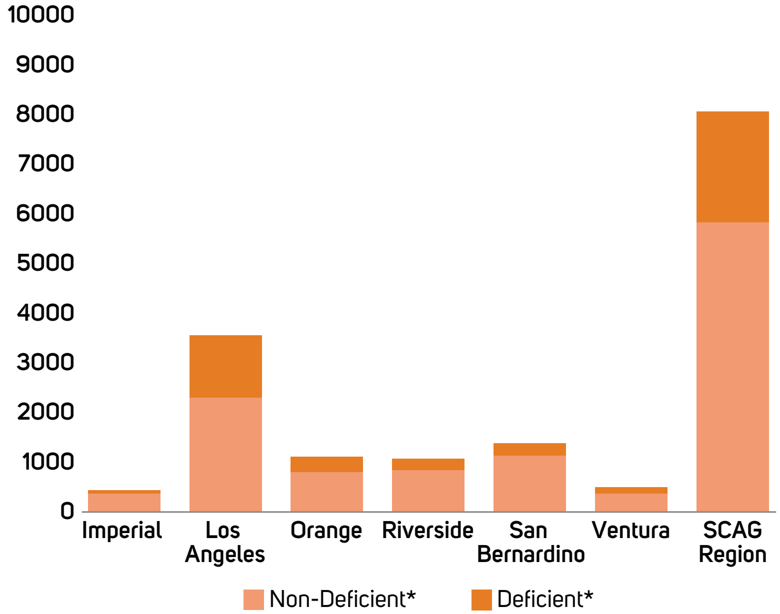
Source: State of the Pavement Report

FIGURE 4 Percent State Highway System Distressed Lane Miles (2013)



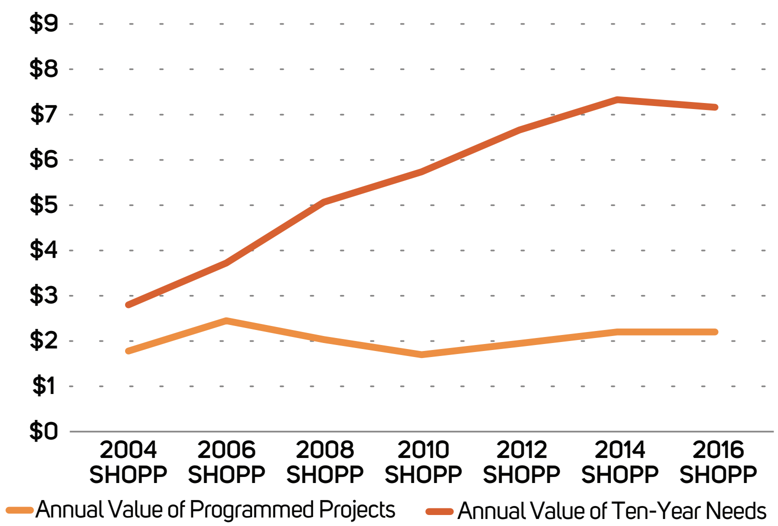
Source: State of the Pavement Report

FIGURE 5 Bridge Conditions in the SCAG Region



**Non-Deficient - to be considered structurally non-deficient a bridge must meet a sufficiency rating of 80 or more.*
**Deficient - to be considered structurally deficient a bridge must meet a sufficiency rating of 80 or less. Source: FHWA*

FIGURE 6 Programmed Project Expenditures versus Need (In Billions)



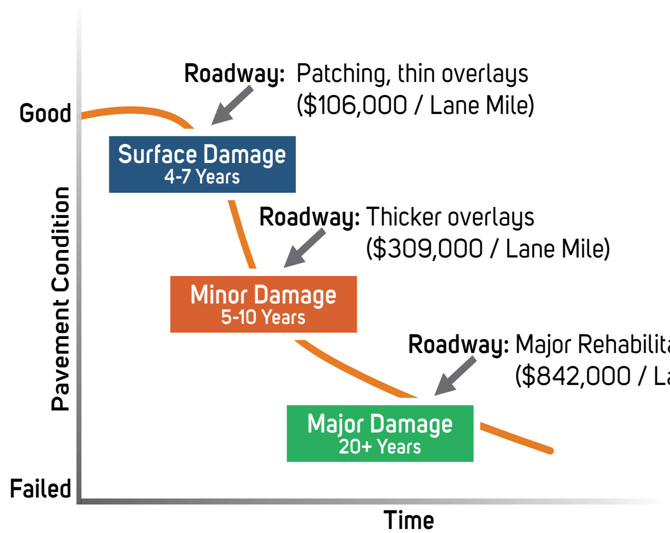
Source: Caltrans State Highway Operation and Protection Program (SHOPP)

CORRIDOR MOBILITY AND SUSTAINABILITY IMPROVEMENT PLANS

Caltrans, SCAG and county partners in the past have worked together to improve the efficiency of our highways and arterials through the development of Corridor System Management Plans (CSMPs). Since the passage of Proposition 1B in November 2006 and with the creation of the Corridor Mobility Improvement Account (CMIA), which served to improve mobility on the state highway system, several CSMPs have been developed for various corridors throughout the SCAG region as shown in **TABLE 1** and **EXHIBIT 1**. Historically, the response to congestion has been to add capacity. However, CSMPs focus on identifying lower cost, higher benefit options for making highways and parallel arterial systems, transit, and incident response management more efficient. The CSMPs accomplish this by identifying ITS strategies, in conjunction with operational and capacity improvements.

The CSMPs contain several key components including: a comprehensive corridor description and understanding; a performance assessment and bottleneck identification; identification of operational and minor infrastructure improvements to relieve congestion; and development of simulation models to estimate improvements from those projects and strategies. The recommended improvements include TSM investments such as ramp metering and enhanced incident management. The recommendations also include small infrastructure improvements such as auxiliary lanes and ramp and interchange improvements. The 2016 RTP/SCS includes $5 billion of funding for CSMP-recommended improvements.

FIGURE 7 Cost Effectiveness of Pavement Treatment



Source: Caltrans 2013 State of the Pavement Report

TABLE 1 Corridor System Management Plans in the SCAG Region

County	Route	Corridor Limits
LOS ANGELES	I-5 North	I-10 to I-210
	I-5 South	I-710 to Orange County Line
	I-405	I-5 to I-110
	I-210	I-5 to SR-57
ORANGE	I-5	Orange/Los Angeles County Line to Orange/San Diego County Line
	SR-57	I-5/SR-22 Interchange to Orange/Los Angeles County Line
	SR-91	I-5 in Buena Park to the Orange/Riverside County Line
	SR-22/ I-405/ I-605	SR-22: I-405 to SR-55 I-405: Los Angeles County Line to I-5 I-605: Los Angeles County Line to I-405
RIVERSIDE & SAN BERNARDINO	I-10	I-15 to SR-60
	I-15	San Diego/Riverside County Line to State Line
	I-215	I-15 in San Bernardino County to I-15 in Riverside County
	SR-91	Orange County Line to I-215/SR-60
VENTURA	US-101	Santa Barbara County to Rice Ave/Oxnard

Since the adoption of the 2012 RTP/SCS, two additional CSMPs have since been completed, including the I-5 corridor in Orange County and the I-15 corridor traversing through the counties of San Bernardino and Riverside.

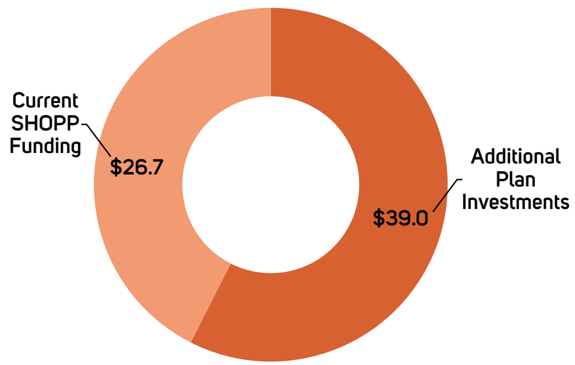
SCAG recognizes the efforts taken thus far under the current CSMP framework to improve mobility, but believes that CSMPs can be further improved upon. SCAG encourages the development of Corridor Sustainability Studies (CSS) which will build upon the existing CSMP framework by analyzing the corridor from a multi-modal perspective. More specifically, these studies will include a focus on newer planning priorities such as Complete Streets and a Smart Mobility Framework (not addressed by current CSMPs). SCAG recognizes that the region could benefit from a site specific CSS focused on improving mobility for all modes of travel throughout the region. SCAG also encourages its partner agencies, including Caltrans and County Transportation Commissions (CTCs), to develop Corridor Sustainability Studies for major corridors throughout the region.

INTEGRATED CORRIDOR MANAGEMENT

The Integrated Corridor Management (ICM) Initiative was first introduced by the U.S. Department of Transportation (USDOT) in 2006. Under the ICM approach, all elements within a corridor are considered when evaluating opportunities to move people and goods in the most efficient manner feasible while simultaneously ensuring that the greatest operational efficiencies are achieved.

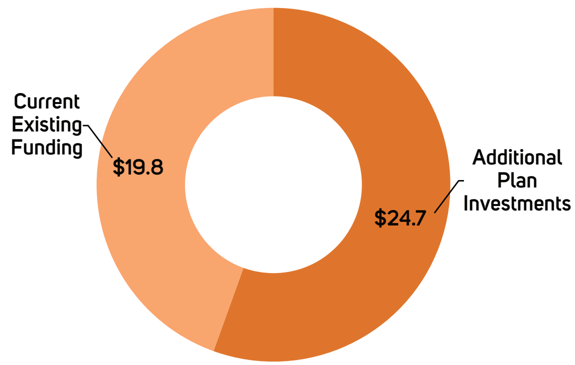
Since the introduction of ICM, much progress has been made specifically in Los Angeles County. Most recently, Caltrans, in coordination with the Los Angeles County Metropolitan Transportation Authority (Metro) and various local cities, have embarked on the development of the first ever ICM system on I-210 (I-210 Pilot). The I-210 Pilot project

FIGURE 8 Regional State Highway Operations and Protection Total Needs: $65.8 Billion



Note: Numbers may not sum to total due to rounding

FIGURE 9 Regional Local Streets and Roads Total Needs to Maintain Current Conditions: $44.6 Billion



Note: Numbers may not sum to total due to rounding aims to minimize congestion and improve mobility in a section of the I-210 corridor in the San Gabriel Valley region through a coordinated management approach of the highway, local surrounding arterials and supporting local transit services. Over the next 10 years Caltrans, in partnership with local agencies, plans to implement similar projects on 25 additional congested corridors statewide. ICM strategies to be considered as part of the I-210 Pilot project include:

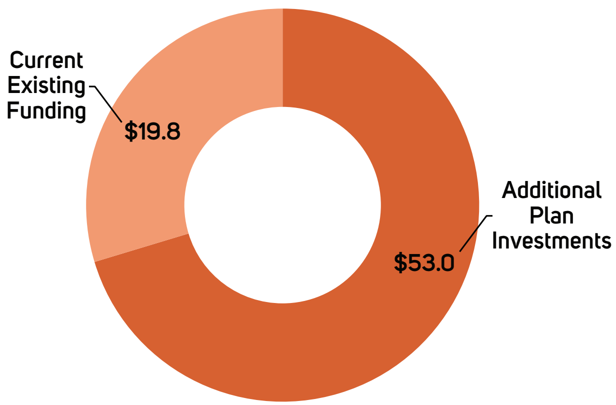
- Integration of highway ramp meters and arterial signal systems;
- Arterial signal coordination;
- Traffic re-routing due to incidents or events;
- Transit signal priority on arterials and on-ramps;
- Parking management;
- Traveler communication (via changeable message signs, 511, radio, social networks and mobile applications) of traffic conditions, transit services, parking and alternate route/trip/mode options; and
- System coordination/communication between Caltrans (highway operator) and local jurisdictions (arterial operators).

ADDITIONAL SYSTEM MANAGEMENT INITIATIVES

Additional initiatives related to maximizing the productivity of our roadways include:

- Arterial Signal Synchronization projects that have been completed on various arterials through the region to optimize traffic flow.
- The Dynamic Corridor Congestion Management (DCCM) initiative in Los Angeles. Caltrans is developing a corridor management initiative on the I-110 to coordinate highway ramp metering with arterial signals.
- Various efforts have been completed to inform the traveling public of expected travel times to various destinations and in some cases provide travel time comparisons with transit.
- SCAG and its partner agencies are developing an understanding of new mobility innovations in the private sector. These include driverless cars and connected vehicles. These innovations will likely have a profound impact on the future of transportation and offer the promise of reduced collisions and incidents and reduced non-recurrent delays. SCAG is also closely monitoring the impact of shared-ride providers such as Uber and Lyft and how these may reduce overall vehicle miles traveled (VMT) and thus reduce overall demand on our roadway systems. We anticipate that the private sector will be a critical partner in maximizing the productivity of our roadway system in the future.

FIGURE 10 Regional Local Streets and Roads Total Needs to Bring the System to a State of Good Repair: $72.8 Billion



Note: Numbers may not sum to total due to rounding

REGIONAL EXPRESS LANE NETWORK

Consistent with our regional emphasis on the System Management Pyramid (**FIGURE 2**), recent planning efforts have focused on enhanced system management, including the integration of value pricing to better utilize existing capacity and to offer users greater travel time reliability and choices. As previously mentioned, express lanes that are appropriately priced to reflect demand can outperform non-priced lanes in terms of throughput, especially during congested periods. Moreover, revenue generated from priced lanes can be used to deliver the needed capacity provided by the express lanes sooner and to support complementary transit investments.

The regional express lane network included in the 2016 RTP/SCS builds on the success of the SR-91 Express Lanes in Orange County and the I-10 and I-110 Express Lanes in Los Angeles County. Additional efforts underway include the extension of the SR-91 Express Lanes to the I-15 as well as the planned express lanes on the I-15 in Riverside County. Express lanes are also planned for the I-15 and the I-10 in San Bernardino County and I-405 in Orange County.

TABLE 2 and **EXHIBIT 8** display the segments in the proposed regional express lane network.

TABLE 2 Regional Express Lane Network

	County	Route	From	To
EXPRESS LANE ADDITIONS	Los Angeles	I-10	I-605	San Bernardino County Line
	Los Angeles	I-105	I-405	I-605
	Los Angeles	I-405	I-5	Orange County Line
	Los Angeles	I-605	I-10	Orange County Line
	Orange	SR-55	SR-91	I-405
	Orange	SR-73	I-405	MacArthur Boulevard
	Orange	I-405**	Los Angeles County Line	SR-55
	Orange	I-605	Los Angeles County Line	I-405
	Riverside	I-15*	San Bernardino County Line	Cajalco Road
	Riverside	SR-91*	Orange County Line	I-15
	San Bernardino	I-10**	Los Angeles County Line	Ford Street
	San Bernardino	I-15*	US-395	Riverside County Line
EXPRESS LANE DIRECT CONNECTORS	Los Angeles	I-405/I-110	I-405 NB to I-110 NB and I-110 SB to I-405 SB	
	Orange	I-5/SR-55	Existing HOV to proposed express lane direct connector	
	Orange	SR-91/SR-55	Existing HOV to proposed express lane direct connector	
	Orange	SR-91/SR-241	SR-241 NB to SR-91 EB and SR-91 WB to SR-241 SB	
	Orange	I-405/SR-55	Existing HOV to proposed express lane direct connector	
	Orange	I-405/SR-73	Planned HOV to proposed express lane direct connector	
	Orange	I-405/I-605	Existing HOV to proposed express lane direct connector	
	Riverside	SR-91/I-15	SR-91 EB to I-15 SB and I-15 NB to SR-91 WB	

*Notes: * Dual Express lanes for entire length ** Dual Express lanes for a section*

TABLE 3 *Sample Major Highway Projects in the FTIP

	County	Route	Description	Completion Year	Cost ($1,000's)
MIXED-FLOW LANES	LA	SR-138	Add 1 mixed-flow lane in each direction from Avenue T to SR-18	2019	$169,362
	OR	SR-55	Add 1 mixed-flow lane in each direction from I-405 to I-5	2020	$274,900
	OR	I-405	Add 1 mixed-flow lane in each direction from SR-73 to I-605	2022	$1,298,000
	VE	US-101	Add 1 mixed-flow lane in each direction at various locations from LA/VE County Line to Moorpark Rd	2016	$15,764
TOLL AND EXPRESS LANES	LA/SB	TBD	Construct new High Desert Corridor connecting Los Angeles and San Bernardino Counties	2020	$5,000,000
	OR	I-405	Add express lane in each direction from SR-73 to I-605	2035	$400,000
	OR	SR-73	Add 1 toll lane in each direction from Bison to I-5	2020	$351,188
	OR	SR-241	Add 2 toll lanes in each direction from Oso Parkway to SR-261	2020	$269,045
	RV	I-15	Add express lanes in each direction from SR-60 to Cajalco	2020	$433,000
	SB	I-10	Add 2 express lanes in each direction from San Antonio to I-10/I-15 interchange	2022	$524,278
HOV LANES	LA	I-5	Add HOV lanes from the LA/OC County Line to I-605	2019	$1,464,697
	LA	I-5	Add 1 HOV lane in each direction from SR-134 to SR-170	2019	$621,231
	LA	I-10	Add 1 HOV lane in direction from Puente to Citrus	2018	$195,580
	LA	I-10	Add 1 HOV lane in each direction from Citrus to SR-57	2018	$241,660
	OR	I-5	Add 1 HOV lane in each direction from South of Avenida Pico to South of Avenida Vista Hermosa	2017	$97,736
	OR	I-5	Add 1 HOV lane in each direction from South of Avenida Pico to South of Pacific Coast Highway	2016	$68,711
	OR	I-5	Add 1 HOV lane in each direction from South of Pacific Coast Highway to San Juan Creek Road	2016	$63,093
	OR	I-5	Add 1 HOV lane in each direction from SR-55 to SR-57	2018	$42,471
	VE	US-101	Add 1 HOV lane in each direction from Mobil Pier to Casitas Pass	2016	$87,760

*Notes: * Project information is recent as of the 2015 FTIP Amendments 1-7 and 12*

STRATEGIC EXPANSION

PROGRAMMED COMMITMENTS

SCAG's Federal Transportation Improvement Program (FTIP) is the short-range element of the Plan and consists of a capital listing of all transportation projects proposed over the first six years of the 2016 RTP/SCS for the SCAG region. The projects vary by type and range from highway improvements, transit, rail and bus facilities to high occupancy vehicle (HOV) lanes, signal synchronization, intersection improvements and highway ramps. The FTIP is prepared to implement near- and mid-term projects and programs as identified in the RTP/SCS and is developed in compliance under state and federal requirements.

TABLE 3 provides a sample of major projects included in the FTIP. For a complete project list please refer to the RTP/SCS's Project List Appendix.

ADDITIONAL COUNTY COMMITMENTS

In addition to the projects included as part of the FTIP, the six CTCs that represent the SCAG region have also identified and committed to completing a number of additional projects through the year 2040. These projects have been identified either through countywide long-range transportation plans (LRTPs) or in part by voter approved sales tax initiatives. **TABLE 4** provides a sample of major projects beyond the FTIP (i.e. projects beyond 2022). **EXHIBITS 2-5** and **8** showcase major highway improvement projects ranging from HOV, express lanes, toll and major mixed-flow improvements throughout the region. The 2016 RTP/SCS commits more than $35.8 billion for various highway improvements, including mixed-flow and interchange improvements, HOV/express lanes and toll facilities as shown in **TABLE 5**. In addition, the 2016 RTP/SCS commits more than $70.7 billion toward goods movement improvements, of which a portion of these funds are allocated specifically toward highway and local arterial improvements.

For a complete project list, please refer to the 2016 RTP/SCS Project List Appendix.

