2024 California High-Occupancy Vehicle Facilities Degradation Report

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Division of Traffic Operations

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Section 1 Overview

As required by Title 23 of the United States Code, Section 166 (23 U.S.C. § 166), the California Department of Transportation (Caltrans) has prepared the 2024 California High Occupancy Vehicle Facilities Degradation Report. This is the annual report on the performance of the high occupancy vehicle (HOV) facilities on the State Highway System (SHS) in California.

Section 2 High-Occupancy Vehicles in California

In 2024, there were approximately 1,509 lane-miles of HOV lanes and about 565 lane-miles of high occupancy toll (HOT) lanes on the SHS. HOV facilities are in Caltrans District 3 (Sacramento, El Dorado, Placer Counties), District 4 (Alameda, Contra Costa, Marin, San Francisco, Santa Clara, Solano, and Sonoma Counties), District 5 (Santa Barbara County), District 7 (Los Angeles and Ventura Counties), District 8 (San Bernardino and Riverside Counties), District 10 (San Joaquin County), District 11 (San Diego County), and District 12 (Orange County). HOT facilities are in Districts 4, 7, 8, 11, and 12. A complete list of all the HOV and HOT lanes on the SHS may be found in Attachment A.

There was one change to the State's HOV facilities in 2024. The northbound (NB) and southbound (SB) US-101 HOV lanes in San Luis Obispo County were extended north by approximately three miles from Santa Monica Creek to the Prado Lane Interchange. This extension was opened to traffic in December 2024.

Two pilot projects are ongoing in San Francisco County in which general-purpose lanes are converted into HOV lanes on local state roads with low-speed limits and signalized intersections. Due to the experimental nature of these HOV lanes and the signalized intersections which require traffic to come to a stop, these HOV facilities cannot meet the minimum average operating speed requirements under Subsection (d) of 23 U.S.C. § 166 and were not deemed suitable for performance reporting. The descriptions of the two pilot projects are below:

- In September 2021, a conversion project was completed to convert two lane-miles on both NB and SB US-101 in San Francisco County from a general-purpose lane into an HOV lane. The posted speed limit is 25 miles per hour (mph). The converted stretch spans from Franklin St. to Lyon St. and is designed to accommodate vehicles with a minimum of two occupants.
- Approximately three lane-miles of the HOV Facilities on NB and SB SR-1 were opened from North of Crossover Drive to North of Lake Street in San Francisco County in April 2022. The pilot project converted a general-purpose lane into an HOV lane. The posted speed limit is 35 mph. The lanes are restricted to vehicles with two or more occupants.

Section 3 Exempt Vehicle Access on High-Occupancy Vehicles in California

Title 23 U.S.C. § 166 includes a provision for states to allow inherently low-emission vehicles (ILEVs), certain gasoline/electric plug-in hybrid vehicles, and toll-paying vehicles to use HOV facilities without meeting occupancy requirements.

States that allow these exempted vehicles to access these facilities must monitor and report the performance of those facilities.

California allows certain ILEVs and plug-in hybrid electric vehicles displaying valid Clean Air Vehicle (CAV) decals to access HOV facilities without meeting occupancy requirements. California also allows toll-paying vehicles not meeting occupancy requirements to access certain HOV facilities, known as HOT lanes.

Topic 1 Clean Air Vehicle Access

California's CAV decal program was first established in 2004. It is managed by the California Department of Motor Vehicles (DMV) in partnership with the California Air Resources Board (CARB). CARB establishes the official list of eligible vehicles based on specified emissions standards. The program was established by the California State Legislature to promote the purchase and lease of clean-air vehicles and has been amended over the years to allow more drivers to participate, incorporate vehicles with the newest technologies, and retire other vehicle technologies that had become commonplace. Each year, a different colored decal is issued to qualifying vehicles, with its own expiration dates and the decals cannot be renewed. In 2024, there were four different colored decals in use:

- Vehicles that registered in 2021 received a blue decal that is valid through January 1, 2025.
- Vehicles that registered in 2022 received a yellow decal that is valid through September 30, 2025.
- Vehicles that registered in 2023 received a green decal that is valid through September 30, 2025.
- Vehicles that registered after November 2023 received a red decal that is valid through September 30, 2025.

As of December 31, 2024, there were 528,137 vehicles registered with a decal. Most of these vehicles were registered in counties with a significant number of HOV facilities. Table 1 below shows the counties with the largest number of vehicles with decals along with the total number of decals. A high percentage of decals were registered in Los Angeles, Orange, and Santa Clara Counties.

Table 1 Decal Registration Versus Lane-Mile in Counties

Counties that have Majority Decals	2022	2023	2024	Number of CAV per HOV Mile
Los Angeles	29,693	31,973	51,363	145
Orange	18,965	21,469	31,345	162
Santa Clara	12,371	14,198	19,619	187
Alameda	9,042	10,694	14,802	228
San Diego	7,979	9,095	15,423	153
Contra Costa	5,363	6,201	9,022	195
Total	114,277	125,793	195,001	

Topic 2 High-Occupancy Toll Lanes

There were 15 HOT facilities in operation on the SHS in 2024. While these facilities are on State highways, the authority to collect the tolls has been granted to regional transportation agencies through legislation. These agencies are responsible for setting the tolls and establishing eligibility requirements, subject to other provisions in State and Federal law. All HOT facilities use congestion pricing, and all facilities except for the HOT lanes on SR-91 use dynamic pricing based on real-time traffic conditions. The HOT lanes on SR-91 are priced based on the time of day, with HOVs traveling in the eastbound (EB) direction during the weekday afternoon peak period paying a discounted toll.

Vehicles with three or more occupants (HOV 3+) are allowed to travel toll-free on HOT lanes along the following routes in California: I-85, US-101, SR-237, I-880, I-10, I-10s, WB SR-91, I-405, and SR-73. Additionally, vehicles with two or more occupants (HOV 2+) can also travel toll-free on HOT lanes along routes I-580, I-680, I-110, and I-15 in California.

Specifically:

- On I-15 and EB SR-91, HOV 3+ are eligible for a 50% discount.
- On US-101 and I-880, HOV 2+ are eligible for a 50% discount.
- The I-10 facility provides toll-free travel for HOV 3+ during peak periods and for HOV 2+ at all other times.

