

System Plan for Managed Lanes on California State Highways



System Metrics Group, Inc.
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Table of Contents

Table of Contents	1	<i>Evolution of the District 8 Managed Lane System</i>	43
List of Exhibits.....	2	<i>District 8 Managed Lane Priorities.....</i>	43
Introduction.....	4	<i>Performance of District 8 Managed Lane System.....</i>	43
Study Approach	5	<i>Managed Lane Pricing in District 8</i>	44
Summary of Findings and Conclusions.....	5	District 10 Managed Lanes.....	53
District 3 Managed Lanes	9	<i>Evolution of the District 10 Managed Lane System</i>	53
<i>Evolution of the District 3 Managed Lane System.....</i>	9	<i>Performance of District 10 Managed Lane System.....</i>	53
<i>Performance of District 3 Managed Lane System</i>	9	District 11 Managed Lanes.....	57
<i>Managed Lane Pricing in District 3.....</i>	9	<i>Evolution of the District 11 Managed Lane System</i>	57
District 4 Managed Lanes	18	<i>District 11 Managed Lane Priorities.....</i>	57
<i>Evolution of the District 4 Managed Lane System.....</i>	18	<i>Performance of District 11 Managed Lane System.....</i>	57
<i>District 4 Managed Lane Priorities</i>	18	District 12 Managed Lanes.....	67
<i>Performance of District 4 Managed Lane System</i>	19	<i>Introduction.....</i>	67
<i>Managed Lane Pricing in District 4.....</i>	19	<i>Current Configuration</i>	68
District 5 Managed Lanes	28	<i>Evolution of the District 12 Managed Lane System</i>	68
<i>Performance of District 5 Managed Lane System</i>	28	<i>District 12 Managed Lane Priorities.....</i>	68
District 7 Managed Lanes	33	<i>Performance of District 12 Managed Lane System.....</i>	68
<i>Evolution of the District 7 Managed Lane System.....</i>	33	List of Acronyms.....	77
<i>District 7 Managed Lane Priorities</i>	33		
<i>Performance of District 7 Managed Lane System</i>	33		
<i>Managed Lane Pricing in District 7.....</i>	34		
District 8 Managed Lanes	43		

List of Exhibits

Exhibit 1: Example of HOV Degradation	5
Exhibit 2: Evolution of Managed Facilities 2016–2040 by District	8
Exhibit 3: District 3 Existing Managed Lanes System Configuration (2016)	10
Exhibit 4: District 3 Existing and Future Lane Miles by Route by Type of Managed Lane Facility	11
Exhibit 5: District 3 Future Managed Lanes System Configuration (2040)	12
Exhibit 6: District 3 Managed Lanes AM Peak-Period Speeds (2014)	13
Exhibit 7: District 3 Managed Lanes PM Peak-Period Speeds (2014)	14
Exhibit 8: District 3 Degraded Managed Lanes (Jul–Dec 2014)	15
Exhibit 9: District 3 Future Managed Lanes AM Peak-Period Speeds (2040)	16
Exhibit 10: District 3 Future Managed Lanes PM Peak-Period Speeds (2040)	17
Exhibit 11: District 4 Existing Managed Lanes System Configuration (2016)	20
Exhibit 12: District 4 Existing and Future Lane Miles by Route by Type of Managed Lane Facility	21
Exhibit 13: District 4 Future Managed Lanes System Configuration (2040)	22
Exhibit 14: District 4 Managed Lanes AM Peak-Period Speeds (2014)	23
Exhibit 15: District 4 Managed Lanes PM Peak-Period Speeds (2014)	24
Exhibit 16: District 4 Degraded Managed Lanes (Jul–Dec 2014)	25
Exhibit 17: District 4 Future Managed Lanes AM Peak-Period Speeds (2040)	26
Exhibit 18: District 4 Future Managed Lanes PM Peak-Period Speeds (2040)	27
Exhibit 19: District 5 Existing and Future Lane Miles by Route	28
Exhibit 20: District 5 Existing Managed Lanes System Configuration (2016)	29
Exhibit 21: District 5 Future Managed Lanes System Configuration (2040)	30
Exhibit 22: District 5 Future Managed Lanes AM Peak-Period Speeds (2040)	31
Exhibit 23: District 5 Future Managed Lanes PM Peak-Period Speeds (2040)	32
Exhibit 24: District 7 Existing Managed Lanes System Configuration (2016)	35
Exhibit 25: District 7 Existing and Future Lane Miles by Route by Type of Managed Lane Facility	36
Exhibit 26: District 7 Future Managed Lanes System Configuration (2040)	37
Exhibit 27: District 7 Managed Lanes AM Peak-Period Speeds (2014)	38
Exhibit 28: District 7 Managed Lanes PM Peak-Period Speeds (2014)	39
Exhibit 29: District 7 Degraded Managed Lanes (Jul–Dec 2014)	40
Exhibit 30: District 7 Future Managed Lanes AM Peak-Period Speeds (2040)	41
Exhibit 31: District 7 Future Managed Lanes PM Peak-Period Speeds (2040)	42
Exhibit 32: District 8 Existing Managed Lanes System Configuration (2016)	45
Exhibit 33: District 8 Existing and Future Lane Miles by Route by Type of Managed Lane Facility	46

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 34: District 8 Future Managed Lanes System Configuration (2040)	47
Exhibit 35: District 8 Managed Lanes AM Peak-Period Speeds (2014)	48
Exhibit 36: District 8 Managed Lanes PM Peak-Period Speeds (2014).....	49
Exhibit 37: District 8 Degraded Managed Lanes (Jul–Dec 2014)	50
Exhibit 38: District 8 Future Managed Lanes AM Peak-Period Speeds (2040).....	51
Exhibit 39: District 8 Future Managed Lanes PM Peak-Period Speeds (2040)	52
Exhibit 40: District 10 Future Lane Miles by Route	53
Exhibit 41: District 10 Future Managed Lanes System Configuration (2040).....	54
Exhibit 42: District 10 Future Managed Lanes AM Peak-Period Speeds (2040).....	55
Exhibit 43: District 10 Future Managed Lanes PM Peak-Period Speeds (2040)	56
Exhibit 44: District 11 Existing Managed Lanes System Configuration (2016)	59
Exhibit 45: District 11 Existing and Future Lane Miles by Route by Type of Managed Lane Facility	60
Exhibit 46: District 11 Future Managed Lanes System Configuration (2040).....	61
Exhibit 47: District 11 Managed Lanes AM Peak-Period Speeds (2014)	62
Exhibit 48: District 11 Managed Lanes PM Peak-Period Speeds (2014).....	63
Exhibit 49: District 11 Degraded Managed Lanes (Jul–Dec 2014)	64
Exhibit 50: District 11 Future Managed Lanes AM Peak-Period Speeds (2040).....	65
Exhibit 51: District 11 Future Managed Lanes PM Peak-Period Speeds (2040)	66
Exhibit 52: Relevant Recent Studies (State, Regional, and District 12)	67
Exhibit 53: Contents and Overlaps among Managed Lane Studies.....	67
Exhibit 54: District 12 Existing Managed Lanes System Configuration (2016)	69
Exhibit 55: District 12 Existing and Future Lane Miles by Route by Type of Managed Lane Facility based on Most Likely Plan	70
Exhibit 57: District 12 Future Managed Lanes System Configuration Most Likely Plan (2040)	71
Exhibit 59: District 12 Managed Lanes AM Peak-Period Speeds (2014)	72
Exhibit 60: District 12 Managed Lanes PM Peak-Period Speeds (2014).....	73
Exhibit 61: District 12 Degraded Managed Lanes (Jul–Dec 2014)	74
Exhibit 62: District 12 Future Managed Lanes AM Peak-Period Speeds (2040).....	75
Exhibit 63: District 12 Future Managed Lanes PM Peak-Period Speeds (2040)	76

Introduction

This report represents the System Plan for Managed Lanes on State Highways developed for the California Department of Transportation (Caltrans) and summarizes the likely evolution of managed lanes in California.

A managed lane is an exclusive- or preferential-use lane that is managed proactively in response to changing conditions in order to achieve improved efficiency and performance. Managed lanes use operations strategies such as access control, vehicle eligibility, and tolling, or a combination thereof. These strategies are determined based on factors such as safety, regional and interregional consistency, impacts on freeway performance, enforcement needs, environmental considerations, and community support. Strategies may be adjusted to meet required performance standards or to address other managed lane or freeway performance issues.

A managed lane is defined as one of the following: high-occupancy vehicle (HOV) lane, high-occupancy/toll (HOT) lane where tolled vehicles can also access the HOV lane, and express toll lane (ETL) where all vehicles must pay a toll to access the lane. A toll managed lane, such as a HOT lane or ETL, is also referred to as an “express lane” and is signed as such.

The managed lane network in California is evolving and will continue to evolve in a significant way in the future. In fact, the network is expected to double in terms of lane miles over the next 30 years and will incorporate pricing on many corridors. This is due to several factors, including, but not limited to:

- **Performance** – Many of the managed lanes in California are considered “degraded” based on the federal definition in federal law. By federal definition, an HOV lane is considered degraded if the average traffic speed during the morning or evening weekday peak commute hour is less than 45 miles per

hour (mph) for more than 10 percent of the time over a 180 consecutive weekday period. In other words, this degradation standard is so strict that the HOV lane’s average traffic speed cannot drop below 45 mph for more than two weekdays each month.

Although this definition is strict, it does provide the identification of managed lane sections that are performing below original expectations. After all, the HOV network was originally developed to offer uncongested travel options to travelers willing to carpool or use transit. Unfortunately, many HOV lane miles are congested at least some of the time during peak travel times. An example of a degraded HOV lane is shown in Exhibit 1 on Interstate 80 (I-80) westbound in Alameda County in District 4 on the approach to the San Francisco–Oakland Bay Bridge.

- **Facilitating Modal Shift to Transit** – Environmental policies and goals encourage strategies and projects that incentivize reducing the reliance on auto travel and encourage transit and active transportation options. However, it has become very expensive to build new rail infrastructure in California. Many transit operators have been adding Bus Rapid Transit (BRT) or Express Bus service along HOV lanes. However, when the HOV system is congested, these services become less efficient.
- **Funding Constraints** – Several regional and county agencies face budget constraints, and using priced managed lanes is viewed in some cases as a way to implement their plans (e.g., completing HOV networks, implementing direct connectors, or expanding congested corridors).

Exhibit 1: Example of HOV Degradation



In addition to expanding the managed lanes network, Caltrans and its partners are considering various operational strategies, including changing hours of operation, changing vehicle occupancy requirements, and implementing pricing. Several studies have been initiated around the state, and today, most Metropolitan Planning Organizations (MPOs) have incorporated these strategies into their adopted Regional Transportation Plans (RTPs)/Sustainable Community Strategies (SCSs).

Although developed and operated differently around the state, managed lanes will play a major role in California's transportation future. This report aims to summarize the likely evolution of managed lanes in the state along with current and future performance projections.

Study Approach

This study focused on coordination with Caltrans and its stakeholder agencies. The Managed Lanes Study team held meetings with every district that currently operates managed lanes on the State Highway System (SHS) or is planning to build and operate managed lanes in the

future. In addition, the study coordinated with previous and ongoing managed lane planning studies across the state. In some cases, the team conducted additional review for districts that requested additional information. Previous and current managed lane studies include:

- The Southern California Association of Governments (SCAG) Regional Express Lane Study, which has not been finalized. Draft conclusions and recommendations are incorporated into this report and will be updated as needed.
- The Bay Area Metropolitan Transportation Commission (MTC) Bay Area High-Occupancy Toll (HOT) Network Study (updated in 2008)¹ and the overall Managed Lanes Implementation Plan.²
- Caltrans District 12 (Orange County) Managed Lanes Network Study, which is still underway. Conclusions from the study will be incorporated into a revised version of this report when available.

This study also included a review of RTP/SCSs of all regions that have current and/or future managed lanes on their part of the SHS. These include SCAG, MTC, the San Diego Association of Governments (SANDAG), the Sacramento Area Council of Governments (SACOG), Santa Barbara County Association of Governments (SBCAG), and the San Joaquin Council of Governments (SJCOG).

Summary of Findings and Conclusions

The managed lanes network on the SHS will grow and operational characteristics will evolve in many of its corridors. Today's system is comprised of nearly 1,756 lane miles. These managed lanes differ in operational characteristics (e.g., hours of operation, access occupancy,

¹ http://files.mtc.ca.gov/library/pub/25864_1-3.pdf

² <http://mtc.ca.gov/our-work/operate-coordinate/freeway-performance-initiative/managed-lanes-implementation-plan>

pricing) from district to district, and in some cases a single district can use multiple operational characteristics.

Several districts and regional agencies are in discussions to change some of these operational characteristics. For instance, District 12 and the Orange County Transportation Authority (OCTA) have converted and plan to convert some of their HOV system from limited access (i.e., vehicles can enter and/or exit the HOV lanes only at specific locations) to continuous access (where vehicles can enter and/or exit at almost any location). District 8 has also implemented similar conversions. Another example of changing operational characteristics could occur in the Bay Area, where there is consideration for extending the hours of operation for HOV lanes beyond today's hours. Changes to occupancy requirements and potential pricing are embedded in most RTPs and studies. Exhibit 2 summarizes today's managed lane system on the SHS and the planned evolution over time. Highlights shown on the table include:

- Today's managed lane network on the SHS includes nearly 1,756 lane miles, of which nearly 206 lane miles are priced throughout the day and about 48 are priced only during peak travel periods.
- By 2040, the managed lane network will nearly double, reflecting nearly 1,639 additional lane miles, totaling about 3,395 lane miles. A significant part of this expansion will occur over the next 10 to 15 years with the remainder included in long-range plans that are implemented by 2035 or beyond. Either way, managed lane expansions will most likely represent the largest share of project development, delivery, and operations on the SHS over the next several decades.
- By 2040, pricing will be implemented on just under 1,787 lane miles across the state. As priced managed lanes are implemented across the state, operations managers will need to monitor corridor performance and adjust policies accordingly. The Division of Traffic Operations will play a key role in coordination with its partners.

- Most of the existing managed lane system is operated with an occupancy requirement of two or more people per vehicle (HOV2+). HOV2+ represents just fewer than 83 percent of the system, with fewer than three percent operated with an occupancy requirement of three or more per vehicle (HOV3+). Approximately 15 percent of the managed lane system consists of priced managed lanes.
- Occupancy requirements are planned to change to HOV3+ on most of the priced managed lanes by 2040. This view is not universally shared. Some people disagree with eliminating HOV2+ vehicles in order to sell this capacity, especially when pricing is implemented when converting existing HOV lanes (as opposed to adding lanes).
- Near-term to mid-term implementation of priced managed lanes will be in Riverside (e.g., State Route 91 or SR-91, which is underway), the Bay Area (e.g., on Interstate 880 and 680), Orange County (e.g., on Interstate 405), and Los Angeles (e.g., on Interstate 605, 105, and 405). It is important to monitor the performance and public reaction to the SR-91 extension since it will represent the first instance of combined occupancy changes and pricing in the state. This would provide important input to other managed lane occupancy requirement changes contemplated on other corridors.
- Park and Ride facilities linked to provide easy access to the managed lanes and with transit (e.g., bus rapid transit) can provide a synergistic effect to increase person throughput. Districts will be working with local partners to better use existing facilities and potentially expand existing or developing additional Park and Ride facilities.
- Toll evasion has become an issue in both District 7 and District 4. Single occupant vehicles using the priced managed lanes without paying take up capacity and often lead to degradation.

The performance of the future managed lane network on the SHS is not yet fully clear due to different data and assumptions used by the various partners. Speed maps showing average peak-period speeds have been extracted from various regional models. However, this data does not compare directly to the more detailed degradation reports developed annually by Caltrans. Regions and districts have prioritized their managed lane projects using differing combinations of factors, including performance, cost, constructability, and revenues.


However, corridor-specific results are difficult to estimate from regional travel demand models used in developing RTPs since these tools generally evaluate the implementation of all RTP improvements at the same time. Off-model, corridor-specific studies in some cases offered estimates by corridor, but these results were high-level estimates. More detailed corridor studies will more closely analyze the benefits separately, but these studies will not capture network effects for an entire region.

As priced managed lanes, are implemented, Caltrans and its partners should carefully consider impacts at jurisdictional borders (e.g., between Los Angeles and Orange County) so that weaving and merging do not lead to the creation of new bottlenecks and delays for transit users, carpools, and other vehicles.

Please note that the future (horizon) year speed maps for each district presented in the remainder of the document represent model average speeds over the peak periods and should not be compared to degradation maps. For instance, in Southern California, model speeds represent three or four hour averages. Degradation maps often represent an hour or less. Moreover, future (horizon) year model speed maps take into account all improvements planned. Comparing future model years to current degradation maps is not recommended.

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 2: Evolution of Managed Facilities 2016–2040 by District

Caltrans District	Counties Served (PURPLE = Current ML, RED = Future ML)	2016 MANAGED LANE (ML) NETWORK (Lane Miles)								2040 MANAGED LANE NETWORK (Lane Miles)								
		Total Managed Lanes	HOV2+		HOV3+		Priced Managed Lanes			Total Managed Lanes	HOV2+		HOV3+		Priced Managed Lanes			
			24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs			24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs		
3 - Marysville/ Sacramento	Butte, Colusa, El Dorado , Glenn, Nevada, Placer , Sacramento , Sierra, Sutter, Yolo , Yuba	98.8		98.8						279.9		279.9						
4 - Oakland	Alameda , Contra Costa , Marin , Napa, San Francisco, San Mateo , Santa Clara , Solano , Sonoma	493.8		401.5		44.6		47.7		900.5		175.9		3.9		720.7		
5 - San Luis Obispo	Monterey, San Benito, San Luis Obispo, Santa Barbara , Santa Cruz	3.4		3.4						24.3		24.3						
7 - Los Angeles	Los Angeles , Ventura	556.9	395.6	79.1				82.2		777.4	314.6	88.6			374.2			
8 - San Bernardino	Riverside , San Bernardino	216.0	199.6	13.6				2.8		684.8	266.7	13.6			404.5			
10 - Stockton	Alpine, Amador, Calaveras, Mariposa, Merced, San Joaquin , Stanislaus, Tuolumne	0.0								75.2		75.2						
11 - San Diego	Imperial, San Diego	118.7	38.5					80.2		304.6	224.4				80.2			
12 - Orange County	Orange	267.9	227.7					40.2		348.0	141.0				207.0			
STATEWIDE		1,755.5	861.4	596.4	0.0	44.6	205.4	47.7		3,394.7	946.7	657.5	0.0	3.9	1,065.9	720.7		

* Mileage totals may not sum due to rounding.

** Note that under District 12's Visionary Plan, an additional 181 managed lane miles would be added

District 3 Managed Lanes

District 3 covers 11 Sacramento Valley and Northern Sierra counties with the urban part of the district primarily centered on the greater Sacramento urban core. As shown on Exhibit 3 in the following page the managed lane system in the district consists of peak period (peak period only), single-lane HOV lanes on Interstate 80 (I-80) connecting Placer County to Sacramento, US 50 connecting El Dorado County to Sacramento, and State Route 99 (SR-99) from the City of Elk Grove north to Sacramento. Together, these represent over 98 lane miles of HOV facilities.

The tables in Exhibit 4 summarize the current extent of the district's managed lane system measured in lane miles for each freeway with an existing or planned facility.

Evolution of the District 3 Managed Lane System

The second table in Exhibit 4 shows the future evolution of the system by the year 2040, and Exhibit 5 is a map that shows the future system configuration. The HOV network is poised to nearly double by 2040. The I-80 HOV lane is going to be extended west past I-5. A new peak period HOV facility will be added between the cities of Davis and West Sacramento on I-80 in both directions. These expansions will more than triple the number of lane miles on I-80 from more than 25 lane miles of HOV2+ lanes to nearly 88 lane miles by 2040.

US 50 HOV lanes will also be extended west to SR-99 and east toward Greenstone Rd in El Dorado County, adding an additional 29 lane miles to the existing system. On I-5, a new peak period HOV lane in both directions will be constructed between Elk Grove in the south through downtown Sacramento to Sacramento International Airport. This new facility will bring more than 42 new peak period lane miles to the district increasing the total number of managed lanes in the district to nearly 280 lane miles by the year 2040.

Performance of District 3 Managed Lane System

Even though the managed lanes network is being expanded in the district, several sections are already experiencing degradation. Exhibit 6 shows the average speeds on the District 3 managed lanes during the AM peak period in 2014 and Exhibit 7 shows the PM Peak-Period Speeds. Peak periods for these two exhibits reflect the Performance Measurement System (PeMS) pre-defined periods, which are from 5 am to 10am and from 3 pm to 8 pm. These are different from the peak periods defined for forecast years in the regional travel demand model. Exhibit 8 shows the level of degradation on the district's managed lanes during the second half of 2014 (July through December). During that period, 33 lane miles were reported as degraded. Exhibit 9 shows the forecast 2040 average speeds on the District 3 managed lanes during the AM peak period. Exhibit 10 shows the PM Peak-Period Speeds.

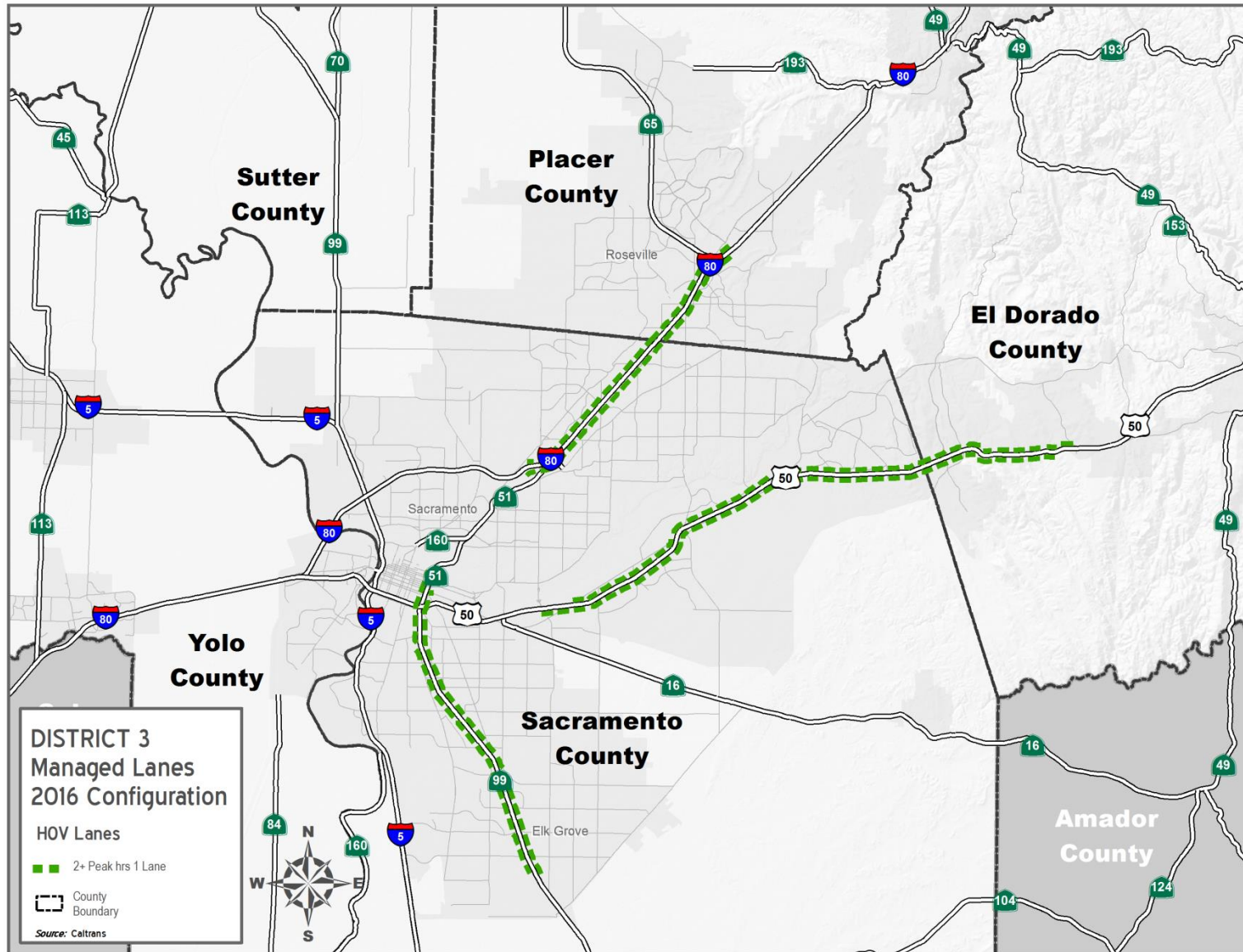
The managed lane system is expected to maintain speeds above 55 mph along most segments during the peak commute periods. The slowest speeds are forecast along the I-5 HOV lanes through downtown Sacramento and southbound on the SR-99 lanes during the PM peak period. No HOV segments are expected to experience speeds below 35 mph during either peak period.