TABLE 4 Sample Major Highway Projects Committed by the Counties

	County	Route	Description	Completion Year	Cost ($1,000's)
MIXED-FLOW LANES	IM	SR-98	Widen and improve SR-98 or Jasper Rd to 4/6 lanes	2025	$1,170,483
MIXED-FLOW LANES	IM	SR-111	Widen and improve to a 6-lane highway with interchanges to Heber, McCabe, and Jasper, and overpass at Chick Rd	2030	$999,136
MIXED-FLOW LANES	LA	SR-57/ SR-60	Improve the SR-57/SR-60 interchange	2029	$475,000
MIXED-FLOW LANES	OR	I-5	Add 1 mixed-flow lane in each direction from SR-57 to SR-91	2040	$305,924
MIXED-FLOW LANES	OR	SR-55	Add 1 mixed-flow lane in each direction and fix chokepoints from I-405 to I-5 and add 1 auxiliary lane in each direction between select on/off ramps and operational improvements through project limits	2030	$274,900
MIXED-FLOW LANES	OR	SR-91	Add 1 eastbound mixed-flow lane on SR-91 from SR-57 to SR-55 and 1 westbound mixed-flow lane from Kraemer to State College	2030	$425,000
MIXED-FLOW LANES	OR	I-405	Add 1 mixed-flow lane in each direction from I-5 to SR-55	2030	$374,540
MIXED-FLOW LANES	OR	I-405	Add 1 mixed-flow lane between SR-73 and I-605	2022	$1,300,000
MIXED-FLOW LANES	VEN	SR-118	Add 1 mixed-flow lane in each direction from Tapo Canyon Rd to LA Avenue	2025	$216,463
EXPRESS LANES	LA	I-110	Construct express lane off-ramp connector from 28th St to Figueroa St	2023	$55,000
EXPRESS LANES	RV	I-15	Add 1 express lane in each direction from Cajalco Rd to SR-74	2029	$453,174
EXPRESS LANES	SB	I-15	Add 2 express lanes in each direction from US-395 to I-15/I-215 interchange	2030	$687,994

TABLE 4 Continued

	County	Route	Description	Completion Year	Cost ($1,000's)
HOV LANES	LA	I-5	Add 1 HOV lane in each direction from Weldon Canyon Rd to SR-14	2017	$410,000
HOV LANES	LA	SR-14	Add 1 HOV lane in each direction from Ave P-8 to Ave L	2027	$120,000
HOV LANES	LA	SR-71	Convert expressway to highway-add 1 HOV lane and 1 mixed-flow lane	2028	$13,392
HOV LANES	OR	I-5	Add 1 HOV lane in each direction from Pico to SD County Line	2040	$237,536
HOV LANES	RV	I-15	Add 1 HOV lane in each direction from SR-74 to I-15/I-215 interchange	2039	$375,664
HOV LANES	SB	I-10	Add 1 HOV lane in each direction from Ford to RV County Line	2030	$126,836
HOV LANES	SB	I-215	Add 1 HOV lane in each direction from SR-210 to I-15	2035	$249,151
HOV LANES	SB	I-210	Add 1 HOV lane in each direction from I-215 to I-10	2040	$178,780
HOV LANES	VEN	US-101	Add 1 HOV lane in each direction from LA/VEN County Line to SR-33	2029	$132,000

ARTERIALS

Our region's local arterial system is comprised of all local streets and roads. These serve many different functions, one of which is to provide our region's residents with linkages to homes, schools, jobs, healthcare, recreation and retail. As shown in **EXHIBIT 6**, our region's local streets and roads account for more than 80 percent of the total road network and carry a majority of overall traffic. In conjunction with our state highway system, a number of local arterials paralleling our major highways serve as major thoroughfares that provide alternate routes to our congested highways. Our local streets also provide for modes of travel other than the automobile, including public transit and active transportation (i.e. walking and bicycling) **TABLE 6** provides the amounts invested by county for

TABLE 5 Plan 2040 Highway Investments

Highways	Description	Cost ($, Billions)
Mixed Flow and Interchange Improvements	Interchange improvements to and closures of critical gaps in the highway network to provide access to all parts of the region	$12.2
High-Occupancy Vehicle (HOV)/Express Lanes	Closure of gaps in the high-occupancy vehicle (HOV) lane network and the addition of highway-to-highway direct HOV connectors to complete Southern California's HOV network A connected network of express lanes	$15.2
Toll Facilities	Closure of critical gaps in the highway network to provide access to all parts of the region	$8.4
Regional Total		$35.8

*Numbers may not sum to total due to rounding

TABLE 6 Plan 2040 Arterial Investments

County	Investment ($, Billions)*
Imperial	$1.3
Los Angeles	$5.2
Orange	$3.4
Riverside	$5.2
San Bernardino	$2.3
Ventura	$1.0
Regional Total	$18.4

**Numbers may not sum to total due to rounding*

capital arterial improvements. The 2016 RTP/SCS commits more than $18.4 billion for arterial improvements.

PERFORMANCE RESULTS

The 2016 RTP/SCS performance results for mobility are summarized in this Appendix. A more complete discussion of all performance results for the 2016 RTP/SCS is contained in Chapter 8 of the main document and in the Performance Measures Appendix. The mobility performance measures rely on the commonly used measure of delay. Delay is the difference between the actual travel time and the travel time at some pre-defined reference or 'optimal' speed for each mode alternative under analysis. It is measured in vehicle-hours of delay (VHD), which can then be used to derive person-hours of delay. This is a relatively straightforward measure to calculate using real-world and modeled data, is understandable by both transportation professionals and the general public, and can be forecasted for the 2040 future scenarios.

In the discussion of performance outcomes, three scenarios are referenced: Base Year, Baseline and Plan.

- Base Year represents existing conditions as of 2012 – that is, the transportation system as it was on the ground and in service in 2012. The year 2012 was selected as the Base Year for this analysis because it is the year of the most recent previous RTP/SCS.
- Baseline assumes a continuation of the development trends of recent decades. This scenario represents a future in 2040 in which the following have been implemented: projects currently under construction or undergoing right of way acquisition; those programs and projects programmed and committed to in the 2015 Federal Transportation Improvement Program (FTIP); and/or projects that have already received environmental clearance.
- The Plan represents future conditions in 2040, in which investments and strategies detailed in the 2016 RTP/SCS are fully realized.

The mobility measures used to evaluate alternatives for this outcome include:

- Person delay by facility type (Mixed Flow, High Occupancy Vehicle (HOV), Arterials)
- Person delay per capita
- Truck delay by facility type

One additional measure for delay that is readily available for ongoing monitoring, but cannot be readily forecast, is non-recurrent delay. Recurrent congestion is the day-to-day congestion that occurs because too many vehicles are on the road at the same time. Non-recurrent congestion is the delay that is caused by collisions, incidents, weather, planned lane closure, special events or other atypical traffic patterns. Non-recurrent congestion can be mitigated or reduced by improving incident management strategies. Other smart uses of technologies, such as traffic signal coordination and real-time travel information about unexpected delays, allow travelers to make better decisions about available transit or other alternatives. Aside from the public sector investments on the system to improve safety, there are emerging and promising new technological advancements within the automobile industry, such as the collision avoidance system, that are having a dramatic impact on reducing collisions on our roadways. Reduced collisions, regardless of how they are reduced, will result in reduced delay given that the significant share of delay on our roadways can be attributed to non-recurring congestion.

PERSON DELAY BY FACILITY TYPE (MIXED FLOW HIGHWAYS, HOV, ARTERIALS)

For the 2016 RTP/SCS, this measure has been expanded to differentiate between single-occupancy vehicle (SOV) and high occupancy vehicle (HOV) delay. As shown in **FIGURE 11**, person-hours of delay is expected to increase from Base Year to Baseline. But overall, the Plan will improve on Baseline conditions by just under 39 percent to conditions that are better than what is experienced today.

FIGURE 11 Daily Person-Hours of Delay by Facility Type (Millions)

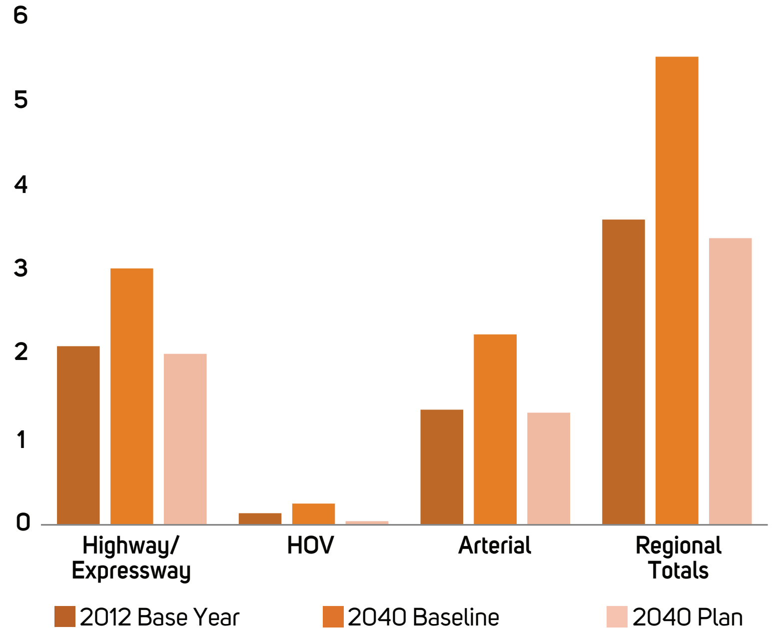
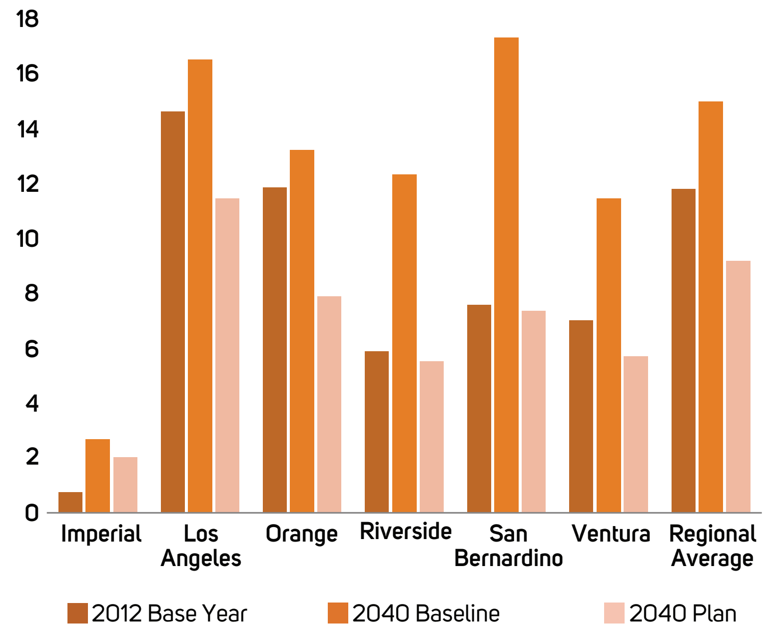


FIGURE 12 Daily Person Delay per Capita by County (Minutes)



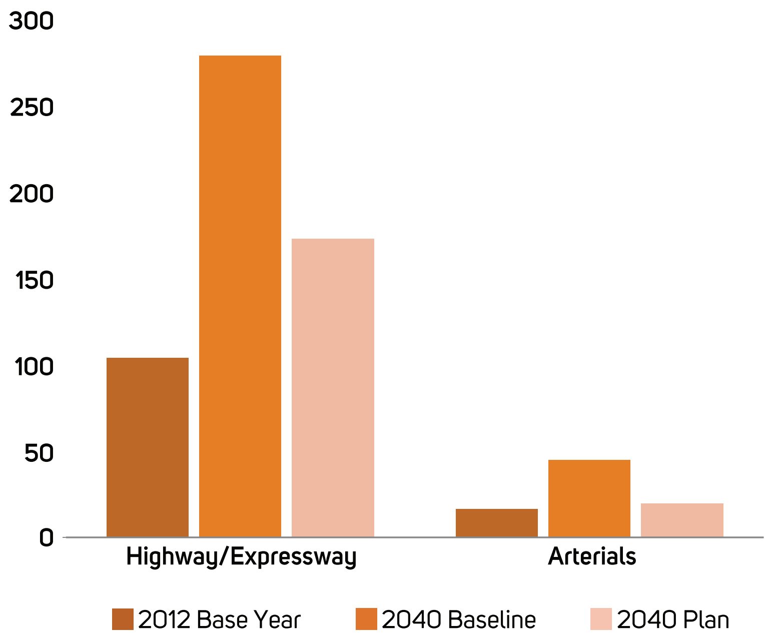
PERSON DELAY PER CAPITA

FIGURE 12 shows the person-hours of delay per capita for each of the six counties in the region, and for the SCAG region as a whole. Normalizing delay by the number of people living in an area provides insight into how well the region is mitigating traffic congestion in light of increasing population growth. Delay per capita is expected to grow considerably, particularly in the Inland Empire counties of Riverside and San Bernardino, under the Baseline conditions. However, implementation of the 2016 RTP/SCS is expected to reduce delay substantially, to below 2012 levels. The regional average delay per capita is expected to improve from more than 15 minutes under the Baseline to slightly above 9 minutes under the Plan. Not only does this represent a 39 percent improvement over Baseline, but also a 22 percent improvement over Base Year.

TRUCK DELAY BY FACILITY TYPE (HIGHWAY, ARTERIALS)

This measure estimates the average daily truck delay by facility type for highways and arterials (**FIGURE 13**). The 2016 RTP/SCS includes significant investments in a regional freight corridor and other improvements to facilitate goods movement. The Plan is estimated to reduce truck delay by just over 37 percent over Baseline on the highway system, and by nearly 56 percent on the arterial system. However, partly due to projected increases in truck traffic, the truck delay under the Plan will still be above Base Year levels.

FIGURE 13 Daily Heavy-Duty Truck Hours of Delay (Thousands)



NON-RECURRENT DELAY

Data from the Caltrans Performance Measurement System (PeMS) was used to assess the level of non-recurrent delay on regional highways using the "congestion pie" feature of PeMS. This module breaks down congestion into recurrent and non-recurrent congestion. As previously mentioned, for the 2016 RTP/SCS, the mobility performance measure is non-recurrent congestion. Recurring congestion is the "day-to-day" traffic congestion when the number of vehicles traveling along a roadway exceeds the available capacity, resulting in slower speeds and travel delays. Non-recurring congestion is the congestion caused by collisions, weather, special events or other unforeseen events. This type of congestion is evaluated in PeMS by dividing non-recurrent congestion into two major components: "Accidents" and "Miscellaneous". Accident-related congestion is estimated by using the Caltrans Traffic Accident Surveillance and Analysis System (TASAS) accident locations and comparing that to congestion levels reported by roadway sensors. If excess congestion beyond normal is reported at a location where TASAS reports that an accident occurred, then that extra congestion is put in the accident-related congestion bucket. If congestion being reported by a sensor is above normal and there was no accident report, then that congestion falls into the miscellaneous bucket.

The most recent PeMS congestion classification data is for 2011. **FIGURE 14** shows the percentage of highway congestion during a typical day (5:00 AM through 8:00 PM) during that year. The data is reported for each county and for the region as a whole. In 2011, the estimated average percentage of congestion that was due to accidents or other incidents was about 48 percent. San Bernardino County has less recurrent delay and is therefore more susceptible to incident-causing congestion. PeMS indicates that up to 78 percent of all congestion may be non-recurrent in the county. (The actual percentage is likely exaggerated due to the manner in which PeMS handles some data; more research is needed to verify this assessment.). In the more urbanized Los Angeles County, the data reported that 44 percent of county-wide congestion was non-recurrent. Other mobility and accessibility measures to be used for on-going system monitoring include mode share for work trips and travel time to work.

EXHIBITS 9-10 show the projected improvement in speed between the Baseline 2040 and Plan 2040 scenarios on our highway and arterial system in the PM peak. Additional speed maps can be found in the Addendum of this document.

FIGURE 14 Percent Non-Recurrent Congestion by County (2011)

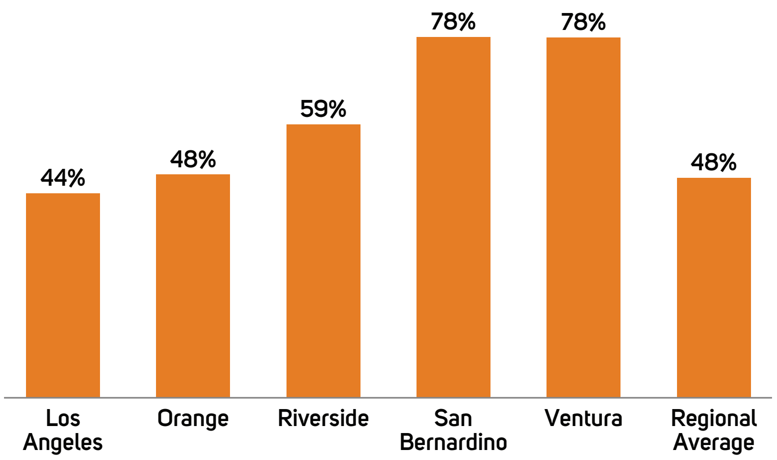
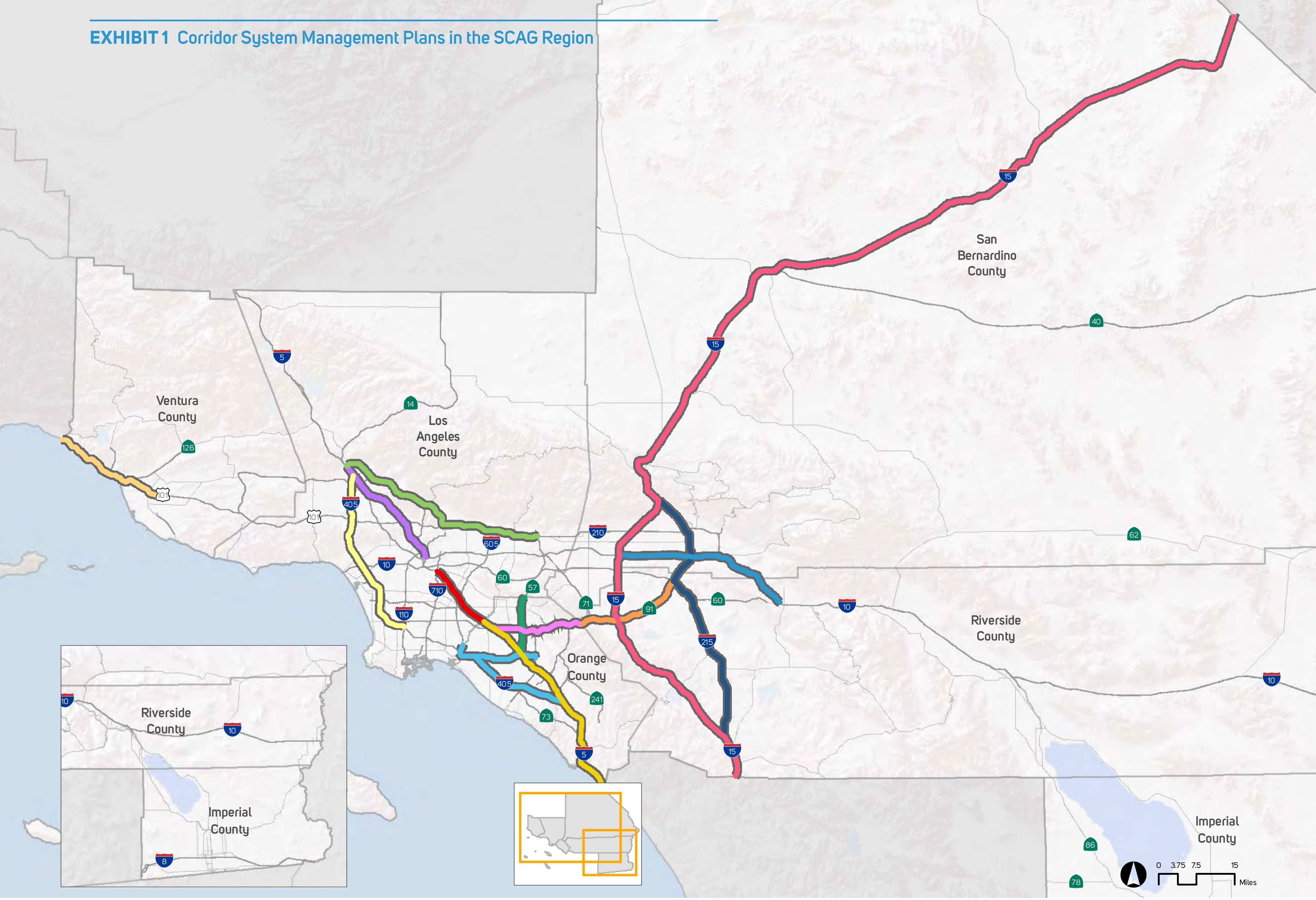


