# 2020 California High Occupancy Vehicle Facilities Degradation Action Plans


**Prepared by**

**California Department of Transportation**
Division of Traffic Operations
Office of Mobility Programs

**Submitted to**

**Federal Highway Administration**
**California Division**

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# 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 *2020 California High Occupancy Vehicle Facilities Degradation Action Plan.* This document details the actions Caltrans will take to make significant progress toward bringing degraded high occupancy vehicle (HOV) facilities on State highways into compliance with the federal performance standard. These actions could include changes to the operation of the facility or other improvements.

Caltrans and the Federal Highway Administration (FHWA) have agreed that beginning in 2020, the annual degradation report would be submitted first in the spring of the following calendar year, and it would be followed six months later by the action plan. This is based on the language in 23 U.S.C. § 166 that gives HOV lane operators 180 days to develop and submit action plans for degraded facilities.

Caltrans and FHWA have also agreed that a comprehensive degradation report and action plan would not be developed for 2020 due to the fact that the Coronavirus Disease 2019 (COVID-19) pandemic resulted in significant changes to traffic conditions which were out of the ordinary. Under this agreement, no action plans would be developed for facilities that were identified as degraded in 2020. Instead, each district would review the degraded facilities and remediation strategies provided in the *2019 California High Occupancy Vehicle Facilities Degradation Report and Action Plan*. Causes of degradation would be reviewed and the action plans would be refined, as appropriate, to ensure that they address the causes. In addition, any actions that have been implemented in the interim would also be reported.

# 2. COMMON CAUSES FOR DEGRADATION ON HOV FACILITIES

The analyses conducted by the districts some common causes for degradation on HOV facilities. These are listed below.

*Demand Exceeding Capacity*

Heavy vehicle volumes on HOV lanes produce congestion and slow traffic conditions. Typical areas where HOV lane vehicle volumes are high include popular commuting routes, such as travel toward job centers in the morning peak hour period and away from job centers in the return afternoon peak hour

period. In addition, heavy use of the HOV lanes can occur at some locations as a result of special events, or because of recreational travel, such as the traffic on routes leaving urban areas just before the weekends. In order to ensure that HOV lanes continue to offer a time-savings incentive to carpool, Caltrans has traditionally set 1,650 vehicles per hour as the maximum capacity of HOV lanes. Some of the most heavily used HOV lanes on the State Highway System are exceeding this threshold.

*Friction Factor*

The term "friction factor" refers to the slowing of vehicles in the HOV lane because of the presence of slow vehicles in the adjacent general purpose (GP) lanes. The speed differential between the HOV lane and the GP lanes can cause travelers in the HOV lane to decelerate in anticipation of slow-moving vehicles suddenly merging into the HOV lane. It can also cause vehicles in the HOV lane to slow as they prepare to change lanes into the slow-moving adjacent traffic in order to access exit ramps on the right side of the freeway. The effect of friction is reduced when there is less expectation that vehicles will change lanes into the HOV lane (such as through the use of painted buffers or physical barriers), and when easier merge opportunities exist for leaving the HOV lane.

Figures 1 and 3 provide a "spot time" look at HOV and GP lane speeds on an HOV facility during a portion of a peak hour period. Figures 2 and 4 provide a "spot location" look at HOV and GP lane speeds at one location on an HOV facility for an entire month. This data was obtained from Caltrans' Performance Measurement System (PeMS). The HOV facilities shown in Figures 1 and 2 are contiguous to the GP lanes, meaning there is no buffer or barrier separation between them. In these figures it can be clearly seen that as the adjacent GP lane speed drops, the HOV facility speed drops as well. The HOV facilities shown in Figures 3 and 4 use buffer separation, but friction factor can still be observed. However, it does not appear to have as significant of an impact on the HOV facility speed.

**FIGURE 1. SPOT TIME HOV AND GP LANE SPEEDS – CONTIGUOUS HOV FACILITY**


NOTE: Direction of travel is from left to right

**FIGURE 2. SPOT LOCATION HOV AND GP LANE SPEEDS – CONTIGUOUS HOV FACILITY**

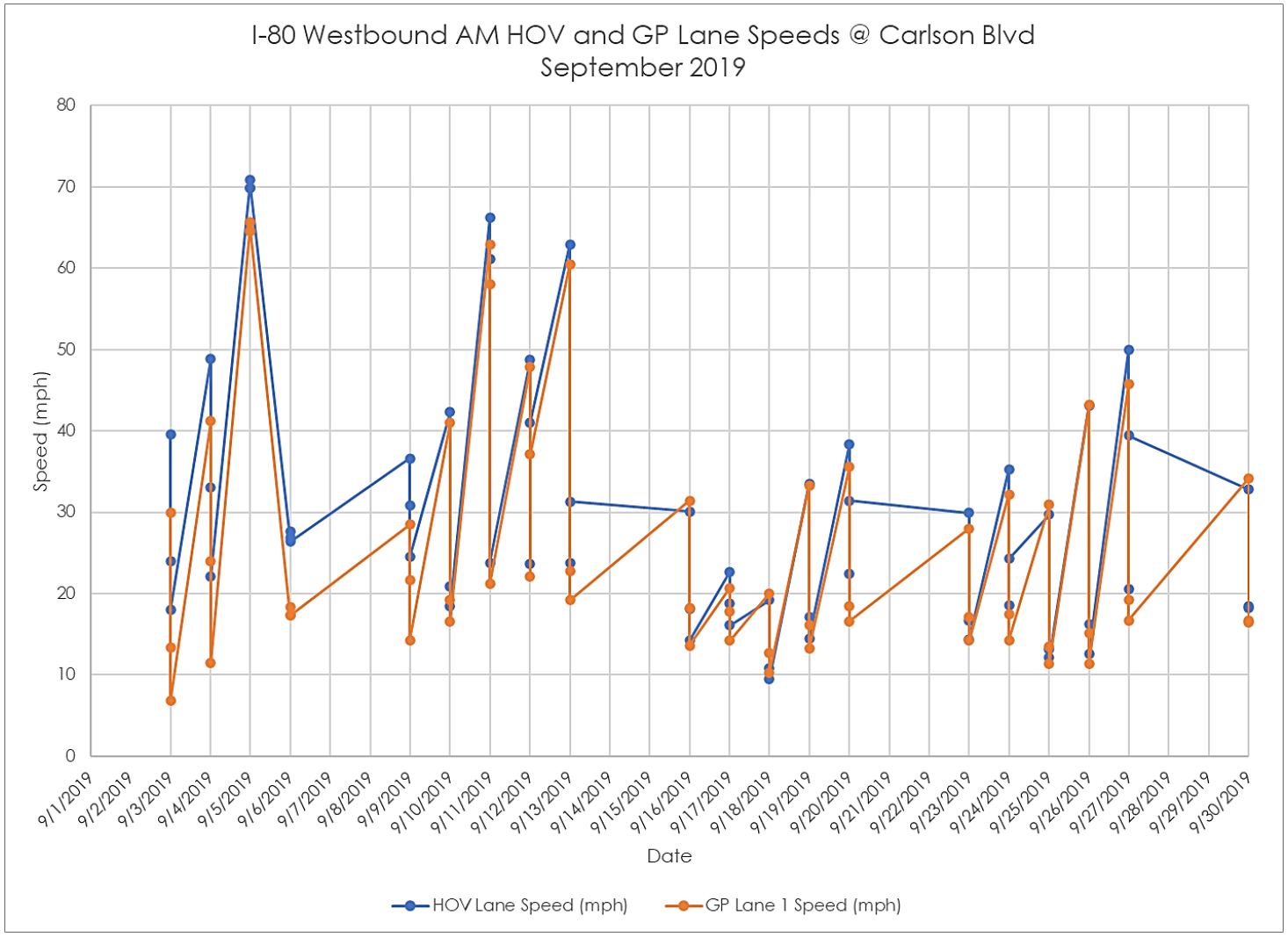


**FIGURE 3. SPOT TIME HOV AND GP LANE SPEEDS – BUFFER-SEPARATED HOV FACILITY**

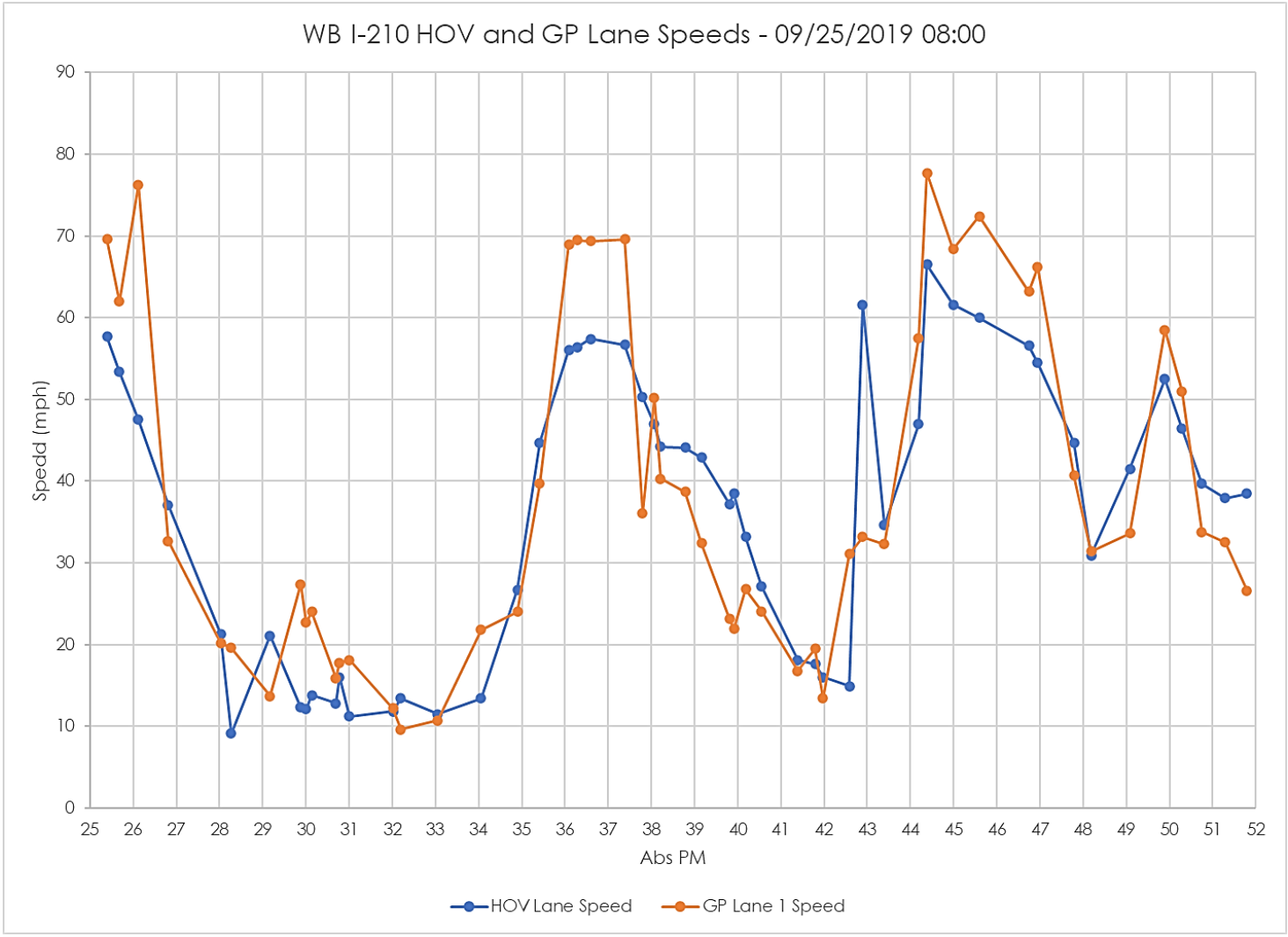
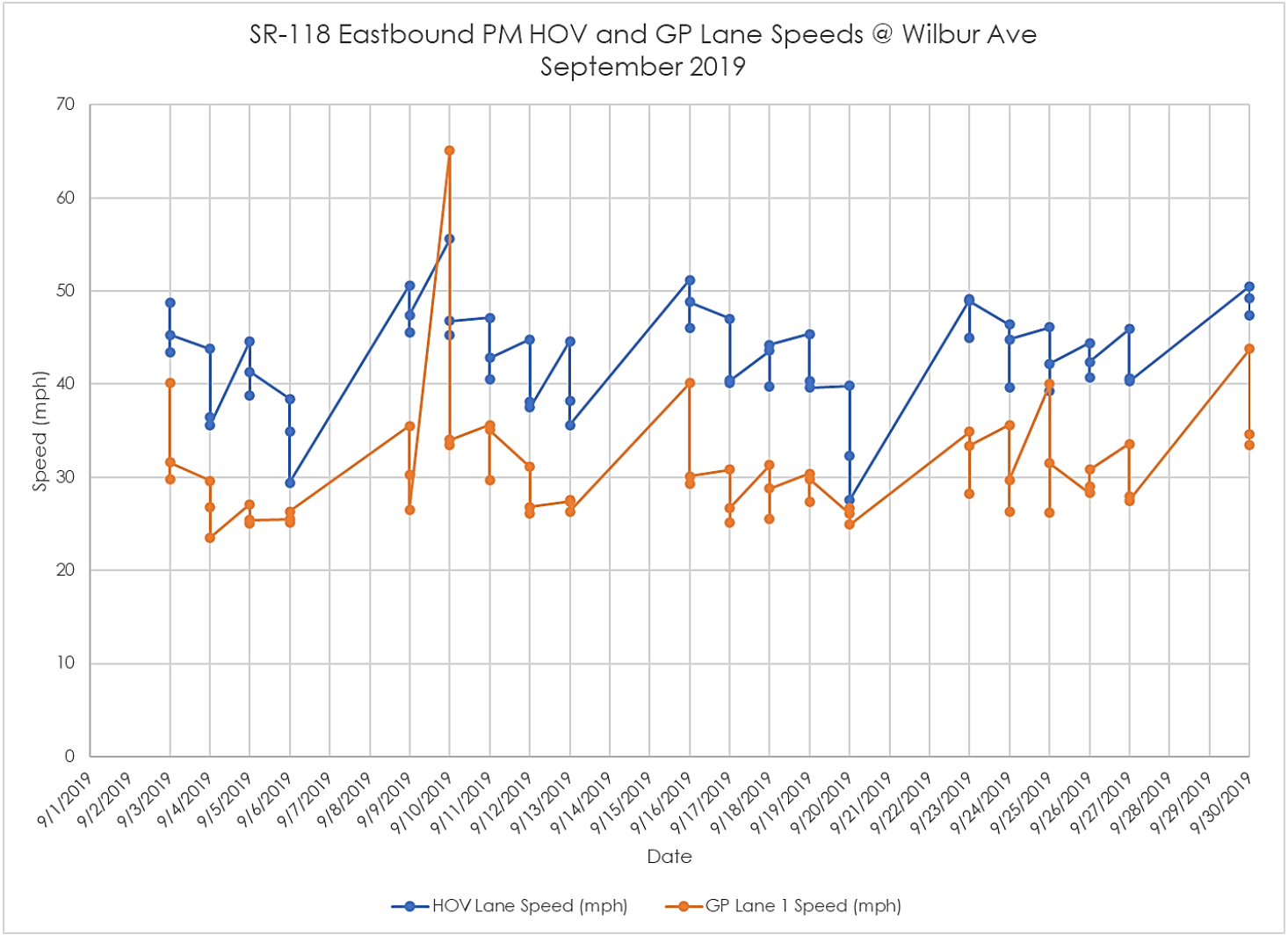


**FIGURE 4. SPOT LOCATION HOV AND GP LANE SPEEDS – BUFFER-SEPARATED HOV FACILITY**



*Roadway Geometry*

The geometry of the GP lanes or the HOV lanes affects traffic by introducing a disruption in the smooth flow of vehicles. Lane drops and bottlenecks in the GP lanes can cause congestion and thus associated lane friction for the HOV lane. Unless otherwise noted, the bottlenecks referred to in these action plans are located in the GP lanes. When an HOV facility ends at the edges of the HOV network or where there is a gap in the HOV network, vehicles must exit the HOV lane and merge into (potentially) slower general traffic.

For HOVs traveling on more than one facility, the lack of direct connectors between intersecting freeways also requires HOVs to merge back into general traffic temporarily, potentially causing slowing and congestion in the HOV lanes.

Figures 5 and 6 are examples of plots of HOV and GP speeds along the length of an HOV facility during the fourth quarter of 2019. These plots, also taken from PeMS, provide a graphical representation of the duration and distance of congested conditions on the HOV facilities and the parallel GP lanes.

**FIGURE 5. AVERAGE HOV LANE SPEEDS – NORTHBOUND ROUTE 99 IN DISTRICT 3 Q4 2019**

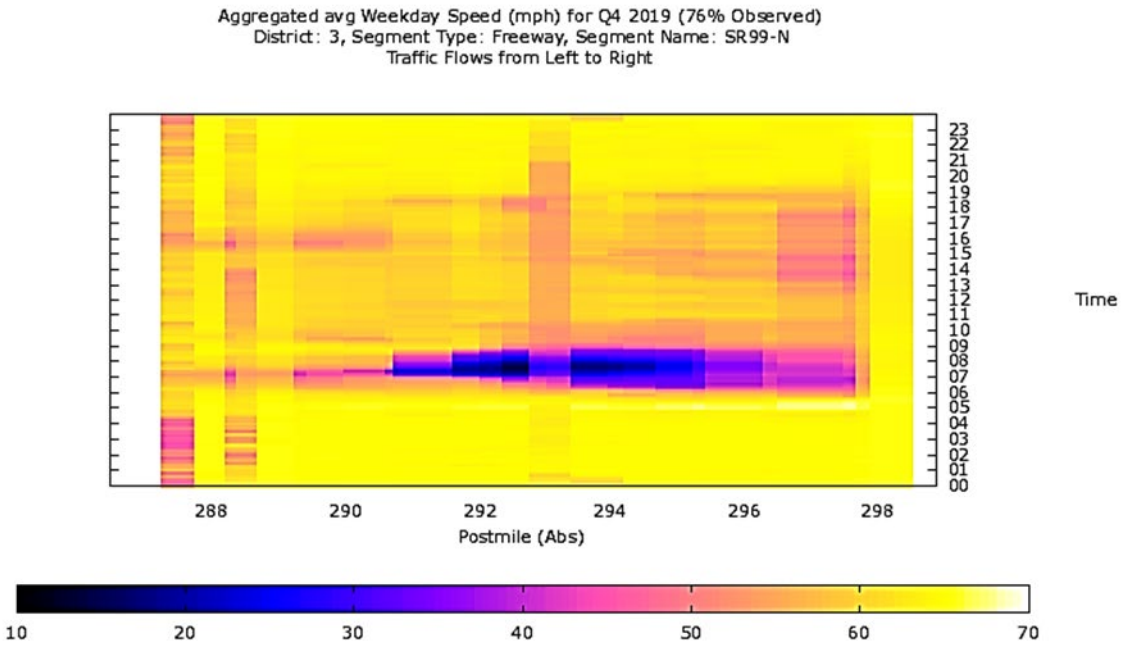
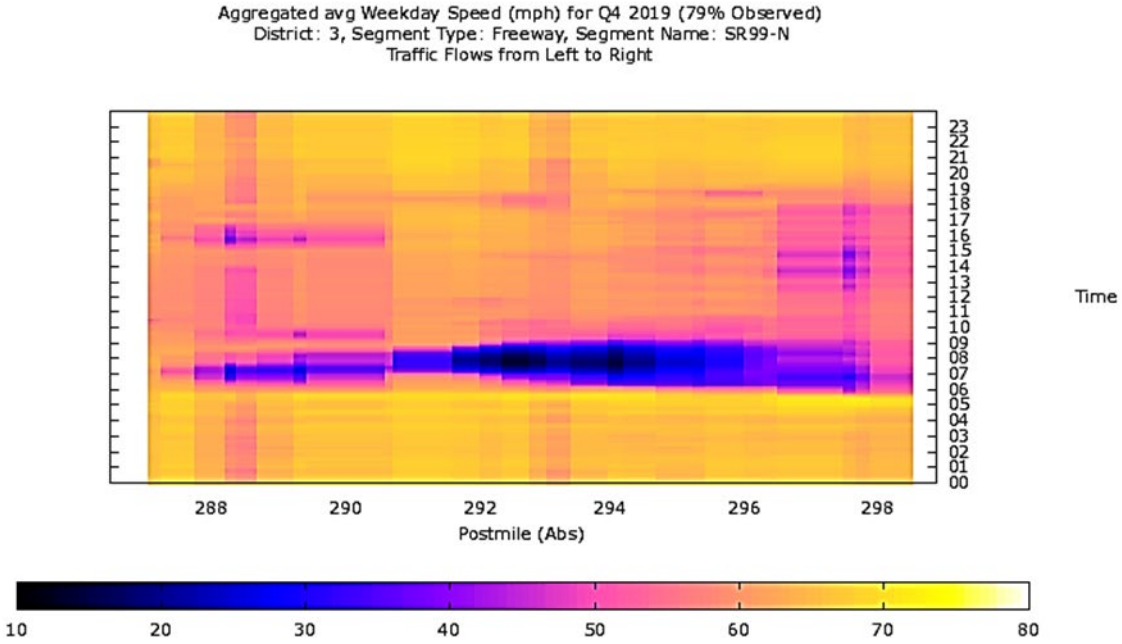


**FIGURE 6. AVERAGE GP LANE SPEEDS – NORTHBOUND ROUTE 99 IN DISTRICT 3 Q4 2019**




## 3. STATEWIDE PLANS FOR ADDRESSING DEGRADATION

Subsection (d) of 23 U.S.C. § 166 requires Caltrans to develop a remediation plan to address degradation. Each district is expected to review local traffic data and field conditions to identify potential causes of degradation on each HOV facility and develop appropriate solutions. These actions could include:

- Increasing the occupancy requirement for the HOV facility
- Varying the toll charged to toll-paying vehicles to reduce demand
- Discontinuing allowing exempt vehicles to use the HOV facility
- Increasing the available capacity of the HOV facility

A list of potential actions has been developed for all districts to consider as they develop their action plans. This list can be found in Table 1. It includes all four (4) of the strategies listed above as well as other strategies identified by the districts and Headquarters. Actions are listed in order of their potential ability to address degradation, as well as whether they can be implemented in the near-term or may require some time to implement.

**TABLE 1. STATEWIDE HOV DEGRADATION REMEDIATION STRATEGIES**

| HOV Degradation Remediation Strategy | Type of Project | Purpose | Potential to Address Degradation | Time to Implementation |
|---|---|---|---|---|
| Increase Occupancy Requirements | Operational | Operational Improvement | High | Near-Term |
| Increase Occupancy Requirements and Convert to HOT Lane | Operational Capital | Operational Improvement | High | Near to Mid-Term |
| Addition of HOV auxiliary (weave) lanes. | Capital | Operational Improvement | High | Mid- to Long-Term |
| Addition of a second HOV lane. | Capital | Add Capacity | High | Mid- to Long-Term |
| Install flexible delineators | Operational | Operational Improvement | Medium to High | Near-Term |
| Enhanced, dedicated, and targeted HOV enforcement including the establishment of enforcement zones. | Operational Capital | Enforcement | Medium to High | Near- to Mid-Term |
| Revise pricing strategy on HOT lanes to address degradation. | Operational | Operational Improvement | Medium to High | Near to Mid-Term |
| Toll exempted clean air vehicles on HOT lanes using tiered/reduced rates | Operational | Operational Improvement | Medium to High | Near to Mid-Term |

| HOV Degradation Remediation Strategy | Type of Project | Purpose | Potential to Address Degradation | Time to Implementation |
|---|---|---|---|---|
| Implement access strategies, including access restrictions, increasing the length of access openings or modification/elimination of bottlenecks such as ingress/egress locations. | Operational Capital | Operational Improvement | Medium to High | Near- to Mid-Term |
| Use Shoulders to Provide Additional Managed Lane Capacity | Capital | Add Capacity | Medium to High | Mid- to Long-Term |
| Implementation of Integrated Corridor Management, or other traffic management techniques such as speed harmonization and lane control signals to optimize system performance. | Capital | Operational Improvement | Medium to High | Mid- to Long-Term |
| Close gaps in the HOV lane network | Capital | Operational Improvement | Medium to High | Long-Term |

| HOV Degradation Remediation Strategy | Type of Project | Purpose | Potential to Address Degradation | Time to Implementation |
|---|---|---|---|---|
| Interchange improvements including, but not limited to, construction of direct HOV connectors, ramp widenings, or truck climbing lanes. | Capital | Add Capacity | Medium to High for direct HOV connectors, Low to Medium for other improvements | Long-Term |
| Increase public awareness. Update HOV violation fine amount on the existing signs to the current value. | Operational | Education | Low to Medium | Near-Term |
| Mark the number of minimum occupants in sequence after the pavement HOV diamond symbol | Operational | Education | Low to Medium | Near-Term |
| Improvement in Traffic Incident Management including the deployment or expansion of Freeway Service Patrol. | Operational | Operational Improvement | Low to Medium | Near- to Mid-Term |
| Evaluate the impacts of incidents, weather or construction | Analysis | Analysis | Medium to High | Immediate |

| HOV Degradation Remediation Strategy | Type of Project | Purpose | Potential to Address Degradation | Time to Implementation |
|---|---|---|---|---|
| Expand the use of ramp metering, through the addition of new meters, metering HOV preferential lanes, or corridor wide adaptive ramp metering | Capital | Operational Improvement | Low to Medium | Near- to Mid-Term |
| Standardize managed lane signing and markings statewide. | Capital | Education | Low to Medium | Near- to Mid-Term |
| Additional or enhanced signing and markings at the beginning and along the HOV lanes. | Capital | Education Enforcement | Low to Medium | Near- to Mid-Term |
| Implement or expand commuter assistance programs such as vanpools and Park-and-Ride facilities. | Operational Capital | Operational Improvement | Low to Medium | Mid to Long-Term |
| Addition of general-purpose auxiliary lanes. | Capital | Operational Improvement | Low | Mid- to Long-Term |

## 3.1. FUNDING FOR ADDRESSING DEGRADATION

Caltrans has set aside approximately $30 million in State Highway Operations and Protection Program (SHOPP) funds for the purpose of addressing HOV degradation. The money will be allocated among the six Caltrans districts where degradation was observed with each district receiving a share proportional to the amount of degradation observed. Funds must be used specifically for projects that are intended to address degradation. The districts and headquarters staff are in the process of identifying projects and developing performance measures and targets; this work will be completed by the spring of 2022. Projects will need to be included in the 2024 SHOPP.

In addition, districts will also now be required to conduct operational investigations for degraded HOV facilities. These investigations will result in either no action or identify improvements needed which can then become candidates for SHOPP funding. This new requirement will take effect in 2022 when the 2021 degradation report is completed.

## 3.2. RESTRICTIONS ON EXEMPT VEHICLES

Currently, California has no plans to prohibit clean air vehicles (CAVs) from HOV facilities since it is state policy to encourage the purchase and use of CAVs, and access to HOV facilities is a primary incentive. There are also no plans at this time to convert high occupancy/toll (HOT) facilities back to HOV lanes. Caltrans coordinates regularly the regional transportation agencies who operate the HOT facilities to ensure that provisions are in place to keep the facilities in compliance with the federal performance standard. These operators generally keep track of the performance of these facilities in addition to Caltrans. Provisions that have been implemented already or are being implemented include raising tolls, operating the facilities in an "HOV Only" mode, and automated enforcement.

## 3.3. CHANGING VEHICLE OCCUPANCY REQUIREMENTS

In November 2020 Caltrans released a policy that directed districts to consider changing vehicle occupancy requirements on HOV and HOT lanes under certain conditions and provided guidance to the districts on this process. One of the conditions is if an HOV facility is very degraded. The analysis would consider the geographic, geometric, and traffic demand characteristics of both the individual HOV facility and the region. All potential issues and actions would be

explored, including violation rates, toll rates on HOT lanes, planned capital improvements to the facility or the other lanes of the freeway, and other multimodal improvements that might be expected to reduce traffic volumes. The guidance recommends that HOV lanes be converted to HOT lanes whenever vehicle occupancy requirements are increased. This can help offset the impacts on freeway performance caused by increasing vehicle occupancy requirements. Other improvements also need to be considered, such as park and ride facilities, and transportation demand management strategies such as vanpools, or other types of programs that can encourage higher vehicle occupancies and/or modal shift.

Occupancy changes on HOV facilities in California typically occur only as part of conversions to HOT operations for the reasons outlined above. In October 2020, occupancy requirements were increased on the HOV facility on Route 880 in District 4 as part of the conversion of that facility to HOT operations. Vehicles with three or more occupants can use the lanes without paying a toll, while vehicles with at least two or more occupants pay fifty percent of the posted toll. A similar operational change was implemented on the HOT facility on Route 237, which connects directly with the facility on Route 880. As noted in the action plans, changes in occupancy requirements are under consideration or planned for several other HOV facilities as part of planned conversions to HOT lanes. And the Los Angeles County Metropolitan Transportation Authority is proposing to raise vehicle occupancy requirements on the Route 10 HOT facility from 3 persons to 5 persons during peak periods.

## 3.4. COORDINATION WITH THE CALIFORNIA HIGHWAY PATROL

The California Highway Patrol (CHP) is responsible for enforcing vehicle occupancy requirements on all HOV facilities. Caltrans regularly coordinates with the CHP, both at the headquarters and the district level, to address violation rates on HOV lanes. The districts provide their local CHP offices with annual reports about violation rates on HOV facilities so that the CHP can be aware of where additional enforcement may be needed. In some locations, dedicated funding has been made available to the CHP for additional enforcement. HOT lane operators typically have agreements in place with the CHP to provide additional enforcement on those facilities above and beyond what the CHP normally provides; this is funded by toll revenues. Automated vehicle occupancy detection systems are being tested or use. More information and results from these efforts can be found in the district-specific degradation analyses and action plans.

## 3.5. WAIVERS

Per 23 U.S.C. § 166, sanctions may be imposed if Caltrans fails to bring degraded HOV facilities into compliance with the federal performance standard. Sanctions may include withholding of Federal transportation funds or approval of projects. A waiver from sanctions may be requested for degraded facilities where good faith efforts have been attempted and found still ineffective, and where it is determined that such a waiver may be in the best interest of the traveling public. If, upon review of the action plans, FHWA believes these or other facilities may qualify for a waiver, Caltrans will then begin the process of formally requesting a waiver. These facilities will continue to be monitored for compliance with the federal performance standards and under the conditions of the waiver certain actions may still be required on those facilities.

# 4. DISTRICT-SPECIFIC ACTION PLANS

Each district has developed an action plan for each route which has a degraded HOV facility. for each facility is provided for each district. No summary is provided for Districts 5 or 10 as the HOV facilities in those districts were not degraded.

The action plans may include general information related to district-wide studies or plans developed to address degradation. These include plans developed by the districts as well as those developed by regional partners.

As part of analyzing each HOV facility for degradation, a spreadsheet was developed which included tables showing the peak period speed data for each detection station on the facility as well as "profiles" showing the average operating speed at each detection station and how frequently the average speed went below 45 mph at each station. The districts review these tables and profiles to identify the locations and causes of degradation, such as roadway geometrics, traffic and travel patterns on the route, or other freeway performance issues. If necessary, the districts may conduct additional operational analyses of the facilities if the cause is unclear. The speed and degradation profiles for each degraded facility in the district are provided at the beginning of each district's section. These plots should be read from left to right. The outcomes of these reviews and analyses are reported in the "Analysis" section of each action plan. This section also includes statistics such as violation rates or percentages of CAVs if those are causes.

If a facility experienced severe, pervasive degradation, the "Analysis" section of the action plans may also include the "spot time" plots or the plots showing the HOV and adjacent GP lane speeds along the length of the HOV facility. The purpose of providing these plots is to provide additional information related to bottlenecks and the length and duration of congestion on HOV facilities and also to provide a snapshot of GP lane performance alongside the HOV facilities. As noted in section 2, GP lane performance issues are a significant contributor to degradation.

The "Remediation Strategies" section describes the specific actions for the route based on the analyses. The actions should be tied back to the causes identified in the "Analysis" section. These actions may include strategies for individual spots on a facility, for portions of a facility, for a facility as a whole, or for the entire route. Information is provided regarding the scope and schedule of the proposed actions and expected outcomes.

In some cases, actions were implemented in calendar year 2020 on some facilities that had been identified as degraded in 2019. The "Remediation Strategies" section will include information on these and other actions that have been taken in the past and the results of those actions, where such information is available. It is important to note that the analyses may also pre-date some of these improvements, and any impacts resulting from those improvements will be addressed in future degradation reports and action plans. In the future, districts will also be asked to provide regular updates on the status of the action plans and any observed outcomes. This evaluation will be included as part of the action plans for each route going forward.

## 4.1. DISTRICT 3 2020 DEGRADATION ACTION PLANS

### 4.1.1 SUMMARY OF DEGRADATION ON HOV FACILITIES IN DISTRICT 3

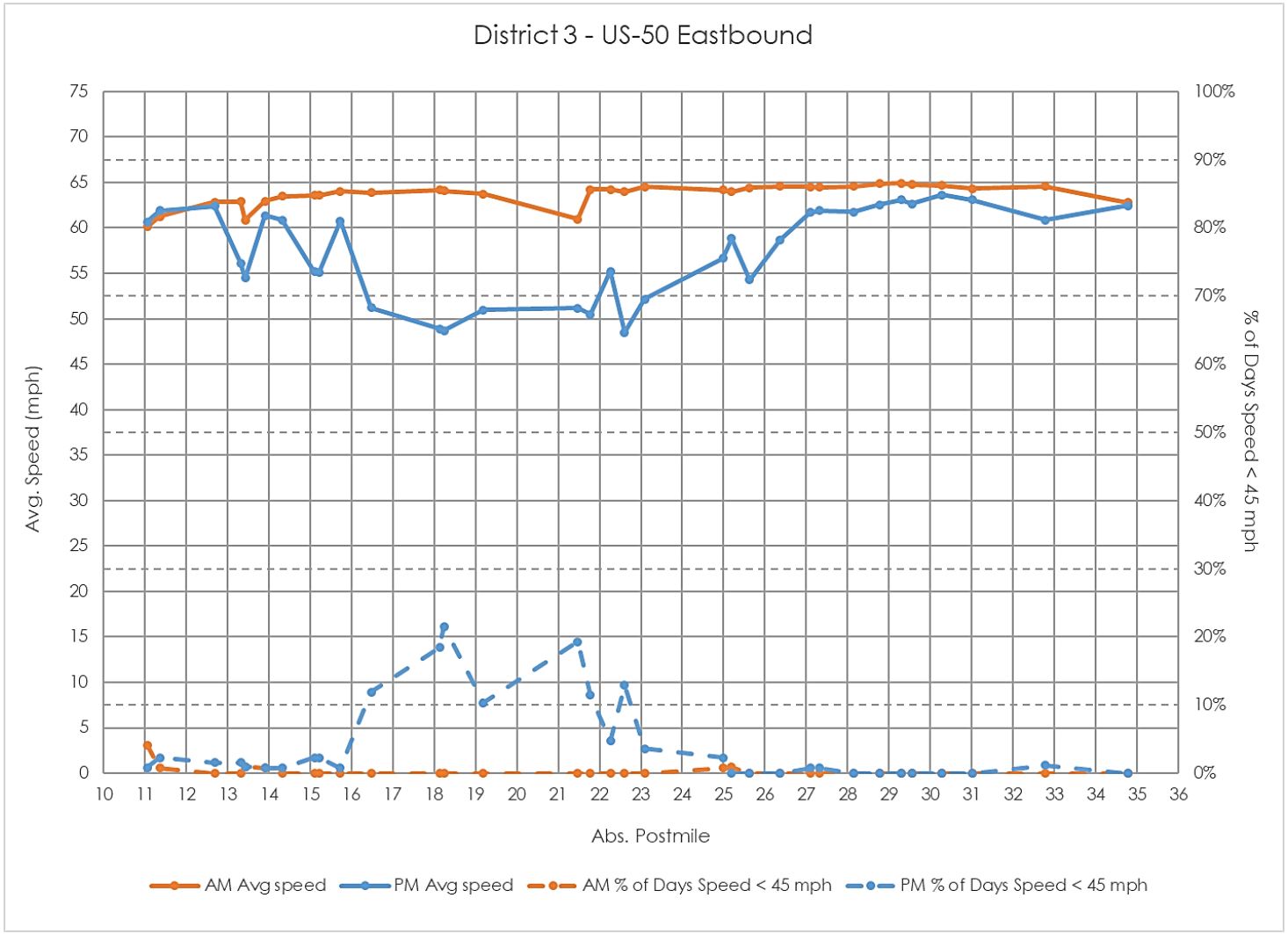
Table 2 provides the list of degraded facilities in District 3 that were identified in the *2019 California High Occupancy Vehicle Facilities Degradation Report and Action Plan*. The speed and degradation profiles for each degraded facility are provided in Figures 7 through 12.

**TABLE 2. DISTRICT 3 LIST OF DEGRADED HOV FACILITIES**

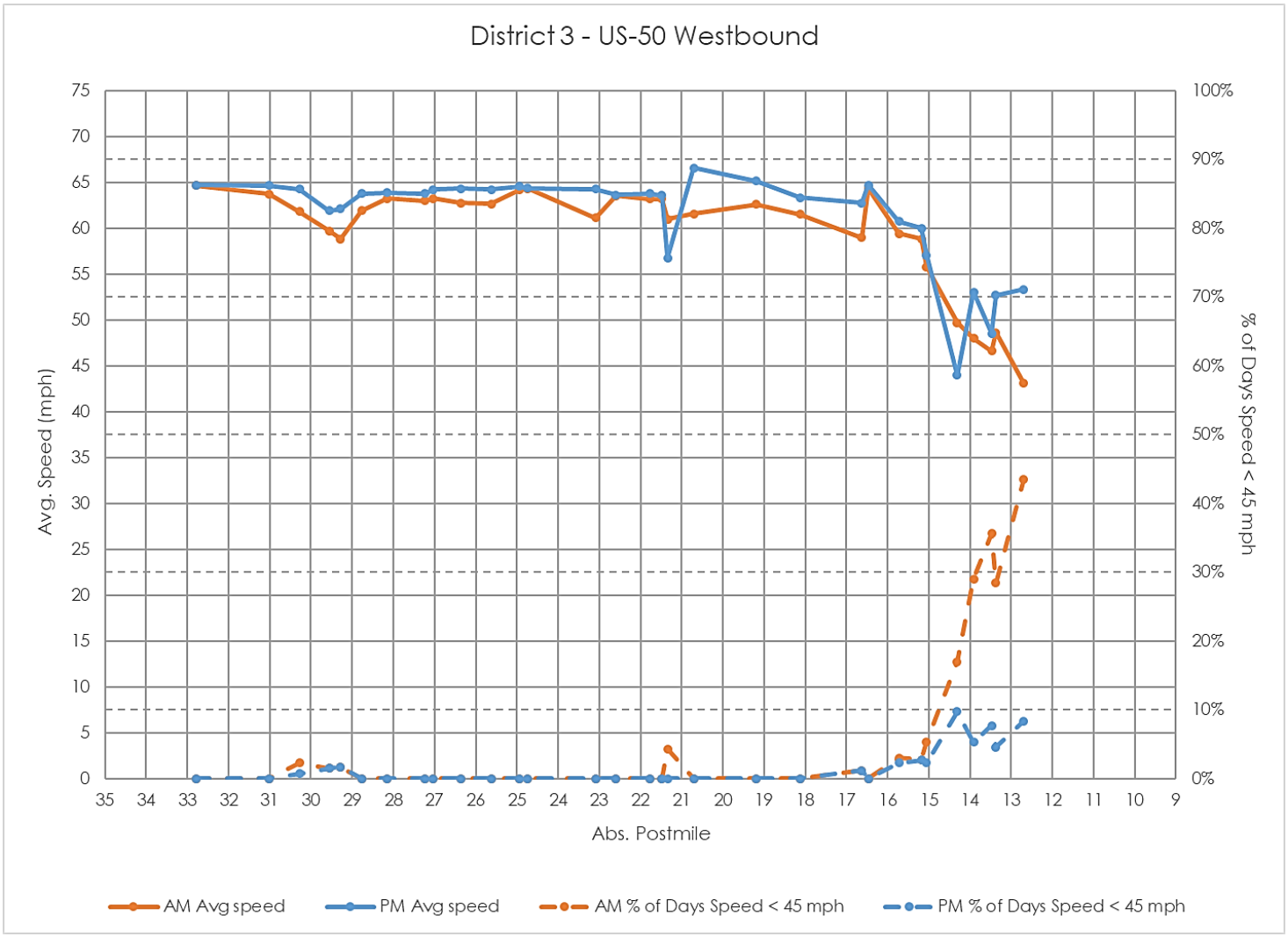
| Route | Direction | Limits | Facility length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 50 | EB | Watt Ave to Cameron Park Dr | 23.6 | 22.3 | AM-22.3<br>PM-17.5 | AM-0.0<br>PM-4.8 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 50 | WB | Cameron Park Dr to Watt Ave | 23.3 | 20.0 | AM-17.9<br>PM-20.0 | AM-2.0<br>PM-0.0 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 80 | EB | West El Camino Ave to Route 65 | 21.5 | 17.6 | AM-17.6<br>PM-10.7 | AM-0.0<br>PM-3.2 | AM-0.0<br>PM-3.2 | AM-0.0<br>PM-0.4 |
| 80 | WB | Route 65 to West El Camino Ave | 21.5 | 18.7 | AM-15.9<br>PM-14.5 | AM-1.9<br>PM-3.1 | AM-0.9<br>PM-1.1 | AM-0.0<br>PM-0.0 |
| 99/ 51 | NB | Elk Grove Blvd to N Street | 13.1 | 9.5 | AM-2.3<br>PM-9.1 | AM-1.7<br>PM-0.4 | AM-1.8<br>PM-0.0 | AM-3.8<br>PM-0.0 |
| 51/ 99 | SB | E Street to Elk Grove Blvd | 13.6 | 12.8 | AM-12.8<br>PM-4.3 | AM-0.0<br>PM-1.6 | AM-0.0<br>PM-0.9 | AM-0.0<br>PM-6.0 |

EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound
Lane-miles may not add up exactly due to rounding

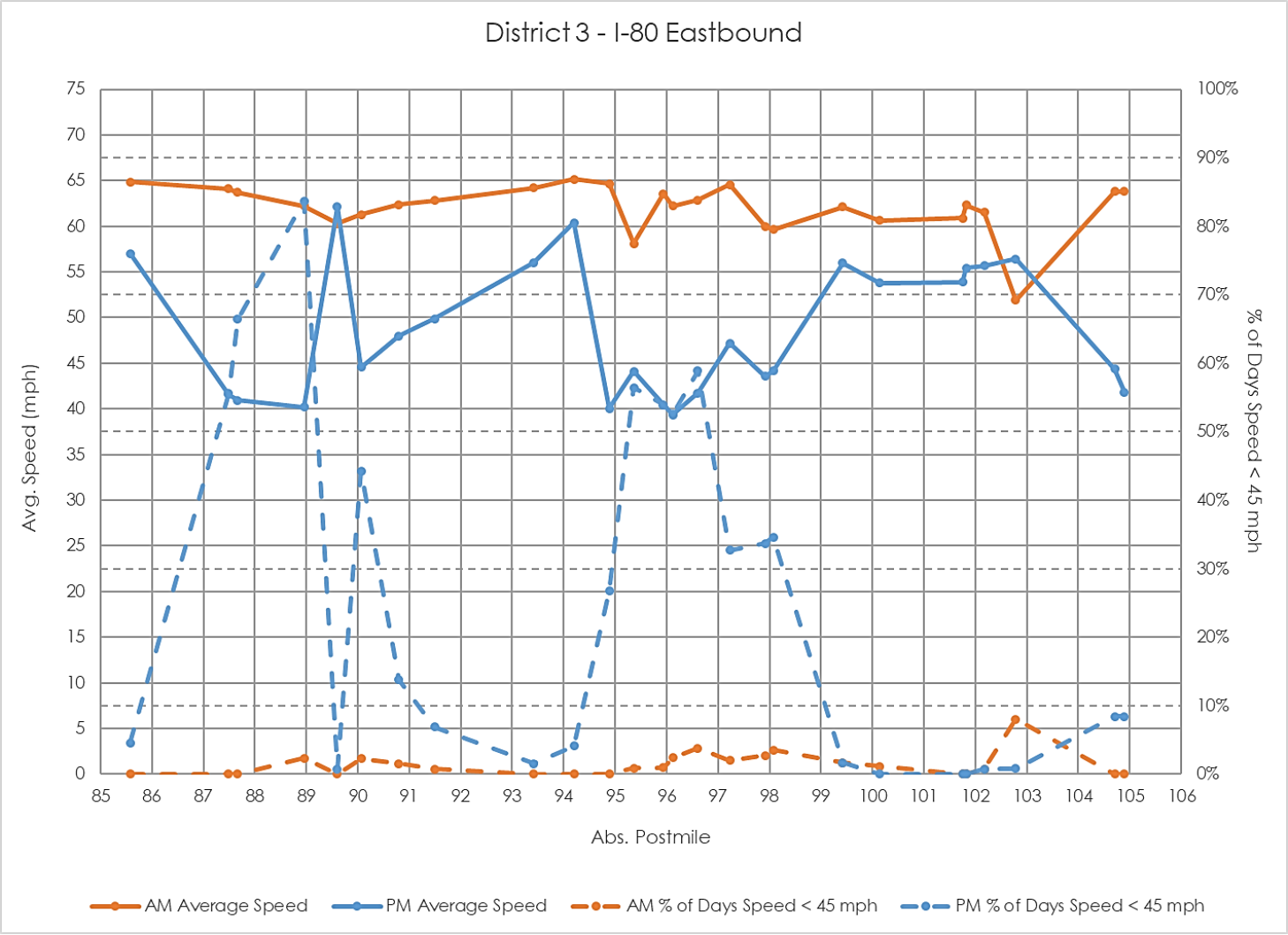
## FIGURE 7. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 50



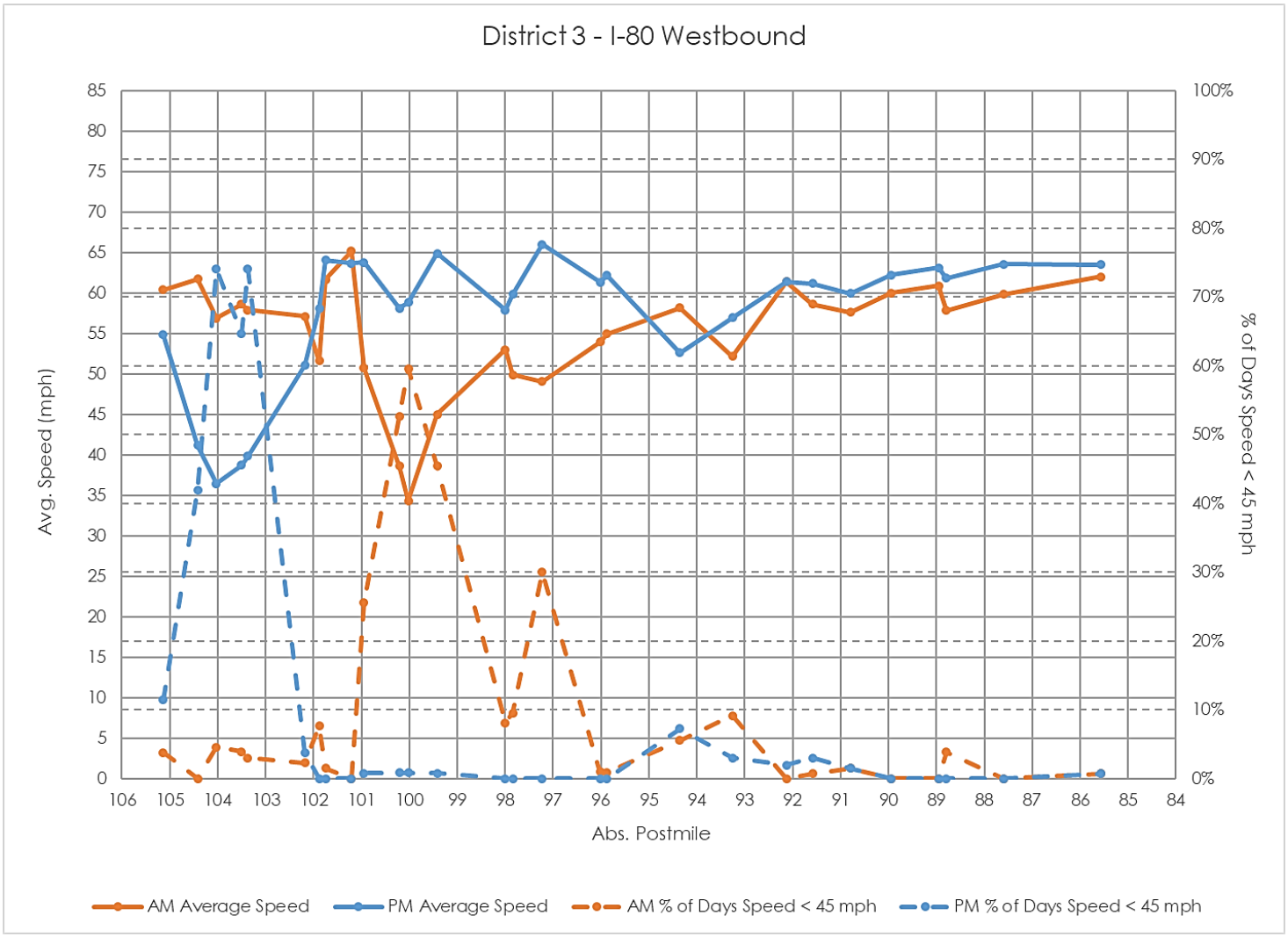
## FIGURE 8. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 50



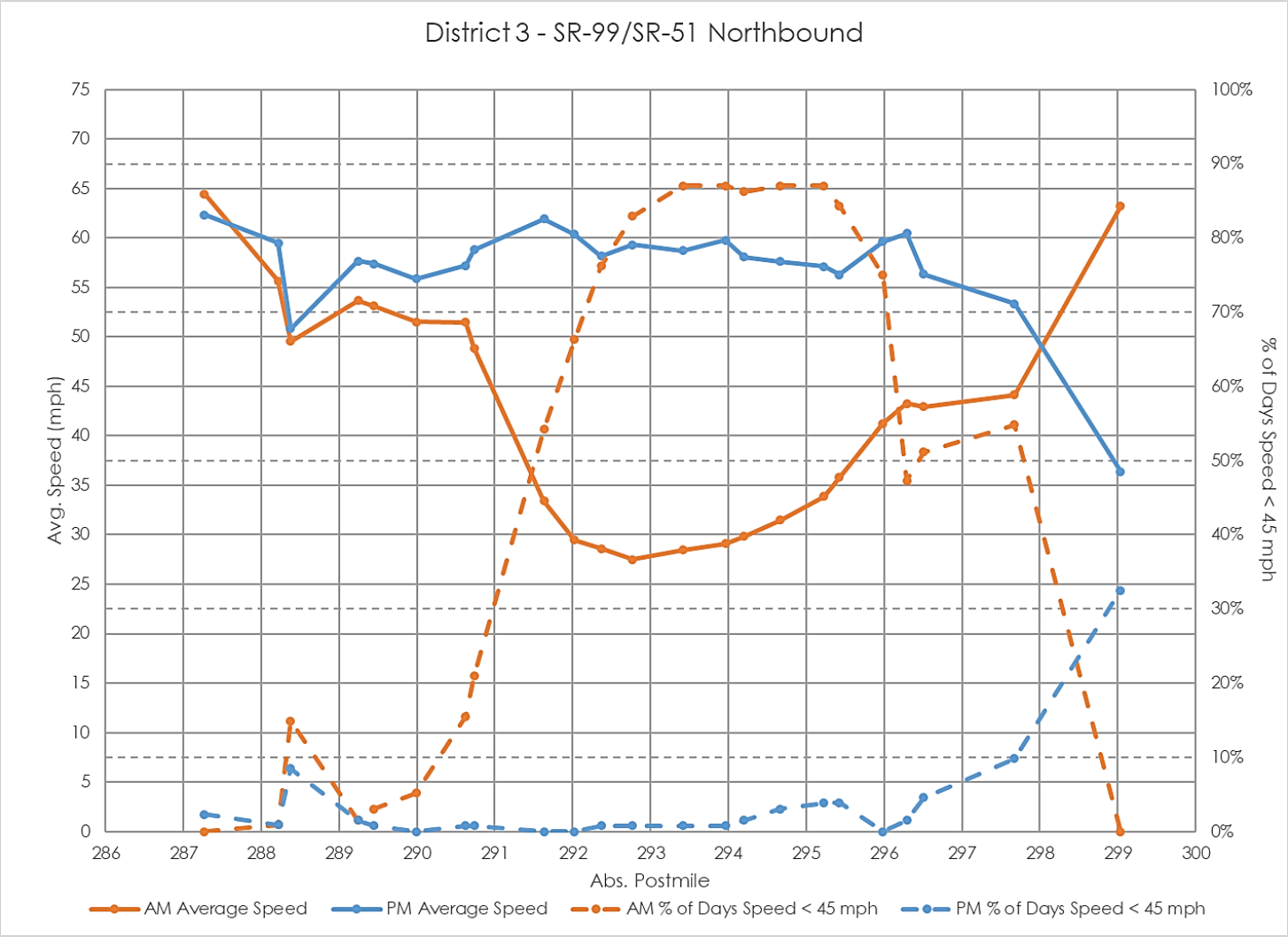
## FIGURE 9. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 80



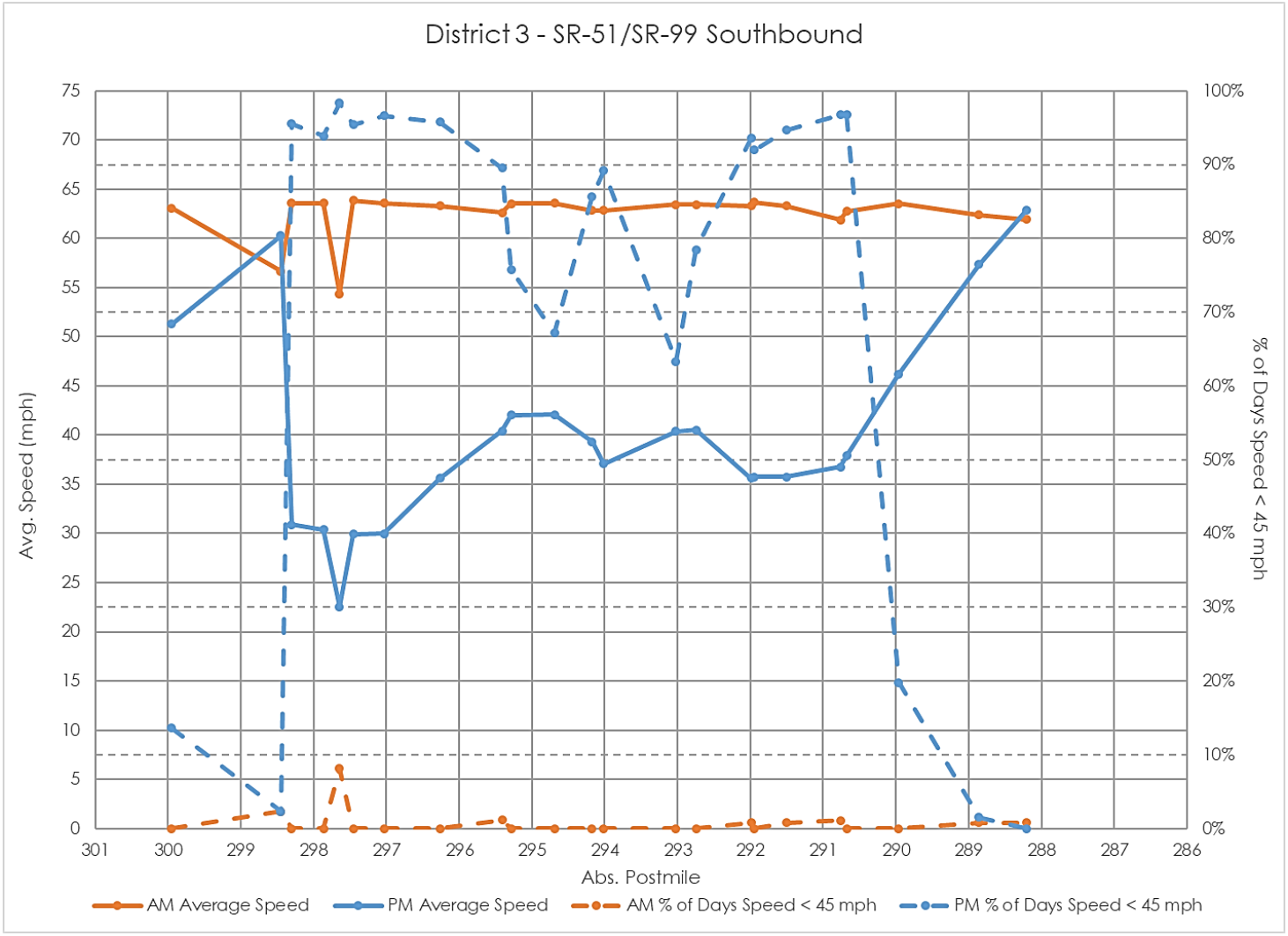
## FIGURE 10. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 80



## FIGURE 11. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTES 99 AND 51



## FIGURE 12. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTES 51 AND 99



### 4.1.2 DISTRICT-WIDE ACTIONS RELATED TO DEGRADATION

District 3 is currently developing a Managed Lanes System Plan to identify and prioritize future managed lanes projects and strategies over the next 20 years. This effort is being led by District 3 Division of Planning, with support from District 3 Traffic Operations and in consultation with regional transportation agencies and other stakeholders. One of the major factors being considered is how to address existing and future HOV degradation.

While the scope of work for the study is still being developed, HOV degradation remediation will be a major part of the project and strategy scoring system. The study is anticipated to kick off in March of 2022, with the study completion scheduled for July of 2023.

### 4.1.3 ACTION PLAN FOR HOV FACILITIES ON ROUTE 50

### A. ANALYSIS

Route 50 in Sacramento experiences directional congestion during the AM and afternoon peak periods. The congestion is concentrated in the westbound direction during the morning commute period and in the eastbound direction during the afternoon commute period. This directional congestion is the result of jobs/housing imbalance where the residents of large housing developments in eastern Sacramento County area commute to employment centers to the west, such as Downtown Sacramento

The HOV lanes on Route 50 initially provided a reliable commute option for carpoolers and transit users traveling between Folsom and Downtown Sacramento. However, as travel demand has increased along this corridor, the HOV lanes have become a less reliable travel option in some segments for commuters during the peak periods.

*Westbound*

During the morning peak period, the HOV lanes on westbound Route 50 experience slight degradation. The main degradation occurs between the lane drop at Watt Avenue where the existing HOV lane ends and west of Mather Field Road.

There are three major causes of degradation for this direction and time period: The lane drop which causes friction between the GP lanes and HOV lane, heavy

HOV lane demand at key bottleneck locations, and a high percentage of HOV lane violators.

Figures 13 and 14 are a 2019 congestion plot and map for westbound Route 50 across all lanes in the morning. The figures show congestion between 7:00 AM and 9:00 AM from Howe Avenue and queueing back upstream to Mather Field Road.