Managed Lane Pricing in District 3

District 3 conducted studies in the past to evaluate the potential pricing on its managed lanes. These studies concluded that the cost of implementation would exceed the benefits with current occupancy requirements. However, this project revisited the costs in light of the successful implementation of continuous access priced managed lanes in the state of Washington and Minnesota. These implementations demonstrate a significant reduction in the costs of implementation. These findings suggest that at some point in the future, the district may consider implementing pricing on some of its corridors. Even if revenues of priced managed lanes do not fully cover the implementation costs, they could still be an effective operational tool, at least during the shoulders of the peak hour/period, since they will likely alleviate congestion on the mixed-flow lanes.

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 3: District 3 Existing Managed Lanes System Configuration (2016)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

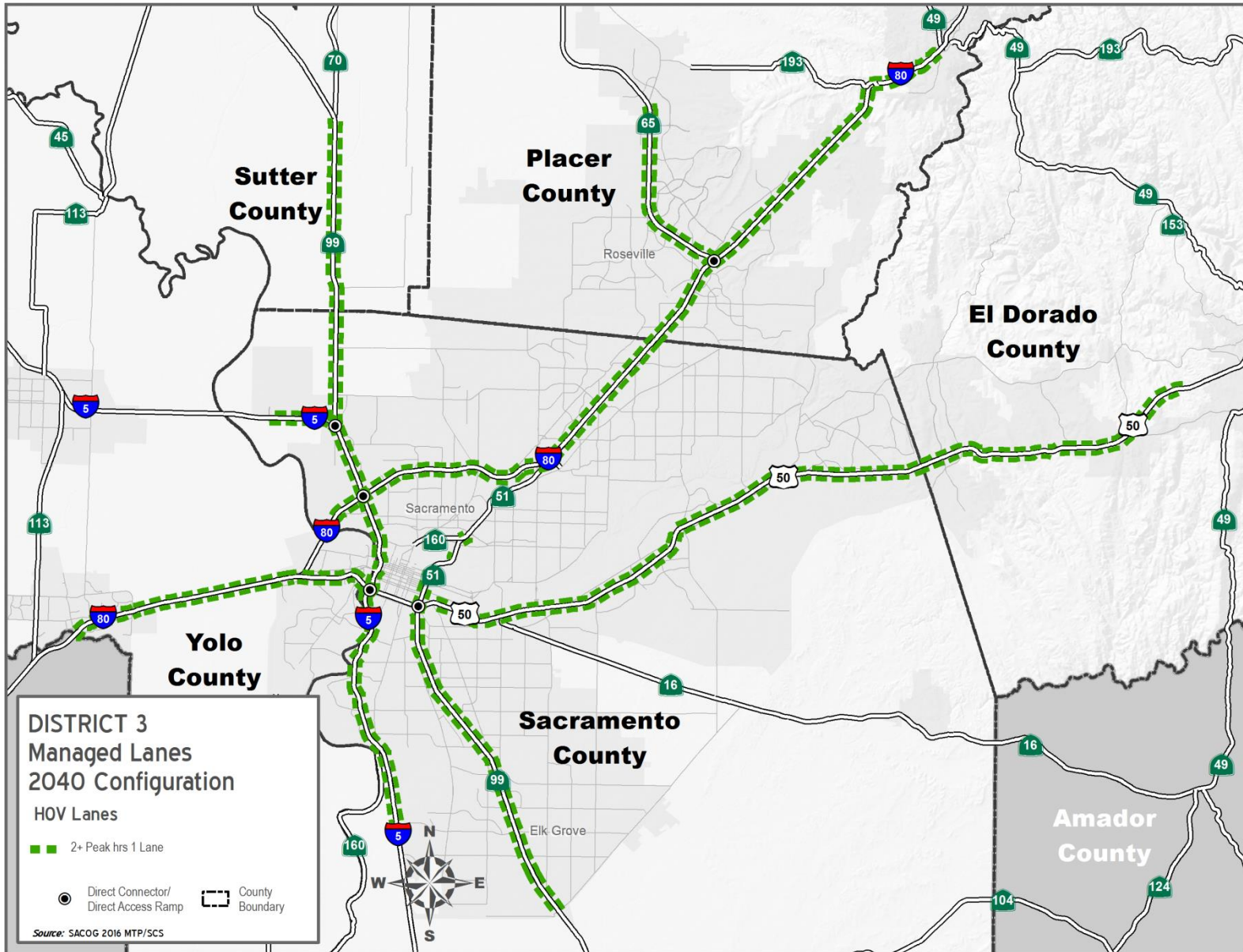
Exhibit 4: District 3 Existing and Future Lane Miles by Route by Type of Managed Lane Facility

Route	Counties Served (GREEN=Current ML BLUE=Future ML)	2016 MANAGED LANE (ML) NETWORK (Lane Miles)									2040 MANAGED LANE NETWORK (Lane Miles)							
		Total Managed Lanes	HOV 2+		HOV 3+		Priced Managed Lanes		Total Managed Lanes		HOV 2+		HOV 3+		Priced Managed Lanes			
			24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs			24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs		
I-5	Sacramento	0.0	Not Constructed							I-5	42.5		42.5					
I-80	Placer, Sacramento, Yolo	25.3		25.3						I-80	87.9		87.9					
SR-99	Sacramento, Sutter	24.5		24.5						SR-99	54.3		54.3					
US 50	El Dorado, Sacramento, Yolo	46.9		46.9						US 50	75.9		75.9					
SR-51	Sacramento	2.1		2.1						SR-51	3.3		3.3					
SR-65	Placer		Not Constructed							SR-65	16.0		16.0					
DISTRICT 3 TOTALS		98.8	0.0	98.8	0.0	0.0	0.0	0.0		TOTALS	279.9	0.0	279.9	0.0	0.0	0.0	0.0	

* Mileage totals may not sum due to rounding.

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 5: District 3 Future Managed Lanes System Configuration (2040)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 6: District 3 Managed Lanes AM Peak-Period Speeds (2014)

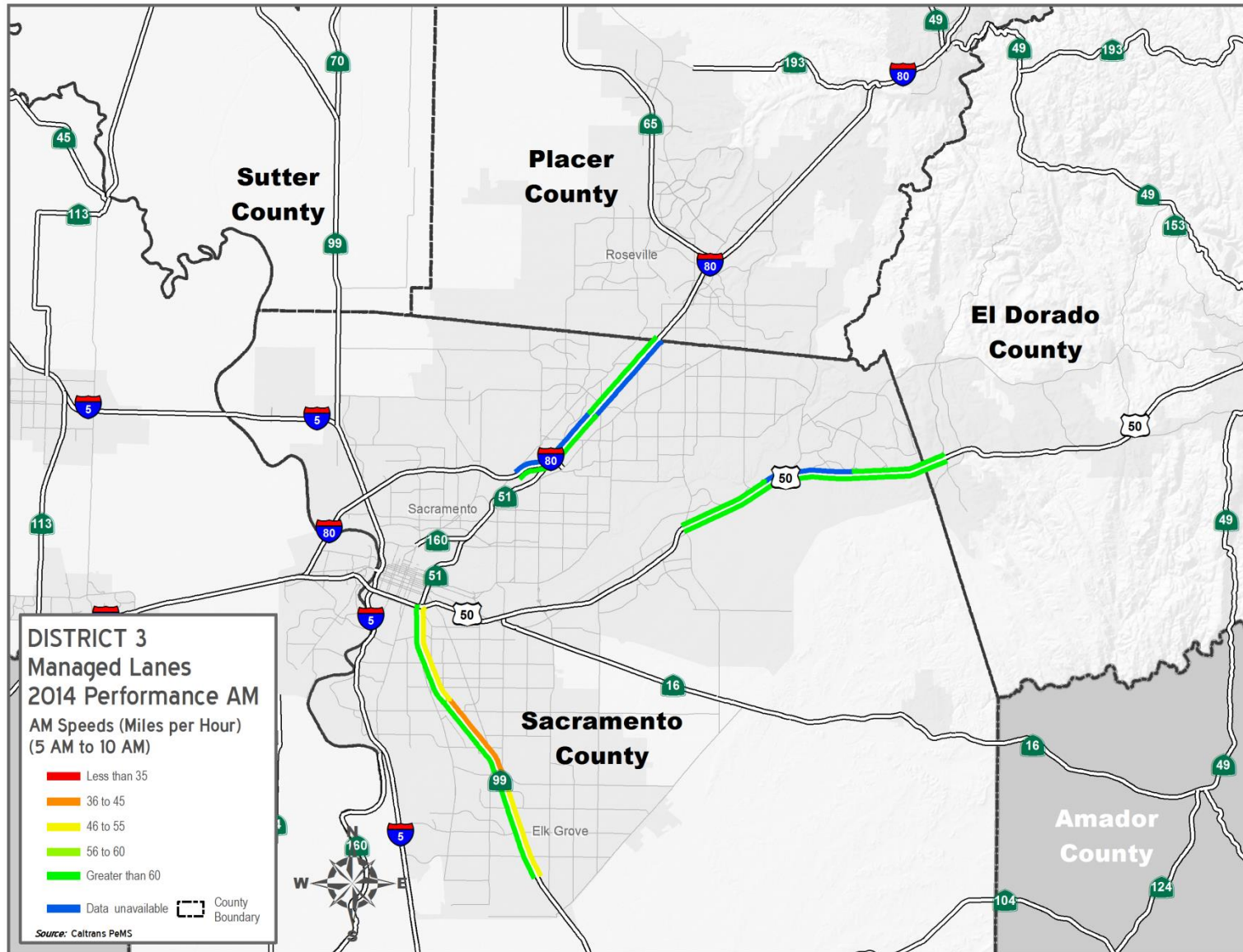
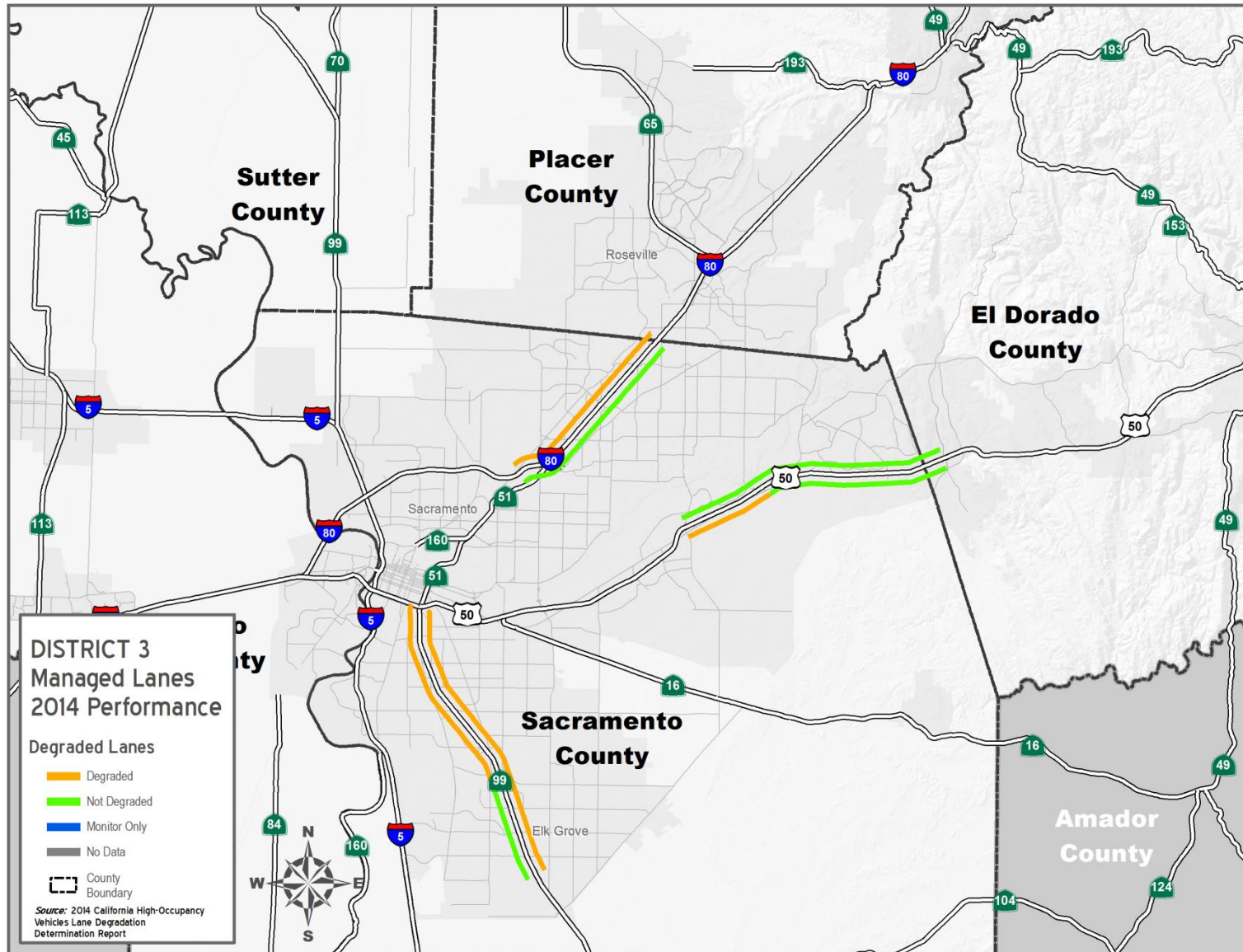


Exhibit 7: District 3 Managed Lanes PM Peak-Period Speeds (2014)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 8: District 3 Degraded Managed Lanes (Jul-Dec 2014)

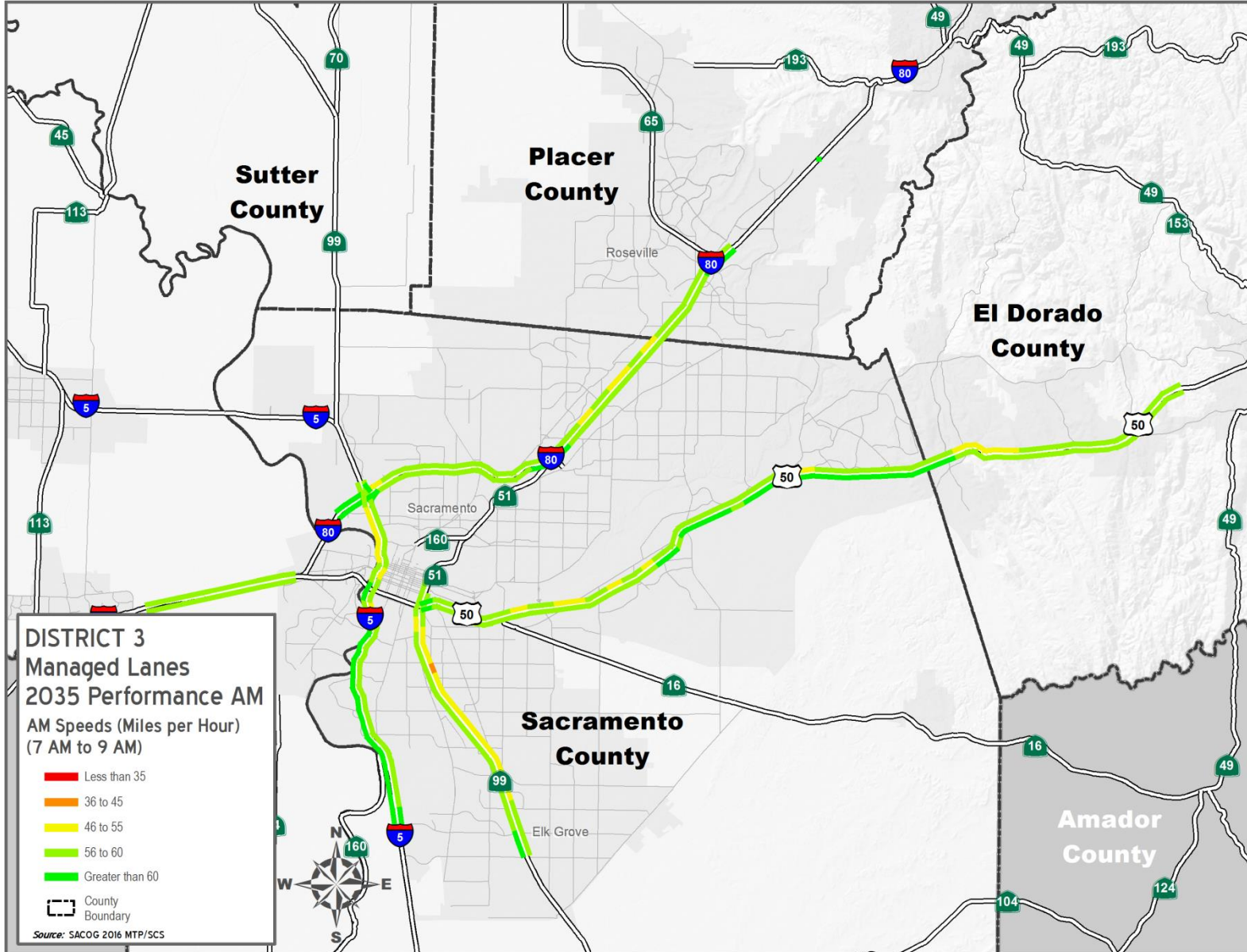


Source: 2014 California High-Occupancy Vehicle Lane Degradation Determination Report. Caltrans. September 1, 2015.

<http://www.dot.ca.gov/trafficops/tm/docs/2014-HOV-degradation-report.pdf>

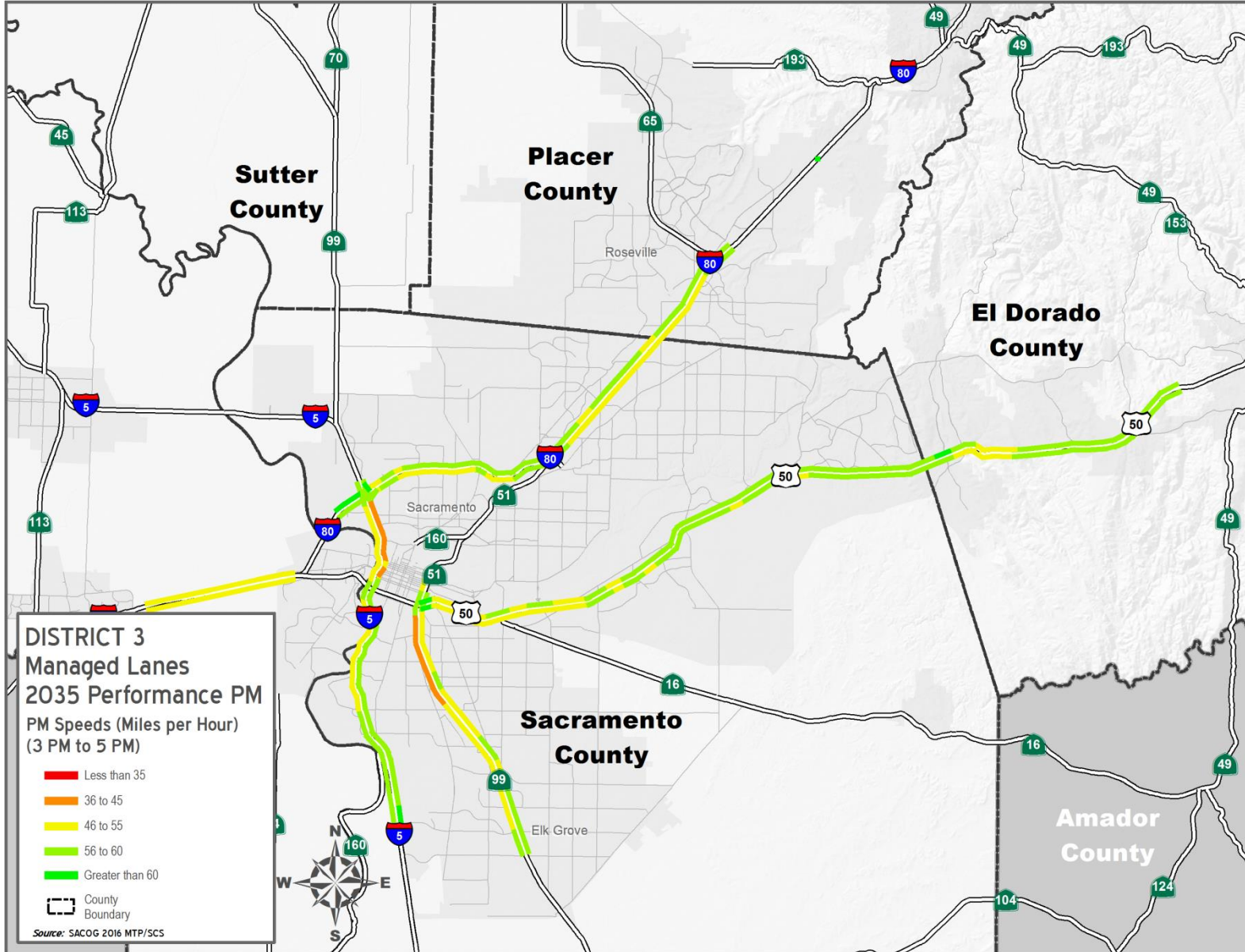
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 9: District 3 Future Managed Lanes AM Peak-Period Speeds (2040)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 10: District 3 Future Managed Lanes PM Peak-Period Speeds (2040)



District 4 Managed Lanes

District 4 serves the nine-county San Francisco Bay Area and includes Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties. Currently, managed lanes are operational in all nine Bay Area counties except for Napa and San Francisco counties. San Francisco County has an HOV on-ramp to eastbound I-80. District 4's HOV lanes consist of part-time operations with continuous access striping.

Exhibit 11 shows the district's managed lane system, which covers the entire range of facility types (i.e., HOV2+, HOV3+, HOT/Express Lane), totaling almost 495 lane-miles. Caltrans maintains nearly 402 lane miles of peak period HOV2+, about 45 lane miles of peak period HOV3+ (primarily along I-80 in Alameda and Contra Costa counties), and about 48 miles of HOT/Express Lanes (along I-580 in Alameda County, I-680 in Alameda and Santa Clara counties, and SR-237/I-880 in Santa Clara County, as shown in the table in Exhibit 10. There are three existing significant gaps in the system, consisting of US 101 in San Francisco/San Mateo Counties, I-880 through the City of Oakland, and I-680 through the City of Walnut Creek.

Evolution of the District 4 Managed Lane System

Exhibit 12 also shows the future evolution of that system in the year 2040. Exhibit 13 is a map that shows the future system configuration.

By the year 2040, District 4 is anticipated to add an additional 407 lane miles of HOV and express lanes (an increase of 82 percent) to total more than 900 lane miles of managed lanes, giving the Bay Area the most extensive system in the state.

Currently, around ten percent of the system (47.7 lane miles) are express lanes, but by the forecast year, over 80 percent (or more than 720.7 lane miles) are planned to be express lanes. Most of the remaining system will be HOV2+.

District 4 Managed Lane Priorities

The San Francisco Bay Area MTC has identified the following express lanes priorities over the coming years in the order of expected completion date:

- I-680 (Contra Costa County) Livorna Road/Rudgear Road to Alcosta Boulevard (Completion 2020)
- I-80 (Solano County) Red Top Road to Air Base Parkway (Completion 2020)
- I-880 (Alameda County) between Oakland and Milpitas (Completion 2019)
- SR-84 (Alameda County) Dumbarton Bridge Westbound Approach (Completion 2020)
- SR-92 (Alameda County) San Mateo Bridge Westbound Approach (Completion 2020)
- I-680 (Contra Costa County) From Milpitas to Pleasanton, Northbound (Completion 2020)
- SR-237 EB (Santa Clara County) 1st St to Mathilda Ave (Completion 2018)
- SR-237 WB (Santa Clara County) Dixon Landing Road (880) to US101 (Completion 2019)
- I-880 (Alameda County) Hegenberger Road/Lewelling Boulevard to SR-237 (Completion 2019)
- I-680 (Contra Costa County) Benicia Bridge to Rudgear Road (Completion 2020)
- I-680 (Contra Costa County) Walnut Creek, Northbound (Completion 2035)
- I-80 (Alameda County) between Carquinez Bridge and Emeryville (Completion 2020)
- I-80 (Solano County) Air Base Parkway to I-505 (Completion 2025)
- I-80 (Solano County) between Carquinez Bridge and Vallejo (Completion 2020)
- I-880 (Alameda County) San Leandro to Oakland, Northbound (Completion 2035)
- SR-85 (Santa Clara County) between Mountain View and San Jose (Completion TBA)
- I-680 (Contra Costa County) Walnut Creek to Benicia Bridge Northbound (Completion 2025)
- I-80 (Solano County) between Fairfield and Vallejo (Completion 2025)
- I-580 (Alameda County) Livermore and Tracy (Completion 2035)
- I-680 (Alameda County) San Ramon and Sunol (Completion 2025)

- I-680 (Solano County) Fairfield and Benicia (Completion 2025)
- I-80 (Solano County) Davis and Vacaville (Completion 2035)
- US 101 (Santa Clara County) Palo Alto and Morgan Hill (Completion TBA)

Performance of District 4 Managed Lane System

Exhibit 14 shows the average speeds on the District 4 managed lanes during the AM peak period in 2014 and Exhibit 15 shows the PM Peak-Period Speeds. Peak periods for these two exhibits reflect the Performance Measurement System (PeMS) pre-defined periods, which are from 5 am to 10 am and from 3 pm to 8 pm. Exhibit 16 shows the level of degradation on the District 4 managed lane network during the second half of 2014 (July through December). During that period, 227 lane miles were reported as degraded. Causes of degradation may include traffic weaving between HOV and general purpose lanes and HOV traffic demand exceeding capacity.