EXHIBIT 1 Corridor System Management Plans in the SCAG Region

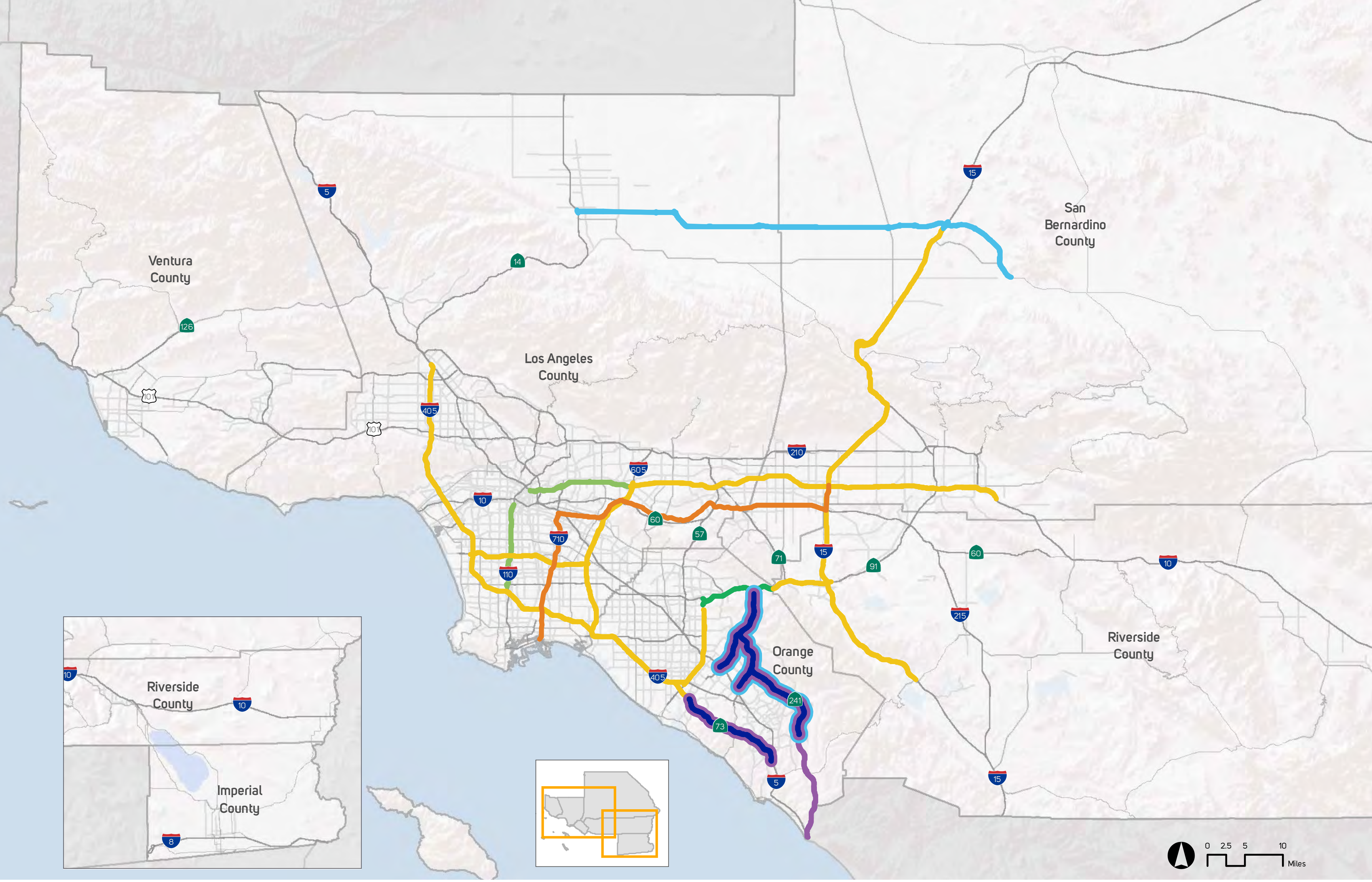


(Source: SCAG)

EXHIBIT 2 Major HOV Projects Proposed by Counties

(Source: SCAG)

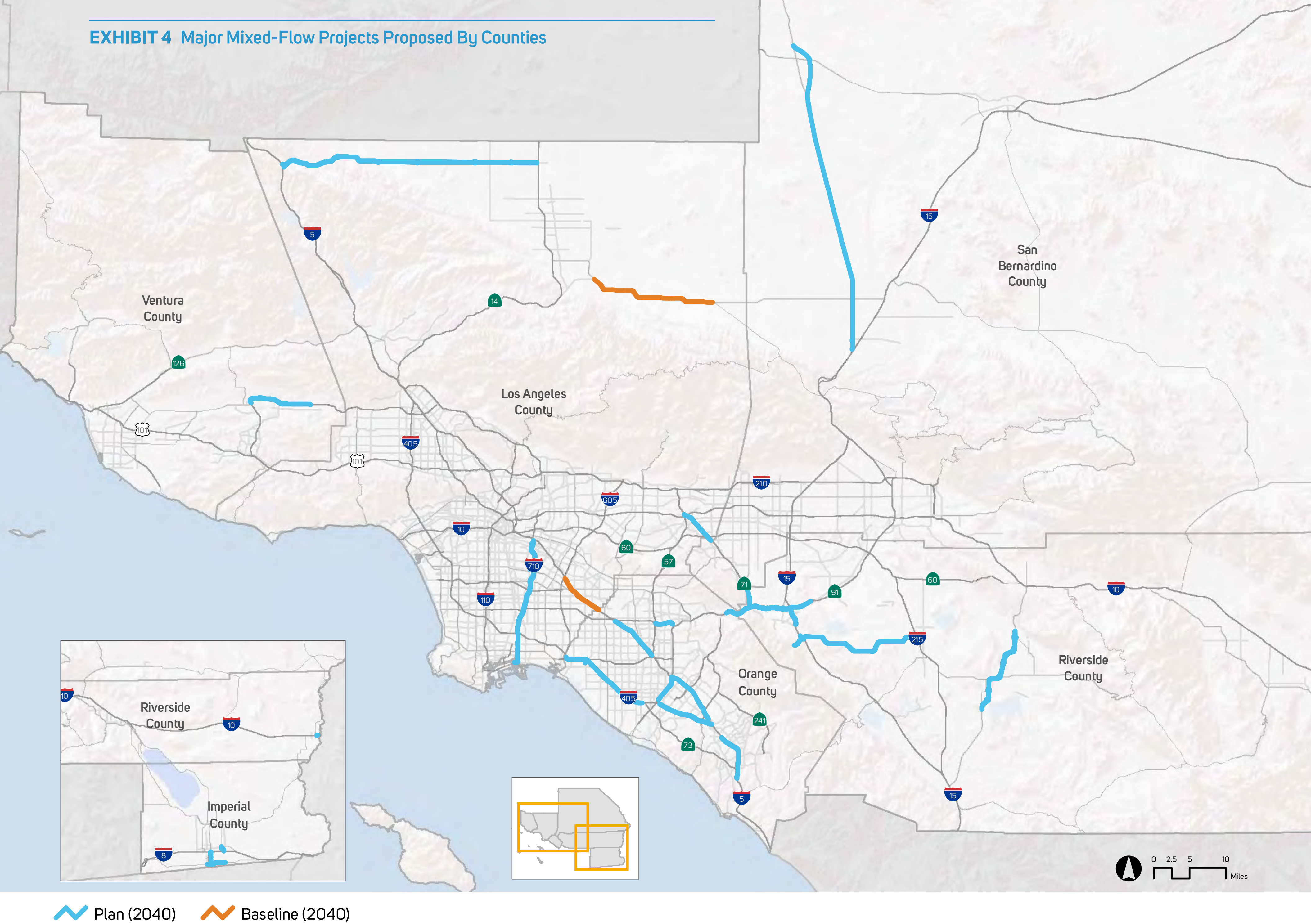
EXHIBIT 3 Major Toll Projects By Counties



Toll Lanes (Plan 2040) | Toll Lanes (Baseline 2040) | Toll Lanes (Base Year 2012) | Express Lanes (Plan 2040) | Express Lanes (Baseline 2040) | Express Lanes (Base Year 2012) | Freight Corridors (Plan 2040)

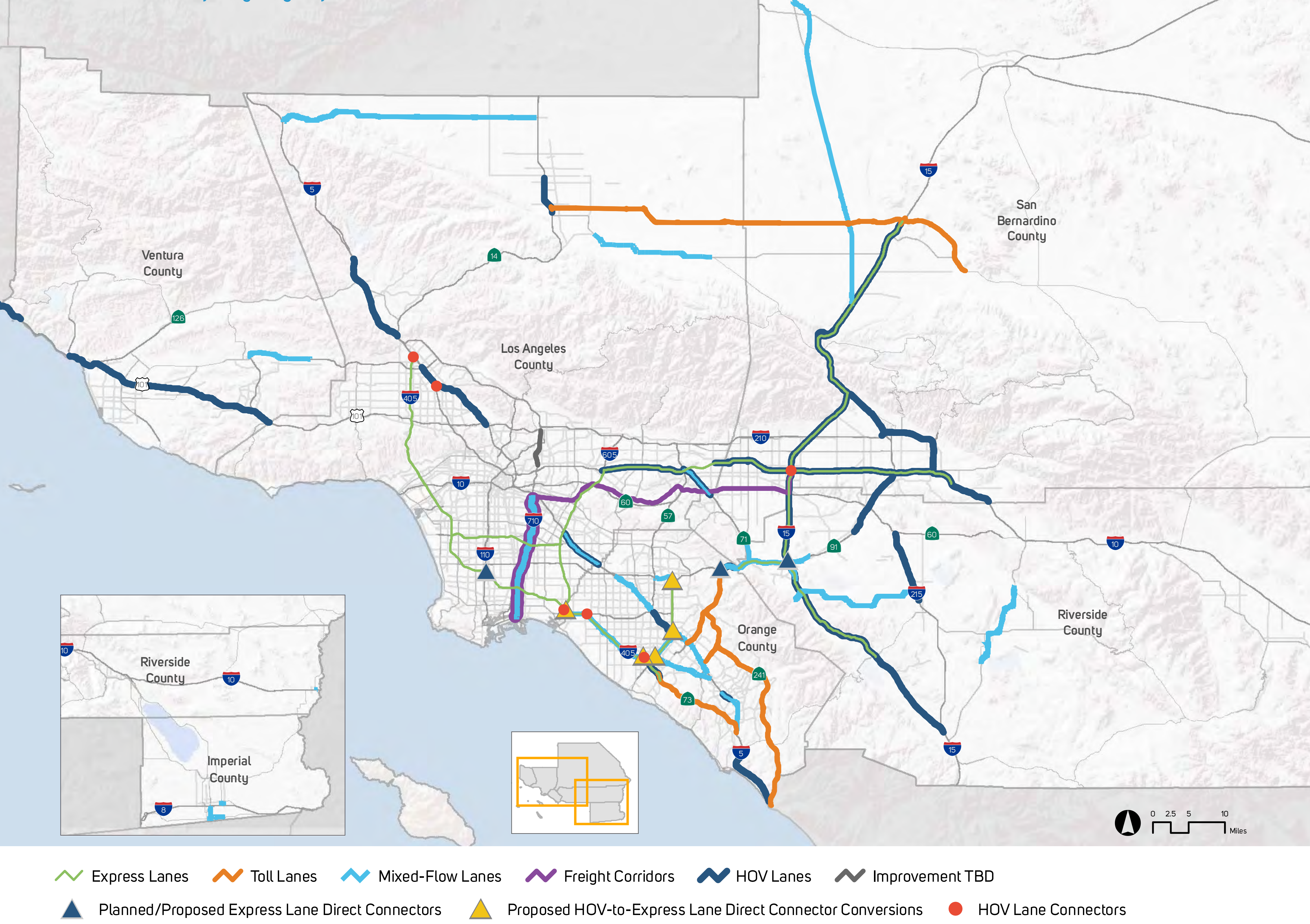
(Source: SCAG)

EXHIBIT 4 Major Mixed-Flow Projects Proposed By Counties



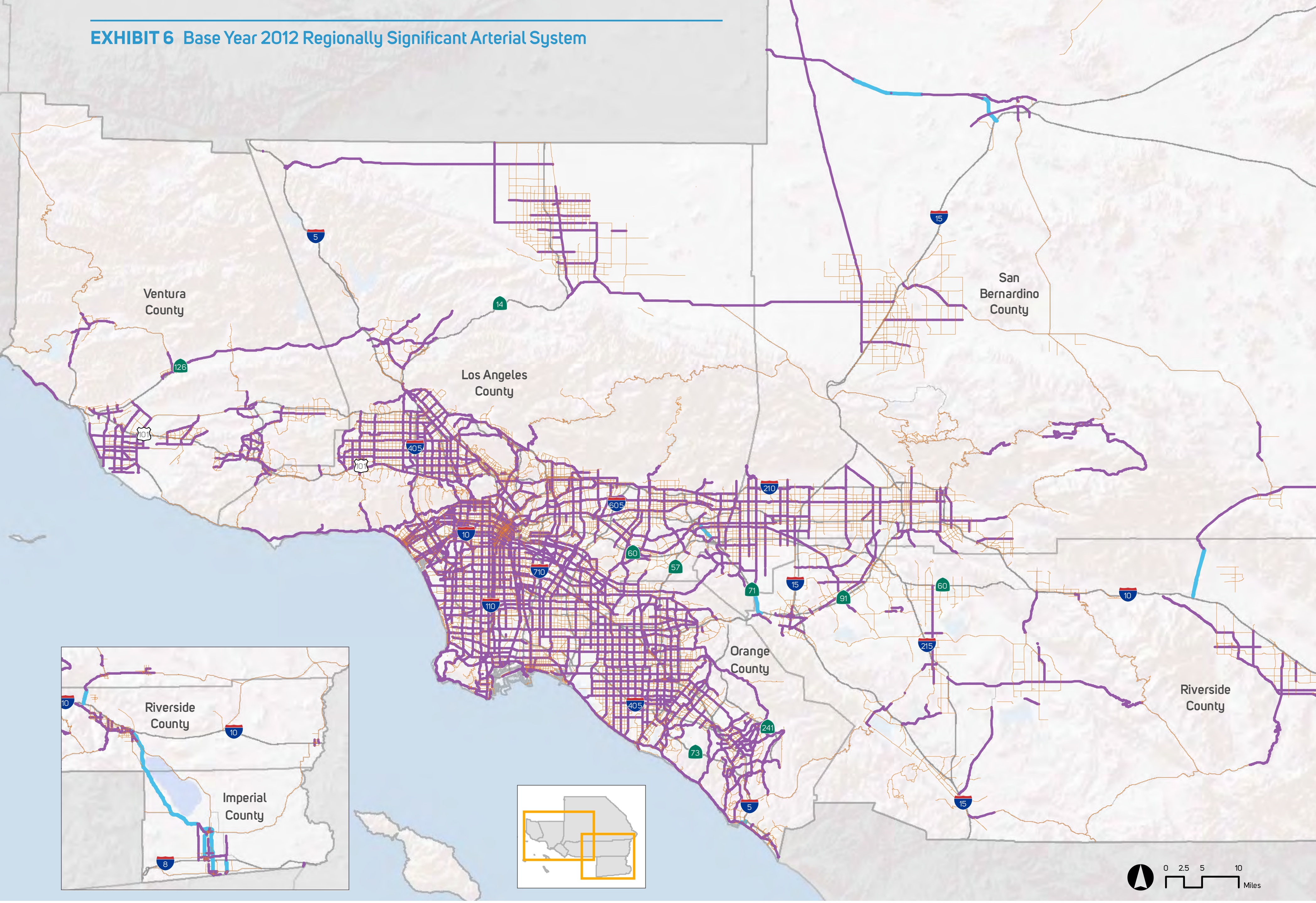
(Source: SCAG)

EXHIBIT 5 Major Highway Projects



(Source: SCAG)

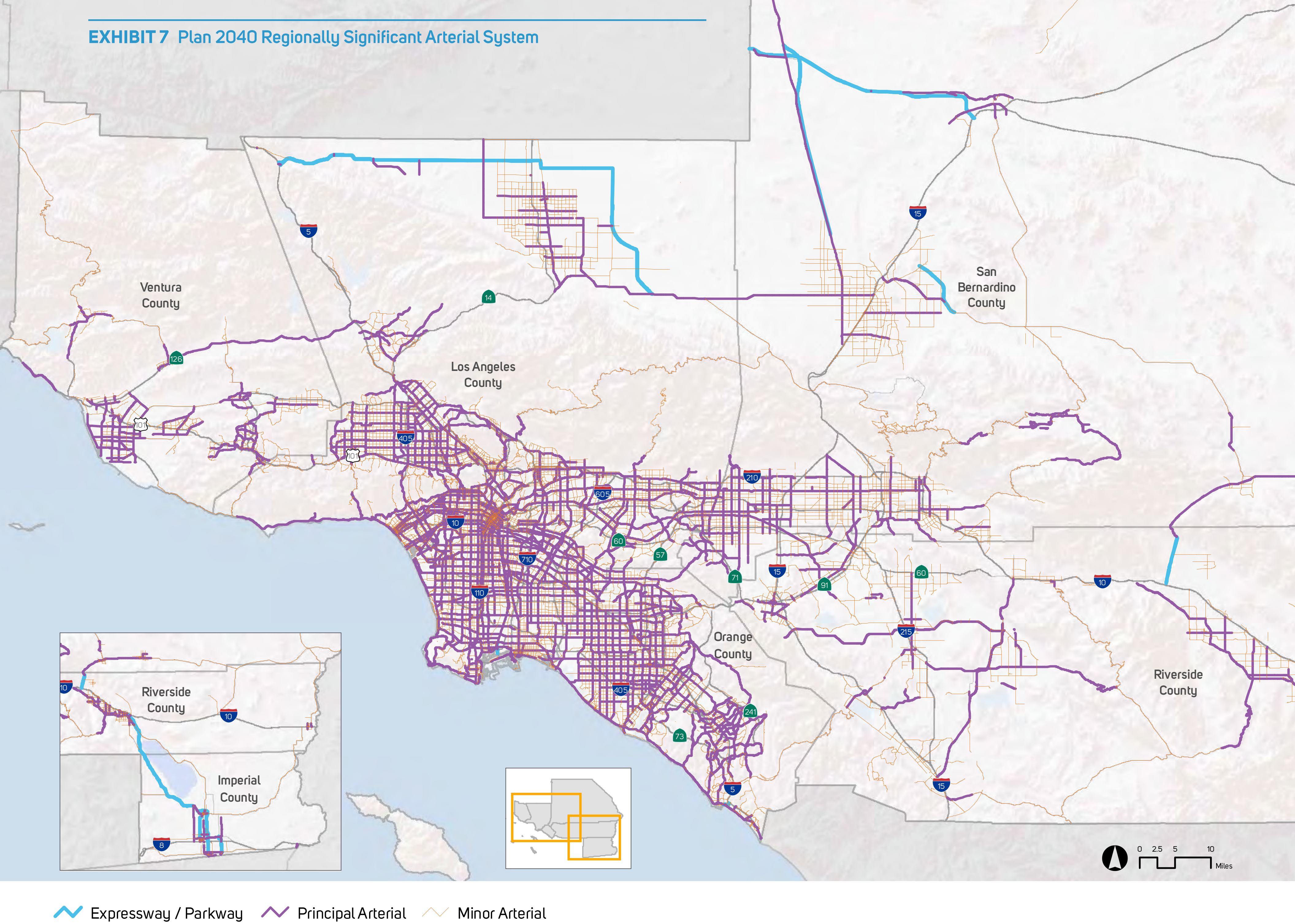
EXHIBIT 6 Base Year 2012 Regionally Significant Arterial System