All HOT facilities require users to have a FasTrak electronic toll collection transponder except I-15 in San Diego County, which currently only requires single-occupant vehicles to have a transponder. HOVs must have a FasTrak Flex transponder to travel toll-free;

this transponder includes a switch that the driver can set prior to travel to indicate how many people are in the vehicle. The HOT facility on SR-91 has separate "declaration lanes" for HOVs at the tolling points, and a FasTrak Flex transponder is not required for toll-free travel on this facility. Requiring all users to carry a transponder is one of the main strategies for reducing violations in HOT facilities. A violation of the transponder requirement usually results in a toll evasion notice issued by the agency that has the legislative authority to collect the toll.

All CAVs with decals qualify for discounted rates on HOT lanes in California. These discounts include 50%, 15%, or special rates off the standard toll charges. Decaled CAVs pay 85% of the posted toll on SR-91 and I-15 in Riverside County and I-10, I-110, and I-405 HOT facilities. Decaled CAVs pay 50% of the posted toll on SR-85, US-101, SR-237, I-580, I-680 and I-880. Decaled CAVs pay a discounted toll on the SR-91 facility when traveling in the EB direction during weekday afternoon peak periods but travel toll-free at all other times. These vehicles must have a special FasTrak electronic toll collection transponder.

Whenever the average vehicle speed begins to fall below 45 mph on a segment of a HOT facility, it will operate in an "HOV Only" status, precluding toll-paying vehicles from entering the lanes to help alleviate the congestion. If ineligible vehicles enter the HOT lanes while they are operating in "HOV Only" mode, they are charged the maximum toll rate as well as additional fines.

The California Highway Patrol (CHP) is responsible for law enforcement on California state highways including the enforcement of vehicle occupancy requirements on all HOV facilities. All HOT facilities use indicator signals at the tolling points to indicate whether a vehicle has paid a toll, and on facilities that require a FasTrak Flex transponder for toll-free or discounted travel; these indicator signals also report the setting on the FasTrak Flex transponder. CHP uses the indicator lights and a visual check of the vehicle to determine if a violation has occurred.

Section 4 Process for Determining Degradation

Subsection (d) of 23 U.S.C. § 166 states that an HOV facility is considered degraded if the average traffic speed during the morning or evening weekday peak hour period is less than 45 mph for more than 10% of the time over a consecutive 180-day period. FHWA has not developed specific procedures or methodologies for states to follow when determining if the operational performance of an HOV facility is degraded. This is primarily because each state has different characteristics, and each agency responsible for operations has different resources to collect and analyze data. However, Caltrans has developed a comprehensive methodology to provide consistent and frequent data collection of HOV lane operations. This process is outlined in the following sections.

Topic 1 Performance Monitoring

Caltrans uses its Performance Measurement System (PeMS) to monitor and analyze the operational performance of State highways. PeMS serves as a central repository to collect, store, and analyze traffic data from vehicle detection stations and traffic census stations. Traffic data is collected automatically from sensors located on or adjacent to freeways throughout the State. Detector stations are usually located where there are existing ramp meters on freeway entrance ramps. In facilities with lower traffic volumes and less congestion, or in a more suburban setting, there may be fewer detector stations. Each detector station covers a set length of the freeway, with data available for each individual lane, including the HOV facilities located on those freeways. This data is collected every 30 seconds and transmitted to a centrally located database where it is reviewed for consistency and aggregated to 5-minute intervals. These 5-minute data sets can then be further aggregated into hourly time blocks. PeMS was used to collect the speed data for all HOV facilities except those facilities in District 11. Facilities in District 11 are analyzed using the Ramp Metering Information System (RMIS) since PeMS is not able to properly calculate speeds for the I-15 HOT facility, which has reversible lanes.

The HOT facility on SR-91 in Orange County is not included in this report. This facility was constructed as a set of toll lanes in the median of the freeway, which HOVs could use for free or at a discounted rate, and as such they are not subject to the monitoring and reporting requirements of 23 U.S.C. § 166. The Riverside County portion of the SR-91 HOT facility was originally constructed as an HOV lane and is subject to the monitoring and reporting requirements and is included in this report.

Topic 2 Period for Analysis

Caltrans collects speed and volume data for HOV facilities twenty-four hours a day, seven days a week. However, since traffic volumes tend to be higher in the second half

of each calendar year, Caltrans and FHWA have agreed to use data collected in the latter half of a calendar year to perform the annual degradation analysis. From July 1 to December 31, 2024, there were 132 weekdays, including six holidays. Holidays were excluded from the analysis period due to their unique travel patterns. Therefore, a total of 126 days were used for the 2024 degradation analysis.

The morning peak hour period is 6 AM to 9 AM, and the afternoon peak hour period is 3 PM to 6 PM. Most HOV facilities in California operate during both time blocks.

Topic 3 Data Collection

Data was collected from Caltrans' detectors for approximately 1,048 lane-miles of HOV/HOT facilities. This is about 55% of the 1,893 lane-miles of HOV and HOT facilities that were subject to monitoring and analysis as required by 23 U.S.C. § 166. Table 2 shows the number of HOV/HOT lane-miles in each Caltrans district and the number of lane-miles for which data was collected.

Table 2 Operating Versus Monitored HOV/HOT Lane-Miles by District

District	Lane-Miles Operating	Lane-Miles Monitored (AM)	Lane-Miles Monitored (PM)
3	142	124	124
4	496	278	273
5	8	6	6
7	547	157	156
8	285	171	170
10	14	13	10
11	147	126	126
12	254	173	173
Total	1893	1048	1039

Tables 3 and 4 show the number of HOV and HOT lane-miles and the number of lane-miles for which data was collected in Caltrans districts with HOT facilities.