Exhibit 17 shows the District 4 managed lane system 2040 forecast average speeds during the AM peak period as output from the MTC regional travel demand model. Exhibit 18 shows the PM peak period forecast speeds, also from the MTC model. Peak periods for these two exhibits differ from the PeMS peak periods in Exhibits 14 through 16, above. The PeMS 2014 AM peak period was from 5 am to 10 am, while the MTC 2040 forecast model peak period used for Exhibit 17 is from 6 am to 10 am. Similarly, the PeMS 2014 PM peak period is from 3 pm to 8 pm, while the MTC model PM peak period shown in Exhibit 18 is from 3 pm to 7 pm.

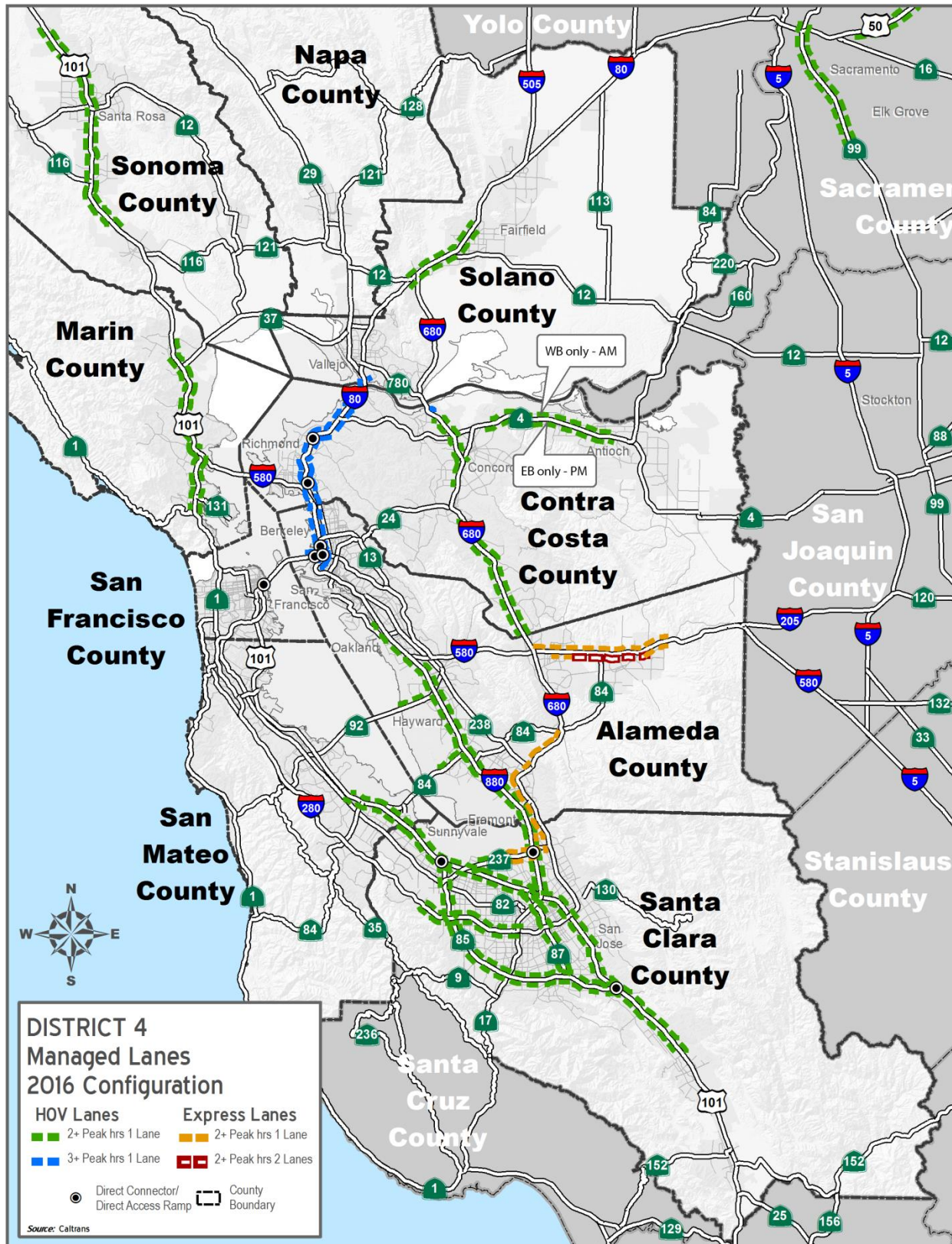
Segments along three routes, I-80, I-680, and I-880 in Alameda County, are forecast to experience severe congestion (i.e., Peak-Period Speeds less than 35 mph) in 2040, as shown in Exhibit 17 and Exhibit 18. Slowing below 45 mph is expected on various managed lane segments in the district, including on all facilities in and around downtown San Jose, along I-680 in various locations in Contra Costa County, and along portions of I-580 in Alameda County.

Managed Lane Pricing in District 4

District 4 has already implemented managed lanes on portions of Interstate 680 and Interstate 580 as well as State Route 237. Additional implementation is planned or underway. District 4 plans to implement uniform hours of operation on HOV lanes in the future (e.g.: 5am to 8pm). In addition, conversion of HOV to HOT lanes is intended to offset the traffic impacts to the managed lanes and general purpose lanes. Occupancy requirement increases may also be considered along with pricing strategies such as discounted tolls for HOV 2+ and clean air vehicles.

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 11: District 4 Existing Managed Lanes System Configuration (2016)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 12: District 4 Existing and Future Lane Miles by Route by Type of Managed Lane Facility

Route		Counties Served (GREEN = Current ML BLUE = Future ML)	2016 MANAGED LANE (ML) NETWORK (Lane Miles)								Route	2040 MANAGED LANE NETWORK (Lane Miles)								
			Total Managed Lanes	HOV2+		HOV3+		Priced Managed Lanes				Total Managed Lanes	HOV2+		HOV3+		Priced Managed Lanes			
				24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs				24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs
I-280	Santa Clara	21.2		21.2						I-280	32.0							32.0		
I-580	Alameda	29.0							29.0	I-580	52.7							52.7		
I-680	Alameda, Contra Costa	50.6		36.3			0.6		13.7	I-680	137.9		12.3					125.6		
I-80	Alameda, Contra Costa, Napa, Solano	57.4		16.2			41.2			I-80	130.5				1.1			129.4		
I-880	Alameda, Santa Clara	57.4		56.1			1.3			I-880	80.2				1.3			78.9		
I-880S	Alameda	1.5					1.5			I-880S	1.5				1.5					
SR-17	Santa Clara	0.0	Not Constructed								SR-17	9.2						9.2		
SR-237	Santa Clara	12.7		7.7					5.0	SR-237	18.8							18.8		
SR-4	Contra Costa	25.7		25.7						SR-4	26.4		26.4							
SR-84	Santa Clara	2.9		2.9						SR-84	2.9		2.9							
SR-85	Santa Clara	48.5		48.5						SR-85	74.6							74.6		
SR-87	Santa Clara	18.4		18.4						SR-87	18.5							18.5		
SR-92	Alameda	3.3		3.3						SR-92	3.1		3.1							
US 101	Santa Clara, San Mateo, Marin, Sonoma	165.2		165.2						US 101	312.0		131.0					181.0		
DISTRICT 4 TOTALS		493.8	0.0	401.5	0.0	44.6	0.0	47.7		TOTALS	900.3	0.0	175.7	0.0	3.9	0.0		720.7		

* Mileage totals may not sum due to rounding.

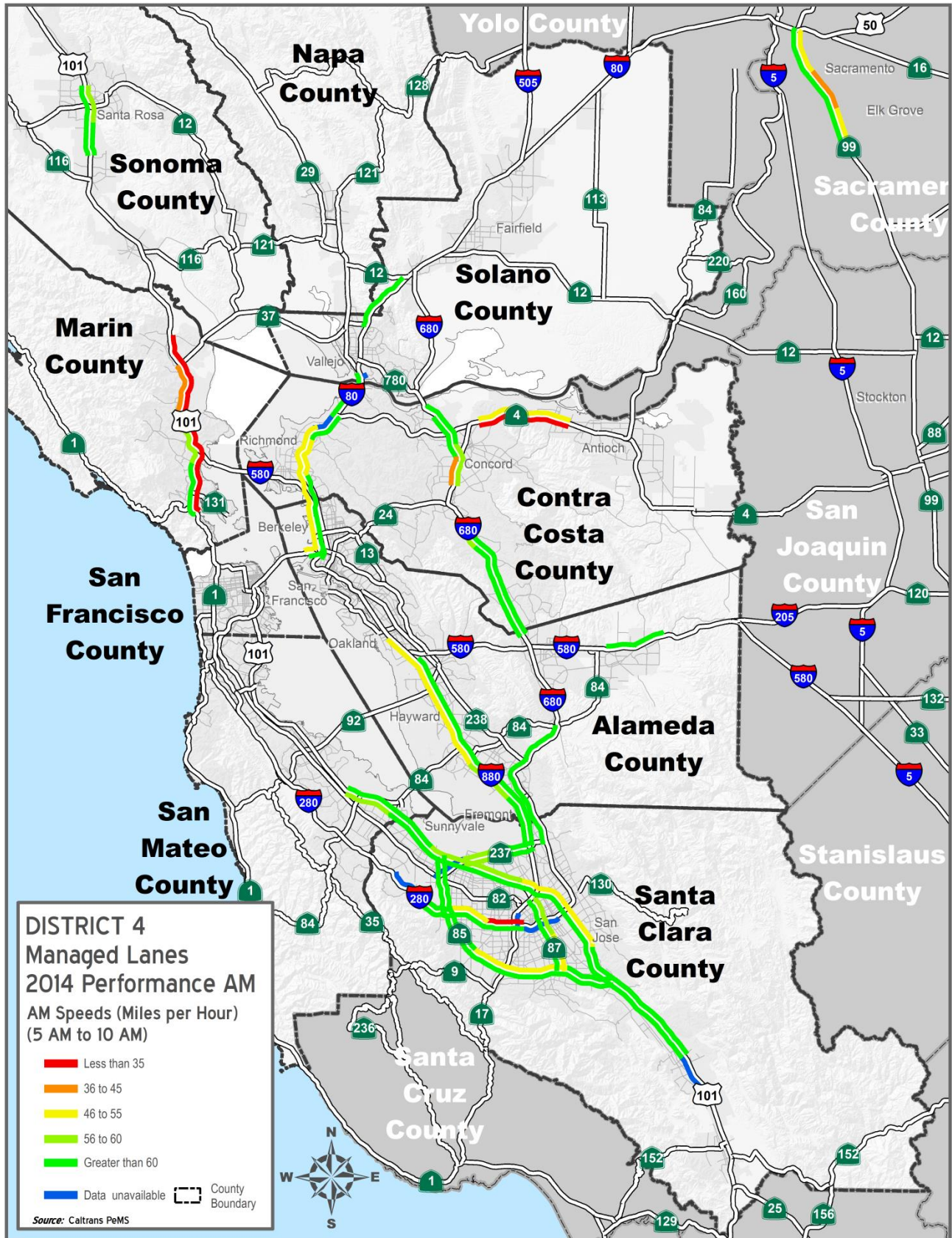
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 13: District 4 Future Managed Lanes System Configuration (2040)



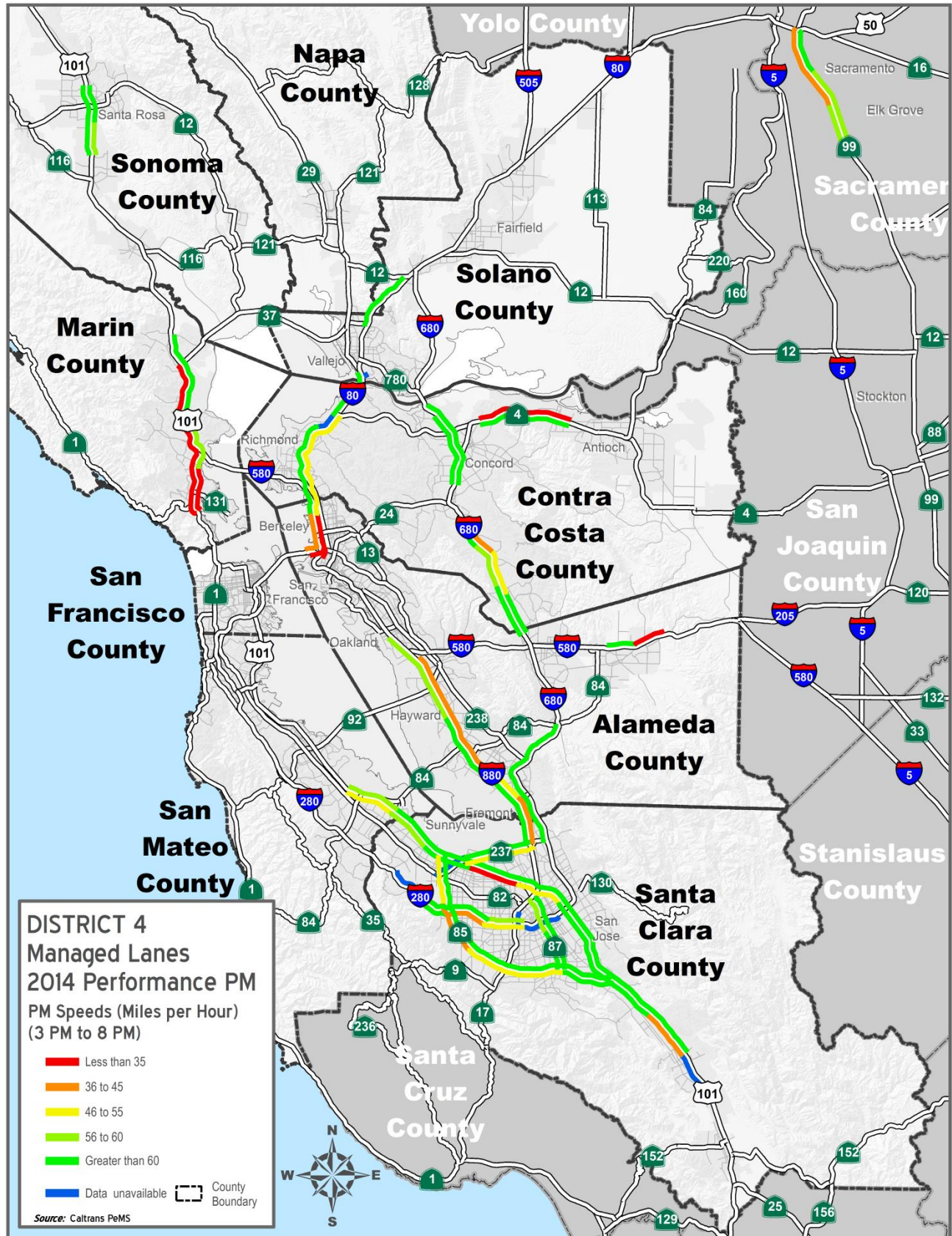
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 14: District 4 Managed Lanes AM Peak-Period Speeds (2014)



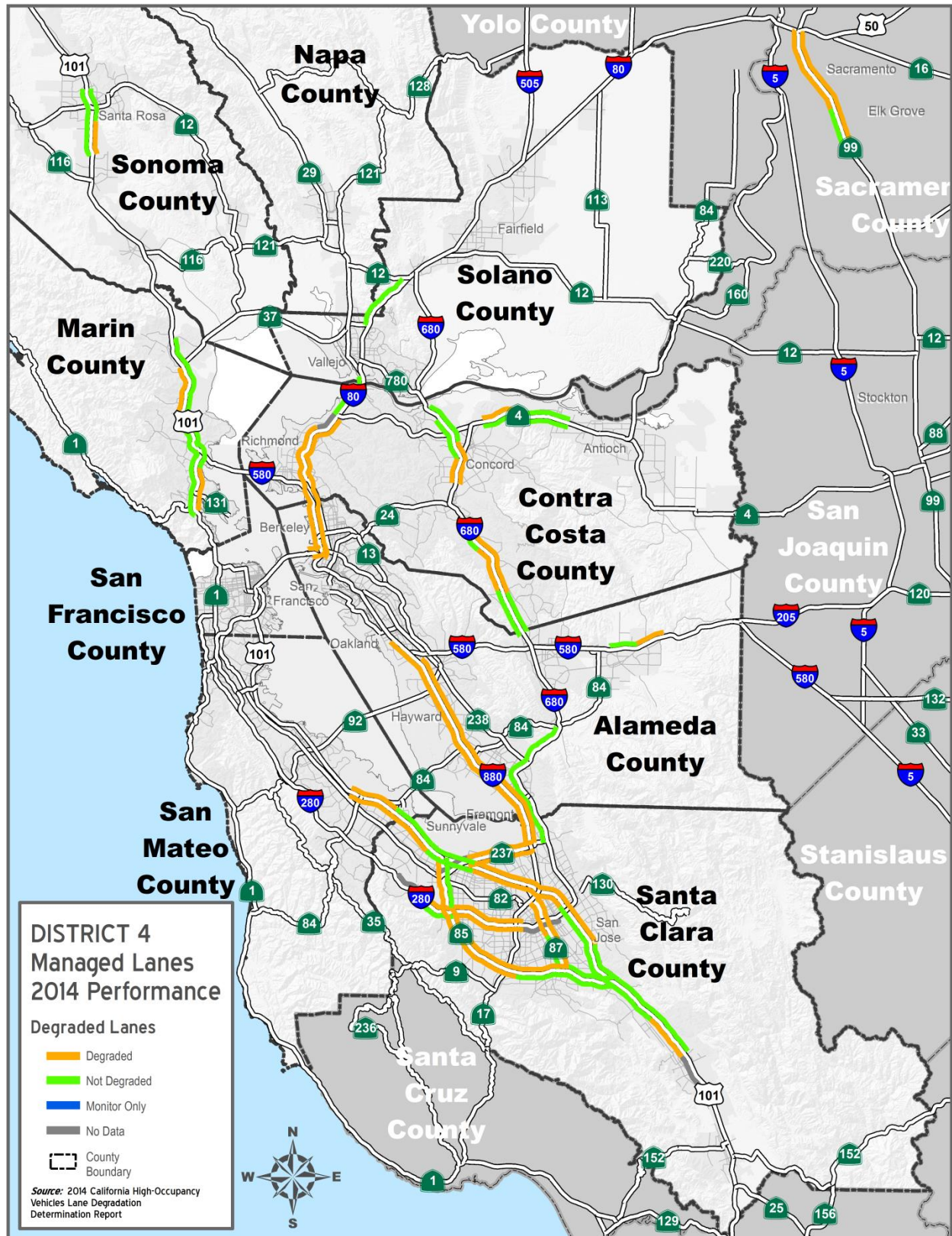
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 15: District 4 Managed Lanes PM Peak-Period Speeds (2014)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

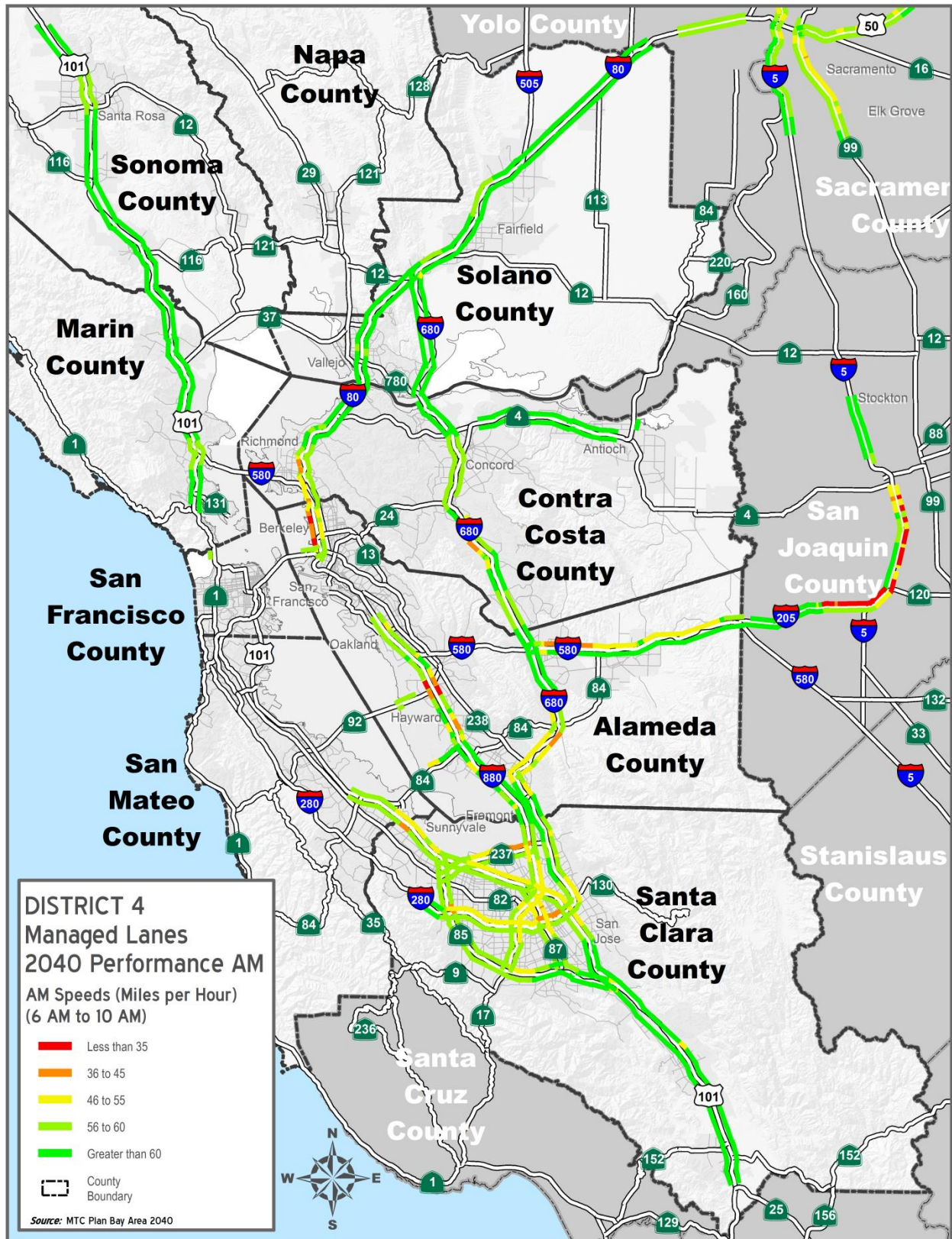
Exhibit 16: District 4 Degraded Managed Lanes (Jul-Dec 2014)



Source: 2014 California High-Occupancy Vehicle Lane Degradation Determination Report. Caltrans. September 1, 2015.
<http://www.dot.ca.gov/trafficops/tm/docs/2014-HOV-degradation-report.pdf>

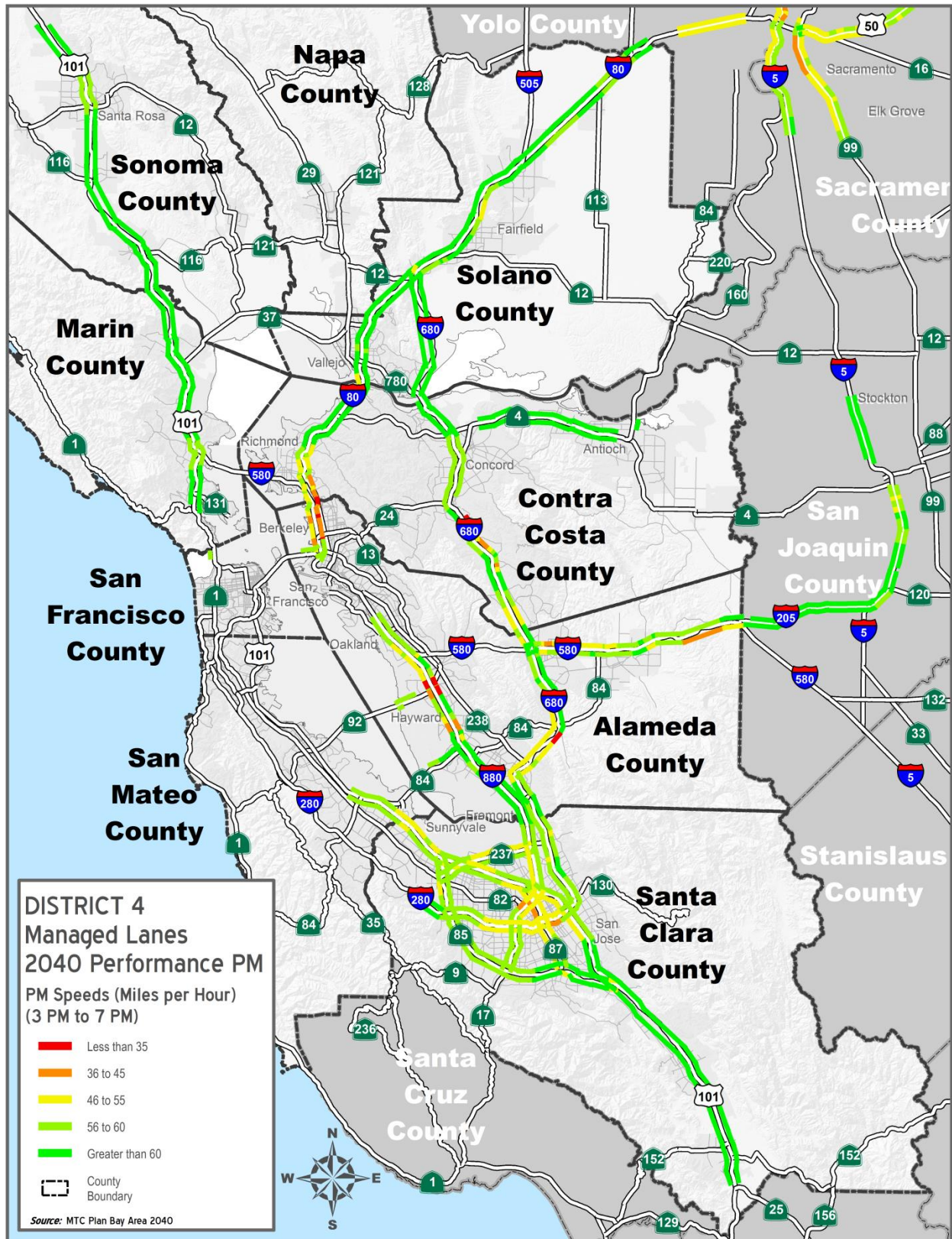
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 17: District 4 Future Managed Lanes AM Peak-Period Speeds (2040)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 18: District 4 Future Managed Lanes PM Peak-Period Speeds (2040)



District 5 Managed Lanes

District 5 serves the five Central Coast counties, which are Monterey, San Benito, San Luis Obispo, Santa Barbara, and Santa Cruz, that lie between the San Francisco Bay Area in the north to the greater Los Angeles Basin in the south. Opened in March 2015, there is a one-lane, peak period HOV2+ lane in each direction on US 101 between the Santa Barbara/Ventura County Line and the City of Carpinteria, which is the continuation of the Ventura County (District 7) HOV lanes.