Expressway / Parkway Principal Arterial Minor Arterial

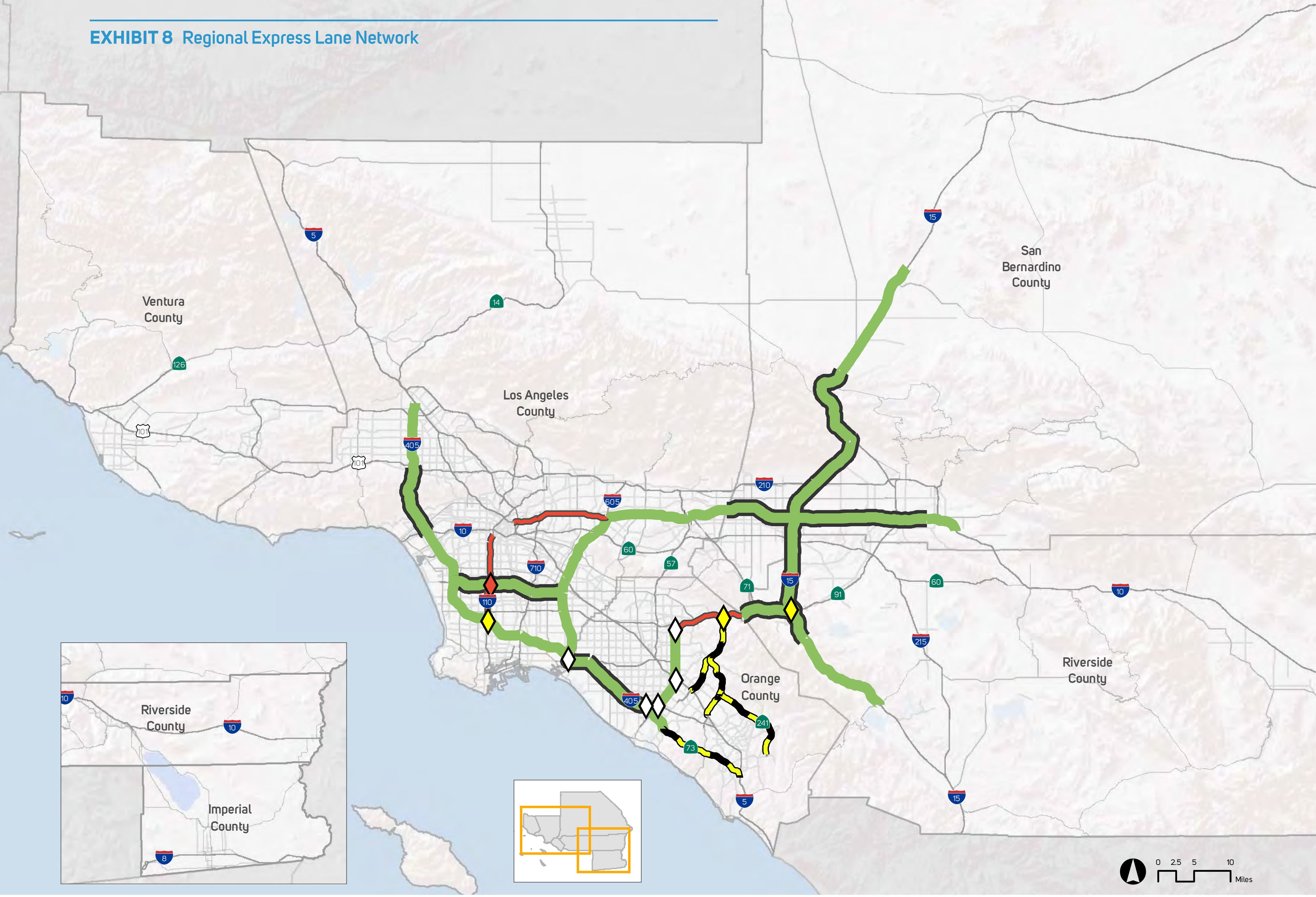
(Source: SCAG)

EXHIBIT 7 Plan 2040 Regionally Significant Arterial System



(Source: SCAG)

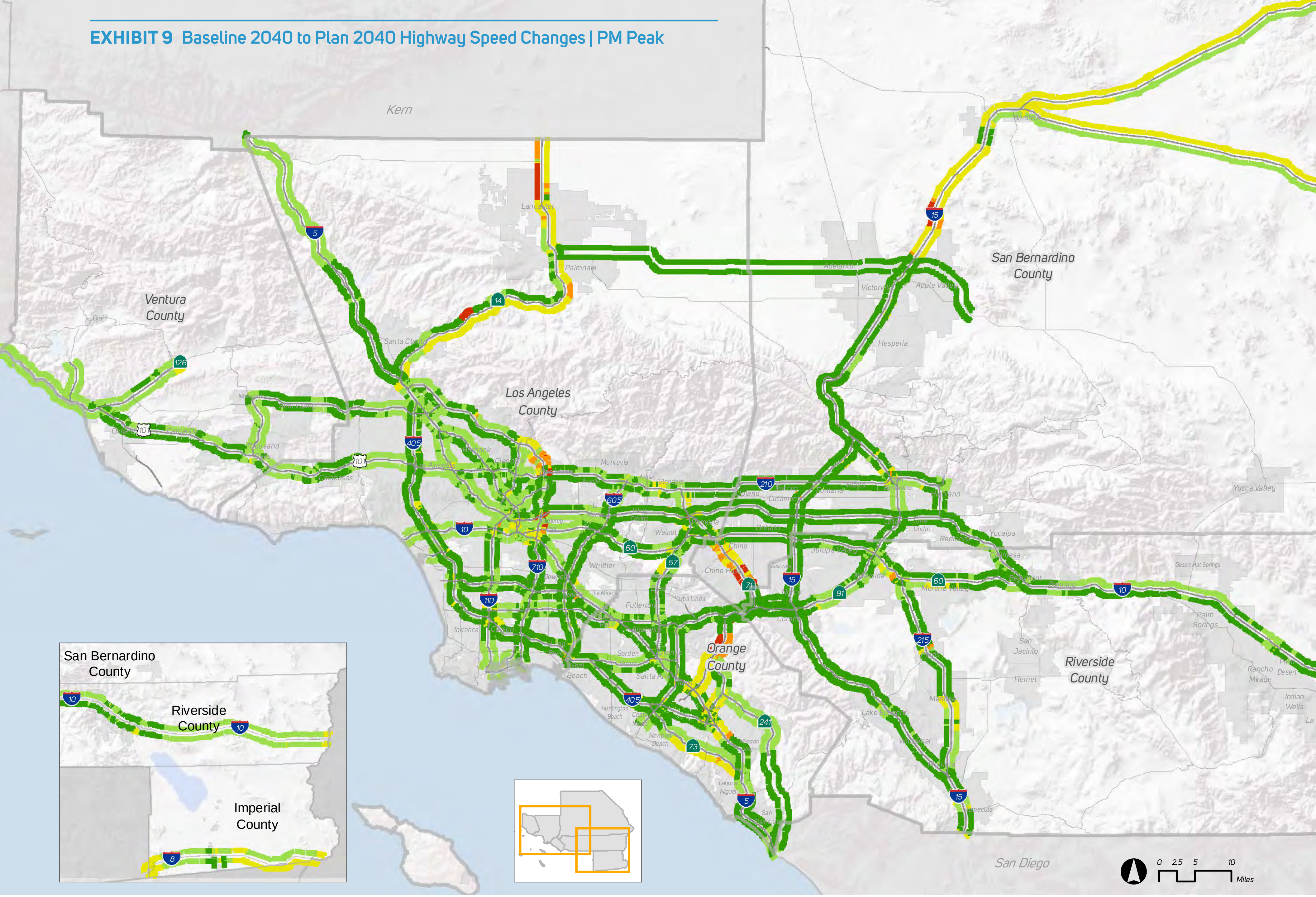
EXHIBIT 8 Regional Express Lane Network



Existing Express Lanes
Existing Toll Road
Planned Express Lane Network
Planned Dual-Lane Segment
Existing Express Lane Direct Connector
Planned Express Lane Direct Connector
Planned HOV-to-Express Lane Direct Connector Conversion

(Source: SCAG)

EXHIBIT 9 Baseline 2040 to Plan 2040 Highway Speed Changes | PM Peak

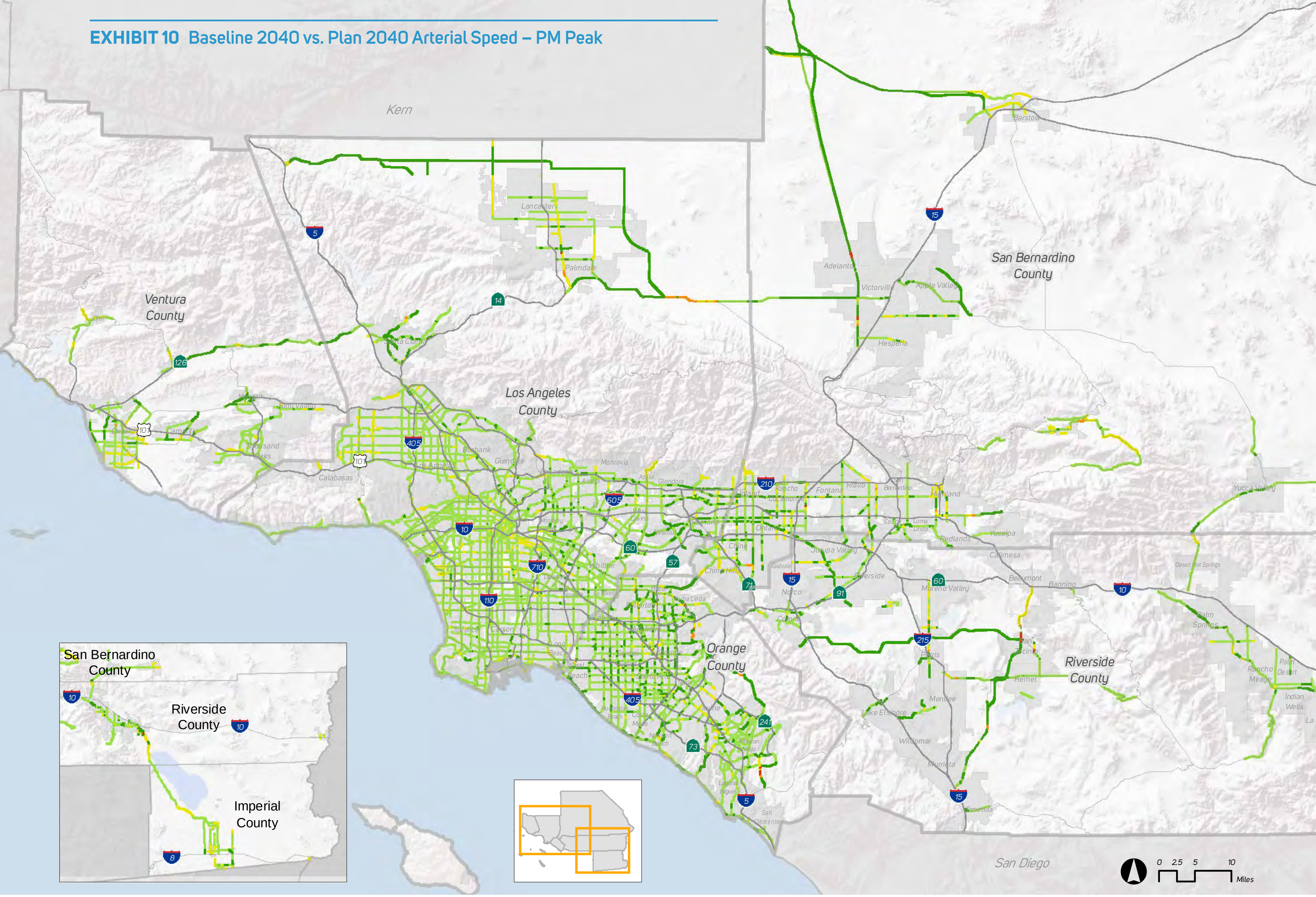


Speed in Miles Per Hour

- Greater than 10.0 decrease
- 5.0 to 10.0 decrease
- 0.0 to 4.9 decrease
- 0.0 to 4.9 increase
- 5.0 or greater increase

(Source: SCAG)

EXHIBIT 10 Baseline 2040 vs. Plan 2040 Arterial Speed – PM Peak



Speed in Miles Per Hour

Greater than 10.0 decrease | *5.0 to 10.0 decrease* | *0.0 to 4.9 decrease* | *0.0 to 4.9 increase* | *5.0 or greater increase*

(Source: SCAG)

ADDENDUM

TABLE A1 Centerline Miles Summary

County	Base Year 2012	Baseline 2040	Plan 2040
Imperial	1,760	1,760	1,762
Los Angeles	8,833	8,876	9,014
Orange	2,194	2,223	2,292
Riverside	3,684	3,720	3,923
San Bernardino	5,581	5,589	5,966
Ventura	1,144	1,148	1,180
Region	23,196	23,317	24,138

**Numbers may not sum to total due to rounding*

TABLE A2 Lane Miles Summary (PM Peak Network)

County	Base Year 2012	Baseline 2040	Plan 2040
Imperial	4,002	4,003	4,080
Los Angeles	29,095	29,316	30,301
Orange	9,022	9,412	10,365
Riverside	10,644	10,917	12,943
San Bernardino	14,805	14,897	17,542
Ventura	3,326	3,342	3,497
Region	70,893	71,886	78,727

**Numbers may not sum to total due to rounding*

TABLE A3 Base Year 2012 Network Statistics

	County	Centerline Miles	Lane Miles (PM)
HIGHWAY (MIXED-FLOW)	Imperial	95	380
	Los Angeles	634	4,581
	Orange	167	1,298
	Riverside	307	1,727
	San Bernardino	472	2,534
	Ventura	94	528
	Subtotal	1,770	11,048
TOLL (INCLUDING TRUCK)	Imperial	0	0
	Los Angeles	3	12
	Orange	62	333
	Riverside	1	3
	San Bernardino	0	0
	Ventura	0	0
	Subtotal	66	348
MAJOR ARTERIAL	Imperial	183	611
	Los Angeles	1,941	8,351
	Orange	692	3,493
	Riverside	306	1,208
	San Bernardino	533	1,798
	Ventura	215	795
	Subtotal	3,870	16,257
MINOR ARTERIAL	Imperial	266	546
	Los Angeles	2,868	8,947
	Orange	779	2,733
	Riverside	997	2,870
	San Bernardino	1,448	3,860
	Ventura	357	992
	Subtotal	6,715	19,949

TABLE A3: Continued

	County	Centerline Miles	Lane Miles (PM)
COLLECTOR	Imperial	1,217	2,465
	Los Angeles	3,140	6,697
	Orange	380	931
	Riverside	2,032	4,755
	San Bernardino	3,076	6,507
	Ventura	478	1,010
	Subtotal	10,323	22,354
HIGHWAY (HOV)	Imperial	0	0
	Los Angeles	246	505
	Orange	114	233
	Riverside	40	82
	San Bernardino	52	105
	Ventura	0	0
	Subtotal	453	926
TOTAL ALL FACILITIES	Imperial	1,760	4,002
	Los Angeles	8,833	29,095
	Orange	2,194	9,022
	Riverside	3,684	10,644
	San Bernardino	5,581	14,805
	Ventura	1,144	3,326
	Subtotal	23,196	70,882

TABLE A4 Baseline 2040 Network Statistics

	County	Centerline Miles	Lane Miles (PM)
HIGHWAY (MIXED-FLOW)	Imperial	95	380
	Los Angeles	635	4,604
	Orange	167	1,325
	Riverside	307	1,761
	San Bernardino	472	2,534
	Ventura	94	528
	Subtotal	1,770	11,131
TOLL (INCLUDING TRUCK & EXPRESS LANE)	Imperial	0	0
	Los Angeles	30	101
	Orange	78	594
	Riverside	1	3
	San Bernardino	0	0
	Ventura	0	0
	Subtotal	109	699
MAJOR ARTERIAL	Imperial	183	612
	Los Angeles	1,942	8,404
	Orange	692	3,534
	Riverside	305	1,238
	San Bernardino	533	1,811
	Ventura	215	802
	Subtotal	3,871	16,402
MINOR ARTERIAL	Imperial	266	546
	Los Angeles	2,870	8,970
	Orange	786	2,771
	Riverside	1,007	2,971
	San Bernardino	1,452	3,915
	Ventura	357	994
	Subtotal	6,738	20,167

TABLE A4: Continued

	County	Centerline Miles	Lane Miles (PM)
COLLECTOR	Imperial	1,217	2,465
	Los Angeles	3,142	6,721
	Orange	384	940
	Riverside	2,050	4,845
	San Bernardino	3,076	6,522
	Ventura	478	1,009
	Subtotal	10,346	22,502
HIGHWAY (HOV)	Imperial	0	0
	Los Angeles	257	516
	Orange	116	248
	Riverside	49	99
	San Bernardino	57	115
	Ventura	4	9
	Subtotal	483	985
TOTAL ALL FACILITIES	Imperial	1,760	4,003
	Los Angeles	8,876	29,316
	Orange	2,223	9,412
	Riverside	3,720	10,917
	San Bernardino	5,589	14,897
	Ventura	1,148	3,342
	Subtotal	23,317	71,886

TABLE A5 Plan 2040 Network Statistics

	County	Centerline Miles	Lane Miles (PM)
HIGHWAY (MIXED-FLOW)	Imperial	101	417
	Los Angeles	649	4,786
	Orange	167	1,433
	Riverside	317	1,872
	San Bernardino	490	2,663
	Ventura	94	561
	Subtotal	1,819	11,732
TOLL (INCLUDING TRUCK & EXPRESS LANE)	Imperial	0	0
	Los Angeles	203	697
	Orange	119	702
	Riverside	42	133
	San Bernardino	110	436
	Ventura	0	0
	Subtotal	474	1,968
MAJOR ARTERIAL	Imperial	184	661
	Los Angeles	1,983	8,704
	Orange	696	3,802
	Riverside	350	1,621
	San Bernardino	586	2,385
	Ventura	220	851
	Subtotal	4,019	18,023
MINOR ARTERIAL	Imperial	261	539
	Los Angeles	2,882	9,068
	Orange	819	3,163
	Riverside	1,047	3,627
	San Bernardino	1,504	4,671
	Ventura	358	1,007
	Subtotal	6,872	22,075

TABLE A5: Continued

	County	Centerline Miles	Lane Miles (PM)
COLLECTOR	Imperial	1,216	2,463
	Los Angeles	3,118	6,686
	Orange	399	1,068
	Riverside	2,101	5,559
	San Bernardino	3,202	7,240
	Ventura	478	1,017
	Subtotal	10,513	24,032
HIGHWAY (HOV)	Imperial	0	0
	Los Angeles	179	360
	Orange	91	197
	Riverside	66	131
	San Bernardino	74	147
	Ventura	30	61
	Subtotal	440	896
TOTAL ALL FACILITIES	Imperial	1,762	4,080
	Los Angeles	9,014	30,301
	Orange	2,292	10,365
	Riverside	3,923	12,943
	San Bernardino	5,966	17,542
	Ventura	1,180	3,497
	Subtotal	24,138	78,727

TABLE A6 Total Person Trips By County

County	Base Year 2012	Baseline 2040	Plan 2040
Imperial	493,222	813,748	789,779
Los Angeles	34,700,117	39,234,452	38,229,873
Orange	11,164,598	12,377,517	12,173,752
Riverside	7,256,802	10,587,481	10,313,427
San Bernardino	6,855,890	9,158,550	9,024,404
Ventura	2,914,012	3,393,653	3,319,158
Region	63,384,641	75,565,401	73,850,393

TABLE A7 Average Vehicle Occupancy for Home Based Work Trips

County	Base Year 2012	Baseline 2040	Plan 2040
Imperial	1.07	1.08	1.08
Los Angeles	1.10	1.12	1.12
Orange	1.10	1.12	1.14
Riverside	1.11	1.11	1.11
San Bernardino	1.11	1.12	1.13
Ventura	1.07	1.07	1.08
Region	1.10	1.11	1.12

TABLE A8 Average Vehicle Occupancy for All Trips

County	Base Year 2012	Baseline 2040	Plan 2040
Imperial	1.40	1.40	1.41
Los Angeles	1.51	1.52	1.55
Orange	1.47	1.50	1.53
Riverside	1.44	1.45	1.47
San Bernardino	1.45	1.44	1.48
Ventura	1.40	1.40	1.42
Region	1.48	1.49	1.52

TABLE A9 Median Home Based Work Trip Length (miles)

County	Base Year 2012	Baseline 2040	Plan 2040
Imperial	10.93	11.47	10.53
Los Angeles	13.28	13.45	13.39
Orange	12.93	12.66	13.26
Riverside	23.20	19.11	19.24
San Bernardino	23.08	21.24	21.95
Ventura	16.49	16.68	16.81
Region	15.44	15.07	15.22

TABLE A10 Median Non-Work Trip Length (miles)

County	Base Year 2012	Baseline 2040	Plan 2040
Imperial	6.96	6.90	6.76
Los Angeles	7.71	7.50	7.45
Orange	7.65	7.65	7.75
Riverside	8.92	8.80	8.34
San Bernardino	9.20	8.36	8.91
Ventura	7.80	7.25	7.22
Region	8.00	7.80	7.79

TABLE A11 Average Daily Delay Per Capita (minutes)

County	Base Year 2012	Baseline 2040	Plan 2040
Imperial	0.65	2.71	2.07
Los Angeles	14.69	15.87	10.51
Orange	11.64	12.93	7.20
Riverside	5.82	12.40	5.56
San Bernardino	7.62	17.28	6.45
Ventura	7.04	11.65	5.76
Region	7.91	12.14	6.26

TABLE A12 Base Year 2012 Daily VMT, VHT, Delay, and Speed by County and Time Period