**FIGURE 13. 2019 CONGESTION PLOT FOR WESTBOUND ROUTE 50**

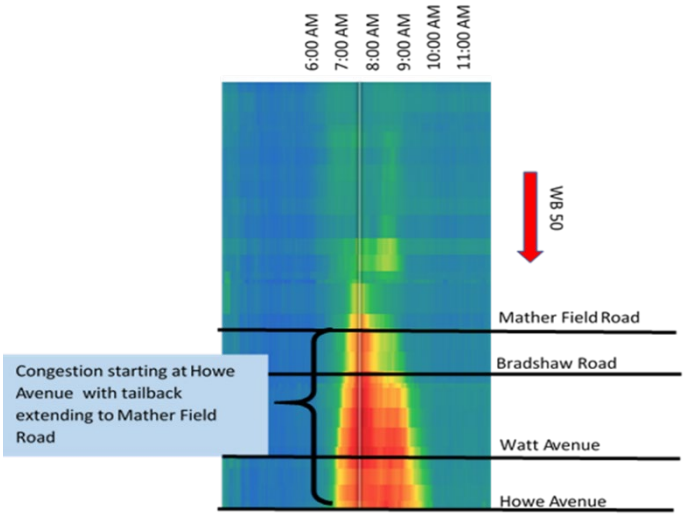
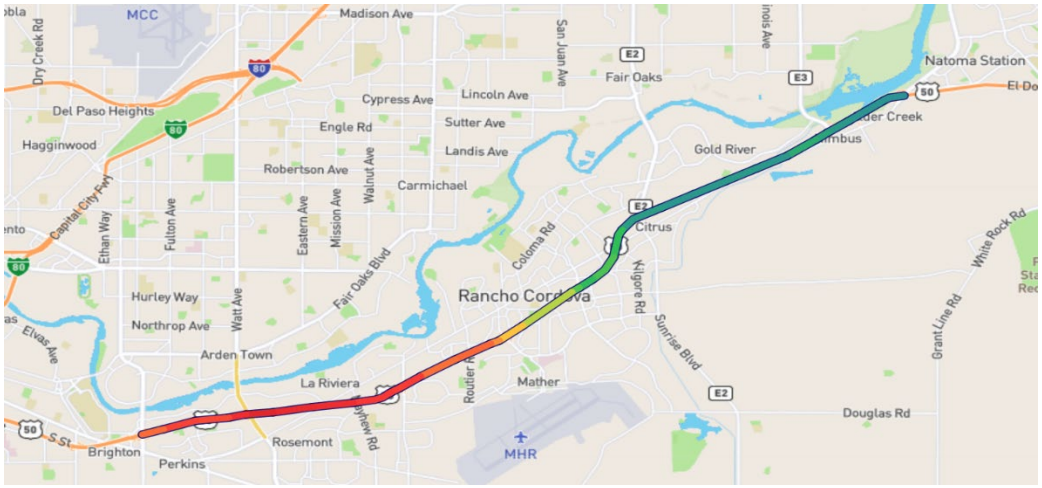



**FIGURE 14. 2019 CONGESTION MAP FOR WESTBOUND ROUTE 50**




Analysis of PeMS lane by lane speed data confirms that adjacent GP lane speeds during the morning peak hour and period drop below 45 mph causing

HOV lane speeds to drop below 45 mph. Table 3 shows the #2 lane and overall GP lane speeds for select locations on westbound Route 50 during the morning peak hour and period within areas of HOV degradation.

**TABLE 3. 2019 GP LANE SPEED DATA FOR WESTBOUND ROUTE 50**

| | | Peak Period | | Peak Hour | |
|---|---|---|---|---|---|
| | | Speed (mph) | Volume (vph) | Speed (mph) | Volume (vph) |
| Mayhew | #2 GP Lane | 44 | 1,697 | 28 | 1,508 |
| | All GP Lanes | 41 | 5,798 | 28 | 5,673 |
| Watt | #2 GP Lane | 42 | 1,525 | 31 | 1,568 |
| | All GP Lanes | 38 | 6,282 | 28 | 6,334 |

*Source: Caltrans Performance Measurement System (PeMS) Fall 2019. Speed and volume data collected and post-processed from individual detector stations listed above.*

Causes of friction in the westbound direction include:

- Heavy directional travel demand
- Geometric Deficiencies - The vertical alignment at the Mayhew Overhead bridge impacts sight distance on the westbound approach, just upstream of the lane drop bottleneck at Watt Avenue
- Lane Drop causing congestion and queueing at Watt Avenue (5 to 4 lanes)
- Unmetered HOV preferential lanes at onramps within congested segments
    - Recent counts have shown violation rates of over 60 percent in the HOV preferential lanes during congested periods.
    - Limits our ability to control freeway volume
    - Leads to freeway reaching capacity, increasing friction factor

Heavy HOV demand, which reaches over 1,400 vehicles in the peak hour between Bradshaw Road and Watt Avenue, contributes to degradation on this route. While HOV demand does not reach theoretical capacity of an HOV lane, the downstream lane drop bottleneck and friction from the adjacent congested GP lanes reduce the effective capacity of the HOV lane. HOV violators also cause degradation by using up available capacity, increasing the

density of vehicles in the lane. The HOV lane violation rates during the peak traffic period on westbound 50 is at 29percent, adding more vehicles to the lane and harming performance.

Additional investigations on the factors resulting in HOV degradation for westbound Route 50 will be conducted this year. Investigation activities will include:

- Field reviews of electrical equipment used to capture degradation
- Data analysis of degradation impacts due to recreational traffic, weather, and incidents
- Evaluating operational issues leading to degradation

*Eastbound*

During the afternoon peak period, the HOV lane on eastbound Route 50 experiences slight degradation. The degradation occurs from the Zinfandel Interchange to the Folsom Boulevard interchange.

Figures 15 and 16 show a 2019 congestion plot and contour heat map for eastbound Route 50 across all lanes in the PM. The figure shows slight congestion between 4:00 PM and 6:00 PM starting at Zinfandel Drive and extending to Folsom Boulevard.

**FIGURE 15. 2019 CONGESTION PLOT FOR EASTBOUND ROUTE 50**

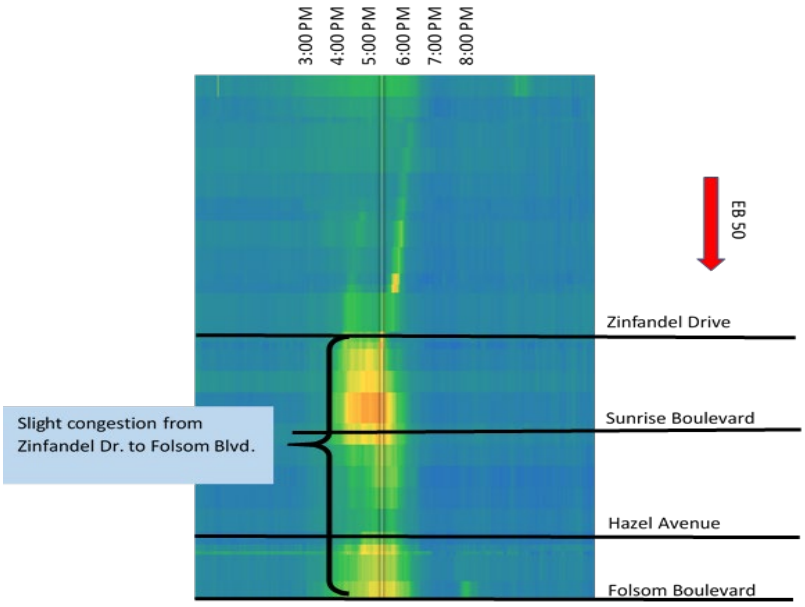
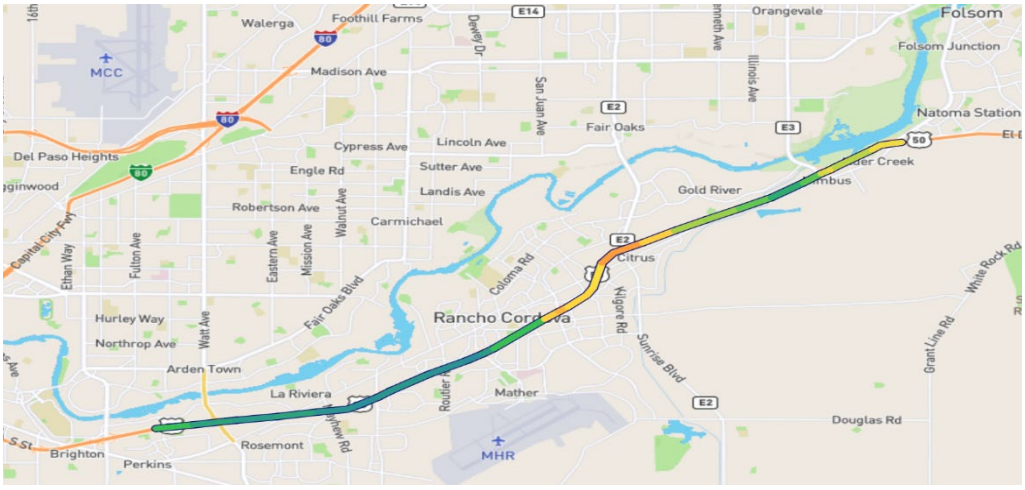



**FIGURE 16. 2019 CONGESTION MAP FOR EASTBOUND ROUTE 50**




Analysis of PeMS lane by lane speed data confirms that the adjacent GP lane speeds during the morning peak hour and period drop below 45 mph causing HOV lane speeds to drop below 45 mph. Table 4 shows the #2 lane and overall GP lane speeds for select locations on westbound Route 50 during the morning peak hour and period.

**TABLE 4. 2019 GP LANE SPEED DATA FOR EASTBOUND ROUTE 50**

| Locations | | Peak Period | | Peak Hour | |
|---|---|---|---|---|---|
| | | Speed (mph) | Volume (vph) | Speed (mph) | Volume (vph) |
| Sunrise | #2 GP Lane | 33 | 1,677 | 32 | 1,618 |
| | All GP Lanes | 34 | 4,518 | 32 | 4,337 |
| Folsom | #2 GP Lane | 40 | 1,656 | 33 | 1,637 |
| | All GP Lanes | 41 | 3,005 | 34 | 3,059 |

*Source: Caltrans Performance Measurement System (PeMS) Fall 2019. Speed and volume data collected and post-processed from individual detector stations listed above.*

Causes of friction in the westbound direction include:

- Heavy directional travel demand
- Lane Drops causing congestion and queueing at Sunrise Boulevard (5 to 4 lanes) and Folsom Boulevard (4 to 3 lanes)
- Geometric Deficiencies
    - The vertical alignment at the West Citrus Overhead bridge impacts sight distance on the eastbound approach, just upstream of the lane drop bottleneck at Sunrise Boulevard
    - The horizontal alignment at Sunrise Boulevard and Folsom Boulevard impacts sight distance on the eastbound approach, just upstream of the lane drop bottlenecks
- Several Interchange off-ramps on eastbound 50 including Zinfandel Drive, Sunrise Boulevard, and Hazel Avenue experience queue spillback on to the mainline causing a decrease in speeds across the freeway. In addition, high volume on-ramp merging and weaving maneuvers lower mainline speeds which also contributes to congestion and lower speeds in the HOV lane.
- Unmetered HOV preferential lanes at onramps within congested segments
    - Limits our ability to control freeway volume
    - Leads to freeway reaching capacity, increasing friction factor

- Recent counts have shown violation rates of over 60percent in the HOV preferential lanes during congested periods.

Heavy HOV demand, which is over 1,650 vehicles in the peak hour between Sunrise Boulevard and Hazel Avenue, contributes to degradation on this route. The HOV demand exceeds the theoretical capacity of an HOV lane. Additionally, the downstream lane drop bottlenecks and friction from the adjacent congested GP lanes reduce the effective capacity of the HOV lane at degraded locations on the route where HOV volumes do not exceed theoretical capacity.

HOV violators also cause degradation by using up available capacity, increasing the density of vehicles in the lane. The HOV lane violation rates during the peak traffic period on eastbound 50 is at 20percent, adding more vehicles to the lane and harming performance.

Additional investigations on the factors resulting in HOV degradation for eastbound Route 50 will be conducted this year. Investigation activities will include:

- Field reviews of electrical equipment used to capture degradation
- Data analysis of degradation impacts due to recreational traffic, weather, and incidents
- Evaluating operational issues leading to degradation

## B. REMEDIATION STRATEGIES

*Both Directions*

District 3 is in the process of implementing an Integrated Corridor Management (ICM) project on Route 50 that includes extensive ITS elements including traffic monitoring, public information displays, integrated corridor ramp meters, metering all unmetered on-ramp HOV preferential lane lanes, and incident management that will decrease congestion and HOV degradation. The field element installation portion is scheduled to complete construction in 2023.

Another remediation strategy includes increased discussion and dialogue with CHP in order to help prioritize HOV lane enforcement. While the goal is to reduce violators and improve HOV degradation, we realize that discussions with

CHP alone will not improve degradation. Additional coordination and/or resources, perhaps at the statewide level, will be needed in order for increase and/or automate enforcement of HOV lane minimum requirements.

District 3 will evaluate impacts of the proposed remediation strategies in this Action Plan to HOV degradation. These evaluation plans will include before and after studies within the project's area of influence using data from PeMS, 3rd party data sources, and field reviews.

*Westbound*

The HOV lane extension from Watt Avenue to the Route 50/Route 5 Interchange is under construction and is part of a Design-Build project that will be completed 2024. This project will extend the existing HOV lanes from Watt Avenue to the Route 50/Route 5 Interchange, which will eliminate the bottleneck that forms as a result of the HOV lane termination. This will lead to a more "complete" HOV lane system on westbound Route50 that relieves congestion that HOV's currently experience during the morning peak period in the westbound direction. It is anticipated that this project will significantly reduce and/or eliminate westbound morning degradation.

*Eastbound*

The Hazel Avenue interchange is being redesigned to accommodate more vehicles at the eastbound off-ramp, while also metering the HOV preferential lane at both the loop and the slip on-ramps and improving local road throughput which will reduce impacts to eastbound Route 50. This will help to limit the number of vehicles in the weave and contain the off-ramp queuing to the interchange while moving traffic more swiftly to allow eastbound 50 to flow uninterrupted. While this project is not fully funded, it is currently planned to complete construction in 2026.

The Zinfandel Drive Interchange modification project was completed at the beginning of 2020 and is anticipated show a reduction in congestion and HOV degradation on eastbound 50 by adding ramp metering to all HOV preferential lanes at on-ramps, while also adding storage at the off-ramps, which reduces queue spillback to the mainline. The benefits related to this project should be reflected in the 2021 HOV Degradation report.

The City of Rancho Cordova has a signed Project Report for the Rancho Cordova Parkway Interchange, which will potentially complete construction in

2027 once funds are available. This project will reduce the number of vehicles using the Sunrise and Hazel off-ramps. This will further limit off-ramp queueing at these locations.

These improvements will provide congestion relief on the freeway by allowing vehicles to have more time and space to merge with freeway traffic while limiting weaving movements and helping to reduce friction between the GP lanes and degraded HOV lane on these segments.

### 4.1.4 ACTION PLAN FOR HOV FACILITIES ON ROUTE 80

### A. ANALYSIS

Route 80 in Sacramento experiences heavy directional congestion during the morning and afternoon peak periods. The congestion is concentrated in the eastbound direction during the afternoon commute period and in the westbound direction during the morning and afternoon commute periods. This heavy directional congestion is the result of jobs/housing imbalance where the residents of large housing developments in Placer County and the surrounding cities commute to employment centers to the west, such as San Francisco Bay Area and Downtown Sacramento, using Route 80 as the connection.

The HOV lanes on Route 80 initially provided a reliable commute option for carpoolers and transit users traveling between Roseville and Downtown Sacramento. However, as travel demand has increased along this corridor, the HOV lanes have become a less reliable option in some segments for commuters during the peak periods.

*Eastbound*

During the afternoon peak period, the HOV lanes on eastbound Route 80 experience degradation ranging from slightly to extreme. The degradation occurs for roughly 4 miles from Truxel Road to east of Norwood Avenue and roughly 4 miles from State Route 244 to Greenback Lane. Approximately 1.5 miles of extreme degradation occurs from Truxel Road to Northgate Boulevard. There are three major causes of degradation for this direction and time period: friction between the GP lanes and HOV lane, heavy weaving caused by HOV vehicles from northbound Route 5 merging over to the eastbound I-80 HOV lane, and a high percentage of HOV lane violators.

Figure 17 is a 2019 congestion plot for eastbound Route 80 across all lanes in the PM. The figure shows significant congestion between 4:00 PM and 6:00 PM from Truxel Road to Norwood Avenue, which coincides with the limits of HOV degradation. Figure 18 is a 2019 congestion plot for eastbound Route 80 across all lanes in the PM. The figure shows significant congestion between 4:00 PM and 6:00 PM from Route 51 to Greenback Lane, which coincides with the limits of HOV degradation.

**FIGURE 17. 2019 CONGESTION PLOT FOR EASTBOUND ROUTE 80 – TRUXEL TO NORWOOD**

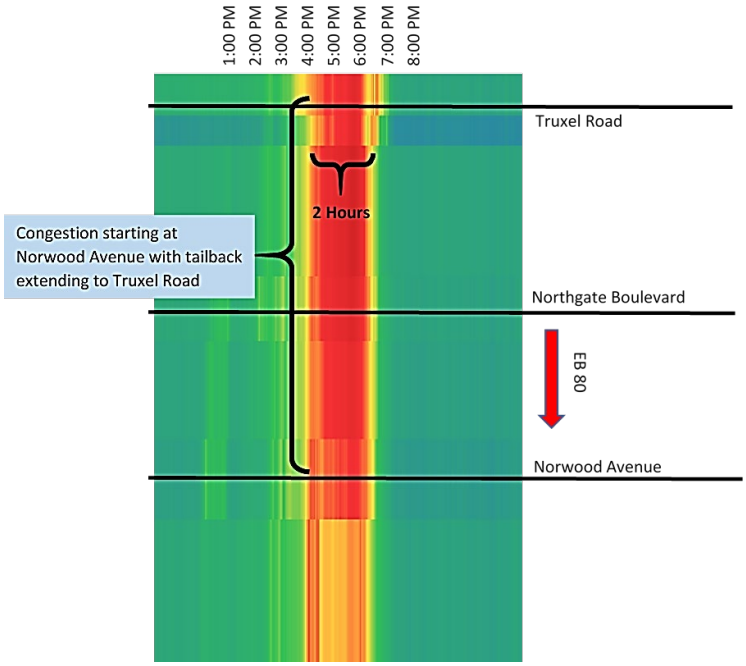
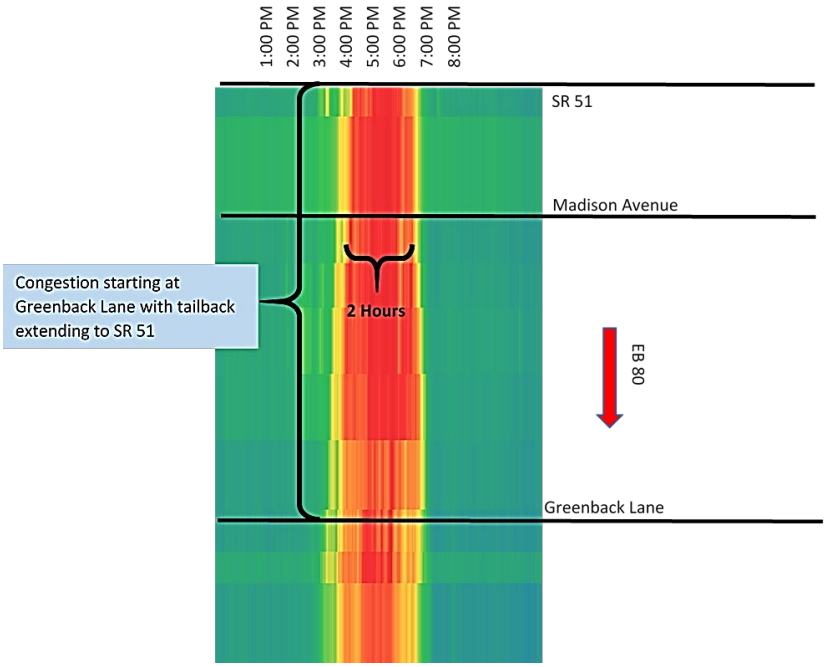


**FIGURE 18. 2019 CONGESTION PLOT FOR EASTBOUND ROUTE 80 – ROUTE 51 TO GREENBACK**




Analysis of PeMS lane by lane speed data confirms that the #2 lane speeds during the morning peak hour and period drop significantly below 45 mph causing HOV lane speeds to drop below 45 mph. Table 5 shows the #2 lane and overall GP lane speeds for select locations on eastbound Route 80 during the afternoon peak hour and period.

**TABLE 5. 2019 GP LANE SPEED DATA FOR EASTBOUND ROUTE 80**

| Locations | | Peak Period | | Peak Hour | |
|---|---|---|---|---|---|
| | | Speed (mph) | Volume (vph) | Speed (mph) | Volume (vph) |
| Truxel | #2 GP Lane | 38 | 1,601 | 25 | 1,365 |
| | All GP Lanes | 44 | 4,885 | 33 | 4,470 |
| East of Madison | #2 GP Lane | 44 | 1,590 | 38 | 1,525 |
| | All GP Lanes | 48 | 7,554 | 43 | 7,365 |

*Source: Caltrans Performance Measurement System (PeMS) Fall 2019. Speed and volume data collected and post-processed from individual detector stations listed above.*

Causes of friction in the eastbound direction include:

- Heavy directional travel demand

- Heavy demand at the Route 5 and Route 51 connectors
    - Leads to queueing on Route 80
- Heavy weaving caused by HOV vehicles from northbound Route 5 merging over to the eastbound I-80 HOV lane
- Geometric Deficiencies
    - The vertical alignment at the Natomas East Canal OH impacts sight distance on the eastbound approach
    - The horizontal alignment between Truxel Road and Northgate Boulevard impacts sight distance on the eastbound approach
- Heavy weaving at consecutive interchanges
    - Truxel Road and Northgate Boulevard
    - Madison Avenue and Greenback Lane
    - Closely spaced interchanges intensify weaving (Route 5/Truxel Road and Route 51/Madison Avenue)
- Unmetered HOV preferential lanes at onramps within congested segments
    - Limits our ability to control freeway volume
    - Leads to freeway reaching capacity, increasing friction factor
    - Recent counts have shown violation rates of over 60percent in the HOV preferential lanes during congested periods.
- Recreational traffic

Eastbound Route 80 experiences heavy recreational traffic because the corridor connects the Bay Area/Sacramento Area with Reno and Lake Tahoe. Travel speeds on Fridays going towards Reno/Lake Tahoe are 15 mph lower than typical weekday travel speeds due to the increase in demand associated with recreational travel. Friday HOV degradation makes up a significant portion of overall degradation between Route 51 and Greenback Lane (30-45percent).

Heavy HOV demand, which is over 1,700 vehicles in the peak hour between Madison Avenue and Greenback Lane, contributes to degradation on this route. The HOV demand exceeds the theoretical capacity of an HOV lane. Additionally, friction from the adjacent congested GP lanes reduces the effective capacity of the HOV lane at degraded locations on the route where HOV volumes do not exceed theoretical capacity.

HOV violators also cause degradation by using up available capacity, increasing the density of vehicles in the lane. In 2019, the eastbound HOV lane had 40 percent violators during the afternoon peak hour.

Additional investigations on the factors resulting in HOV degradation for eastbound Route 80 will be conducted this year. Investigation activities will include:

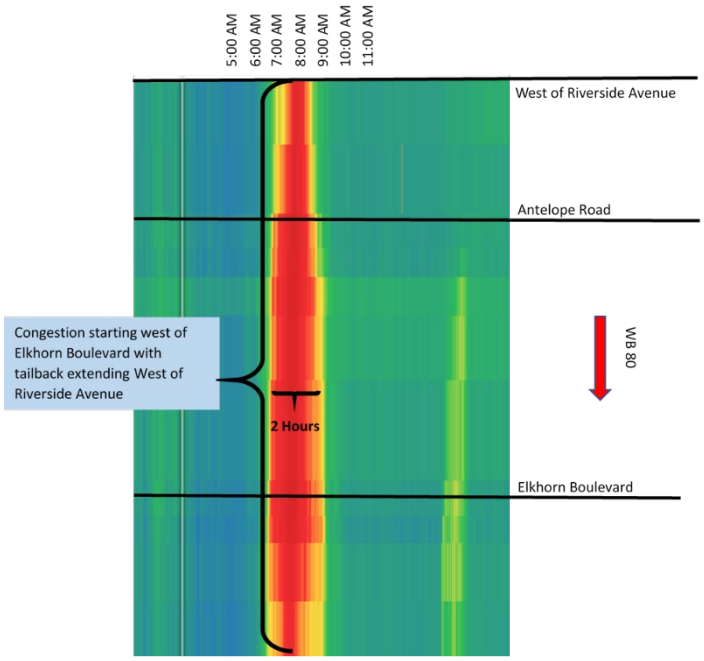
- Field reviews of electrical equipment used to capture degradation
- Data analysis of degradation impacts due to recreational traffic, weather, and incidents
- Evaluating operational issues leading to degradation

*Westbound*

During the morning peak period, the HOV lanes on westbound Route 80 experience slight degradation. The degradation occurs for roughly 5 miles from west of Riverside Avenue to the west of Elkhorn Boulevard. There are two major causes of degradation for this direction and time period: friction between the GP lanes and HOV lane and a high percentage of HOV lane violators.

Figure 19 is a 2019 congestion plot for westbound Route 80 across all lanes in the PM. The figure shows significant congestion between 7:00 AM and 9:00 AM from west of Riverside Avenue to the west of Elkhorn Boulevard, which coincides with the limits of HOV degradation.

**FIGURE 19. 2019 CONGESTION PLOT FOR WESTBOUND ROUTE 80 – RIVERSIDE AVE TO ELKHORN BLVD**




Causes of friction in the westbound direction include:

- Heavy directional travel demand
- Heavy demand from the Antelope Interchange
- Unmetered HOV preferential lanes at onramps within congested segments
    - Limits our ability to control freeway volume
    - Leads to freeway reaching capacity, increasing friction factor
    - Recent counts have shown violation rates of over 60percent in the HOV preferential lanes during congested periods.

Heavy HOV demand, which is over 1,800 vehicles in the peak hour between Greenback Lane and Madison Avenue, contributes to degradation on this route. The HOV demand exceeds the theoretical capacity of an HOV lane. Additionally, friction from the adjacent congested GP lanes reduces the effective capacity of the HOV lane at degraded locations on the route where HOV volumes do not exceed theoretical capacity.

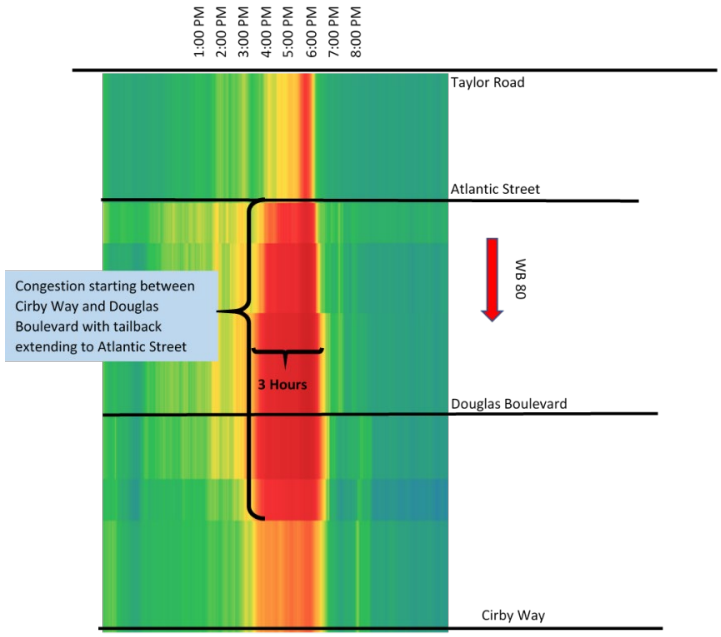
Additional investigations on the factors resulting in HOV degradation for westbound Route 80 will be conducted this year. Investigation activities will include:

- Field reviews of electrical equipment used to capture degradation
- Data analysis of degradation impacts due to recreational traffic, weather, and incidents
- Evaluating operational issues leading to degradation

During the afternoon peak period, the HOV lanes on westbound Route 80 experiences degradation ranging from slightly to extreme. The degradation occurs for roughly 4 miles from Taylor Road to Cirby Way. Approximately 2 miles of extreme degradation occurs from Atlantic Street to west of Douglas Boulevard. There are two major causes of degradation for this direction and time period: friction between the GP lanes and HOV lane and a high percentage of HOV lane violators.

Figure 20 is a 2019 congestion plot for westbound Route 80 across all lanes in the PM. The figure shows significant congestion between 3:00 PM and 6:00 PM from Atlantic Street to west of Douglas Boulevard, which coincides with the limits of HOV degradation.

## FIGURE 20. 2019 CONGESTION PLOT FOR WESTBOUND ROUTE 80 – TAYLOR ROAD TO CIRBY WAY




Analysis of PeMS lane by lane speed data confirms that lane 2 speeds during the morning peak hour and period drop significantly below 45 mph causing HOV lane speeds to drop below 45 mph. Table 6 shows the #2 lane and overall GP lane speeds for select locations on eastbound Route 80 during the afternoon peak hour and period.

### TABLE 6. 2019 GP LANE SPEED DATA FOR WESTBOUND ROUTE 80

| Location | | Peak Period | | Peak Hour | |
|---|---|---|---|---|---|
| | | Speed (mph) | Volume (vph) | Speed (mph) | Volume (vph) |
| Douglas Blvd | #2 GP Lane | 30 | 1,695 | 23 | 1,595 |
| | All GP Lanes | 27 | 4,090 | 21 | 3,915 |

*Source: Caltrans Performance Measurement System (PeMS) Fall 2019. Speed and volume data collected and post-processed from individual detector stations listed above.*

Causes of friction in the westbound direction include:

- Heavy directional travel demand
- Lane Drop causing congestion and queueing at Douglas Boulevard (5 to 4 lanes)

- Weaving at closely spaced consecutive interchanges, Douglas Boulevard and Atlantic Street
- Limited shoulder widths
- Closely spaced interchanges (Route 65 and Taylor Road)

HOV violators also cause degradation by using up available capacity and increasing the density of vehicles in the lane. In 2019, the eastbound HOV lane had 24 percent violators in the afternoon peak hour.

Additional investigations on the factors resulting in HOV degradation for westbound Route 80 will be conducted this year. Investigation activities will include:

- Field reviews of electrical equipment used to capture degradation
- Data analysis of degradation impacts due to recreational traffic, weather, and incidents
- Evaluating operational issues leading to degradation

## B. REMEDIATION STRATEGIES

*Both Directions*

District 3 is in the planning stage for a project (03-2J180) to address degradation by evaluating other managed lanes strategies for the current HOV lanes along the entire limits of Route 80 corridor. Changes in managed lane type, minimum occupancy requirements, access control, and operational improvements, like reducing weaving and friction from slower operating general-purpose lanes through limited access striping, will be studied and part of the project alternatives. The Project Initiation Document is scheduled to be completed by June 2022.

Another remediation strategy includes increased discussion and dialogue with CHP in order to help prioritize HOV lane enforcement. While the goal is to reduce violators and improve HOV degradation, we realize that discussions with CHP alone will not improve degradation. Additional coordination and/or resources, perhaps at the statewide level, will be needed in order for increase and/or automate enforcement of HOV lane minimum requirements.

District 3 will evaluate impacts of the proposed remediation strategies in this Action Plan to HOV degradation. These evaluation plans will include before and after studies within the project's area of influence using data from PeMS, 3rd party data sources, and field reviews.

*Eastbound*

In February of 2020, the northbound Truxel Road slip on-ramp HOV preferential lane was converted to a metered lane. The addition of this meter will help reduce HOV preferential lane violators and decreases the number of vehicles entering the freeway at one time which has frequently led to deteriorating traffic operations across all lanes of the freeway. Additionally, ramp metering rates were recently changed along the corridor to help address peak period congestion. District 3 operations staff was not able to evaluate the impacts from this upgrade due to COVID-19.

The Route 5/Route 80 interchange project 03-2C990 is currently in the planning phase. The project will add HOV connectors from northbound 5 to eastbound 80 and westbound 80 to southbound 5. The addition of the HOV connectors plus other upgrades at the interchange will help limit the vehicles that are in the weaving section between Route 5 and Truxel Road. The weave is the major cause of the bottleneck, and with this being improved, operations in the GP lanes and the HOV lane will improve greatly. While early in the project development process, this project is planned to complete construction post 2030.

This degraded segment has 4 unmetered HOV preferential lanes (2 at Madison Avenue and 2 at Greenback Lane) that contribute to congestion along the corridor. District 3 is currently working towards funding these 4 locations in a future project; therefore, construction completion dates are currently unknown.

*Westbound*

District 3 received Cycle 2 Trade Corridor Enhancement Program funding for a project that eliminates the lane drop at Douglas Boulevard, which is the cause of extreme degradation in the PM. The project is scheduled to complete construction in 2024. This project will construct a 5th GP lane from Douglas Boulevard to Riverside Avenue and upgrade existing on-ramps to help limit congestion and increase throughput at Douglas Boulevard.

District 3 has identified several ramp metering issues along the westbound (westbound) Route 80 corridor associated with unmetered HOV preferential lane's, which greatly impact the effectiveness of the ramp meters along this corridor. Project 03-1J450 will meter 2 total HOV preferential lanes within the degraded segment of westbound Route 80 at the Elkhorn Boulevard slip on-ramp and the Madison Avenue slip on-ramp. The project will complete construction in 2022. These ramp improvements will help reduce congestion and improve the efficiency of the ramp meters near a major bottleneck along the corridor.

The Atlantic Street on-ramp has limited storage which limits District 3's ability to meter this location effectively. Vehicle must be released at a faster rate in order to limit queue spillback onto local streets. Project 03-0H460 is currently under construction and will widen the existing single lane on-ramp to a 3 lane on-ramp, which will allow for greater storage and gives District 3 the ability to better manage traffic entering the freeway on this degraded section of westbound Route 80. The project will complete construction in 2022

### 4.1.5 ACTION PLAN FOR HOV FACILITIES ON ROUTES 51 AND 99

### A. ANALYSIS

HOV facilities on Route 99 extend northward onto a short segment of Route 51.

Route 99 in Sacramento experiences heavy directional congestion during the morning and afternoon peak periods. The congestion is concentrated in the northbound direction during the morning commute period and in the southbound direction during the afternoon commute period. This heavy directional congestion is the result of jobs/housing imbalance where the residents of large housing developments in the South Sacramento/Elk Grove area commute to employment centers to the north, such as Downtown Sacramento, using Route 99 as the connection.

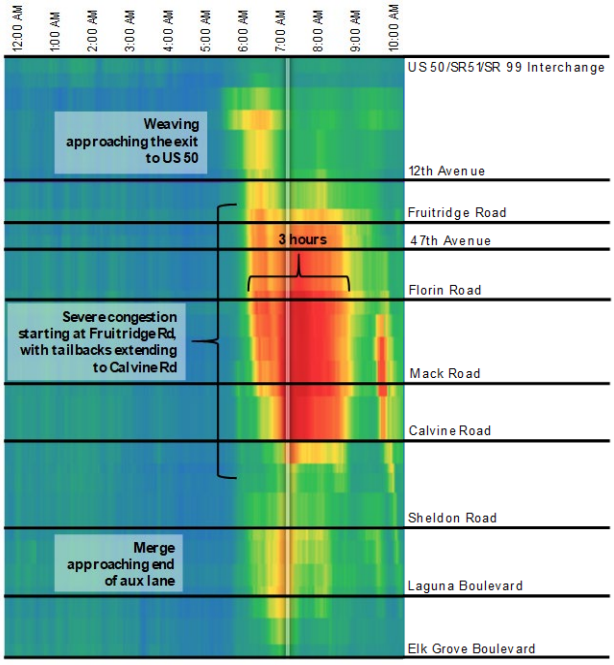
The HOV lanes on Route 99 initially provided a reliable commute option for carpoolers and transit users traveling between Elk Grove and Downtown Sacramento. However, as travel demand has increased along this corridor, the HOV lanes no longer provide reliable travel option for commuters during the peak periods.

*Northbound Route 99*

During the morning peak period, the HOV lanes on northbound Route 99 experience degradation ranging from slightly to extreme. The degradation occurs for roughly 8 miles from Calvine Road to the Route 50 connectors. Approximately 4 miles of extreme degradation occurs from Mack Road to Fruitridge Road. There are two major causes of degradation for this direction and time period: friction between the GP lanes and HOV lane and a high percentage of HOV lane violators.

Figure 21 is a 2019 congestion plot for northbound Route 99 across all lanes in the morning. The figure shows significant congestion between 6:00 AM and 9:00 AM from Calvine Road to Fruitridge Road, which coincides with the limits of HOV degradation.

**FIGURE 21. 2019 CONGESTION PLOT FOR NORTHBOUND ROUTE 99**




Analysis of PeMS lane by lane speed data confirms that lane 2 speeds during the morning peak hour and period drop significantly below 45 mph causing HOV lane speeds to drop below 45 mph. Table 7 shows lane number 2 and overall GP lane speeds for select locations on northbound Route 99 during the morning peak hour and period.

**TABLE 7. 2019 GP LANE SPEED DATA FOR NORTHBOUND ROUTE 99**

| Locations | | Peak Period | | Peak Hour | |
|---|---|---|---|---|---|
| | | Speed (mph) | Volume (vph) | Speed (mph) | Volume (vph) |
| Florin Rd | #2 GP Lane | 25 | 1,130 | 16 | 1,020 |
| | All GP Lanes | 26 | 3,575 | 17 | 3,265 |
| 47th Avenue | #2 GP Lane | 30 | 1,465 | 26 | 1,480 |
| | All GP Lanes | 31 | 4,475 | 25 | 4,450 |

*Source: Caltrans Performance Measurement System (PeMS) Fall 2019. Speed and volume data collected and post-processed from individual detector stations listed above.*

Causes of friction in the northbound direction include:

- Heavy directional travel demand - Heavy demand at the Route 50 connectors leads to queueing on Route 99
- Geometric Deficiencies - Narrow inside shoulders
- Weaving at consecutive cloverleaf interchanges: Florin Road, 47th Avenue, and Fruitridge Road
- Closely spaced interchanges (Route 50 and 12th Avenue)
- Unmetered HOV preferential lanes at onramps within congested segments
    - Limits our ability to control freeway volume
    - Leads to freeway reaching capacity, increasing friction factor

      Recent counts have shown violation rates of over 60 percent in the HOV preferential lanes during congested periods.

Heavy HOV demand, which reaches over 1,800 vehicles in the peak hour between Florin Road and 47th Avenue, contributes to degradation on this route. The HOV demand exceeds the theoretical capacity of an HOV lane. Additionally, friction from the adjacent congested GP lanes reduces the effective capacity of the HOV lane at degraded locations on the route where HOV volumes do not exceed theoretical capacity.

HOV violators also cause degradation by using up available capacity, increasing the density of vehicles in the lane. In 2019, the northbound HOV lane

had 25 percent violators during the morning peak period. Historically, the HOV lane has experienced up to 34 percent violators in the during the morning peak period.

Additional investigations on the factors resulting in HOV degradation for northbound Route 99 will be conducted this year. Investigation activities will include:

- Field reviews of electrical equipment used to capture degradation
- Data analysis of degradation impacts due to recreational traffic, weather, and incidents
- Evaluating operational issues leading to degradation

*Northbound Route 51*

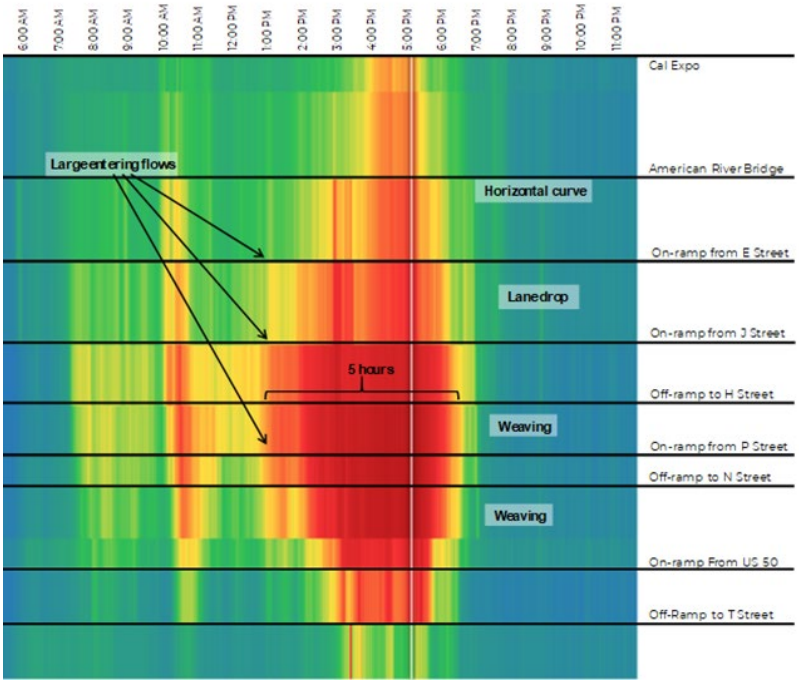
Northbound Route 51 experiences slight HOV degradation in the afternoon peak hour period due to queue spillback from congestion at the E Street bottleneck, which is one of the worst on the region, caused by geometric issues (lane drop/horizontal curves). Figure 22 is a 2019 congestion plot for northbound Route 51, which shows significant congestion in the afternoon peak period.

*Southbound*

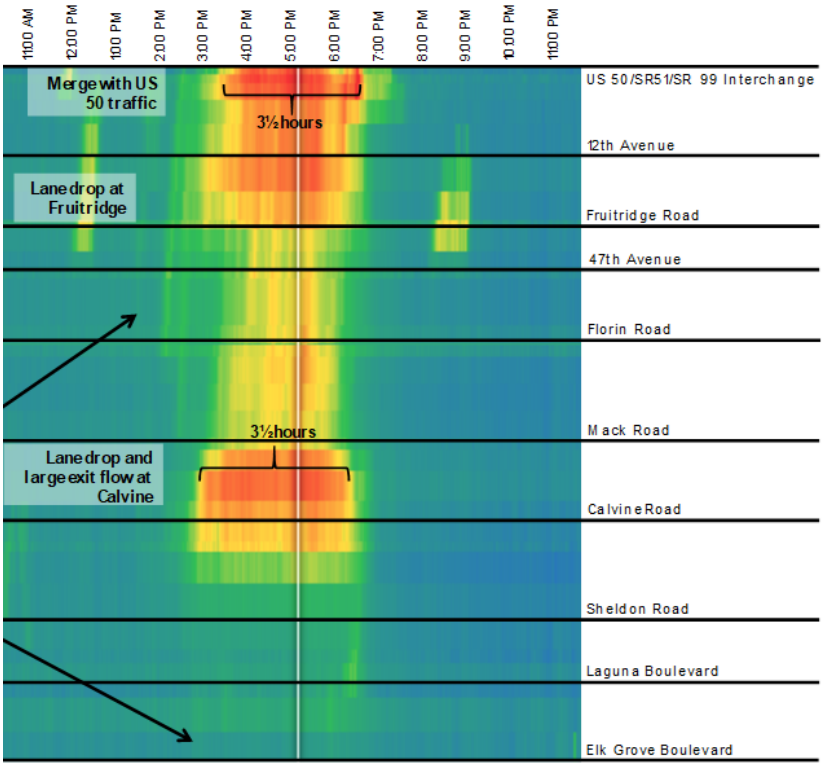
During the afternoon peak period, the HOV lanes on southbound Routes 51 and 99 experience degradation ranging from slightly to extreme. The degradation occurs for roughly 10 miles from N Street on Route 51 to Calvine Road. Approximately 6 miles of extreme degradation occurs from Broadway to Fruitridge Road and Florin Road to Calvine Road. There are two major causes of degradation for this direction and time period: friction between the GP lanes and HOV lane and a high percentage of HOV lane violators.

Figure 23 is a 2019 congestion plot for southbound Route 99 across all lanes in the morning. The figure highlights significant congestion between 3:00 PM and 7:00 PM at two major bottleneck locations (lane drops at Fruitridge Road and Calvine Road), which coincides with the limits of HOV degradation.

## FIGURE 22. 2019 CONGESTION PLOT FOR NORTHBOUND ROUTE 51




## FIGURE 23. 2019 CONGESTION PLOT FOR SOUTHBOUND ROUTE 99



Analysis of PeMS lane by lane speed data confirms that lane 2 speeds during the afternoon peak hour and afternoon peak period drop significantly below 45 mph, causing HOV lane speeds to drop below 45 mph. Table 7 shows lane number 2 and overall GP lane speeds at one of the major bottleneck locations on southbound Route 99 during the afternoon peak hour and period.

**TABLE 8. 2019 GP LANE SPEED DATA FOR SOUTHBOUND ROUTE 99**

| Location | | Peak Period | | Peak Hour | |
|---|---|---|---|---|---|
| | | Speed (mph) | Volume (vph) | Speed (mph) | Volume (vph) |
| Stockton Blvd | #2 GP Lane | 22 | 1,180 | 18 | 1,140 |
| | All GP Lanes | 23 | 3,690 | 19 | 3,630 |

*Source: Caltrans Performance Measurement System (PeMS) Fall 2019. Speed and volume data collected and post-processed from individual detector stations listed above.*

Causes of friction in the southbound direction include:

- Heavy directional travel demand (discussed earlier)
- Geometric Deficiencies - Narrow inside shoulders
- Lane Drops causing congestion and queueing at Fruitridge Road (5 to 4 lanes) and Calvine Road (4 to 3 lanes)
- Weaving at consecutive cloverleaf interchanges - Florin Road and 47th Avenue
- Closely spaced interchanges (Route 50 and 12th Avenue)
- Unmetered onramps (in 2019 condition). Almost all onramps on southbound Route 99 were unmetered in 2019. District 3 activated new meters on all onramps along the corridor late 2019/early 2020

Heavy HOV demand, which reaches over 2,000 vehicles in the peak hour between Fruitridge Road and 47th Avenue, contributes to degradation on this route. The HOV demand exceeds the theoretical capacity of an HOV lane. Additionally, the lane drop bottlenecks and friction from the adjacent congested GP lanes reduce the effective capacity of the HOV lane at degraded locations on the route where HOV volumes do not exceed theoretical capacity.

HOV violators also cause degradation by using up available capacity and increasing the density of vehicles in the lane. In 2019, the southbound HOV lane had 28 percent violators in the afternoon peak period. Historically, the HOV lane has experienced up to 35 percent violators in the afternoon peak period.

Additional investigations on the factors resulting in HOV degradation for southbound Route 99 will be conducted this year. Investigation activities will include:

- Field reviews of electrical equipment used to capture degradation
- Data analysis of degradation impacts due to recreational traffic, weather, and incidents
- Evaluating operational issues leading to degradation

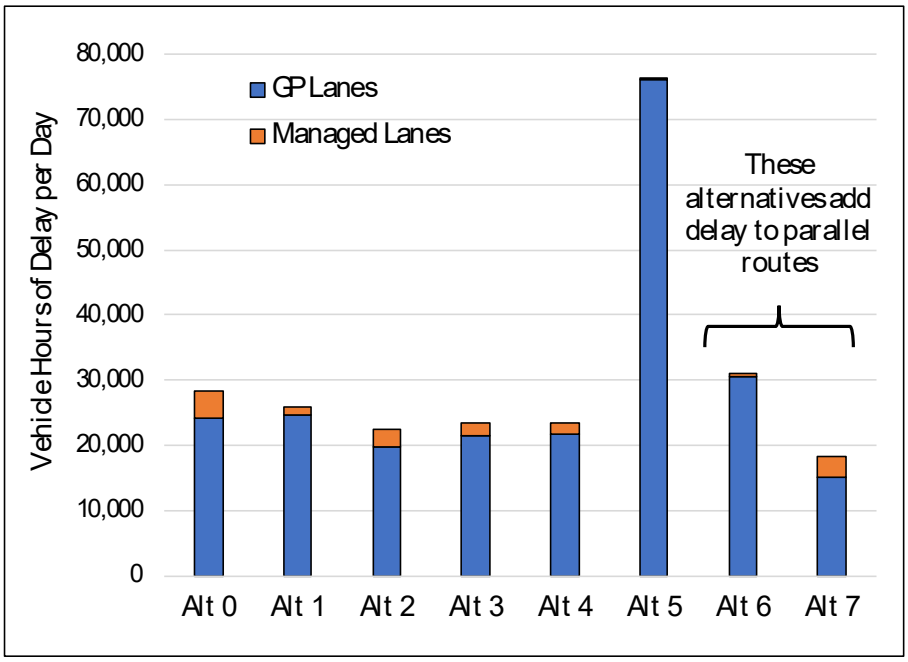
## B. REMEDIATION STRATEGIES

*Both Directions*

District 3 conducted a Managed Lane Study for the Route 99 HOV lanes with the goal to identify short-term and long-term improvements to help mitigate HOV degradation. The Managed Lanes Study produced a preliminary Concept of Operations report for the corridor that included possible solutions for HOV degradation and identified engagement activities with CHP and other stakeholders. Changes in managed lane type, minimum occupancy requirements, and operational improvements, like reducing weaving and friction from slower operating general-purpose lanes through limited access striping, were studied. Results included:

- Minimum Occupancy Requirement Change Analysis: To be consistent with Traffic Operations Policy Directive 20-02, raising the minimum occupancy requirement on Route 99 was analyzed. Using analytical tools, including the SACSIM travel demand model, we concluded that raising the minimum occupancy from 2+ to 3+ would almost triple the delay in the GP lanes, as shown in Figure 24.

**FIGURE 24. FORECAST OF VEHICLE HOURS OF DELAY ON ROUTE 99 IN 2050**




- Long Range Improvements: Several project alternatives were analyzed to specifically address HOV degradation, including conversion of the existing HOV lane to a HOT lane. With some positive initial results, some alternatives are being analyzed further and moving forward in the planning phase (project 03-2J210). Currently, the project is scheduled to complete the planning phase in June of 2022.

- Short Range Improvements: Limited access for the existing HOV lane was analyzed in order to determine feasibility and impacts to underserved communities. Three locations were analyzed (1 for northbound, 2 for southbound) using the SACSIM travel demand model, HCM methodologies, and Cal EnviroScreen3. While the analysis showed limited access may have operational benefits for the HOV lane, there may be adverse impacts to underserved communities and transit. Further evaluation may be needed to include limited access as an HOV degradation remediation strategy.

Another remediation strategy includes increased discussion and dialogue with CHP in order to help prioritize HOV lane enforcement. While the goal is to reduce violators and improve HOV degradation, we realize that discussions with CHP alone will not improve degradation. Additional coordination and/or resources, perhaps at the statewide level, will be needed in order for increase and/or automate enforcement of HOV lane minimum requirements.

District 3 will evaluate impacts of the proposed remediation strategies in this Action Plan to HOV degradation. These evaluation plans will include before and after studies within the project's area of influence using data from PeMS, 3rd party data sources, and field reviews.

*Northbound*

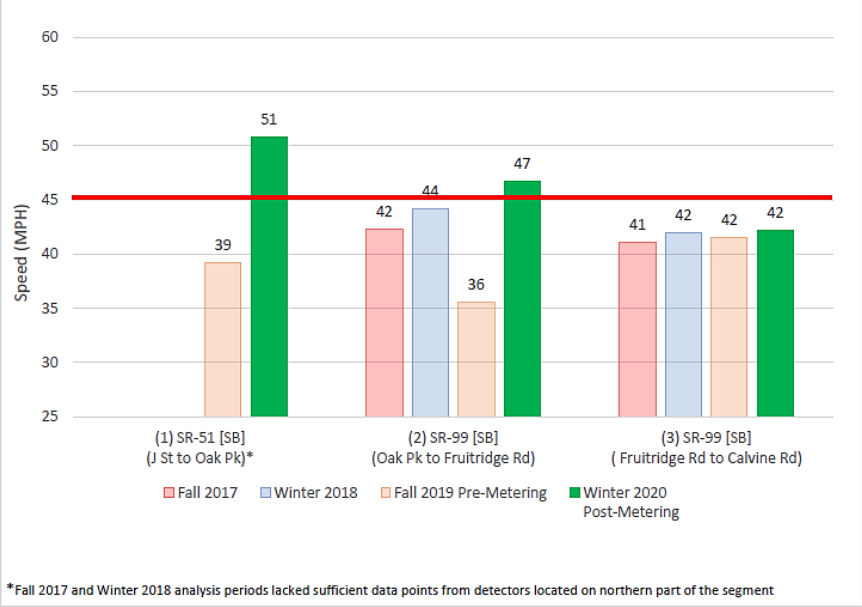
District 3 has identified several ramp metering deficiencies along the northbound Route 99 corridor associated with unmetered HOV preferential lanes. Recent ramp count data shows HOV preferential lanes violation rates of over 60 percent, which greatly impacts the effectiveness of the ramp meters along this corridor. Recently, District 3 implemented its first HOV preferential lane metering in this segment of Route 99 (Mack Road Slip to northbound 99) and observed improvements in travel times across all lanes in the project area (roughly 2 percent to 4 percent).

District 3 has initiated projects to meter 7 unmetered HOV preferential lanes along the degraded portion of this corridor. Project 03-1J460 will meter 3 total HOV preferential lanes at the Florin Road slip on-ramp and at both onramps from 47th Avenue to northbound Route 99. The project will complete construction in 2022. Project 03-1H630 is currently in the environmental phase and will meter the 4 total HOV preferential lanes at Calvine Road (Slip and Loop) and Sheldon Road (Slip and Loop). The project is currently scheduled to complete construction in 2025.

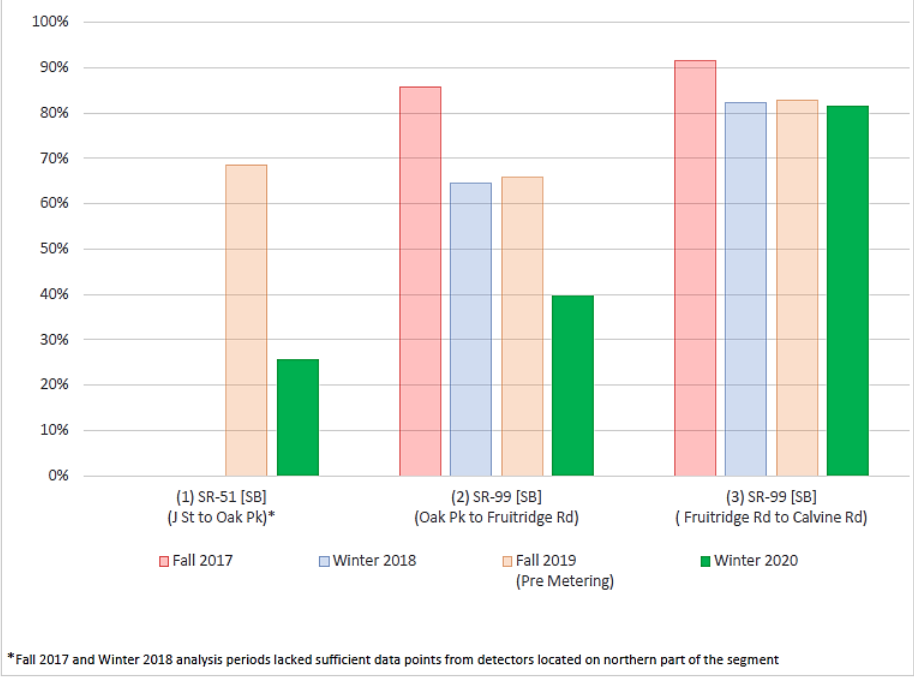
*Southbound*

District 3 activated 15 new ramp meters along this corridor in December 2019. District 3 is also conducting a before and after study to evaluate the impact of new ramp meter activation on HOV lane performance. Due to COVID-19, the sample size was limited to only 2 months. However, the observed improvements during this period include an increase in average travel speed, and decreases in average travel time, planning time, delay, and VMT. Additionally, the number of degraded days reduced significantly (between 40 percent and 65 percent) in two of the three segments on southbound Route 99. Figures 25 and 26 show the impact to HOV lane speeds and degradation percentage before and after the ramp meter activation.

## FIGURE 25. HOV SPEED SUMMARY FOR ROUTES 99 AND 51 BEFORE AND AFTER RAMP METERING




## FIGURE 26. HOV DEGRADATION ON ROUTES 99 AND 51 BEFORE AND AFTER RAMP METERING



Benefits from these meters will be captured in future HOV degradation data analysis. Additionally, District 3 is working with UC Berkeley PATH on implementing the Coordinated Adaptive Ramp Metering (CARM) algorithm, which is currently being used on northbound Route 99, for the southbound direction as well. During the initial (CARM) activation for northbound in 2016, results showed an average increase in peak hour speeds of over 7 percent.

Furthermore, project 03-1H630, which is scheduled to complete construction in 2025, will construct auxiliary lanes at two locations: Calvine Road to Sheldon Road (slightly degraded location) and Laguna Boulevard to Elk Grove Boulevard

These improvements will provide congestion relief on the freeway by allowing vehicles to have more time and space to merge with freeway traffic while limiting weaving movements and helping to reduce friction between the GP lanes and degraded HOV lane on these segments.

## 4.2. DISTRICT 4 2020 DEGRADATION ACTION PLANS

### 4.2.1 SUMMARY OF DEGRADATION ON HOV FACILITIES IN DISTRICT 4

Table 9 provides the list of degraded facilities in District 4 that were identified in the *2019 California High Occupancy Vehicle Facilities Degradation Report and Action Plan*. The speed and degradation profiles for each degraded facility are provided in Figures 27 through 56.