Exhibit 19 to the right and the map in Exhibit 20 on the next page summarize the existing lane miles.

Evolution of the District 5 Managed Lane System

The table in Exhibit 19 also shows the future evolution of that system in the year 2040 with the expansion of the lanes from Carpinteria north to the City of Santa Barbara. Exhibit 21 is a map that shows the future system configuration.

Performance of District 5 Managed Lane System

Since the most recent HOV degradation report was last produced in 2014 and the District 5 HOV lanes opened in 2015, there is no degradation to report for US 101 in Santa Barbara County. Exhibit 22 shows the forecast 2040 average speeds on the District 5 managed lanes during the AM peak period. Exhibit 23 shows the PM Peak-Period Speeds.

Exhibit 19: District 5 Existing and Future Lane Miles by Route

Route	Counties Served (■ SB = Current ML ■ US = Future ML)	2016 MANAGED LANE (ML) NETWORK (Lane Miles)					
		Total Managed Lanes	HOV2+		HOV3+		Priced Managed Lanes
			24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	
US 101	Santa Barbara	3.4		3.4			
DISTRICT 5 TOTALS		3.4	0.0	3.4	0.0	0.0	0.0

* Mileage totals may not sum due to rounding.



Route	2040 MANAGED LANE NETWORK (Lane Miles)					
	Total Managed Lanes	HOV2+		HOV3+		Priced Managed Lanes
		24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	
US 101	24.3		24.3			
TOTALS	24.3	0.0	24.3	0.0	0.0	0.0

* Mileage totals may not sum due to rounding.

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 20: District 5 Existing Managed Lanes System Configuration (2016)



Exhibit 21: District 5 Future Managed Lanes System Configuration (2040)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 22: District 5 Future Managed Lanes AM Peak-Period Speeds (2040)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 23: District 5 Future Managed Lanes PM Peak-Period Speeds (2040)



District 7 Managed Lanes

District 7 is comprised of two counties, which are Los Angeles and Ventura counties, in Southern California. District 7 has the most expansive managed lane network in the state, covering over 556 lane miles, or approximately one-third of the entire state.

Exhibit 24 is a map showing the district's managed lane system. Caltrans maintains nearly 396 lane miles of 24-hour HOV2+ and approximately 79 lane miles of peak period HOV2+ on SR-14 in north Los Angeles County and US 101 in Ventura County. In addition, there are currently just less than 83 miles of 24-hour priced managed lanes on I-10 (San Bernardino Freeway) and I-110 (Harbor Freeway) to downtown Los Angeles. Vehicles meeting minimum occupancy requirement do not pay the toll when using these lanes. These are summarized in the first table in Exhibit 25.

Evolution of the District 7 Managed Lane System

The table in Exhibit 25 also shows the future evolution of that system in the year 2040, while Exhibit 26 is a map that shows the future system configuration.

By 2040, the district is expected to add an additional 221 managed lane miles to the system, bringing the total to nearly 778 lane miles.

In the future, the network will also have more than 374 lane miles of priced managed lanes by constructing new facilities or converting existing HOV2+ lanes. In addition to the current I-10 and I-110 priced lanes, new lanes are planned for I-5, I-105, I-405, and I-605.

Other expansions will occur on routes that already have managed facilities with the exception of a 10-mile addition of 24-hour HOV2+ on SR-71 in eastern Los Angeles County that will be a continuation of the SR-71 HOV lanes in San Bernardino County.

District 7 Managed Lane Priorities

The SCAG 2016 RTP/SCS has identified the following strategic expansion projects to be express lane and HOV projects to be implemented over the coming years, including:

I-5 (Los Angeles)

- HOV lanes Weldon Canyon Road to Parker Road (Two projects completed by 2020)
- HOV lanes Los Angeles/Orange County Line to I-605 (Completion 2019)
- HOV lanes SR-134 to Hollywood Way SR-134 to SR-170 (Completion 2019)

I-10 (Los Angeles)

- HOV lanes Puente to SR-57 (Two projects completed by 2018)

I-110 (Los Angeles)

- HOT off-ramp Connector 28th Street to Figueroa Street (Completion 2023)
-

High Desert Corridor (Los Angeles/San Bernardino)

- Toll/express lanes (Completion 2020)

Longer-term projects that are expected to be completed after 2025 include:

SR-14 (Los Angeles)

- HOV lanes Ave P-8 to Ave L (Completion 2027)

SR-71 (Los Angeles)

- HOV lanes I-10 to Los Angeles/San Bernardino County Line (Two projects completed by 2029)

US 101 (Ventura)

- HOV lanes Moorpark Road to SR-33 (Completed by 2029)

Performance of District 7 Managed Lane System

Exhibit 27 shows the average speeds on the District 7 managed lanes during the AM peak period in 2014 and Exhibit 28 shows the PM Peak-Period Speeds. Peak periods for these two exhibits reflect the Performance Measurement System (PeMS) pre-defined periods, which are from 5 am to 10 am and from 3 pm to 8 pm. These are different from the peak periods defined for forecast years in the regional travel demand model. Exhibit 29 shows the level of degradation on the

District 7 managed lane network during the second half of 2014 (July through December). During that period, 320 lane miles were reported as degraded. This represents around 60 percent of all managed lanes in the district.

Exhibit 30 shows the forecast 2040 average speeds on the District 7 managed lanes during the AM peak period. Exhibit 31 shows the PM Peak-Period Speeds.

Forecasts developed from the SCAG regional travel demand model indicate that most future degradation will be eliminated on most of the District 7 managed lane network. Severe slowing is expected to continue in the vicinity of the I-5/SR-14 interchange near the City of Santa Clarita in north Los Angeles County. I-405 is also expected to experience peak period slowing in the southbound direction over the Sepulveda Pass in west Los Angeles.

Managed Lane Pricing in District 7

The implementation of pricing on Interstate 110 has demonstrated some of the benefits and some of the challenges related to priced managed lanes. The facility generates revenues that are invested back into the corridor. However, increased merging and weaving sometimes lead to additional delays for travelers. The district is considering operational improvements to improve performance, including a flyover at Adams Boulevard.

Other challenges are likely to emerge as priced managed lanes are implemented elsewhere. This is especially true at the end of the priced lane facility and when a lane is dropped. This will be a factor for the proposed Interstate 405 managed lane. The district will also need to monitor the impact of the implementation of managed lanes in neighboring districts so that they do not inadvertently affect performance.

Exhibit 24: District 7 Existing Managed Lanes System Configuration (2016)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 25: District 7 Existing and Future Lane Miles by Route by Type of Managed Lane Facility

Route	Counties Served <small>(GREEN = Current ML BLUE = Future ML)</small>	2016 MANAGED LANE (ML) NETWORK (Lane Miles)									Route	2040 MANAGED LANE NETWORK (Lane Miles)							
		Total Managed Lanes	HOV2+		HOV3+		Priced Managed Lanes		Total Managed Lanes			HOV2+		HOV3+		Priced Managed Lanes			
			24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs				24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs		
I-10	Los Angeles	58.8	15.4					43.4			I-10	87.8	HOV Converted to Priced Managed Lanes -->				87.8		
I-105		32.0	32.0								I-105	63.0	HOV Converted to Priced Managed Lanes -->				63.0		
I-110		38.8						38.8			I-110	38.8					38.8		
I-210		55.0	55.0								I-210	55.0	55.0						
I-405		96.1	96.1								I-405	116.9	HOV Converted to Priced Managed Lanes -->				116.9		
I-5		26.6	26.6								I-5	93.6	66.5				27.1		
I-605		40.6	40.6								I-605	40.6	HOV Converted to Priced Managed Lanes -->				40.6		
SR-118	Los Angeles, Ventura	21.7	21.7								SR-118	21.7	21.7						
SR-134	Los Angeles	24.0	24.0								SR-134	24.0	24.0						
SR-14		72.2		72.2							SR-14	81.7		81.7					
SR-170		11.7	11.7								SR-170	11.7	11.7						
SR-57		10.8	10.8								SR-57	10.8	10.8						
SR-60		35.3	35.3								SR-60	35.3	35.3						
SR-71		0.0	Not Constructed								SR-71	9.8	9.8						
SR-91		26.4	26.4								SR-91	26.4	26.4						
US 101	Los Angeles, Ventura	6.9		6.9							US 101	60.3	53.4	6.9					
DISTRICT 7 TOTALS		556.9	395.6	79.1	0.0	0.0	82.2	0.0			TOTALS	777.4	314.6	88.6	0.0	0.0	374.2	0.0	

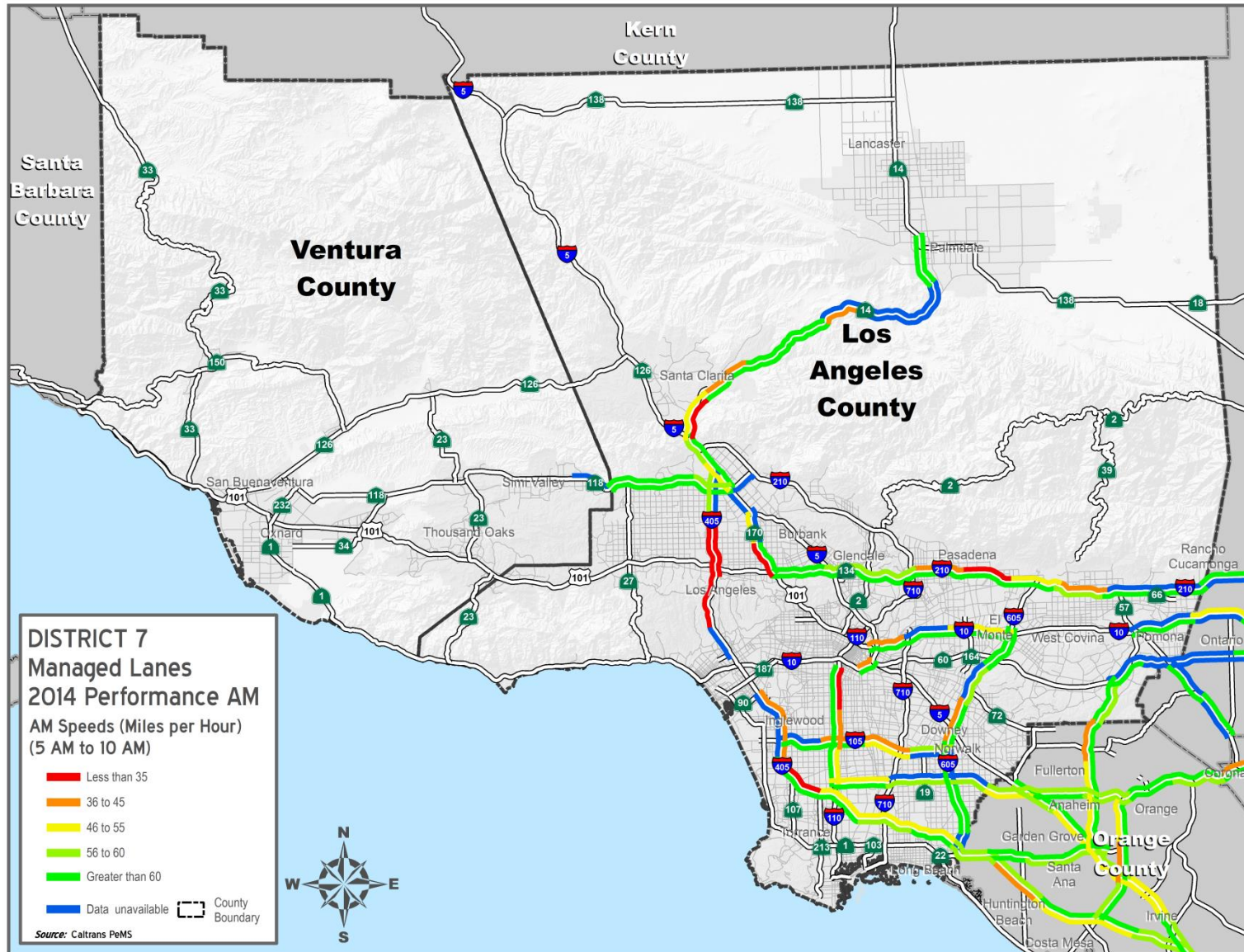
* Mileage totals may not sum due to rounding.

Exhibit 26: District 7 Future Managed Lanes System Configuration (2040)



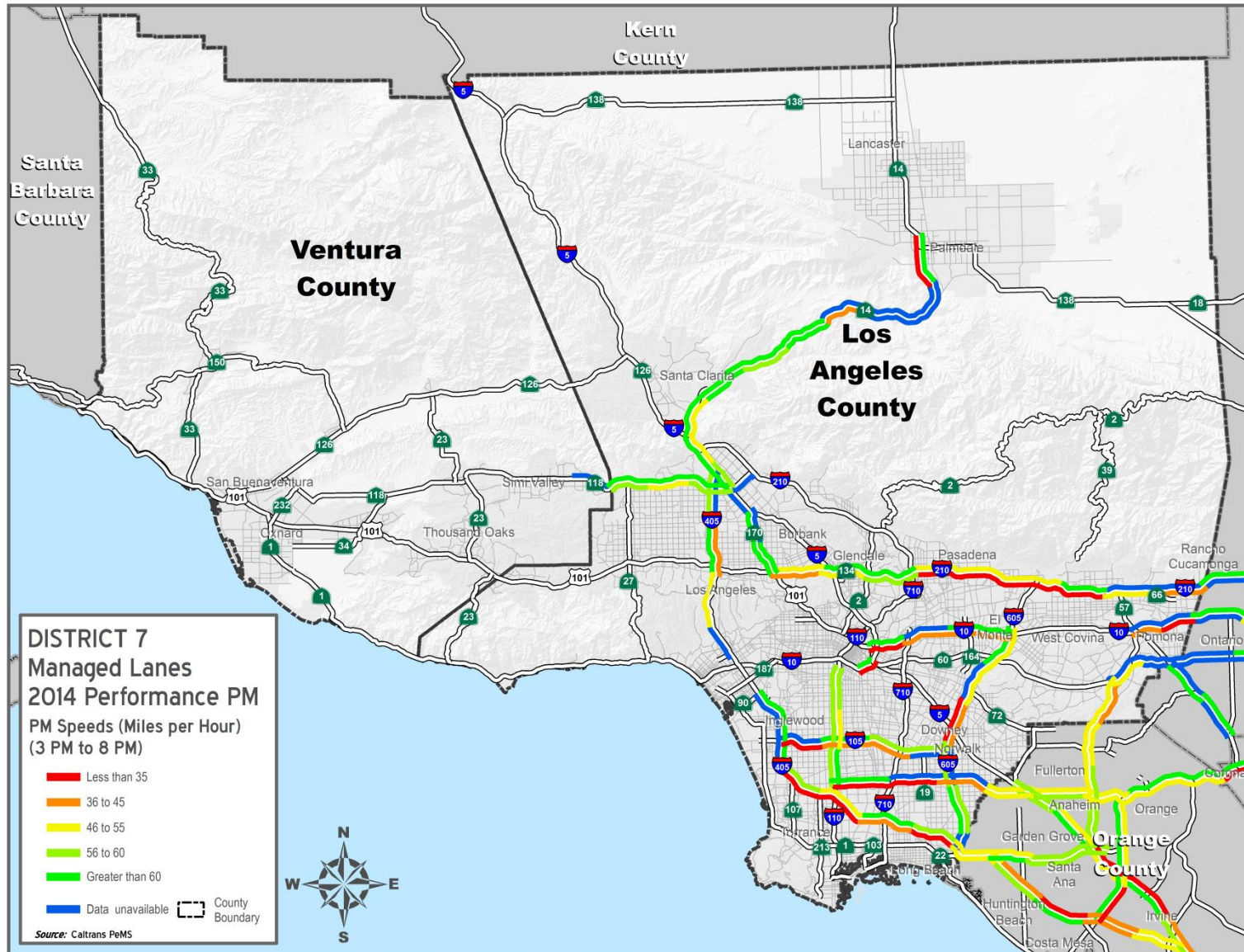
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 27: District 7 Managed Lanes AM Peak-Period Speeds (2014)



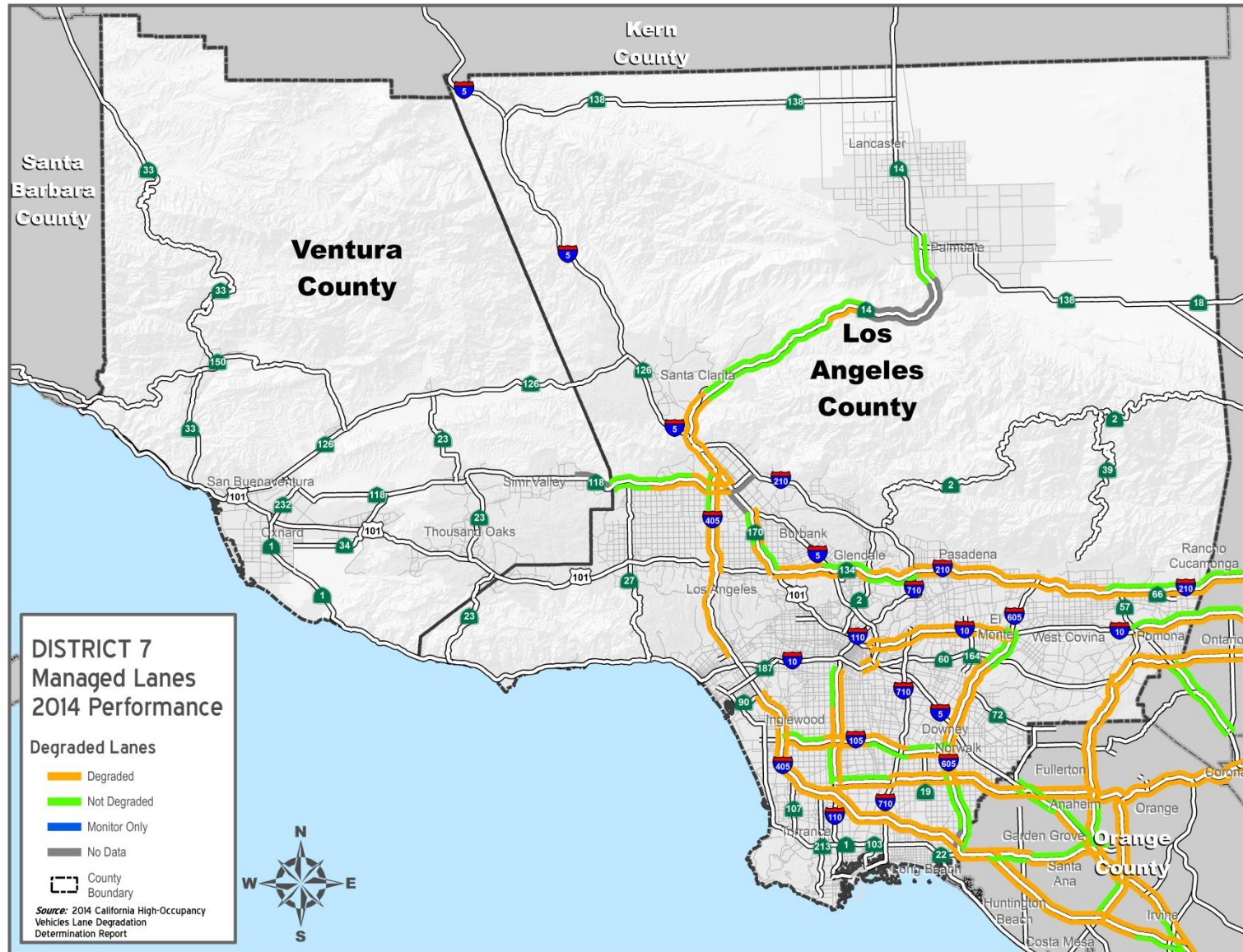
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 28: District 7 Managed Lanes PM Peak-Period Speeds (2014)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 29: District 7 Degraded Managed Lanes (Jul-Dec 2014)



Source: 2014 California High-Occupancy Vehicle Lane Degradation Determination Report. Caltrans. September 1, 2015.