County	VMT (thousands)		VHT (thousands)		Delay (thousands)		Speed (MPH)		Total (Auto+Truck)			
	Auto	Truck	Auto	Truck	Auto	Truck	Auto	Truck	VMT	VHT	Delay	Speed
	AM PEAK											
Imperial	656	114	11	2	*	*	59.3	66.5	770	13	*	60.3
Los Angeles	38,566	1,727	1,249	50	412	18	30.9	34.7	40,294	1,298	430	31.0
Orange	13,229	481	384	13	116	4	34.5	37.8	13,710	396	120	34.6
Riverside	8,233	785	187	14	43	3	44.0	55.7	9,018	201	46	44.8
San Bernardino	9,317	1,066	231	22	62	6	40.3	48.3	10,383	253	68	41.0
Ventura	3,119	139	76	3	17	1	41.2	44.8	3,258	79	17	41.4
Regional Total	73,119	4,313	2,137	104	651	31	34.2	41.7	77,432	2,241	682	34.6
	PM PEAK											
Imperial	1,016	130	17	2	*	*	59.3	66.5	1,146	19	*	60.0
Los Angeles	58,777	2,057	2,068	64	762	26	28.4	32.3	60,834	2,131	788	28.5
Orange	20,235	550	631	16	212	6	32.1	34.7	20,785	647	219	32.1
Riverside	12,340	926	286	17	68	3	43.2	54.7	13,267	303	71	43.8
San Bernardino	13,896	1,250	333	25	77	6	41.8	50.1	15,146	357	84	42.4
Ventura	4,842	156	126	4	34	1	38.4	42.0	4,998	130	35	38.5
Regional Total	111,107	5,069	3,460	127	1,154	42	32.1	39.9	116,176	3,587	1,196	32.4
	DAILY											
Imperial	3,729	756	63	11	1	*	59.5	66.7	4,485	74	1	60.6
Los Angeles	193,356	11,549	5,749	276	1,532	70	33.6	41.8	204,906	6,026	1,603	34.0
Orange	66,692	3,230	1,779	72	414	16	37.5	45.0	69,922	1,850	431	37.8
Riverside	41,904	5,561	874	92	137	10	48.0	60.6	47,465	965	147	49.2
San Bernardino	47,383	7,034	1,026	123	166	17	46.2	57.4	54,416	1,149	184	47.4
Ventura	15,623	903	358	19	61	2	43.6	48.7	16,527	377	63	43.9
Regional Total	368,687	29,033	9,849	592	2312	116	37.4	49.0	397,720	10,441	2,428	38.1

** Value is less than 1,000*
Numbers may not sum to total due to rounding

TABLE A13 Base Year 2012 Daily VMT, VHT, Delay, and Speed by Facility Type and Time Period

Facility Type	VMT (thousands)		VHT (thousands)		Delay (thousands)		Speed (MPH)		Total (Auto+Truck)			
	Auto	Truck	Auto	Truck	Auto	Truck	Auto	Truck	VMT	VHT	Delay	Speed
	AM PEAK											
Highway (MF) & Toll	40,090	3,491	1,071	77	452	26	37.4	45.1	43,581	1,149	478	37.9
Highway (HOV)	2,931	0	57	0	15	0	51.5	N/A	2,931	57	15	51.5
Arterial	30,099	822	1,009	26	184	5	29.8	31.5	30,921	1,035	189	29.9
Regional Total	73,119	4,313	2,137	104	651	31	34.2	41.7	77,432	2,241	682	34.6
	PM PEAK											
Highway (MF) & Toll	57,980	4,146	1,630	96	731	36	35.6	43.1	62,125	1,726	767	36.0
Highway (HOV)	4,389	-	91	0	28	0	48.3	N/A	4,389	91	28	48.3
Arterial	48,738	923	1,739	31	395	7	28.0	29.9	49,661	1,770	401	28.1
Regional Total	111,107	5,069	3,460	127	1,154	42	32.1	39.9	116,176	3,587	1,196	32.4
	DAILY											
Highway (MF) & Toll	204,294	24,548	4,676	459	1,506	100	43.7	53.5	228,841	5,135	1,606	44.6
Highway (HOV)	10,768	0	200	0	46	0	53.7	0.0	10,768	200	46	53.7
Arterial	153,626	4,485	4,972	134	760	16	30.9	33.5	158,111	5,106	776	31.0
Regional Total	368,687	29,033	9,849	593	2,312	116	37.4	49.0	397,720	10,442	2,428	38.1

MF = mixed-flow or general purpose lanes, HOV = high-occupancy vehicle lanes
Numbers may not sum to total due to rounding

TABLE A14 Baseline 2040 Daily VMT, VHT, Delay, and Speed by County and Time Period

County	VMT (thousands)		VHT (thousands)		Delay (thousands)		Speed (MPH)		Total (Auto+Truck)			
	Auto	Truck	Auto	Truck	Auto	Truck	Auto	Truck	VMT	VHT	Delay	Speed
	AM PEAK											
Imperial	1,041	294	18	4	1	*	56.9	66.7	1,334	23	1	58.8
Los Angeles	40,638	2,887	1,398	88	512	36	29.1	33.0	43,525	1,485	547	29.3
Orange	13,854	851	408	22	127	8	33.9	38.5	14,705	430	135	34.2
Riverside	10,782	1,679	295	36	104	12	36.5	46.4	12,460	331	116	37.6
San Bernardino	11,813	2,196	377	55	158	22	31.4	40.1	14,009	431	180	32.5
Ventura	3,451	238	102	6	36	2	33.9	39.8	3,689	108	38	34.3
Regional Total	81,578	8,144	2,598	211	939	78	31.4	38.6	89,722	2,809	1,017	31.9
	PM PEAK											
Imperial	1,607	335	28	5	1	*	56.7	66.7	1,941	33	1	58.2
Los Angeles	62,009	3,356	2,298	111	915	50	27.0	30.4	65,365	2,409	965	27.1
Orange	21,515	968	695	27	250	11	31.0	35.3	22,483	722	262	31.1
Riverside	16,360	1,873	457	41	165	13	35.8	45.9	18,232	498	179	36.6
San Bernardino	17,781	2,638	544	65	213	26	32.7	40.7	20,419	609	239	33.5
Ventura	5,349	266	164	7	61	2	32.6	38.4	5,615	171	63	32.9
Regional Total	124,620	9,436	4,187	256	1,607	103	29.8	36.9	134,056	4,442	1,709	30.2
	DAILY											
Imperial	5,971	1,974	105	30	5	1	57.0	66.8	7,945	134	1	59.2
Los Angeles	203,897	18,986	6,350	472	1,869	141	32.1	40.3	222,883	6,822	2,010	32.7
Orange	70,836	5,672	1,952	126	500	33	36.3	45.0	76,507	2,078	533	36.8
Riverside	56,059	11,292	1,355	210	359	46	41.4	53.8	67,351	1,565	405	43.0
San Bernardino	61,856	15,069	1,613	301	481	80	38.3	50.0	76,925	1,915	561	40.2
Ventura	17,305	1,542	446	33	114	6	38.8	46.4	18,847	480	120	39.3
Regional Total	415,923	54,535	11,822	1,172	3,329	306	35.2	46.5	470,458	12,993	3,629	36.2

** Value is less than 1,000*
Numbers may not sum to total due to rounding

TABLE A15 Baseline 2040 Daily VMT, VHT, Delay, and Speed by Facility Type and Time Period

Facility Type	VMT (thousands)		VHT (thousands)		Delay (thousands)		Speed (MPH)		Total (Auto+Truck)			
	Auto	Truck	Auto	Truck	Auto	Truck	Auto	Truck	VMT	VHT	Delay	Speed
	AM PEAK											
Highway (MF) & Toll	42,867	6,746	1,282	165	621	68	33.4	40.8	49,613	1,447	689	34.3
Highway (HOV)	3,507	0	77	0	27	0	45.6	0.0	3,507	77	27	45.6
Arterial	35,204	1,398	1,239	46	291	11	28.4	30.6	36,602	1,285	301	28.5
Regional Total	81,578	8,144	2,598	211	939	78	31.4	38.6	89,722	2,809	1,017	31.9
	PM PEAK											
Highway (MF) & Toll	62,821	7,934	1,953	202	983	88	32.2	39.2	70,755	2,156	1,071	32.8
Highway (HOV)	5,314	-	121	-	45	-	44.0	0.0	5,314	121	45	44.0
Arterial	56,486	1,502	2,112	53	579	15	26.7	28.3	57,987	2,166	593	26.8
Regional Total	124,620	9,436	4,187	256	1,607	103	29.8	36.9	134,056	4,442	1,710	30.2
	DAILY											
Highway (MF) & Toll	221,714	47,098	5,495	943	2,069	264	40.4	49.9	268,812	6,438	2,333	41.8
Highway (HOV)	13,241	0	268	0	79	0	49.3	N/A	13,241	268	79	49.3
Arterial	180,968	7,437	6,059	229	1,181	42	29.9	32.5	188,404	6,287	1,223	30.0
Regional Total	415,923	54,535	11,822	1,172	3,329	306	35.2	46.5	470,458	12,993	3,635	36.2

MF = mixed-flow or general purpose lanes, HOV = high-occupancy vehicle lanes
Numbers may not sum to total due to rounding

TABLE A16 Plan 2040 VMT, VHT, Delay, and Speed by County and Time Period

County	VMT (thousands)		VHT (thousands)		Delay (thousands)		Speed (MPH)		Total (Auto+Truck)			
	Auto	Truck	Auto	Truck	Auto	Truck	Auto	Truck	VMT	VHT	Delay	Speed
	AM PEAK											
Imperial	970	295	17	4	*	*	58.6	67.2	1,266	21	*	60.4
Los Angeles	36,901	2,685	1,103	68	314	20	33.5	39.5	39,586	1,171	335	33.8
Orange	12,942	844	320	18	65	4	40.4	47.0	13,786	338	69	40.8
Riverside	10,208	1,657	219	31	40	7	46.5	52.7	11,865	251	47	47.3
San Bernardino	11,356	2,169	259	41	55	9	43.9	53.0	13,526	300	65	45.1
Ventura	3,150	238	75	5	16	1	41.8	46.5	3,388	80	17	42.1
Regional Total	75,528	7,888	1,993	168	490	41	37.9	47.0	83,416	2,161	532	38.6
	PM PEAK											
Imperial	1,503	336	26	5	1	*	58.4	67.1	1,840	31	1	59.9
Los Angeles	56,678	3,047	1,837	82	591	28	30.9	37.1	59,724	1,919	619	31.1
Orange	20,318	944	548	22	138	6	37.1	43.3	21,263	570	144	37.3
Riverside	15,570	1,885	349	36	72	8	44.6	53.0	17,454	385	80	45.3
San Bernardino	17,078	2,557	386	47	74	9	44.3	54.8	19,634	432	83	45.4
Ventura	4,937	266	123	6	29	1	40.0	45.1	5,204	129	30	40.3
Regional Total	116,084	9,035	3,269	197	905	52	35.5	45.8	125,119	3,466	958	36.1
	DAILY											
Imperial	5,670	1,981	97	30	3	1	58.3	67.1	7,651	127	4	60.3
Los Angeles	186,038	18,449	5,240	401	1,198	83	35.5	46.0	204,488	5,641	1,281	36.2
Orange	66,693	5,623	1,611	110	269	18	41.4	51.2	72,316	1,721	287	42.0
Riverside	52,404	11,358	1,091	195	156	31	48.1	58.1	63,762	1,286	187	49.6
San Bernardino	59,091	14,966	1,236	251	168	33	47.8	59.6	74,057	1,487	202	49.8
Ventura	16,013	1,546	364	31	56	3	44.0	50.0	17,559	394	60	44.5
Regional Total	385,910	53,924	9,638	1,018	1,852	169	40.0	53.0	439,833	10,656	2,021	41.3

** Value is less than 1,000*
Numbers may not sum to total due to rounding

TABLE A17 Plan 2040 VMT, VHT, Delay, and Speed by Facility Type and Time Period

Facility Type	VMT (thousands)		VHT (thousands)		Delay (thousands)		Speed (MPH)		Total (Auto+Truck)			
	Auto	Truck	Auto	Truck	Auto	Truck	Auto	Truck	VMT	VHT	Delay	Speed
AM PEAK												
Highway (MF) & Toll	43,104	6,789	1,015	135	351	37	42.5	50.1	49,892	1,150	388	43.4
Highway (HOV)	1,905	0	32	0	5	0	58.7	N/A	1,905	32	5	58.7
Arterial	30,520	1,100	946	32	135	4	32.3	33.9	31,619	978	139	32.3
Regional Total	75,528	7,888	1,993	168	490	42	37.9	47.0	83,416	2,161	532	38.6
PM PEAK												
Highway (MF) & Toll	62,672	7,802	1,553	159	585	46	40.3	49.1	70,473	1,712	631	41.2
Highway (HOV)	2,828	0	48	0	8	0	58.6	N/A	2,828	48	8	58.6
Arterial	50,584	1,233	1,667	38	313	6	30.3	32.4	51,817	1,705	319	30.4
Regional Total	116,084	9,035	3,269	197	905	53	35.5	45.8	125,119	3,466	958	36.1
DAILY												
Highway (MF) & Toll	215,897	47,628	4,548	840	1,208	152	47.5	56.7	263,525	5,388	1,359	48.9
Highway (HOV)	6,102	0	101	0	13	0	60.6	N/A	6,102	101	13	60.6
Arterial	163,911	6,295	4,990	178	631	17	32.9	35.4	170,206	5,167	648	32.9
Regional Total	385,910	53,924	9,638	1,018	1,852	169	40.0	53.0	439,833	10,656	2,021	41.3

MF = mixed-flow or general purpose lanes, HOV = high-occupancy vehicle lanes
Numbers may not sum to total due to rounding

EXHIBIT A1 Base Year 2012 Number of Highway Lanes (Mixed-Flow and Toll)

Number of Lanes in Each Direction

- *2 or fewer*
- *3*
- *4*
- *5 or more*

(Source: SCAG)

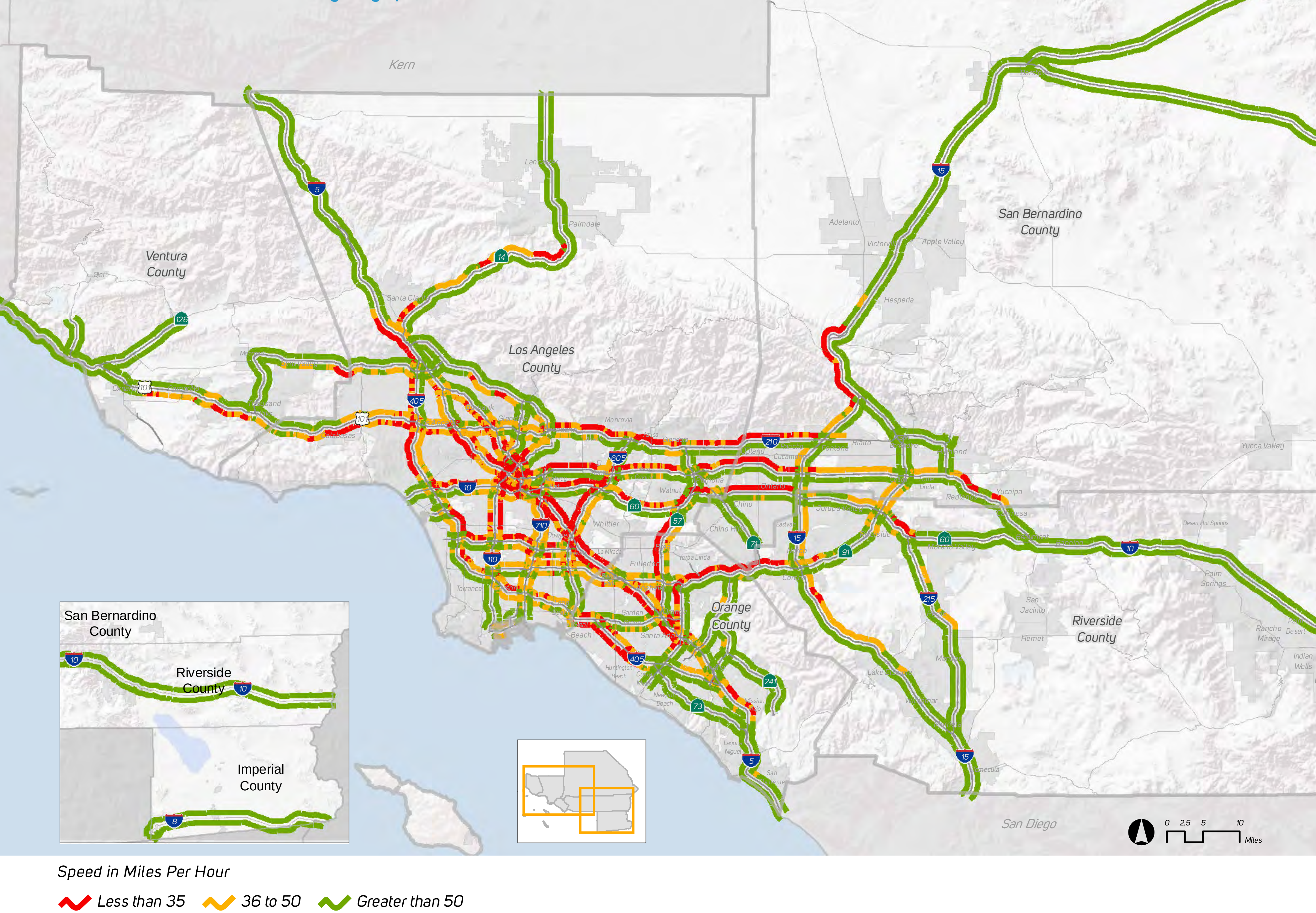
EXHIBIT A2 Plan 2040 Number of Highway Lanes (Mixed-Flow and Toll)

Number of Lanes in Each Direction

2 or fewer | 3 | 4 | 5 or more

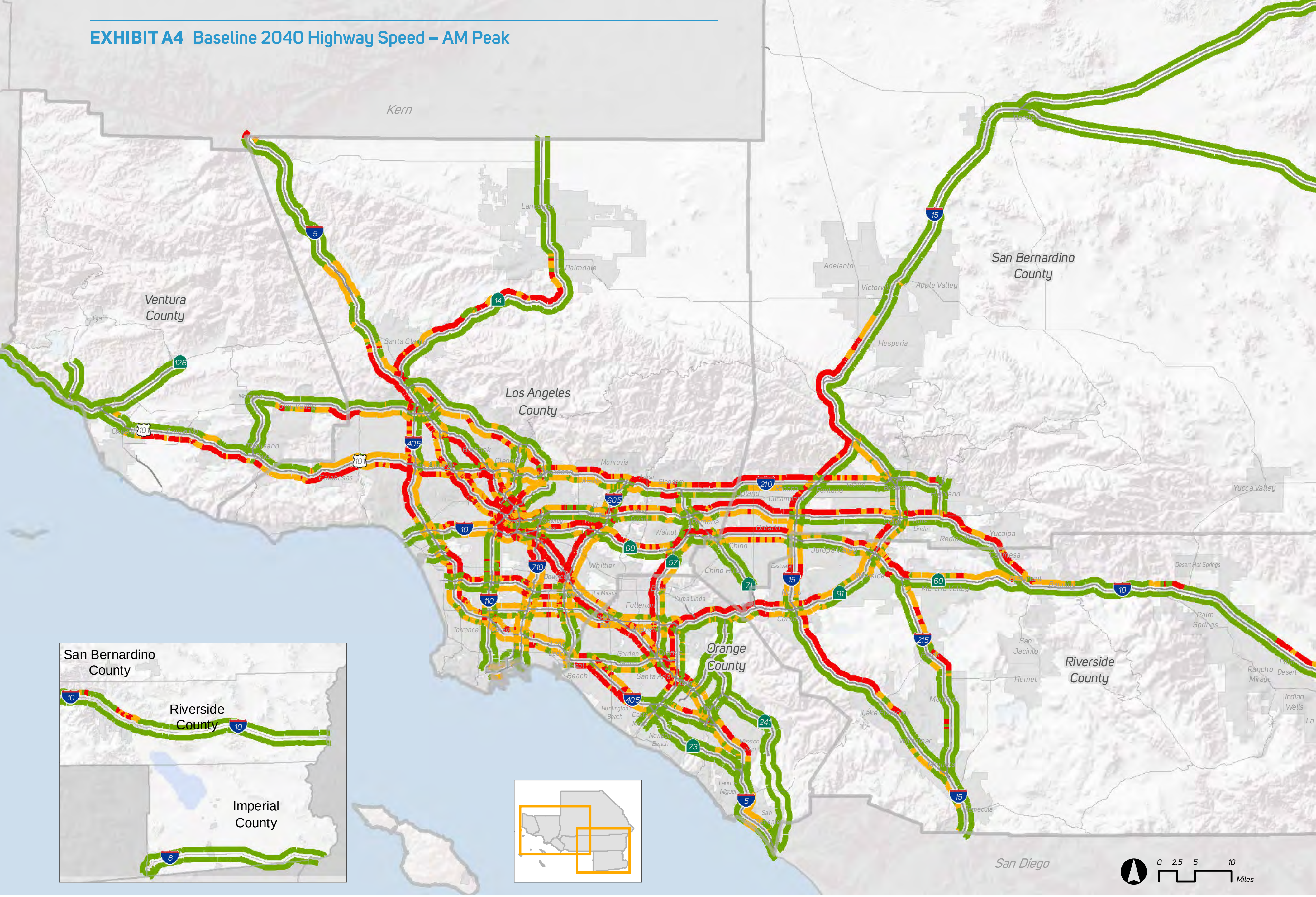
(Source: SCAG)