**TABLE 9. DISTRICT 4 LIST OF DEGRADED HOV FACILITIES**

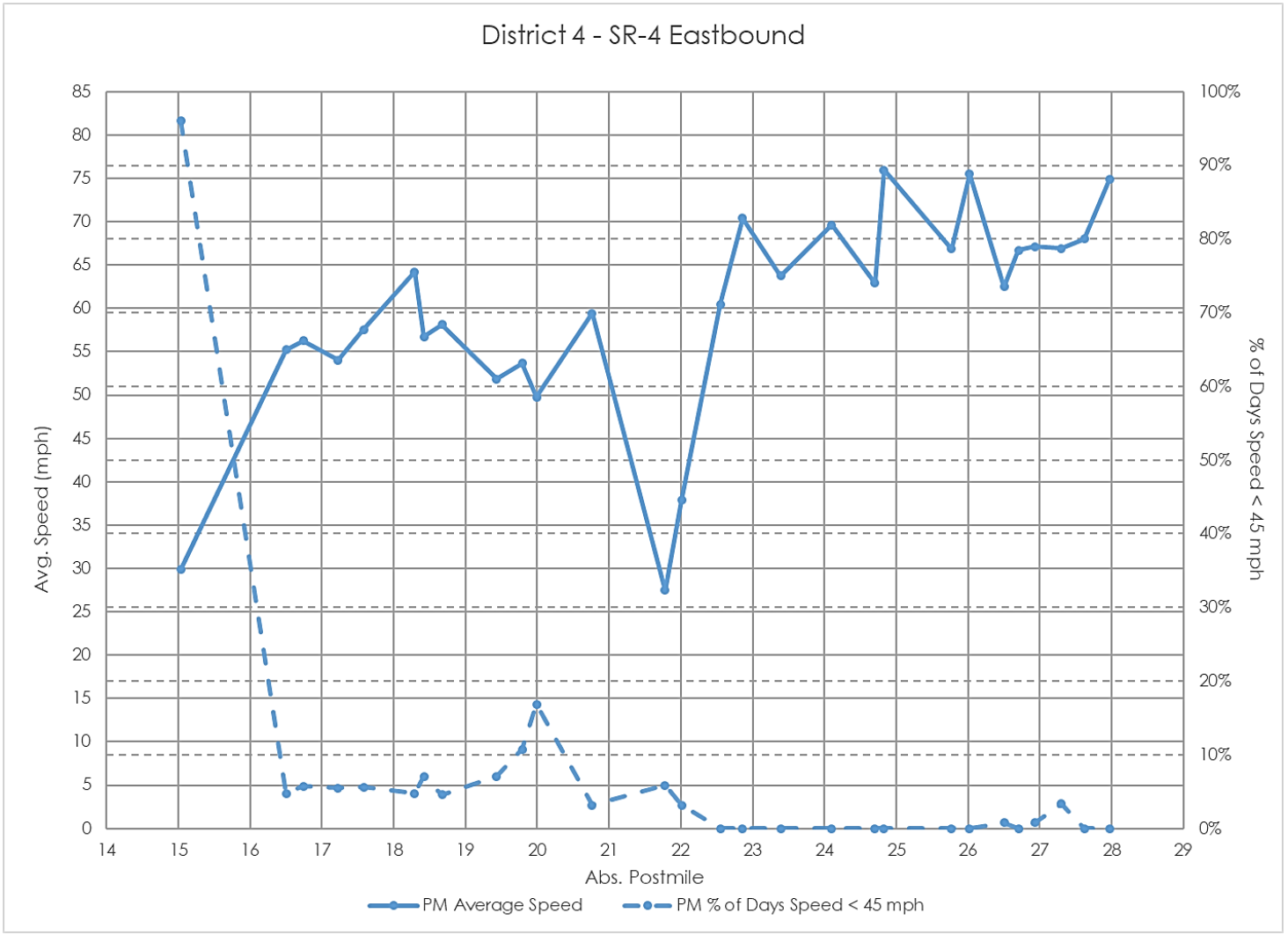
| Route | Direction | Limits | Facility length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 4 | EB | Port Chicago Hwy to Hillcrest Ave | 13.3 | 10.8 | 9.6 | 0.8 | 0.0 | 0.4 |
| 4 | WB | Hillcrest Ave to Port Chicago Hwy | 12.3 | 10.9 | 4.0 | 1.5 | 1.8 | 3.6 |
| 80 | EB | Route 880 to Cummings Skyway | 18.6 | 17.8 | AM-17.8 PM-4.6 | AM-0.0 PM-1.8 | AM-0.0 PM-2.0 | AM-0.0 PM-9.4 |
| 80 | EB | Red Top Road to Air Base Pkwy | 8.1 | 5.6 | AM-5.3 PM-3.1 | AM-0.3 PM-1.9 | AM-0.0 PM-0.6 | AM-0.0 PM-0.0 |
| 80 | WB | Air Base Pkwy to Route 680 | 7.5 | 4.8 | AM-2.5 PM-4.5 | AM-2.3 PM-0.4 | AM-0.0 PM-0.0 | AM-0.0 PM-0.0 |
| 80 | WB | Route 29 to San Francisco-Oakland Bay Bridge Toll Plaza | 23.6 | 19.2 | AM-5.1 PM-17.0 | AM-5.5 PM-0.9 | AM-6.8 PM-1.3 | AM-1.9 PM-0.0 |
| 85 | NB | Route 101 (South San Jose) to Route 101 (Mountain View) | 25.6 | 19.7 | AM-6.1 PM-19.7 | AM-5.4 PM-0.0 | AM-5.5 PM-0.0 | AM-2.6 PM-0.0 |
| 85 | SB | Route 101 (Mountain View) to Route 101 (South San Jose) | 25.6 | 22.1 | AM-22.1 PM-5.9 | AM-0.0 PM-1.7 | AM-0.0 PM-6.0 | AM-0.0 PM-8.6 |
| 87 | NB | Route 85 to Route 101 | 9.7 | 7.5 | AM-2.9 PM-7.5 | AM-2.8 PM-0.0 | AM-1.0 PM-0.0 | AM-0.8 PM-0.0 |
| 87 | SB | Route 101 to Route 85 | 9.1 | 5.7 | AM-5.7 PM-0.8 | AM-0.0 PM-4.3 | AM-0.0 PM-0.6 | AM-0.0 PM-0.0 |

| Route | Direction | Limits | Facility length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 92 | WB | Hesperian Blvd to San Mateo Bridge Toll Plaza | 3.3 | 2.9 | AM-0.0 PM-2.9 | AM-0.0 PM-0.0 | AM-0.3 PM-0.0 | AM-2.6 PM-0.0 |
| 101 | NB | Cochrane Rd to Whipple Ave | 44.7 | 26.9 | AM-16.1 PM-25.0 | AM-2.1 PM-1.6 | AM-5.3 PM-0.4 | AM-3.5 PM-0.0 |
| 101 | NB | Richardson Bay Bridge to North of Atherton Ave | 18.7 | 7.2 | 6.9 | 0.3 | 0.0 | 0.0 |
| 101 | NB | Old Redwood Hwy to Windsor River Rd | 21.4 | 20.2 | AM-20.2 PM-16.6 | AM-0.0 PM-3.6 | AM-0.0 PM-0.0 | AM-0.0 PM-0.0 |
| 101 | SB | Windsor River Rd to Old Redwood Hwy (Petaluma Blvd) | 21.3 | 15.2 | AM-15.2 PM-9.6 | AM-0.0 PM-3.2 | AM-0.0 PM-0.8 | AM-0.0 PM-1.6 |
| 101 | SB | De Long Ave to Richardson Bay Bridge | 16.2 | 6.7 | 2.9 | 1.1 | 2.3 | 0.4 |
| 101 | SB | Whipple Ave to Cochrane Rd | 44.0 | 27.5 | AM-23.9 PM-9.3 | AM-3.0 PM-7.1 | AM-0.6 PM-2.3 | AM-0.0 PM-8.8 |
| 237 | EB | Mathilda Avenue to Route 880 | 7.2 | 3.9 | AM-3.9 PM-0.0 | AM-0.0 PM-0.7 | AM-0.0 PM-0.0 | AM-0.0 PM-3.3 |
| 237 | WB | Route 880 to Lawrence Expwy | 6.2 | 3.8 | AM-2.1 PM-3.8 | AM-1.3 PM-0.0 | AM-0.4 PM-0.0 | AM-0.0 PM-0.0 |
| 280 | NB | Leland Ave to Magdalena Ave | 10.7 | 6.9 | AM-1.9 PM-6.9 | AM-1.3 PM-0.0 | AM-2.6 PM-0.0 | AM-1.1 PM-0.0 |
| 280 | SB | Magdalena Ave to Leland Ave | 10.6 | 8.8 | AM-8.8 PM-0.0 | AM-0.0 PM-3.0 | AM-0.0 PM-0.8 | AM-0.0 PM-4.9 |
| 580 | EB | Hacienda Rd to Greenville Rd | 17.1 | 12.6 | AM-12.6 PM-9.8 | AM-0.0 PM-1.6 | AM-0.0 PM-0.4 | AM-0.0 PM-0.8 |
| 580 | WB | Greenville Rd to Route 680 | 11.9 | 8.0 | AM-6.7 PM-8.0 | AM-1.3 PM-0.0 | AM-0.0 PM-0.0 | AM-0.0 PM-0.0 |
| 680 | NB | Alcosta Blvd to Livorna Road | 12.0 | 11.5 | AM-11.2 PM-7.3 | AM-0.3 PM-3.5 | AM-0.0 PM-0.7 | AM-0.0 PM-0.0 |
| 680 | NB | Route 242 to the south of Marina Vista | 4.5 | 2.4 | AM-2,4 PM-2.4 | AM-0.0 PM-0.0 | AM-0.0 PM-0.0 | AM-0.0 PM-0.0 |

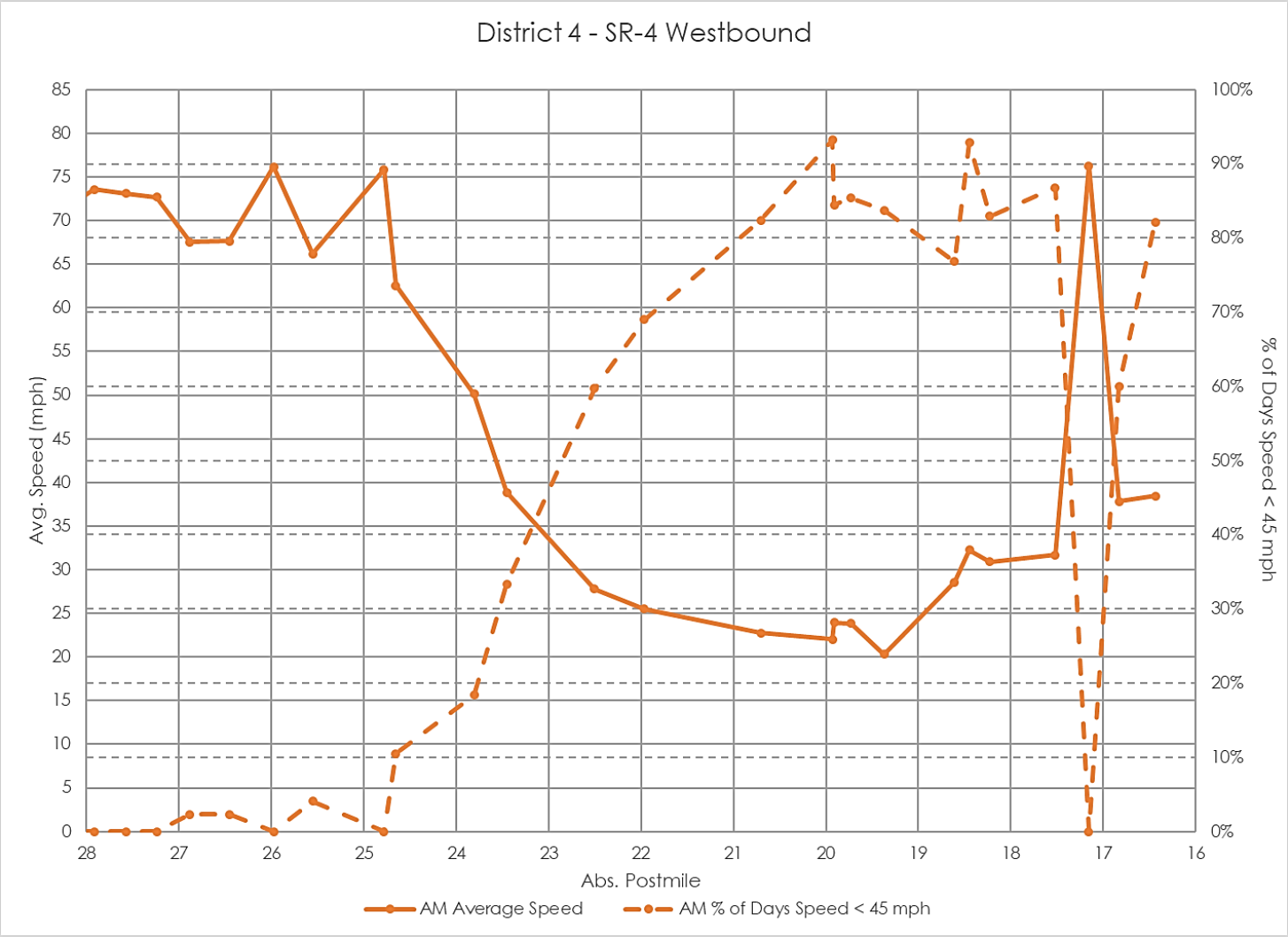
| Route | Direction | Limits | Facility length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 680 | SB | South of Marina Vista to Treat Blvd/Geary Rd | 7.4 | 4.5 | AM-2.9<br>PM-4.5 | AM-0.3<br>PM-0.0 | AM-1.0<br>PM-0.0 | AM-0.3<br>PM-0.0 |
| 680 | SB | Rudgear Rd to Alcosta Blvd | 12.2 | 9.5 | AM-9.0<br>PM-9.5 | AM-0.5<br>PM-0.0 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 680 | SB | Route 84 to Route 237 | 13.7 | 6.5 | AM-5.6<br>PM-5.6 | AM-0.8<br>PM-0.9 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 880 | NB | Old Bayshore Hwy to Route 238 | 24.7 | 11.8 | AM-11.6<br>PM-4.6 | AM-0.2<br>PM-1.5 | AM-0.0<br>PM-0.8 | AM-0.0<br>PM-4.9 |
| 880 | NB | West Grand Ave to Route 80 | 1.3 | 0.2 | AM-0.2<br>PM-0.2 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 880 | SB | Hegenberger Rd to Route 101 | 31.4 | 15.9 | AM-5.9<br>PM-10.2 | AM-5.3<br>PM-3.4 | AM-2.9<br>PM-0.6 | AM-1.7<br>PM-1.7 |

EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound
Lane-miles may not add up exactly due to rounding

## FIGURE 27. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 4



## FIGURE 28. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 4



## FIGURE 29. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 80 (BAY BRIDGE TO CARQUINEZ BRIDGE)

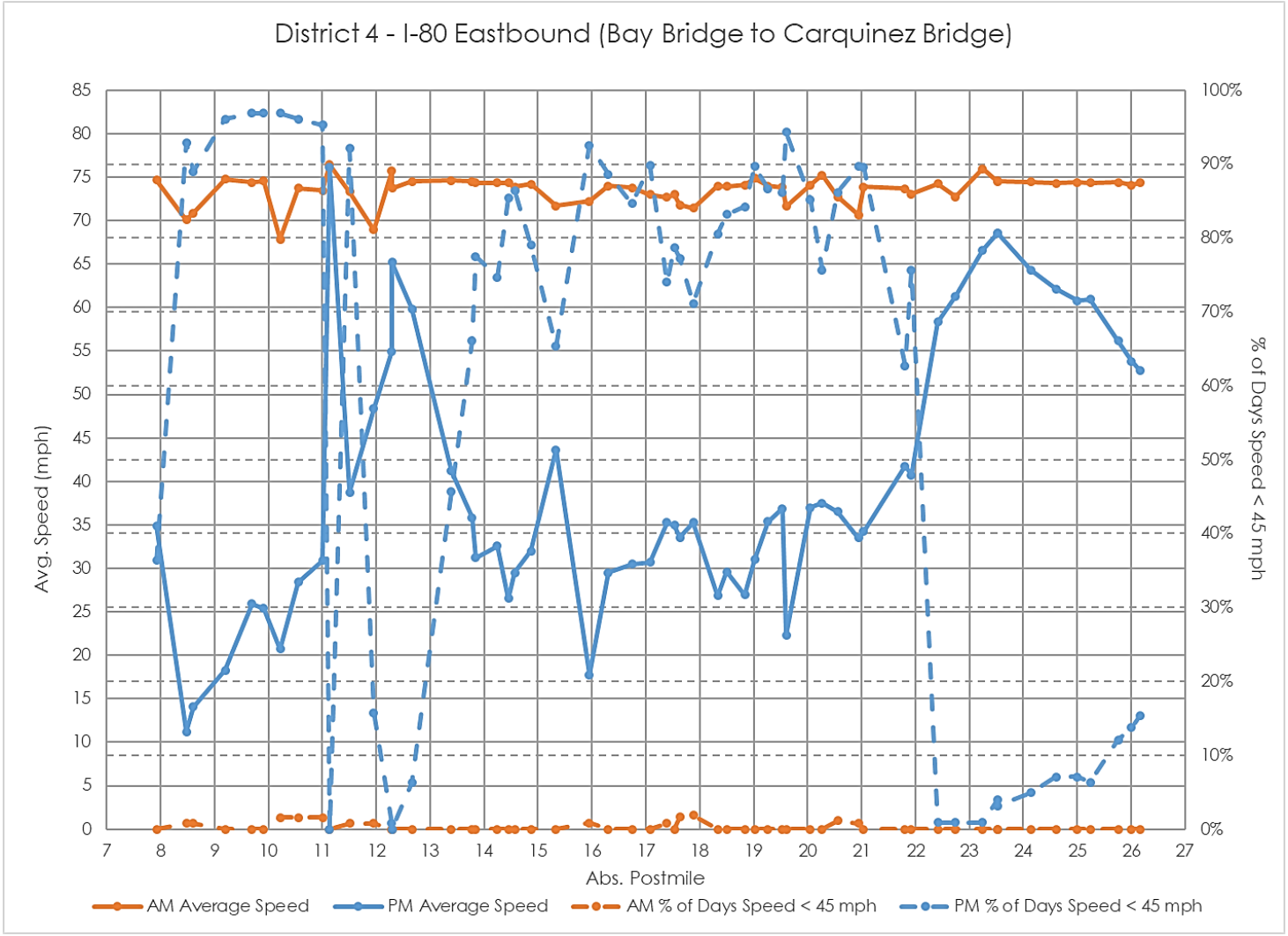
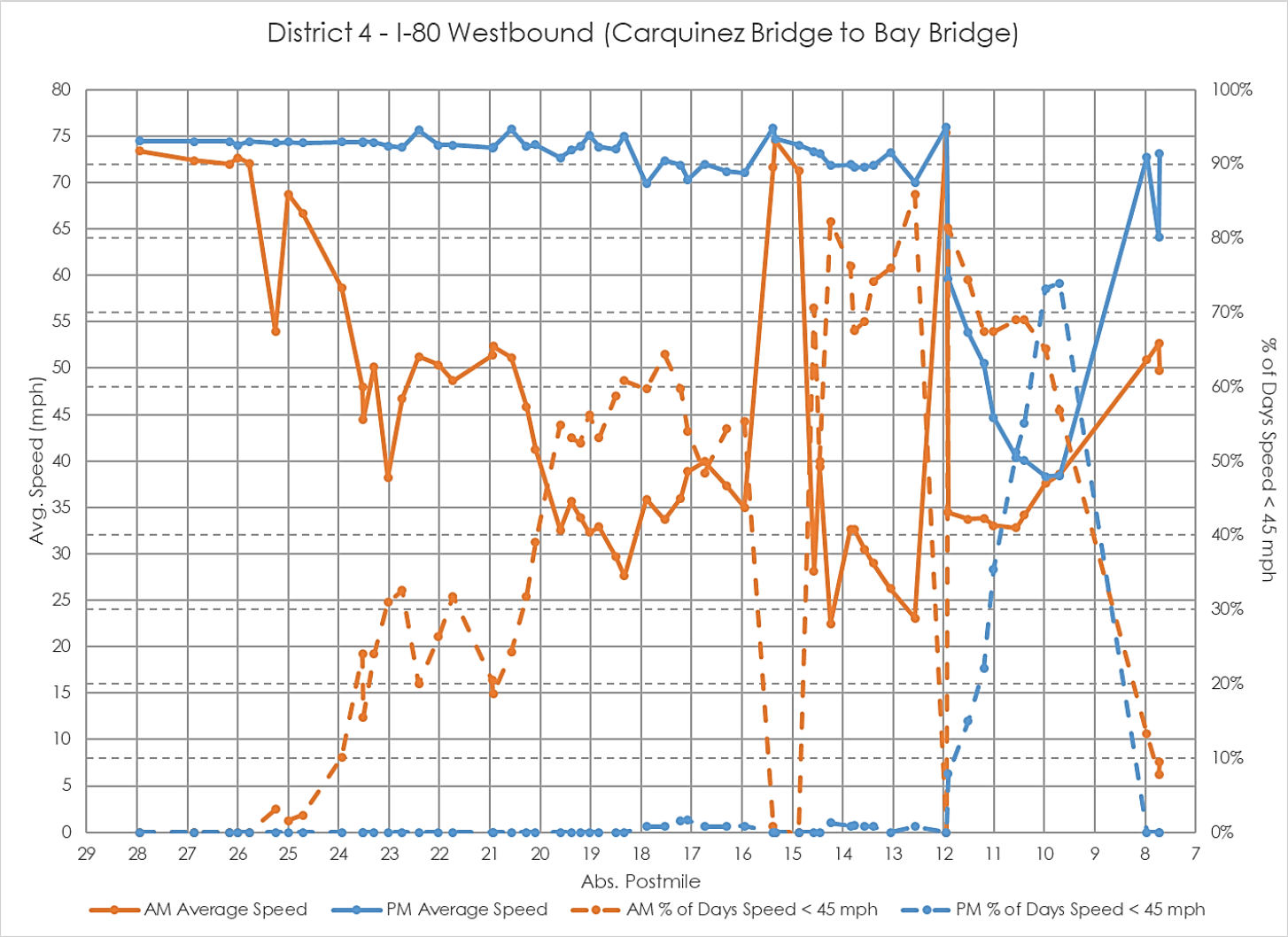
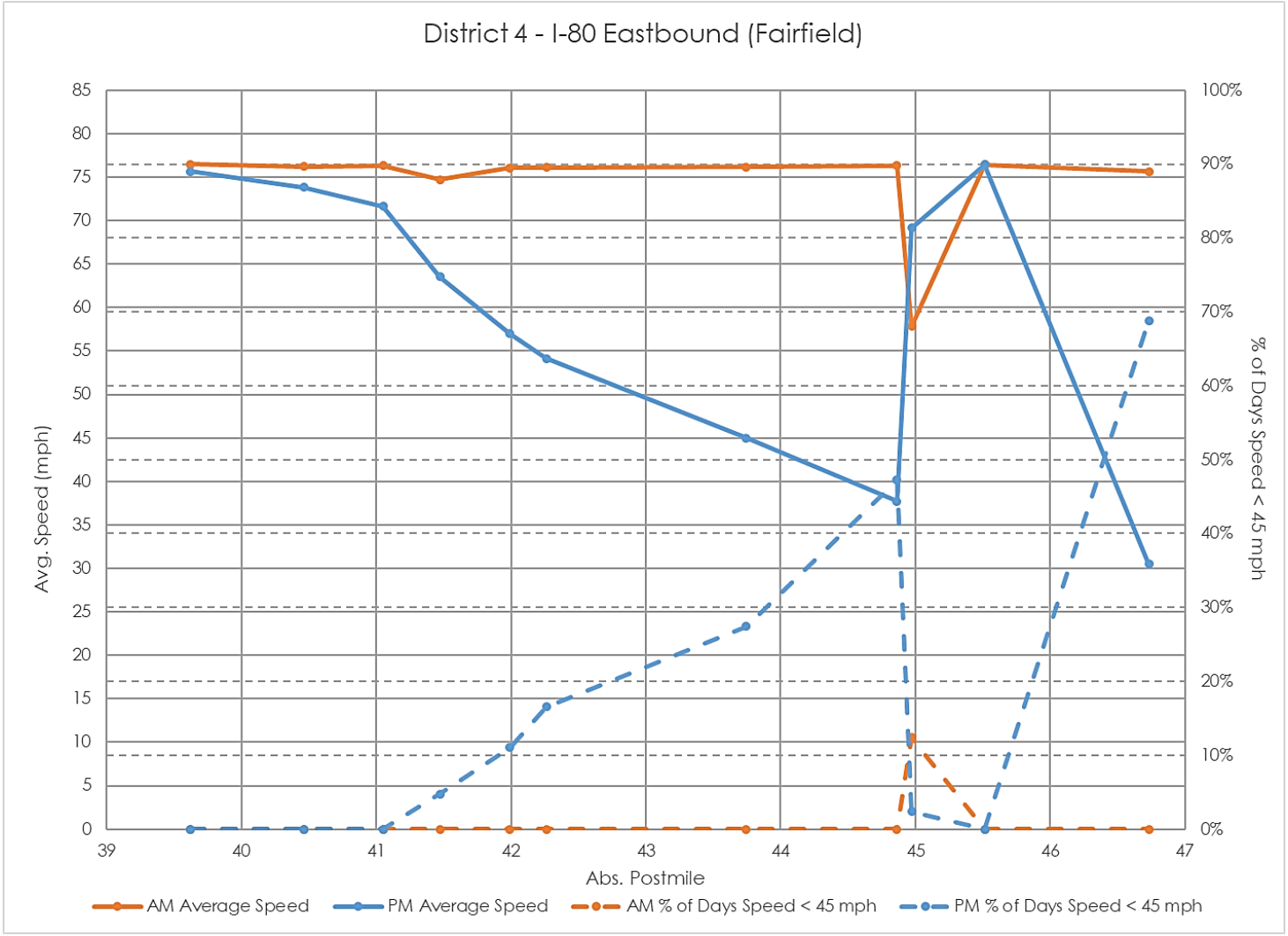


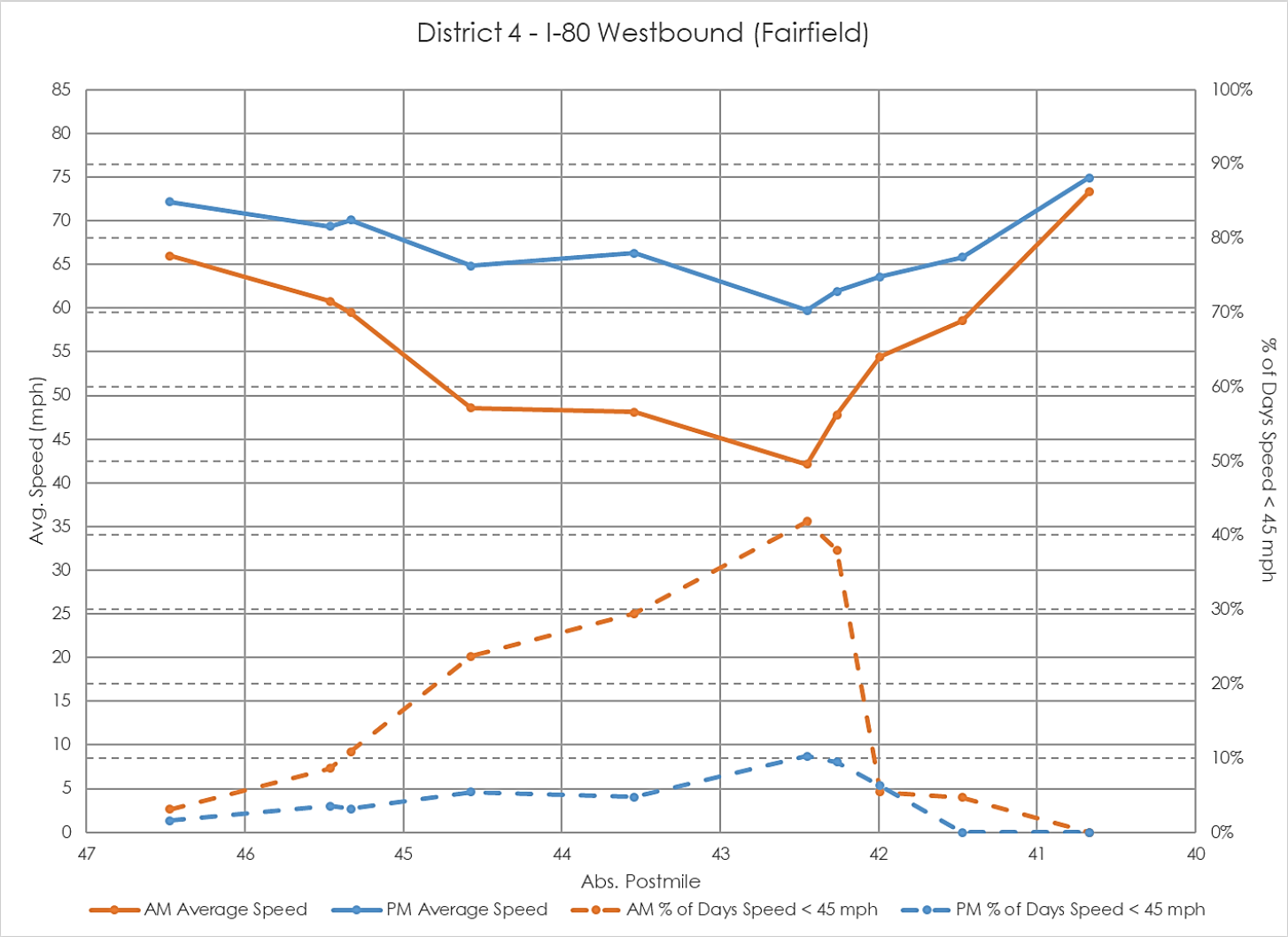
**FIGURE 30. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 80 (BAY BRIDGE TO CARQUINEZ BRIDGE)**



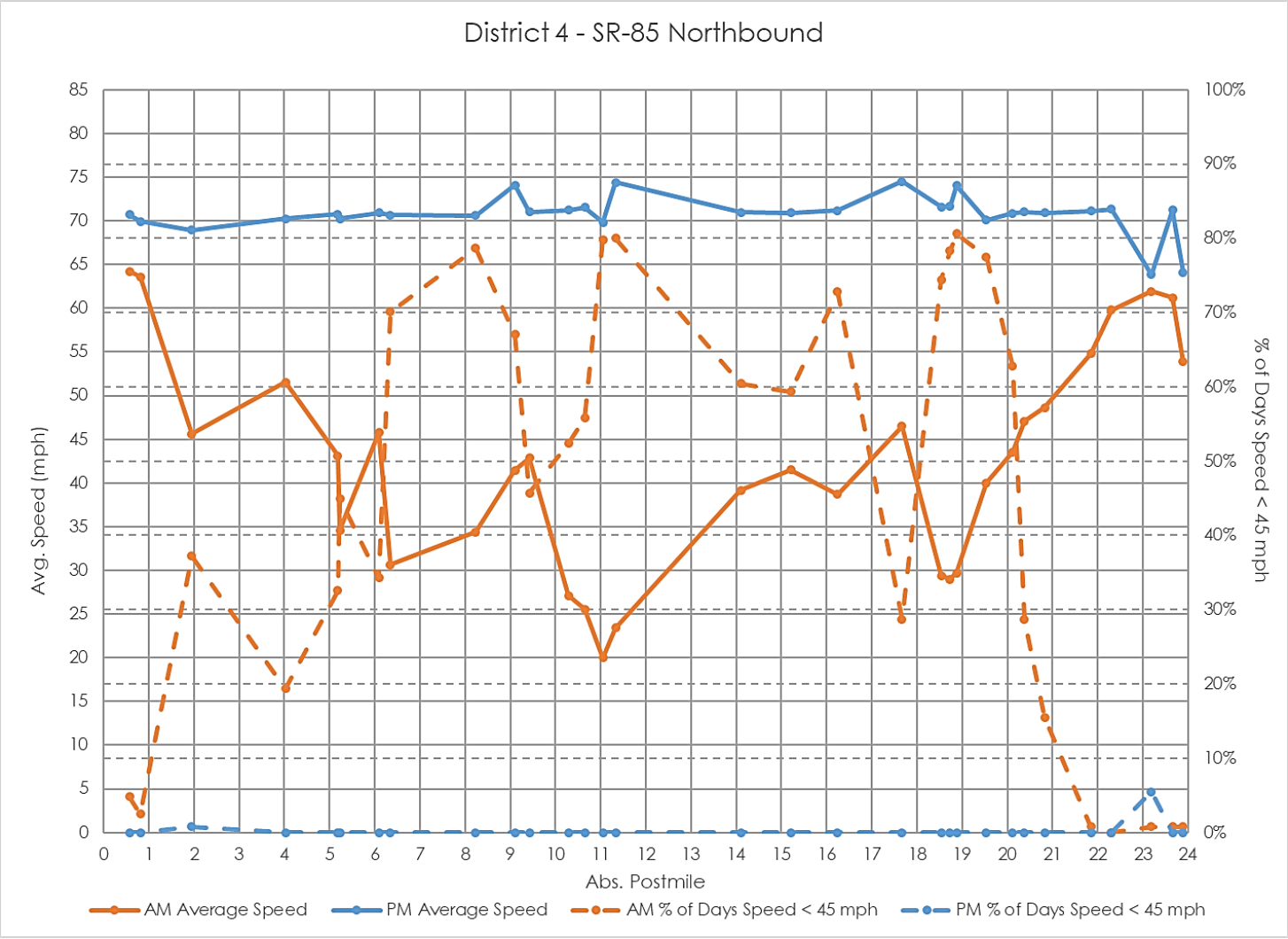
## FIGURE 31. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 80 (RED TOP ROAD TO AIR BASE PARKWAY)



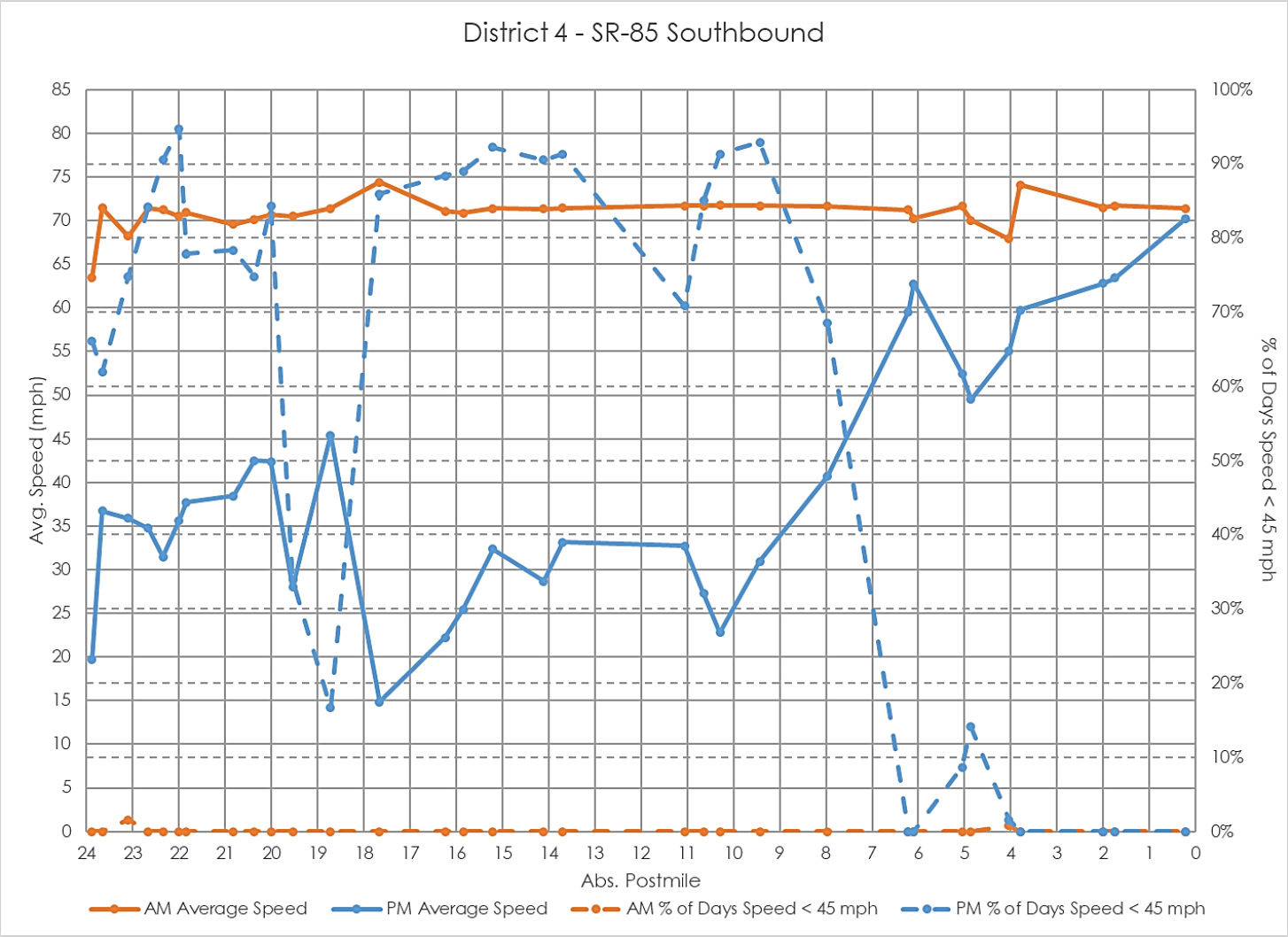
## FIGURE 32. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 80 (RED TOP ROAD TO AIR BASE PARKWAY)



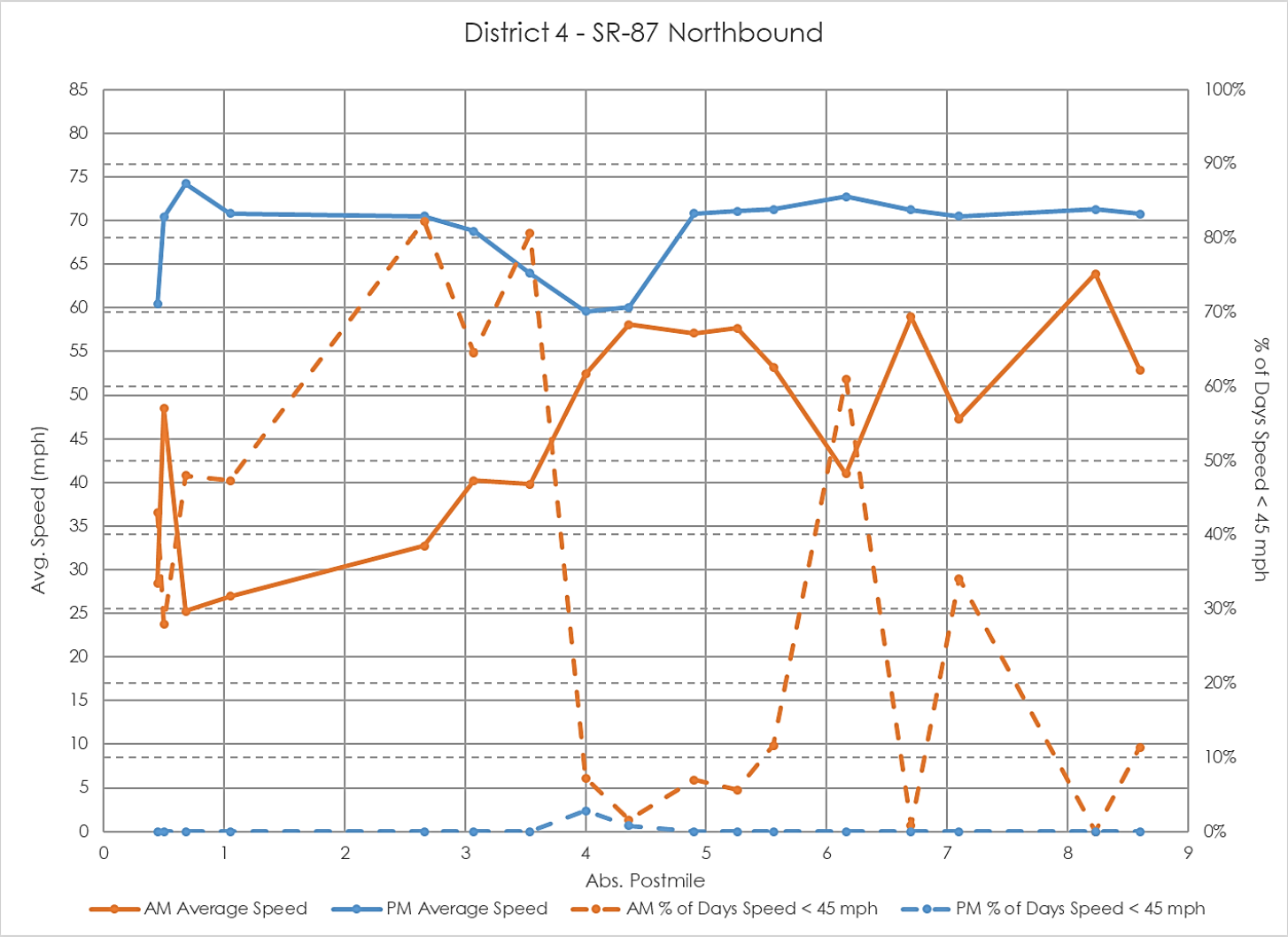
## FIGURE 33. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 85



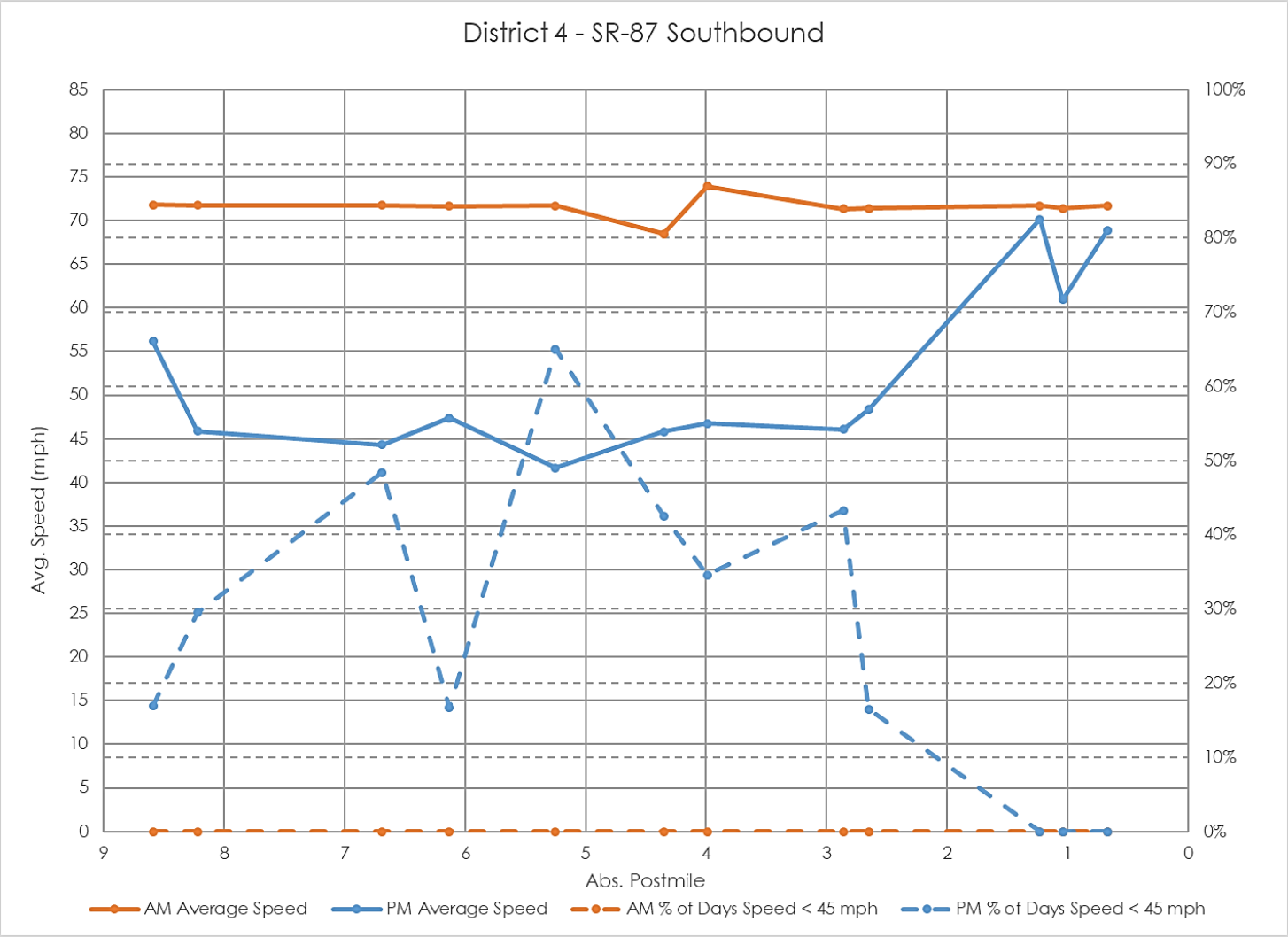
## FIGURE 34. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 85



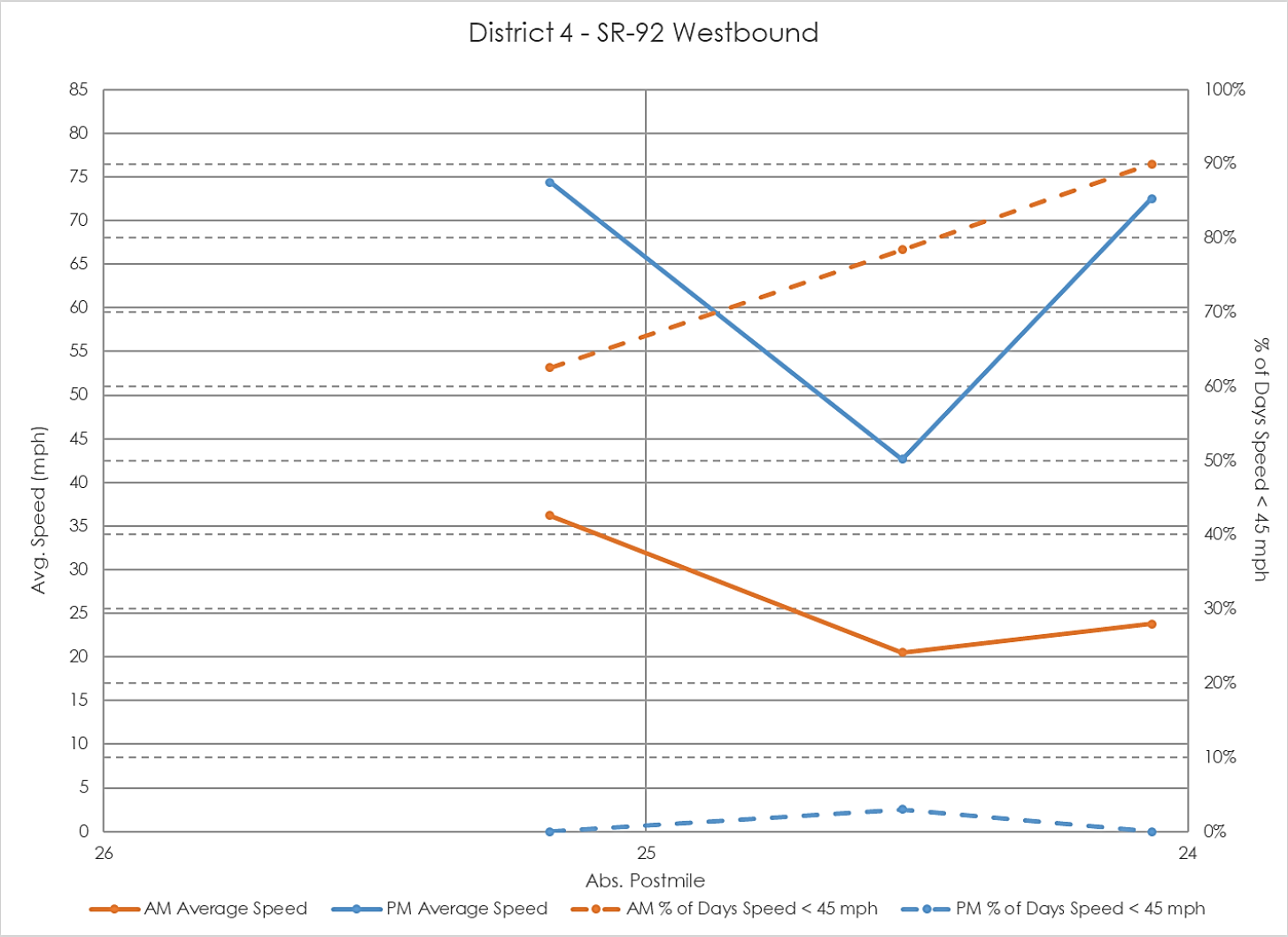
## FIGURE 35. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 87



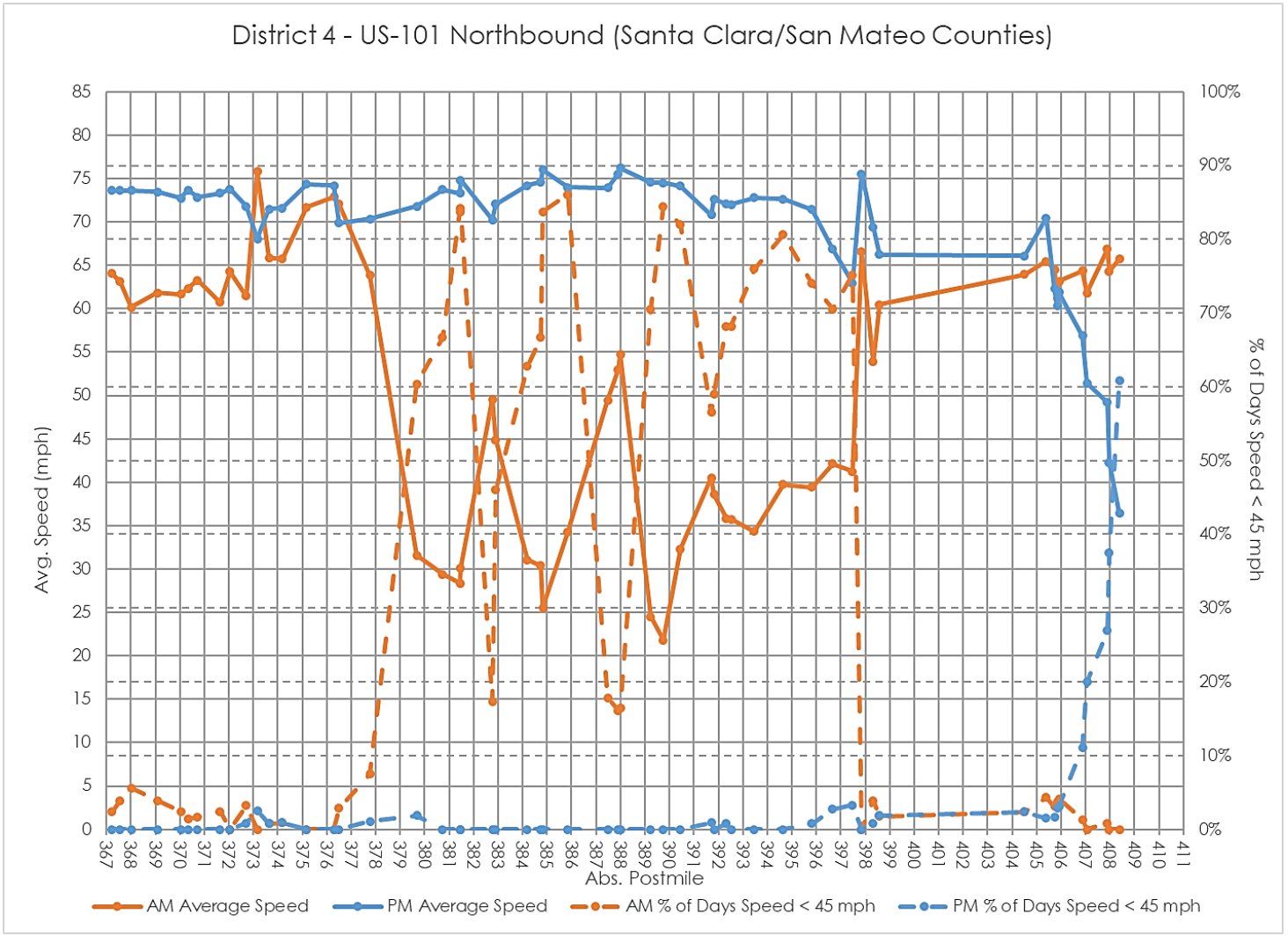
## FIGURE 36. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 87



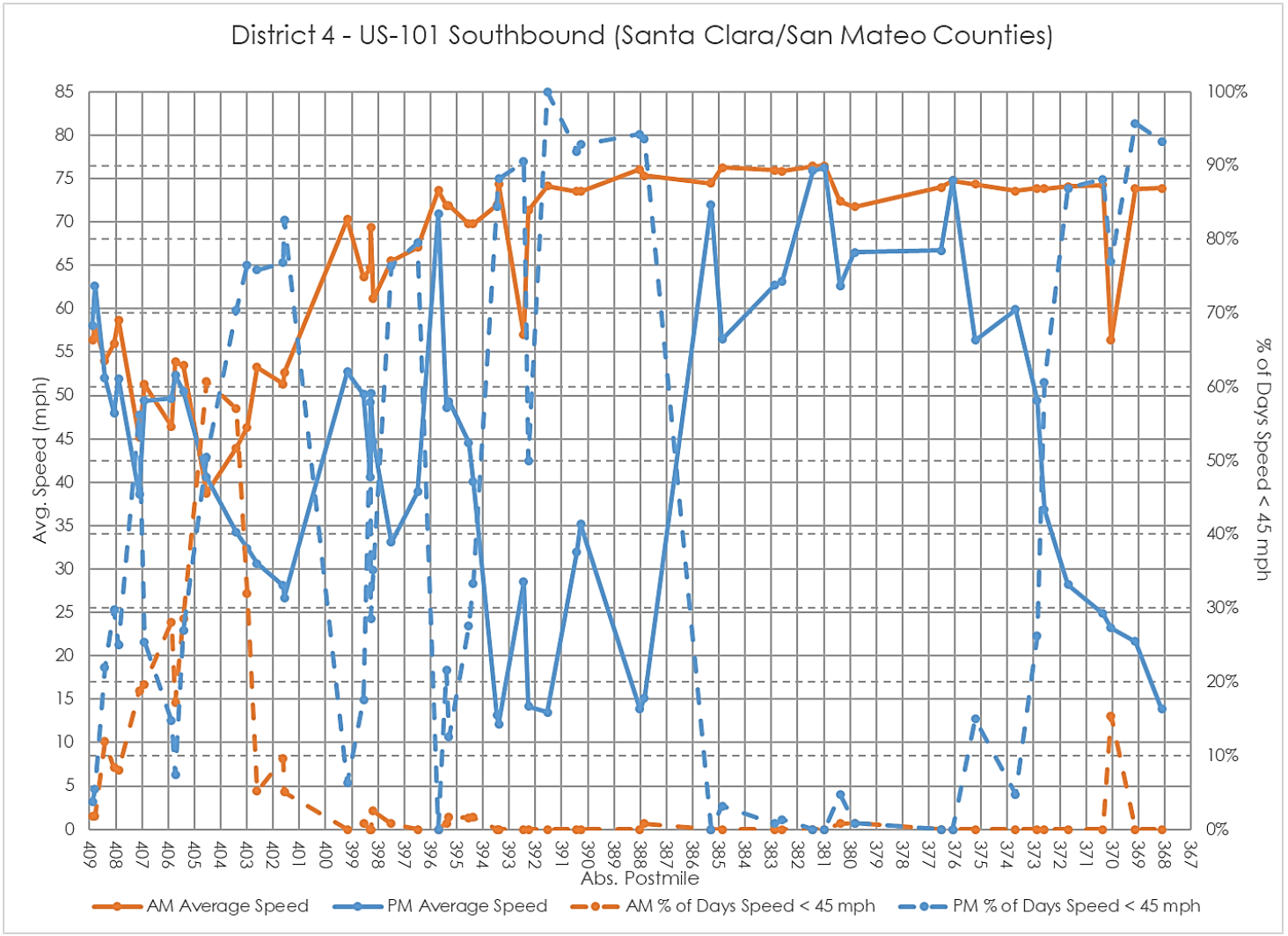
## FIGURE 37. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 92



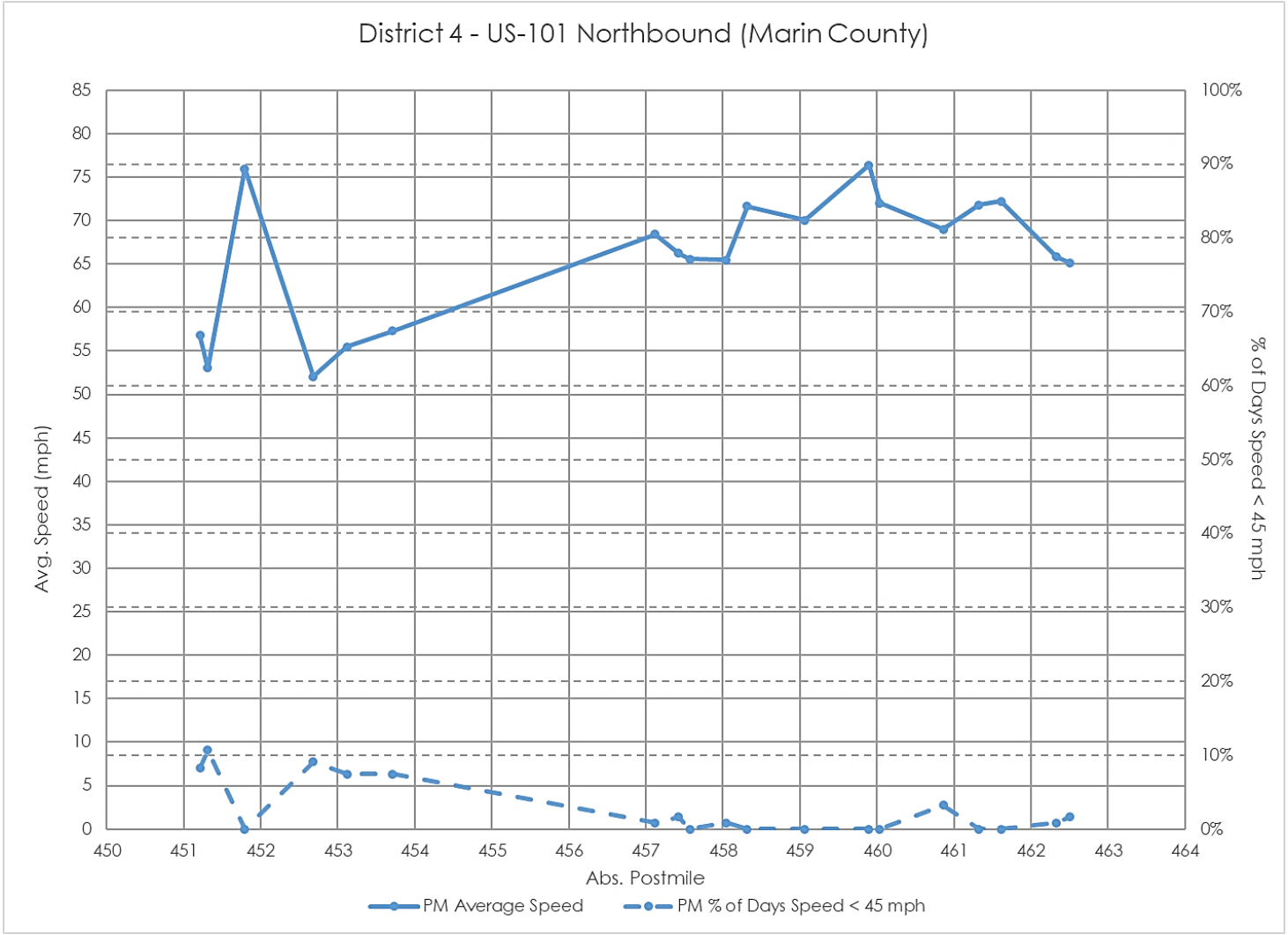
## FIGURE 38. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 101 (COCHRANE ROAD TO WHIPPLE AVENUE)