<http://www.dot.ca.gov/trafficops/tm/docs/2014-HOV-degradation-report.pdf>

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 30: District 7 Future Managed Lanes AM Peak-Period Speeds (2040)

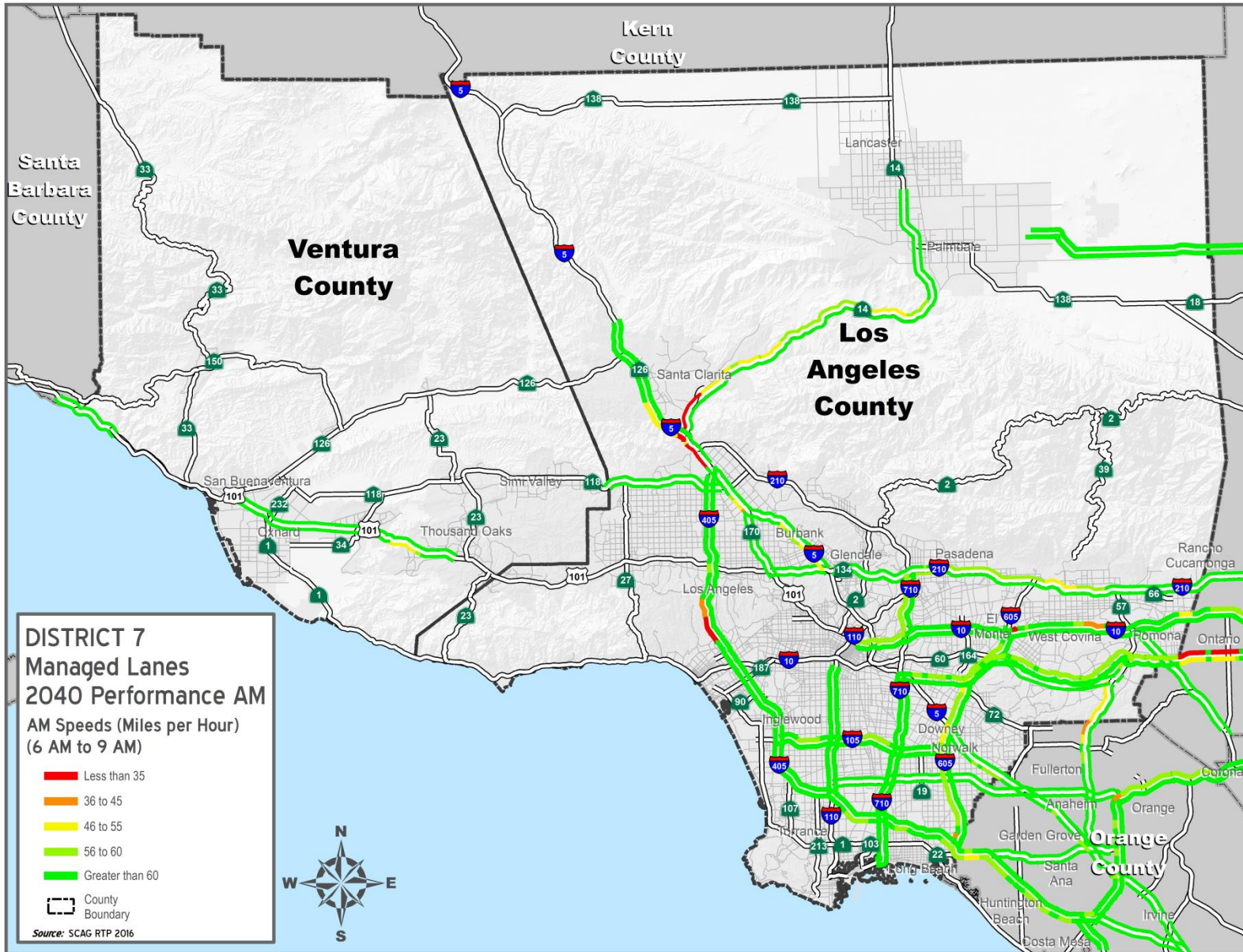


Exhibit 31: District 7 Future Managed Lanes PM Peak-Period Speeds (2040)



District 8 Managed Lanes

District 8 serves two counties in the Inland Empire of Southern California: Riverside and San Bernardino counties. Though the district covers an expansive geography (from the greater Los Angeles Basin to the Nevada and Arizona state lines), all of the district's managed lanes lie in the western portion of the region, west of the San Jacinto and Santa Rosa mountain ranges.

Exhibit 32 is a map showing the District 8 managed lane system. Caltrans currently maintains just under 214 lane miles of HOV2+ and a relatively short 2.8 miles of priced managed lanes on SR-91 in Riverside County that are a continuation of the SR-91 express lanes in Orange County. These are summarized in the first table in Exhibit 33.

Evolution of the District 8 Managed Lane System

The table in Exhibit 33 also shows the future evolution of that system in the year 2040, while Exhibit 34 is a map that shows the future system configuration.

By 2040, the district is expected to add an additional 469 managed lane miles to the system, bringing the total to more than 684 lane miles. This represents the largest expansion of managed facilities in the state.

In the future, the network will also have more than 404 lane miles of priced managed lanes by constructing new facilities or converting existing HOV2+ lanes. In addition to the short stretch of express lanes on SR-91, priced lanes are planned for I-10 and I-15.

District 8 Managed Lane Priorities

There are several District 8 express lane strategic expansion projects programmed for completion in the SCAG Federal Transportation Improvement Program (FTIP) in the coming years, including:

- I-15 HOT lanes from SR-60 to Cajalco (Completion by 2020)

- I-10 Two HOT lanes in each direction from San Antonio to I-15 (Completion by 2020)

The following projects have been identified in the 2016 SCAG RTP/SCS as high-priority projects to complete the regional express lane network over the next 20 years:

- I-15 (complete dual HOT lanes along entire length) in Riverside and San Bernardino counties
- I-10 (dual express lanes for a section) in San Bernardino County from Los Angeles County Line to Ford Street
- SR-91 express lanes from the Orange/Riverside County Line to I-15, including a direct connector to I-15

There are also several HOV projects for District 8 that were recently completed or are under construction. These include:

- I-215 Bi-County project from the junction of SR-60, SR-91, and I-215 to the junction of I-10 in Riverside and San Bernardino counties (Completed)
- SR-91 project from Adams Street to the junction of SR-60, SR-91, and I-215 through the City of Riverside (Under Construction)

Performance of District 8 Managed Lane System

Exhibit 35 shows the average speeds on the District 8 managed lanes during the AM peak period in 2014 and Exhibit 36 shows the PM Peak-Period Speeds. Peak periods for these two exhibits reflect the Performance Measurement System (PeMS) pre-defined periods, which are from 5 am to 10 am and from 3 pm to 8 pm. These are different from the peak periods defined for forecast years in the regional travel demand model. Exhibit 37 shows the level of degradation on the District 8 managed lane network during the second half of 2014 (July through December). During that period, 87 lane miles were reported as degraded.

Exhibit 38 shows the forecast 2040 average speeds on the District 8 managed lanes during the AM peak period and Exhibit 39 shows the PM Peak-Period Speeds.

The SCAG travel demand model projects that segments of the I-15, SR-60, and SR-91 managed lanes will experience severe congestion in 2040 with Peak-Period Speeds dropping below 35 mph in either the AM or PM peak period. I-15 through the Cajon Pass to Victorville in the High Desert Corridor is expected to experience severe congestion during the AM peak period. SR-60 and SR-91, both between SR-71 and I-15, are also expected to experience speeds below 35 mph in 2040.

Managed Lane Pricing in District 8


As mentioned before, the implementation of priced managed lanes on SR-91 represents the first example in the state where pricing is implemented in conjunction with an occupancy increase. The district and Caltrans as a whole should carefully monitor this case study since it is being contemplated on other corridors around the state.

Exhibit 32: District 8 Existing Managed Lanes System Configuration (2016)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

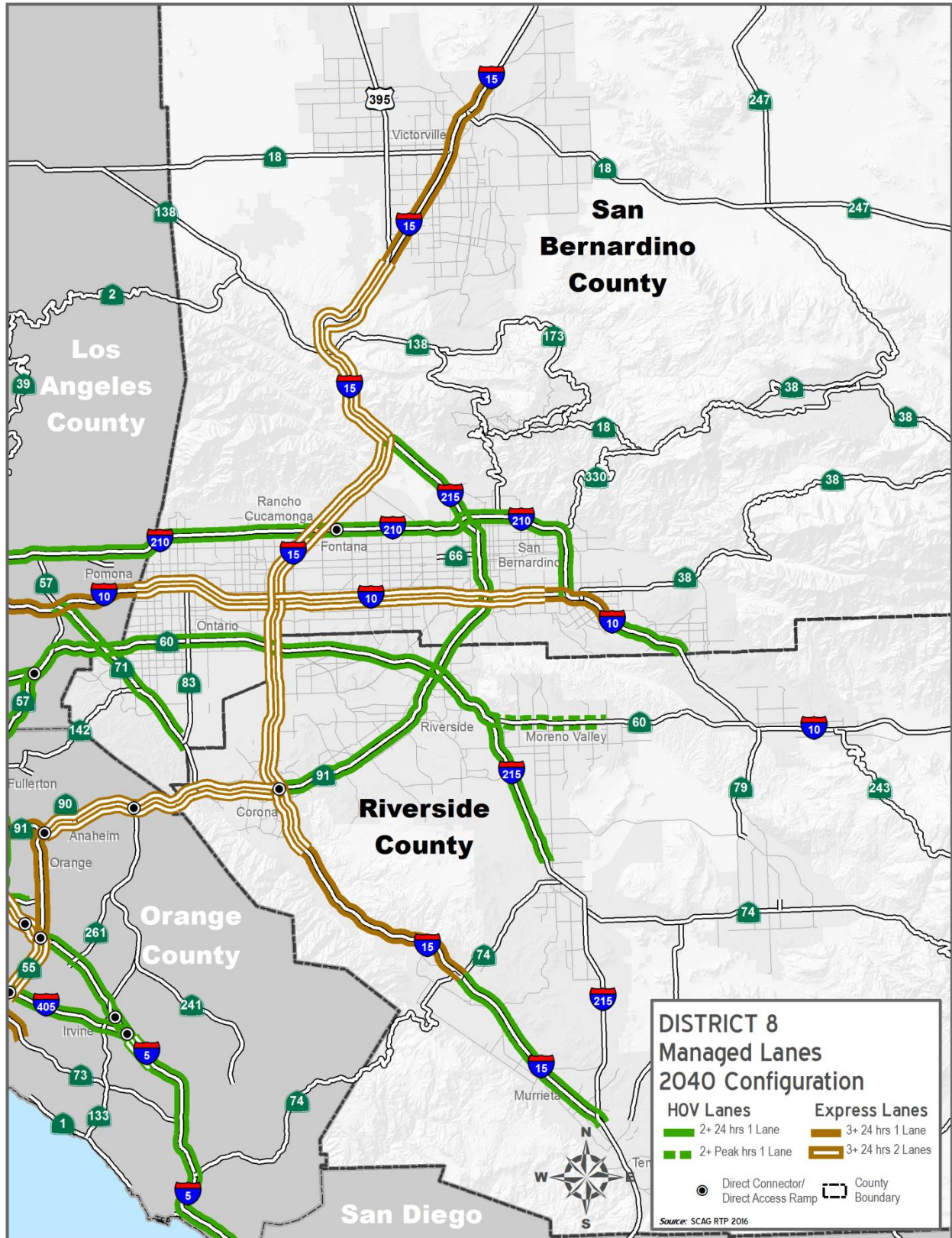
Exhibit 33: District 8 Existing and Future Lane Miles by Route by Type of Managed Lane Facility

Route	Counties Served <div><div>GREEN = Current ML</div><div>BLUE = Future ML</div></div>	2016 MANAGED LANE (ML) NETWORK (Lane Miles)									Route	2040 MANAGED LANE NETWORK (Lane Miles)							
		Total Managed Lanes	HOV2+		HOV3+		Priced Managed Lanes		Total Managed Lanes			HOV2+		HOV3+		Priced Managed Lanes			
			24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs				24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs		
I-10	San Bernardino	16.8	16.8							I-10	134.9	12.0				122.9			
I-15	San Bernardino, Riverside	0.0								I-15	279.6	28.3				251.3			
I-215	Riverside, San Bernardino	33.2	33.2							I-215	71.0	71.0							
I-210	San Bernardino	42.8	42.8							I-210	66.4	66.4							
SR-60	Riverside, San Bernardino	59.3	45.7	13.6						SR-60	59.3	45.7	13.6						
SR-71	San Bernardino	14.4	14.4							SR-71	14.4	14.4							
SR-91	Riverside	49.5	46.7					2.8		SR-91	59.2	28.9				30.3			
DISTRICT 8 TOTALS		216.0	199.6	13.6	0.0	0.0	2.8	0.0		TOTALS	684.8	266.7	13.6	0.0	0.0	404.5	0.0		

* Mileage totals may not sum due to rounding.

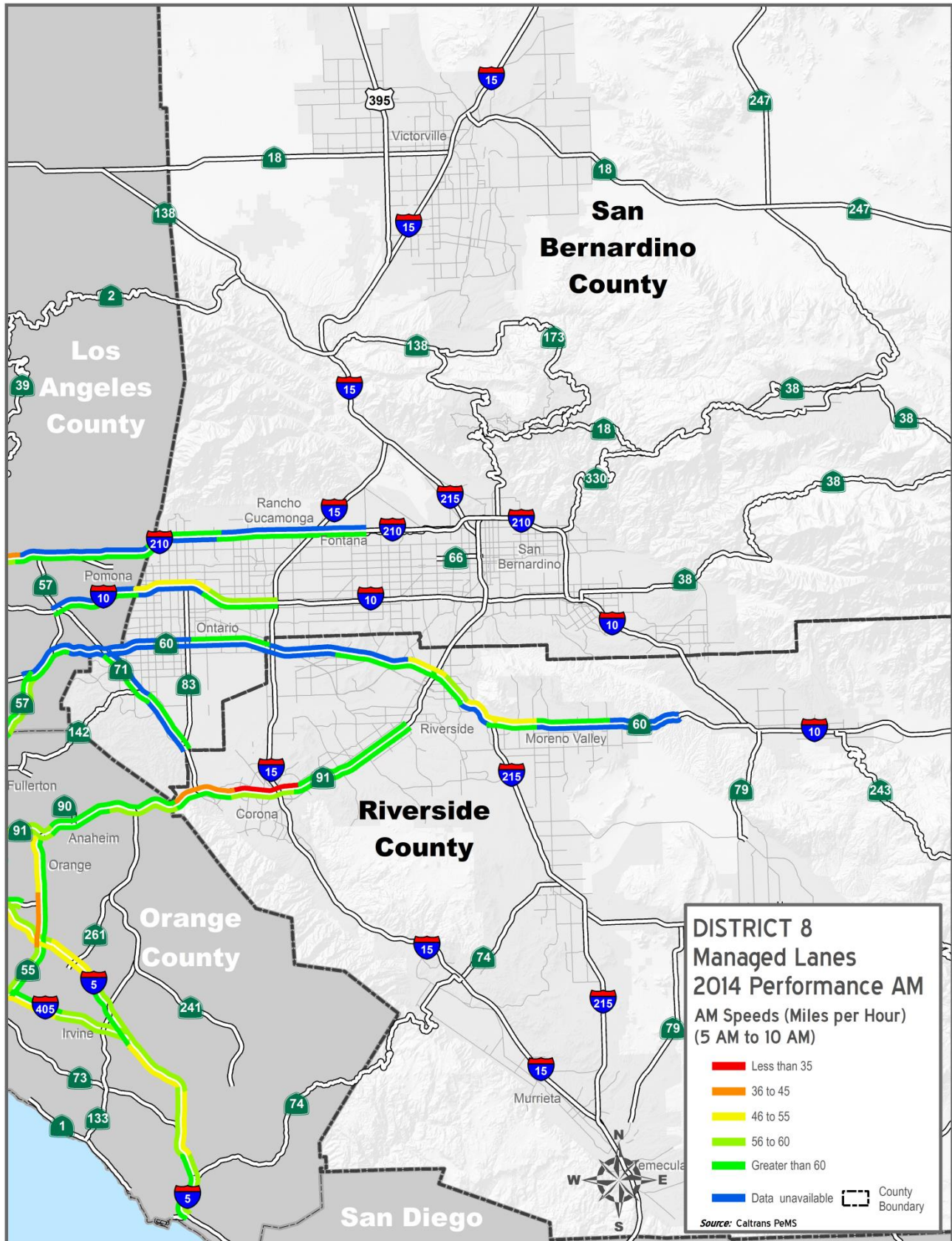
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 34: District 8 Future Managed Lanes System Configuration (2040)



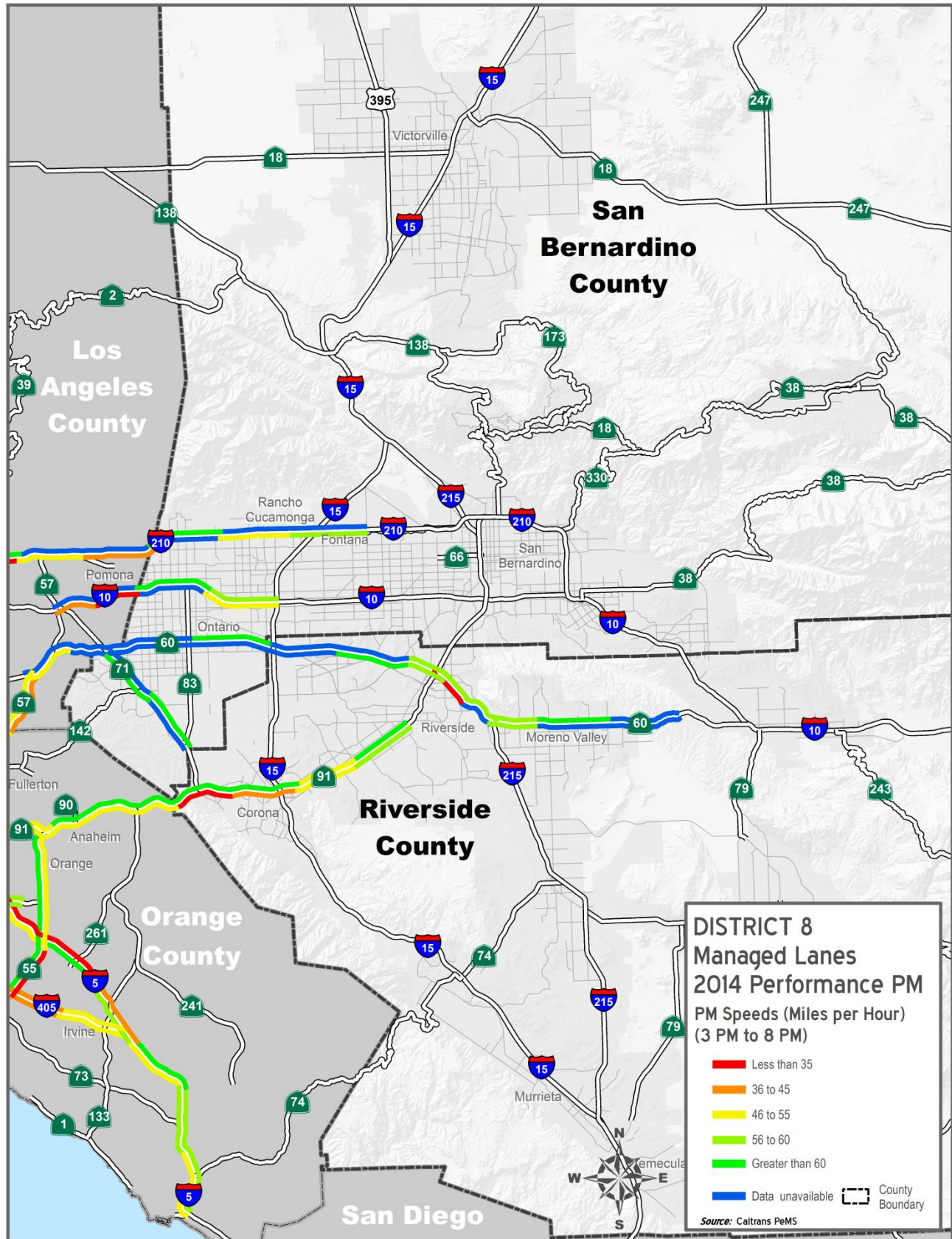
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 35: District 8 Managed Lanes AM Peak-Period Speeds (2014)



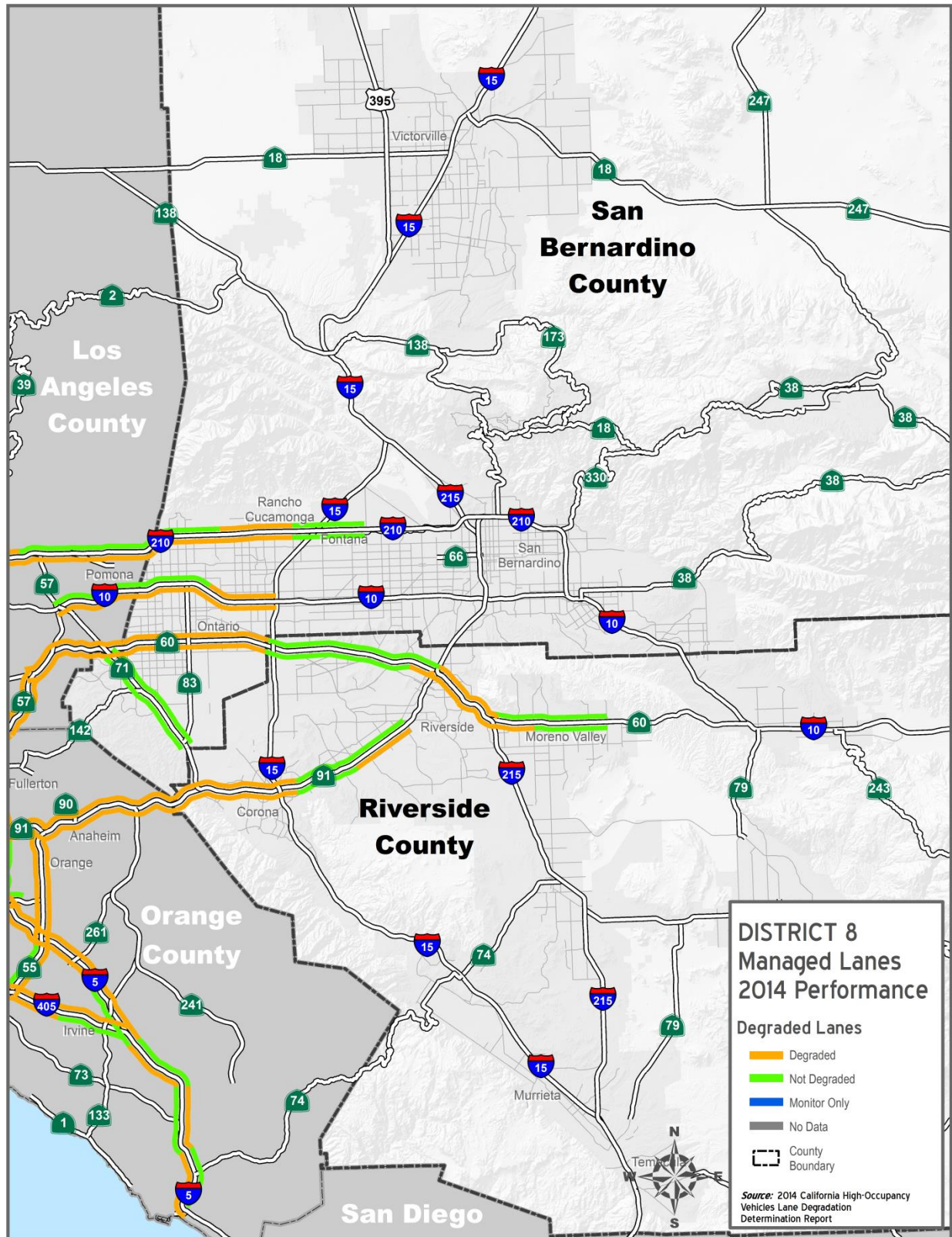
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 36: District 8 Managed Lanes PM Peak-Period Speeds (2014)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

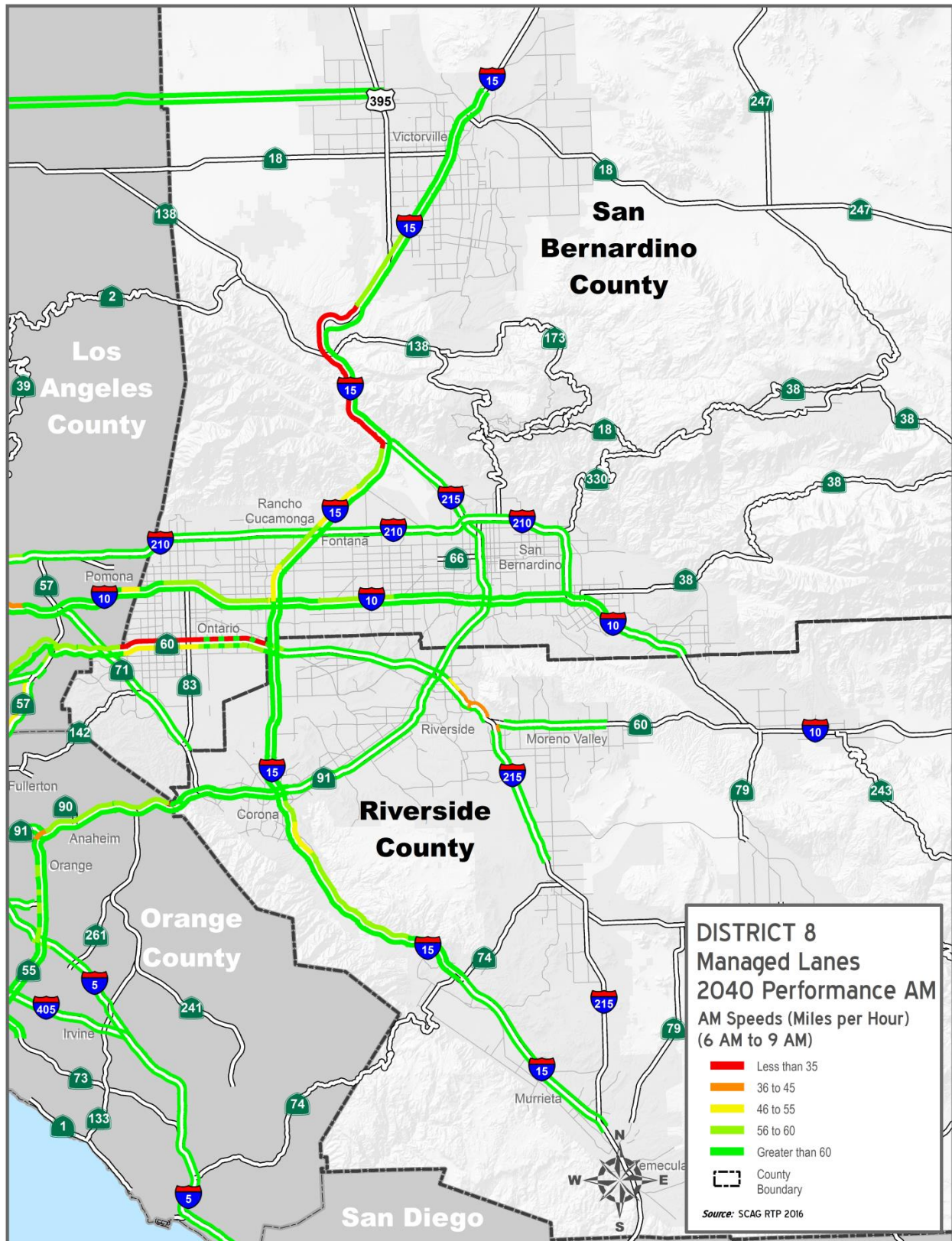
Exhibit 37: District 8 Degraded Managed Lanes (Jul-Dec 2014)