EXHIBIT A3 Base Year 2012 Highway Speed – AM Peak



(Source: SCAG)

EXHIBIT A4 Baseline 2040 Highway Speed – AM Peak

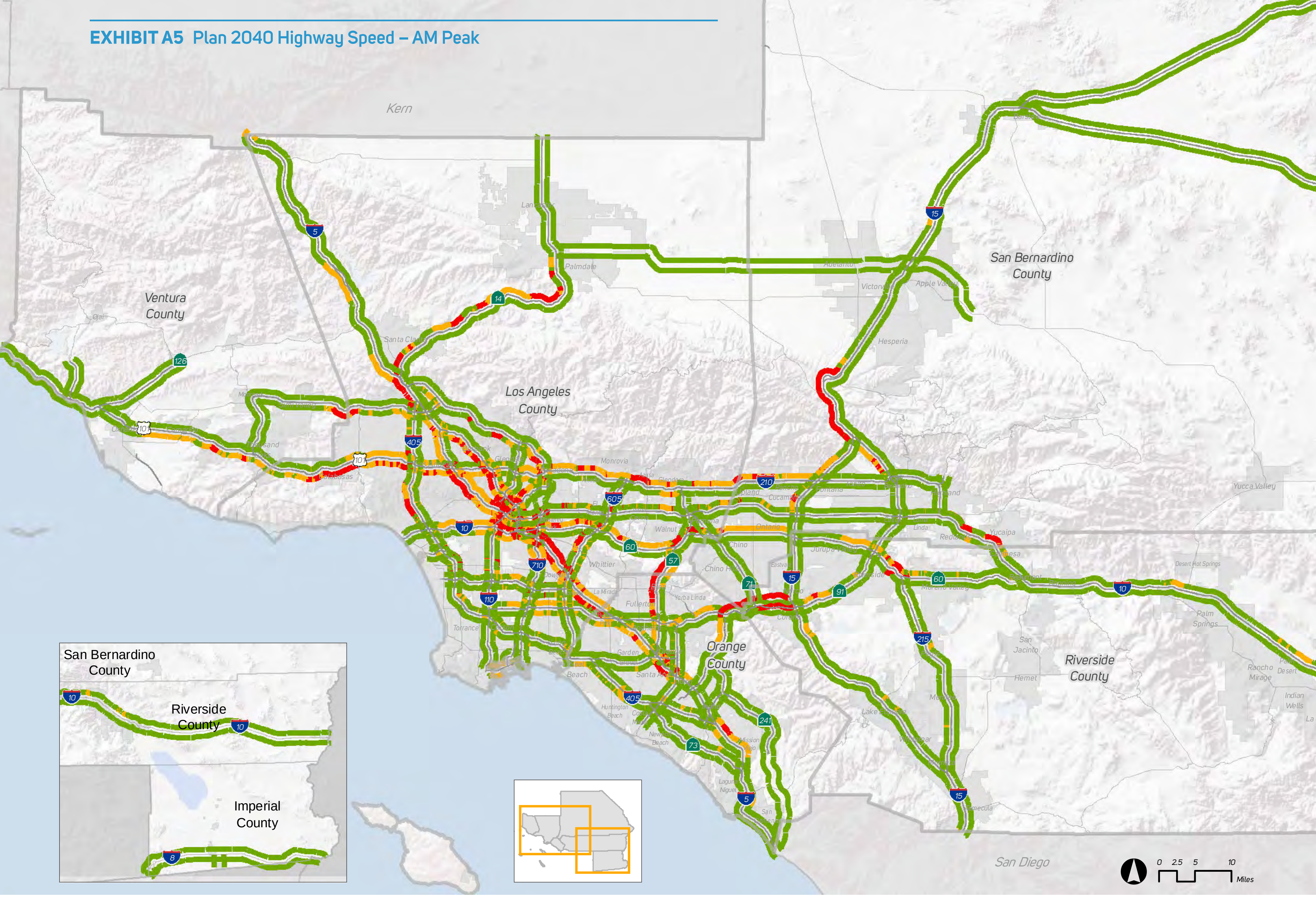


Speed in Miles Per Hour

Less than 35 *36 to 50* *Greater than 50*

(Source: SCAG)

EXHIBIT A5 Plan 2040 Highway Speed – AM Peak

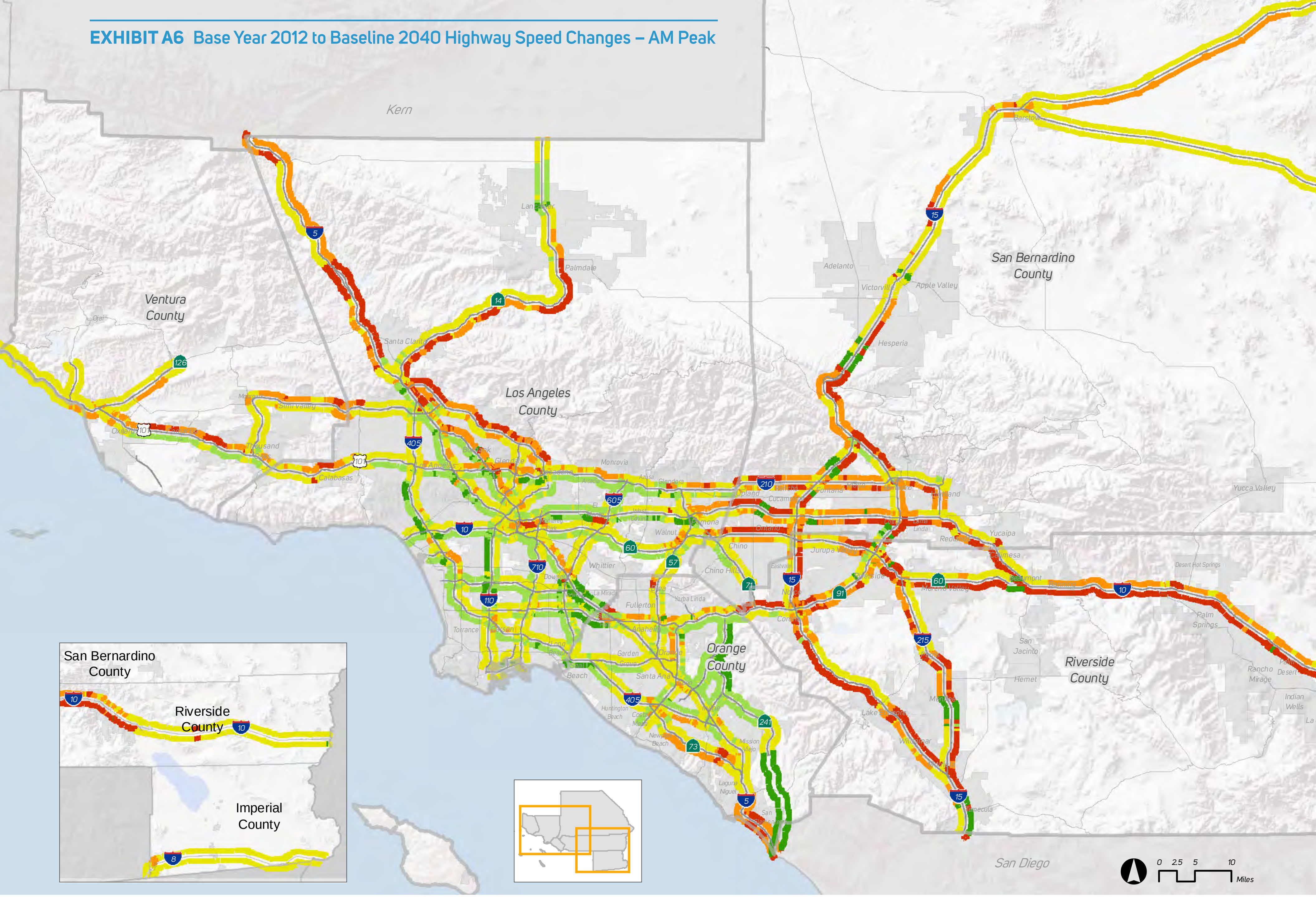


Speed in Miles Per Hour

Less than 35 *36 to 50* *Greater than 50*

(Source: SCAG)

EXHIBIT A6 Base Year 2012 to Baseline 2040 Highway Speed Changes – AM Peak

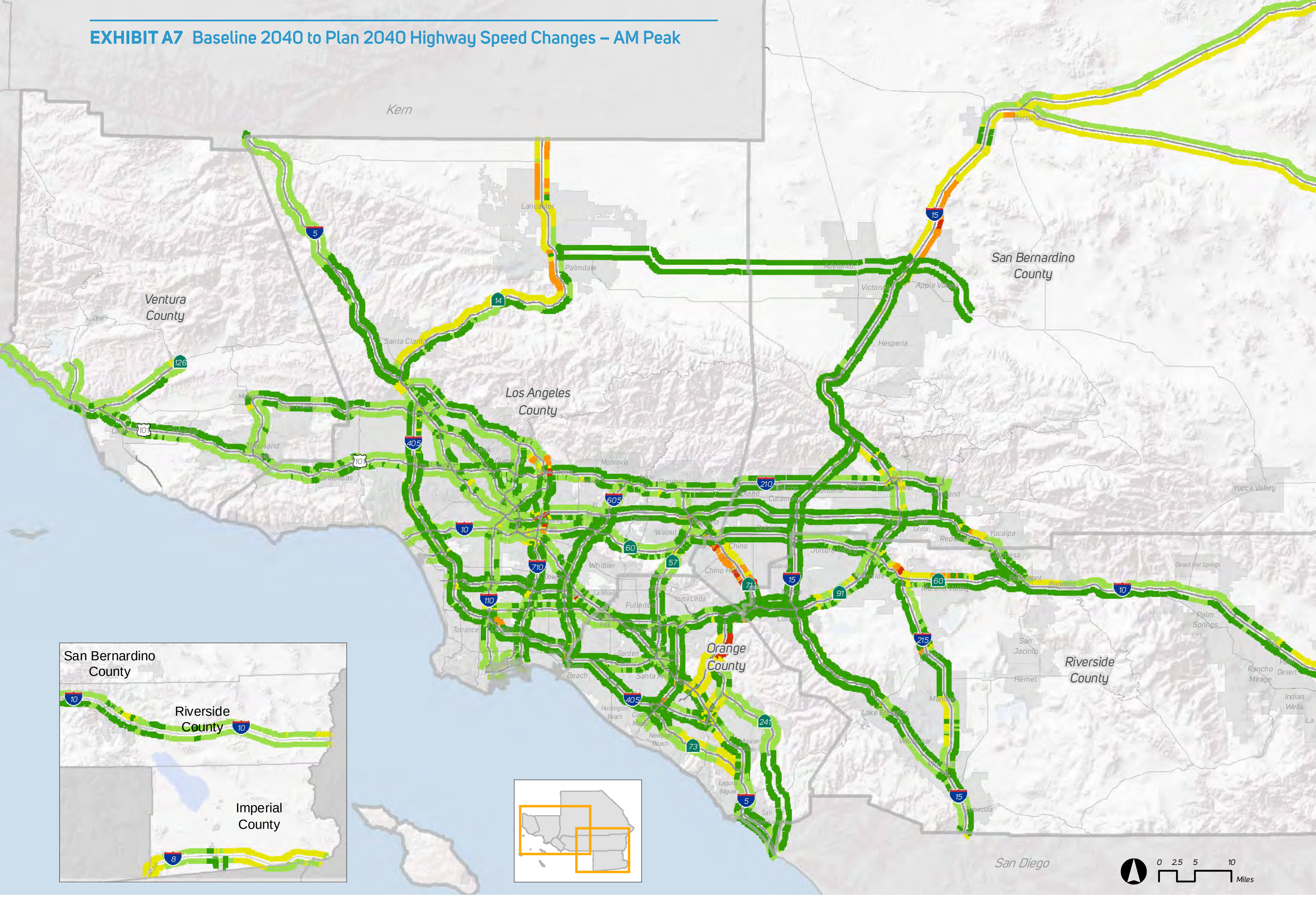


Speed in Miles Per Hour

- Greater than 10.0 decrease
- 5.0 to 10.0 decrease
- 0.0 to 4.9 decrease
- 0.0 to 4.9 increase
- 5.0 or greater increase

(Source: SCAG)

EXHIBIT A7 Baseline 2040 to Plan 2040 Highway Speed Changes – AM Peak

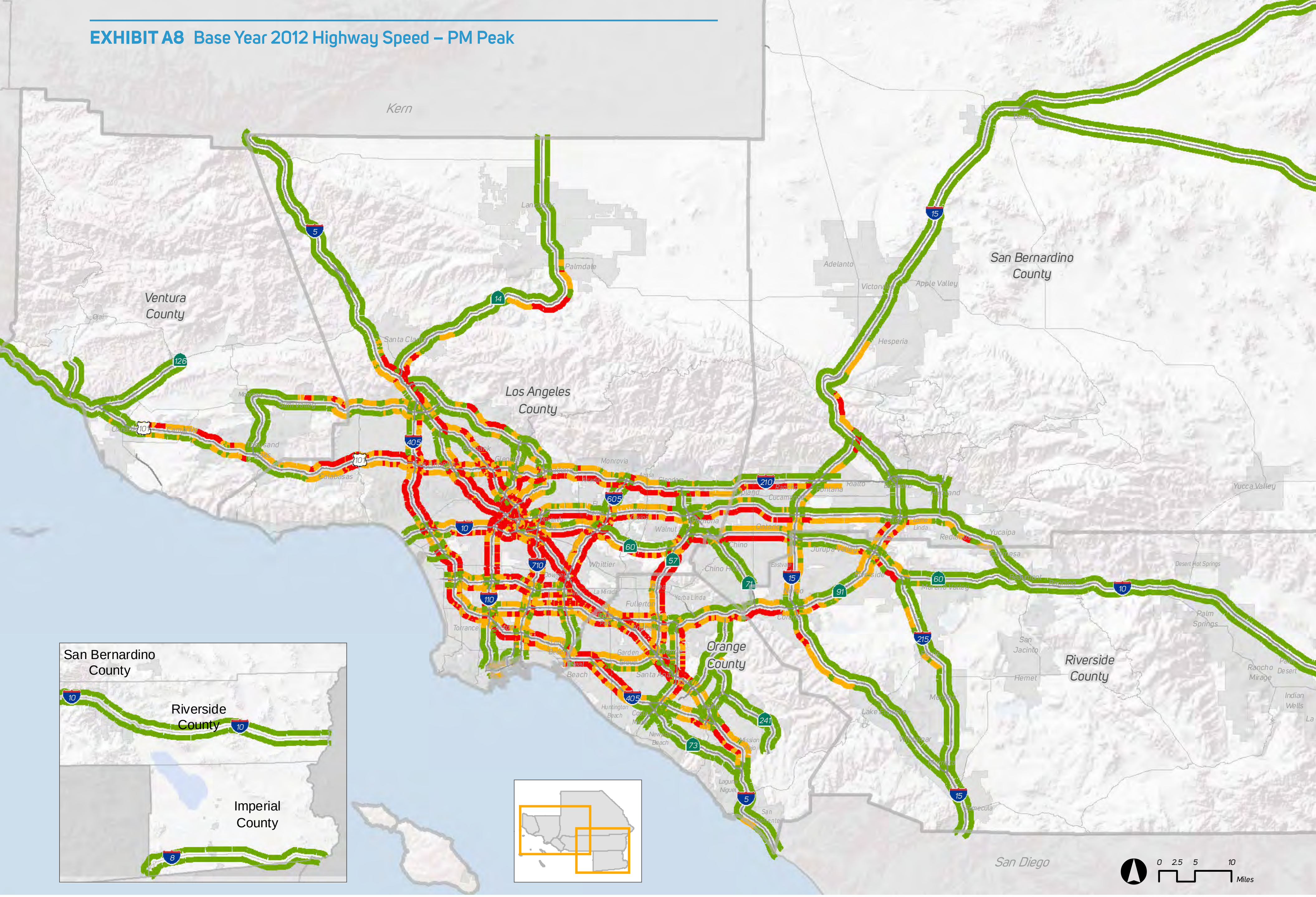


Speed in Miles Per Hour

- Greater than 10 decrease
- 5.0 to 10.0 decrease
- 0.0 to 4.9 decrease
- 0.0 to 4.9 increase
- 5.0 or greater increase

(Source: SCAG)

EXHIBIT A8 Base Year 2012 Highway Speed – PM Peak

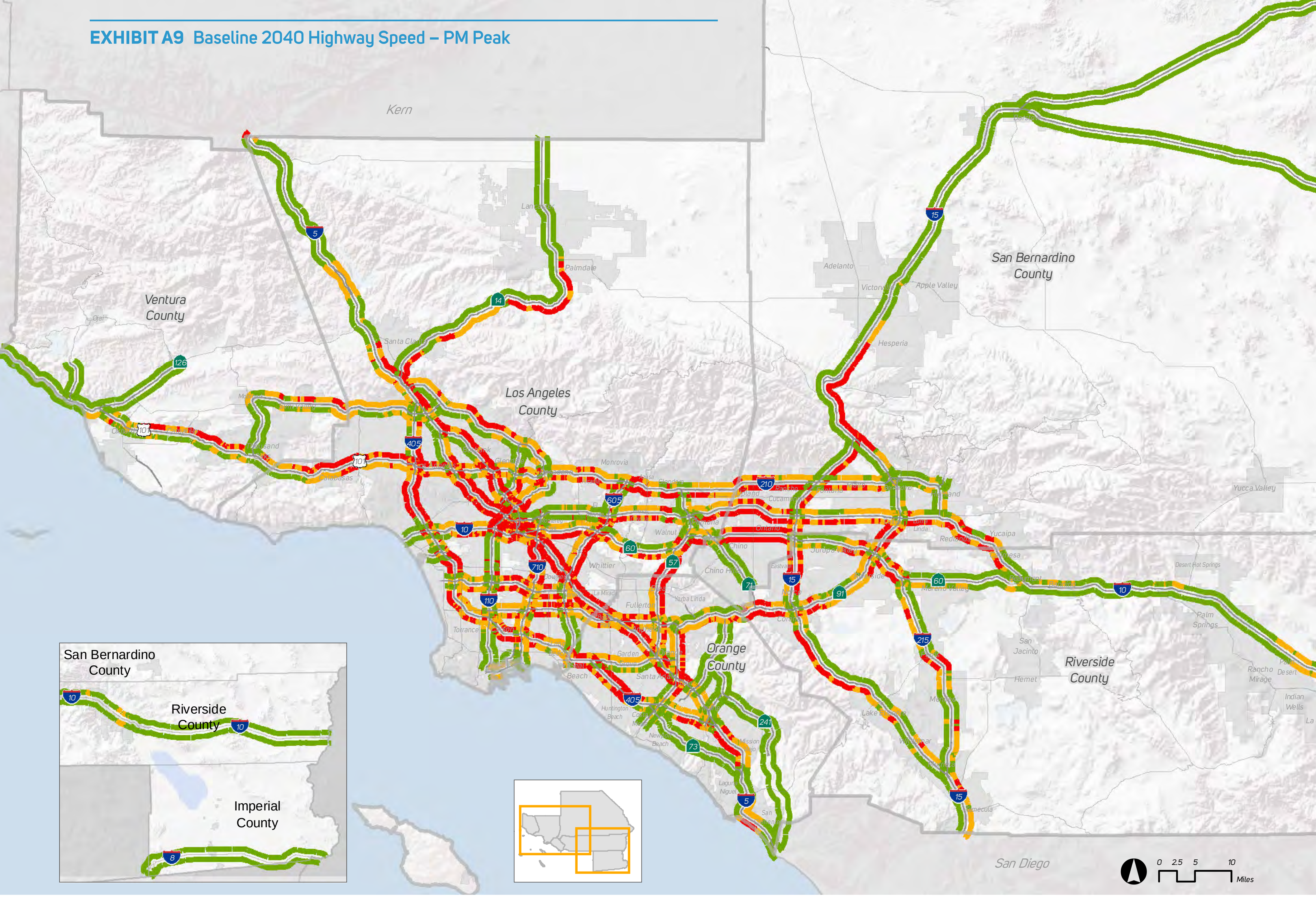


Speed in Miles per Hour

Less than 35 *36 to 50* *Greater than 50*

(Source: SCAG)