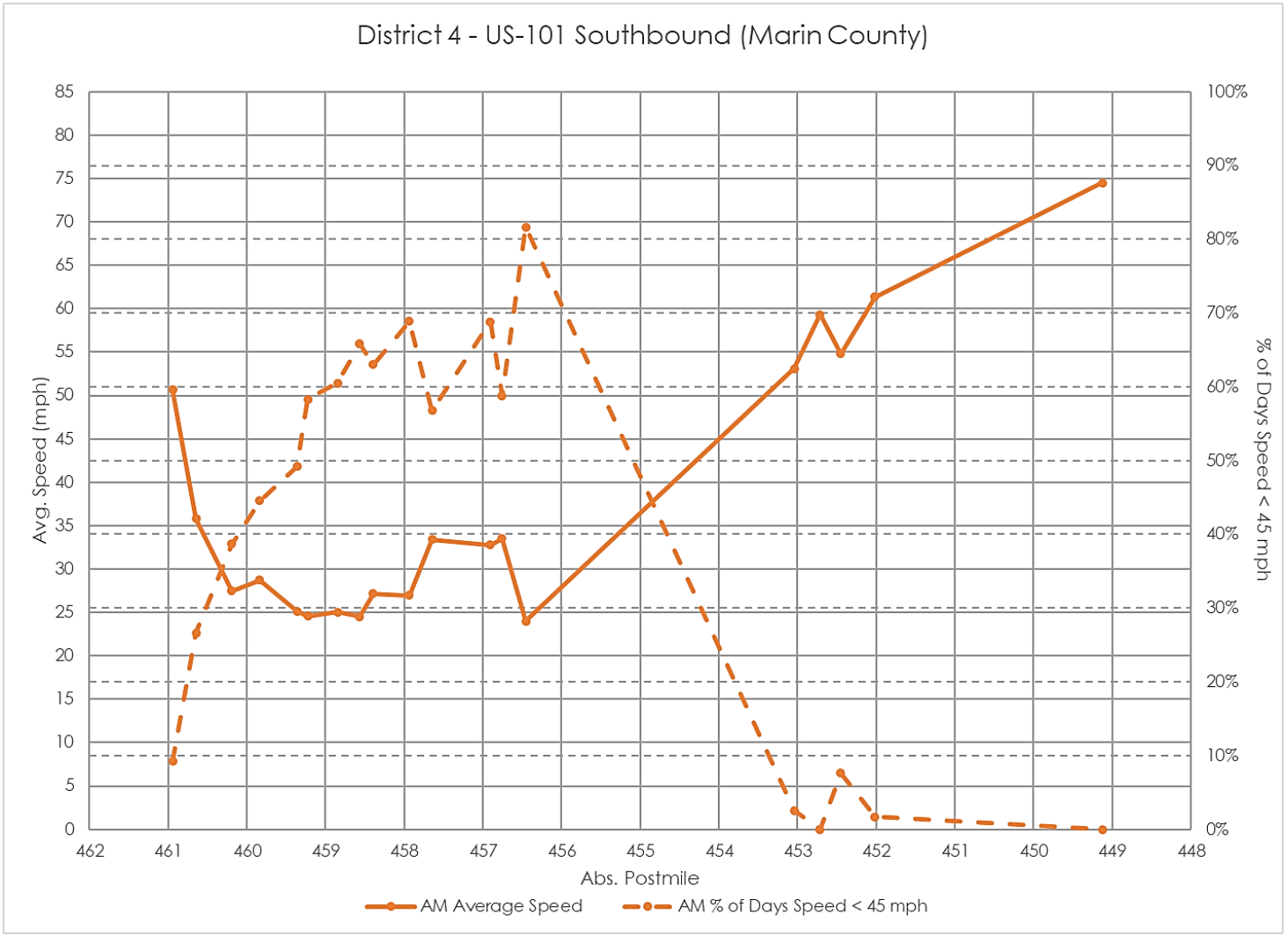
## FIGURE 39. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 101 (COCHRANE ROAD TO WHIPPLE AVENUE)



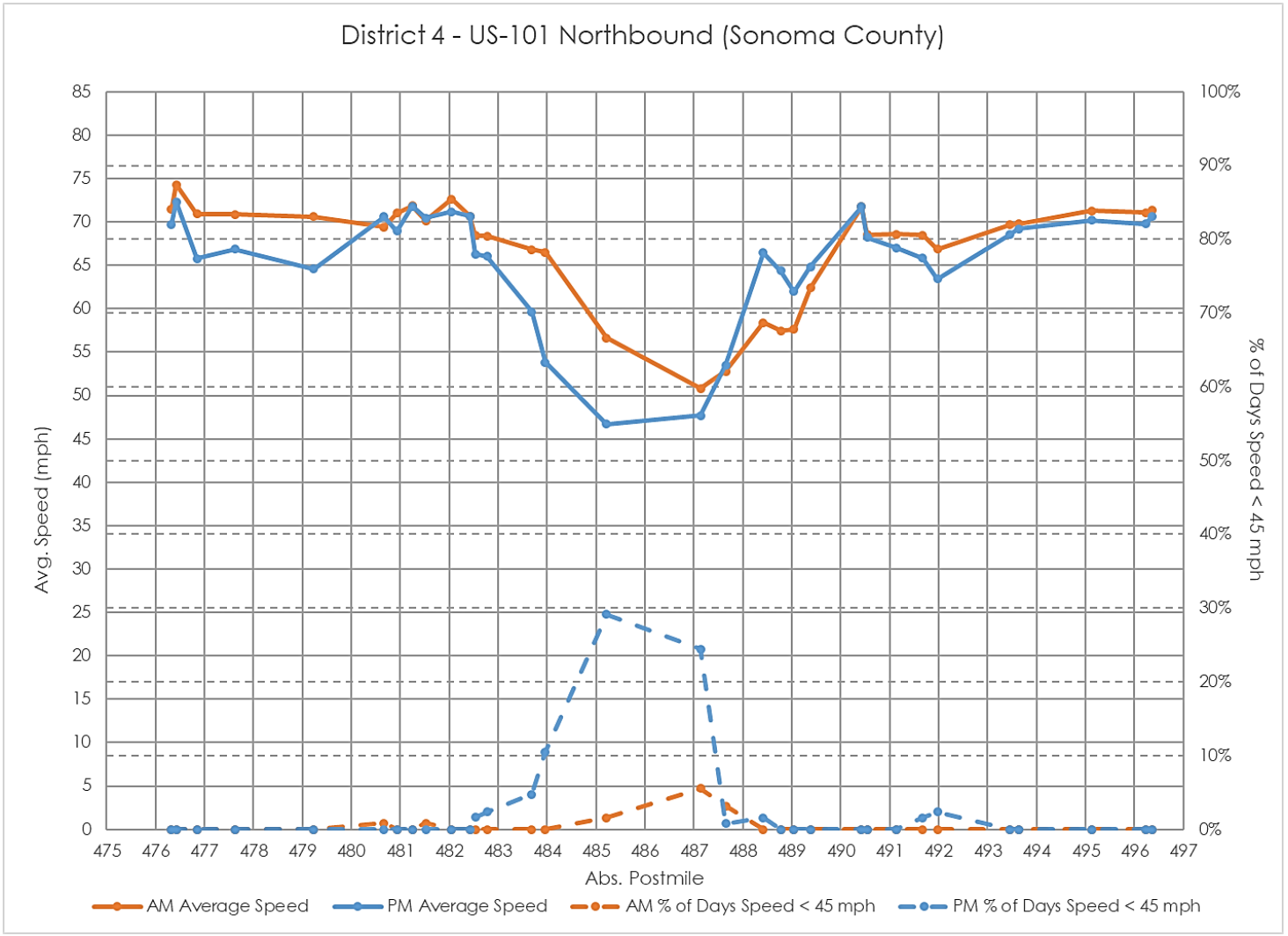
## FIGURE 40. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 101 (RICHARDSON BAY BRIDGE TO ATHERTON AVENUE)



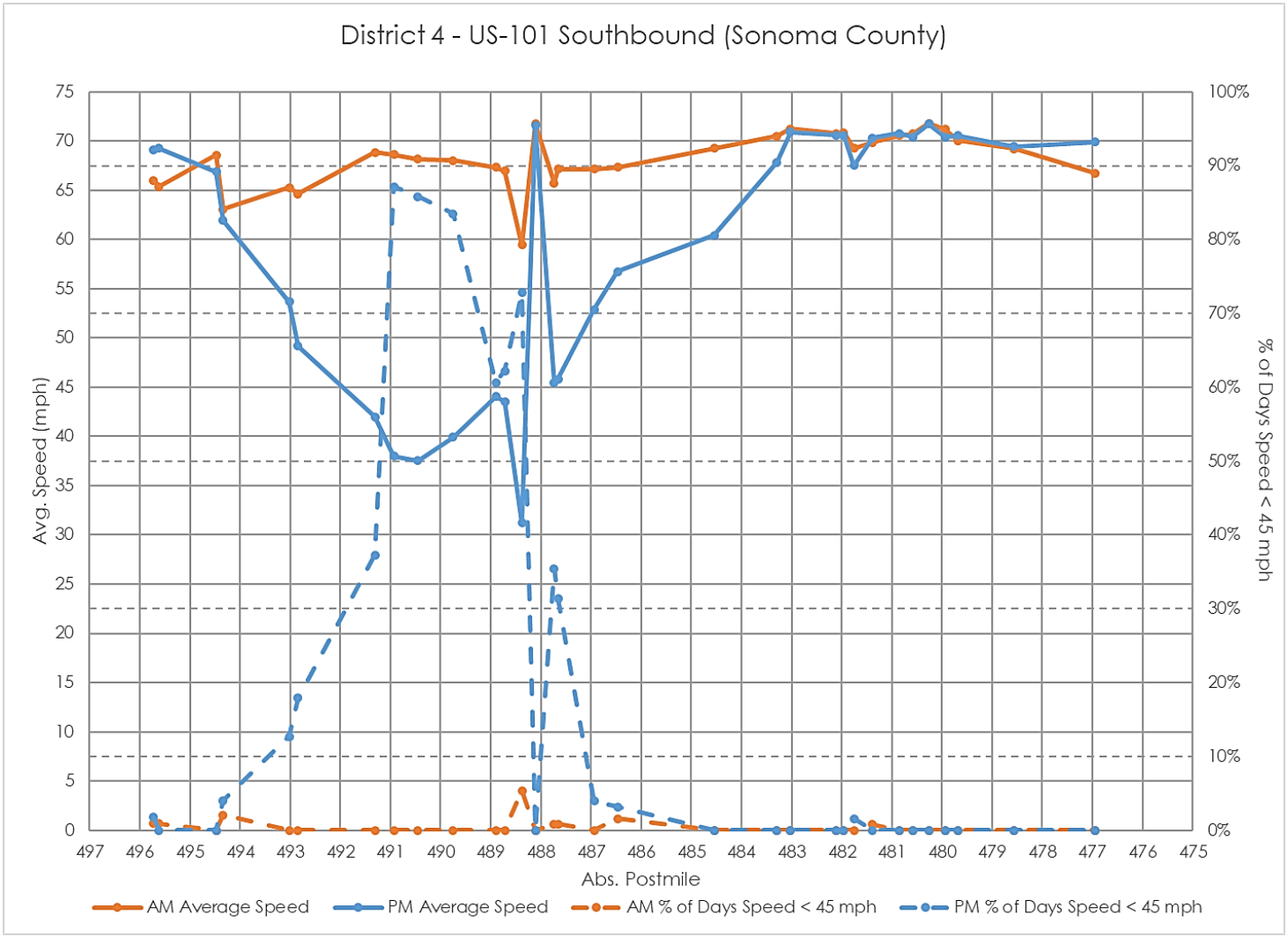
## FIGURE 41. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 101 (RICHARDSON BAY BRIDGE TO ATHERTON AVENUE)



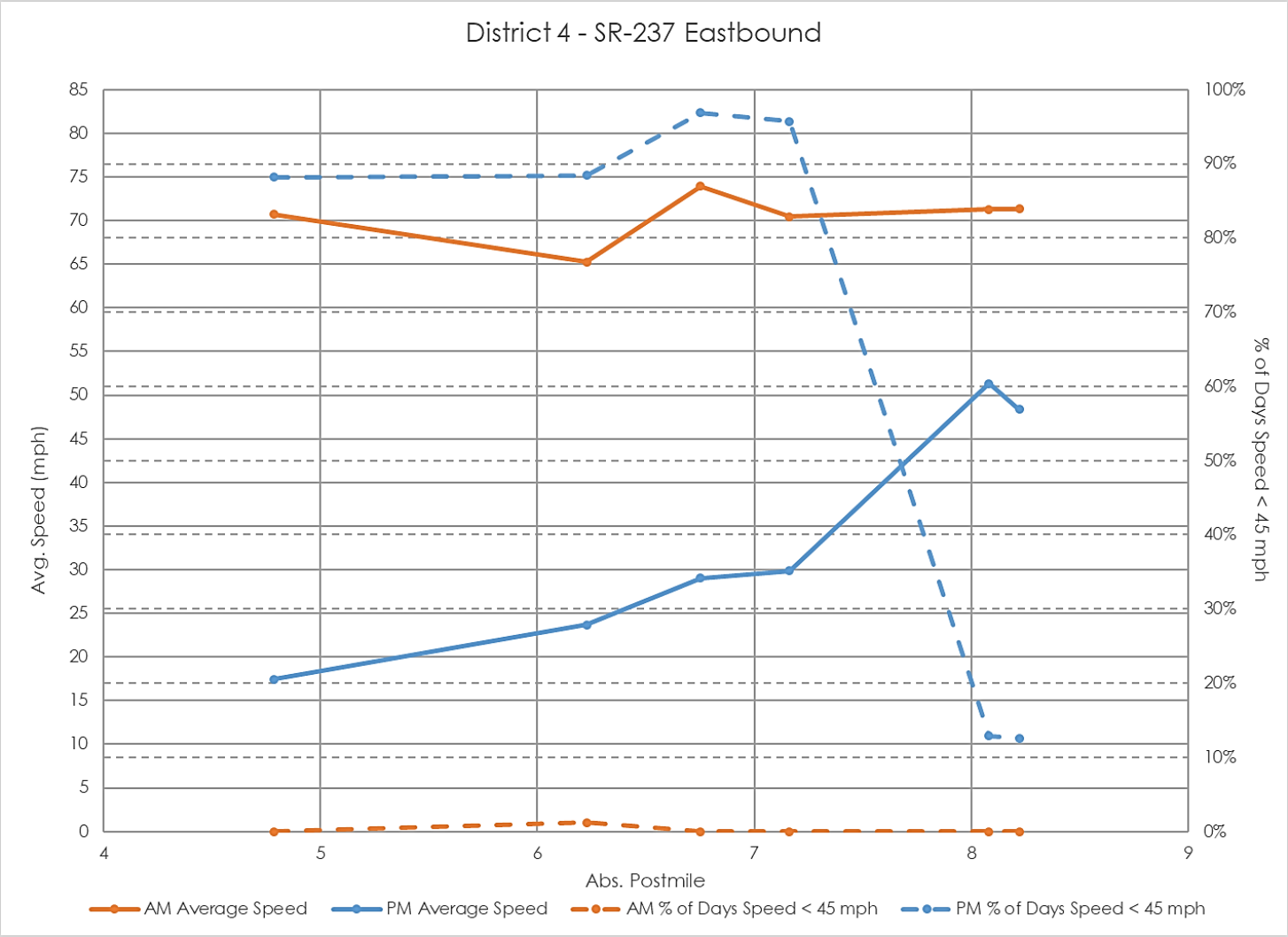
## FIGURE 42. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 101 (OLD REDWOOD HIGHWAY TO WINDSOR RIVER ROAD)



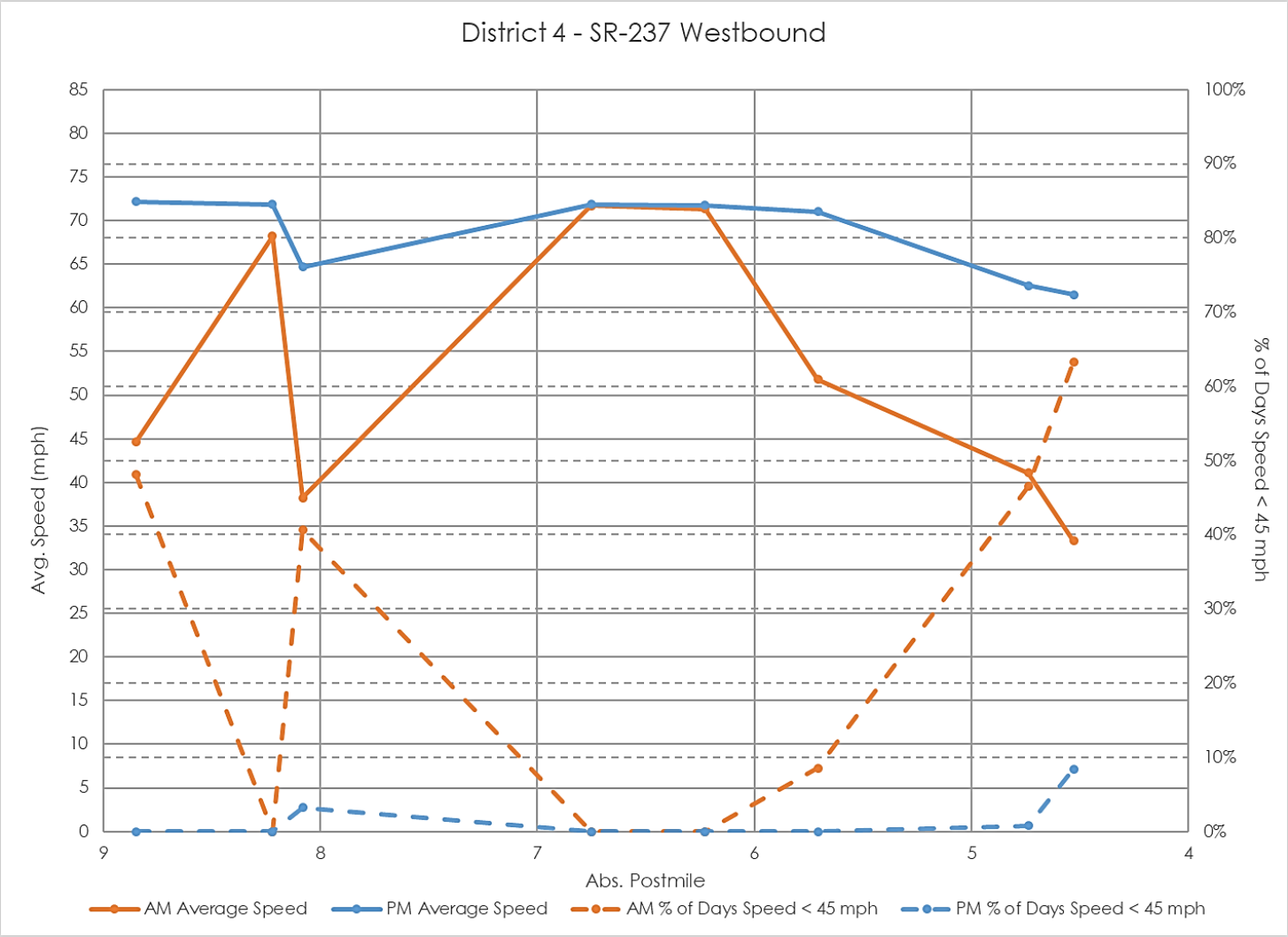
## FIGURE 43. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 101 (OLD REDWOOD HIGHWAY TO WINDSOR RIVER ROAD)



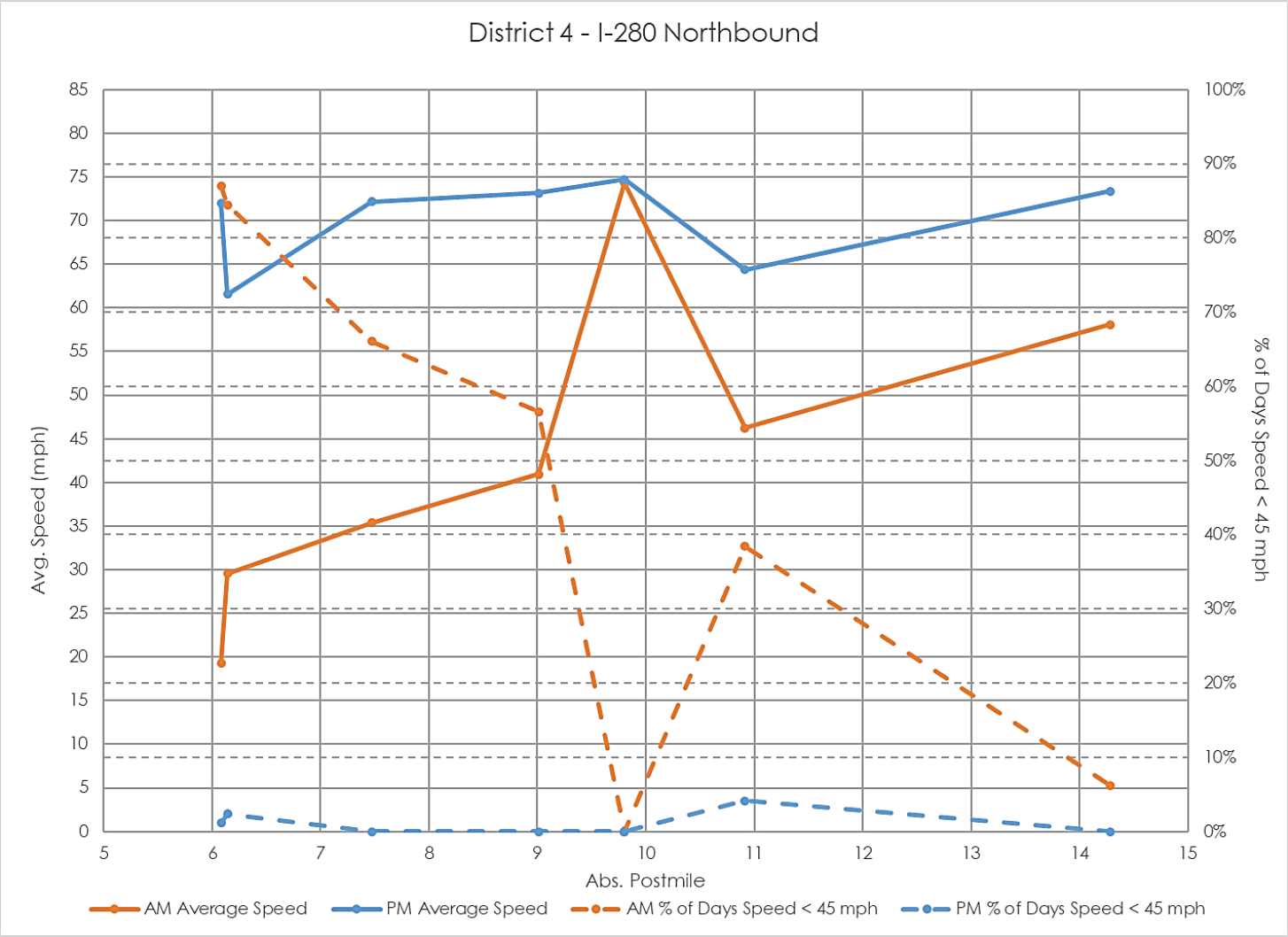
## FIGURE 44. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 237



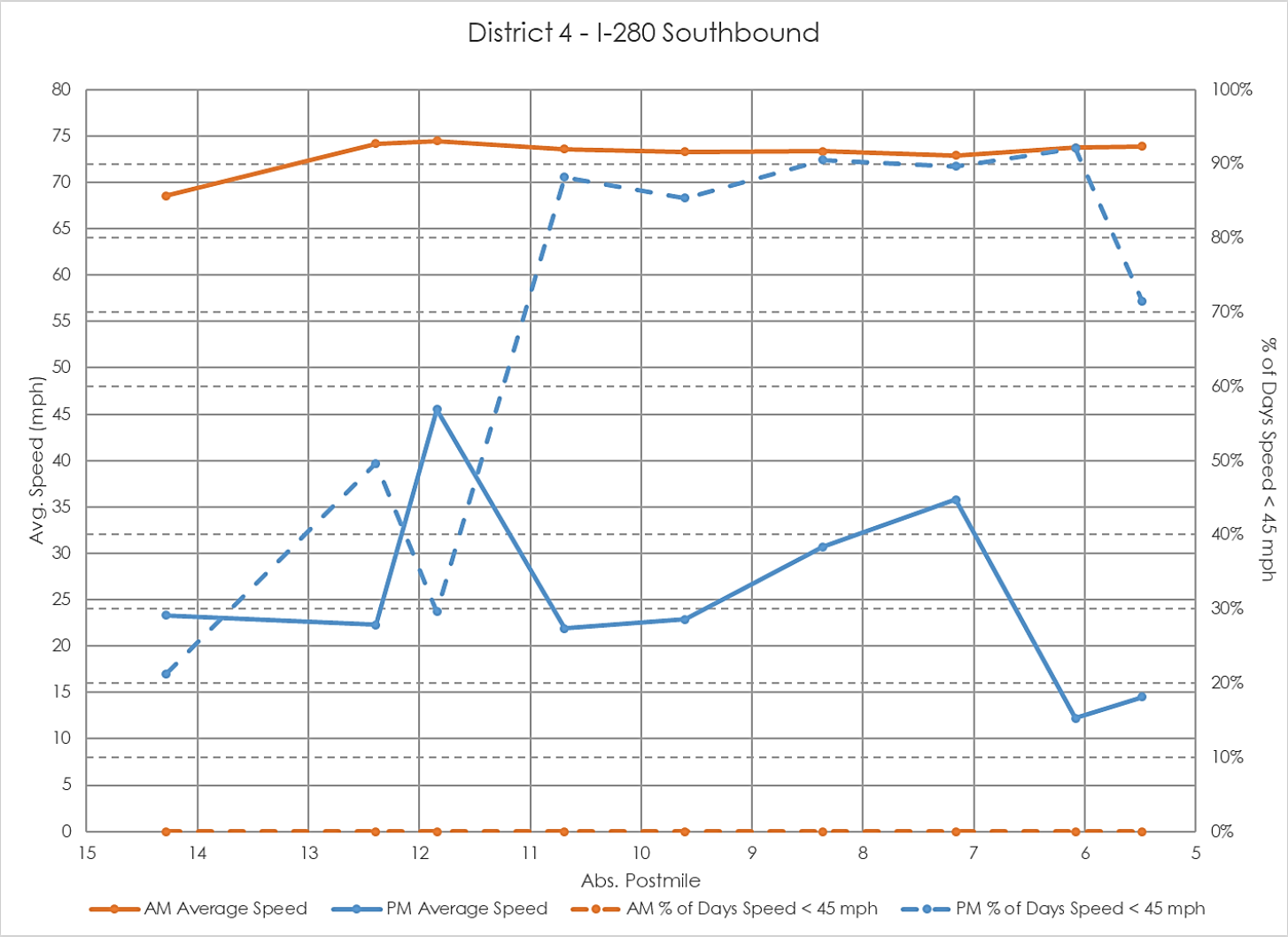
## FIGURE 45. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 237



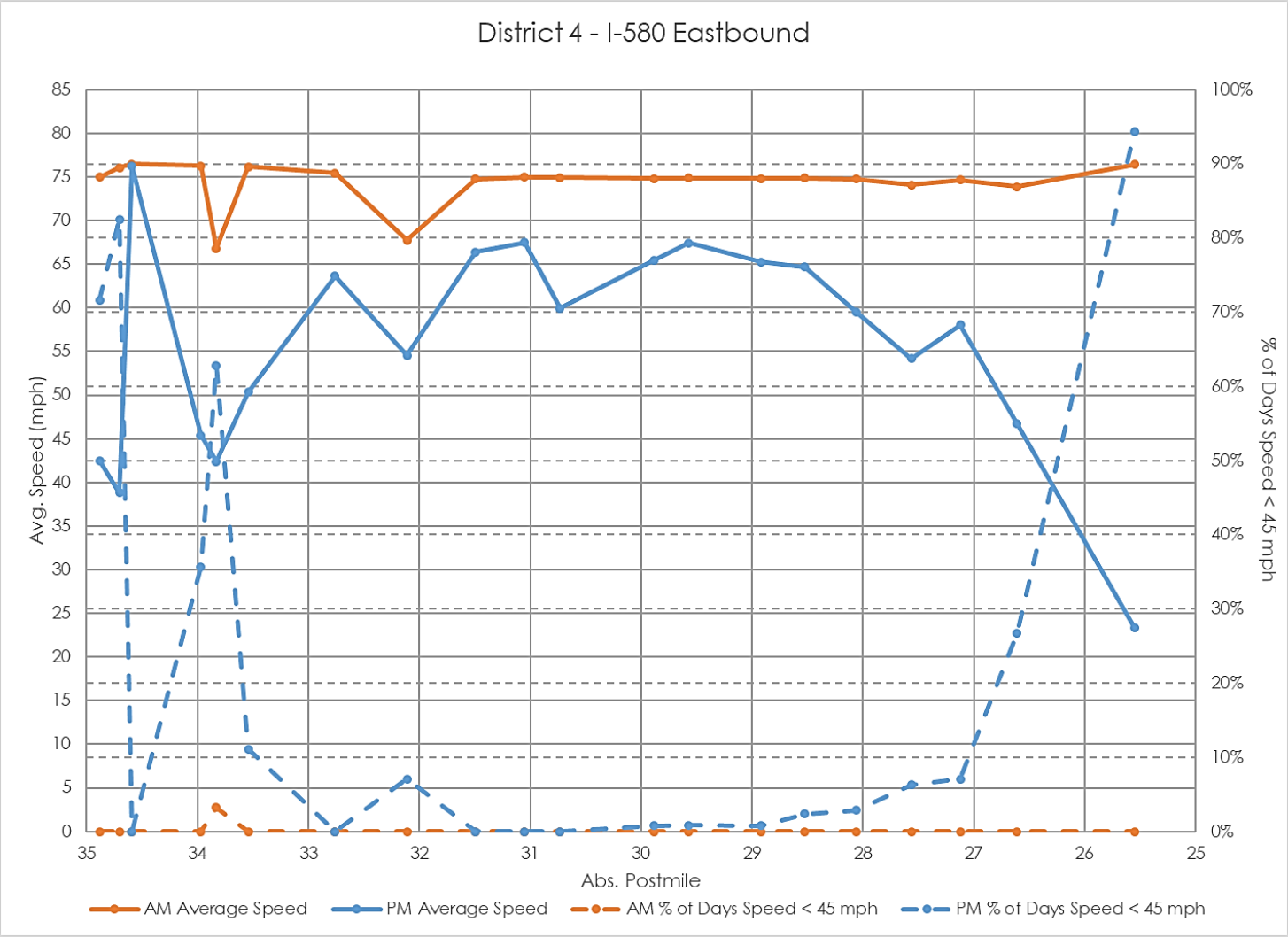
## FIGURE 46. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 280



## FIGURE 47. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 280



## FIGURE 48. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 580



## FIGURE 49. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 580

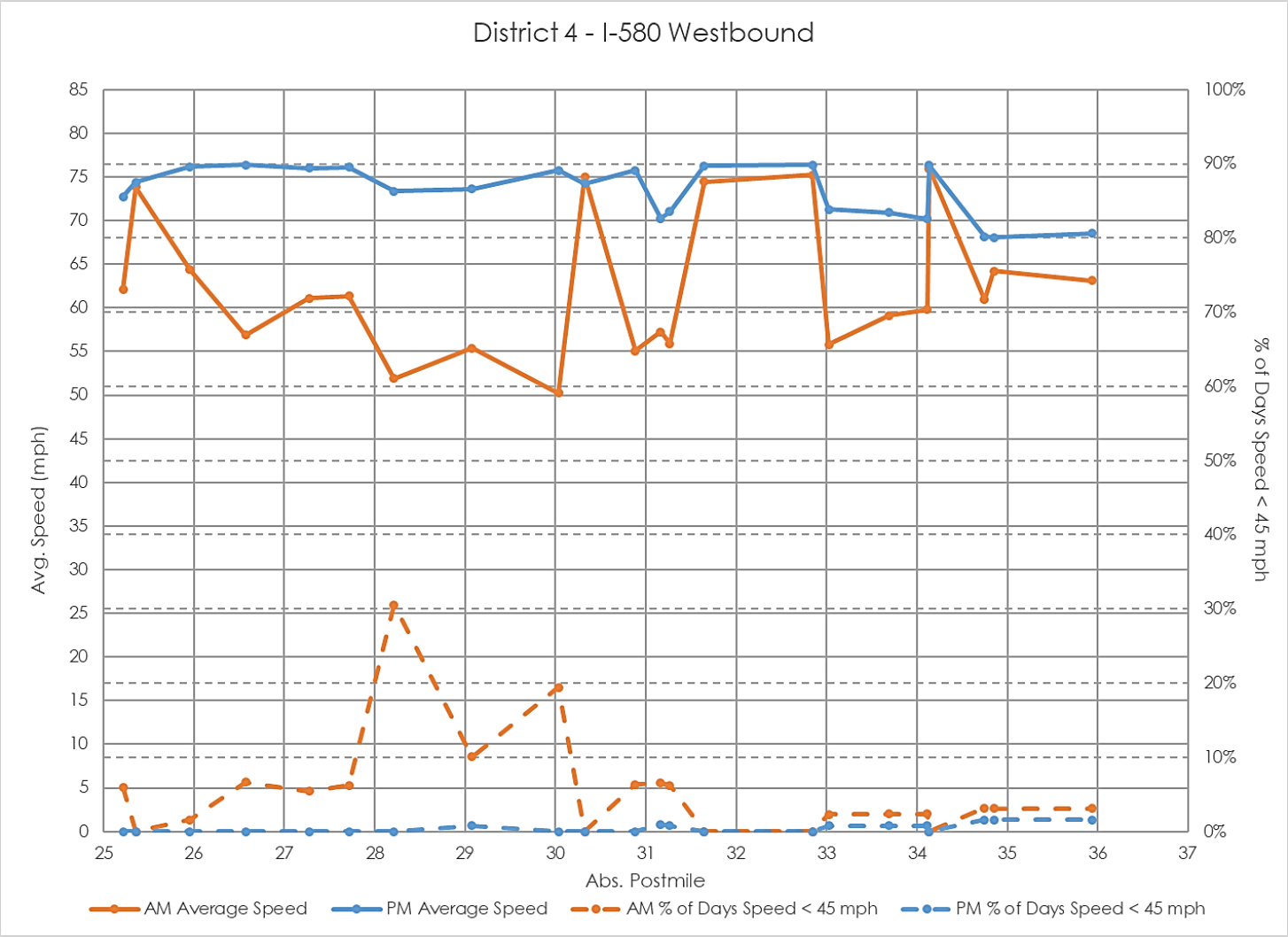
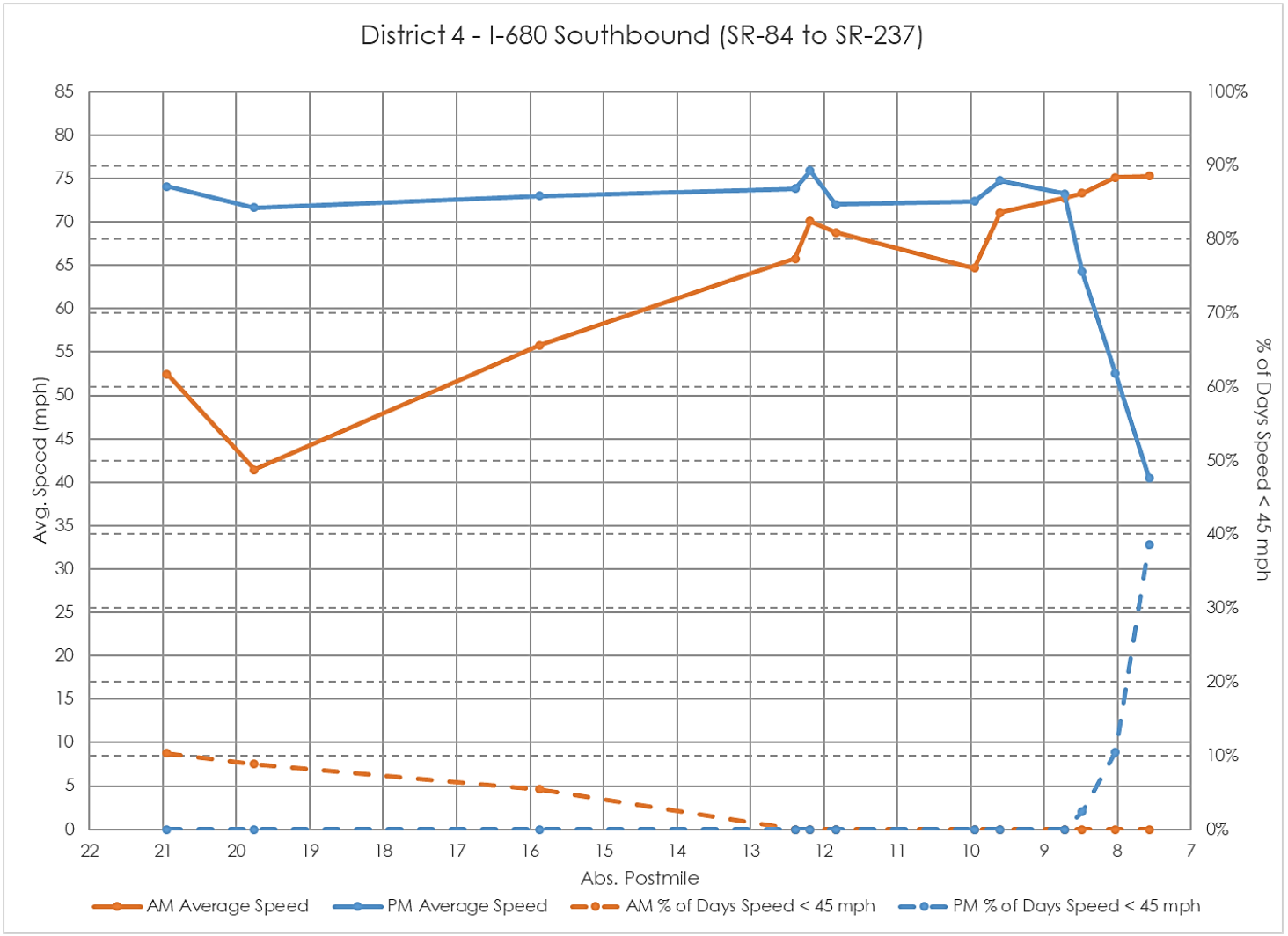
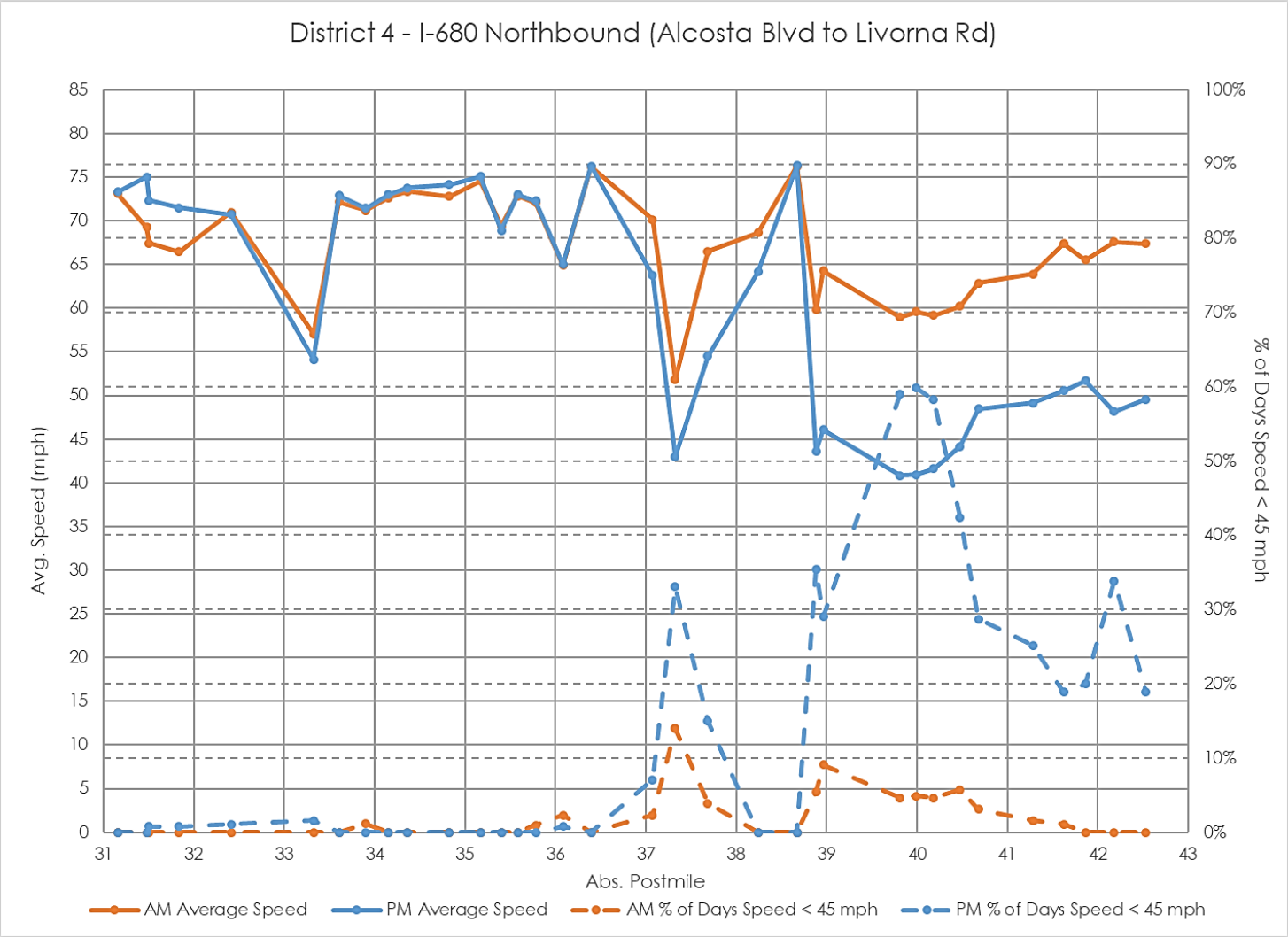


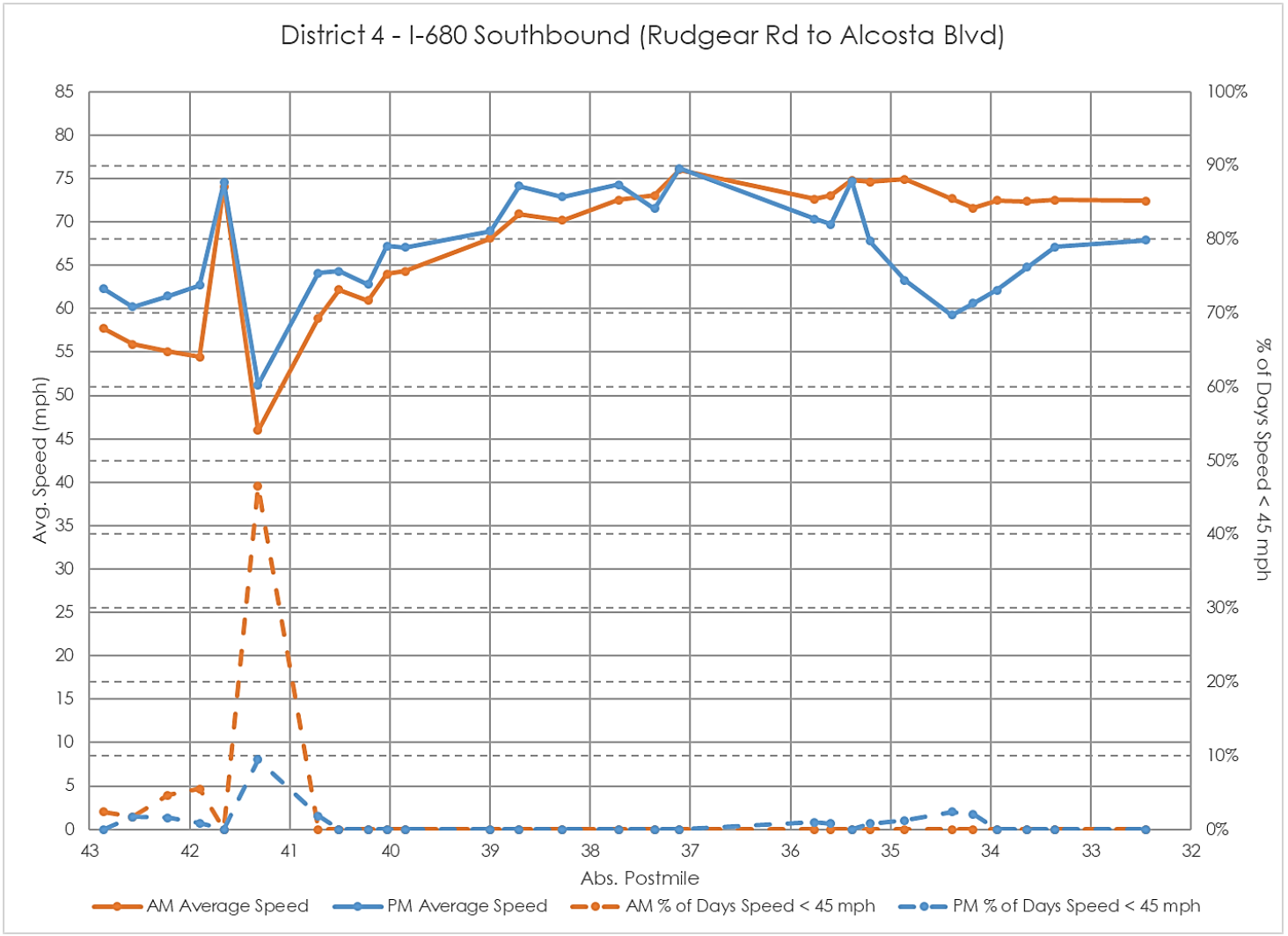
**FIGURE 50. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 680 (ROUTE 237 TO ROUTE 84)**



## FIGURE 51. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 680 (ALCOSTA BLVD TO LIVORNA RD)



## FIGURE 52. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 680 (ALCOSTA BLVD TO LIVORNA RD)



## FIGURE 53. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 680 (TREAT BLVD TO MARINA VISTA)

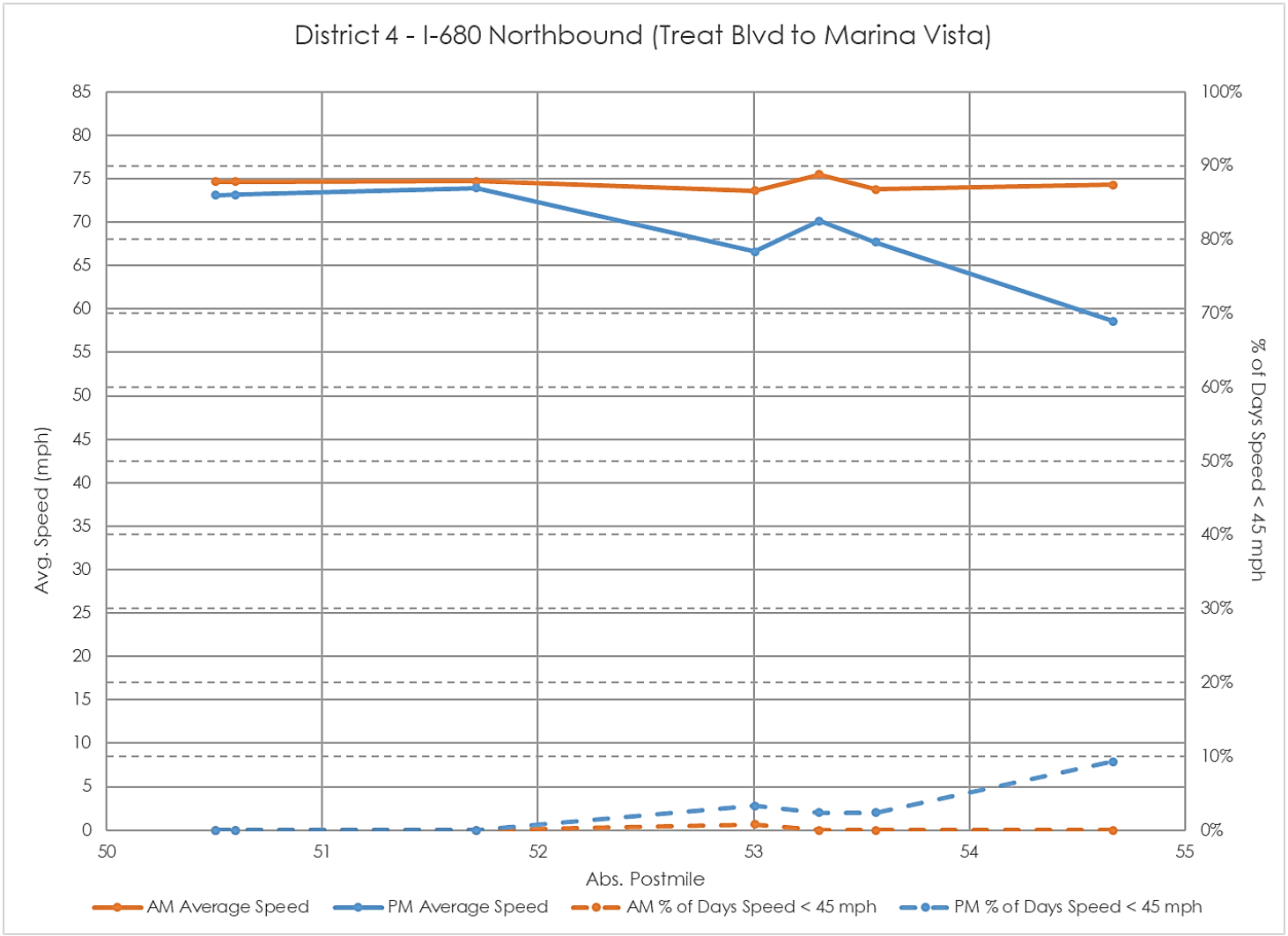
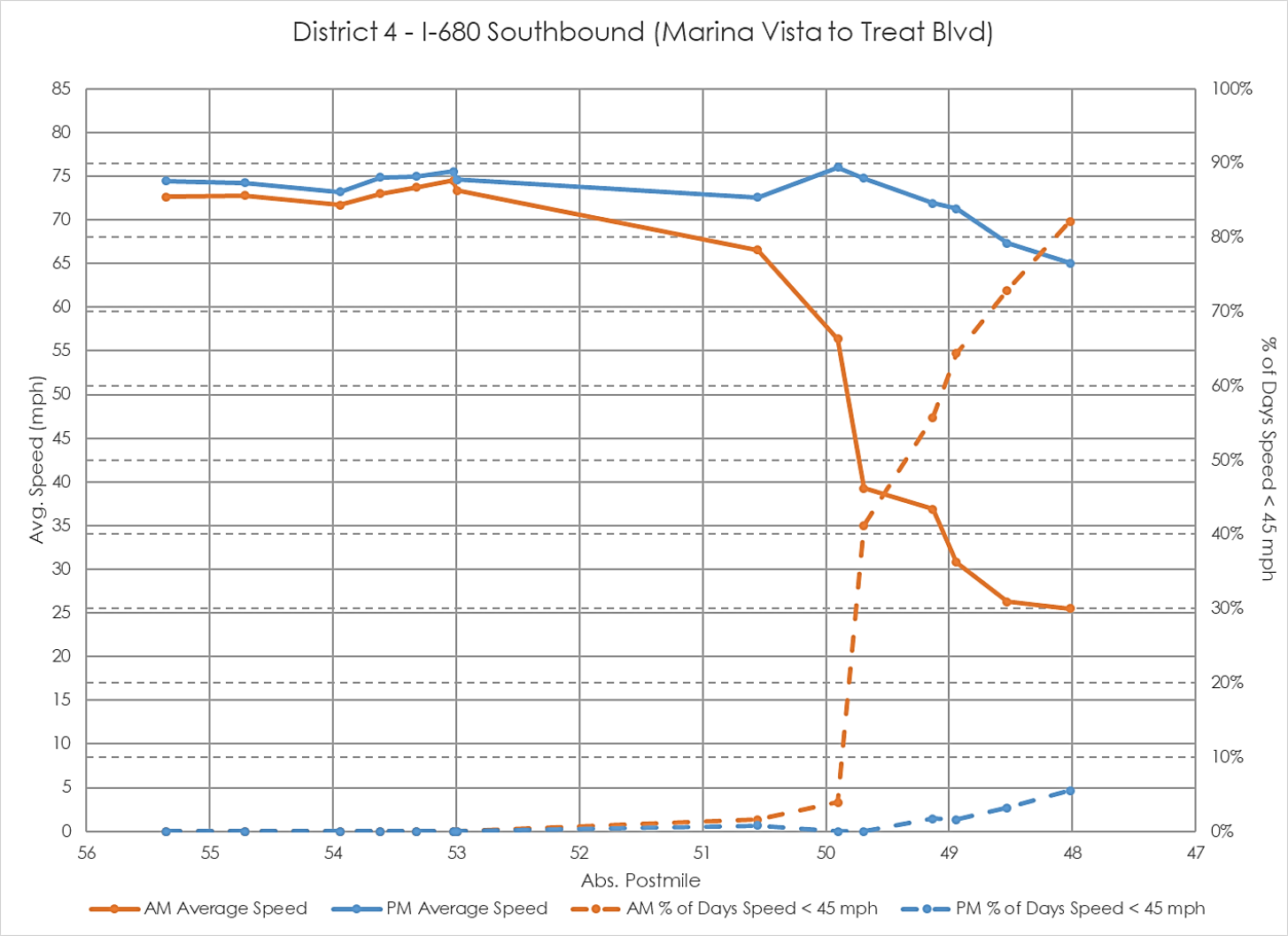
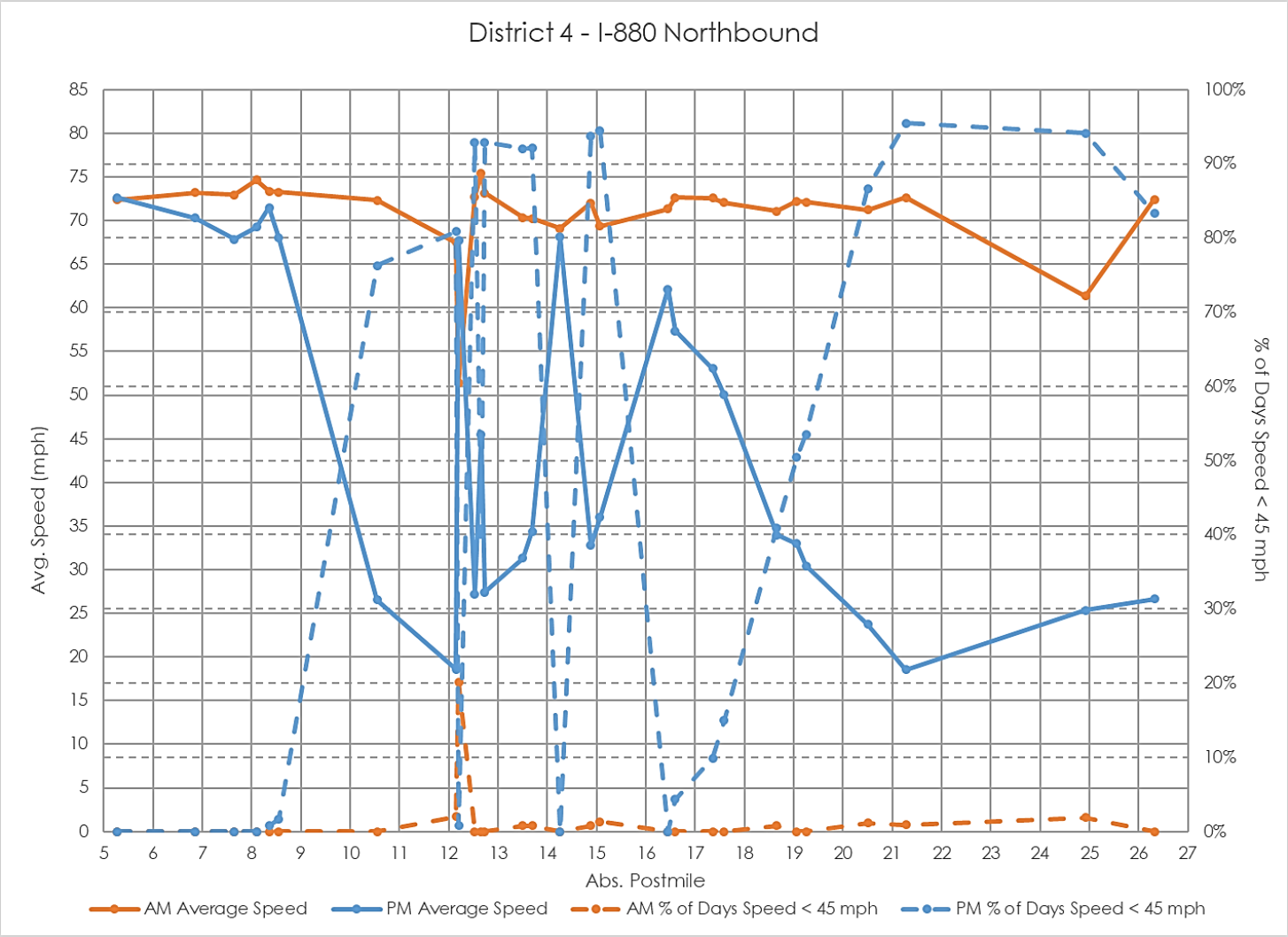


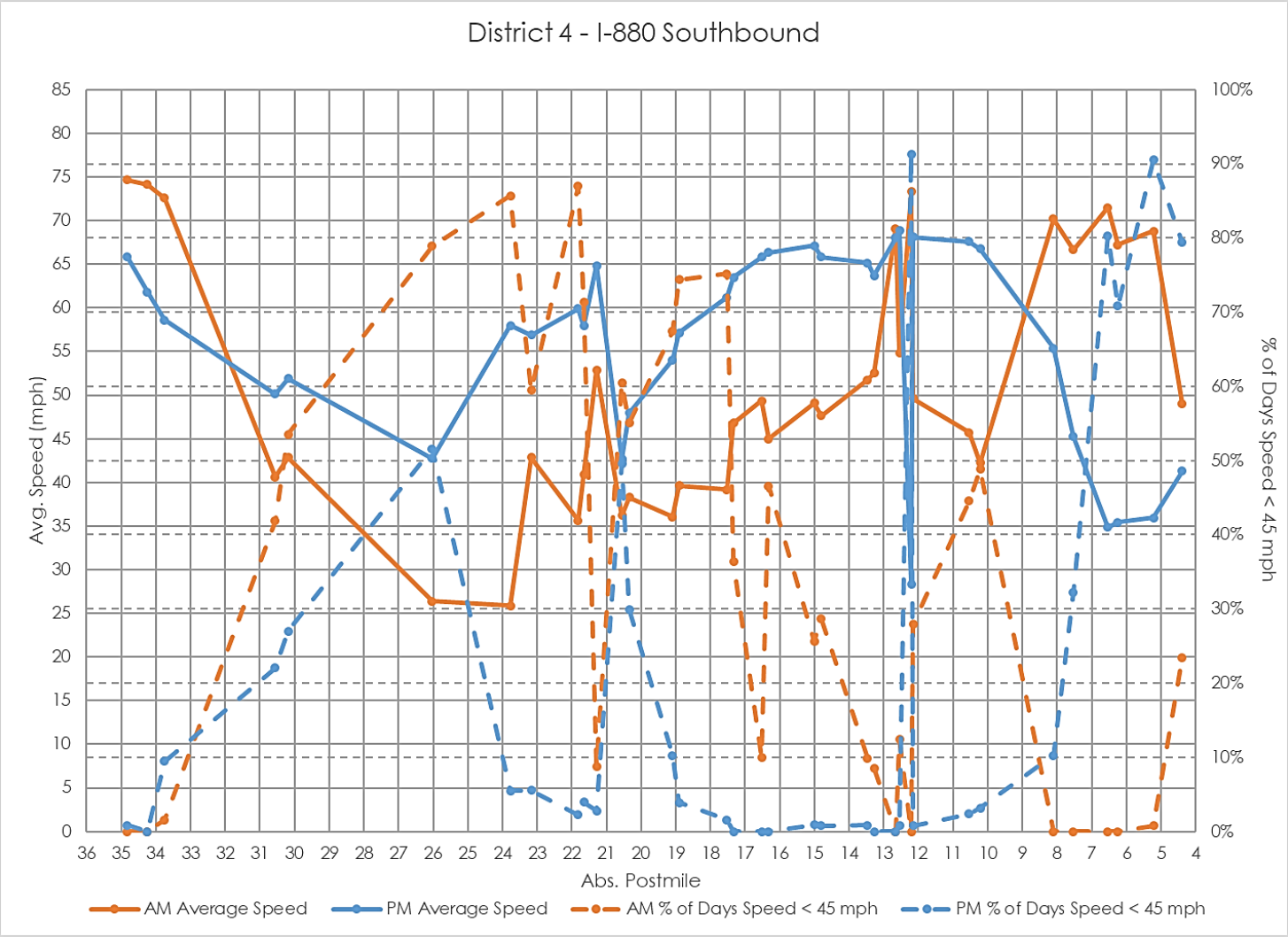
**FIGURE 54. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 680 (TREAT BLVD TO MARINA VISTA)**



## FIGURE 55. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 880



## FIGURE 56. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 880



### 4.2.2 DISTRICT-WIDE ACTIONS RELATED TO DEGRADATION

Several improvements to the managed lane system in District 4 occurred in 2020, such as raising occupancy from HOV 2+ to HOT 3+ on Routes 880 and 237 along with closing gaps on Route 680. These may have significant changes in operations to the managed lanes. Other operational changes are planned in 2022, such as conversion of HOV facilities on Routes 85 and 101 to HOT lanes, with planned increases in occupancy requirements on Route 101. District 4 plans to monitor how these improvements as well as changes in travel patterns due to the pandemic will affect the performance of managed lanes in the San Francisco Bay Area.