Table 3 Operating Versus Monitored HOV Lane-Miles by District

District	Lane-Miles Operating	Lane-Miles Monitored (AM)	Lane-Miles Monitored (PM)
4	311	177	178
7	482	153	152
8	294	117	116
11	68	56	56
12	199	125	125
Total	1354	628	627

Table 4 Operating Versus Monitored HOT Lane-Miles by District

District	Lane-Miles Operating	Lane-Miles Monitored (AM)	Lane-Miles Monitored (PM)
4	185	101	95
7	65	4	4
8	91	54	54
11	79	70	70
12	55	48	48
Total	475	277	271

Reasons for a lack of data include defective sensors, incorrectly transmitted data, or no detection along that segment. Data that was imputed or estimated by PeMS was not included in the analysis. This ensures that only actual and not estimated data is used for the analysis. Any faulty or inaccurate data was also removed from the analysis. Also, stations that do not have data for at least 20% of the analysis days were omitted from the analysis. This year, stations that had less than 26 days of data were omitted. As part of its asset management and fix-it-first efforts, Caltrans is continuously focusing on the health of the detector stations and has a process in place for replacing detector stations that have reached the end of their service life cycle or are beyond repair. Caltrans HQ is working with the districts that have the lowest detector coverage to

improve the level of coverage. Caltrans is also exploring alternative traffic data options that could supplement PeMS data.

As part of the data collection for this year, Toll Operators that manage the toll collection on HOT facilities provided their speed and volume data collected at toll gantries. This supplemental data was used to calculate degradation for HOT facilities. The process for calculating degradation using the Toll Operator data is the same as the process for calculating degradation using PeMS data.

The locations and technology Toll Operators use to collect and calculate speed data are different from the traffic monitoring stations Caltrans uses. Due to these differences, the degradation results using the data from Toll Operators will be used to supplement existing analysis from PeMS data rather than replace it. However, where PeMS data coverage is poor, the Toll Operator data will be used in place of the PeMS data. Specifically, entire routes in District 7 are missing PeMS data due to major construction projects or vandalism affecting the fiber optic network used to transmit PeMS data. In these cases, Toll Operator data may be used for degradation analysis.

Topic 4 Calculating Degradation

The vehicle miles traveled (VMT) and vehicle hours traveled (VHT) during the peak periods were calculated from the PeMS data for each detector station. The VMT and the VHT were then used to determine the average speed for each peak hour period for each day for the entire six months.

- The average peak period speed for each day was determined by dividing the total VMT for the peak hour period by the total VHT for the peak hour period (miles traveled / hours traveled = mph).
- The average peak period speed for the entire six months was determined by taking the total VMT and the total VHT for the peak period for the entire six months and then dividing that VMT by that VHT.

For all stations from which data was collected, a count was taken of the number of weekdays where the average speed at the detector station was less than 45 mph. The total number of weekdays with data was also counted for each sensor. The number of weekdays where the speed was less than 45 mph was then divided by the number of weekdays for which data was available. If this value exceeded 10%, that portion of the HOV facility covered by that detector station was deemed degraded. Each detector station covers a predetermined length of the facility, as previously noted in Section 4.1. The lane-miles for each detector station with data were added up to determine the total number of lane-miles with data available as well as the total number of lane-miles that were degraded. Graphs were then developed for each HOV facility showing the average weekday speed at these detector stations for each peak hour period as well as the percentage of time when the average speed at the detector stations was less than 45 mph.

Topic 5 Degradation Category

While the federal standard distinguishes HOV facilities' performance as degraded or not degraded, Caltrans further classifies degradation into three categories based on how frequently it occurs. The three classes are defined as follows:

- Slightly Degraded—degradation occurs from 10% to 49% of the time.
- Very Degraded—degradation occurs from 50% to 74% of the time.
- Extremely Degraded—degradation occurs 75% or more of the time.

Section 5 Statewide Degradation Summary

Tables 3, 4, and 5 summarize the statewide managed lane facility degradation monitoring in 2024 for the entire managed lane network and HOV and HOT facilities. Of the 1,048 HOV and HOT lane-miles monitored during the morning peak period, about 22% (230 lane-miles) were degraded. Of the 1,039 lane-miles monitored during the afternoon peak period, approximately 34% (356 lane-miles) were degraded. For HOV facilities, 25% (190 lane-miles) of the lane-miles were degraded in the morning peak period, whereas 38% (294 lane-miles) of the lane-miles were degraded in the afternoon peak period. For HOT facilities, 15% (41 lane-miles) of the lane-miles were degraded in the morning peak period, whereas 23% (62 lane-miles) of the lane-miles were degraded in the afternoon peak period.

Table 5 2024 Statewide Monitored HOV/HOT Degraded Lane-Miles Summary

Peak Hour Period	Category	Lane-Miles
Morning	Degraded	231
Morning	Not Degraded	817
Afternoon	Degraded	356
Afternoon	Not Degraded	683

Table 6 2024 Statewide Monitored Degraded HOV Lane-Miles Summary

Peak Hour Period	Category	Lane-Miles
Morning	Degraded	190
Morning	Not Degraded	581
Afternoon	Degraded	294
Afternoon	Not Degraded	474

Table 7 2024 Statewide Monitored Degraded HOT Lane-Miles Summary

Peak Hour Period	Category	Lane-Miles
Morning	Degraded	41
Morning	Not Degraded	236
Afternoon	Degraded	62
Afternoon	Not Degraded	208

Figure 1 shows the lane-miles of degraded managed lane facilities by district. District 4, District 7, District 8, and District 12 had the most degradation. Districts 5 and 10 experienced no degradation. Figures 2 and 3 show the degraded lane-miles of HOV and HOT facilities, specifically, for districts with operating HOT facilities.