EXHIBIT A9 Baseline 2040 Highway Speed – PM Peak



Speed in Miles Per Hour

Less than 35 *36 to 50* *Greater than 50*

(Source: SCAG)

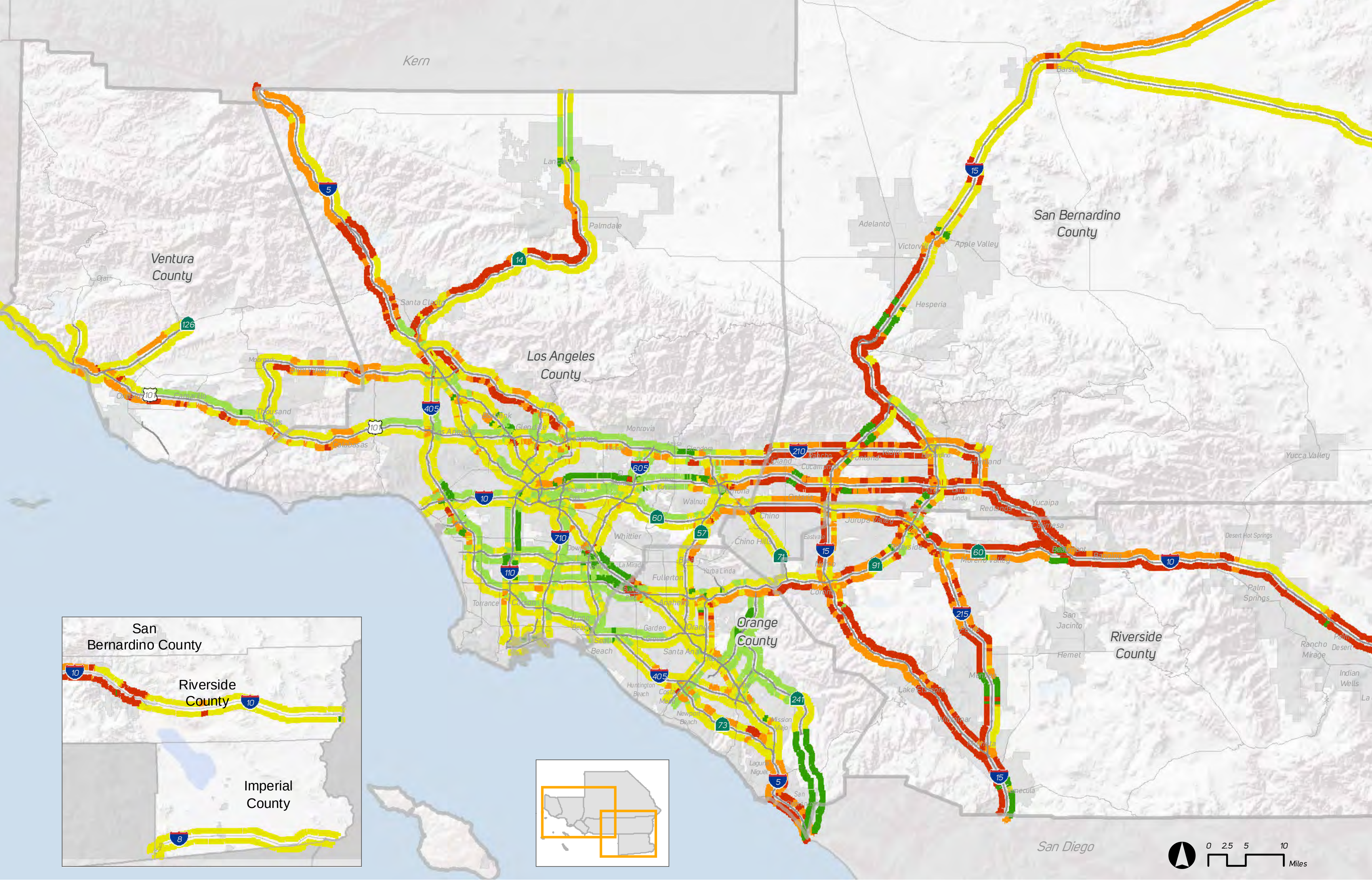
EXHIBIT A10 Plan 2040 Highway Speed – PM Peak

Speed in Miles Per Hour

Less than 35 *36 to 50* *Greater than 50*

(Source: SCAG)

EXHIBIT A11 Base Year 2012 to Baseline 2040 Highway Speed Changes – PM Peak

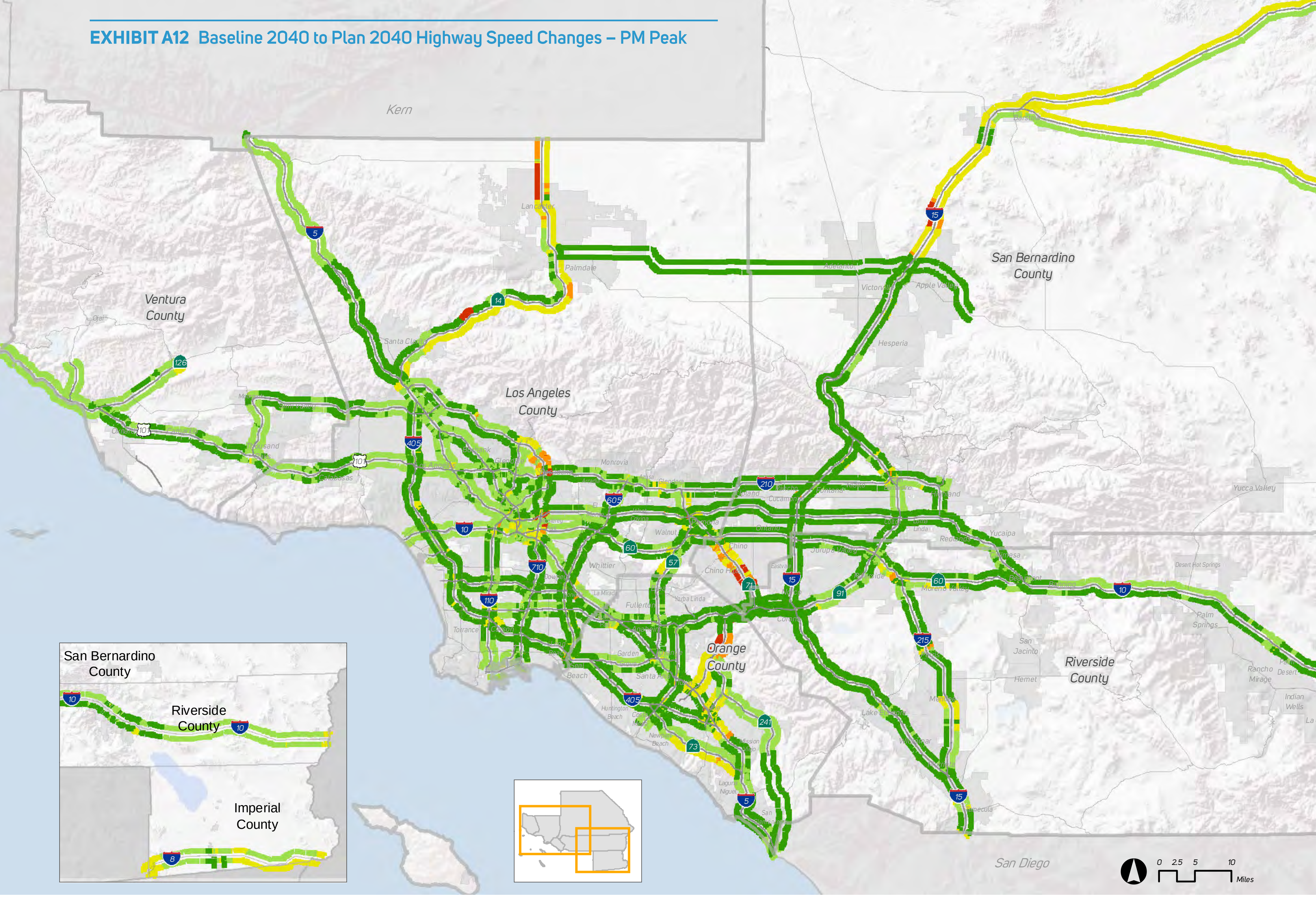


Speed in Miles Per Hour

- *Greater than 10.0 decrease*
- *5.0 to 10.0 decrease*
- *0.0 to 4.9 decrease*
- *0.0 to 4.9 increase*
- *5.0 or greater increase*

(Source: SCAG)

EXHIBIT A12 Baseline 2040 to Plan 2040 Highway Speed Changes – PM Peak

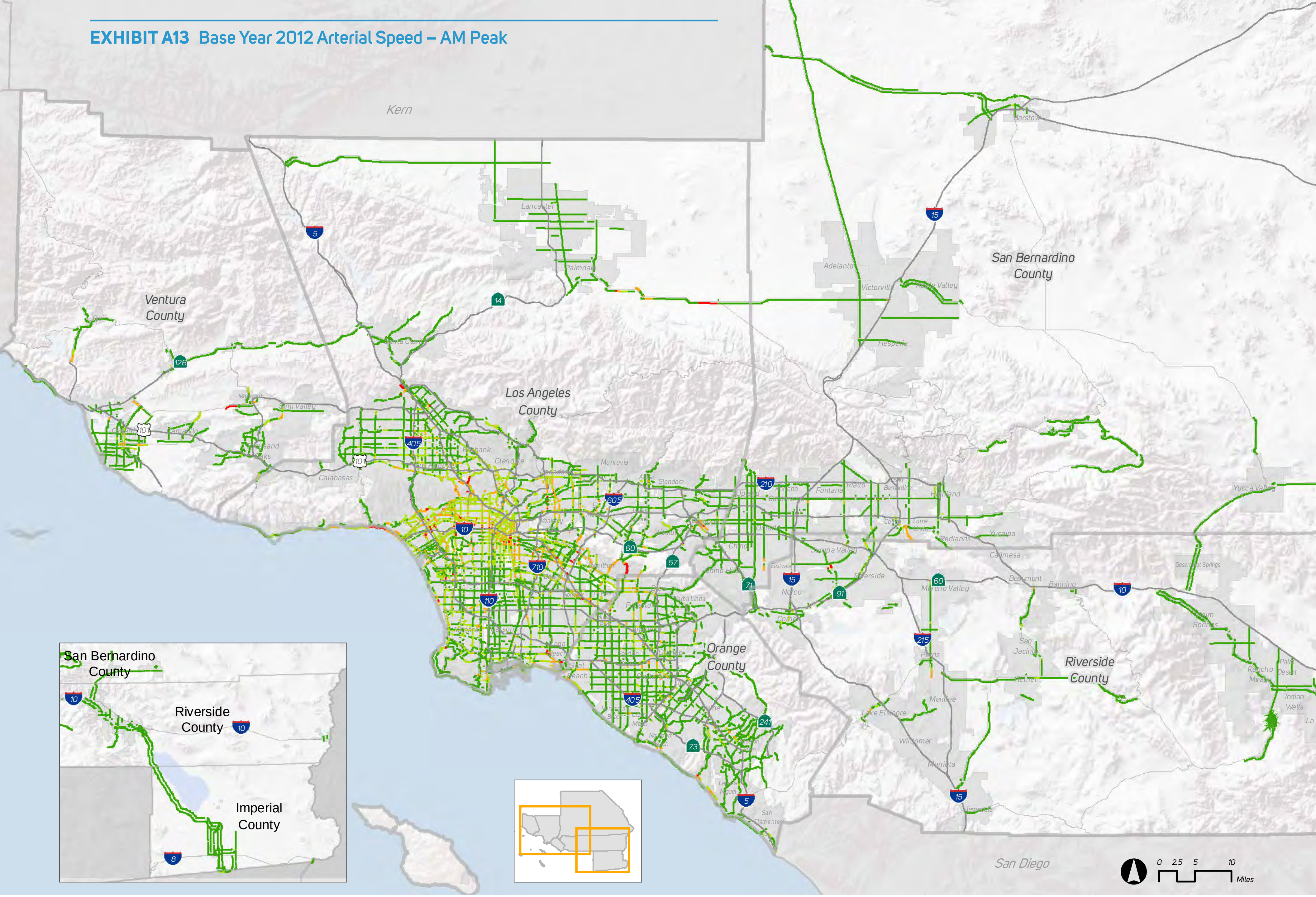


Speed in Miles Per Hour

Greater than 10.0 decrease | 5.0 to 10.0 decrease | 0.0 to 4.9 decrease | 0.0 to 4.9 increase | 5.0 or greater increase

(Source: SCAG)

EXHIBIT A13 Base Year 2012 Arterial Speed – AM Peak

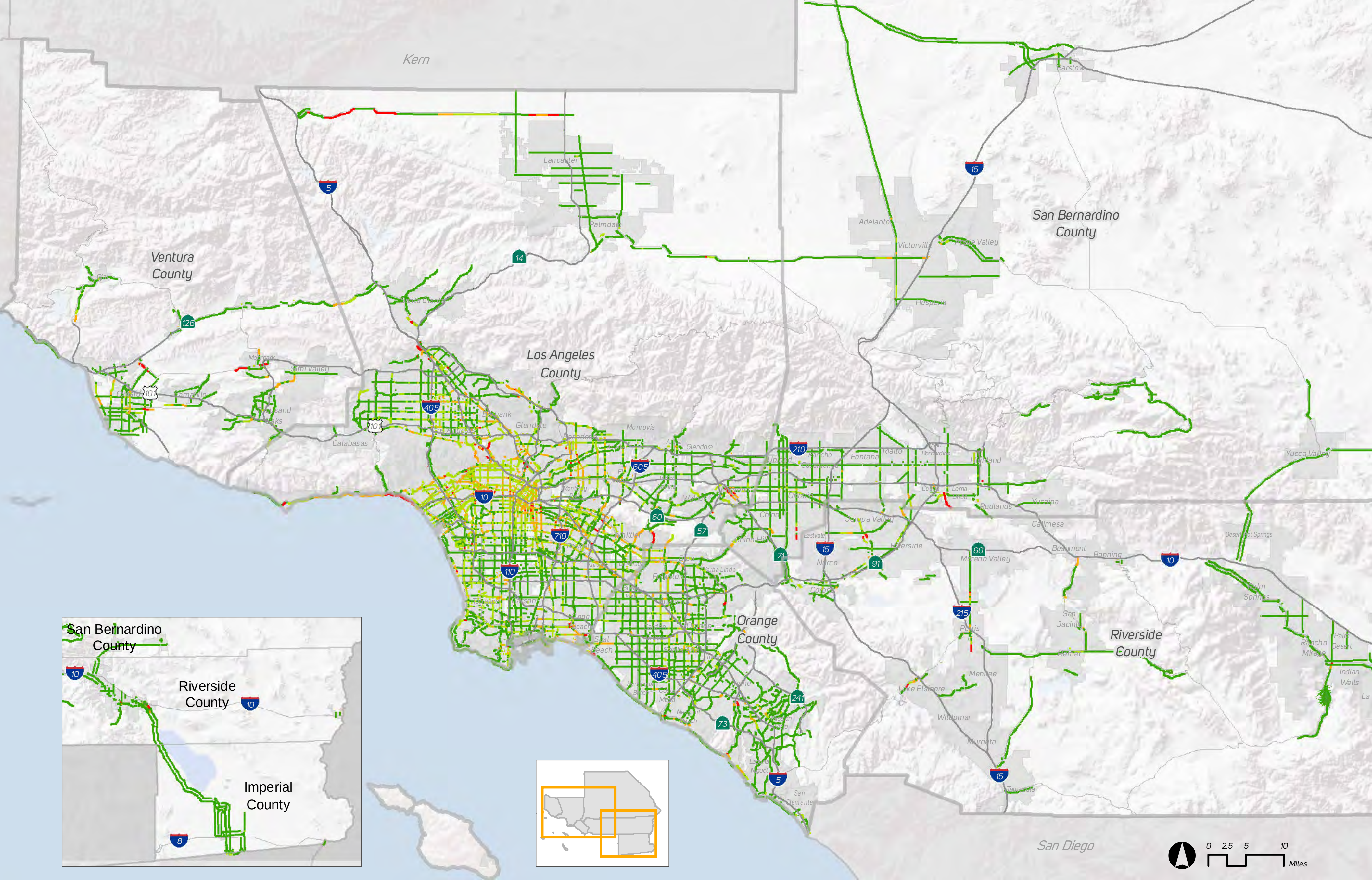


Speed in Miles per Hour

Lower than 15.0 | *15.0 to 24.9* | *25.0 to 29.9* | *30.0 or higher*

(Source: SCAG)

EXHIBIT A14 Baseline 2040 Arterial Speed – AM Peak

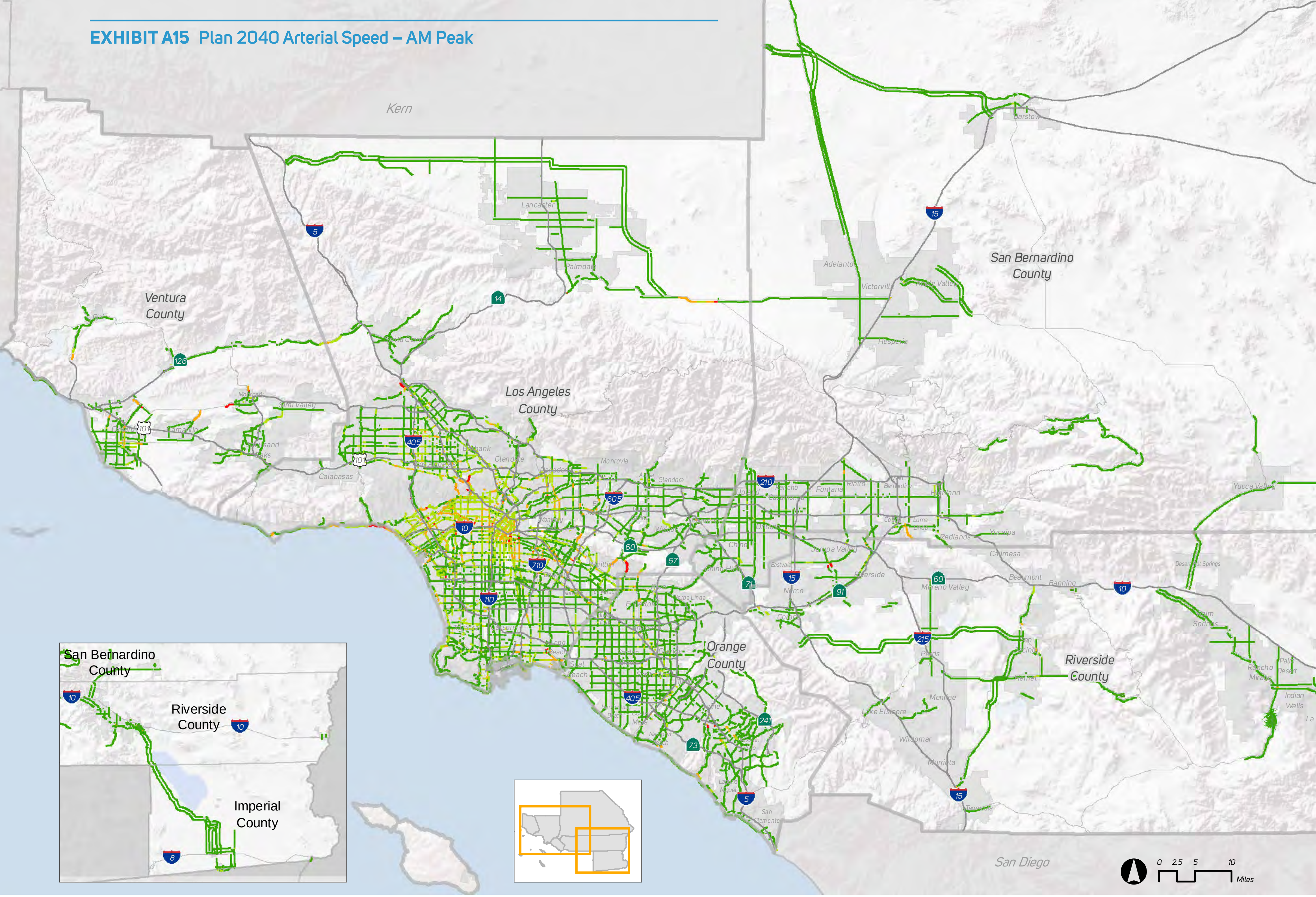


Speed in Miles per Hour

Lower than 15.0 | *15.0 to 24.9* | *25.0 to 29.9* | *30.0 or higher*

(Source: SCAG)