### 4.2.3 ACTION PLAN FOR HOV FACILITIES ON ROUTE 4

## A. ANALYSIS

*Eastbound*

The beginning of the eastbound HOV lane at Port Chicago Highway is degraded due to GP lane congestion from Route 242 traffic merging and a lane drop at this location. HOV lane speed is reduced due to the friction factor with lower speeds in the GP lanes. HOV speeds are approximately 10-15 mph greater than the GP lanes and therefore still providing a time savings for HOVs.

The eastbound HOV lane at Bailey Road is slightly degraded due to peak period recurrent congestion in the general purpose lanes which reduces HOV lane performance and speed.

*Westbound*

In the westbound direction there is congestion in all lanes from a bottleneck between Willow Pass Road and Port Chicago Highway, which reduces HOV lane performance and speed due to the friction factor. Queuing from this bottleneck extends back to Loveridge Road, approximately 7.5 miles. HOVs are receiving approximately 6 mins of timesaving over length of the HOV lane.

Vehicle weaving at the end of the westbound HOV lane causes reduced speed in all lanes.

## B. REMEDIATION STRATEGIES

- A project in construction has extended the eastbound HOV lane from the northbound Route 680 on-ramp to start of existing HOV lane will provide longer distance to merge into HOV lane and allow HOV traffic to bypass congestion near the Route 242 interchange and lane drop at the Port Chicago Hwy interchange. The HOV lane extension opened Sept 27, 2021.

- An Operation Improvements Project (OIP) includes several phases to add sections of GP lane or auxiliary lanes in the eastbound direction and widen off-ramps on Route 4 between Route 242 and Bailey Road. It includes future phases for westbound improvements of new auxiliary lanes, conversion of auxiliary lanes to GP lanes, or new GP lanes. First Phase of project is currently in PA&ED and scheduled to complete in 2021, with construction completion in 2025. PSR-PDS completed in 2016 estimated entire OIP project cost estimate is $220M.

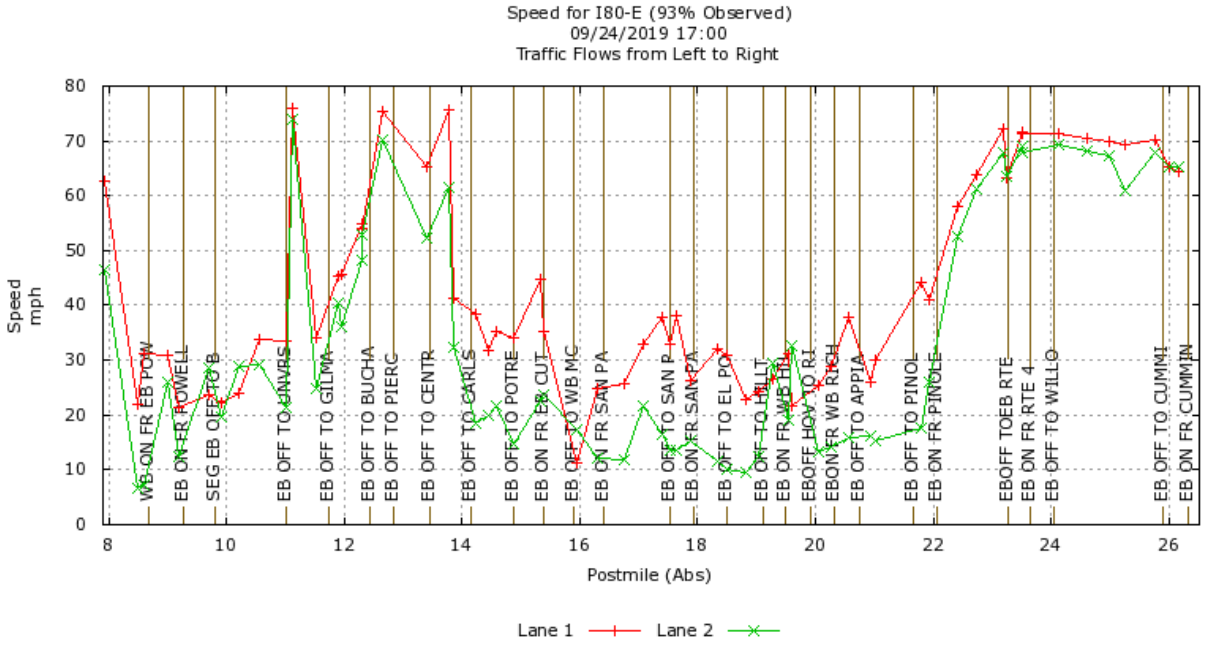
### 4.2.4 ACTION PLAN FOR HOV FACILITIES ON ROUTE 80

## A. ANALYSIS

*San Francisco Oakland Bay Bridge to Carquinez Bridge - Eastbound*

There are two controlling bottlenecks on eastbound Route 80 in the afternoon peak period. One bottleneck is between the University Avenue on-ramp and the Gilman Avenue off-ramp. The queue from this bottleneck extends back beyond the start of the HOV lane on eastbound Route 80 approximately 3.5 miles. The other bottleneck is downstream between Pinole Valley Road on-ramp and the Route 4 off-ramp. The queue from this bottleneck extends back to Central Avenue, approximately 8.5 miles. Peak period recurrent congestion in all lanes due to these conditions reduced HOV lane performance and speed due to the friction factor. Even though the HOV lanes are degraded, HOVs in the eastbound direction experience approximately 15 minutes of travel time savings over the general-purpose traffic during the afternoon peak hour. A "spot time" plot of the HOV and GP lane speeds on eastbound Route 80 for a typical afternoon peak hour is shown in Figure 57. Lane 1 represents the HOV lane and lane 2 represents the adjacent GP lane.

## FIGURE 57. HOV AND GP LANE SPEEDS – EASTBOUND ROUTE 80 (BAY BRIDGE TO CARQUINEZ BRIDGE)




The demand also exceeds HOV lane capacity; see volumes listed in Table 10 below. The highlighted cells show where the HOV lane flow is constrained due to excessive demand.

On the eastbound facility the HOV violation rate is as high as 33 percent. The percentage of Clean Air Vehicles (CAVs) is as high as 13 percent.

## TABLE 10. TRAFFIC VOLUMES – EASTBOUND ROUTE 80, ASHBY AVENUE TO UNIVERSITY AVENUE

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 15:00 | 1754 | 27.00 | 1537 | 32.60 |
| 9/23/2019 16:00 | 1673 | 33.40 | 1415 | 35.80 |
| 9/23/2019 17:00 | 1487 | 19.30 | 1468 | 23.50 |
| 9/24/2019 15:00 | 1748 | 30.60 | 1570 | 35.30 |
| 9/24/2019 16:00 | 1492 | 21.60 | 1510 | 25.20 |
| 9/24/2019 17:00 | 1420 | 19.30 | 1440 | 26.40 |
| 9/25/2019 15:00 | 1654 | 27.20 | 1533 | 34.90 |
| 9/25/2019 16:00 | 1414 | 19.80 | 1457 | 29.00 |
| 9/25/2019 17:00 | 1404 | 18.40 | 1466 | 26.10 |
| 9/26/2019 15:00 | 1450 | 22.60 | 1506 | 30.20 |

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/26/2019 16:00 | 1360 | 17.70 | 1447 | 22.70 |
| 9/26/2019 17:00 | 1353 | 17.50 | 1398 | 20.30 |
| 9/27/2019 15:00 | 1603 | 26.10 | 1584 | 30.20 |
| 9/27/2019 16:00 | 1466 | 20.60 | 1478 | 27.80 |
| 9/27/2019 17:00 | 1436 | 19.20 | 1410 | 21.70 |

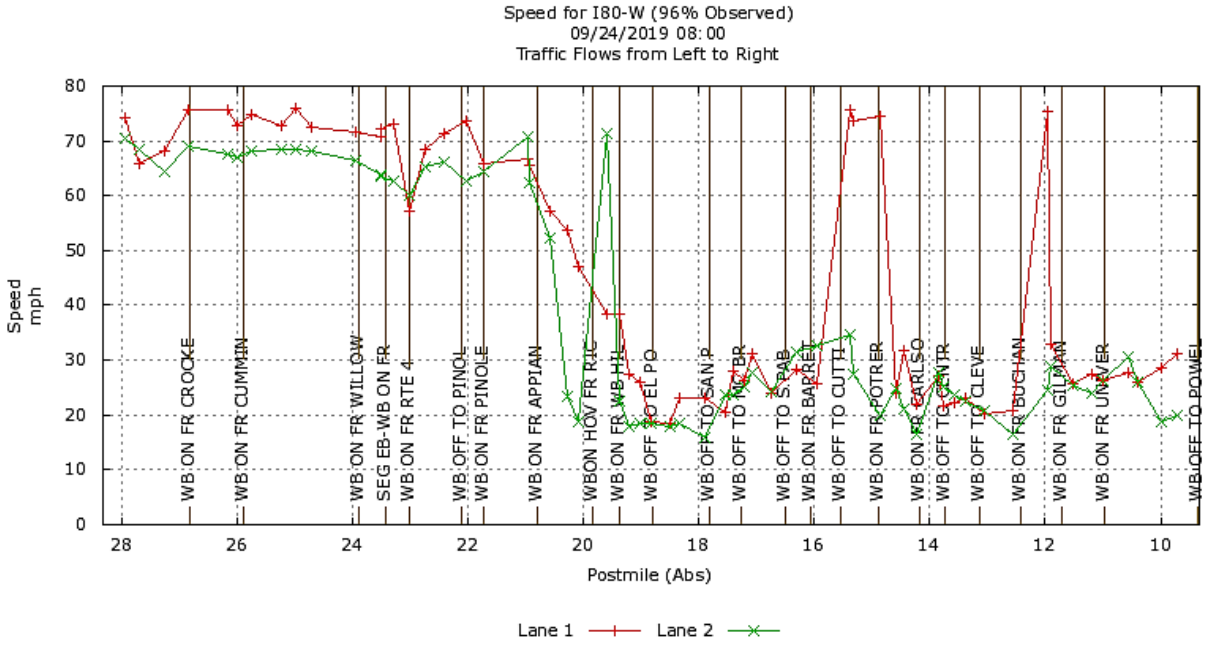
*San Francisco Oakland Bay Bridge to Carquinez Bridge - Westbound*

In the westbound direction, there is a bottleneck at the San Francisco-Oakland Bay Bridge mainline metering lights. This congestion extends back through a bottleneck between the Powell Street loop on-ramp to the off-ramp to Routes 580 and 880. The queue from these bottlenecks extend back beyond the Richmond Parkway interchange in the morning peak hour peak period, approximately 13.0 miles. In the afternoon peak hour period, the queue from these bottlenecks extends back beyond the University Avenue interchange, approximately 2.5 miles.

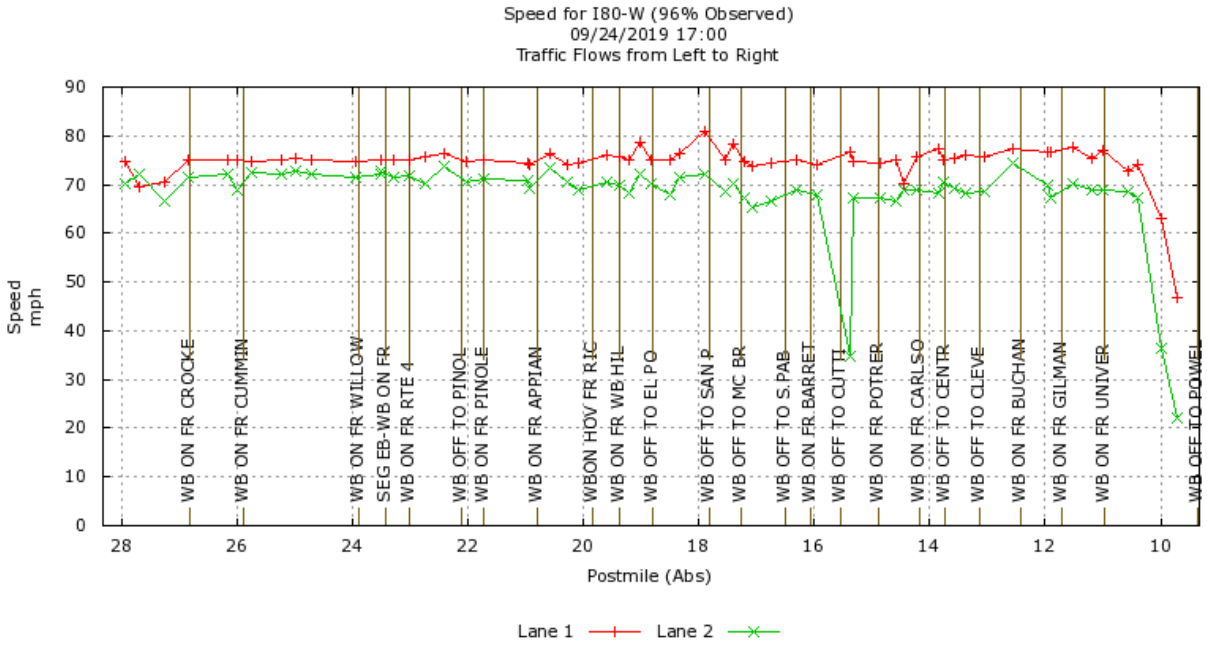
Figure 58 shows a "spot time" plot of the HOV and GP lane speeds on westbound Route 80 during a typical morning peak hour, and Figure 59 shows this data for a typical afternoon peak hour. Lane 1 represents the HOV lane and lane 2 represents the adjacent GP lane.

Even though the HOV lanes are degraded, HOVs in the westbound direction experience approximately 33 minutes of travel time savings over the general-purpose traffic during the morning peak hour.

## FIGURE 58. HOV AND GP LANE SPEEDS – EASTBOUND ROUTE 80, MORNING PEAK HOUR (BAY BRIDGE TO CARQUINEZ BRIDGE)




## FIGURE 59. HOV AND GP LANE SPEEDS – EASTBOUND ROUTE 80, AFTERNOON PEAK HOUR (BAY BRIDGE TO CARQUINEZ BRIDGE)



The demand exceeds HOV lane capacity; see the morning peak hour period volumes in Table 11 below. The highlighted cells show where the HOV lane flow is constrained due to excessive demand.

**TABLE 11. HOV AND GP LANE VOLUMES AND SPEEDS - WESTBOUND ROUTE 80 BETWEEN UNIVERSITY AVE AND ASHBY AVE**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1640 | 44.80 | 1802 | 43.90 |
| 9/23/2019 7:00 | 1471 | 30.40 | 1530 | 26.90 |
| 9/23/2019 8:00 | 1415 | 23.80 | 1445 | 23.40 |
| 9/24/2019 6:00 | 1668 | 50.70 | 1820 | 49.30 |
| 9/24/2019 7:00 | 1546 | 44.10 | 1690 | 43.40 |
| 9/24/2019 8:00 | 1456 | 25.00 | 1446 | 27.10 |
| 9/25/2019 6:00 | 1508 | 33.80 | 1542 | 30.70 |
| 9/25/2019 7:00 | 1187 | 17.30 | 1167 | 14.80 |
| 9/25/2019 8:00 | 1304 | 18.70 | 1368 | 20.80 |
| 9/26/2019 6:00 | 1533 | 33.90 | 1569 | 32.90 |
| 9/26/2019 7:00 | 1383 | 23.70 | 1430 | 23.80 |
| 9/26/2019 8:00 | 1220 | 18.10 | 1108 | 14.50 |
| 9/27/2019 6:00 | 1592 | 39.00 | 1723 | 36.40 |
| 9/27/2019 7:00 | 1533 | 36.20 | 1601 | 32.10 |
| 9/27/2019 8:00 | 1460 | 30.50 | 1414 | 25.40 |

HOV violation rates in the westbound direction in the morning are as high as 22 percent.

*Red Top Road to Airbase Parkway - Eastbound*

As this route is a getaway route for drivers heading to Tahoe/Reno area degradation mainline occurs around the major holidays (Independence Day, Labor Day, Thanksgiving, and week before Christmas). During the normal afternoon peak period the HOV lane is slightly degraded, occasional congestion in all lanes reduce HOV lane performance and speed due to the friction factor. This is due to several geometric factors on the GP lanes. In the eastbound direction there are two consecutive general-purpose lane drops – first is a mandatory off to Route 12 east (7 lanes), second is lane drop after connector to Route 12 (from 6 to 5 lanes). There is also a lane drop downstream of the end of HOV lane causing congestion to queue back into the end of the HOV lane.

Violation rates as high as 26 percent were observed in the eastbound direction during the afternoon peak period.

*Red Top Road to Airbase Parkway - Westbound*

In the westbound direction there is a very short auxiliary lane between the Travis Boulevard on-ramp and Oliver Road off-ramp. In addition, there is extremely heavy traffic entering from Route 12 east. During the morning peak period the HOV lane is slightly degraded. With HOV demand approaching capacity and congestion in all lanes reduce HOV lane performance and speed due to the friction factor. Table 12 shows volumes during the morning peak hour period.

**TABLE 12. HOV AND GP LANE VOLUMES AND SPEEDS - WESTBOUND ROUTE 80 @ CORDELIA TRUCK INSPECTION STATION**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1578 | 26.50 | 1552 | 24.30 |
| 9/23/2019 7:00 | 1605 | 26.50 | 1552 | 24.70 |
| 9/23/2019 8:00 | 1550 | 25.00 | 1481 | 22.60 |
| 9/24/2019 6:00 | 737 | 54.40 | 1191 | 55.20 |
| 9/24/2019 7:00 | 1022 | 74.40 | 1634 | 72.30 |
| 9/24/2019 8:00 | 1528 | 28.60 | 1558 | 29.00 |
| 9/25/2019 6:00 | 1596 | 26.90 | 1575 | 26.00 |
| 9/25/2019 7:00 | 1679 | 29.40 | 1633 | 27.80 |
| 9/25/2019 8:00 | 1098 | 48.20 | 1615 | 46.30 |
| 9/26/2019 6:00 | 1670 | 30.10 | 1593 | 28.20 |
| 9/26/2019 7:00 | 1642 | 28.30 | 1570 | 25.70 |
| 9/26/2019 8:00 | 1216 | 43.70 | 1594 | 37.90 |
| 9/27/2019 6:00 | 1142 | 71.60 | 1758 | 69.20 |
| 9/27/2019 7:00 | 1236 | 71.60 | 1844 | 68.60 |
| 9/27/2019 8:00 | 859 | 75.00 | 1584 | 72.00 |

## B. REMEDIATION STRATEGIES

*San Francisco-Oakland Bay Bridge to Carquinez Bridge*

- Starting in July 2018, the Metropolitan Transportation Commission (MTC) provided CHP with funding of $1.2 million in funding to the CHP for one year (with an option to extend it to three years) for four CHP officers to specifically conduct enhanced HOV enforcement. The limits on Route 80 are from the

Carquinez Bridge to the San Francisco-Oakland Bay Bridge. MTC and Caltrans will collect data to evaluate effectiveness of the enhanced enforcement effort. This enforcement pilot was stopped due to shelter in place (SIP) order. Preliminary results only showed slight improvement in violation and did not significantly reduce degradation

- Caltrans has updated the HOV violation fine amount on existing signs along this corridor to the current dollar amount to support the enhanced HOV enforcement effort, completed end of 2018.

- Caltrans is utilizing the westbound Route 80 electronic overhead lane use control sign to display HOV diamond symbol on the lane #1 control signal; this pilot was extended until end of August 2021 due to SIP.

- A future project will convert the HOV lanes to HOT lanes. Preliminary engineering and environmental studies are pending. Scheduled to open early 2026. Preliminary project cost is estimated at $190 million and would be funded by the MTC. With HOT lane projects there is dedicated funding provided by the HOT lane operators for CHP enforcement of the HOT lanes. This will insure a more consistent approach to enforcing and deterring violations of the HOT lanes. In addition, MTC is embarking on a design alternative assessment (DAA) that could alter the project scope, cost and schedule. The DAA will identify and evaluate a range of near-term and mid-term operational improvements and demand management strategies to address congestion in the corridor focusing on improving high occupancy modes of travel such as express buses and carpools, Managed lanes, and associated operational policies. The outcome of the DAA will be a set of near- and mid-term project concepts, starting in November 2020 and to be completed by early 2022.

- A State Highway Operation Protection Program (SHOPP) project will an add auxiliary lane in the eastbound direction between Pinole Valley Road to Route 4. This project will reduce vehicle hours of delay on eastbound Route 80. Construction is scheduled for FY 24/25.

*Red Top Road to Airbase Parkway.*

A future project will convert the HOV lanes to HOT lanes and will extend them from Airbase Parkway eastward to Route 505 in Vacaville. The project cost is $183M, completion scheduled for end 2023. With HOT lane projects there is dedicated funding provided by the HOT lane operators for CHP enforcement of

the HOT lanes. This will insure a more consistent approach to enforcing and deterring violations of the HOT lanes

### 4.2.5 ACTION PLAN FOR HOV FACILITIES ON ROUTE 85

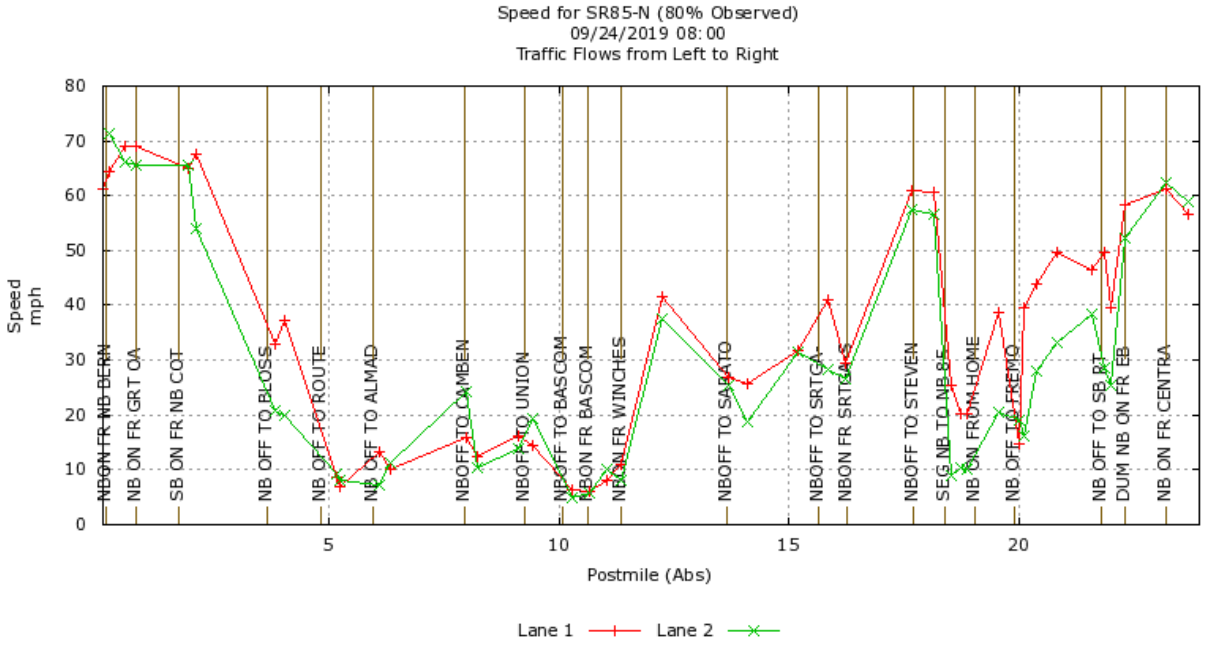
## A. ANALYSIS

*Northbound*

In the northbound direction there are two controlling bottlenecks. One bottleneck is between the Winchester Boulevard on-ramp and the Saratoga Avenue off-ramp. North of Saratoga Avenue to De Anza Boulevard the freeway operates at capacity with speeds around 35 mph. The queue from the bottleneck at Winchester Boulevard extends back to the Route 87 interchange, approximately 6.25 miles. The other bottleneck is downstream between the Fremont Avenue on-ramp and the El Camino Real diagonal off-ramp. The queue from this bottleneck extends back to the Stevens Creek Boulevard interchange, approximately 2.25 miles. Peak period recurrent congestion in all lanes reduce HOV lane performance and speed due to the friction factor. HOVs in the northbound direction are still receiving approximately 9 mins of timesaving over the general-purpose lane traffic. Figure 60 shows a "spot time" plot of the HOV and GP lane speeds on northbound Route 85 during a typical morning peak hour.

Demand also exceeds HOV lane capacity, as shown in Tables 13 and 14.

## FIGURE 60. HOV AND GP LANE SPEEDS – NORTHBOUND ROUTE 85, MORNING PEAK HOUR




## TABLE 13. HOV AND GP LANE VOLUMES AND SPEEDS - NORTHBOUND ROUTE 85 @ DE ANZA BLVD

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1504 | 54.00 | 2096 | 49.00 |
| 9/23/2019 7:00 | 1698 | 35.80 | 1665 | 28.90 |
| 9/23/2019 8:00 | 1802 | 37.90 | 1808 | 36.60 |
| 9/24/2019 6:00 | 1608 | 50.10 | 1988 | 42.00 |
| 9/24/2019 7:00 | 1684 | 29.40 | 1653 | 28.20 |
| 9/24/2019 8:00 | 1660 | 29.10 | 1667 | 29.00 |
| 9/25/2019 6:00 | 1592 | 55.90 | 2084 | 50.30 |
| 9/25/2019 7:00 | 1692 | 30.80 | 1674 | 28.00 |
| 9/25/2019 8:00 | 1718 | 35.60 | 1760 | 32.70 |
| 9/26/2019 6:00 | 1558 | 59.40 | 2137 | 54.40 |
| 9/26/2019 7:00 | 1633 | 34.70 | 1669 | 31.50 |
| 9/26/2019 8:00 | 1391 | 56.50 | 1560 | 57.50 |
| 9/27/2019 6:00 | 1397 | 61.40 | 2114 | 59.20 |
| 9/27/2019 7:00 | 1731 | 41.60 | 1919 | 39.10 |
| 9/27/2019 8:00 | 1508 | 49.80 | 1922 | 46.70 |

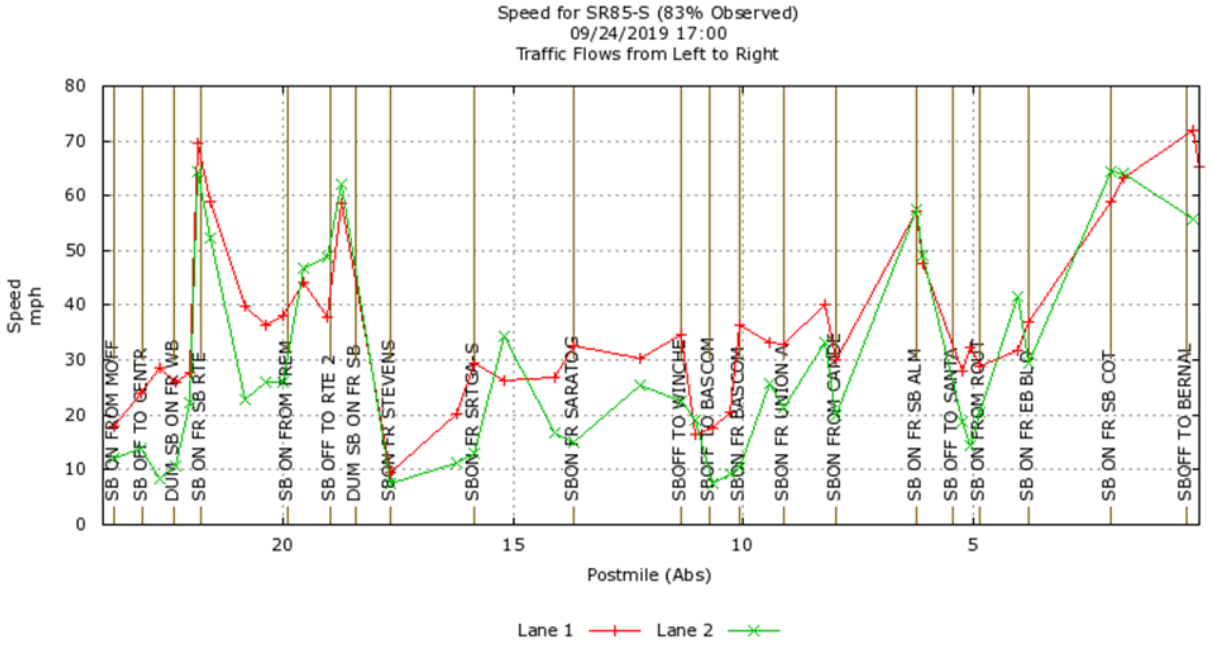
**TABLE 14. HOV AND GP LANE VOLUMES AND SPEEDS - NORTHBOUND ROUTE 85 @ FREMONT AVENUE**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 945 | 60.70 | 1989 | 55.70 |
| 9/23/2019 7:00 | 1497 | 52.50 | 1938 | 40.40 |
| 9/23/2019 8:00 | 1799 | 36.30 | 1591 | 25.00 |
| 9/24/2019 6:00 | 1143 | 63.80 | 2263 | 57.80 |
| 9/24/2019 7:00 | 1553 | 54.30 | 2123 | 48.30 |
| 9/24/2019 8:00 | 1719 | 33.60 | 1295 | 16.30 |
| 9/25/2019 6:00 | 955 | 66.50 | 2081 | 63.50 |
| 9/25/2019 7:00 | 1557 | 57.50 | 2268 | 56.10 |
| 9/25/2019 8:00 | 1768 | 38.60 | 1643 | 27.40 |
| 9/26/2019 6:00 | 973 | 70.70 | 2151 | 63.20 |
| 9/26/2019 7:00 | 1519 | 53.90 | 2104 | 47.70 |
| 9/26/2019 8:00 | 1724 | 32.60 | 1460 | 20.90 |
| 9/27/2019 6:00 | 893 | 71.20 | 2043 | 63.40 |
| 9/27/2019 7:00 | 1507 | 54.70 | 2315 | 54.10 |
| 9/27/2019 8:00 | 1751 | 36.60 | 1652 | 29.70 |

*Southbound*

In the southbound direction there are two controlling bottlenecks affecting traffic in the afternoon peak period. One bottleneck is between the Fremont Avenue on-ramp and the Homestead Road off-ramp. The queue from this bottleneck extends back onto southbound Route 101, approximately 4.5 miles. The other bottleneck is downstream between the Union Avenue on-ramp and the Camden Avenue off-ramp. The queue from this bottleneck extends back to the I-280 interchange, approximately 9.5 miles. Peak period recurrent congestion in all lanes reduce HOV lane performance and speed due to the friction factor. HOVs in the southbound direction are still receiving approximately 13 minutes of timesaving over the general-purpose lane traffic. Figure 61 shows a "spot time" plot of the HOV and GP lane speeds on southbound Route 85 during a typical afternoon peak hour.

## FIGURE 61. HOV AND GP LANE SPEEDS – SOUTHBOUND ROUTE 85, AFTERNOON PEAK HOUR




Demand exceeds HOV lane capacity as shown in Table 15. The highlighted cells show where the HOV lane flow is constrained due to excessive demand.

Violation rate is as high as 26 percent. CAVs make up approximately 32 percent of vehicles.

## TABLE 15. HOV AND GP LANE VOLUMES AND SPEEDS - SOUTHBOUND ROUTE 85 @ FREMONT AVENUE

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 15:00 | 1670 | 37.80 | 1658 | 27.30 |
| 9/23/2019 16:00 | 1627 | 38.20 | 1607 | 24.50 |
| 9/23/2019 17:00 | 1619 | 32.00 | 1504 | 21.70 |
| 9/24/2019 15:00 | 1594 | 33.00 | 1532 | 23.70 |
| 9/24/2019 16:00 | 1631 | 31.00 | 1585 | 25.20 |
| 9/24/2019 17:00 | 1535 | 28.10 | 1461 | 21.40 |
| 9/25/2019 15:00 | 1652 | 39.70 | 1636 | 28.80 |
| 9/25/2019 16:00 | 1632 | 32.60 | 1564 | 24.90 |
| 9/25/2019 17:00 | 1365 | 24.50 | 1031 | 12.10 |
| 9/26/2019 15:00 | 1501 | 27.50 | 1447 | 21.20 |

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/26/2019 16:00 | 1629 | 33.60 | 1546 | 24.70 |
| 9/26/2019 17:00 | 1591 | 30.00 | 1468 | 21.80 |
| 9/27/2019 15:00 | 1652 | 30.60 | 1651 | 26.50 |
| 9/27/2019 16:00 | 1549 | 25.90 | 1578 | 24.10 |
| 9/27/2019 17:00 | 1565 | 25.90 | 1573 | 25.70 |

## B. REMEDIATION STRATEGIES

There is a project to convert existing HOV lanes to HOT lanes and add a second HOT lane to provide a dual lane facility. The project limits are from the Route 101 interchange in south San Jose to the Rout 101 interchange in Mountain View. Preliminary project cost is estimated at $185 million and would be funded by the Santa Clara Valley Transportation Authority (VTA) through the design stage of the project. There is also a proposal to raise occupancy to HOV 3+ with HOT lane conversion. The HOT lane would operate in "HOV Only" mode if the lane becomes degraded. In addition, HOV 2 and Clean Air Vehicles would be tolled at a discounted rate. With HOT lane projects there is dedicated funding provided by the HOT lane operators for additional CHP enforcement of the HOT lanes. This will insure a more consistent approach to enforcing and deterring violations of the HOT lanes. VTA plans to build this project and the Route 101 HOT lane project in phases. The first segment is between Route 237 and Route 101 (Mountain View). Construction began in the summer 2019 and scheduled to be completed January 2022. The segment from Route 101 (south San Jose) to Route 87 is in the Caltrans PS&E phase now. Construction to start in the 2023, and completed in 2025, project cost $50 M. The middle section of Route 85 HOT lane conversion and lane addition will follow.

## 4.2.6 ACTION PLAN FOR HOV FACILITIES ON ROUTE 87

## A. ANALYSIS

*Northbound*

On northbound Route 87 there are three controlling bottlenecks in the morning peak period. One bottleneck is between the Almaden Expressway on-ramp and the Route 280 off-ramp. The queue from this bottleneck extends back to the Route 85 interchange, approximately 3.5 miles. Another bottleneck develops downstream between the Julian Street on-ramp and the Taylor Street off-ramp.

The queue from this bottleneck extends back to the Route 280 interchange, approximately 1.25 miles. The third bottleneck is at the meter to northbound Route 101 with a queue extending upstream to Airport Parkway, approximately 0.5 miles. Peak period recurrent congestion in all lanes due to these conditions reduces HOV lane performance and speed due to the friction factor. On average HOV lane speeds are approximately 10-15 mph greater than the GP lane speeds.

Demand exceeds HOV lane capacity as seen in Tables 16 and 17.

Violation rates are as high as 26 percent in the northbound direction.

CAVs account for approximately 30 percent.of the vehicles in the northbound direction.

**TABLE 16. HOV AND GP LANE VOLUMES AND SPEEDS - NORTHBOUND ROUTE 87 @ ALMADEN EXPRESSWAY**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1476 | 49.30 | 1819 | 39.60 |
| 9/23/2019 7:00 | 1708 | 33.30 | 1611 | 29.30 |
| 9/23/2019 8:00 | 1771 | 33.30 | 1683 | 29.10 |
| 9/24/2019 6:00 | 1669 | 46.10 | 1727 | 27.70 |
| 9/24/2019 7:00 | 1746 | 36.20 | 1634 | 24.60 |
| 9/24/2019 8:00 | 1688 | 33.60 | 1485 | 21.10 |
| 9/25/2019 6:00 | 1570 | 48.70 | 1783 | 30.30 |
| 9/25/2019 7:00 | 1792 | 35.30 | 1645 | 24.40 |
| 9/25/2019 8:00 | 1783 | 35.20 | 1560 | 23.30 |
| 9/26/2019 6:00 | 1684 | 50.40 | 1786 | 30.20 |
| 9/26/2019 7:00 | 1807 | 36.00 | 1615 | 23.30 |
| 9/26/2019 8:00 | 1711 | 32.60 | 1495 | 21.20 |

**TABLE 17. HOV AND GP LANE VOLUMES AND SPEEDS - NORTHBOUND ROUTE 87 @ TAYLOR STREET**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1270 | 64.20 | 1829 | 64.20 |
| 9/23/2019 7:00 | 1676 | 48.90 | 2067 | 51.20 |
| 9/23/2019 8:00 | 1647 | 32.50 | 1862 | 33.00 |
| 9/24/2019 6:00 | 1407 | 60.90 | 1980 | 61.00 |
| 9/24/2019 7:00 | 1736 | 48.20 | 2032 | 45.80 |
| 9/24/2019 8:00 | 1605 | 31.20 | 1824 | 30.30 |
| 9/25/2019 6:00 | 1306 | 63.60 | 1886 | 65.60 |
| 9/25/2019 7:00 | 1650 | 52.60 | 2057 | 52.00 |
| 9/25/2019 8:00 | 1586 | 32.40 | 1879 | 31.70 |
| 9/26/2019 6:00 | 1343 | 64.20 | 1975 | 64.90 |
| 9/26/2019 7:00 | 1687 | 61.20 | 2106 | 59.30 |
| 9/26/2019 8:00 | 1650 | 35.00 | 1888 | 34.20 |
| 9/27/2019 6:00 | 1193 | 64.80 | 1810 | 65.20 |
| 9/27/2019 7:00 | 1623 | 57.20 | 2035 | 56.50 |
| 9/27/2019 8:00 | 1630 | 33.00 | 1917 | 33.30 |

*Southbound*

On southbound Route 87 there is one controlling bottleneck in the afternoon peak period between the I-280 on-ramp and the Almaden Expressway off-ramp. The queue from this bottleneck extends back to Airport Parkway, approximately 4.5 miles. Peak period recurrent congestion in all lanes reduce HOV lane performance and speed due to the friction factor. On average HOV lane speeds are approximately 10-15 mph greater than the GP lane speeds.

Demand exceeds HOV lane capacity; see Table 18. Violation rates are as high as 31 percent in the southbound direction. CAVs account for approximately 26 percent of the vehicles in the southbound direction.

**TABLE 18. HOV AND GP LANE VOLUMES AND SPEEDS - SOUTHBOUND ROUTE 87 @ ROUTE 280**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 15:00 | 1172 | 73.20 | 1651 | 30.90 |
| 9/23/2019 16:00 | 1349 | 66.90 | 1533 | 22.50 |
| 9/23/2019 17:00 | 1606 | 54.20 | 1495 | 21.80 |
| 9/24/2019 15:00 | 1433 | 53.50 | 1499 | 21.10 |
| 9/24/2019 16:00 | 1739 | 51.00 | 1461 | 18.60 |
| 9/24/2019 17:00 | 1742 | 42.60 | 1382 | 16.80 |
| 9/25/2019 15:00 | 1316 | 48.00 | 1502 | 25.00 |
| 9/25/2019 16:00 | 1371 | 45.70 | 1436 | 19.60 |
| 9/25/2019 17:00 | 1601 | 38.90 | 1462 | 22.00 |
| 9/26/2019 15:00 | 1368 | 45.80 | 1505 | 24.40 |
| 9/26/2019 16:00 | 1452 | 44.70 | 1489 | 21.40 |
| 9/26/2019 17:00 | 1658 | 37.90 | 1457 | 20.00 |
| 9/27/2019 15:00 | 1186 | 49.60 | 1622 | 35.60 |
| 9/27/2019 16:00 | 1373 | 41.10 | 1388 | 20.80 |
| 9/27/2019 17:00 | 1578 | 39.70 | 1520 | 22.10 |

## B. REMEDIATION STRATEGIES

- VTA conducted a corridor study and is planning a future project to convert the HOV lane to a HOT lane. At the time of conversion, occupancy may be increased to HOV 3+ with the HOT lane conversion. Also, the HOT lane would operate in "HOV Only" mode if the lane becomes degraded. In addition, HOV 2 and Clean Air Vehicles can be tolled at a discounted rate. The corridor study was completed in August 2018. The HOT lane conversion does not currently have a schedule.

- A Technology-Based Corridor improvement project ($3 Million), part-time lane (Bus or HOV), which would convert the right shoulder to a part-time lane for transit, is scheduled to start construction Summer 2023 with completion in fall 2024.

## 4.2.7 ACTION PLAN FOR HOV FACILITY ON ROUTE 92

### A. ANALYSIS

On westbound Route 92 in the morning peak period there is congestion caused by the San Mateo/Hayward Bridge toll plaza. The queue extends from the toll plaza to beyond the Route 880 interchange. Morning high corridor traffic demand growth for both HOV lane and GP lanes is impacting the HOV lane. Toll plaza and approaching GP lanes queuing is reducing the HOV lane speeds due to the friction factor and HOV/GP lane merge downstream of the toll plaza.

Violation rates are as high as 35 percent.

CAVs account for 15 percent of vehicles.

### B. REMEDIATION STRATEGIES

MTC is studying increasing HOV occupancy to HOV 3+ due to legislative requirements at the San Mateo-Hayward Bridge Toll Plaza. In addition, all cash tolling has been eliminated and only electronic toll collection is in place with future mainline metering and open road tolling in the near future. The mainline meter will be just downstream of the toll plaza and will meter traffic onto the bridge so that the bridge operates at free flow conditions. Mainline metering can also provide a timesaving for the HOV lane by providing this lane a green signal or meter the lane at a faster rate than the GP lanes.

## 4.2.8 ACTION PLAN FOR HOV FACILITIES ON ROUTE 101

There are multiple HOV facilities on Route 101 in District 4. There are facilities located in Santa Clara and San Mateo Counties between Cochrane Road and Whipple Avenue A second set of facilities is located in Marin County between Richardson Bay Bridge and Atherton Avenue. There are also facilities in Sonoma County between the Marin County line and the south junction with State Route 116 (no data was available for this segment). Lastly there are facilities in Sonoma County between Old Redwood Highway and Windsor River Road.

### A. ANALYSIS

*Cochrane Road to Whipple Avenue, Northbound*

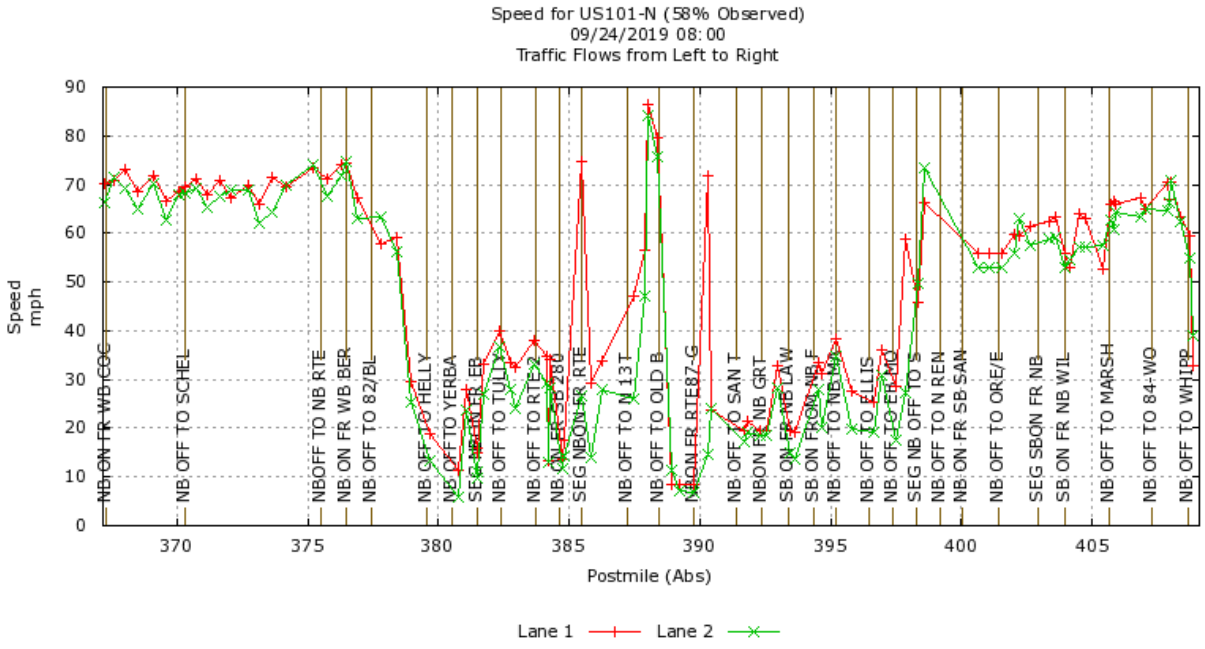
In the morning peak hour period there is a controlling bottleneck on northbound Route 101 between the Route 85 on-ramp and the Rengstorff Avenue off-ramp.

The queue from this bottleneck extends back through a secondary bottleneck between the Tully Road diagonal on-ramp and the Route 280/Route 680 off-ramp, to Blossom Hill Road, approximately 11.0 miles. In addition, there is a minor bottleneck downstream between the Embarcadero Road/Oregon Expressway on-ramp and the University Avenue off-ramp. The queue from this bottleneck extends upstream of the Embarcadero Road/Oregon Expressway interchange. This peak period recurrent congestion reduces HOV lane performance and speed due to the friction factor. However, HOVs are still receiving approximately 17 mins of timesaving over the general-purpose lane traffic during the morning peak period. Figure 62 shows a "spot time" plot of the HOV and GP lane speeds during a typical morning peak hour.

Demand exceeds HOV lane capacity as seen in Tables 19 and 20. The highlighted cells show where the HOV lane flow is constrained due to excessive demand. Violation rates are as high as 30 percent and CAVs account for as much as 21 percent of vehicles.

In the afternoon peak hour period, there is a bottleneck at the University Avenue interchange caused by queue spilling back onto the freeway from the off-ramp and high volumes from the Embarcadero Road/Oregon Expressway on-ramp. Queue from this bottleneck extends upstream to the San Antonio Road interchange. In addition, due to a bottleneck downstream at the Route 92 connector off-ramp a queue extends back upstream to Woodside Road beyond the end of the HOV restriction at Whipple Avenue. Congestion in lane 1 extends back into the end of the HOV lane causing the lane to breakdown.

## FIGURE 62. HOV AND GP LANE SPEEDS – NORTHBOUND ROUTE 101, MORNING PEAK HOUR (COCHRANE RD TO WHIPPLE AVE)




## TABLE 19. HOV AND GP LANE VOLUMES AND SPEEDS - NORTHBOUND ROUTE 101 @ TULLY ROAD

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1595 | 46.60 | 1912 | 39.80 |
| 9/23/2019 7:00 | 1735 | 40.20 | 1834 | 33.10 |
| 9/23/2019 8:00 | 1705 | 41.90 | 1846 | 34.90 |
| 9/24/2019 6:00 | 1512 | 43.10 | 1745 | 32.90 |
| 9/24/2019 7:00 | 1702 | 39.10 | 1774 | 32.10 |
| 9/24/2019 8:00 | 1607 | 34.80 | 1570 | 24.80 |
| 9/25/2019 6:00 | 1553 | 44.00 | 1815 | 40.40 |
| 9/25/2019 7:00 | 1717 | 39.10 | 1823 | 34.90 |
| 9/25/2019 8:00 | 1607 | 33.60 | 1599 | 29.10 |
| 9/26/2019 6:00 | 1582 | 44.30 | 1827 | 35.90 |
| 9/26/2019 7:00 | 1710 | 39.90 | 1779 | 30.30 |
| 9/26/2019 8:00 | 1617 | 38.10 | 1698 | 29.20 |
| 9/27/2019 6:00 | 1448 | 30.70 | 1709 | 25.80 |
| 9/27/2019 7:00 | 1763 | 42.40 | 1901 | 35.40 |
| 9/27/2019 8:00 | 1657 | 48.60 | 1919 | 39.20 |

**TABLE 20. HOV AND GP LANE VOLUMES AND SPEEDS - NORTHBOUND ROUTE 101 @ ROUTE 87**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1632 | 57.70 | 1908 | 55.80 |
| 9/23/2019 7:00 | 1658 | 37.00 | 1616 | 37.00 |
| 9/23/2019 8:00 | 1488 | 27.40 | 1385 | 28.30 |
| 9/24/2019 6:00 | 1615 | 52.40 | 1757 | 46.00 |
| 9/24/2019 7:00 | 1566 | 29.60 | 1471 | 28.80 |
| 9/24/2019 8:00 | 1253 | 18.40 | 1238 | 19.60 |
| 9/25/2019 6:00 | 1671 | 52.10 | 1894 | 50.00 |
| 9/25/2019 7:00 | 1573 | 29.30 | 1539 | 32.30 |
| 9/25/2019 8:00 | 1406 | 22.70 | 1390 | 25.50 |
| 9/26/2019 6:00 | 1591 | 45.90 | 1808 | 46.40 |
| 9/26/2019 7:00 | 1559 | 28.50 | 1505 | 29.60 |
| 9/26/2019 8:00 | 1258 | 18.60 | 1198 | 20.10 |
| 9/27/2019 6:00 | 1583 | 52.40 | 1948 | 51.60 |
| 9/27/2019 7:00 | 1698 | 32.20 | 1745 | 33.00 |
| 9/27/2019 8:00 | 1719 | 33.30 | 1718 | 31.90 |

*Cochrane Road to Whipple Avenue, Southbound*

During the morning peak hour period, there is a bottleneck between the University Avenue on-ramp and the Embarcadero Road/Oregon Expressway off-ramp in the morning peak period. Queue from this bottleneck extends upstream to the Woodside Road interchange, approximately 4.5 miles. The peak period recurrent congestion in all lanes reduce HOV lane performance and speed due to the friction factor.

Demand exceeds HOV lane capacity (assumed 1650 vph); see Table 21.

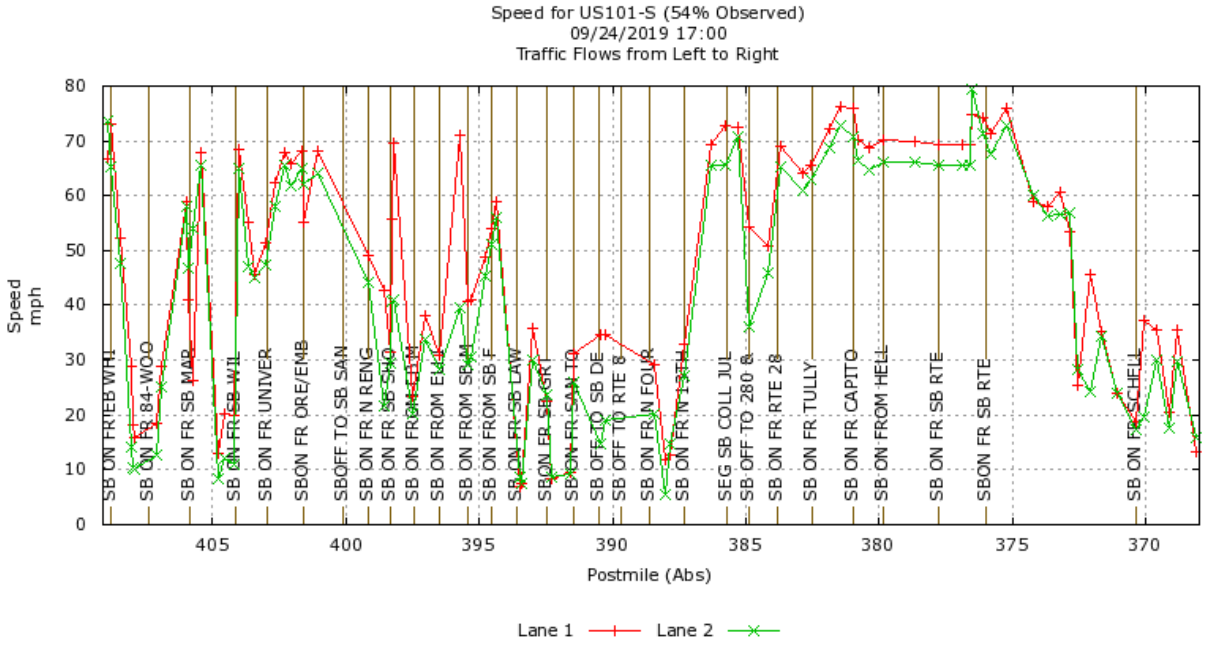
**TABLE 21. HOV AND GP LANE VOLUMES AND SPEEDS - SOUTHBOUND ROUTE 101 @ UNIVERSITY AVENUE**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 545 | 74.00 | 1686 | 58.30 |
| 9/23/2019 7:00 | 1246 | 54.40 | 2086 | 54.50 |
| 9/23/2019 8:00 | 1652 | 35.70 | 1818 | 35.20 |
| 9/24/2019 6:00 | 595 | 76.30 | 1895 | 66.70 |

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/24/2019 7:00 | 1308 | 52.30 | 2017 | 50.50 |
| 9/24/2019 8:00 | 1655 | 31.20 | 1784 | 30.70 |
| 9/25/2019 6:00 | 587 | 73.00 | 1852 | 63.40 |
| 9/25/2019 7:00 | 1318 | 45.40 | 1984 | 44.10 |
| 9/25/2019 8:00 | 1637 | 29.20 | 1727 | 30.20 |
| 9/26/2019 6:00 | 592 | 71.40 | 1784 | 65.40 |
| 9/26/2019 7:00 | 1333 | 44.40 | 2053 | 46.30 |
| 9/26/2019 8:00 | 1673 | 30.50 | 1772 | 32.10 |
| 9/27/2019 6:00 | 471 | 72.50 | 1659 | 65.90 |
| 9/27/2019 7:00 | 1215 | 50.10 | 2082 | 51.50 |
| 9/27/2019 8:00 | 1671 | 31.80 | 1814 | 31.10 |

There are multiple bottlenecks on southbound Route 101 in the afternoon peak period. A bottleneck between the Rengstorff Avenue on-ramp and southbound Route 85 off-ramp causes a queue to extend back to the Woodside Road interchange, approximately 8.5 miles. Further downstream there is a bottleneck between the De La Cruz Boulevard diagonal on-ramp and the southbound Route 87 off-ramp. Queue from this bottleneck extends upstream to the Route 85 interchange, approximately 7.5 miles. Downstream of this bottleneck there is a bottleneck between the Oakland Road on-ramp and the Julian Street off-ramp. Queue from this bottleneck extends upstream to the Route 87 interchange, approximately 2.25 miles. In addition, there is a bottleneck south of the end of the HOV lane between the Cochrane Road on-ramp and the Dunne Avenue off-ramp. This causes a queue to extend back into the end of the HOV lane and beyond to the Bailey Road interchange, approximately 5.75 miles. The resultant recurrent congestion in all lanes from these conditions reduces HOV lane performance and speed due to the friction factor. Despite this congestion HOVs traveling southbound are still receiving approximately 14 mins of timesaving over the general-purpose lane traffic. Figure 63 shows a "spot time" plot of the HOV and GP lane speeds during a typical afternoon peak hour.

## FIGURE 63. HOV AND GP LANE SPEEDS – SOUTHBOUND ROUTE 101, AFTERNOON PEAK HOUR (COCHRANE RD TO WHIPPLE AVE)




Demand at time exceeds HOV lane capacity, as seen in Table 22. Violation rates are as high as 30 percent. CAVs account for as much as 18 percent of vehicles using the lanes.

## TABLE 22. HOV AND GP LANE VOLUMES AND SPEEDS - SOUTHBOUND ROUTE 101 @ ELLIS STREET

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 545 | 74.00 | 1686 | 58.30 |
| 9/23/2019 7:00 | 1246 | 54.40 | 2086 | 54.50 |
| 9/23/2019 8:00 | 1652 | 35.70 | 1818 | 35.20 |
| 9/24/2019 6:00 | 595 | 76.30 | 1895 | 66.70 |
| 9/24/2019 7:00 | 1308 | 52.30 | 2017 | 50.50 |
| 9/24/2019 8:00 | 1655 | 31.20 | 1784 | 30.70 |
| 9/25/2019 6:00 | 587 | 73.00 | 1852 | 63.40 |
| 9/25/2019 7:00 | 1318 | 45.40 | 1984 | 44.10 |
| 9/25/2019 8:00 | 1637 | 29.20 | 1727 | 30.20 |
| 9/26/2019 6:00 | 592 | 71.40 | 1784 | 65.40 |
| 9/26/2019 7:00 | 1333 | 44.40 | 2053 | 46.30 |
| 9/26/2019 8:00 | 1673 | 30.50 | 1772 | 32.10 |

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/27/2019 6:00 | 471 | 72.50 | 1659 | 65.90 |
| 9/27/2019 7:00 | 1215 | 50.10 | 2082 | 51.50 |
| 9/27/2019 8:00 | 1671 | 31.80 | 1814 | 31.10 |

*Richardson Bay Bridge to Atherton Avenue, Northbound*

There are two controlling bottlenecks on northbound Route 101 in Marin County. The first bottleneck is between the Tamalpais Drive diagonal on-ramp and the Lucky Drive off-ramp. The queue from this bottleneck extends upstream to the Monte Mar Drive on-ramp, approximately 5.5 miles. The second bottleneck is typically downstream at the end of the HOV lane caused by a GP lane drop north of the Atherton Avenue on-ramp. Queue from this bottleneck extends back to Atherton Avenue , approximately 0.75 miles. In 2019, from the Marin/Sonoma County line north, a project to add an HOV lane in Sonoma County caused queue spill back into this bottleneck due to the on-going construction.

In 2019, a portion of the northbound HOV lane near the Route 580 interchange was slightly degraded (10.66 percent of days) due to the friction factor with the GP lanes.

The violation rate on these facilities was as high as 24 percent in the northbound direction. CAVs account for up to 7 percent of vehicles in the northbound direction.

*Richardson Bay Bridge to Delong Avenue, Southbound*

On southbound Route 101 there is a bottleneck at the North San Pedro Road on-ramp to the Lincoln Avenue off-ramp. The queue from this bottleneck extends upstream to north of the Rowland Boulevard interchange, approximately 7.75 miles. Morning peak period recurrent congestion caused by this bottleneck reduces HOV lane performance and speed due to the friction factor. HOVs are still receiving approximately 7 mins of timesaving over the GP lane traffic.

The violation rate on these facilities was as high as 19 percent in the southbound direction. CAVs account for up to 17 percent of vehicles in the southbound direction.

*Old Redwood Highway to Windsor River Road, Northbound*

There is minor bottleneck between the Baker Avenue on-ramp and the Route 12 off-ramp due to weaving between the heavy volume Baker Avenue on-ramp and the heavy volume Route 12 off-ramp. Combined volumes approximately 3300 vph (2013 latest volumes) with 2000 ft between ramps. Slow speeds extend upstream to Wilfred Avenue , approximately 3.5 miles. Peak period recurrent congestion due to these conditions reduces HOV lane performance and speed due to the friction factor. However, on average HOV lane speeds are approximately 10-20 mph greater than the GP lane speeds.

Violation rates are as high as 20 percent in the northbound direction. CAVs account for 3 percent of vehicles using the northbound HOV lane.