Figure 1 HOV/HOT Facilities Degraded Lane-Miles by District

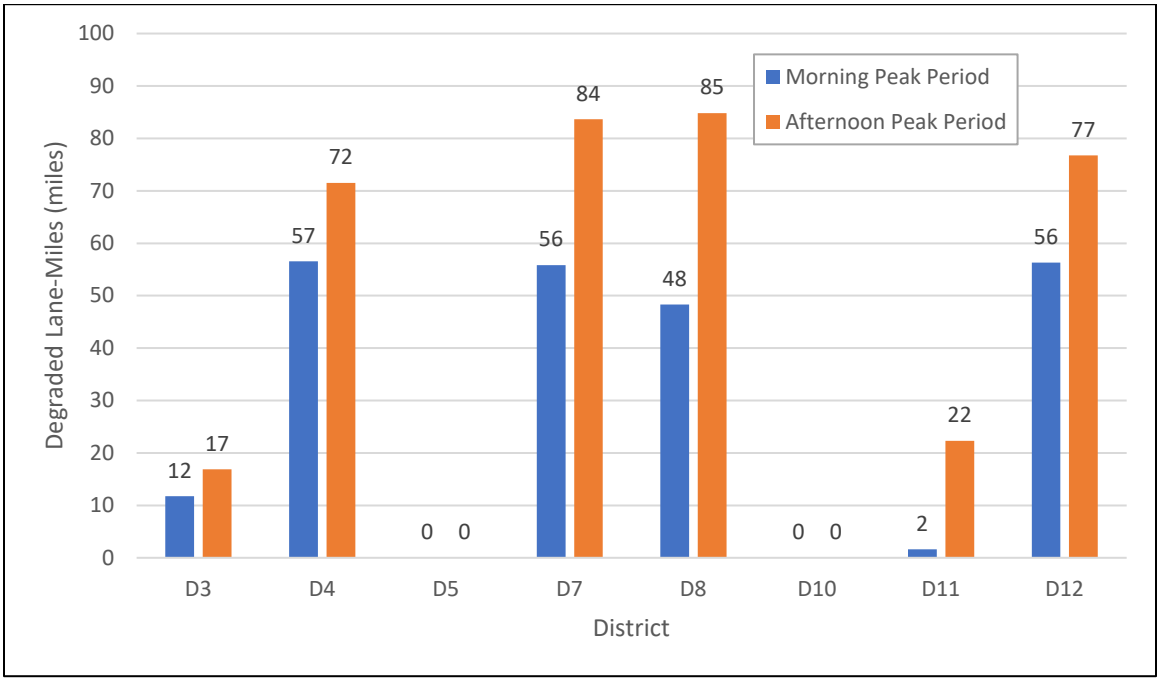


Figure 2 HOV Facilities Degraded Lane-Miles by District

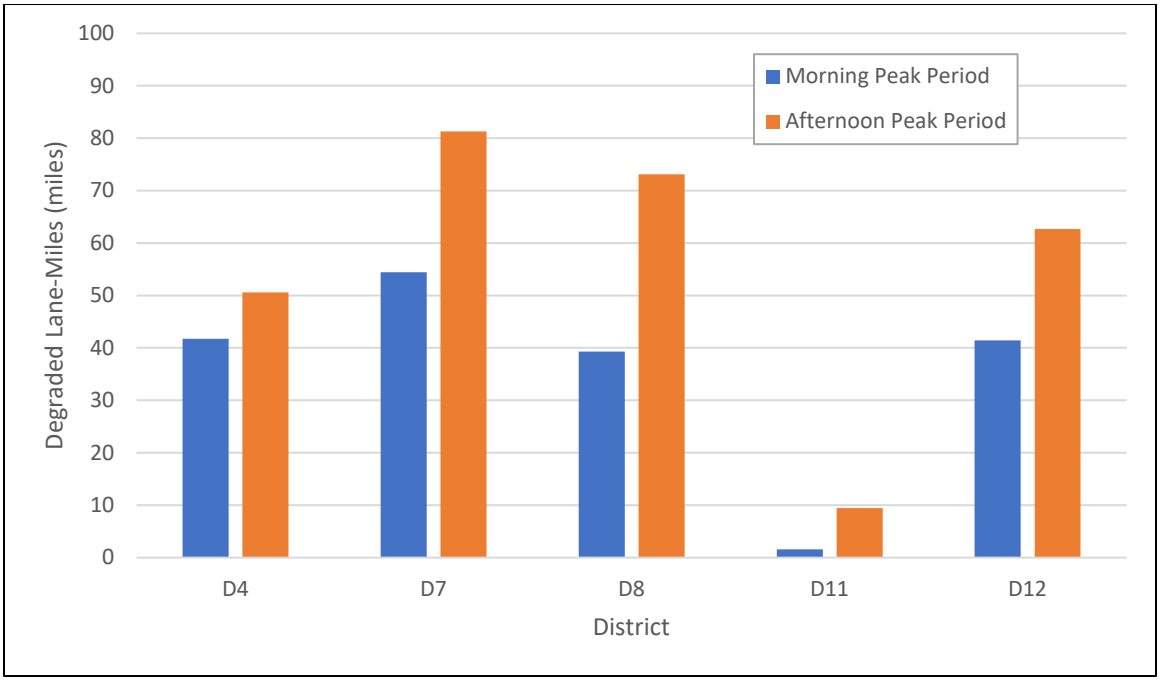
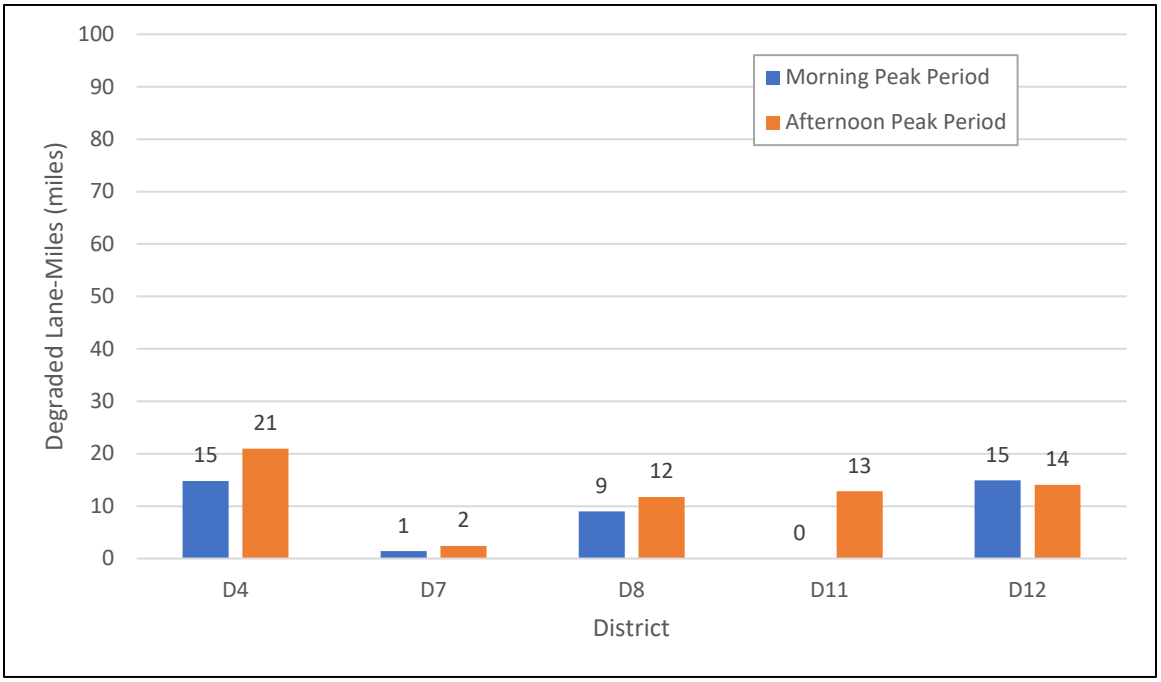