Source: 2014 California High-Occupancy Vehicle Lane Degradation Determination Report. Caltrans. September 1, 2015.
<http://www.dot.ca.gov/trafficops/tm/docs/2014-HOV-degradation-report.pdf>

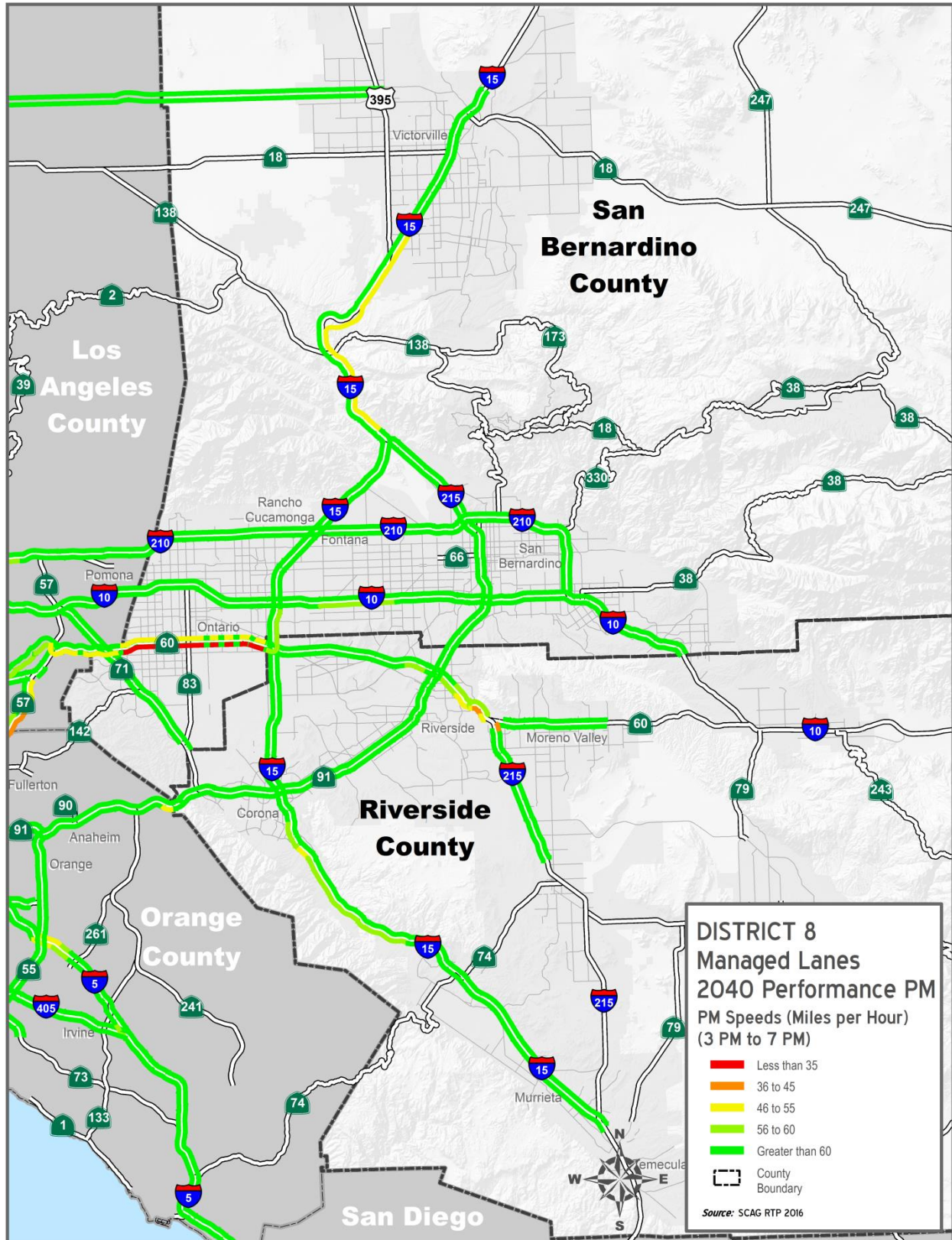
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 38: District 8 Future Managed Lanes AM Peak-Period Speeds (2040)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 39: District 8 Future Managed Lanes PM Peak-Period Speeds (2040)



District 10 Managed Lanes

The eight District 10 counties, Alpine, Amador, Calaveras, Mariposa, Merced, San Joaquin, Stanislaus, and Tuolumne, lie primarily in the agricultural Central Valley of California, but represent a geographically diverse region that extends eastward into the Sierra Nevada Mountains and west into the Southern Coast Ranges.

District 10 does not currently have any managed lanes, though the first segment of I-5 HOV2+ lanes is slated to be completed by 2016. By 2040, the district will have constructed HOV2+ lanes on I-5 through the cities of Manteca and Stockton and on I-205 from I-580 in the west connecting with the I-5 HOV lanes in the east near Lathrop.

Evolution of the District 10 Managed Lane System

The future HOV2+ system lane system will have nearly 47 lane miles on I-5 and about 29 lane miles on I-205, as summarized in the table in Exhibit 40 and shown on the map in Exhibit 41.

Performance of District 10 Managed Lane System

District 10 is completing the first HOV2+ lanes along I-5, so there is no existing degradation to report. Exhibit 42 shows the forecast 2040 average speeds on the District 10 managed lanes during the AM peak period. Exhibit 43 shows the PM Peak-Period Speeds.

The AM peak period shows severe slowing to less than 35 mph on segments of I-5 northbound through Lathrop and Stockton and on westbound I-205 just west of the I-5 interchange in Lathrop. There is little forecast slowing during the PM peak period.

Exhibit 40: District 10 Future Lane Miles by Route

Route	Counties Served (■ = Current ML ■ = Future ML)	Total Managed Lanes	2040 MANAGED LANE NETWORK (Lane Miles)					
			HOV2+		HOV3+		Priced Managed Lanes	
			24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs
I-5	San Joaquin	46.8		46.8				
I-205	San Joaquin	28.4		28.4				
DISTRICT 10 TOTALS		75.2	0.0	75.2	0.0	0.0	0.0	0.0

* Mileage totals may not sum due to rounding.

Exhibit 41: District 10 Future Managed Lanes System Configuration (2040)



Exhibit 42: District 10 Future Managed Lanes AM Peak-Period Speeds (2040)

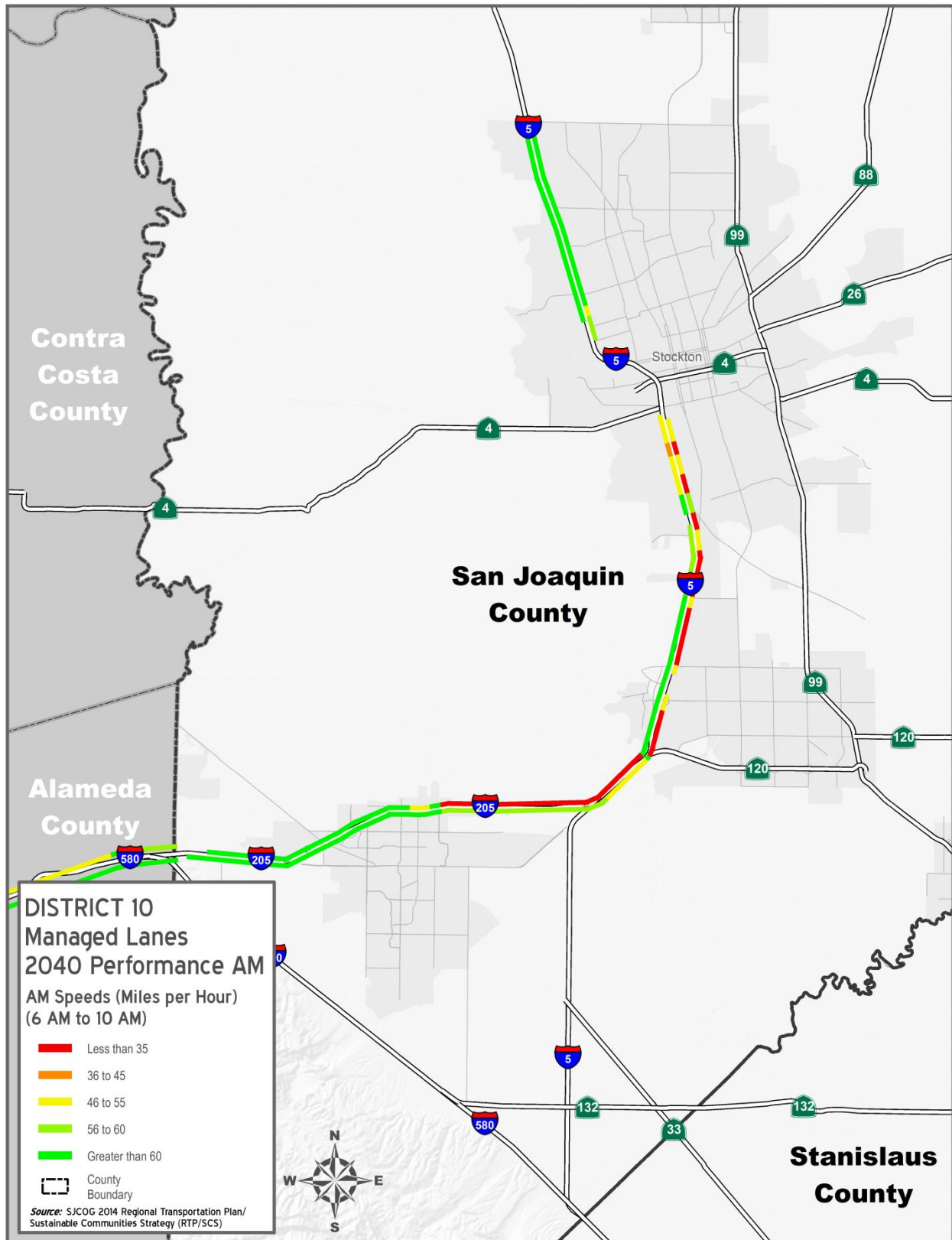
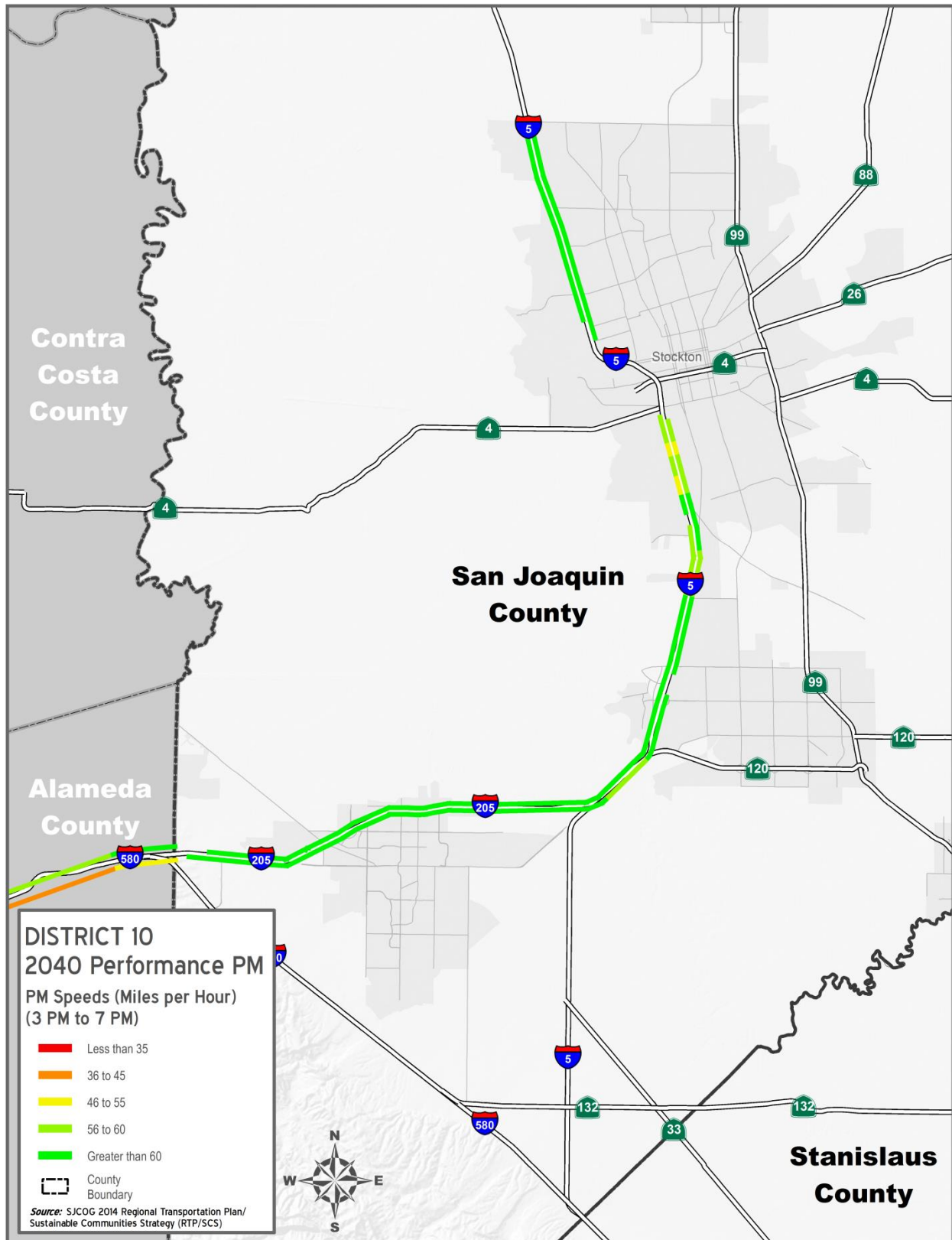


Exhibit 43: District 10 Future Managed Lanes PM Peak-Period Speeds (2040)



District 11 Managed Lanes

District 11 serves the two southernmost counties in California, San Diego and Imperial, that lie adjacent to the Mexican border. All existing and future managed lanes are located in San Diego County and are primarily located in the cities and urbanized communities near the City of San Diego.

The existing managed lanes for the district are shown on the map in Exhibit 44. District 11 currently has nearly 39 HOV2+ lane miles along I-5 and I-805, as well as nearly 81 lane miles of I-15 express lanes. The system configuration is summarized in the table in Exhibit 45.

Evolution of the District 11 Managed Lane System

The table in Exhibit 45 also shows the future evolution of that system in the year 2040. Between 2016 and 2040, the managed lane miles in District 11 will more than double from nearly 186 lane miles to just under 305 lane miles. Exhibit 46 is a map that shows the future system configuration.

Managed lanes on I-5 will expand from 13 lane miles to around 110 lane miles by 2040.

District 11 Managed Lane Priorities

There are several District 11 managed lane/HOV strategic expansion projects programmed in the SANDAG Regional Plan³ to be completed by the year 2020. These include:

- I-5 HOV from Manchester Ave to SR-78 (Completion by 2020)
- I-805 HOV/managed lanes from SR-52 to Carroll Canyon Road (Completion by 2020)

By the year 2035, there are other projects slated for completion. These include:

- I-5 managed lanes from SR-905 to SR-54, SR-54 to SR-15, La Jolla Village Drive to I-5/I-805 merge, I-5/I-805 merge to SR-56, SR-56 to Manchester Ave, Manchester Ave to SR-78, and SR-78 to I-15 (Completion by 2035)
- I-805 managed lanes from SR-54 to SR-52, SR-163 to Carroll Canyon Road, and SR-905 to Palomar Street (Multiple projects completed by 2035)
- I-15 managed lanes from SR-94 to I-805 and I-8 to SR-163 (Both completed by 2035)
- SR-78 managed lanes from I-5 to I-15 (Completion by 2035)
- SR-94 managed lanes from I-5 to I-805 (Completion by 2035)

Finally, by 2050 the following major projects have been identified in the SANDAG Plan:

- I-5 managed lanes from I-8 to La Jolla Village Drive and SR-78 to Vandergrift Blvd (Both completed by 2050)
- I-15 managed lanes from I-5 to SR-94 and Viaduct (Both completed by 2050)
- SR-52 managed lanes from I-805 to I-15 and from I-15 to SR-52 (Both completed by 2050)
- SR-54 managed lanes from I-5 to SR-125 (Completion by 2050)
- SR-94 managed lanes from I-805 to SR-125 (Completion by 2050)
- SR-125 managed lanes from SR-54 to SR-94 and SR-94 to I-8 (Both completed by 2050)
- I-805 managed lanes from SR-94 to I-15, I-15 to SR-163, and SR-163 to SR-52 (Multiple projects completed by 2035)

Performance of District 11 Managed Lane System

Exhibit 47 shows the average speeds on the District 11 managed lanes during the AM peak period in 2014 and Exhibit 48 shows the PM Peak-Period Speeds. Exhibit 49 shows the level of degradation on the District 11 managed lane network during the second half of 2014 (July through

³ http://www.sdfoward.com/pdfs/RP_final/The%20Plan%20-%20combined.pdf

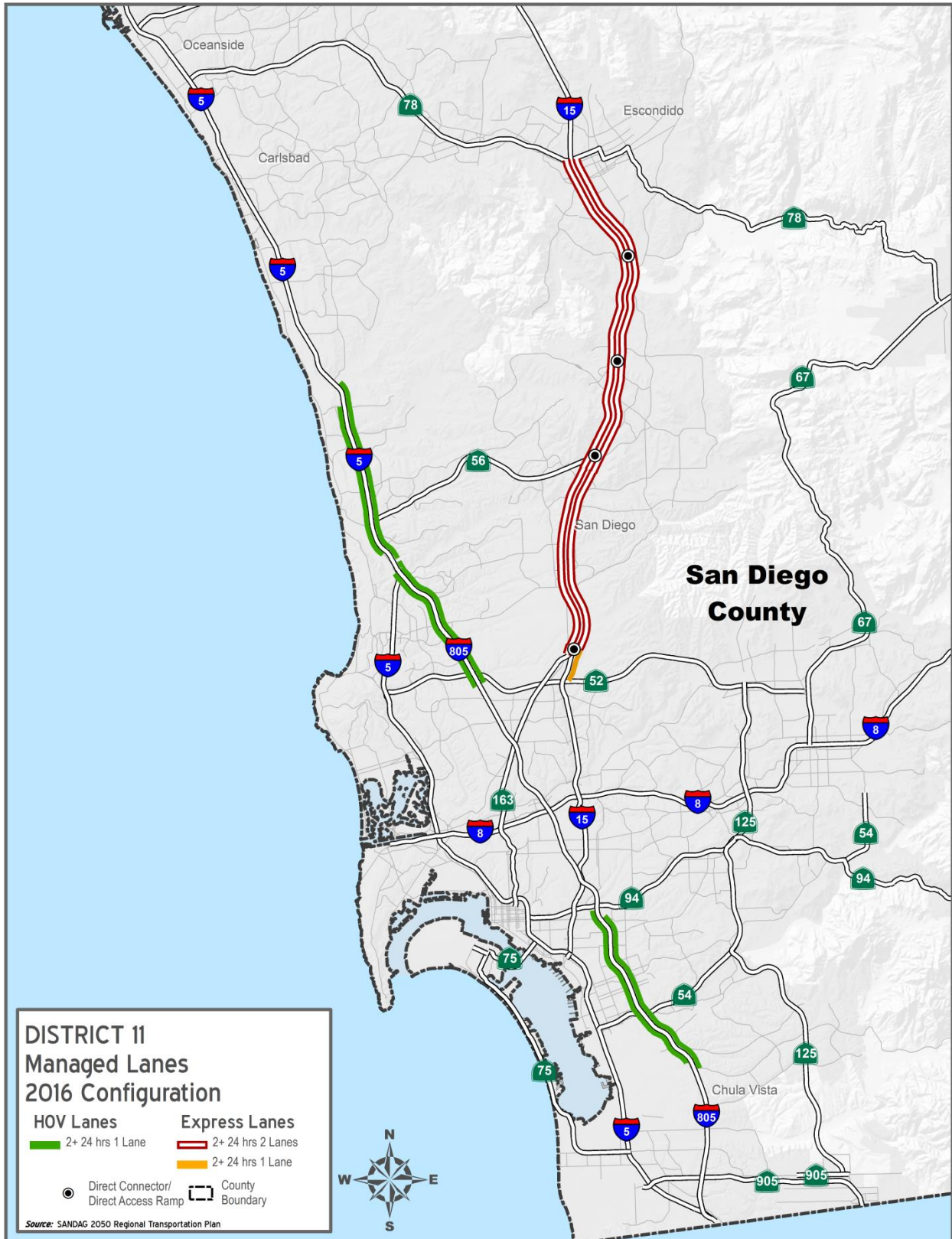
December). During that period, 16 lane miles were reported as degraded.

Exhibit 50 shows the forecast 2040 average speeds on the District 11 managed lanes during the AM peak period and Exhibit 51 shows the PM Peak-Period Speeds.

The SANDAG travel demand model reports severe congestion on the I-805 HOV lanes during the AM peak period just north of the SR-52 interchange. There is also moderate slowing below 45 mph along other segments of I-805.

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 44: District 11 Existing Managed Lanes System Configuration (2016)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

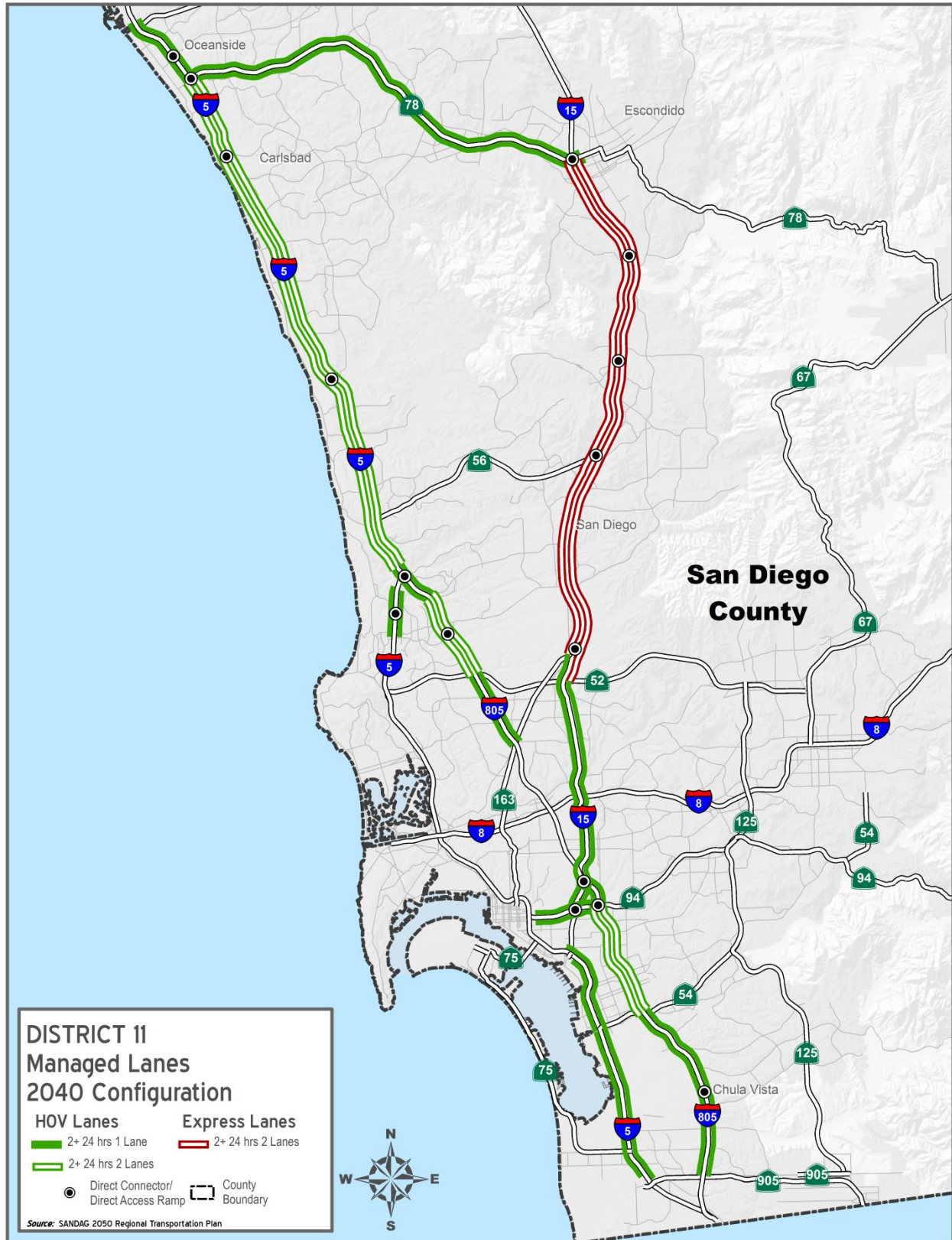
Exhibit 45: District 11 Existing and Future Lane Miles by Route by Type of Managed Lane Facility

Route	Counties Served (GREEN = Current ML BLUE = Future ML)	2016 MANAGED LANE (ML) NETWORK (Lane Miles)								Route	2040 MANAGED LANE NETWORK (Lane Miles)						
		Total Managed Lanes	HOV2+		HOV3+		Priced Managed Lanes				Total Managed Lanes	HOV2+		HOV3+		Priced Managed Lanes	
			24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs				24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs
I-5	San Diego	13.0	13.0							I-5	109.4	109.4					
I-15	San Diego	80.2						80.2		I-15	98.8	18.6				80.2	
I-805	San Diego	25.5	25.5							I-805	58.1	58.1					
SR-78	San Diego	0.0								SR-78	33.9	33.9					
SR-94	San Diego	0.0								SR-94	4.4	4.4					
DISTRICT 11 TOTALS		118.7	38.5	0.0	0.0	0.0	80.2	0.0		TOTALS	304.6	224.4	0.0	0.0	0.0	80.2	0.0

* Mileage totals may not sum due to rounding.