*Old Redwood Highway to Windsor River Road, Southbound*

On southbound Route 101 there is a bottleneck between the Route 12 on-ramp and the Baker Avenue off-ramp. The queue from this bottleneck extends upstream to the River Road interchange, approximately 6.5 miles.

Recurrent congestion in all lanes reduces HOV lane performance and speed due to the friction factor.

Violation rates are as high as 29 percent in the southbound direction. CAVs account for 5 percent of vehicles in the southbound HOV lane.

## B. REMEDIATION STRATEGIES

*Cochrane Road to Whipple Avenue*

- There are plans to convert the existing HOV lanes to HOT lanes and add a second HOT lane to create a dual lane facility. The project limits are from East Dunne Avenue to Oregon Expressway/Embarcadero Road in Santa Clara County. Preliminary project cost is estimated at $416 million and would be funded by VTA. VTA plans to build this project and the Route 85 HOT lane project in segments. The first segment would be between Route 237 and the San Mateo County line. Construction began March 8, 2019 with this segment to be completed in Jan. 2022. Occupancy requirements will be increased to HOV 3+ with HOT lane conversion. The HOT lane can operate in "HOV Only" mode if lane becomes degraded. In addition, HOV 2 and Clean Air Vehicles would be tolled at a discounted rate. With HOT lane projects there is

dedicated funding provided by the HOT lane operators for CHP enforcement of the HOT lanes. This will insure a more consistent approach to enforcing and deterring violations of the HOT lanes. The second phase, between Route 237 and I-880, is now in the PS&E phase, with start construction date of Dec. 2023, opening to traffic May 2026 as a dual HOT lane.

- A portion of the HOV lanes south of Route 85 will be converted to HOT lanes as part of planned HOV to HOT conversion on Route 85.

- There is a project that will fill in the ramp metering gaps and extend ramp metering on northbound Route 101 from Fair Oaks Avenue to Embarcadero Road to be completed in June 2021, project cost $8.3M.

- San Mateo County Transportation Agency, City/County Association of Governments, and Caltrans are developing a project for HOT lanes between San Antonio Road and Route 380. This lane is being proposed as a HOT 3+ lane and began construction in February 2020. Estimated cost of the project is $514 million with an estimated completion in 2022. This project will convert the existing HOV lane between the Santa Clara County line and Whipple Avenue into a HOT lane; this conversion will be completed in January 2022. Between Whipple Avenue and Route 380 project will add a HOT lane, which should be opened to traffic at the end of 2022. With HOT lane projects there is dedicated funding provided by the HOT lane operators for CHP enforcement of the HOT lanes. This will insure a more consistent approach to enforcing and deterring violations of the HOT lanes.

- The connector to southbound Route 87 will be widened to two lanes. Currently, the demand for this off-ramp exceeds the capacity of one lane causing congestion on southbound Route 101. Estimated construction is to start in the September 2021 and be completed by the Spring 2022, project cost $4.2 M

*Richardson Bay Bridge to Atherton Avenue*

- A proposed third lane on eastbound Route 580 starting from Sir Francis Drake Boulevard could improve traffic flow in the northbound direction. Traffic on northbound Route 101 is routinely congested due to traffic exiting at Sir Francis Drake Boulevard to continue to the Richmond-San Rafael Bridge. Construction was completed for the third eastbound traffic lane in April 2018. The Bay Area Toll Authority funded the $60 million cost. This project is a four-year pilot project part-time third lane on the San Rafael/Richmond bridge.

- Several projects along the Marin-Sonoma Narrows Corridor are being developed that will close the gaps in the HOV lanes in Sonoma and Marin Counties. These projects include:
    - Realigning Route 101 at San Antonio Road to upgrade roadway profile and alignment. Project was completed at the end of 2019 at a cost of $71 million.
    - Constructing HOV lanes on Route 101 from the Marin County/Sonoma County line and Atherton Avenue Project in Project Initiation Document (PID) phase, construction completion projected for 2024/2025.
    - The southbound HOV lane on Route 101 between Rte. 116 and the Marin/Sonoma County line was completed in Dec 2019. Any Improvements in degradation will not be known until the 2021 Degradation Report.
- Current HOV hours of operation start at 6:30 a.m. HOV lane hours of operation may be changed to provide consistency with HOV hours north of the corridor upon completion of the projects to close the gap in the HOV lane between Marin and Sonoma County.
- Part Time Bus Only lane pilot project from Novato Boulevard to Mission Boulevard is currently being studied.

*Old Redwood Highway to Windsor River Road*

- There are no current projects to address the bottlenecks near Route 12 which is causing degradation in the northbound and southbound Route 101 HOV lanes in Sonoma County. Heavy traffic to and from Route 12 is causing these bottlenecks.
- As noted in the plan for the facilities in Marin County, there are several projects along the Marin-Sonoma Narrows Corridor are being developed that will close the gaps in the HOV lanes in Sonoma and Marin Counties. In addition to those projects previously listed, other improvements are as follows:
    - New HOV lanes were constructed between Marin/Sonoma County line and the south junction of Route 116. The northbound facility opened in November 2019 and the southbound facility opened in December 2019.

- Construction is underway to close the gap in HOV lanes between Route 116 and Old Redwood Hwy; completion is expected in Spring 2023, project cost $70 M.

### 4.2.9 ACTION PLAN FOR HOV FACILITIES ON ROUTE 237

## A. ANALYSIS

The HOV facilities on Route 237 underwent significant operational changes in 2020 as mentioned in the *2019 California High Occupancy Vehicle Facilities Degradation Report and Action Plan* and the *2020 California High Occupancy Vehicle Facilities Degradation Report*. The segment between Mathilda Avenue and Great America Parkway was converted to HOT operations in November 2019 and the minimum HOV occupancy requirements on this facility were increased from two to three persons per vehicle in October 2020. The analyses below pre-date these changes.

*Eastbound*

There is a controlling bottleneck between North First Street on-ramp and the Zanker Road off-ramp. Queuing from this bottleneck extends back to the Maude Avenue on-ramp, approximately 5.0 miles. There is also a queue that spills back from the Calaveras Boulevard off-ramp that impacts the output of this bottleneck during part of the afternoon peak period. Peak period recurrent congestion in all lanes reduces HOT lane performance and speed due to the friction factor. HOT lane users are still receiving approximately 7 mins of timesaving over the general-purpose lane traffic.

Demand exceeds HOV lane capacity; see Table 23. The highlighted cells show where the HOV lane flow is constrained due to excessive demand. CAVs account for 18 percent of vehicles using the eastbound HOT lane.

**TABLE 23. HOV AND GP LANE VOLUMES AND SPEEDS - EASTBOUND ROUTE 237 @ NORTH FIRST STREET**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 15:00 | 1504 | 36.00 | 1512 | 20.50 |
| 9/23/2019 16:00 | 1648 | 29.90 | 1512 | 19.60 |
| 9/23/2019 17:00 | 1588 | 24.20 | 1512 | 18.60 |
| 9/24/2019 15:00 | 1446 | 39.20 | 1458 | 21.00 |
| 9/24/2019 16:00 | 1537 | 31.20 | 1507 | 23.10 |
| 9/24/2019 17:00 | 1543 | 24.70 | 1424 | 17.90 |
| 9/25/2019 15:00 | 1560 | 37.60 | 1512 | 20.70 |
| 9/25/2019 16:00 | 1589 | 27.70 | 1504 | 19.20 |
| 9/25/2019 17:00 | 1496 | 23.70 | 1386 | 18.20 |
| 9/26/2019 15:00 | 1533 | 30.60 | 1451 | 20.10 |
| 9/26/2019 16:00 | 1469 | 21.60 | 1227 | 14.60 |
| 9/26/2019 17:00 | 1300 | 15.00 | 970 | 9.30 |
| 9/27/2019 15:00 | 1555 | 37.40 | 1519 | 20.70 |
| 9/27/2019 16:00 | 1286 | 37.40 | 1218 | 22.40 |
| 9/27/2019 17:00 | 1510 | 33.70 | 1463 | 27.40 |

*Westbound*

There is a bottleneck in the morning peak period between the Zanker Road on-ramp and the North First Street off-ramp. Queue from this bottleneck extends upstream back onto southbound I-880 and westbound Calaveras Boulevard. In addition, a queue downstream of this bottleneck spills back from the westbound Route 237 off-ramp to northbound Route 101. This queue extends back onto westbound Route 237 to the Great America Parkway interchange. Peak period recurrent congestion in all lanes reduces HOT lane performance and speed due to the friction factor. HOT lane users are still receiving approximately 7 mins of timesaving over the general-purpose lane traffic.

Demand exceeds HOV lane capacity as seen in Table 24. Note that the HOV lane speeds do not appear to be accurate. CAVs account for 22 percent of vehicles in the westbound HOT lane.

**TABLE 24. HOV AND GP LANE VOLUMES AND SPEEDS - WESTBOUND ROUTE 237 @ NORTH FIRST STREET**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1237 | 71.70 | 1817 | 60.60 |
| 9/23/2019 7:00 | 1669 | 71.70 | 1955 | 56.70 |
| 9/23/2019 8:00 | 1736 | 72.00 | 1824 | 35.10 |
| 9/24/2019 6:00 | 1253 | 71.60 | 1822 | 63.40 |
| 9/24/2019 7:00 | 1691 | 71.50 | 1855 | 48.60 |
| 9/24/2019 8:00 | 1716 | 71.50 | 1635 | 25.70 |
| 9/25/2019 6:00 | 1356 | 71.50 | 1846 | 62.00 |
| 9/25/2019 7:00 | 1724 | 71.30 | 1829 | 41.30 |
| 9/25/2019 8:00 | 1722 | 71.60 | 1632 | 24.50 |
| 9/26/2019 6:00 | 1393 | 71.20 | 1888 | 62.40 |
| 9/26/2019 7:00 | 1720 | 71.20 | 1784 | 40.40 |
| 9/26/2019 8:00 | 1709 | 71.20 | 1565 | 22.70 |
| 9/27/2019 6:00 | 1156 | 71.60 | 1835 | 62.00 |
| 9/27/2019 7:00 | 1548 | 71.60 | 1952 | 56.00 |
| 9/27/2019 8:00 | 1713 | 71.50 | 1836 | 57.00 |

## B. REMEDIATION STRATEGIES

- As noted above, the limits of the HOT operation were extended in November 2019. Occupancy requirements were changed on October 2, 2020 to HOT 3+ as the I-880 connecting HOT lane facility began operations; HOV 2 and CAVs are now tolled at a discounted rate. The impacts of these changes will be monitored and any observations will be noted in the 2021 degradation report.

- A future project will add an auxiliary lane in the eastbound direction by widening the freeway between North 1st and Zanker Road. The Project Approval and Environmental Document (PA&ED) phase was completed August 2020. Start construction 2022. Estimated to be completed by 2024, cost of $15.2 M.

- There was a future project to add an auxiliary lane in the westbound direction by widening the freeway between Zanker Road and North 1st Street. However, this project was removed as it would have released the upstream congestion down to the congestion at the Route 101 interchange and would not have improved conditions on westbound Route 237.

## 4.2.10 ACTION PLAN FOR HOV FACILITIES ON ROUTE 280

## A. ANALYSIS

*Northbound*

There is a controlling bottleneck between the Stevens Creek Boulevard on-ramp and the Wolfe Road off-ramp during the morning peak period. During the peak hour there is a controlling bottleneck downstream between the Foothill Expwy. on-ramp and the Magdalena Avenue off-ramp. The queue from this bottleneck extends through the upstream bottleneck and back to the Route 87 interchange, approximately 9.0 miles. The peak period recurrent congestion in all lanes reduces HOV lane performance and speed due to the friction factor.

Demand exceeds HOV lane capacity; see Tables 25 through 27. The highlighted cells show where the HOV lane flow is constrained due to excessive demand. Northbound the violation rate is as high as 22 percent. About 9 percent of vehicles in the northbound lane are CAVs

**TABLE 25. HOV AND GP LANE VOLUMES AND SPEEDS - NORTHBOUND ROUTE 280 @ ROUTE 880.**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1749 | 52.90 | 1568 | 54.80 |
| 9/23/2019 7:00 | 1369 | 22.70 | 1426 | 25.50 |
| 9/23/2019 8:00 | 1074 | 13.60 | 1192 | 16.00 |
| 9/24/2019 6:00 | 1698 | 40.30 | 1606 | 41.10 |
| 9/24/2019 7:00 | 1187 | 18.60 | 1264 | 20.50 |
| 9/24/2019 8:00 | 933 | 10.90 | 992 | 11.80 |
| 9/25/2019 6:00 | 1708 | 47.10 | 1594 | 47.70 |
| 9/25/2019 7:00 | 1255 | 19.50 | 1348 | 20.70 |
| 9/25/2019 8:00 | 1011 | 13.20 | 1091 | 13.80 |
| 9/26/2019 6:00 | 1757 | 49.10 | 1600 | 48.50 |
| 9/26/2019 7:00 | 1198 | 17.70 | 1255 | 18.90 |
| 9/26/2019 8:00 | 944 | 12.70 | 1077 | 14.30 |
| 9/27/2019 6:00 | 1659 | 49.80 | 1579 | 51.10 |
| 9/27/2019 7:00 | 1444 | 26.10 | 1512 | 29.10 |
| 9/27/2019 8:00 | 1639 | 32.30 | 1676 | 33.60 |

## TABLE 26. HOV AND GP LANE VOLUMES AND SPEEDS - NORTHBOUND ROUTE 280 @ SARATOGA AVENUE

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1298 | 60.70 | 2348 | 57.40 |
| 9/23/2019 7:00 | 1740 | 31.20 | 1938 | 28.60 |
| 9/23/2019 8:00 | 1441 | 17.00 | 1748 | 19.40 |
| 9/24/2019 6:00 | 1527 | 61.70 | 2297 | 57.40 |
| 9/24/2019 7:00 | 1685 | 25.70 | 1855 | 21.70 |
| 9/24/2019 8:00 | 1386 | 14.60 | 1696 | 15.70 |
| 9/25/2019 6:00 | 1401 | 65.90 | 2344 | 59.50 |
| 9/25/2019 7:00 | 1624 | 23.90 | 1870 | 22.70 |
| 9/25/2019 8:00 | 1543 | 18.40 | 1725 | 19.40 |
| 9/26/2019 6:00 | 1490 | 61.00 | 2286 | 57.50 |
| 9/26/2019 7:00 | 1638 | 24.50 | 1929 | 22.40 |
| 9/26/2019 8:00 | 1336 | 15.50 | 1591 | 16.50 |
| 9/27/2019 6:00 | 1303 | 63.90 | 2196 | 62.30 |
| 9/27/2019 7:00 | 1816 | 41.40 | 2050 | 34.90 |
| 9/27/2019 8:00 | 1607 | 51.90 | 2066 | 43.50 |

## TABLE 27. HOV AND GP LANE VOLUMES AND SPEEDS - NORTHBOUND ROUTE 280 @ ROUTE 85

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1743 | 66.70 | 780 | 62.80 |
| 9/23/2019 7:00 | 1765 | 39.50 | 1446 | 46.00 |
| 9/23/2019 8:00 | 1584 | 31.70 | 1337 | 41.00 |
| 9/24/2019 6:00 | 1685 | 67.40 | 871 | 70.30 |
| 9/24/2019 7:00 | 1611 | 32.20 | 1434 | 42.00 |
| 9/24/2019 8:00 | 956 | 21.80 | 1074 | 30.50 |
| 9/25/2019 6:00 | 1745 | 66.60 | 857 | 67.00 |
| 9/25/2019 7:00 | 1682 | 36.50 | 1451 | 43.10 |
| 9/25/2019 8:00 | 1374 | 21.90 | 1478 | 32.30 |
| 9/26/2019 6:00 | 1733 | 66.60 | 856 | 69.70 |
| 9/26/2019 7:00 | 1583 | 37.20 | 1375 | 36.50 |
| 9/26/2019 8:00 | 1253 | 23.00 | 1409 | 27.20 |
| 9/27/2019 6:00 | 1547 | 67.30 | 771 | 70.20 |
| 9/27/2019 7:00 | 1796 | 46.20 | 1418 | 48.50 |
| 9/27/2019 8:00 | 1286 | 26.50 | 1216 | 39.00 |

*Southbound*

There is a bottleneck between the Saratoga Avenue on-ramp and the Winchester Boulevard off-ramp during the afternoon peak Period. A second bottleneck develops downstream of the end of the HOV facility between the 7th Street on-ramp and the Mclaughlin Avenue off-ramp that queues back into the upstream bottleneck during the afternoon peak hour. The queue these two bottlenecks extends upstream to the Foothill Expressway interchange, approximately 10.0 miles. The peak period recurrent congestion in all lanes reduces HOV lane performance and speed due to the friction factor. On the southbound facility HOVs are still receiving approximately 4 mins of timesaving over the general-purpose lane traffic.

Demand exceeds HOV lane capacity as seen in Table 28. About 7 percent of vehicles in the southbound lane are CAVs.

**TABLE 28. HOV AND GP LANE VOLUMES AND SPEEDS - SOUTHBOUND ROUTE 280 @ SARATOGA AVENUE**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 15:00 | 1736 | 42.20 | 1765 | 27.30 |
| 9/23/2019 16:00 | 1621 | 35.10 | 1693 | 23.30 |
| 9/24/2019 15:00 | 1610 | 38.70 | 1665 | 25.70 |
| 9/24/2019 16:00 | 1603 | 37.20 | 1605 | 23.10 |
| 9/25/2019 15:00 | 1637 | 21.60 | 1694 | 26.40 |
| 9/25/2019 16:00 | 1630 | 20.50 | 1696 | 24.80 |
| 9/26/2019 15:00 | 1664 | 36.40 | 1704 | 27.20 |
| 9/26/2019 16:00 | 1628 | 38.20 | 1658 | 26.80 |
| 9/27/2019 15:00 | 1468 | 37.60 | 1737 | 35.70 |
| 9/27/2019 16:00 | 1677 | 32.00 | 1695 | 26.30 |
| 9/23/2019 15:00 | 1736 | 42.20 | 1765 | 27.30 |
| 9/23/2019 16:00 | 1621 | 35.10 | 1693 | 23.30 |
| 9/24/2019 15:00 | 1610 | 38.70 | 1665 | 25.70 |
| 9/24/2019 16:00 | 1603 | 37.20 | 1605 | 23.10 |
| 9/25/2019 15:00 | 1637 | 21.60 | 1694 | 26.40 |

## B. REMEDIATION STRATEGIES

- A corridor study was completed in 2017 to determine potential improvements.

- Projects programmed and listed in Envision Silicon Valley Project List October 1, 2015 include: A phased strategy for northbound & southbound I-280 for a HOV lane extension between Route 101 and Leland Avenue and Magdalena Avenue and the SM County line. Total cost: $112 million. Then a Magdalena Avenue to San Mateo County Line HOT lane conversion $95 million, Leland Avenue to Magdalena Avenue HOT lane conversion $63 million, Route 101 to Leland Avenue HOT lane conversion $27 million. With conversion to HOT lane raising occupancy to HOT 3+ can be considered. There aren't any projects proposed in the near-turn, route should be considered for a waiver.

## 4.2.11 ACTION PLAN FOR HOV FACILITIES ON ROUTE 580

## A. ANALYSIS

*Eastbound*

There is a controlling bottleneck between the Tassajara Road on-ramp and the El Charro Road off-ramp. Queue from this bottleneck extends upstream to the Eden Canyon Road interchange, approximately 8.5 miles. A second controlling bottleneck is located downstream of the end of the HOT lane due to a lane drop and the uphill gradient ascending the Altamont Pass grade. The queue from this bottleneck extends upstream to the First Street interchange, approximately 6.25 miles and affects the HOT lanes as well as the GP lanes. The congestion due to these bottlenecks reduces HOT lane performance and speed due to the friction factor.

The first two miles of the HOT facility (between Hacienda Drive and El Charro Road) has only one lane. Demand exceeds capacity in this segment. See the volumes listed in Table 29.

**TABLE 29. HOV AND GP LANE VOLUMES AND SPEEDS - EASTBOUND ROUTE 580 @ TASSAJARA ROAD**

| Hour | HOT Lane Flow (Veh/Hour) | HOT Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 15:00 | 1653 | 47.50 | 1609 | 45.10 |
| 9/23/2019 16:00 | 1637 | 49.10 | 1592 | 47.50 |
| 9/23/2019 17:00 | 1507 | 56.60 | 1459 | 55.60 |
| 9/24/2019 15:00 | 1643 | 46.70 | 1609 | 38.00 |
| 9/24/2019 16:00 | 1658 | 46.80 | 1635 | 38.20 |
| 9/24/2019 17:00 | 1096 | 59.50 | 1072 | 48.70 |
| 9/25/2019 15:00 | 1701 | 40.20 | 1655 | 42.70 |
| 9/25/2019 16:00 | 1724 | 38.80 | 1690 | 41.20 |
| 9/25/2019 17:00 | 1503 | 45.00 | 1456 | 47.70 |
| 9/26/2019 15:00 | 1704 | 41.70 | 1651 | 44.40 |
| 9/26/2019 16:00 | 1702 | 40.70 | 1653 | 44.10 |
| 9/26/2019 17:00 | 1665 | 44.30 | 1552 | 46.70 |
| 9/27/2019 15:00 | 1742 | 42.70 | 1683 | 46.10 |
| 9/27/2019 16:00 | 1728 | 43.00 | 1640 | 45.90 |
| 9/27/2019 17:00 | 1671 | 47.20 | 1513 | 48.60 |

*Westbound*

In the westbound direction the portion from First Street to Isabel Avenue (Route 84). is slightly degraded during the morning commute due to peak period recurrent congestion in the GP lanes reducing HOT lane performance and speed due to the friction factor; weaving to exit to Route 84 maybe adding to this degradation.

CAVs make up about 4 percent of vehicles using the HOT lanes.

## B. REMEDIATION STRATEGIES

- There is no short-term solution for the downstream eastbound bottleneck on the Altamont Pass grade. However, Caltrans District 4, District 10 and other regional partners have initiated a 580/205 Altamont Pass Corridor Executive Working Group. The purpose of the group and subsequent working teams is to focus on multimodal transportation challenges, improvements along the corridor on commuter and goods movement trips over the Altamont Pass.

- Alameda County Transportation Commission (ACTC) plans to upgrade toll system equipment and modify the toll zone limits in 2022. The project is still in progress as ACTC and Caltrans executed a cooperative agreement for a PEER/ Encroachment Permit approval process.

- The district will work with ACTC to increase pricing of the lane to better manage the demand.

### 4.2.12 ACTION PLAN FOR HOV FACILITIES ON ROUTE 680

There are multiple HOV facilities on Route 680 in District 4. HOT lanes operate in Santa Clara and Alameda Counties between State Route 237/Calaveras Boulevard and State Route 84. HOT and HOV lanes also operate in Contra Costa County between Alcosta Boulevard and Marina Vista

### A. ANALYSIS

The HOV facilities on Route 680 underwent significant operational changes in 2020 as mentioned in the *2020 California High Occupancy Vehicle Facilities Degradation Report*. A new northbound HOT facility was opened to traffic between South Grimmer Boulevard and State Route 84. In 2020, a gap in the southbound direction between Treat Boulevard and Rudgear Road was closed, and the HOV lane between Marina Vista and Treat Boulevard was converted to HOT operations to provide one continuous HOT facility in the southbound direction between Marina Vista and Alcosta Boulevard. The analyses below pre-date these changes.

*Route 237 to Route 84, Southbound*

Concentrated weaving movement at beginning southbound ingress point at Route 84 causes slight degradation in the morning peak period. A Bottleneck in the GP lanes downstream of the southbound end of the EL between the Berryessa Road on-ramp and the McKee off-ramp causes a queue to extend upstream beyond the Calaveras (Route 237) interchange and slightly degrade the HOT lane at the southern end of the EL during the afternoon peak period. HOT lane users were still receiving approximately 7 mins of timesaving over the general-purpose lane traffic.

Approximately 29 percent of the vehicles are CAVs.

*Alcosta Boulevard to Marina Vista, Northbound*

There is a gap in the managed lane facilities between Livorna Road and State Route 242. Between Alcosta Boulevard and Livorna Road the facility operates as a HOT lane. From State Route 242 to Marina Vista it operates as an HOV lane.

There is a minor bottleneck between the El Cerro Boulevard on-ramp and the Stone Valley Road off-ramp. Queue from this bottleneck extends back to beyond the Sycamore Valley Road interchange during the morning peak hour period. Speeds in the HOV lane are reduced as more vehicles start to enter the HOV lane at this point and due to the friction factor with the lower speeds in the GP lanes.

In the afternoon peak hour period a bottleneck forms between El Pintado Road and Stone Valley Road. Queue from this bottleneck extends back beyond the Sycamore Valley Road interchange, approximately 2.5 miles. There is a second bottleneck downstream between the Oak Park Boulevard on-ramp and the Contra Costa Boulevard off-ramp. Queue from this bottleneck extends upstream to the Livorna Road interchange, approximately 5.75 miles, which is also where the northbound HOT facility terminates. This peak period recurrent congestion in all lanes reduces HOT lane performance and speed due to the friction factor. On average HOT lane speeds were approximately 5-10 mph greater than the GP lane speeds.

About 9 percent of vehicles in the northbound lane were CAVs

*Alcosta Boulevard to Marina Vista, Southbound*

In the southbound direction, an HOV lane operated between Marina Vista and Treat Boulevard. A HOT lane operated between Rudgear Road and Alcosta Boulevard. As noted above, in 2020 the gap between Treat Boulevard and Rudgear Road was closed, and the HOV lane between Marina Vista and Treat Boulevard was converted to HOT operations to provide one continuous HOT facility between Marina Vista and Alcosta Boulevard.

In the morning peak hour period a bottleneck develops at the lane drop at the Route 24 off-ramp. Queue from this bottleneck extends upstream to the Route 242 interchange, approximately 3.75 miles. A second bottleneck develops downstream between the Livorna Road on-ramp and the Stone Valley Road off-ramp. Queue from this bottleneck extends to Olympic Boulevard interchange, approximately 2.25 miles. This peak period recurrent congestion in all lanes

reduced HOV lane performance and speed due to the friction factor. In 2019 the HOV lane ended in a queue at Treat Boulevard due to the downstream bottleneck at Route 24 interchange lane drop.

In the HOT lane portion between Rudgear Road and Alcosta Boulevard, demand exceeded capacity as shown in Table 30 below. About 7 percent of the vehicles in the southbound lane were CAVs.

**TABLE 30. HOV AND GP LANE VOLUMES AND SPEEDS - SOUTHBOUND ROUTE 680 @ STONE VALLEY ROAD**

| Hour | HOt Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1189 | 48.80 | 1864 | 52.20 |
| 9/23/2019 7:00 | 1732 | 39.50 | 1962 | 36.00 |
| 9/23/2019 8:00 | 1723 | 44.60 | 1966 | 36.30 |
| 9/24/2019 6:00 | 1404 | 53.30 | 2158 | 59.40 |
| 9/24/2019 7:00 | 1677 | 44.40 | 2014 | 47.70 |
| 9/24/2019 8:00 | 1614 | 39.00 | 1814 | 35.10 |
| 9/25/2019 6:00 | 1250 | 55.20 | 2028 | 61.80 |
| 9/25/2019 7:00 | 1729 | 45.50 | 2169 | 50.10 |
| 9/25/2019 8:00 | 1619 | 35.70 | 1806 | 35.00 |
| 9/26/2019 6:00 | 1343 | 52.70 | 2155 | 58.50 |
| 9/26/2019 7:00 | 1712 | 43.00 | 1930 | 39.90 |
| 9/26/2019 8:00 | 1601 | 37.30 | 1760 | 33.20 |
| 9/27/2019 6:00 | 1110 | 69.70 | 2051 | 59.60 |
| 9/27/2019 7:00 | 1505 | 53.60 | 2028 | 53.00 |
| 9/27/2019 8:00 | 1437 | 51.40 | 1998 | 49.60 |

## B. REMEDIATION STRATEGIES

*State Route 237 to State Route 84*

As part of the project to construct the northbound HOT lane, the southbound HOT lane will be converted from a buffer separated facility to open access which should eliminate concentrated movement at existing ingress and egress points. Construction should be completed in 2022 at a cost of $6.3 M.

Currently there is no project to address the mainline bottleneck downstream of the end of the southbound HOT lane. The only other way to address

degradation would be to shorten the HOT lane, however this would reduce the travel time savings that HOT lane users currently receive.

*Alcosta Boulevard to Marina Vista*

- As noted above, a project was completed in 2020 that closes the gap on the southbound HOV facility between Treat Boulevard and Rudgear Road. The estimated construction cost is $74.5 million. This project also removed a lane drop in the general-purpose lanes and added access control striping between Route 242 and North Main Street and from Rudgear Road to Stone Valley Road. The impacts of these changes will be monitored and any observations will be noted in the 2021 degradation report.

- Innovate 680 is overall project sponsored by the Contra Costa Transportation Authority (CCTA) that include completion of HOT lane network as well as other short-term strategies to enhance Transportation Demand Management (TDM), Integrated Corridor Management (ICM), Corridor Adaptive Ramp Metering. Cost of Short-Term Strategies elements is $39M estimated to be implemented by end of 2025.

- The Innovate 680 also includes a proposed project to close the northbound gap between Livorna Road and Route 242. This is currently in PA&ED phase. Estimated construction completion is year 2025 (HOT lane project cost $350M). Completion of HOT lane system is part of Innovate 680 Project sponsored by CCTA.

### 4.2.13 ACTION PLAN FOR HOV FACILITIES ON ROUTE 880

### A. ANALYSIS

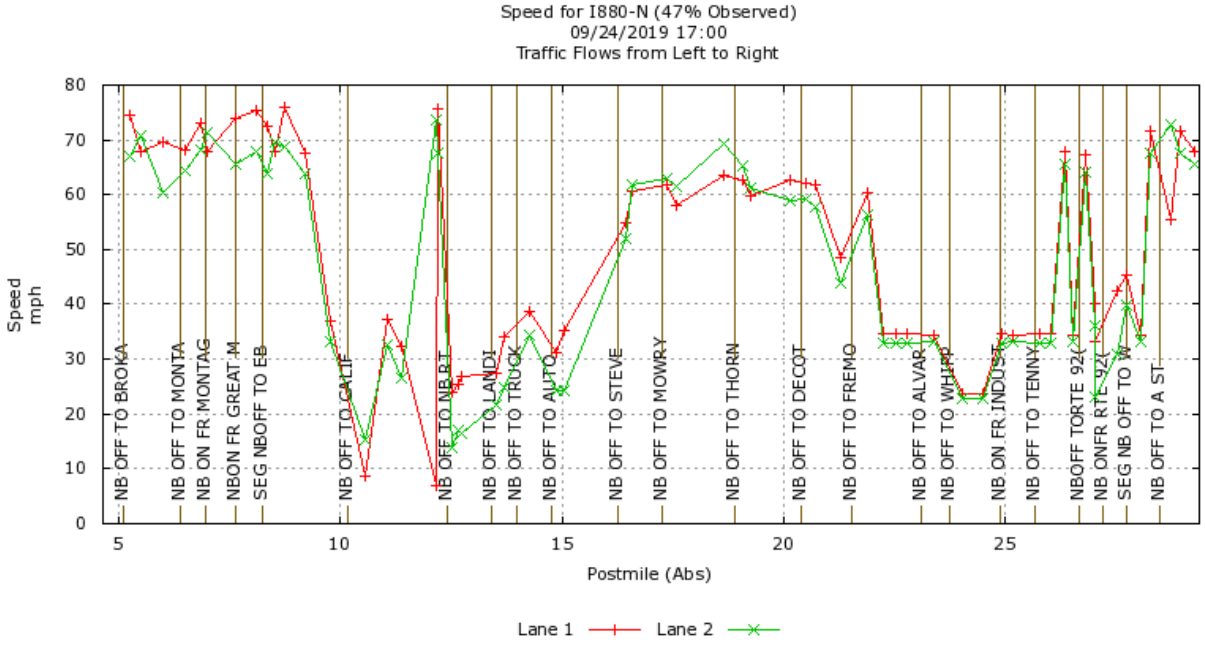
The HOV facilities on Route 880 underwent significant operational changes in 2020 as mentioned in the *2020 California High Occupancy Vehicle Facilities Degradation Report* and in Section 3.3. These facilities were converted from HOV to HOT operation, and occupancy requirements were increased. This analysis pre-dates these operational changes.

*Northbound*

In the afternoon peak hour period there is a controlling bottleneck between Auto Mall Pkwy diagonal on-ramp and Stevenson Boulevard off-ramp. Queue from this bottleneck extends upstream to the Dixon Landing Road off-ramp,

approximately 5.25 miles. There is a second bottleneck downstream between the Winton Avenue on-ramp and the A Street off-ramp. Queue from this bottleneck extends upstream to the Mowry Avenue, approximately 10.25 miles. High demand to and from Route 84 and Route 92 causes vehicle weaving conflicts around those interchanges. Peak period recurrent congestion in all lanes due to these conditions reduced HOV lane performance and speed due to the friction factor. In the northbound direction, HOVs still experienced approximately 7 mins of timesaving over the general-purpose lane traffic. Figure 64 shows a "spot time" plot of the HOV and GP lane speeds during a typical afternoon peak hour.

**FIGURE 64. HOV AND GP LANE SPEEDS – NORTHBOUND ROUTE 880, AFTERNOON PEAK HOUR**




Demand exceeded HOV lane capacity as seen in Table 31. The highlighted cells show where the HOV lane flow was constrained due to excessive demand. About 12 percent of vehicles in the northbound lane were CAVs. Northbound the violation rate is as high as 6 percent,

**TABLE 31. HOV AND GP LANE VOLUMES AND SPEEDS - NORTHBOUND ROUTE 880 @ DIXON LANDING ROAD**

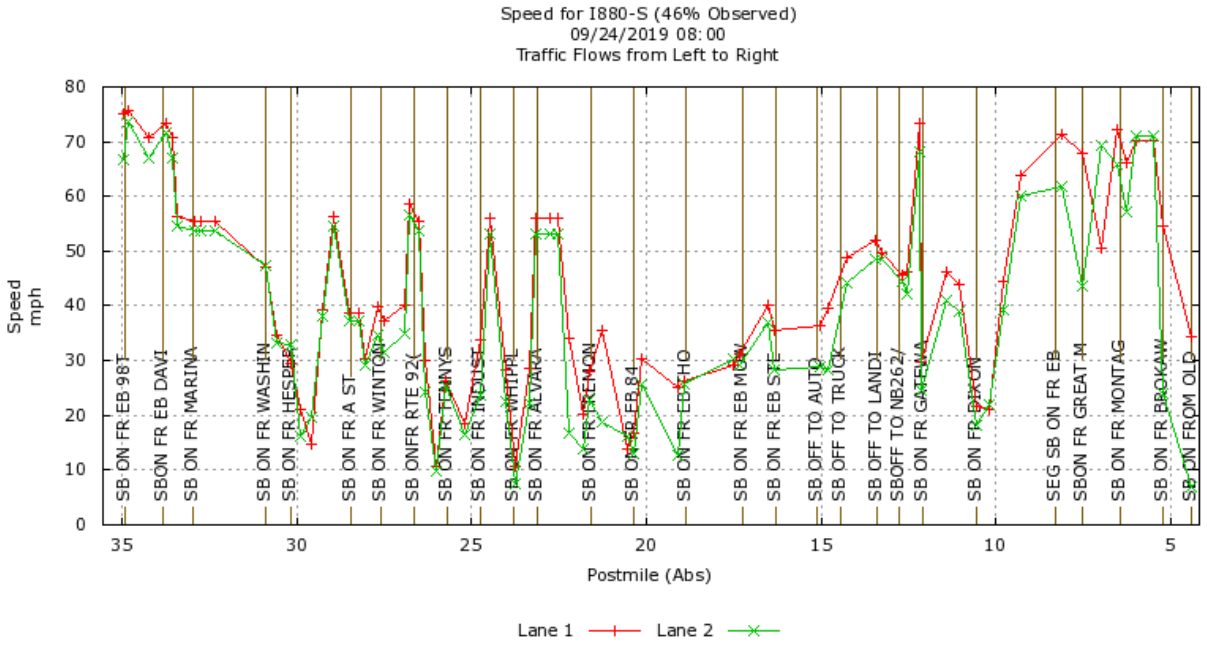
| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 15:00 | 1739 | 64.90 | 1298 | 58.20 |
| 9/23/2019 16:00 | 1475 | 39.70 | 1290 | 27.10 |
| 9/23/2019 17:00 | 963 | 11.20 | 966 | 9.80 |
| 9/24/2019 15:00 | 1462 | 43.80 | 1255 | 48.50 |
| 9/24/2019 16:00 | 1023 | 13.30 | 1200 | 19.80 |
| 9/24/2019 17:00 | 839 | 7.60 | 997 | 11.10 |
| 9/25/2019 15:00 | 1603 | 52.30 | 1322 | 46.30 |
| 9/25/2019 16:00 | 1244 | 23.70 | 1181 | 18.30 |
| 9/25/2019 17:00 | 1051 | 14.90 | 1002 | 13.20 |
| 9/26/2019 15:00 | 1658 | 59.20 | 1348 | 52.80 |
| 9/26/2019 16:00 | 1301 | 25.50 | 1219 | 24.40 |
| 9/26/2019 17:00 | 834 | 8.00 | 1019 | 11.90 |
| 9/27/2019 15:00 | 1051 | 13.50 | 1192 | 16.80 |
| 9/27/2019 16:00 | 1318 | 24.20 | 1189 | 16.20 |
| 9/27/2019 17:00 | 1319 | 39.20 | 1189 | 31.00 |

*Southbound*

There are multiple bottlenecks on southbound I-880 in the morning peak period. There is a bottleneck between A Street on-ramp and Winton Avenue off-ramp. Queue extends upstream to the Route 238 interchange, approximately 2.0 miles. Another bottleneck is located between the Auto Mall Pkwy. diagonal on-ramp and the Fremont Boulevard off-ramp. The queue extends back to the Route 92 interchange, approximately 12.0 miles. The next bottleneck is at the Route 237 interchange caused by queue spillback from the GP lane and HOT lane off-ramps. Queuing on to southbound I-880 and extending back to Mission Boulevard (Route 262) interchange, approximately 4.5 miles. The last bottleneck on southbound I-880 that impacts the HOV lane is between North First Street diagonal on-ramp and the Coleman Avenue off-ramp. Queue from this bottleneck extends upstream to the Old Bayshore Road off-ramp, approximately 1.0 mile. Peak period recurrent congestion in all lanes due to these conditions reduced HOV lane performance and speed due to the friction factor. In the southbound direction HOVs are experiencing approximately 12 mins of timesaving over the general-purpose lane traffic. Figure 65 shows a

"spot time" plot of the HOV and GP lane speeds during a typical morning peak hour.

**FIGURE 65. HOV AND GP LANE SPEEDS – SOUTHBOUND ROUTE 880, MORNING PEAK HOUR**




Demand exceeds HOV lane capacity; see volumes in Table 32. The highlighted cells show where the HOV lane flow was constrained due to excessive demand. Southbound the violation rate is as high as 19 percent. About 19 percent of the vehicles in the southbound lane were CAVs

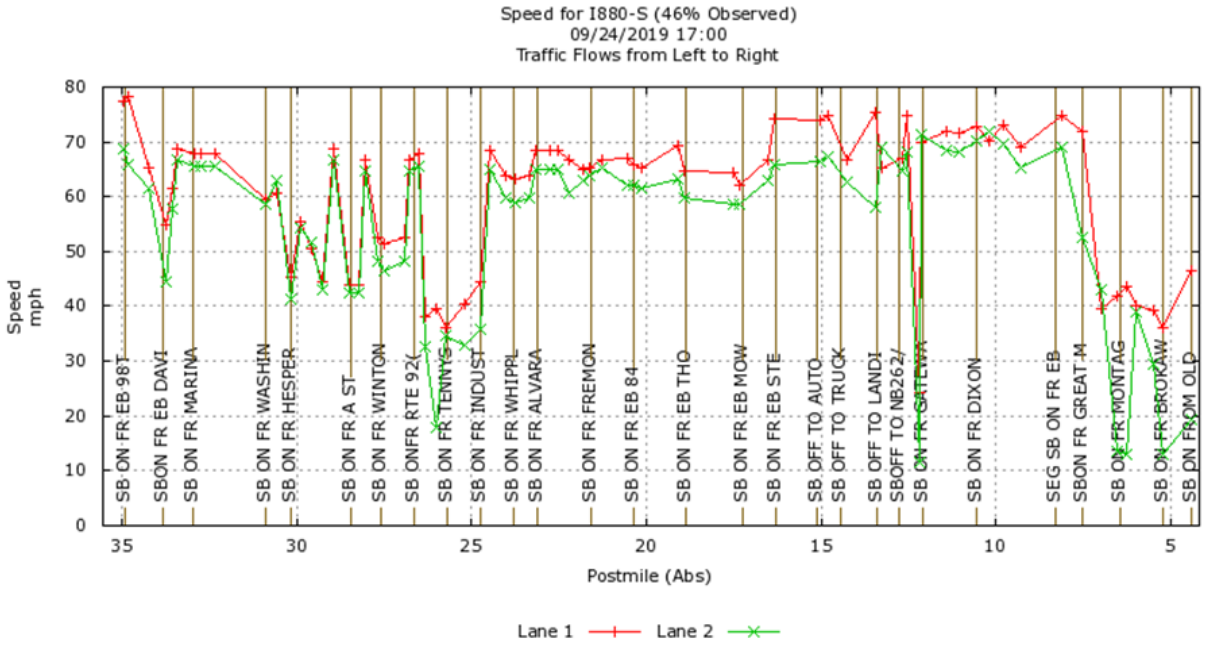
**TABLE 32. HOV AND GP LANE VOLUMES AND SPEEDS - SOUTHBOUND ROUTE 880 @ MISSION BLVD**

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 6:00 | 1530 | 63.90 | 1274 | 64.70 |
| 9/23/2019 7:00 | 1681 | 60.50 | 1655 | 56.90 |
| 9/23/2019 8:00 | 1014 | 17.80 | 1082 | 15.20 |
| 9/24/2019 6:00 | 1557 | 60.00 | 1409 | 65.40 |
| 9/24/2019 7:00 | 1604 | 48.80 | 1640 | 45.90 |
| 9/24/2019 8:00 | 991 | 13.50 | 1107 | 13.50 |
| 9/25/2019 6:00 | 1566 | 61.50 | 1366 | 63.90 |
| 9/25/2019 7:00 | 1683 | 58.80 | 1663 | 56.20 |

| Hour | HOV Lane Flow (Veh/Hour) | HOV Lane Speed (mph) | GP Lane Flow (Veh/Hour) | GP Lane Speed (mph) |
|---|---|---|---|---|
| 9/25/2019 8:00 | 1099 | 18.40 | 1179 | 17.40 |
| 9/26/2019 6:00 | 1505 | 61.20 | 1409 | 64.90 |
| 9/26/2019 7:00 | 1627 | 57.60 | 1651 | 57.40 |
| 9/26/2019 8:00 | 1107 | 17.70 | 1191 | 18.40 |
| 9/27/2019 6:00 | 1471 | 58.80 | 1336 | 65.70 |
| 9/27/2019 7:00 | 1526 | 50.20 | 1501 | 49.50 |
| 9/27/2019 8:00 | 1536 | 47.00 | 1583 | 44.60 |

In the afternoon peak period there are also multiple bottlenecks on southbound I-880 but not to the same impact as in the morning peak period. There is a bottleneck between A Street on-ramp and the Winton Avenue off-ramp. Queue from this bottleneck extends upstream to the Route 238 interchange, approximately 2.0 miles. A second bottleneck develops downstream between the Industrial Boulevard on-ramp and the Whipple Road off-ramp. Queue from this bottleneck extends upstream to the Route 92 interchange, approximately 2.5 miles. There is a bottleneck south of Route 101, beyond the end of the HOV. The queue from this bottleneck extends upstream of the end of the HOV to the Tasman Drive interchange. Peak period recurrent congestion in all lanes due to these conditions reduced HOV lane performance and speed due to the friction factor. Figure 66 shows a "spot time" plot of the HOV and GP lane speeds during a typical afternoon peak hour.

## FIGURE 66. HOV AND GP LANE SPEEDS – SOUTHBOUND ROUTE 880, AFTERNOON PEAK HOUR




Demand exceeds HOV lane capacity in the afternoons, as seen in Table 33.

## TABLE 33. HOV AND GP LANE VOLUMES AND SPEEDS - SOUTHBOUND ROUTE 880 @ OLD BAYSHORE HIGHWAY

| Hour | HOVL 1 Flow (Veh/Hour) | HOVL 1 Speed (mph) | GP Lane 2 Flow (Veh/Hour) | GP Lane 2 Speed (mph) |
|---|---|---|---|---|
| 9/23/2019 15:00 | 1488 | 47.40 | 1948 | 39.50 |
| 9/23/2019 16:00 | 1668 | 43.40 | 1772 | 29.90 |
| 9/24/2019 15:00 | 1508 | 49.80 | 1755 | 35.20 |
| 9/24/2019 16:00 | 1613 | 47.50 | 1609 | 23.60 |
| 9/25/2019 15:00 | 1621 | 40.60 | 1639 | 26.10 |
| 9/25/2019 16:00 | 1665 | 40.90 | 1569 | 21.80 |
| 9/26/2019 15:00 | 1620 | 47.90 | 1666 | 30.30 |
| 9/26/2019 16:00 | 1578 | 48.90 | 1599 | 26.30 |
| 9/27/2019 15:00 | 1779 | 39.10 | 1793 | 31.70 |
| 9/27/2019 16:00 | 1191 | 49.30 | 1653 | 42.20 |

## B. REMEDIATION STRATEGIES

- As noted above the HOV lanes were converted to HOT lanes on October 2, 2020. Project limits are from Hegenberger Road to Route 237. Access control striping was implemented in segments between Route 84 and Route 92 in the summer 2020 ahead of the conversion to mitigate HOV lane degradation, and to minimize weaving and movement conflicts between the general-purpose lanes and the HOV/HOT lanes. Occupancy requirements were raised to HOV 3+ with the conversion. In addition, HOV 2 and Clean Air Vehicles will be tolled at a discounted rate. The impacts of these changes will be monitored and any observations will be noted in the 2021 degradation report.

- MTC conducted a pilot project (Video Occupancy Detection) to increase enforcement on Route 880; this pilot completed in May 2018. Results showed an accuracy rate at about 75 percent. This was too low to use as an occupancy enforcement tool. MTC is also exploring additional technology for occupancy enforcement, including mobile based applications.

- Recent and planned improvements on westbound Route 237 are expected to improve conditions on southbound Route 880 at the direct connector to westbound Route 237.

## 4.3. DISTRICT 7 2020 DEGRADATION ACTION PLAN

### 4.3.1 SUMMARY OF DEGRADATION ON HOV FACILITIES IN DISTRICT 7

Table 34 provides the list of degraded facilities in District 7 that were identified in the *2019 California High Occupancy Vehicle Facilities Degradation Report and Action Plan*. The speed and degradation profiles for each degraded facility are provided in Figures 67 through 96.

**TABLE 34. DISTRICT 7 LIST OF DEGRADED HOV FACILITIES**

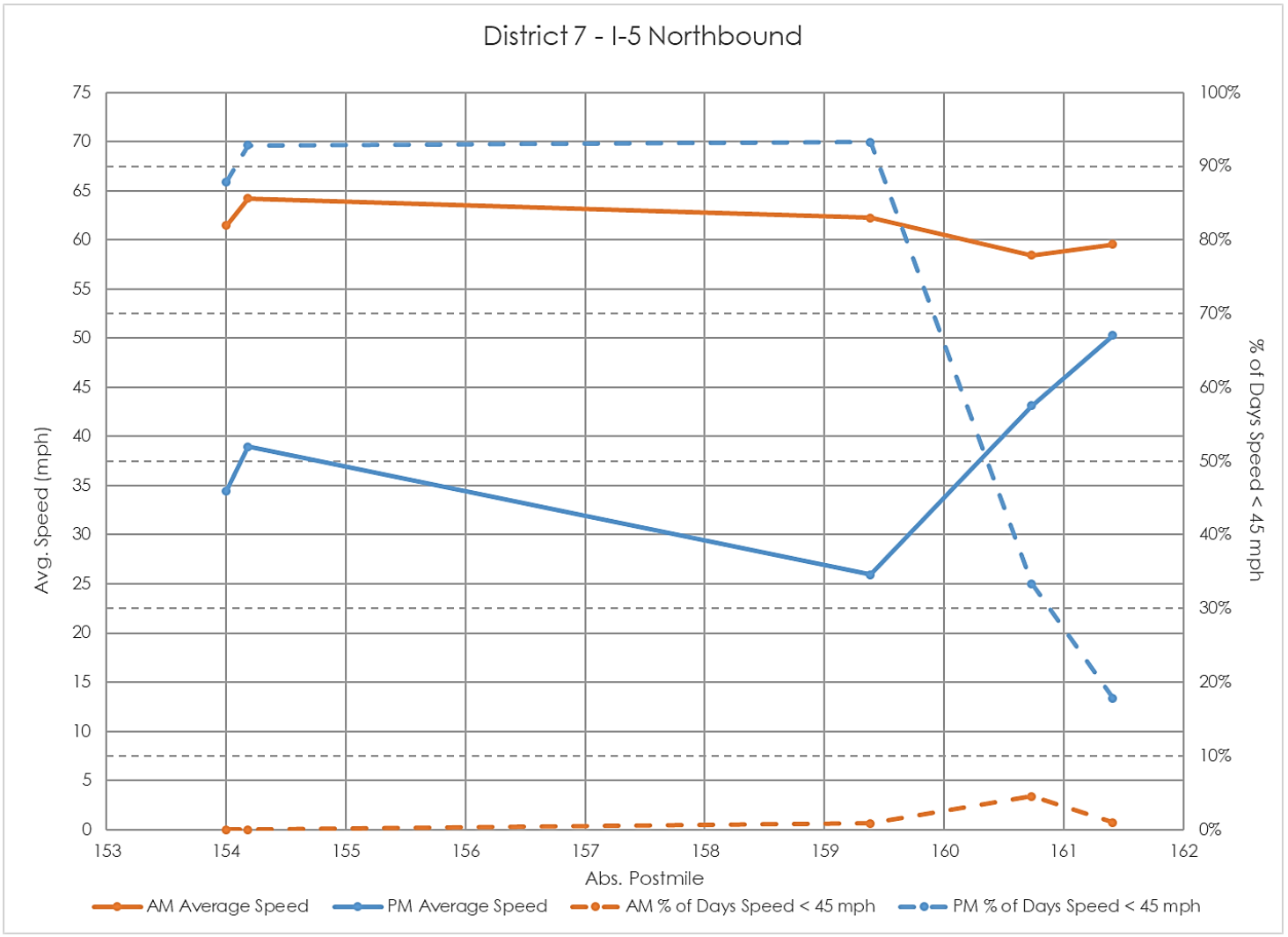
| Route | Direction | Limits | Facility Length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 10 | WB | San Bernardino County Line to Route 57 | 5.4 | 5.2 | AM-1.8<br>PM-3.6 | AM-3.0<br>PM-1.5 | AM-0.4<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 10<br>10S | WB | 0.5 miles west of Puente Ave to Alameda Street | 22.9 | 14.0 | AM-1.5<br>PM-14.0 | AM-5.0<br>PM-0.0 | AM-7.0<br>PM-0.0 | AM-0.5<br>PM-0.0 |
| 14 | NB | Route 5 to 0.3 miles north of Palmdale Blvd | 35.8 | 13.8 | AM-13.8<br>PM-8.7 | AM-0.0<br>PM-2.4 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-2.7 |
| 14 | SB | Avenue P-8 to Route 5 | 36.4 | 17.5 | AM-11.1<br>PM-17.5 | AM-2.2<br>PM-0.0 | AM-0.0<br>PM-0.0 | AM-4.2<br>PM-0.0 |
| 57 | NB | Orange County Line to Route 60 | 5.4 | 4.3 | AM-4.3<br>PM-0.0 | AM-0.0<br>PM-2.7 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-1.6 |
| 60 | EB | Route 605 to San Bernardino County Line | 18.7 | 16.3 | AM-14.7<br>PM-1.2 | AM-1.4<br>PM-3.7 | AM-0.3<br>PM-3.6 | AM-0.0<br>PM-7.8 |
| 60 | WB | San Bernardino County Line to 0.4 miles west of 7th Ave | 16.6 | 13.3 | AM-4.7<br>PM-10.0 | AM-1.5<br>PM-2.3 | AM-3.0<br>PM-0.4 | AM-4.1<br>PM-0.6 |
| 91 | EB | Route 110 to Orange County Line | 14.2 | 13.8 | AM-10.4<br>PM-0.0 | AM-3.4<br>PM-1.4 | AM-0.0<br>PM-1.9 | AM-0.0<br>PM-10.5 |

| Route | Direction | Limits | Facility Length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 91 | WB | Orange County Line to Central Avenue | 12.2 | 11.5 | AM-1.1<br>PM-6.0 | AM-2.9<br>PM-3.0 | AM-4.8<br>PM-0.0 | AM-2.8<br>PM-2.5 |
| 105 | EB | Route 405 to Studebaker Rd | 16.3 | 7.3 | AM-6.7<br>PM-0.0 | AM-0.6<br>PM-0.6 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-6.7 |
| 105 | WB | Studebaker Rd to Route 405 | 15.7 | 8.9 | AM-3.7<br>PM-7.4 | AM-1.0<br>PM-1.0 | AM-0.7<br>PM-0.4 | AM-3.5<br>PM-0.0 |
| 110 | NB | Harbor Gateway Transit Center to Adams Blvd | 18.1 | 11.8 | AM-3.0<br>PM-8.7 | AM-0.7<br>PM-3.0 | AM-7.2<br>PM-0.0 | AM-0.8<br>PM-0.0 |
| 110 | SB | Flower St/28th St to Harbor Gateway Transit Center | 17.8 | 6.7 | AM-3.6<br>PM-3.9 | AM-3.1<br>PM-2.8 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 118 | EB | 0.1 mile east of Ventura County Line to Route 5 | 10.4 | 10.5 | AM-10.5<br>PM-5.0 | AM-0.0<br>PM-2.5 | AM-0.0<br>PM-1.5 | AM-0.0<br>PM-1.5 |
| 118 | WB | Route 5 to 0.3 miles west of Rocky Peak Road | 11.3 | 11.0 | AM-9.3<br>PM-11.0 | AM-1.7<br>PM-0.0 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 134 | EB | Route 101/Route 170 to Route 5 | 5.0 | 4.6 | AM-4.3<br>PM-1.4 | AM-0.3<br>PM-0.1 | AM-0.0<br>PM-0.5 | AM-0.0<br>PM-2.6 |
| 134 | EB | Route 5 to Route 210 | 7.7 | 7.1 | AM-7.1<br>PM-1.3 | AM-0.0<br>PM-3.0 | AM-0.0<br>PM-1.1 | AM-0.0<br>PM-1.7 |
| 134 | WB | Route 210 to Route 5 | 7.2 | 6.8 | AM-4.3<br>PM-6.8 | AM-1.9<br>PM-0.0 | AM-0.5<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 134 | WB | Route 5 to 0.1 mile west of Cahuenga Blvd | 4.2 | 3.7 | AM-3.7<br>PM-0.7 | AM-0.0<br>PM-1.6 | AM-0.0<br>PM-0.4 | AM-0.0<br>PM-1.0 |
| 134 | EB | Route 5 to Route 210 | 7.7 | 7.1 | AM-7.1<br>PM-1.3 | AM-0.0<br>PM-3.0 | AM-0.0<br>PM-1.1 | AM-0.0<br>PM-1.7 |
| 210 | EB | Route 134 to San Bernardino County Line | 27.2 | 24.8 | AM-24.8<br>PM-0.7 | AM-0.0<br>PM-4.0 | AM-0.0<br>PM-2.8 | AM-0.0<br>PM-17.3 |

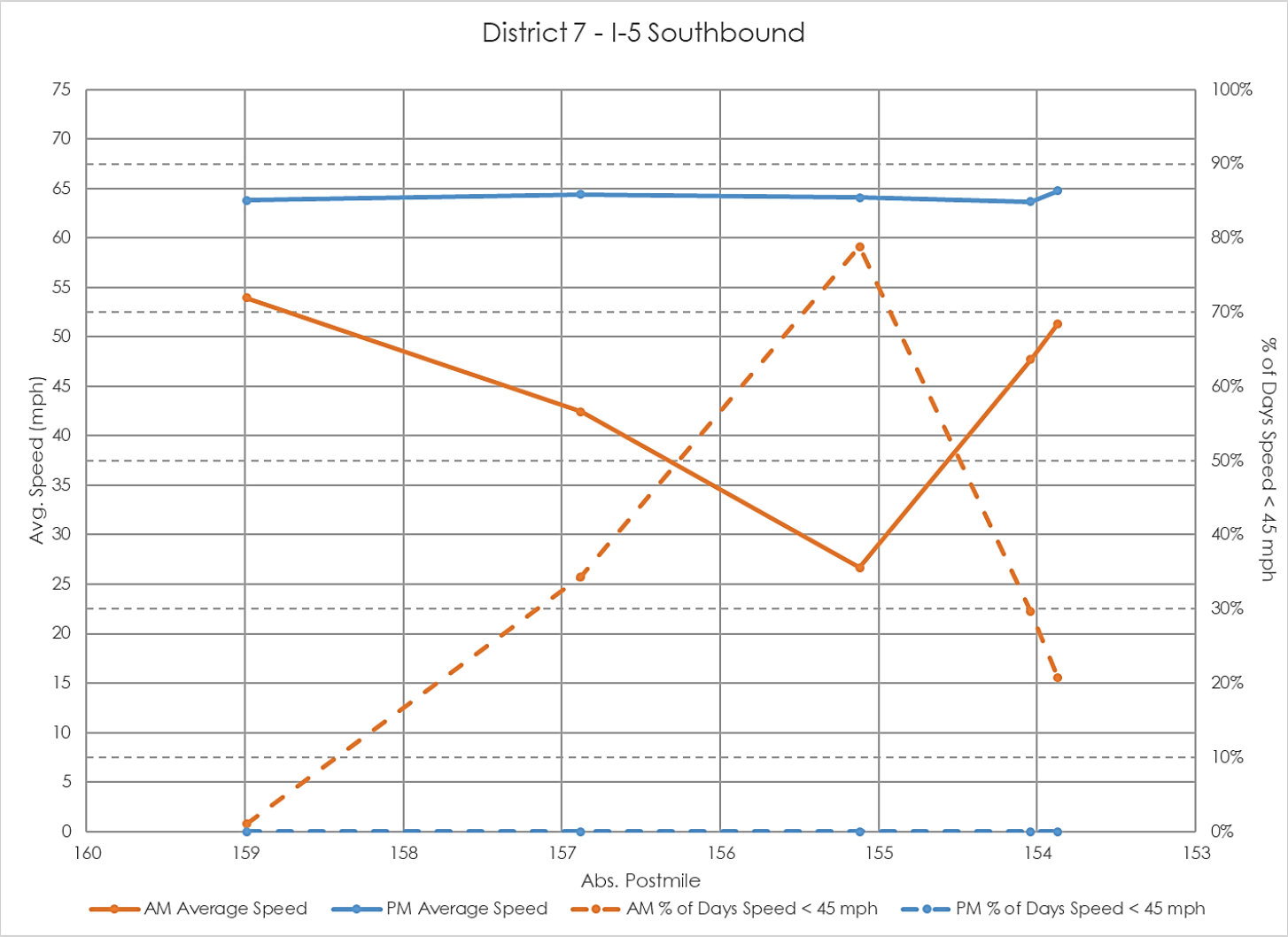
| Route | Direction | Limits | Facility Length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 210 | WB | San Bernardino County Line to Route 134 | 27.2 | 25.6 | AM-4.6<br>PM-13.6 | AM-6.0<br>PM-9.8 | AM-0.4<br>PM-0.7 | AM-14.5<br>PM-1.5 |
| 405 | NB | Orange County Line to Route 5 | 48.4 | 33.2 | AM-18.0<br>PM-10.9 | AM-0.9<br>PM-5.6 | AM-6.5<br>PM-2.7 | AM-7.7<br>PM-14.0 |
| 405 | SB | Route 5 to Orange County Line | 47.7 | 36.3 | AM-25.4<br>PM-13.3 | AM-3.4<br>PM-2.1 | AM-0.5<br>PM-2.6 | AM-7.0<br>PM-18.3 |
| 605 | NB | Orange County Line to Route 10 | 19.8 | 13.8 | AM-10.6<br>PM-1.5 | AM-2.6<br>PM-4.3 | AM-0.6<br>PM-3.2 | AM-0.0<br>PM-4.8 |
| 605 | SB | Route 10 to Orange County Line | 20.7 | 12.4 | AM-8.0<br>PM-6.6 | AM-1.6<br>PM-1.4 | AM-0.7<br>PM-0.8 | AM-2.0<br>PM-3.6 |

EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound
Lane-miles may not add up exactly due to rounding

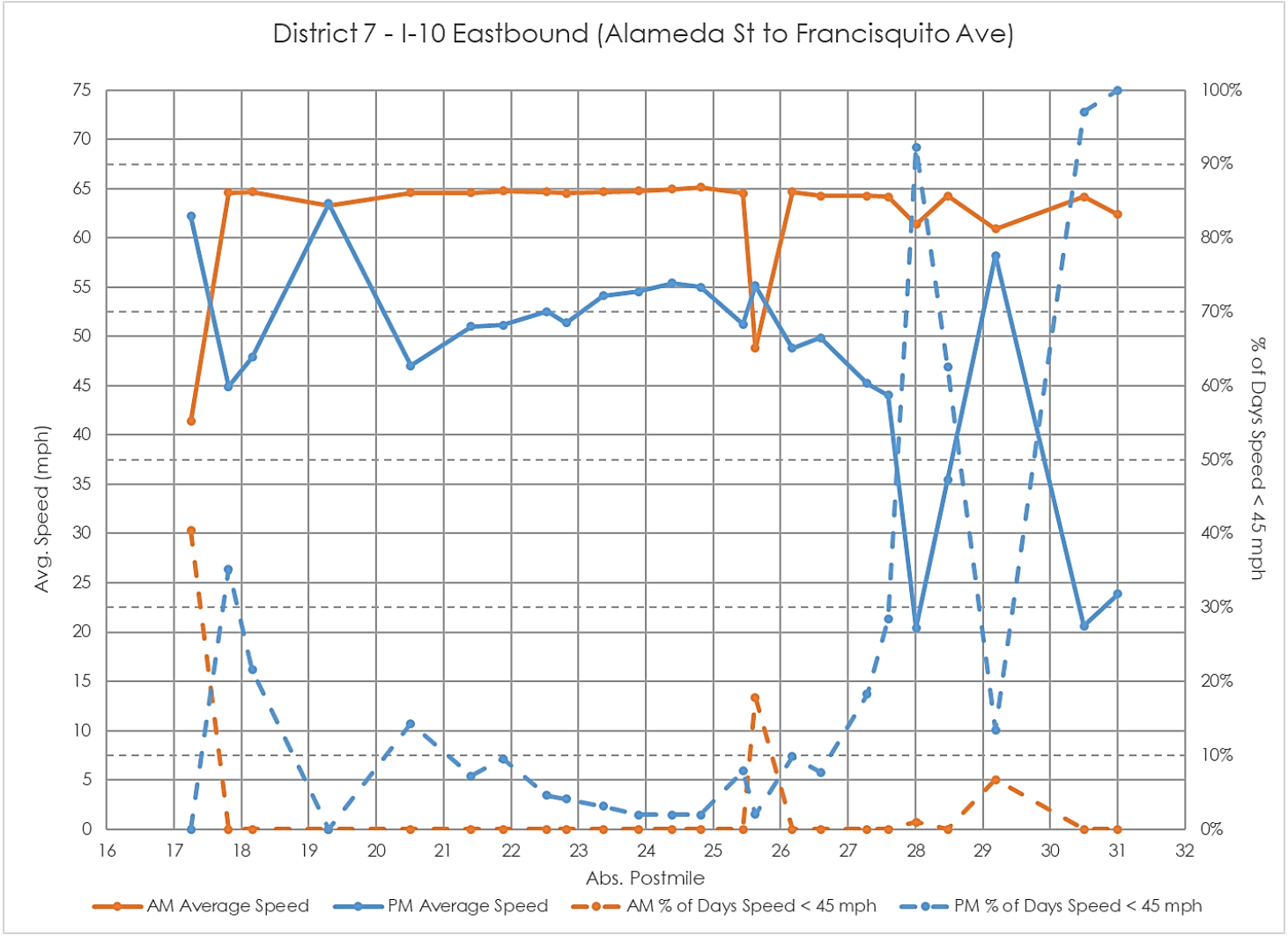
## FIGURE 67. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 5



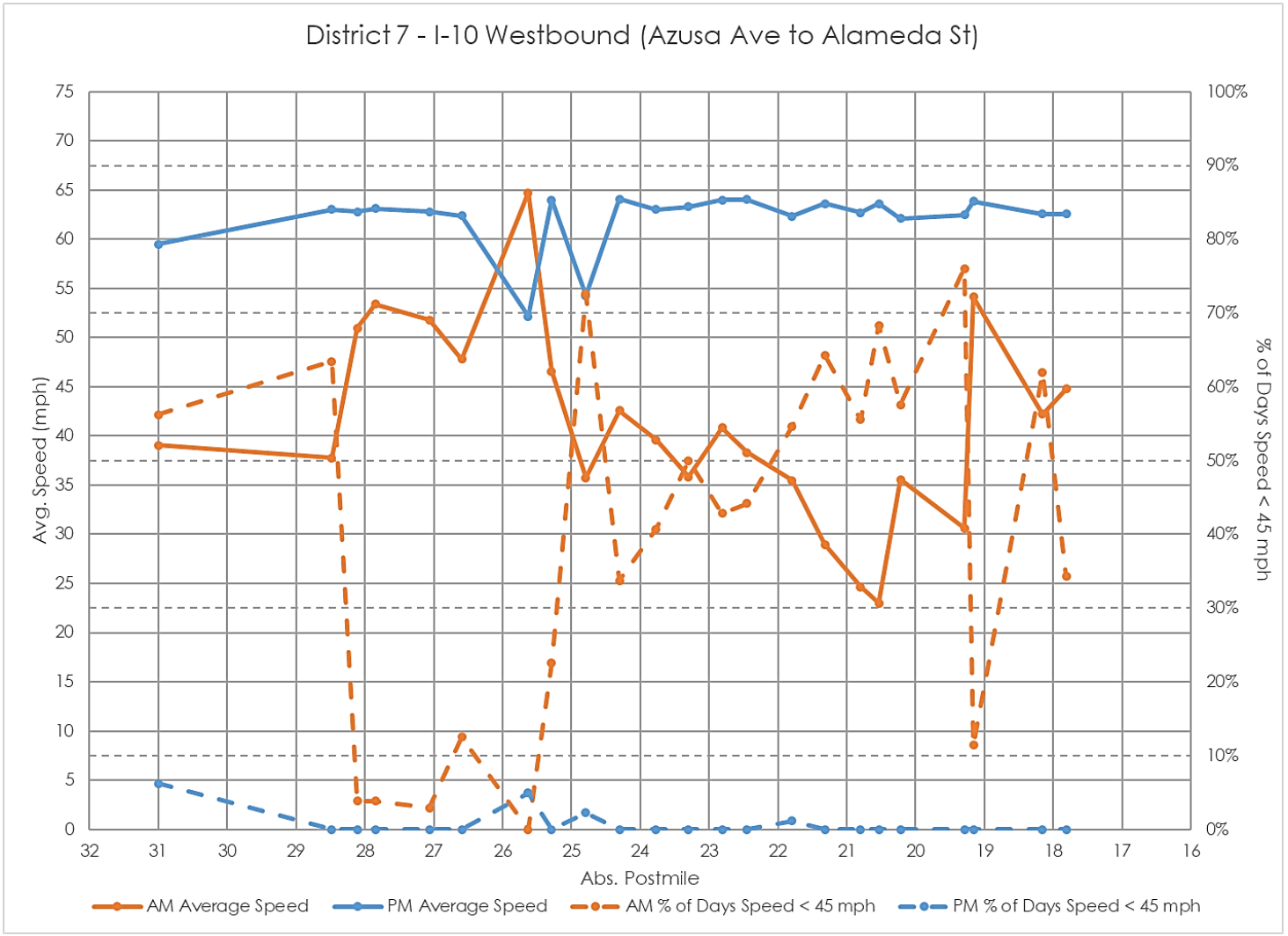
## FIGURE 68. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 5



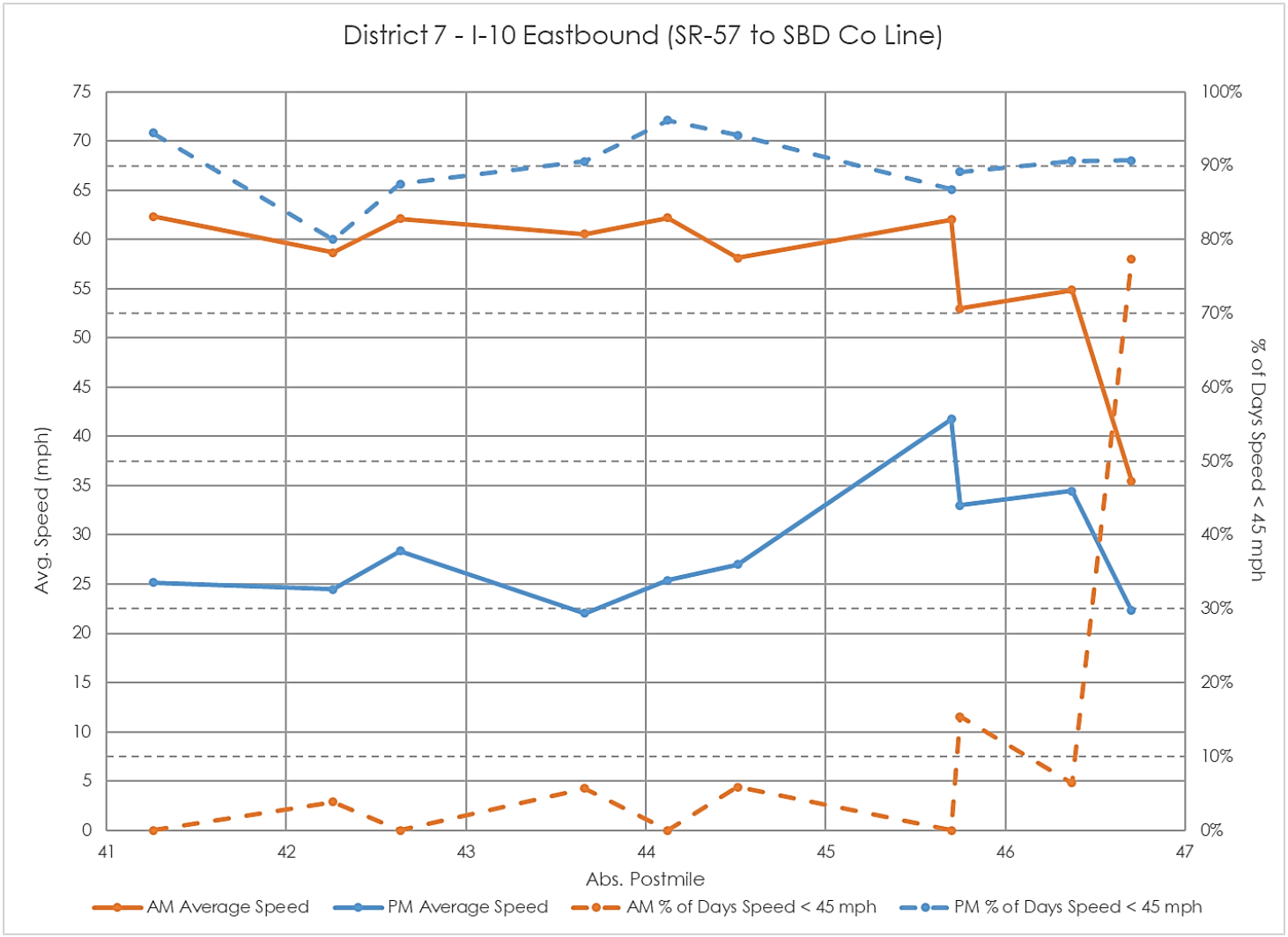
## FIGURE 69. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 10 (ALAMEDA ST TO AZUSA AVE)



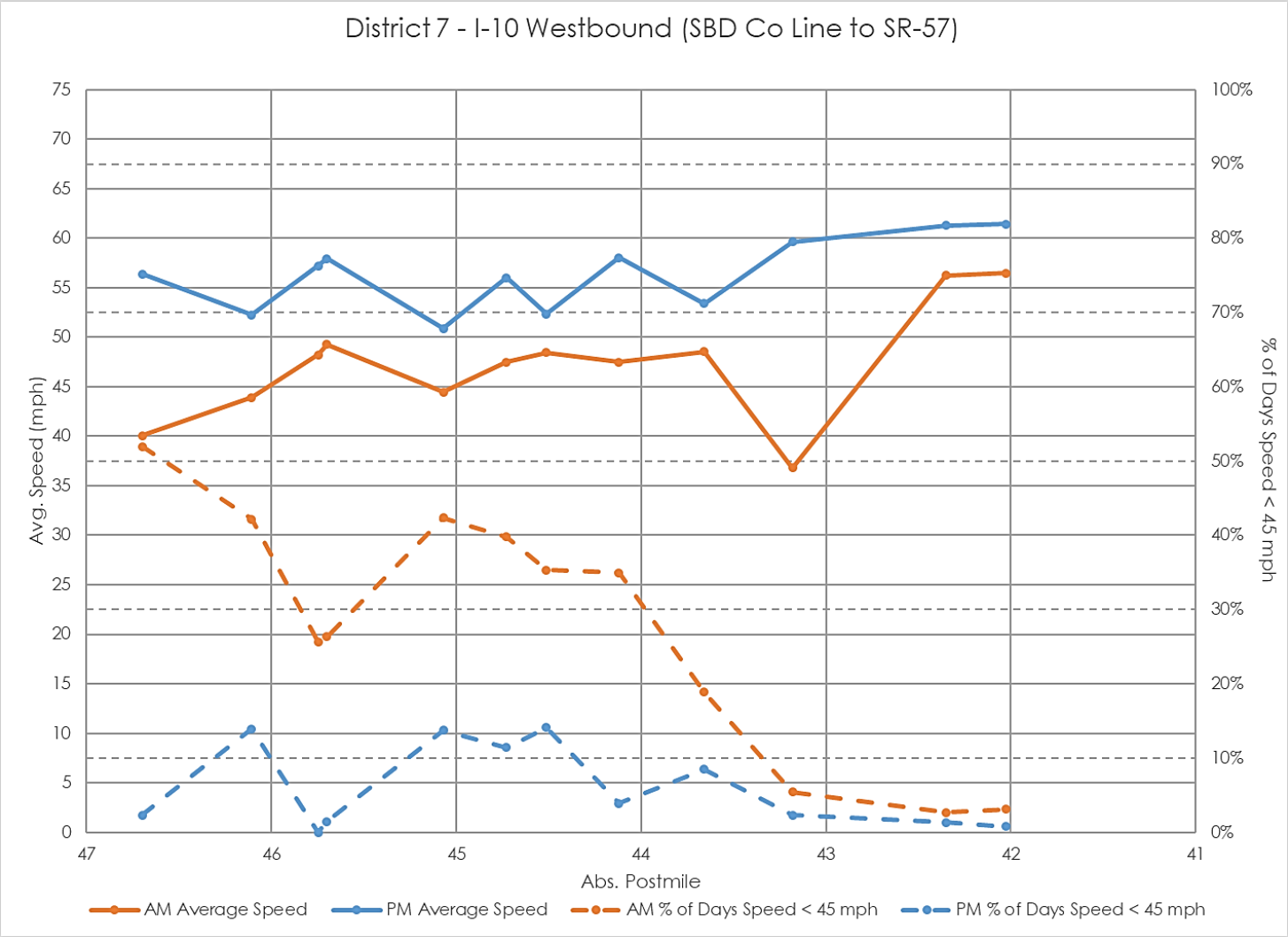
## FIGURE 70. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 10 (ALAMEDA ST TO AZUSA AVE)



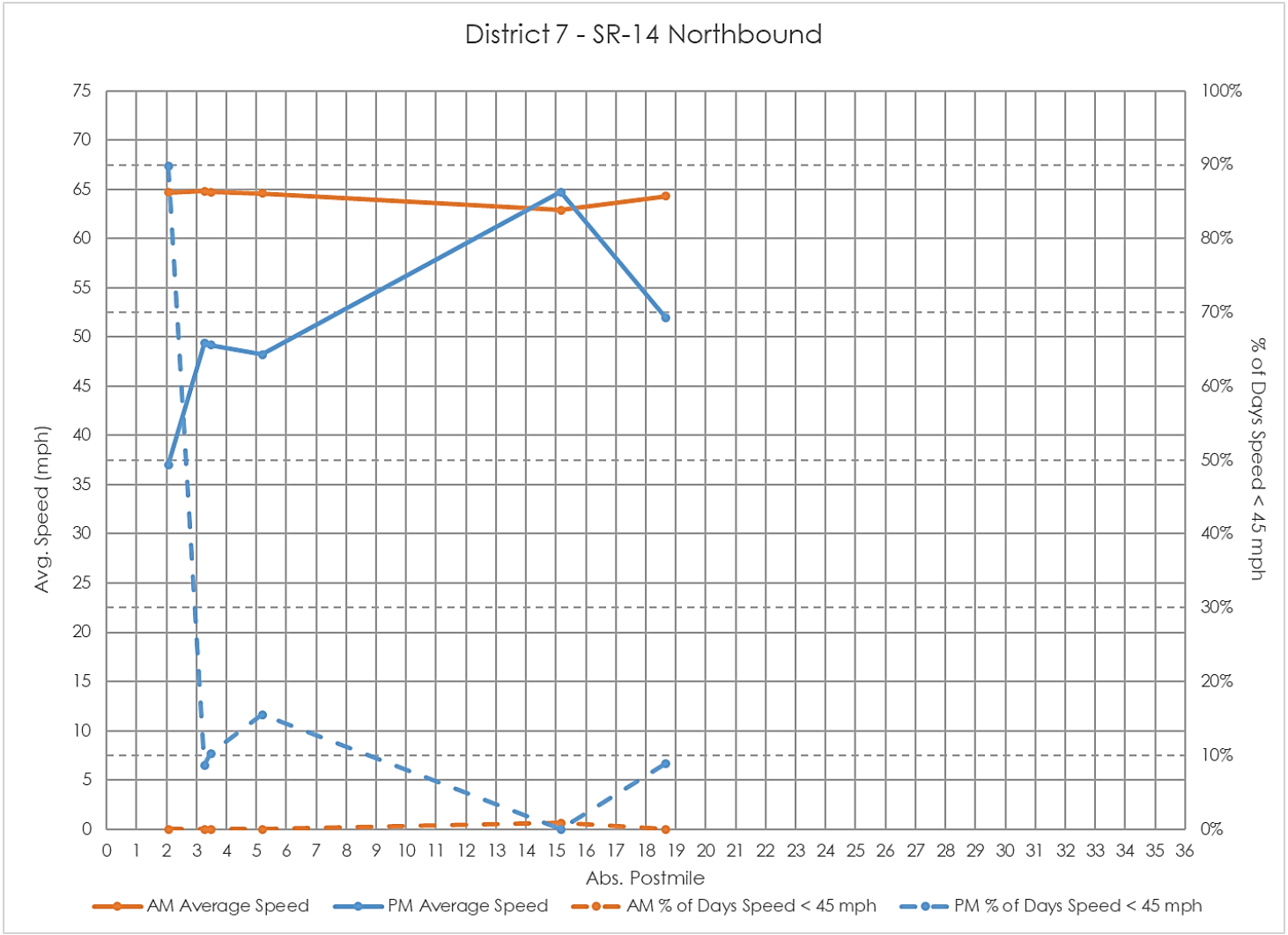
## FIGURE 71. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 10 (ROUTE 57 TO SAN BERNARDINO COUNTY LINE)



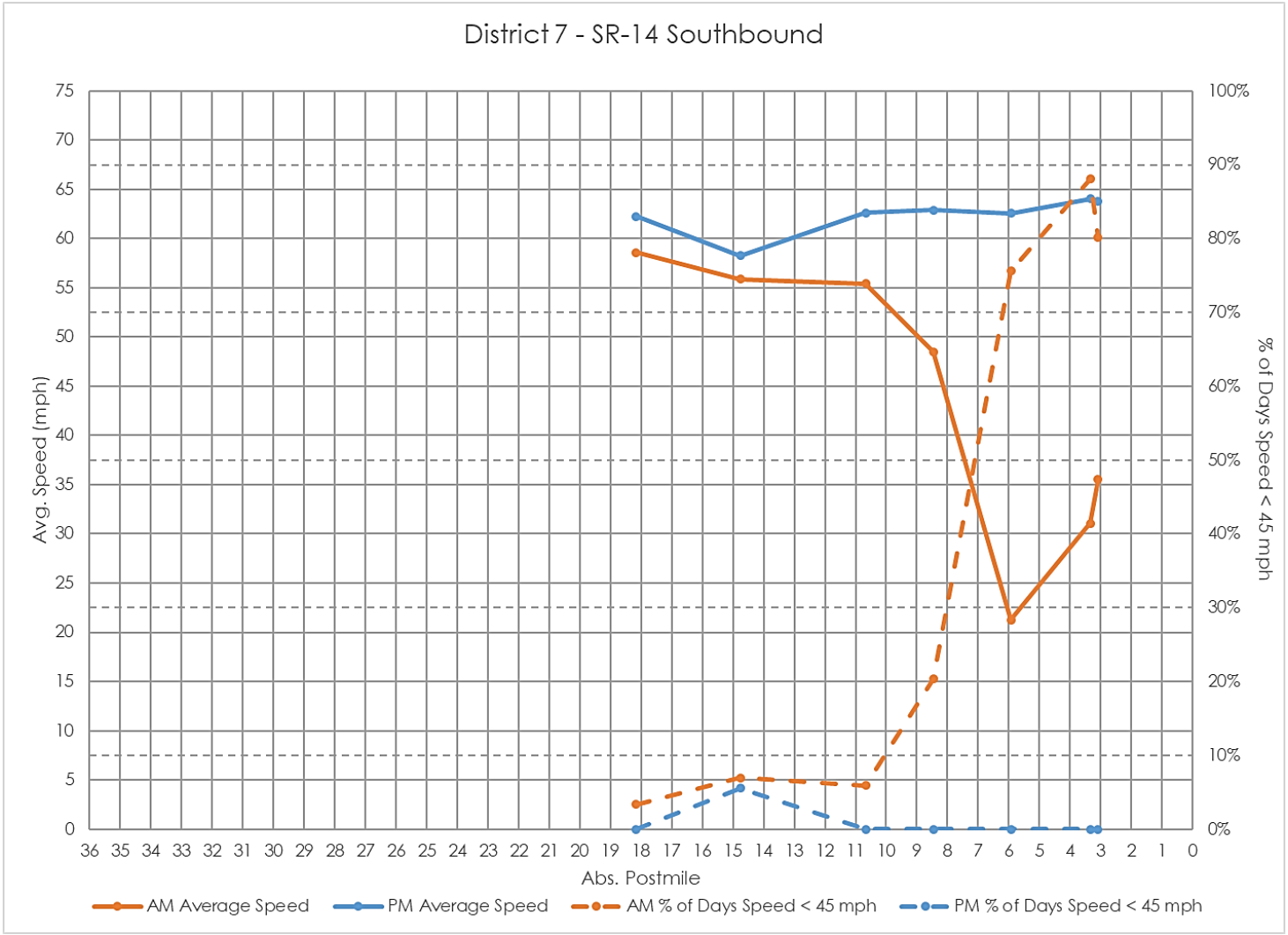
## FIGURE 72. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 10 (ROUTE 57 TO SAN BERNARDINO COUNTY LINE)



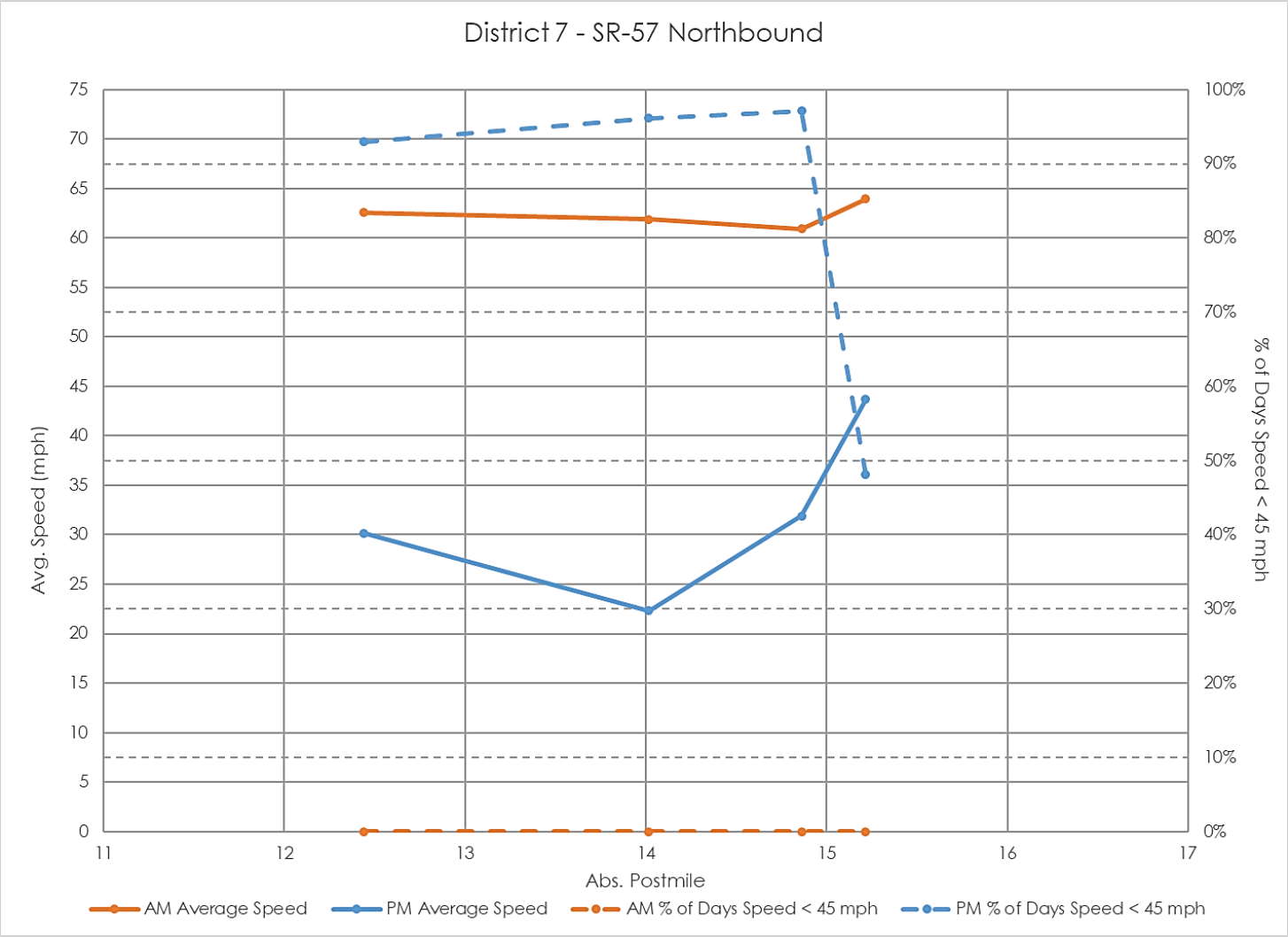
## FIGURE 73. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 14



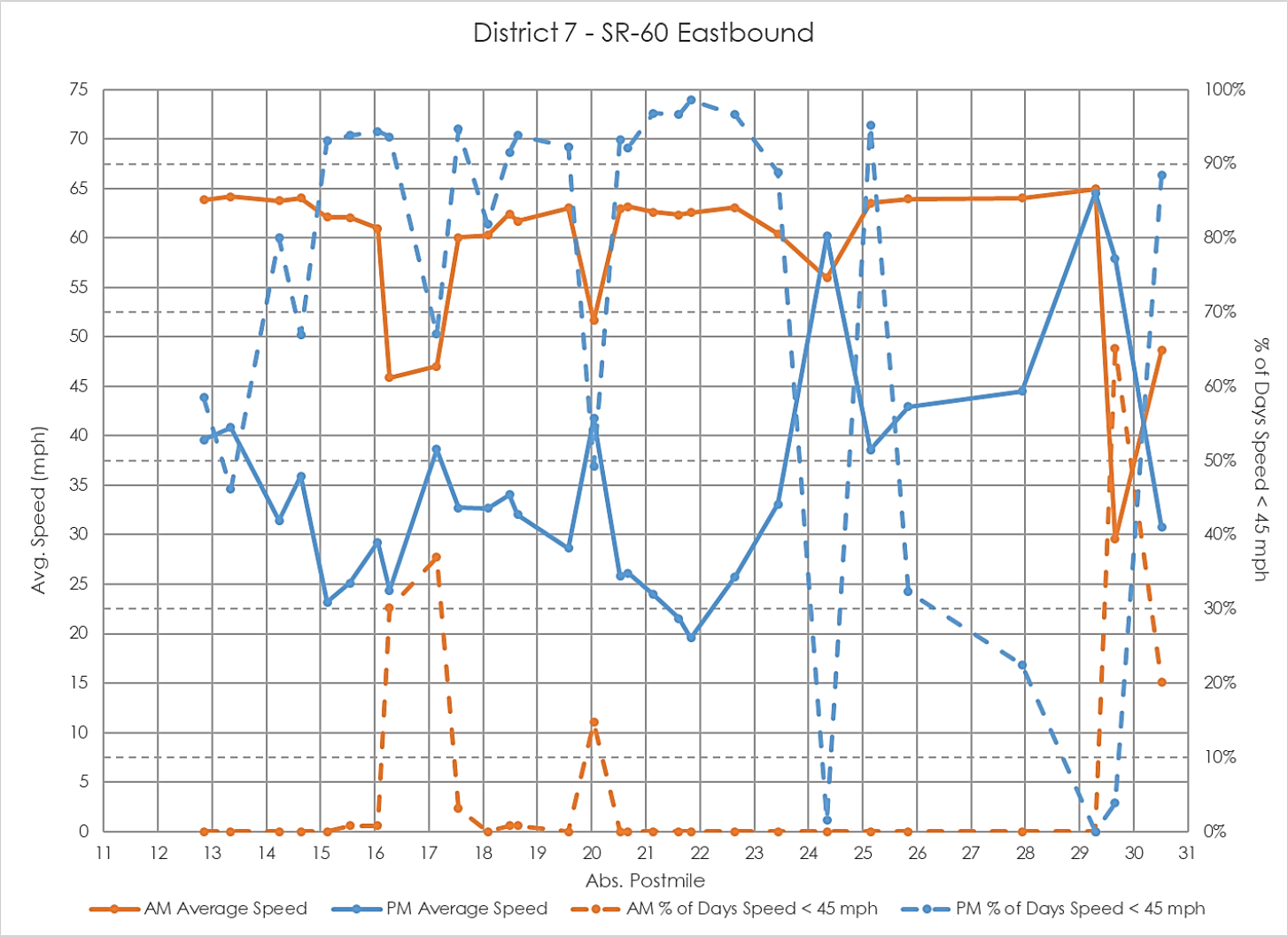
## FIGURE 74. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 14



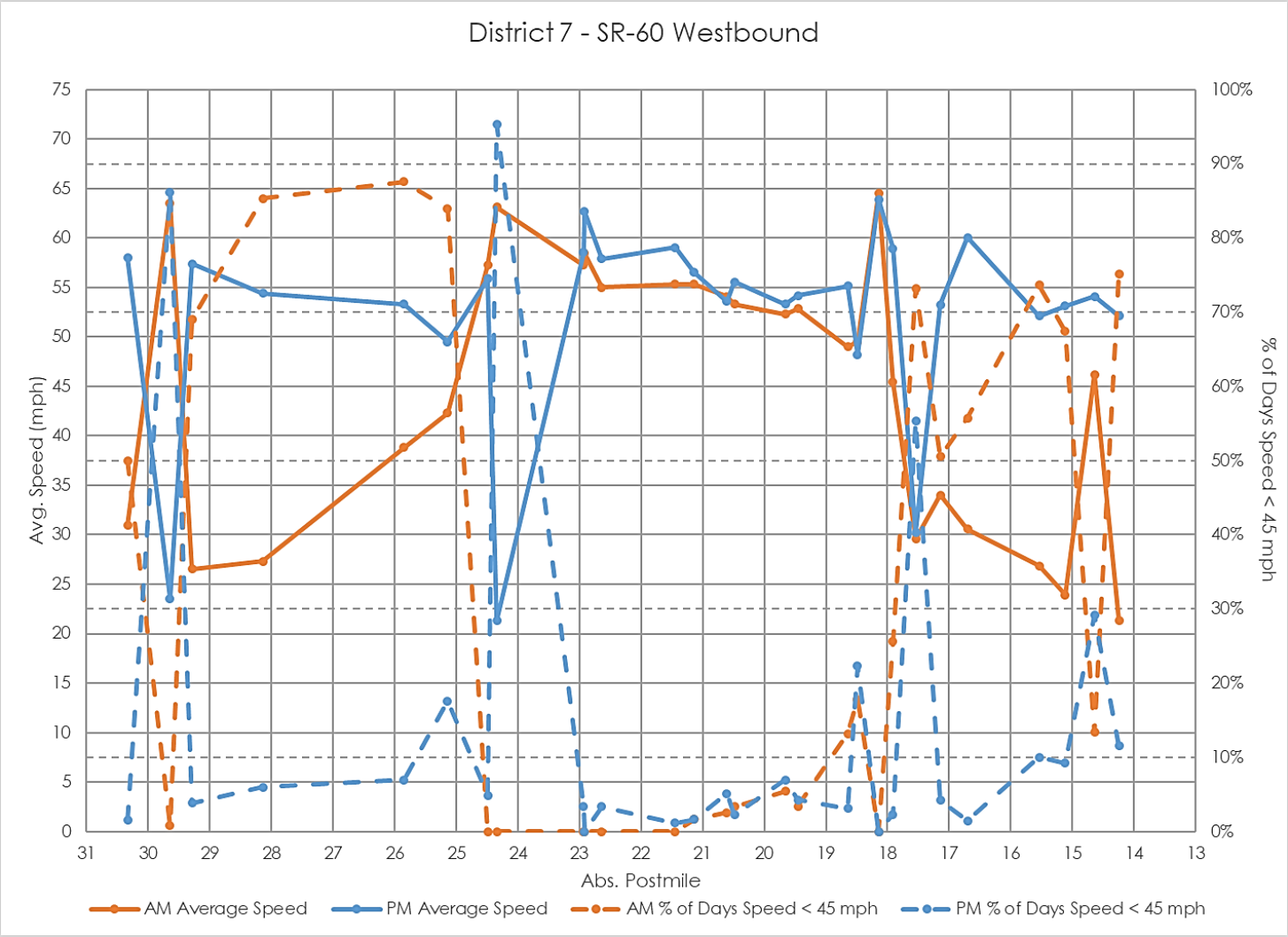
## FIGURE 75. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 57



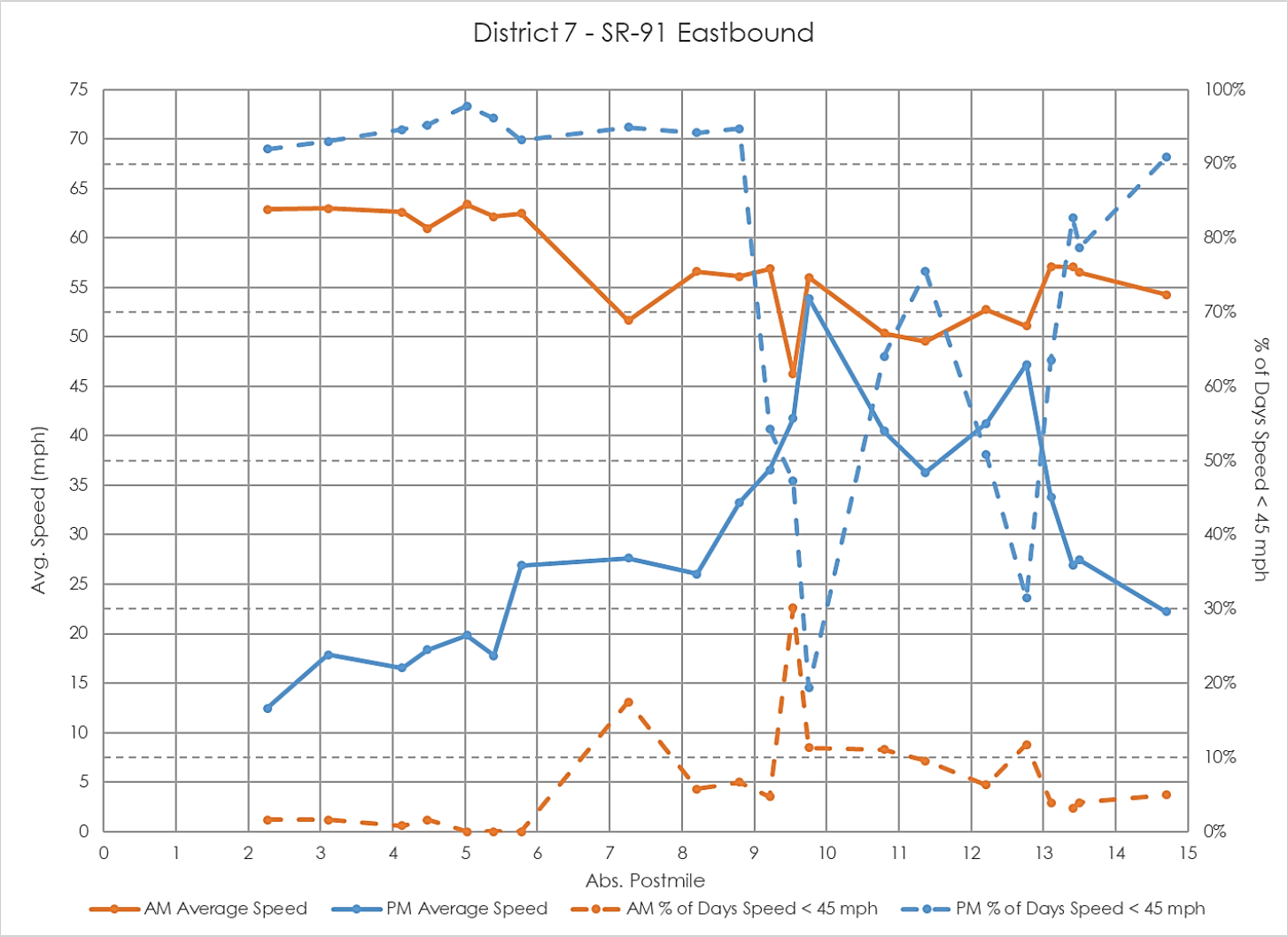
## FIGURE 76. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 60



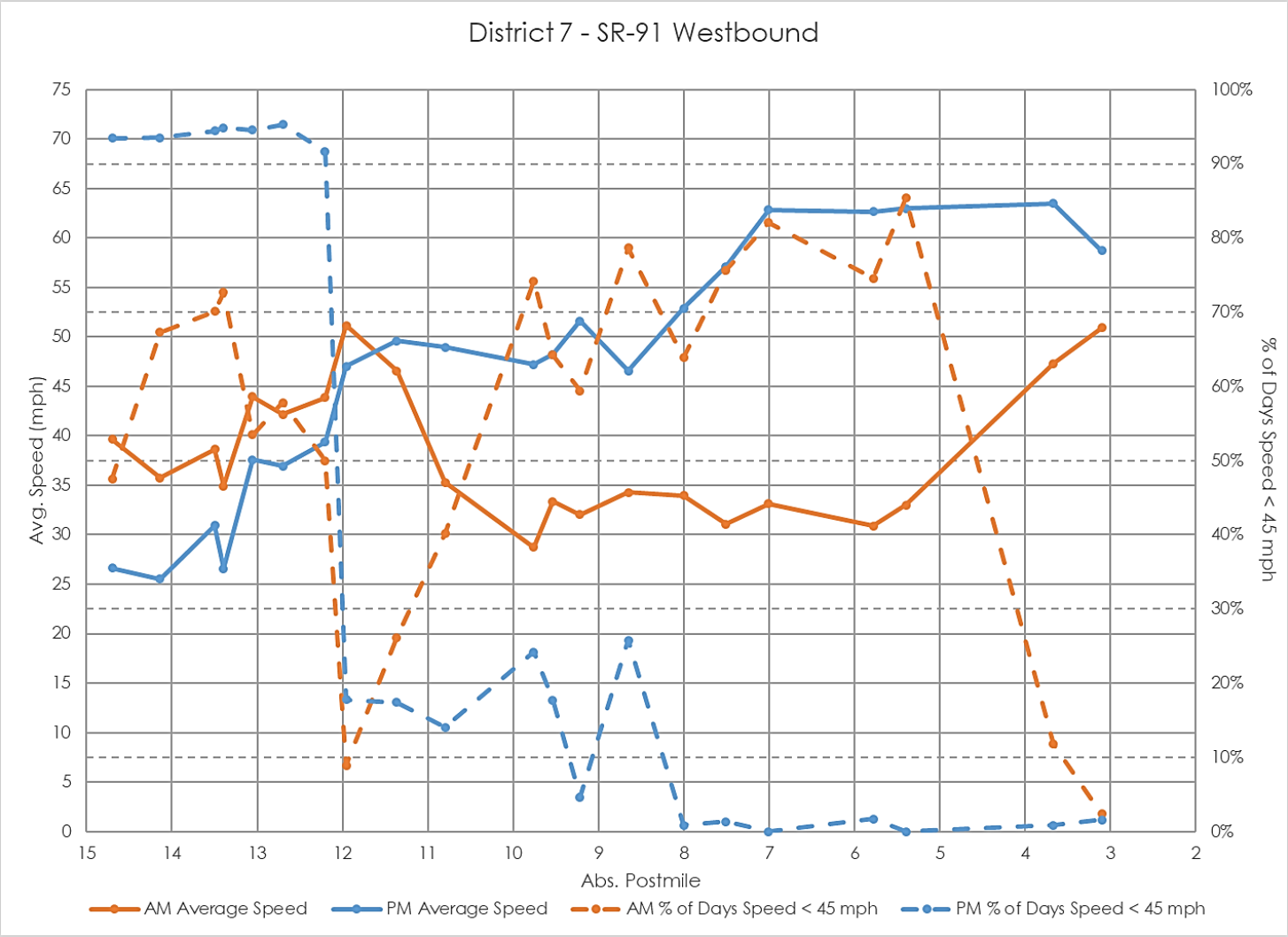
## FIGURE 77. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 60



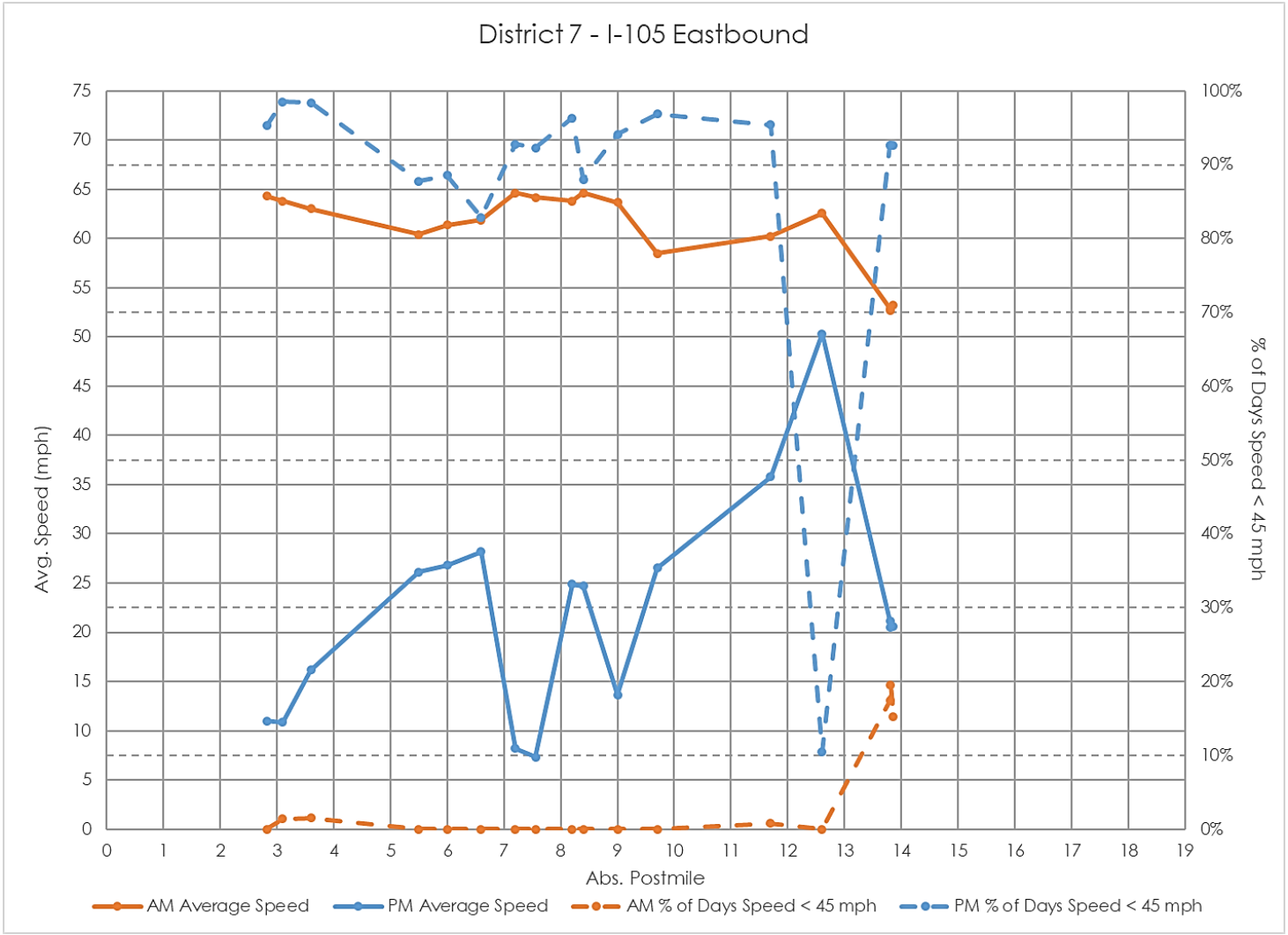
## FIGURE 78. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 91



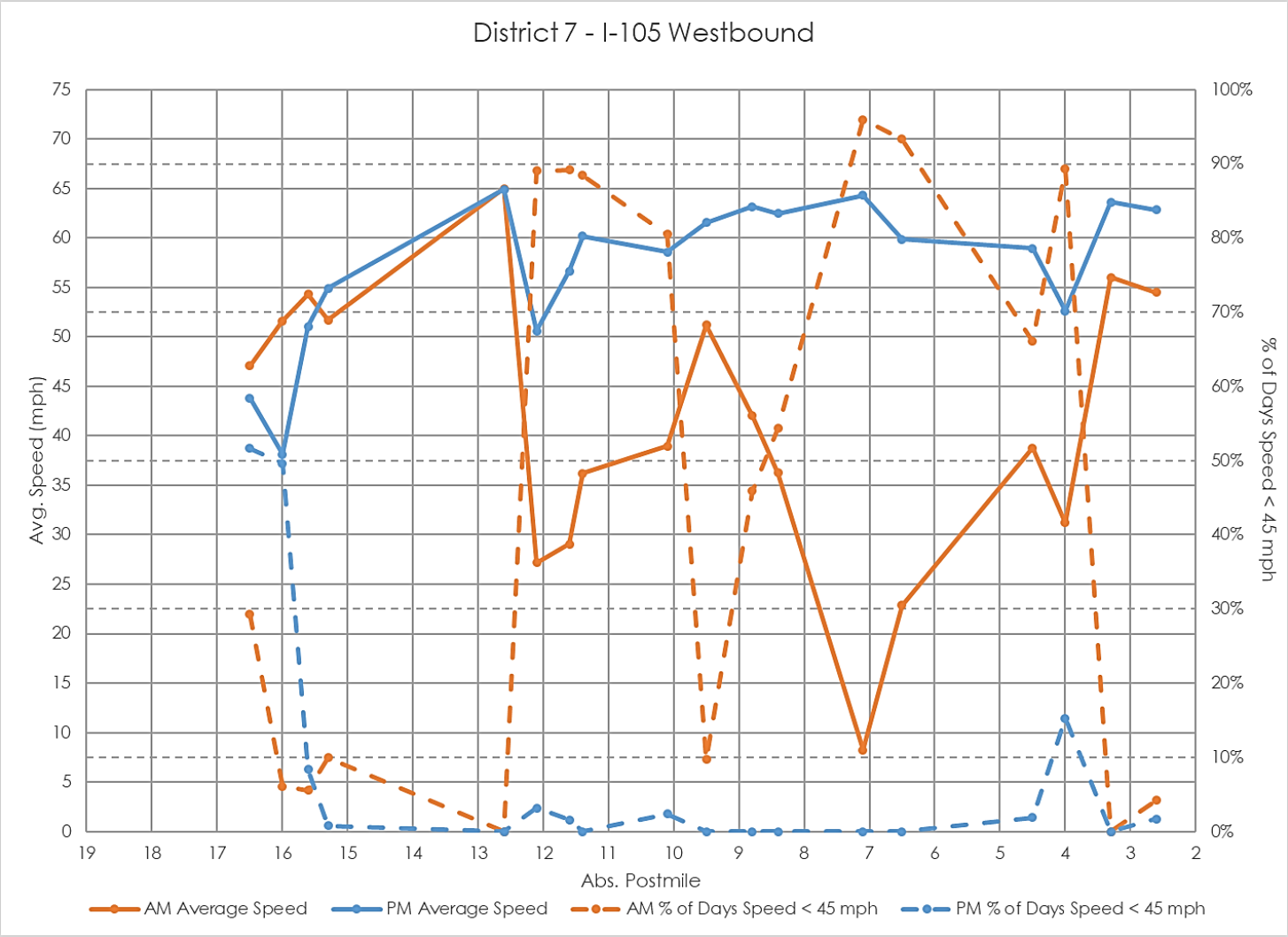
## FIGURE 79. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 91



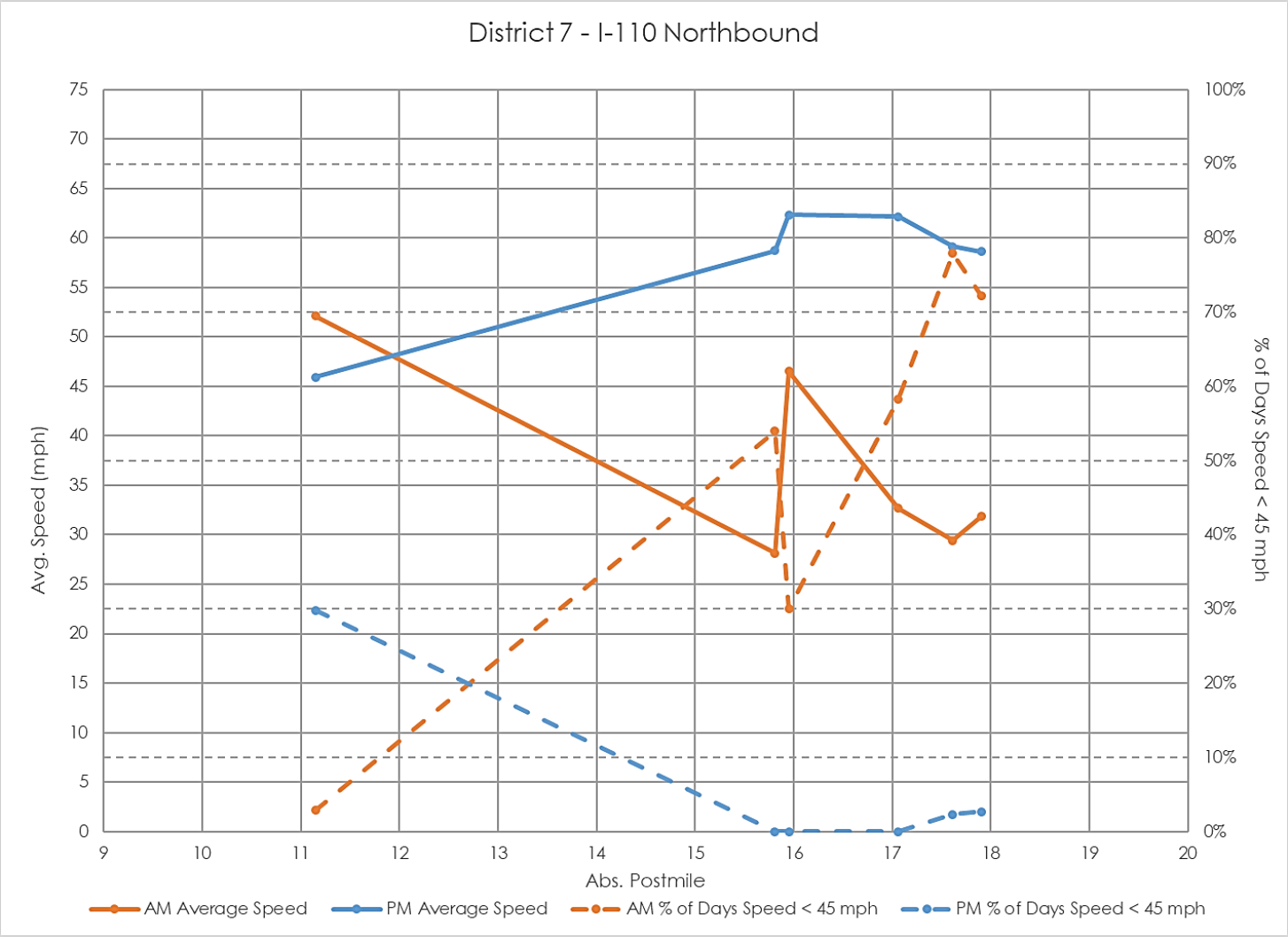
## FIGURE 80. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 105