EXHIBIT A15 Plan 2040 Arterial Speed – AM Peak

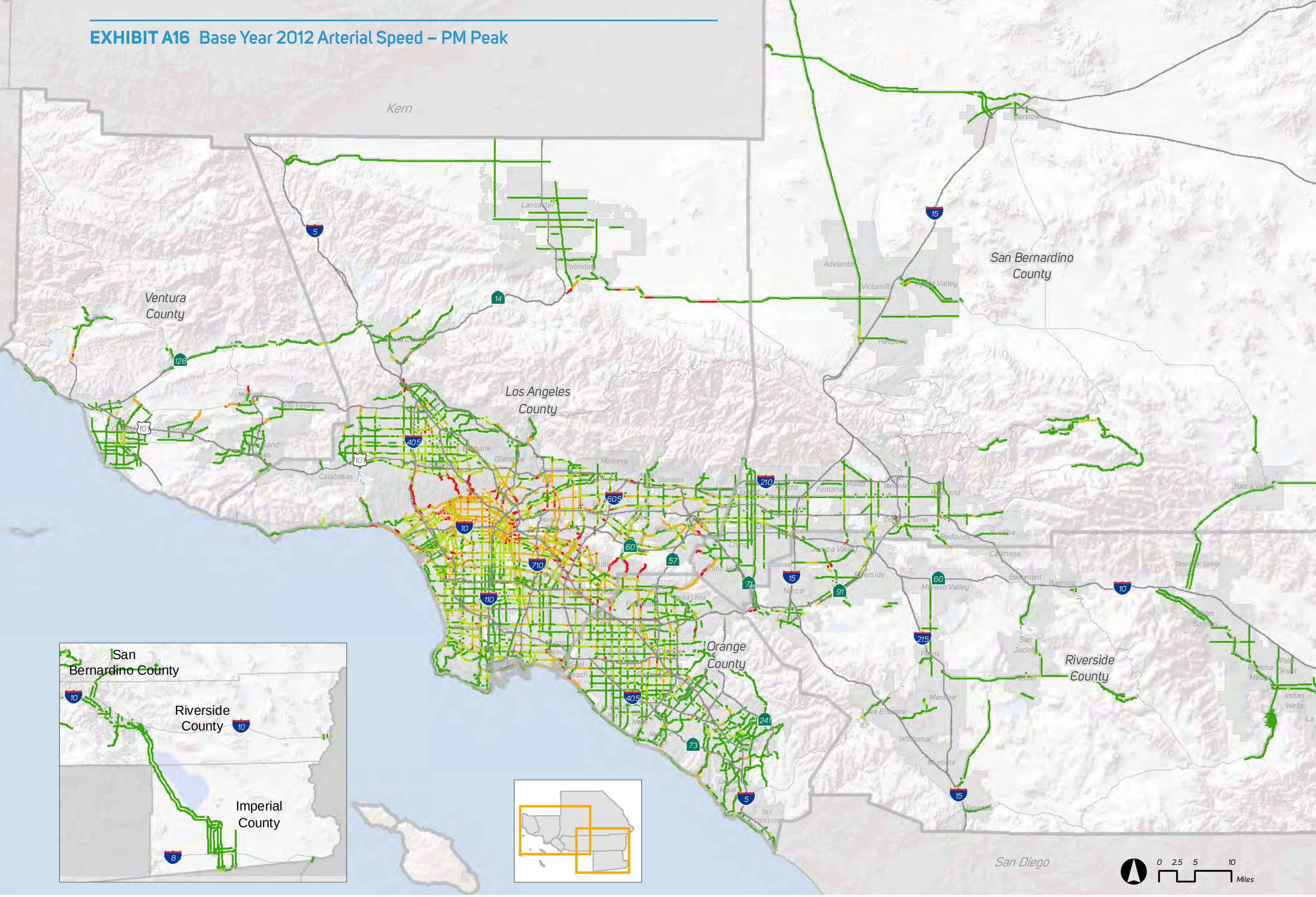


Speed in Miles per Hour

Lower than 15.0 | 15.0 to 24.9 | 25.0 to 29.9 | 30.0 or higher

(Source: SCAG)

EXHIBIT A16 Base Year 2012 Arterial Speed – PM Peak

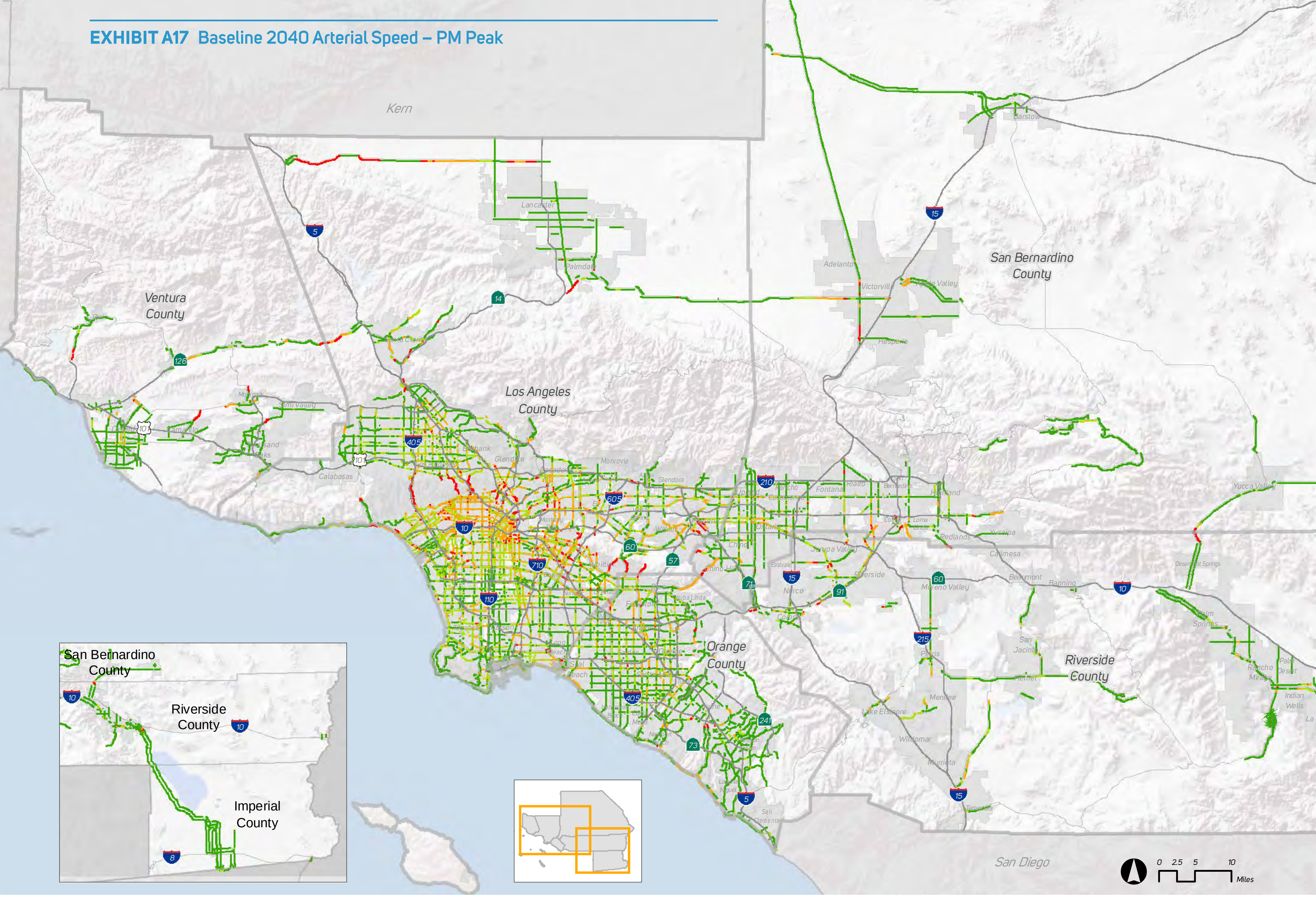


Speed in Miles per Hour

Lower than 15.0 | *15.0 to 24.9* | *25.0 to 29.9* | *30.0 or higher*

(Source: SCAG)

EXHIBIT A17 Baseline 2040 Arterial Speed – PM Peak

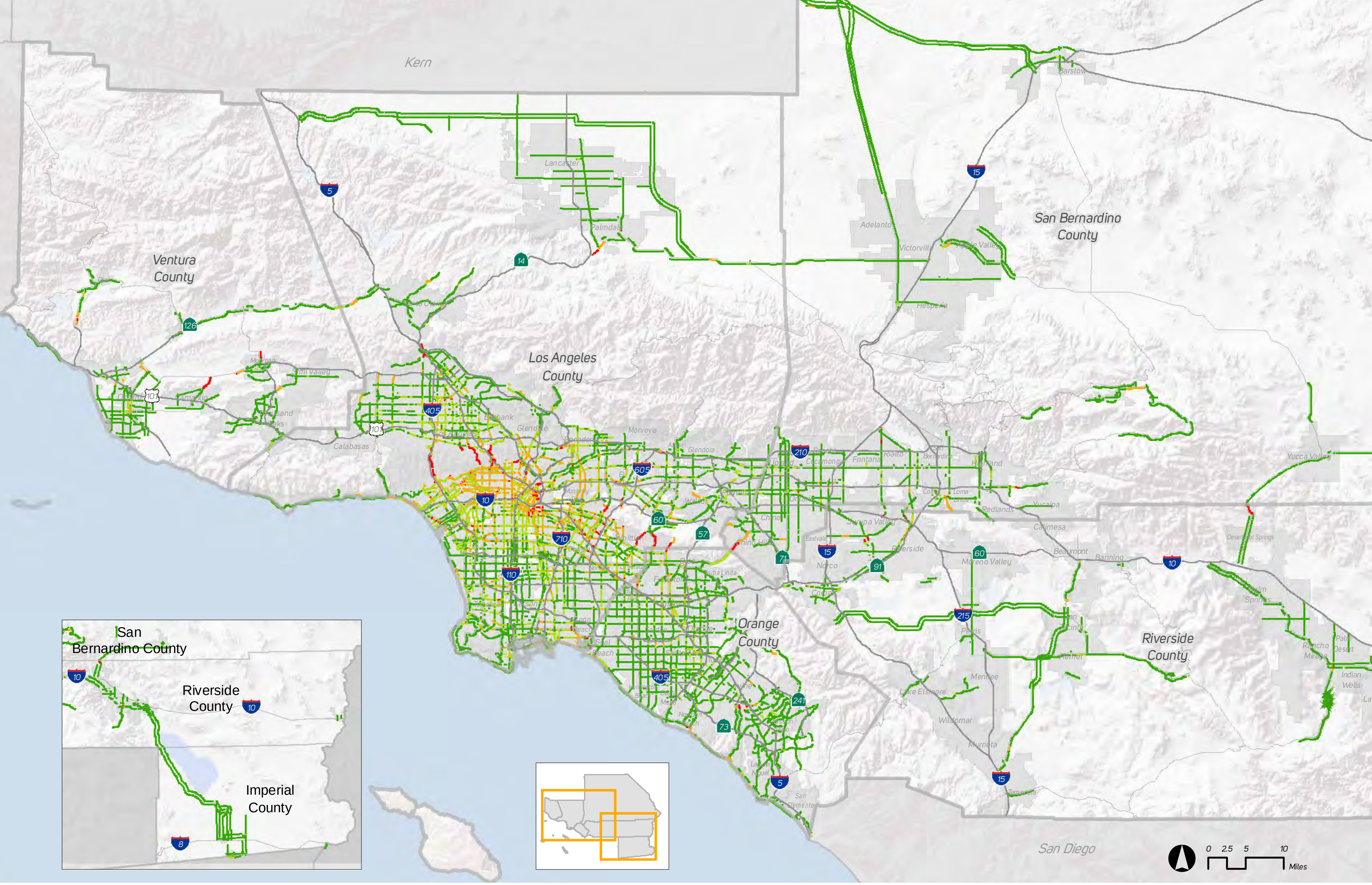


Speed in Miles per Hour

Lower than 15.0 | *15.0 to 24.9* | *25.0 to 29.9* | *30.0 or higher*

(Source: SCAG)

EXHIBIT A18 Plan 2040 Arterial Speed – PM Peak

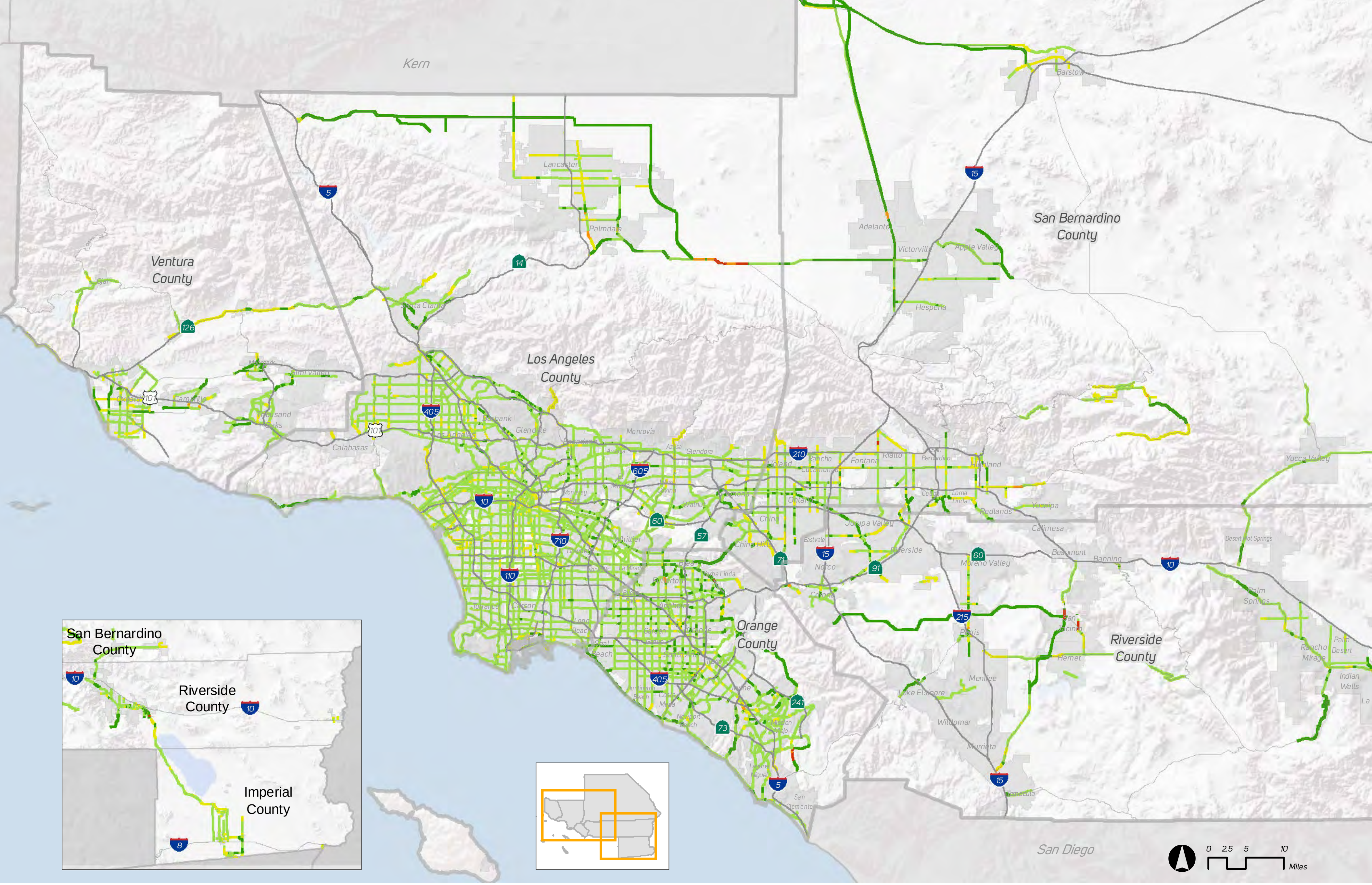


Speed in Miles per Hour

Lower than 15.0 | *15.0 to 24.9* | *25.0 to 29.9* | *30.0 or higher*

(Source: SCAG)

EXHIBIT A19 Baseline 2040 to Plan 2040 Arterial Speed Changes – AM Peak

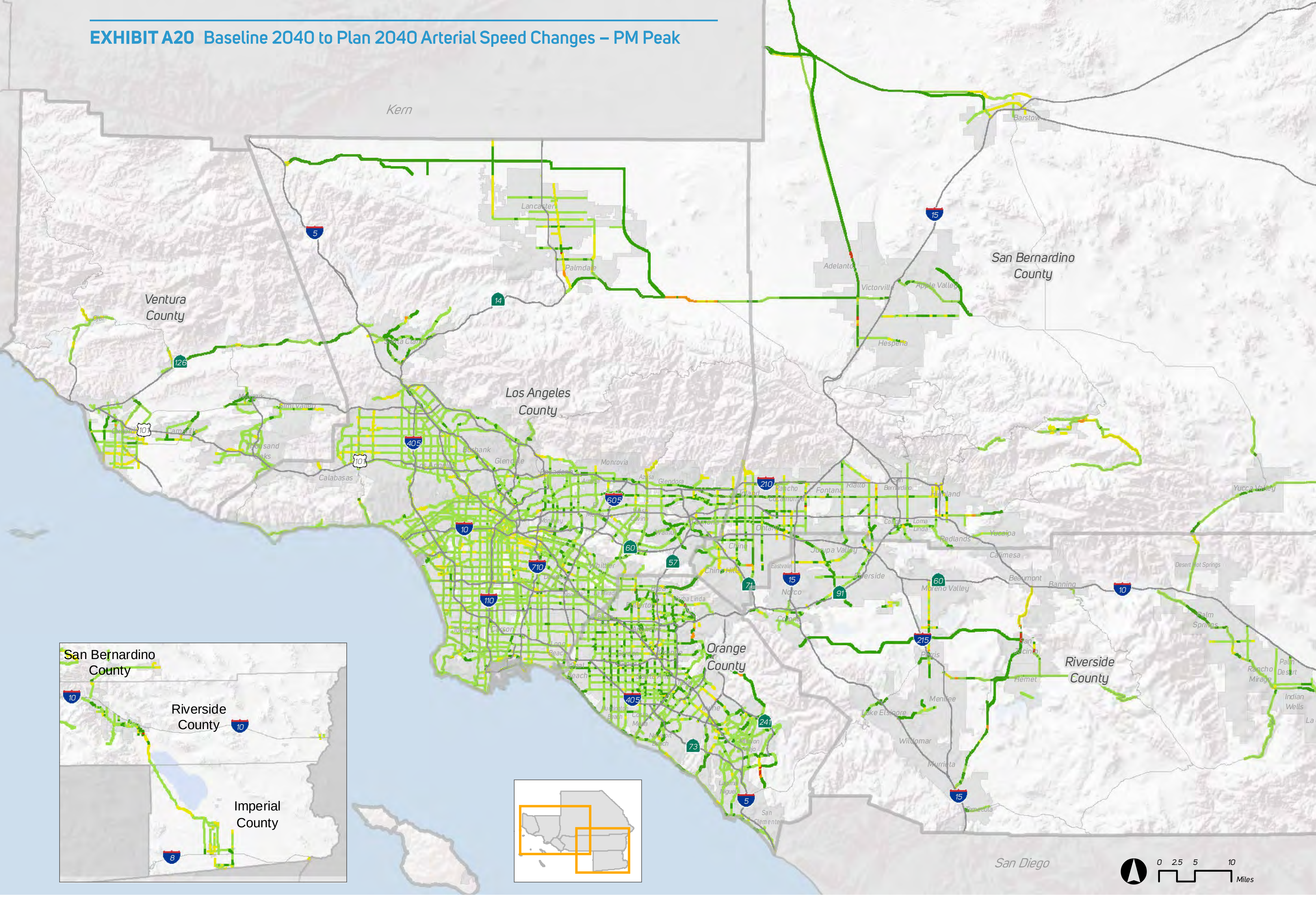


Speed in Miles Per Hour

Greater than 10.0 decrease | *5.0 to 10.0 decrease* | *0.0 to 4.9 decrease* | *0.0 to 4.9 increase* | *5.0 or greater increase*

(Source: SCAG)

EXHIBIT A20 Baseline 2040 to Plan 2040 Arterial Speed Changes – PM Peak



Speed in Miles Per Hour

Greater than 10.0 decrease
5.0 to 10.0 decrease
0.0 to 4.9 decrease
0.0 to 4.9 increase
5.0 or greater increase

(Source: SCAG)

NOTES

[1] SCAG Regional Travel Demand Model

SOUTHERN CALIFORNIA
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2016–2040 RTPSCS

APPENDIX

TRANSPORTATION SYSTEM | HIGHWAYS & ARTERIALS

ADOPTED | APRIL 2016

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