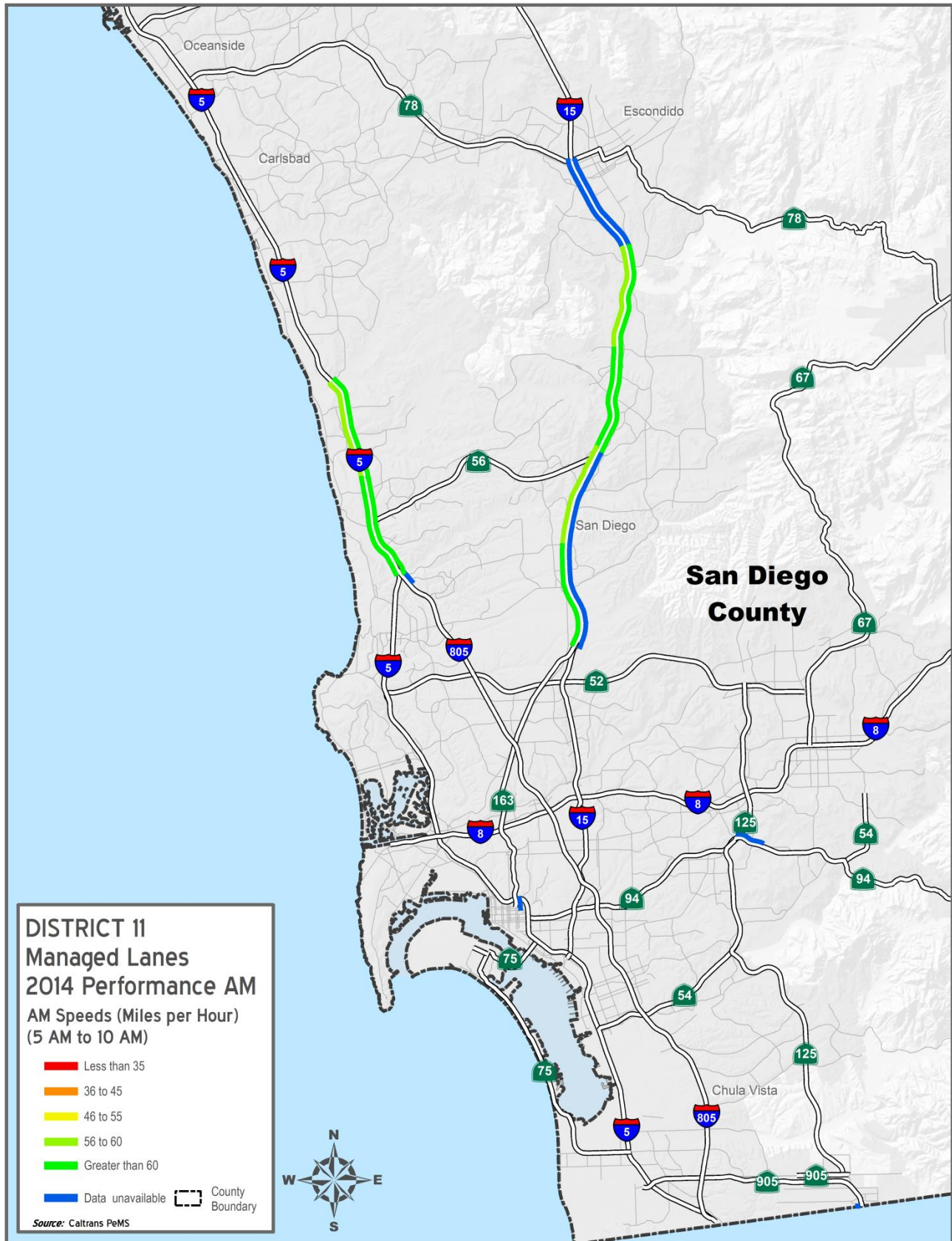
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 46: District 11 Future Managed Lanes System Configuration (2040)



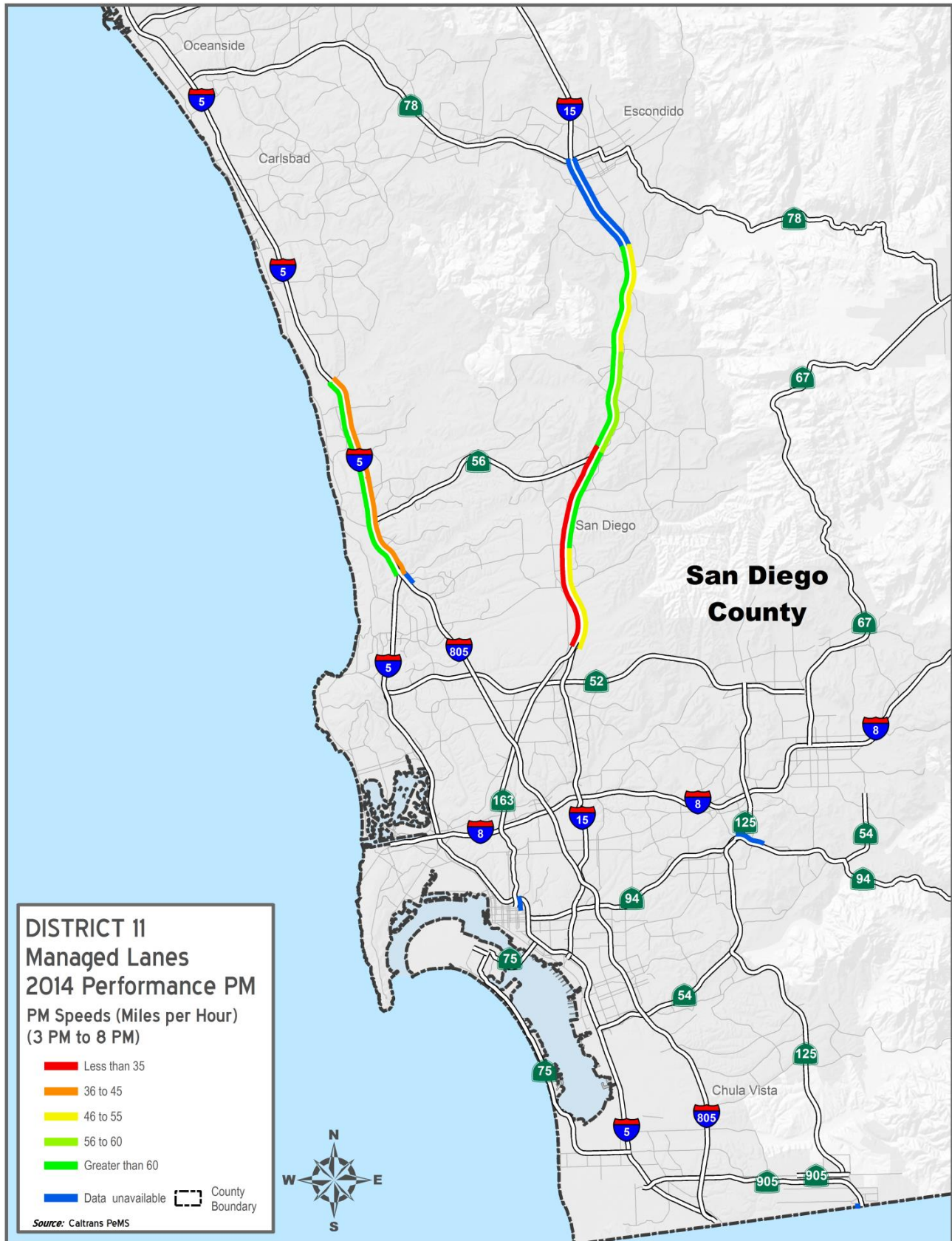
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 47: District 11 Managed Lanes AM Peak-Period Speeds (2014)



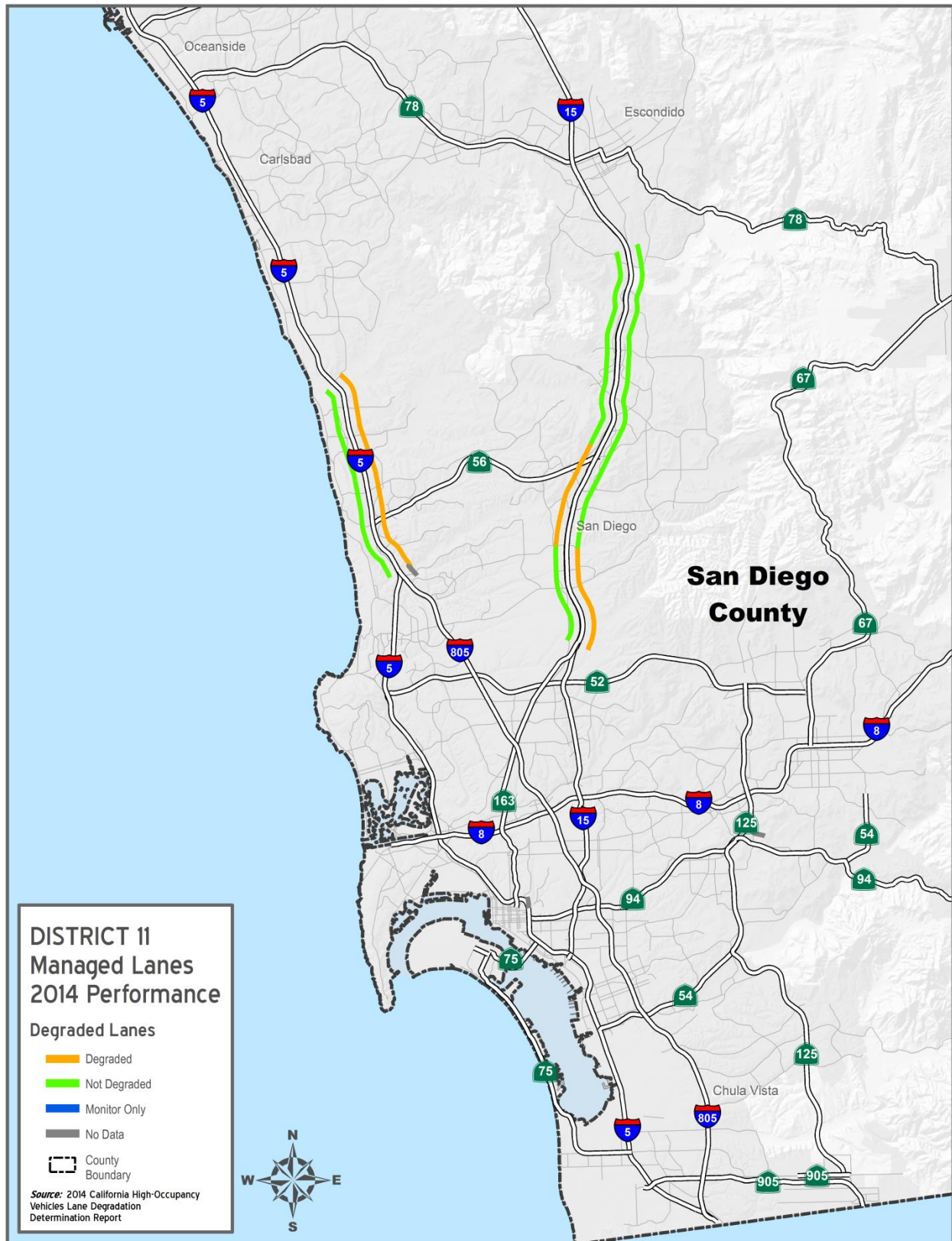
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 48: District 11 Managed Lanes PM Peak-Period Speeds (2014)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

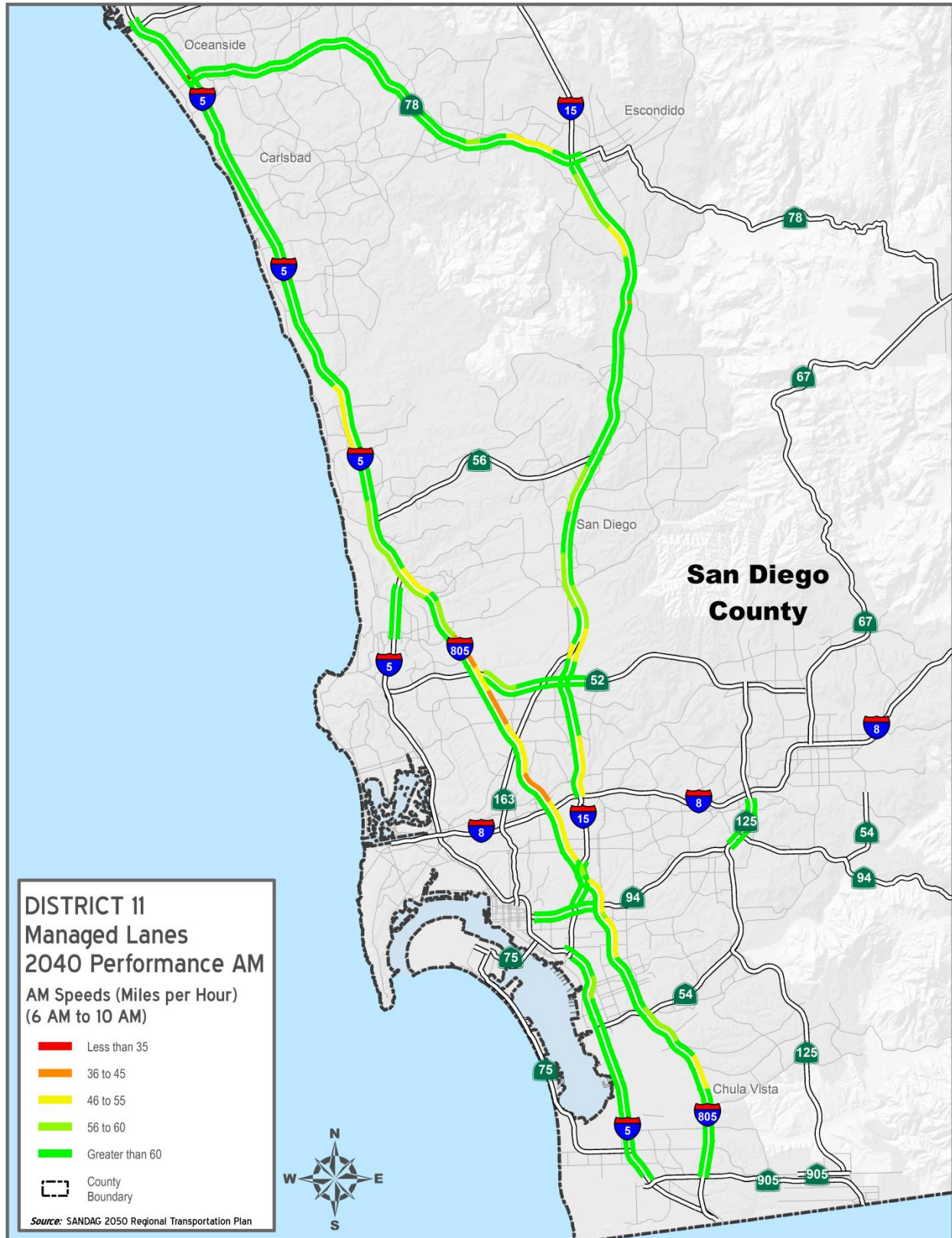
Exhibit 49: District 11 Degraded Managed Lanes (Jul-Dec 2014)



Source: 2014 California High-Occupancy Vehicle Lane Degradation Determination Report. Caltrans. September 1, 2015.
<http://www.dot.ca.gov/trafficops/tm/docs/2014-HOV-degradation-report.pdf>

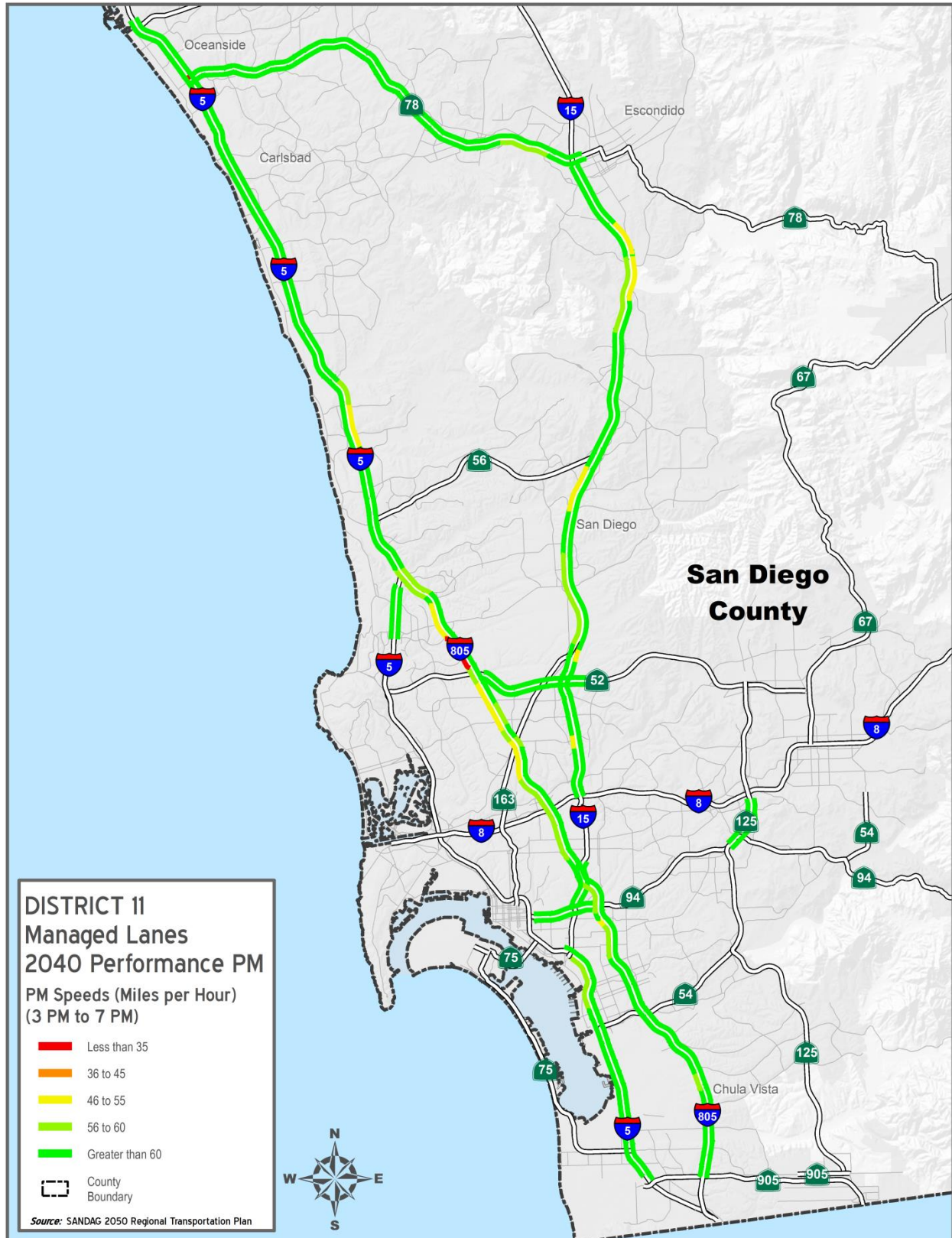
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 50: District 11 Future Managed Lanes AM Peak-Period Speeds (2040)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 51: District 11 Future Managed Lanes PM Peak-Period Speeds (2040)



District 12 Managed Lanes

Introduction

District 12 represents one county, which is Orange, in Southern California. District 12 currently has just approximately 228 miles of HOV2+ lanes and 40.2 miles of express lanes on SR-91. District 12 is unique in the state since it conducted two separate studies to develop a plan and priorities for expanding and adding pricing to the current system.

The Managed Lanes Feasibility Study (MLFS) evaluated the costs of implementing various managed lanes strategies and resulted in a most likely plan to be implemented over the next 15 years, as well as a more visionary plan for the district.

The Managed Lanes Network Study (MLNS) was conducted as a companion to the MLFS, adding a wide range of screening criteria, including comprehensive traffic analysis, and resulted in a set of recommended corridors to prioritize in the next phase of the project development process. The study evaluated pricing on all corridors and led to a larger set of priorities beyond the 2016 SCAG RTP and the related SCAG Express Travel Choices Study.

Note that both studies are specific to managed lanes in Orange County. They are different from the SCAG Express Travel Choices Study, which examined express lanes throughout the SCAG region (Ventura, Los Angeles, Orange, Riverside, San Bernardino, and Imperial counties) with a focus on regional connectivity. Exhibit 52 illustrates the connection between the District 12 studies in relation to other relevant planning efforts. Exhibit 53 illustrates the contents and overlaps among the different studies.

Note, however, that the MLNS is still a draft document and that some numbers may change before it is finalized.

Exhibit 52: Relevant Recent Studies (State, Regional, and District 12)

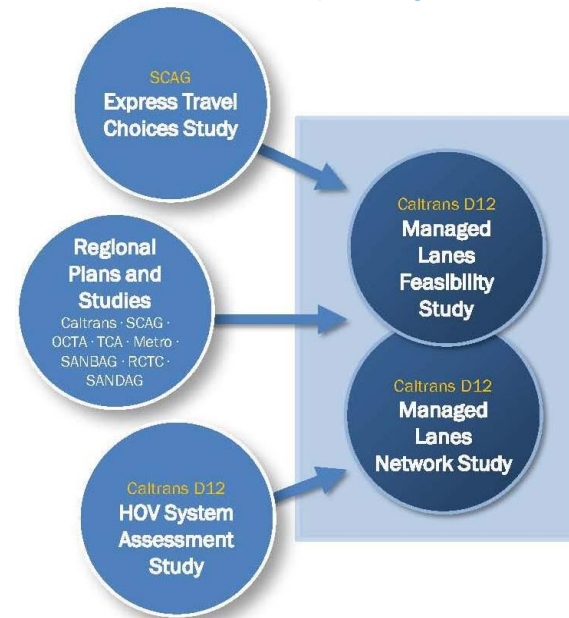
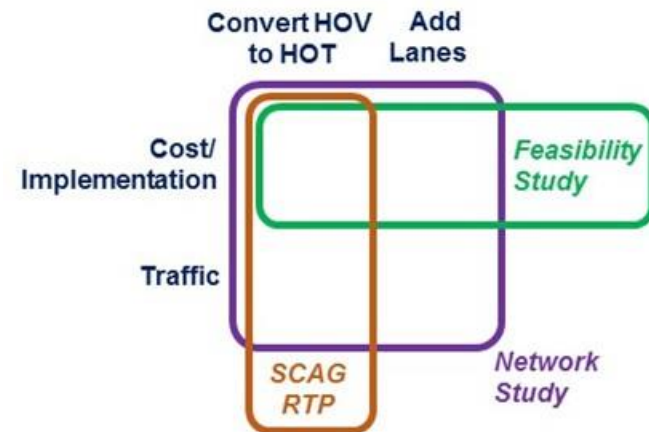


Exhibit 53: Contents and Overlaps among Managed Lane Studies



Current Configuration

The existing configuration of managed lanes in District 12 is shown on the map in Exhibit 54.