Figure 3 HOT Facilities Degraded Lane-Miles by District



Figures 4 and 5 show HOV/HOT district degradation levels as a percentage of the total monitored lane-miles in that district for the morning and afternoon peak periods. Figures 6 and 7 show the HOV degradation levels for the morning peak period, while Figures 8 and 9 show the HOT degradation levels for the afternoon peak period. Figures 6, 7, 8, and 9 only include districts with operating HOT facilities.

Figure 4 HOV/HOT District Degradation Levels as Percentage of Monitored Lane-Miles (Morning Peak Period)

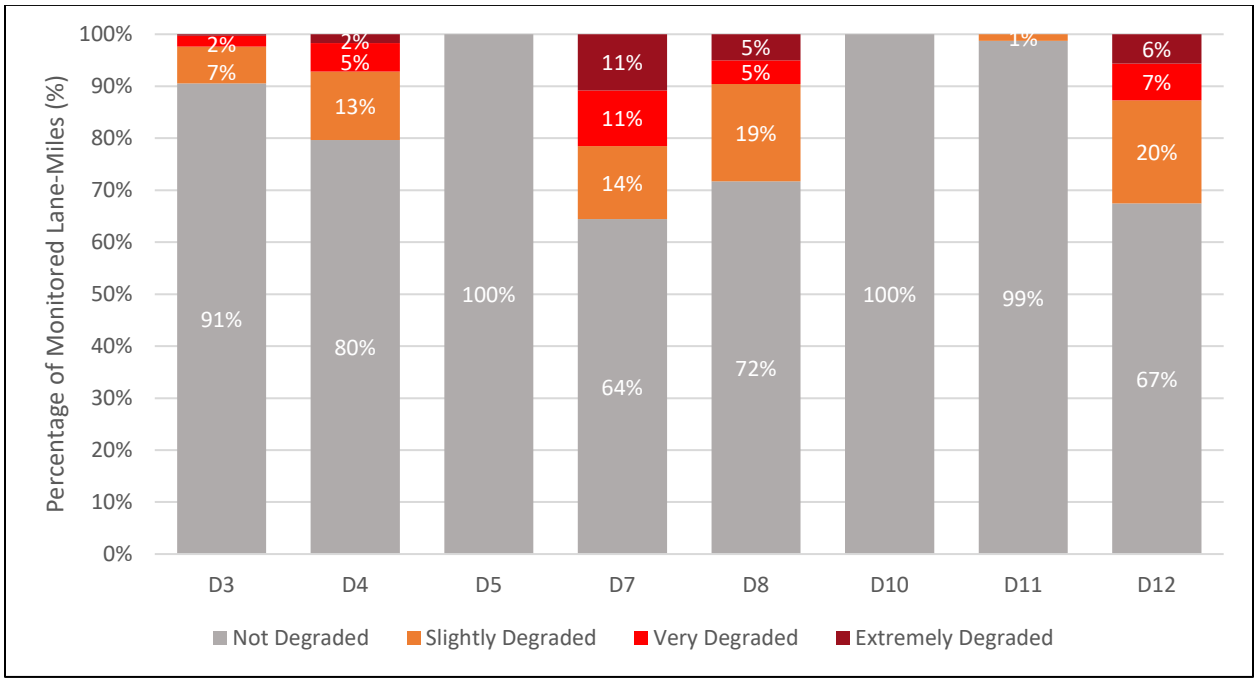


Figure 5 HOV/HOT District Degradation Levels as Percentage of Monitored Lane-Miles (Afternoon Peak Period)