Evolution of the District 12 Managed Lane System

Exhibit 55 summarizes the current managed lane system and the most likely plan. Exhibit 56 presents a map to show the future system configuration and is based on the MLFS.

Under the most likely plan, Orange County will add more than 80 lane miles of managed lanes and convert most of them into express (HOT) lanes. All of these are subject to further studies, required for implementation, and funding availability.

District 12 Managed Lane Priorities

Several District 12 managed lanes strategic expansion projects are programmed in the FTIP for completion in the coming years, including:

- I-5 HOV lane from south of Avenida Pico to south of Avenida Vista Hermosa (Completion by 2017)
- I-405 (adding capacity and implementing dual express lanes for a section) from Orange/Los Angeles County Line to SR-73

The following projects have been identified in the MLFS and MLNS as high-priority projects:

- SR-73 add HOV lane from I-405 to MacArthur Boulevard by 2023 (per Orange County Transportation Authority)
- Convert Single HOV lane to single priced managed lane (from MLFS):

- I-405 from SR-55 to SR-73
 - SR-55 from I-5 to SR-91
 - SR-91 from I-5 to SR-55
- Convert Dual HOV lanes to dual priced managed lanes:
 - I-5 from SR-55 to SR22/SR57
 - SR-55 from I-405 to I-5
- Add single express (HOT) lane:
 - SR-73 from Bison Avenue to I-405
- Add one lane to single HOV lane, and convert to dual express (HOT) lanes:
 - I-5 from SR-22/SR-57 to SR-91

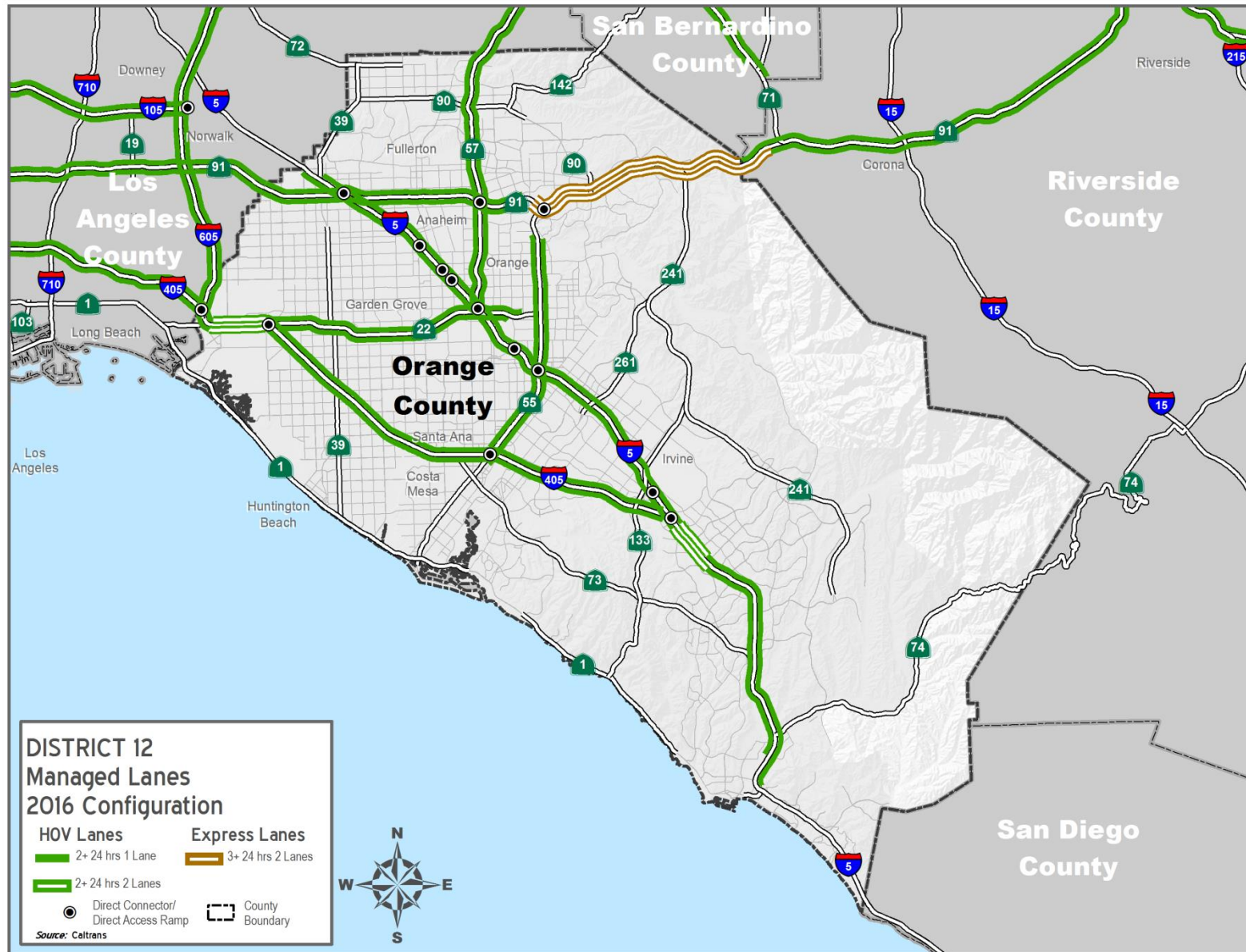
Performance of District 12 Managed Lane System

Exhibit 57 shows the average speeds on the District 12 managed lanes during the AM peak period in 2014 and Exhibit 58 shows the PM Peak-Period Speeds. Peak periods for these two exhibits reflect the Performance Measurement System (PeMS) pre-defined periods, which are from 5 am to 10 am and from 3 pm to 8 pm. These are different from the peak periods defined for forecast years in the regional travel demand model. Exhibit 59 shows the level of degradation on the District 12 managed lane network during the second half of 2014 (July through December). During that period, 146 lane miles were reported as degraded.

Exhibit 60 shows the forecast 2040 average speeds on the District 12 managed lanes during the AM peak period. Exhibit 61 shows the PM Peak-Period Speeds. Both maps were developed using the speeds from the MLNS traffic modeling efforts. By 2040, it is expected that mobility be improved, degradation addressed and greater options be provided for a more reliable trip.

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 54: District 12 Existing Managed Lanes System Configuration (2016)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 55: District 12 Existing and Future Lane Miles by Route by Type of Managed Lane Facility based on Most Likely Plan

Route	Counties Served (GREEN=Current ML BLUE=Future ML)	2016 MANAGED LANE (ML) NETWORK (Lane Miles)									Route	2040 MANAGED LANE NETWORK (Lane Miles)							
		Total Managed Lanes	HOV 2+		HOV 3+		Priced Managed Lanes		Total Managed Lanes			HOV 2+		HOV 3+		Priced Managed Lanes			
			24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs				24 Hrs	Pk Hrs	24 Hrs	Pk Hrs	24 Hrs	Pk Hrs		
I-5	Orange	77.3	77.3							I-5	116.6	69.2				47.4			
I-405	Orange	55.3	55.3							I-405	75.0	17.2				57.8			
I-605	Orange	3.3	3.3							I-605	3.3					3.3			
SR-22	Orange	23.0	23.0							SR-22	23.0	23.0							
SR-55	Orange	21.0	21.0							SR-55	32.8					32.8			
SR-57	Orange	24.2	24.2							SR-57	24.2	24.2							
SR-73	Orange	0.0	Not Constructed							SR-73	8.8					8.8			
SR-91	Orange	63.8	23.6					40.2		SR-91	64.3	7.4				56.9			
DISTRICT 12 TOTALS		267.9	227.7	0.0	0.0	0.0	40.2	0.0		TOTALS	348.0	141.0	0.0	0.0	0.0	207.0	0.0		

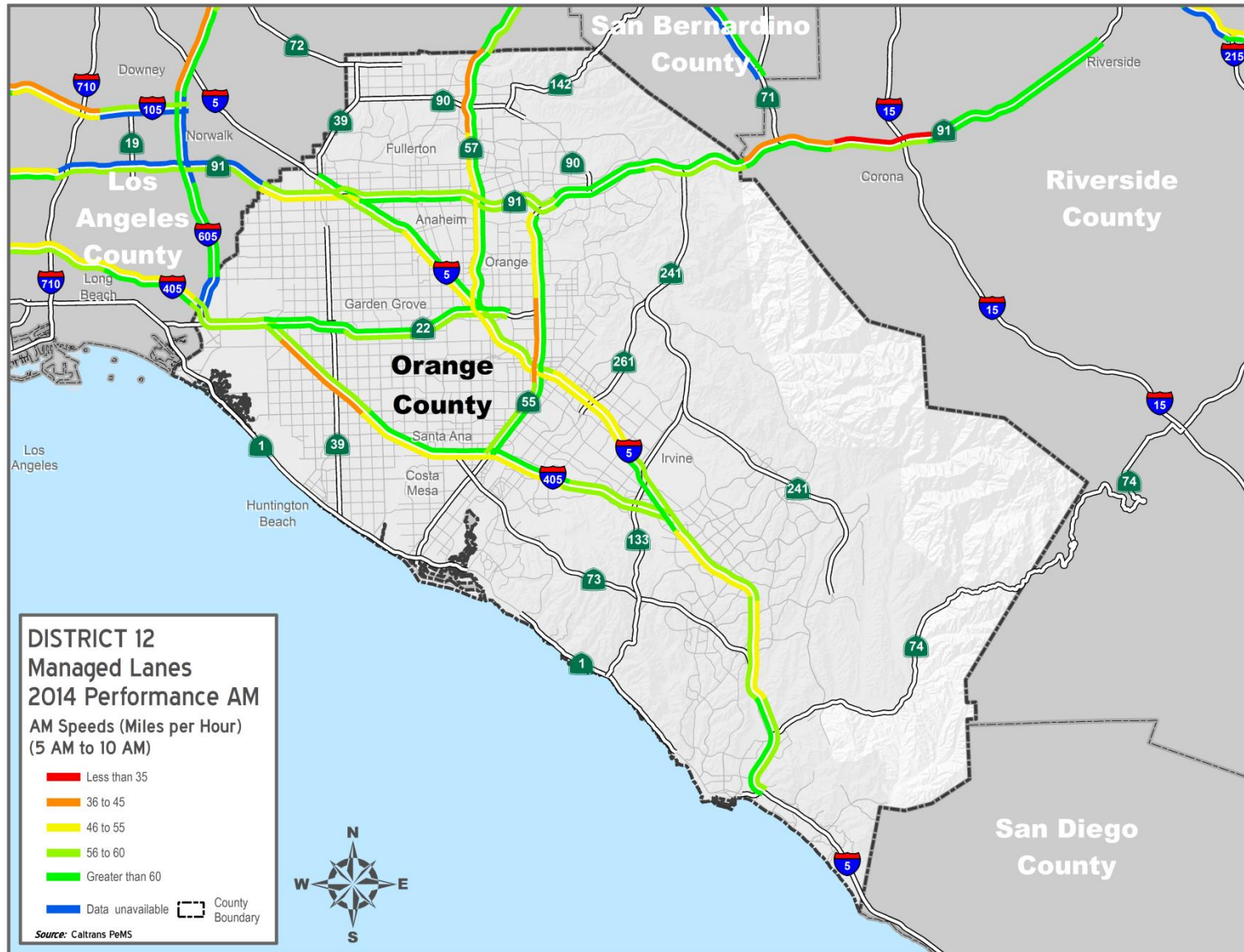
* Mileage totals may not sum due to rounding.

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 56: District 12 Future Managed Lanes System Configuration Most Likely Plan (2040)

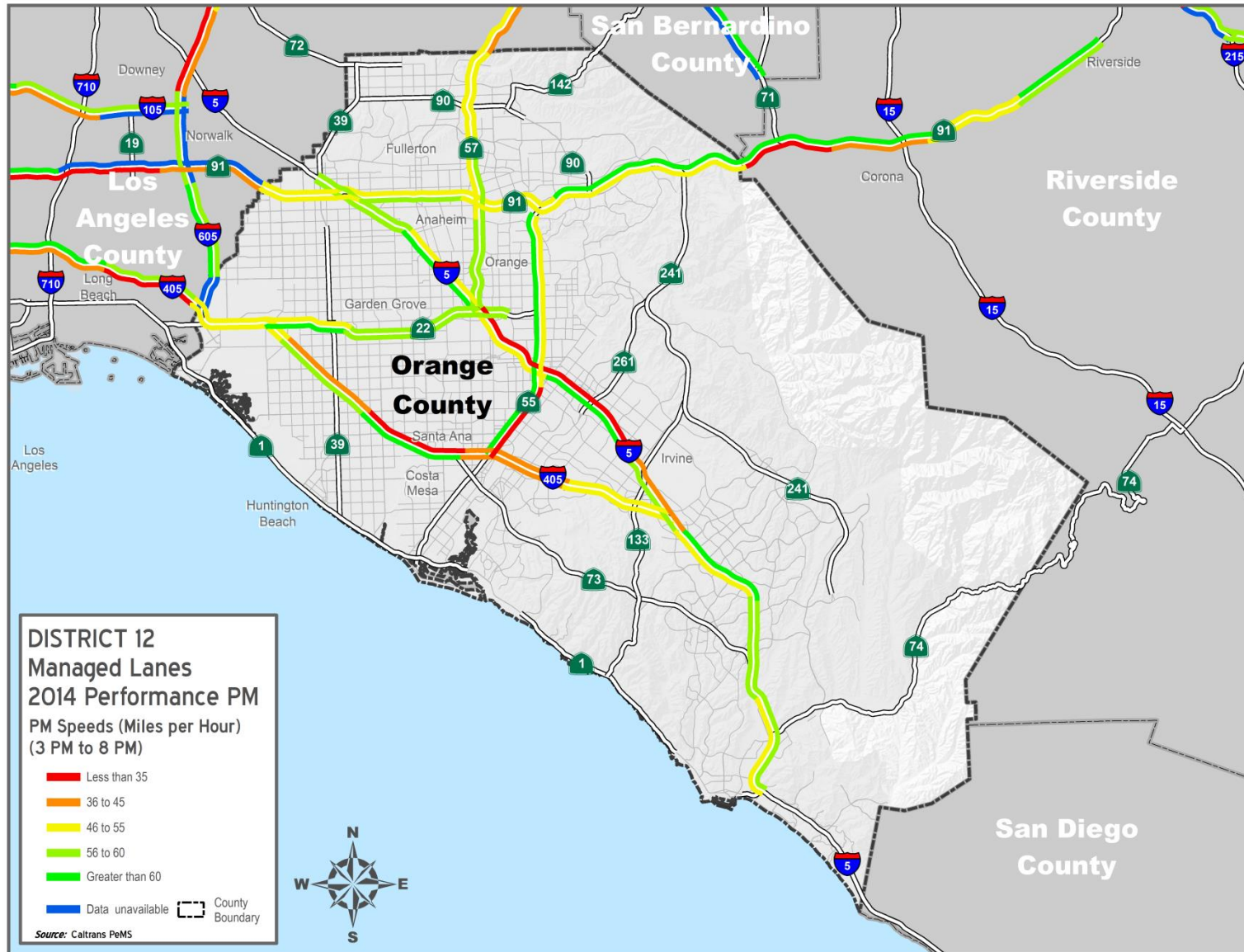


Exhibit 57: District 12 Managed Lanes AM Peak-Period Speeds (2014)



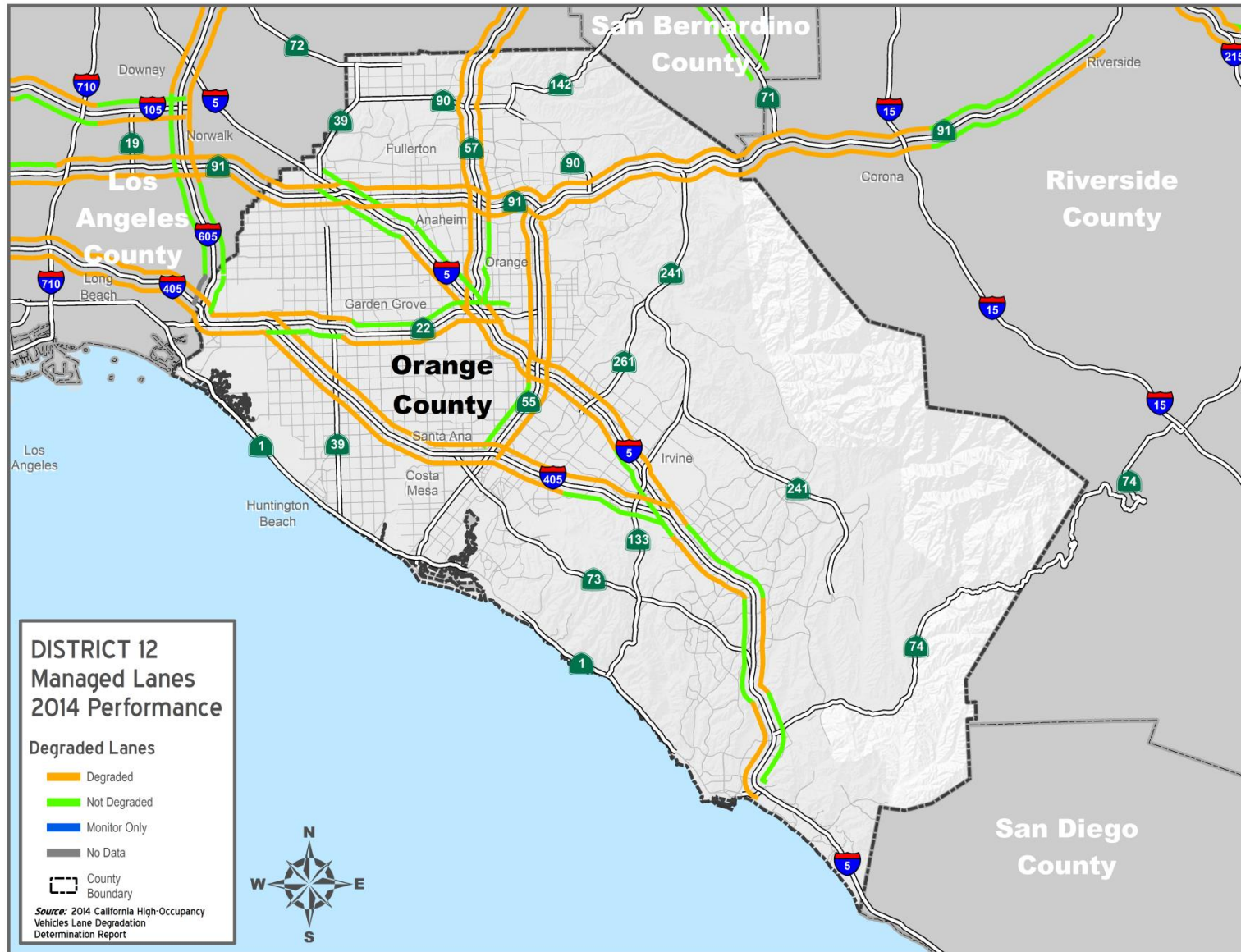
SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 58: District 12 Managed Lanes PM Peak-Period Speeds (2014)



SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 59: District 12 Degraded Managed Lanes (Jul-Dec 2014)



Source: 2014 California High-Occupancy Vehicle Lane Degradation Determination Report. Caltrans. September 2015.
<http://www.dot.ca.gov/trafficops/tm/docs/2014-HOV-degradation-report.pdf>

SYSTEM PLAN FOR MANAGED LANES ON CALIFORNIA STATE HIGHWAYS

Exhibit 60: District 12 Future Managed Lanes AM Peak-Period Speeds (2040)

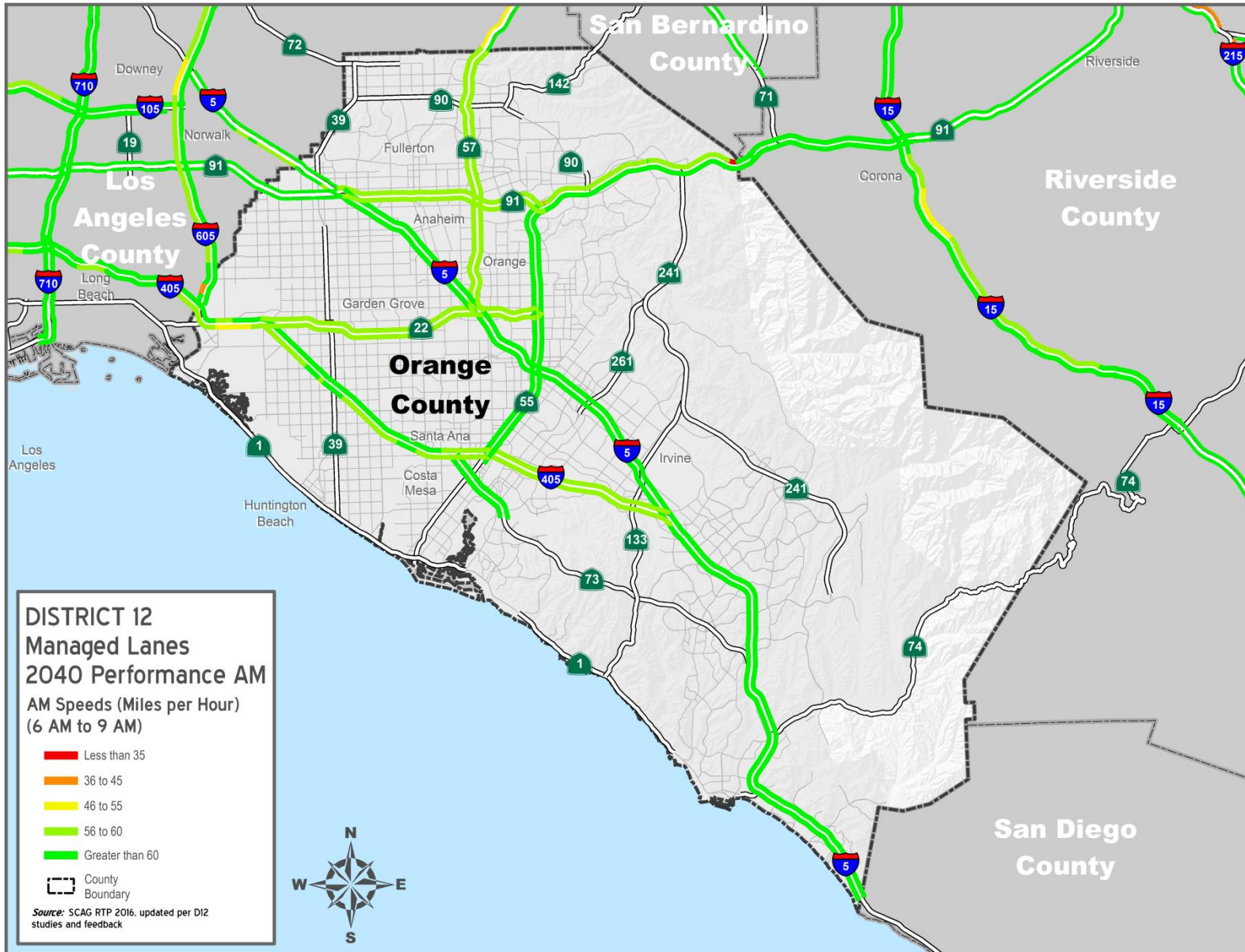


Exhibit 61: District 12 Future Managed Lanes PM Peak-Period Speeds (2040)



List of Acronyms

BRT.....	Bus Rapid Transit
HOT	High-Occupancy Toll Lanes or Express Lanes
HOV.....	High-Occupancy Vehicle
HOV2+.....	High-Occupancy Vehicle lane system is operated with an occupancy requirement of two or more people per vehicle
HOV3+.....	High-Occupancy Vehicle lane system is operated with an occupancy requirement of three or more people per vehicle
I-.....	Interstate
ML.....	Managed Lane: High-Occupancy Vehicle or High-Occupancy Toll/Express Lanes
MPOs	Metropolitan Planning Organizations
MTC	Bay Area Metropolitan Transportation Commission
OCTA.....	Orange County Transportation Authority
PeMS.....	Performance Measurement System
RTP/SCS	Regional Transportation Plans/Sustainable Community Strategy
SACOG.....	Sacramento Area Council of Governments
SANDAG	San Diego Association of Governments
SBCAG	Santa Barbara County Association of Governments
SCAG	Southern California Association of Governments
SHS.....	State Highway System
SJCOG.....	San Joaquin Council of Governments
SR-.....	California State Route
US.....	United States Numbered Routes