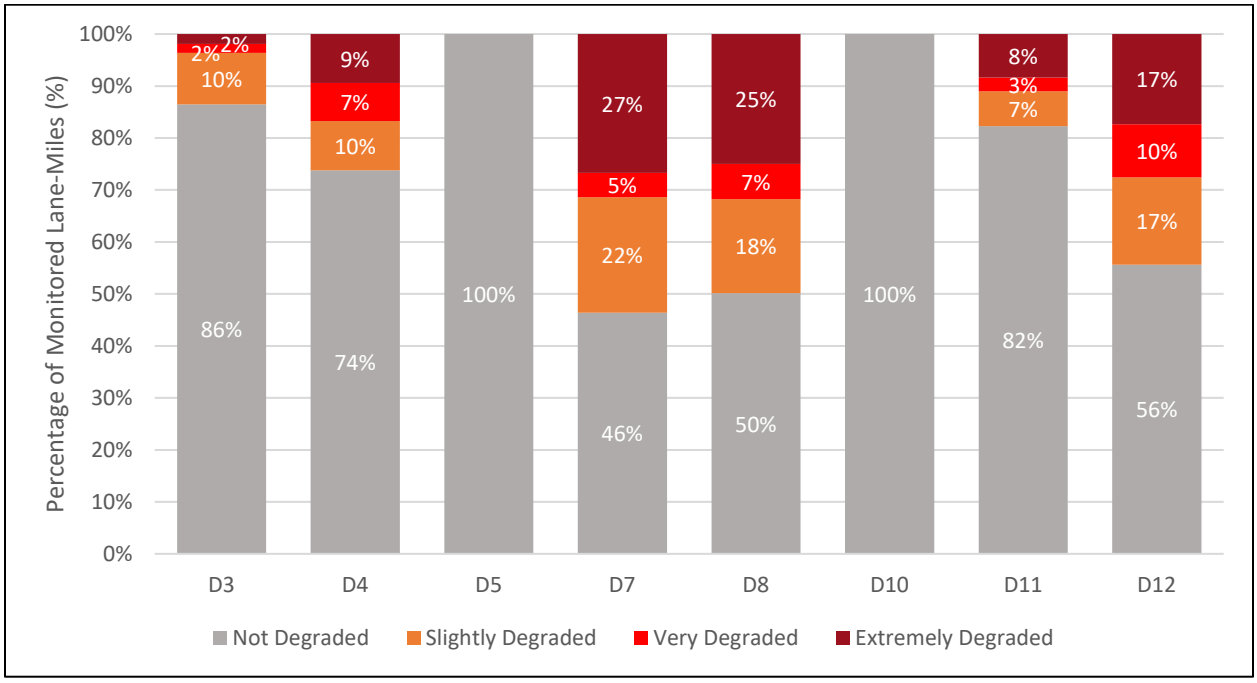


Figure 6 HOV District Degradation Levels as Percentage of Monitored Lane-Miles (Morning Peak Period)

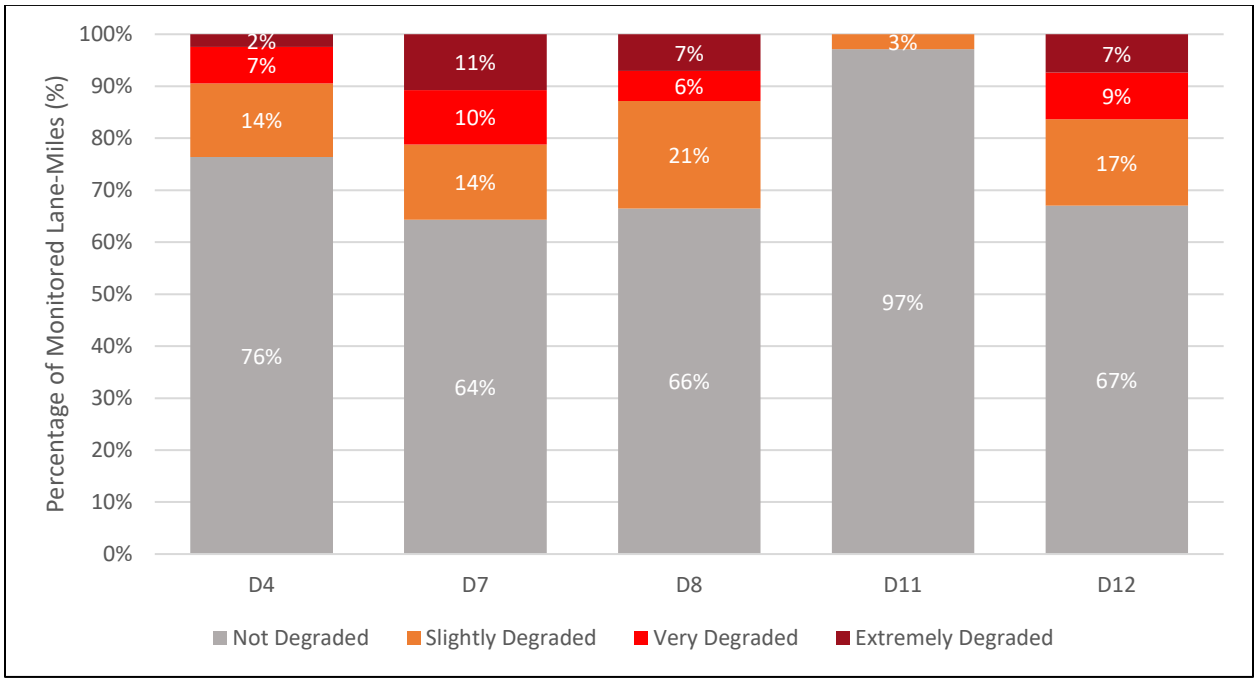


Figure 7 HOV District Degradation Levels as Percentage of Monitored Lane-Miles (Afternoon Peak Period)

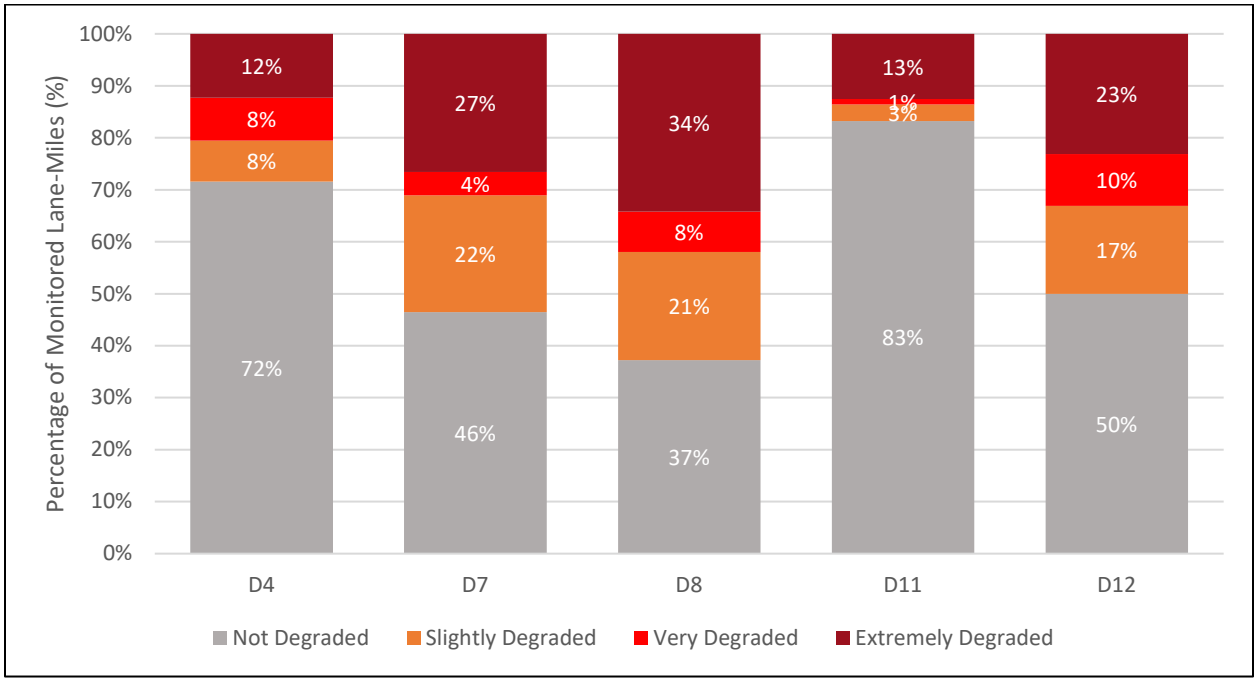


Figure 8 HOT District Degradation Levels as Percentage of Monitored Lane-Miles (Morning Peak Period)

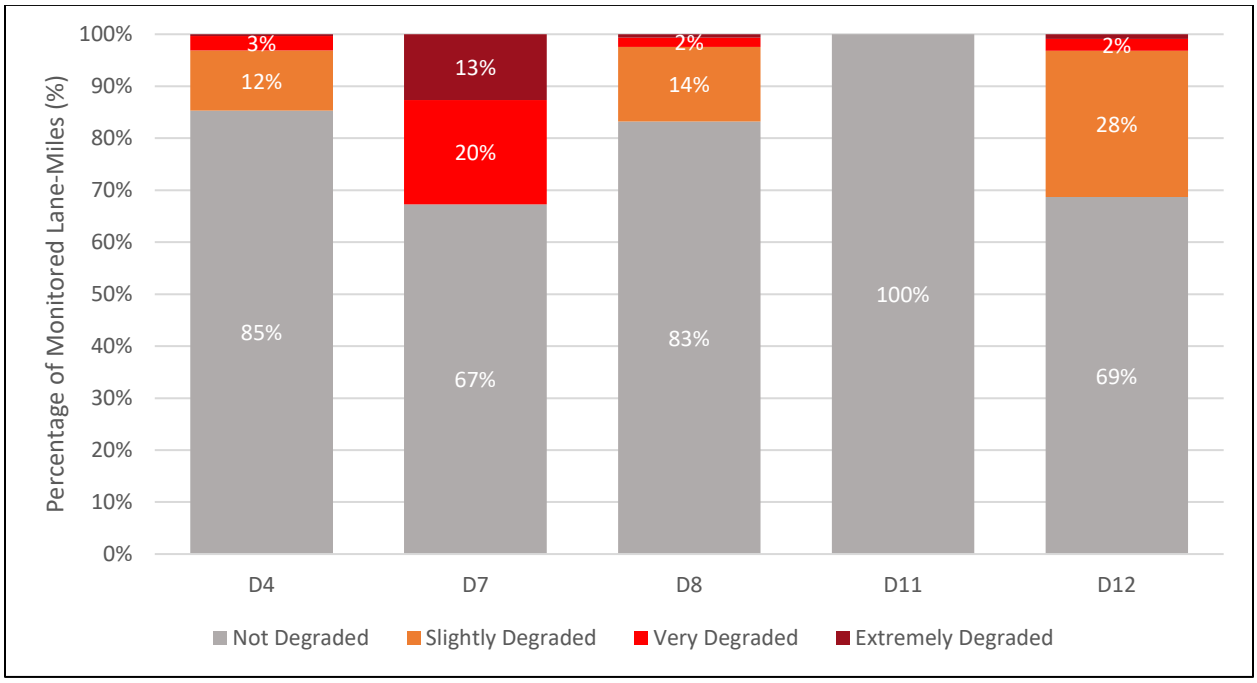
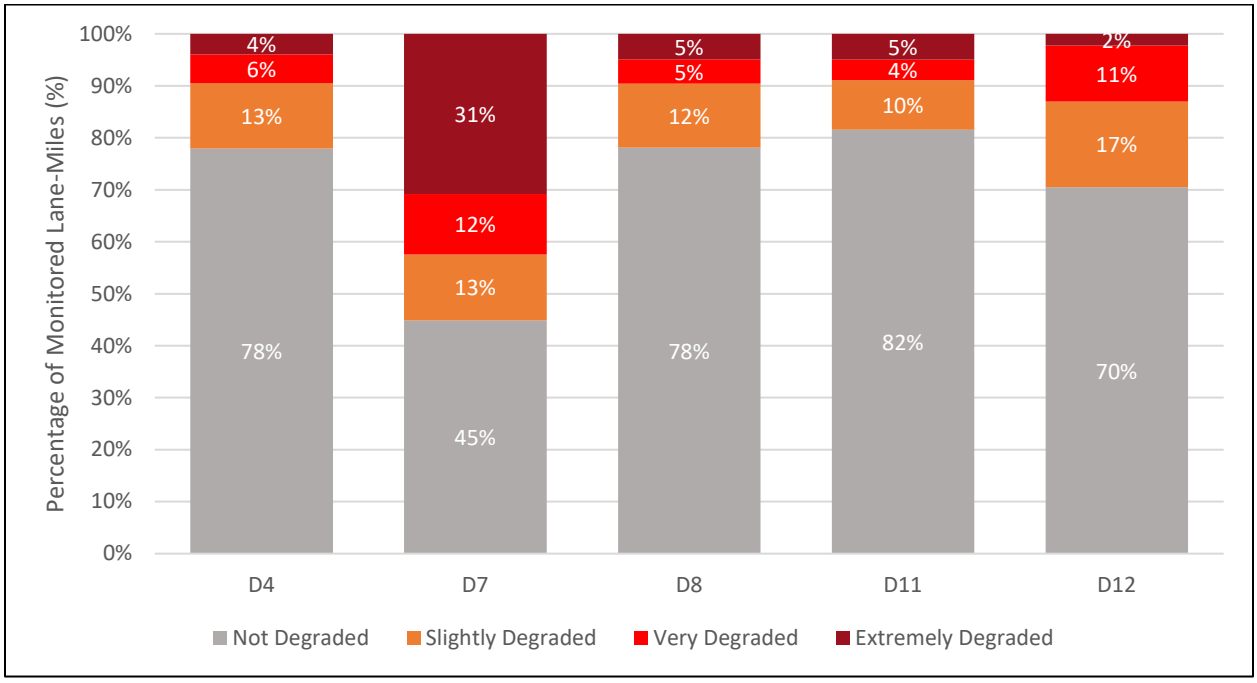


Figure 9 HOT District Degradation Levels as Percentage of Monitored Lane-Miles (Afternoon Peak Period)



Based on degradation analysis, various factors have been known to contribute to degradation. Common factors include:

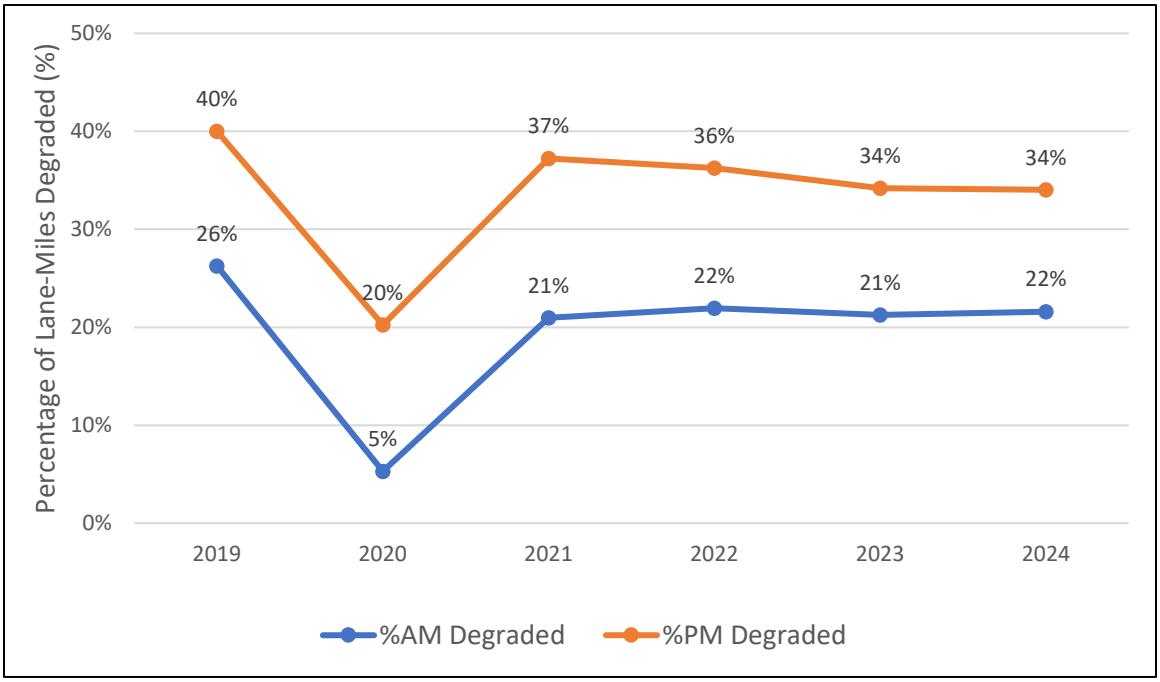
- HOV demand exceeding the capacity of the facility. Single-occupant vehicles operating in HOV facilities, including CAVs and violators, contribute to excess demand in HOV facilities.
- Recurrent congestion on the freeway mainline.
- Disruptions to the traffic flow from vehicles entering or exiting the HOV facility.
- Congestion at the downstream end of the HOV facility backing up traffic into the HOV facility.

The results of the degradation analysis for each district's HOV facilities are provided in Attachment B.

Topic 1 Assessing HOV Facilities Degradation Over the Past Six Years

Figure 10 shows the statewide morning and afternoon percentage of lane-miles degraded in the last six years. The HOV degradation levels have shown distinct patterns based on the time of day. Since the dip in degradation in 2020 due to the traffic impacts of Stay-at-Home orders of the COVID-19 pandemic, degradation levels have remained below pre-pandemic levels. While the HOV degradation levels during the morning have remained relatively stable since 2021, hovering around 22%, the degradation levels for HOV during the afternoon have exhibited a gradual decline, decreasing from 37% to 34% over the same period.

Figure 10 Statewide Percentage of HOV/HOT Lane-Miles Degraded in the Last Six Years



Section 6 Conclusions

The tables in Attachment B provide a summary of the HOV/HOT facilities that experienced degradation. In 2024, 52 HOV facilities were degraded. Listed below are some general observations from the 2024 degradation analysis:

- Degradation was more prevalent in the afternoon peak hour period, versus the morning peak hour period, as shown in Figure 10.
- While some facilities were degraded during both the morning and afternoon periods, many facilities experienced degradation specifically in either the morning or afternoon period.
- The HOV facilities in Districts 5 and 10 remained unaffected by degradation during the specified period.
- Districts 4, 7, 8, and 12 encountered the most significant degradation. All four districts observed degradation during both the morning and afternoon peak hours.

Section 7 Next Steps

Caltrans continues to work towards implementing a more strategic and programmatic approach to addressing degradation, including considering continued dedicated funding to address performance issues in the SHS, including degradation. In February 2022, the Division of Traffic Operations issued a policy that requires all districts with degraded HOV/HOT facilities to perform traffic investigations on those facilities. Caltrans remains committed to adhering to policy guidelines and conducting thorough analyses of the factors contributing to degradation. If a degraded HOV/HOT facility has already undergone a traffic investigation in the last three years, districts won't need to conduct another investigation on the same facility. Any facility that was degraded in 2024 and has not been previously investigated will require an investigation. It should be noted that some of the operational changes that were highlighted in Section 2 of this report are expected to have addressed the degradation of those facilities and will be reflected in the action plans. Subsequently, Caltrans will implement targeted actions to directly mitigate their underlying causes. Caltrans will provide FHWA with a draft degradation action plan for review, and the final version will be delivered within 180 days following the submission of this final report.

Section 8 Attachments

A. List of HOV Facilities on the State Highway System in 2024.
B. Summary of 2024 Degradation on HOV/HOT Facilities.
C. Summary of 2024 Degradation on HOT Facilities With Toll Operator Data.