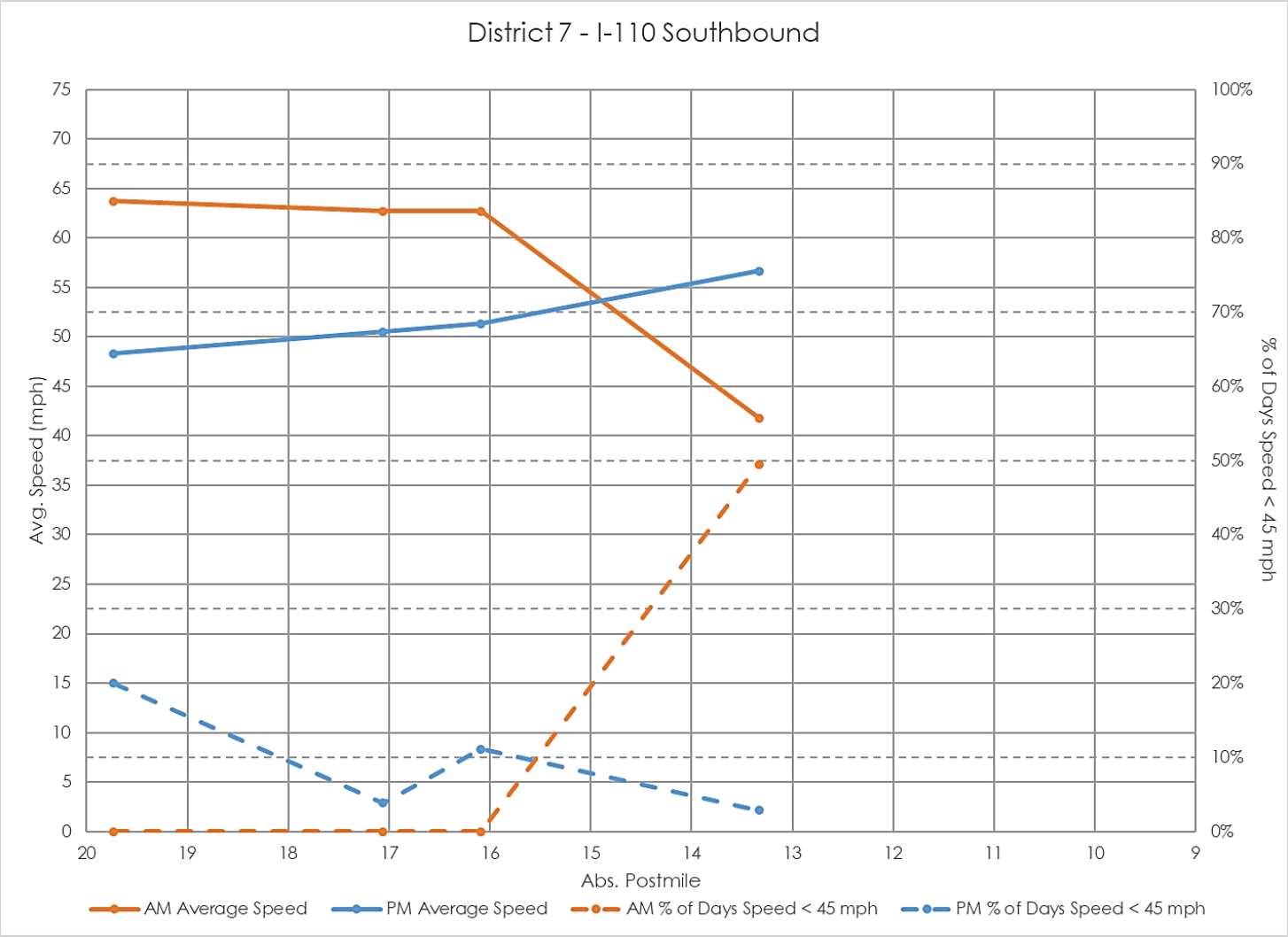
## FIGURE 81. SPEED AND DEGRADATION PROFILE - WESTBOUND ROUTE 105



## FIGURE 82. SPEED AND DEGRADATION PROFILE - NORTHBOUND ROUTE 110



## FIGURE 83. SPEED AND DEGRADATION PROFILE - SOUTHBOUND ROUTE 110



## FIGURE 84. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 118

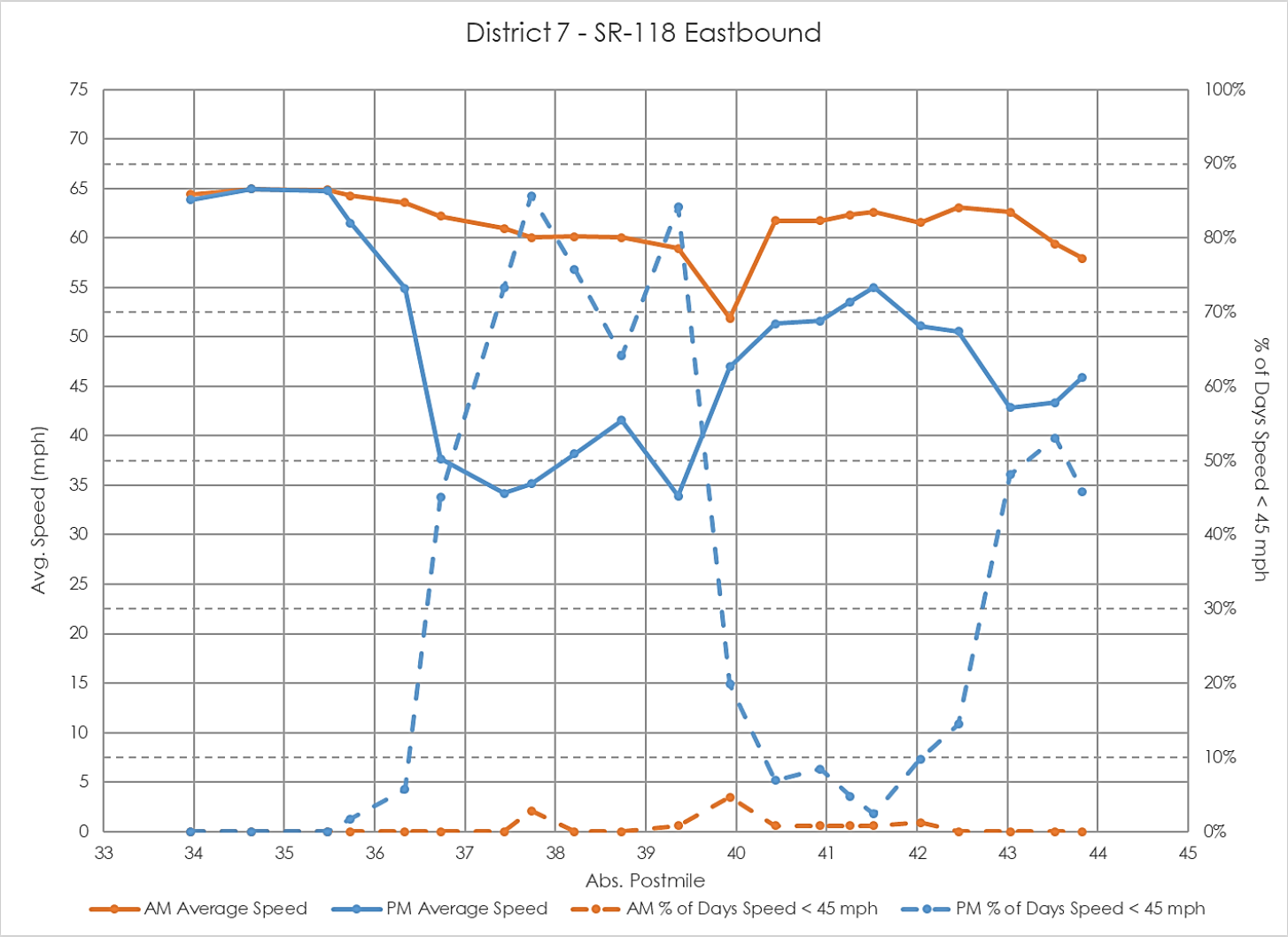
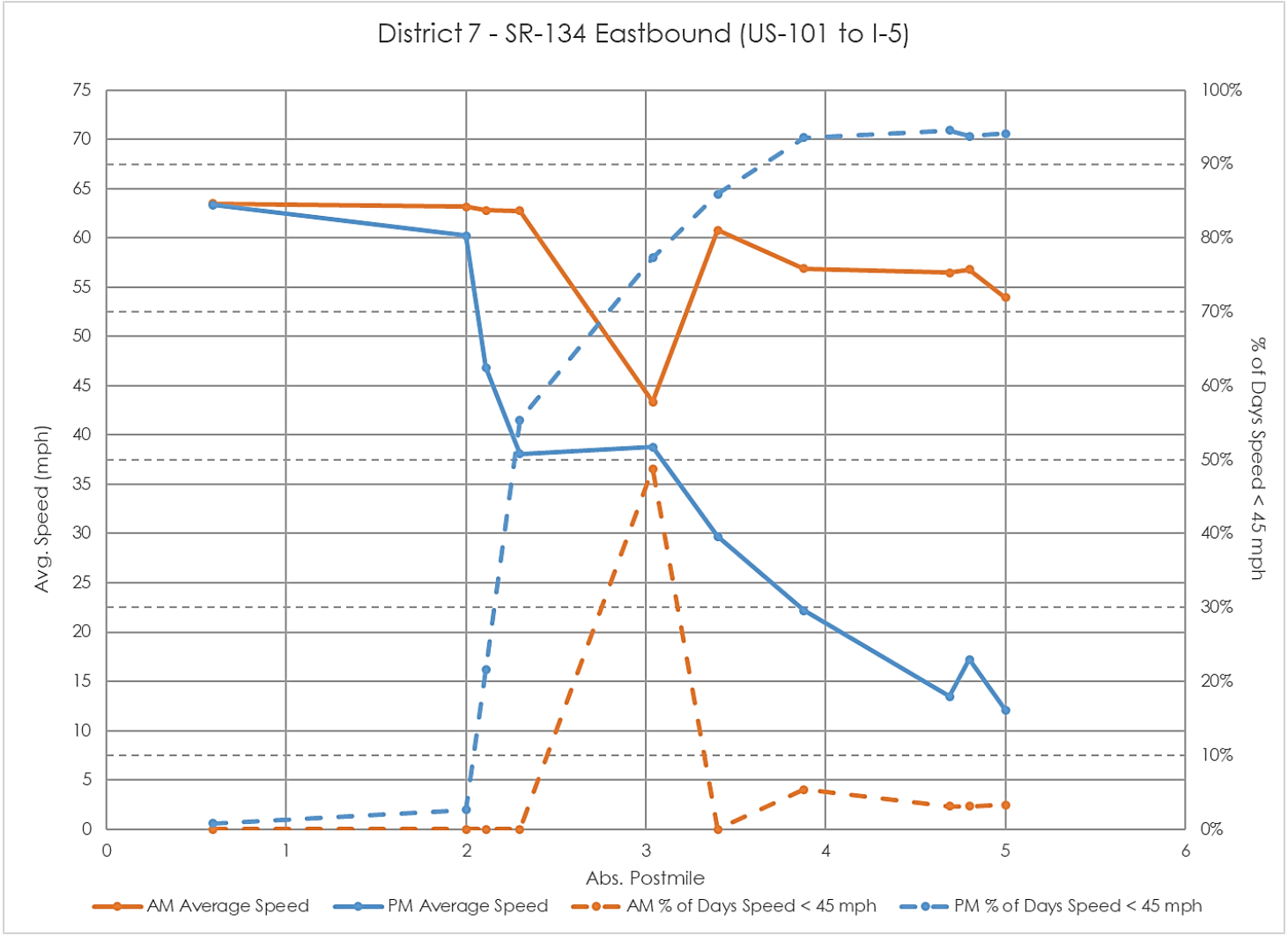


**FIGURE 85. SPEED AND DEGRADATION PROFILE - EASTBOUND ROUTE 134 (ROUTE 101 TO ROUTE 5)**



## FIGURE 86. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 134 (ROUTE 101 TO ROUTE 5)

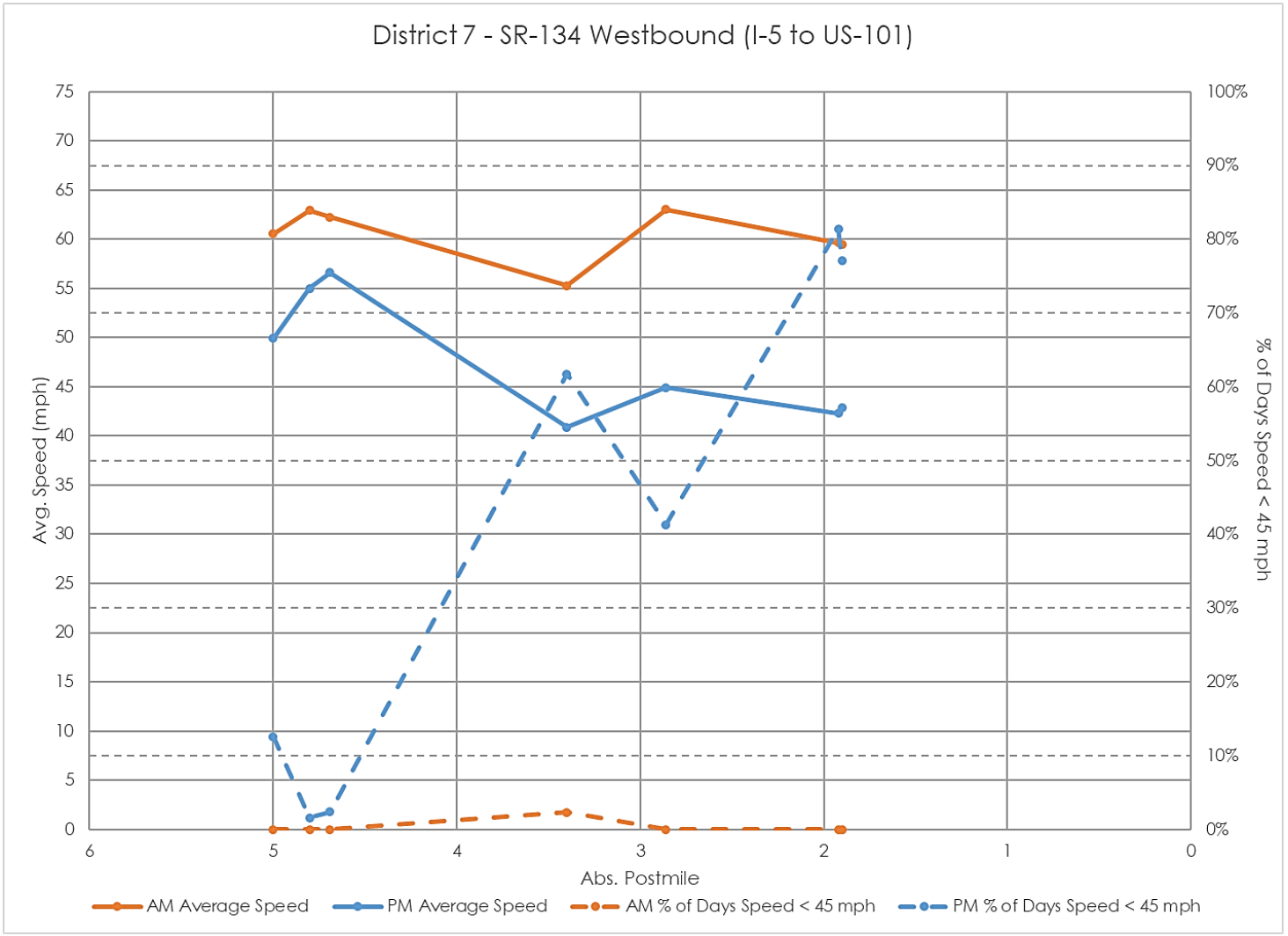
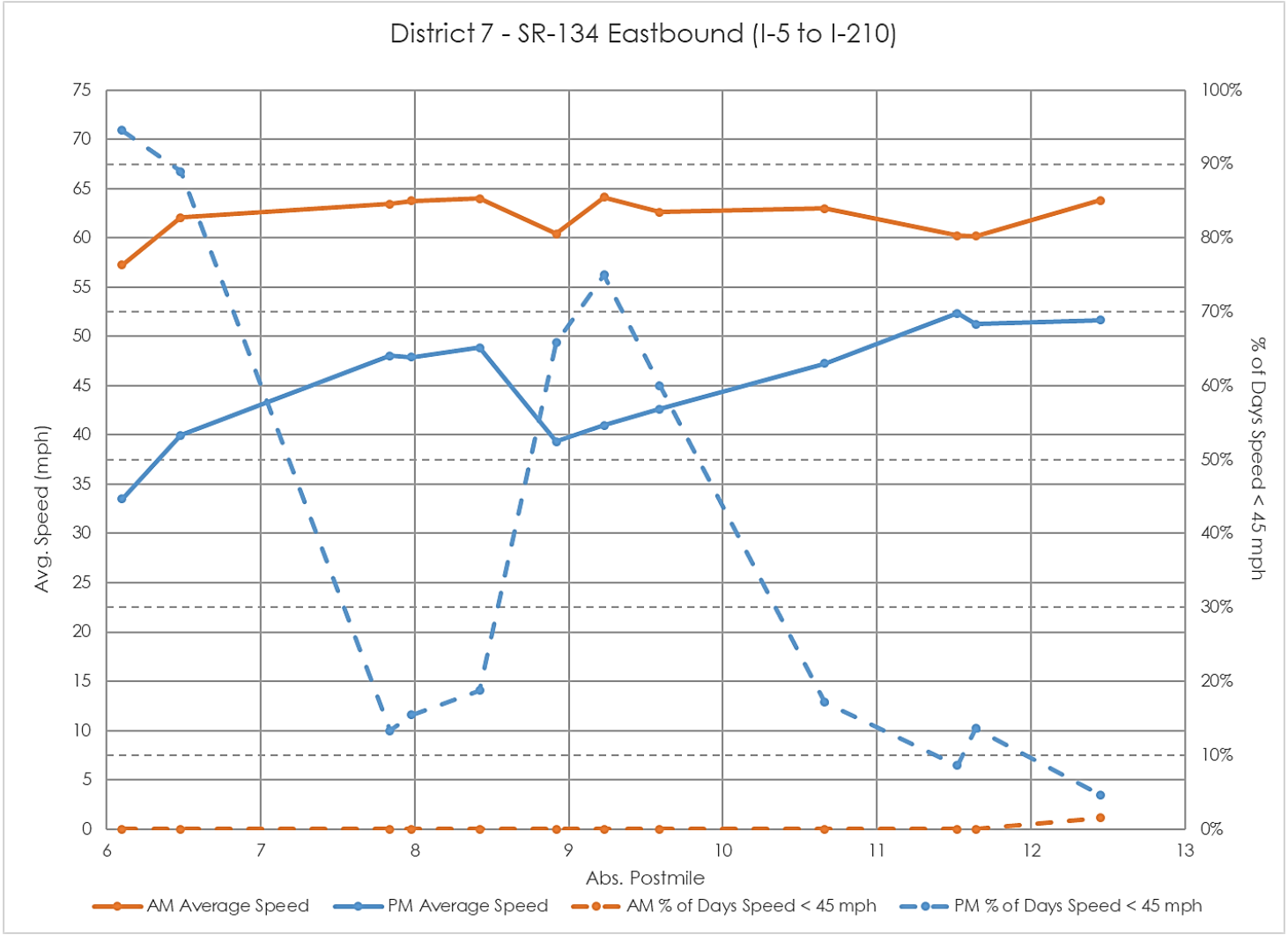
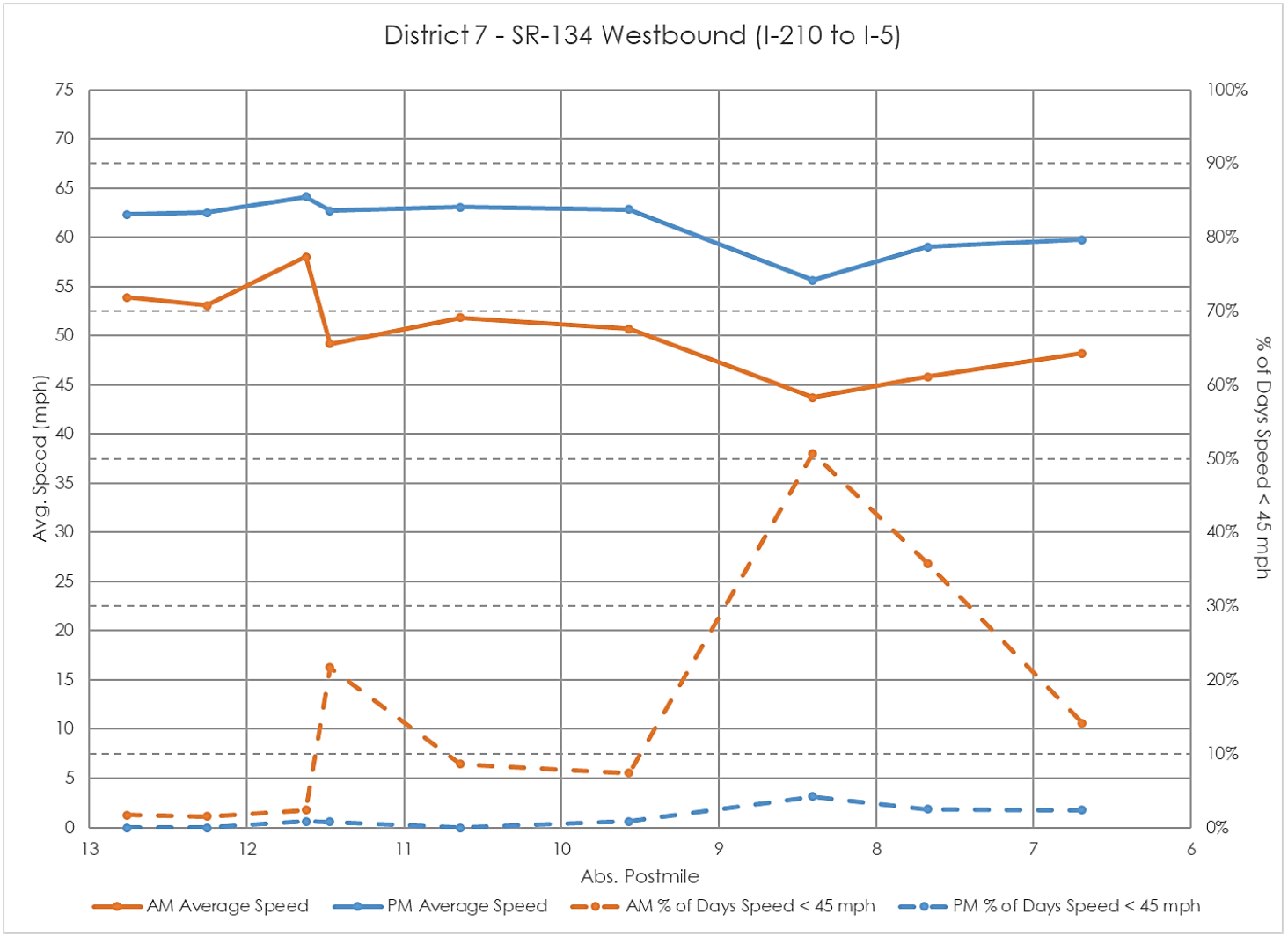


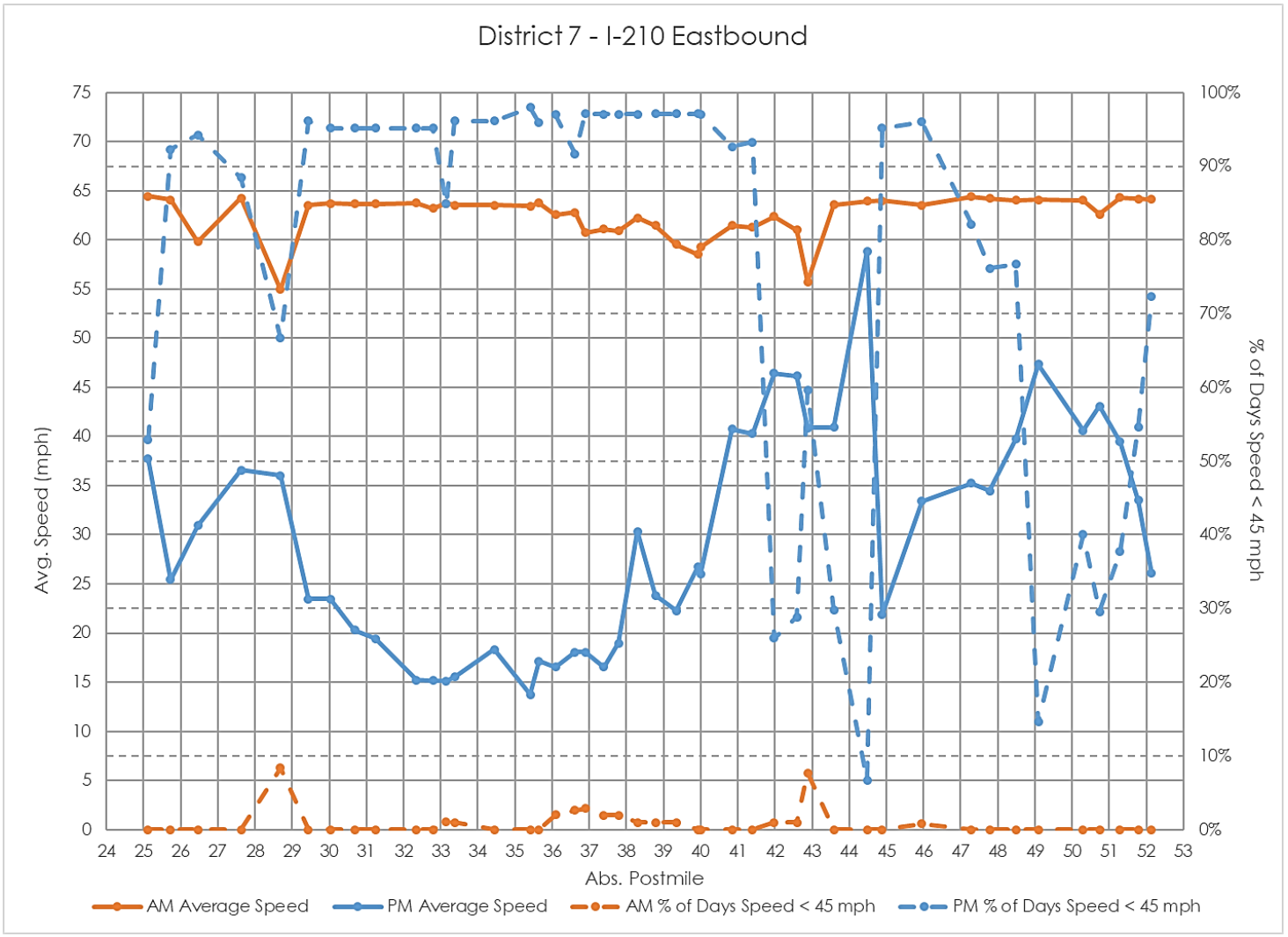
**FIGURE 87. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 134 (ROUTE 5 TO ROUTE 210)**



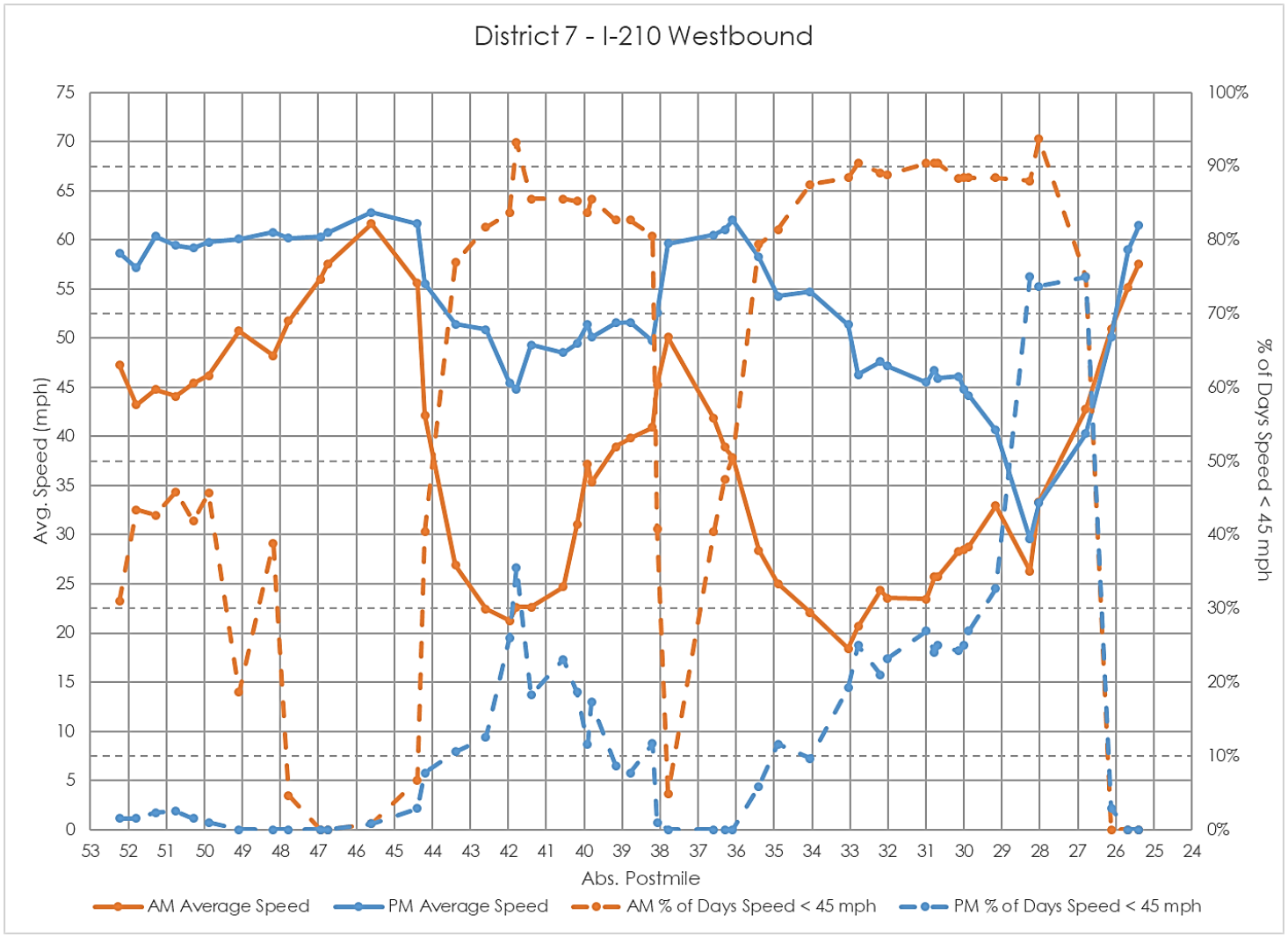
## FIGURE 88. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 134 (ROUTE 5 TO ROUTE 210)



## FIGURE 89. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 210



## FIGURE 90. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 210



## FIGURE 91. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 405 (ORANGE COUNTY LINE TO ROUTE 105)

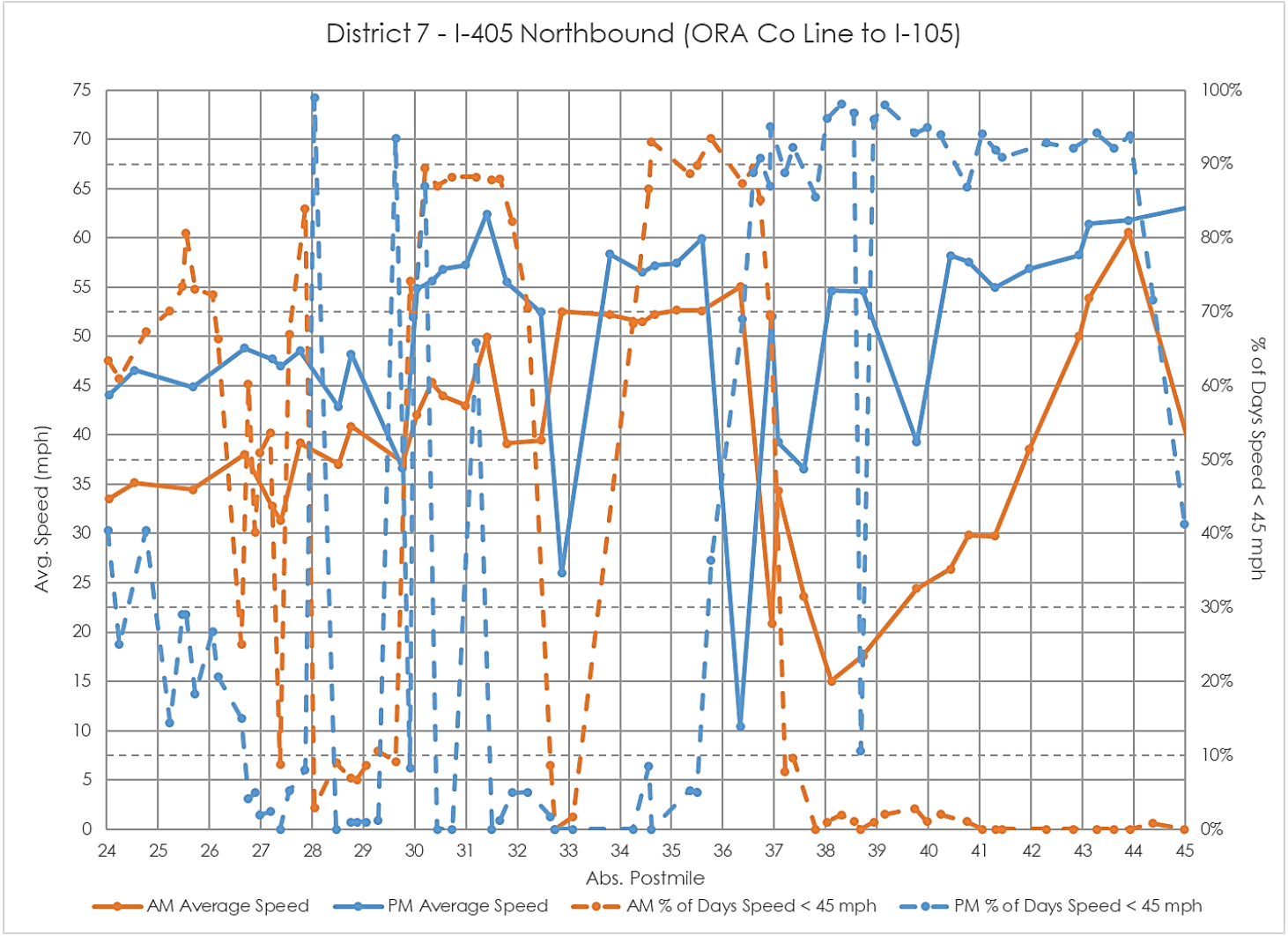


**FIGURE 92. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 405 (ROUTE 105 TO ROUTE 5)**

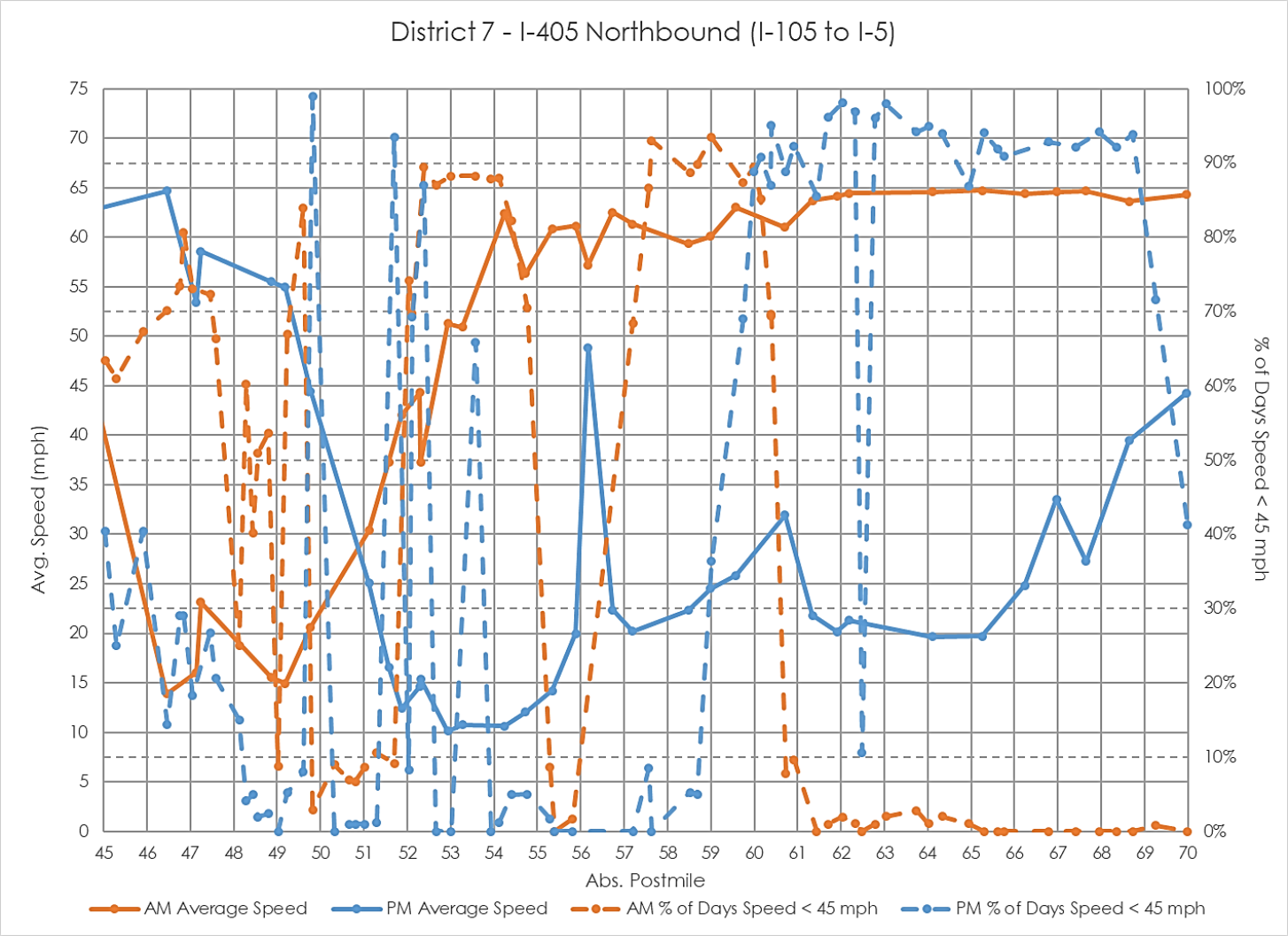


**FIGURE 93. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 405 (ROUTE 105 TO ROUTE 5)**

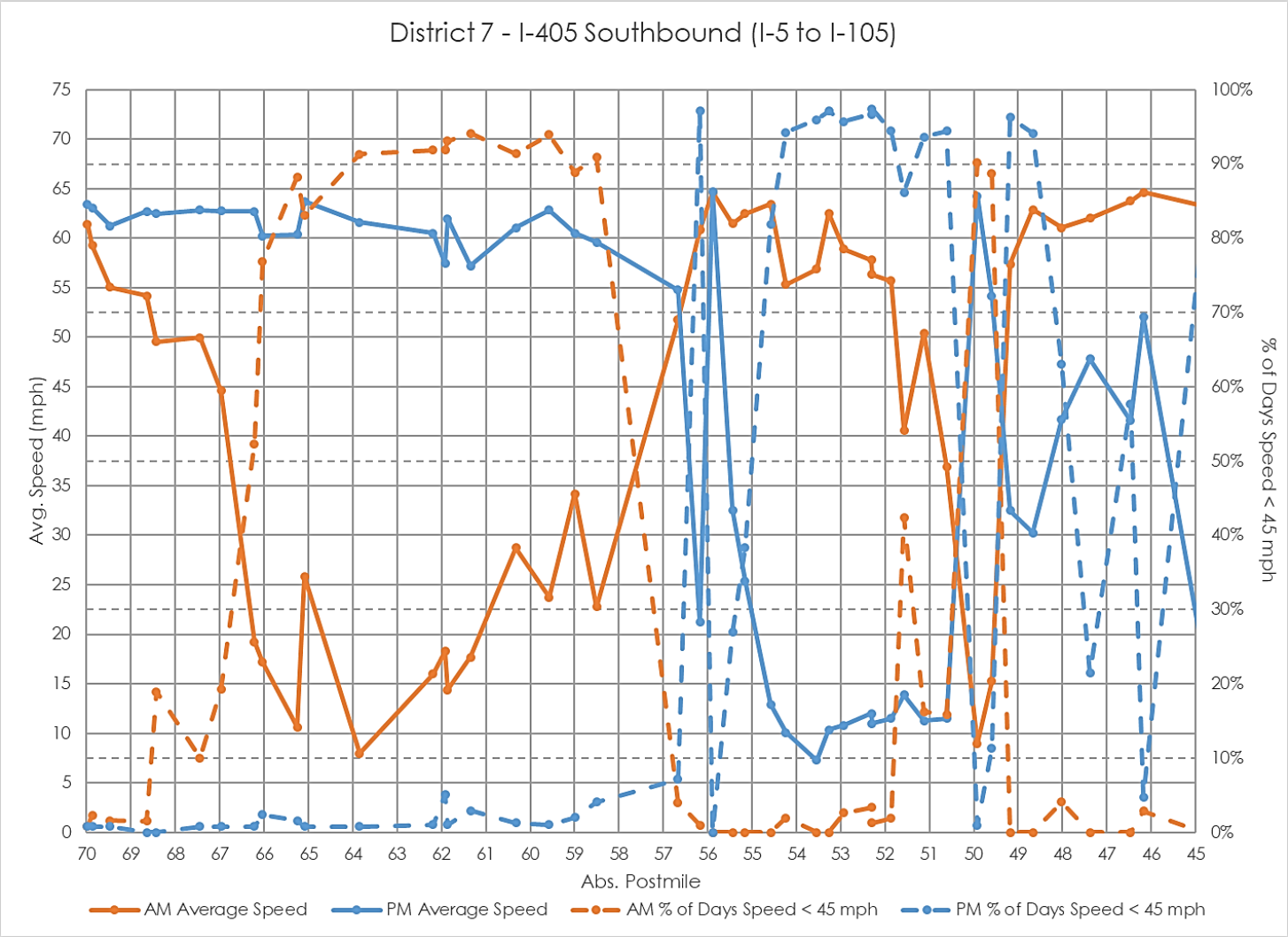
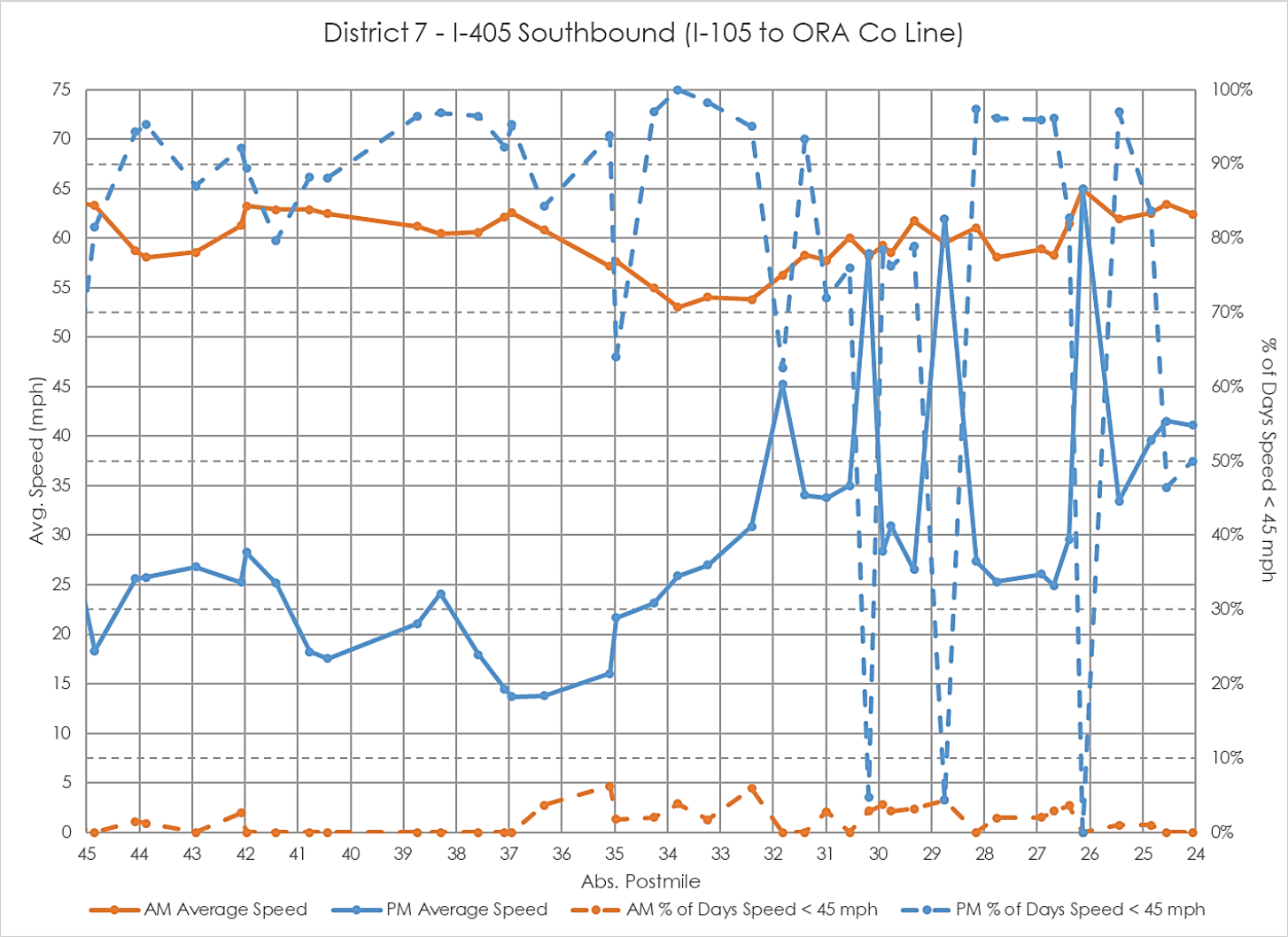
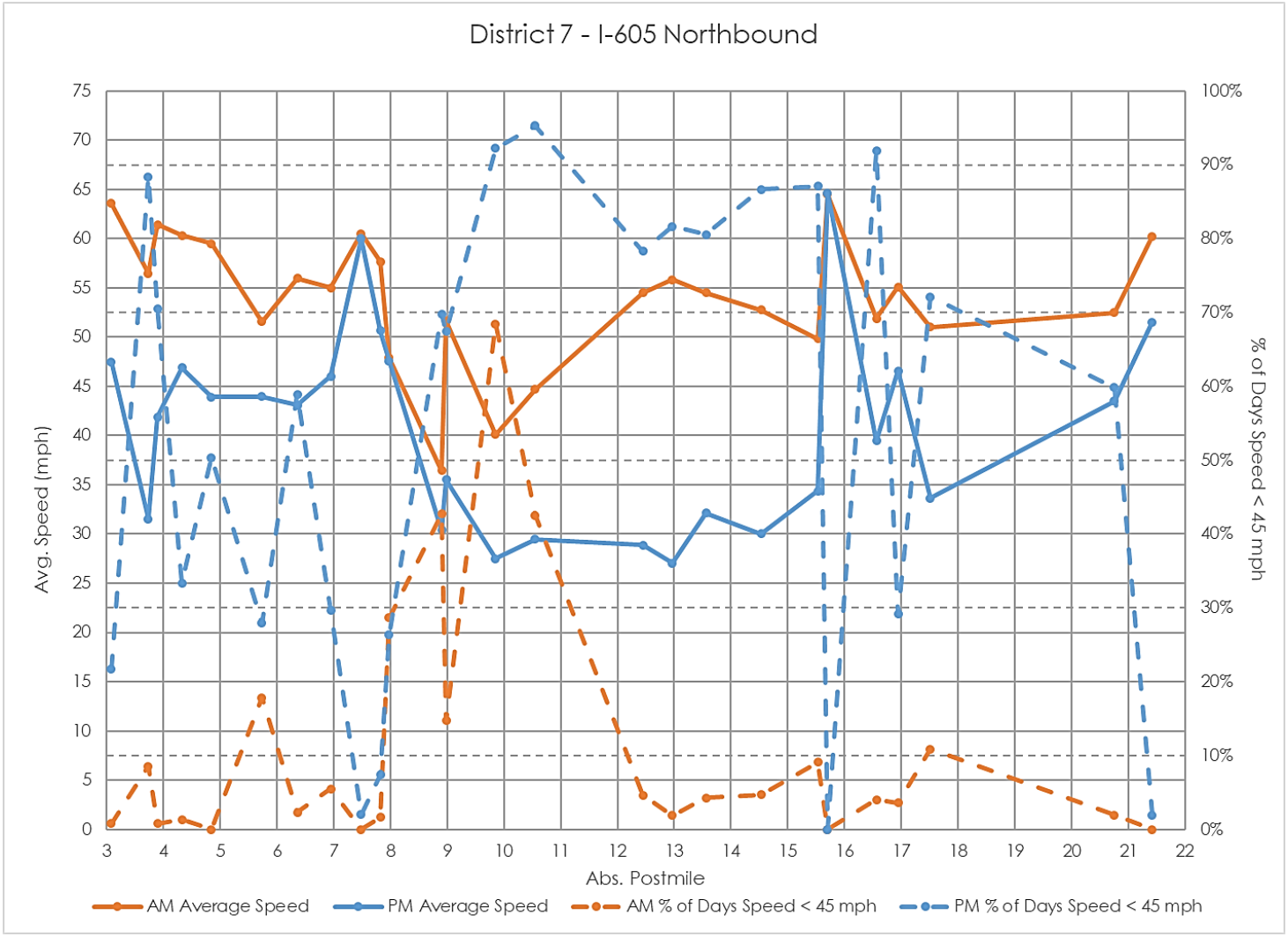


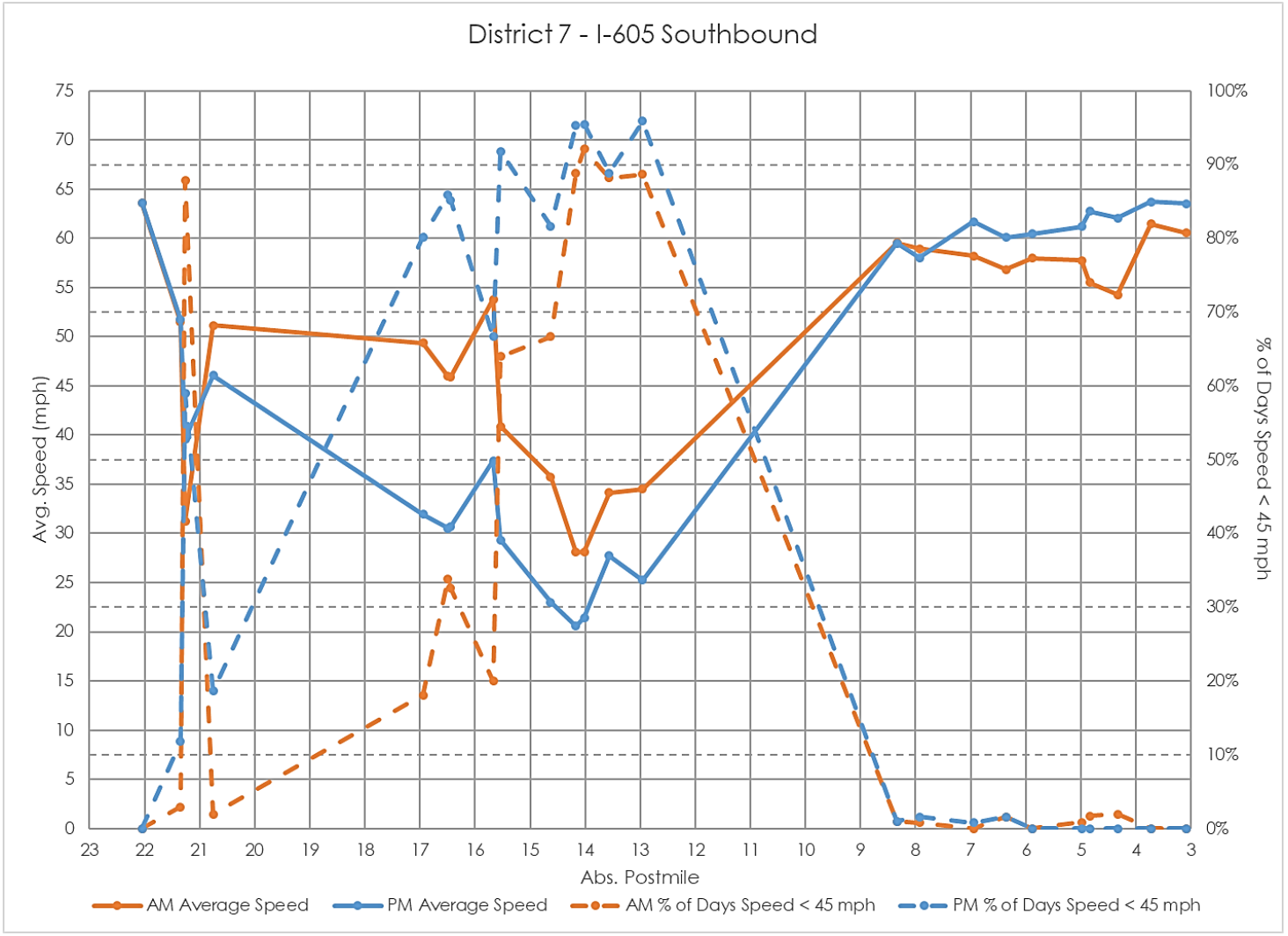
**FIGURE 94. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 405 (ORANGE COUNTY LINE TO ROUTE 105)**



## FIGURE 95. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 605



## FIGURE 96. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 605



### 4.3.2 ACTION PLAN FOR HOV FACILITIES ON ROUTE 5

## A. ANALYSIS

- Afternoon peak period recurrent congestion in all lanes reduces northbound HOV lane performance and speed. The average volume reaches 1,500 vehicles/hour in the HOV lane during the peak period. The average volume of GP fast lane (#1 lane) is similar to HOV lane's, but GP slow lanes' volumes and speeds (#3, 4, and 5 lanes) are less and slower than the HOV lane.

- Northbound GP lane drops at San Fernando Mission Road causing a bottleneck.

- Vehicle weaving conflicts at northbound ingress/egress (I/E) locations (6 I/E's in the southbound direction and 7 I/E's in the northbound direction) due to congestion in the GP lane and HOV direct connector traffic from Route 170.

- Volume exceeds capacity north of the junction of Route 405. The entire volume of the northbound Route 405 merges onto the Route 5 freeway. This merging point shows the highest percentage of degradation on the northbound HOV lane due to the volume of vehicles.

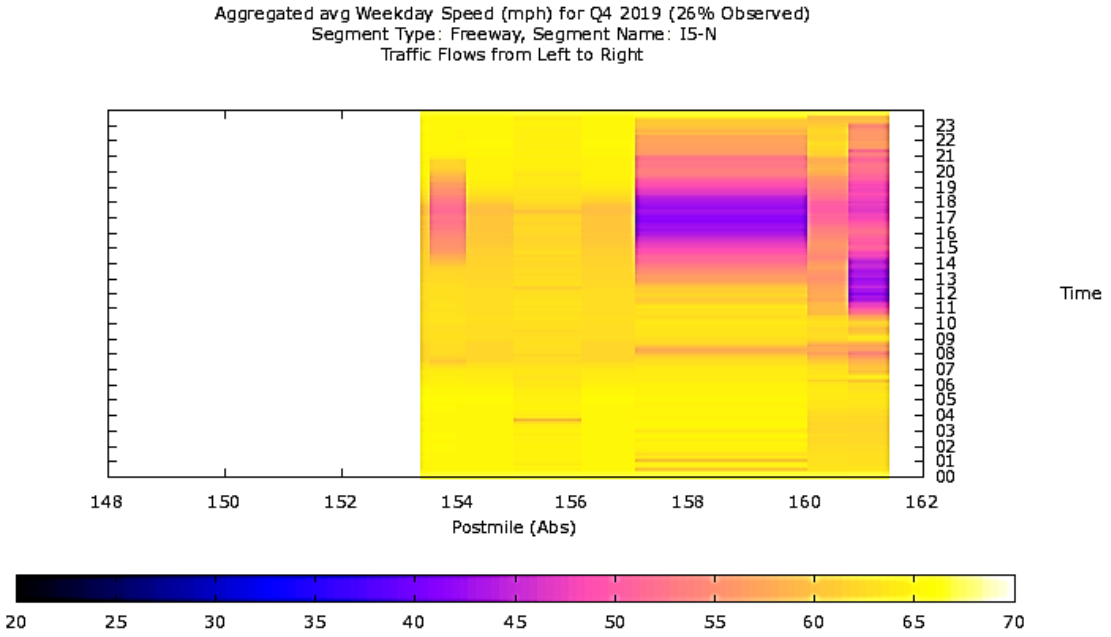
- Volume from the westbound Route 210 merging onto Route 5 northbound, especially the truck volume (6.3 to 8.7 percent) on northbound.

- The right lane drops just upstream of the end of the northbound HOV lane. Then within one mile from the end of HOV lane, the separate designated truck route merges into the northbound Route 5.

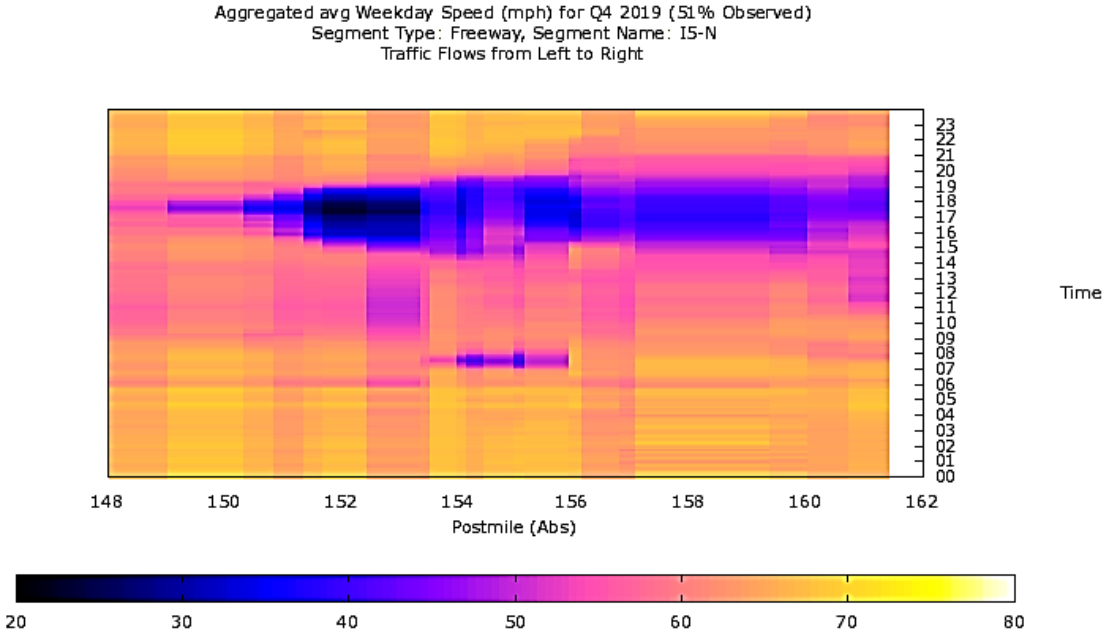
- Morning peak period recurrent congestion in all lanes reduces southbound HOV lane performance and operating speeds. Vehicle weaving conflict at ingress/egress locations due to congestion in the GP lane.

Figures 97 and 98 provide plots of northbound HOV and GP lane speeds along the length of the HOV facility during the fourth quarter of 2019. Figures 99 and 100 provide plots of southbound HOV and GP lane speeds along the length of the HOV facility during the fourth quarter of 2019. Note that HOV lane detection does not cover the entire length of the HOV facility.

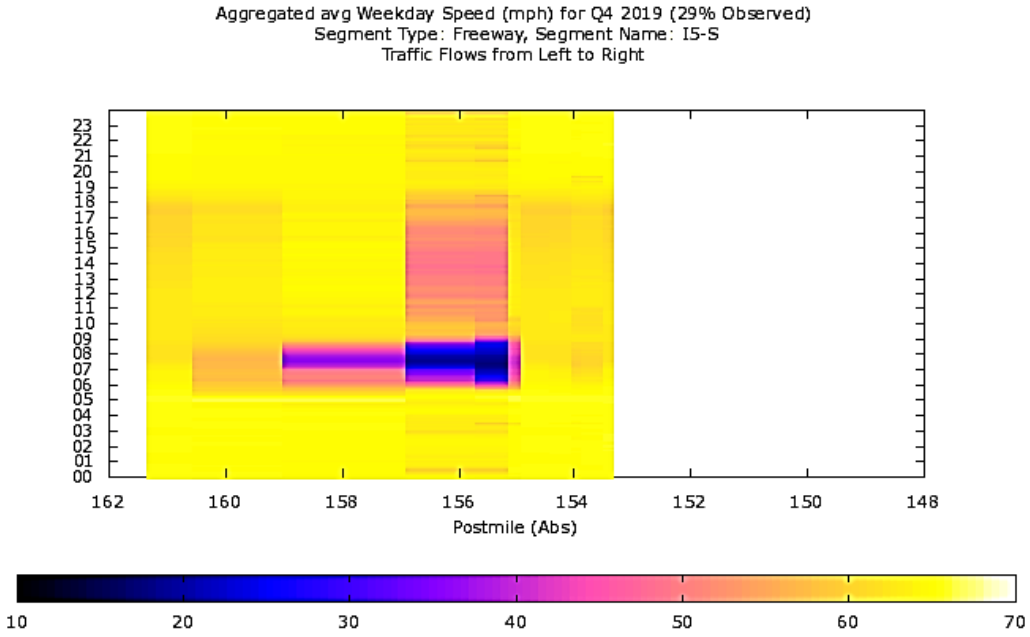
## FIGURE 97. AVERAGE HOV LANE SPEEDS – NORTHBOUND ROUTE 5, Q4 2019



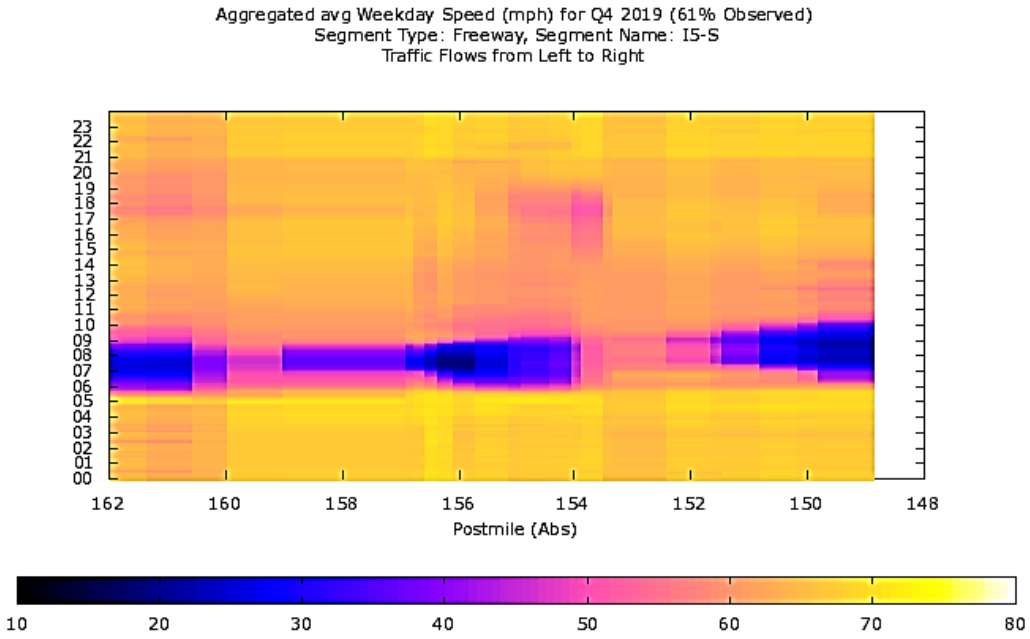

## FIGURE 98. AVERAGE GP LANE SPEEDS – NORTHBOUND ROUTE 5, Q4 2019



## FIGURE 99. AVERAGE HOV LANE SPEEDS – SOUTHBOUND ROUTE 5, Q4 2019




## FIGURE 100. AVERAGE GP LANE SPEEDS – SOUTHBOUND ROUTE 5, Q4 2019



## B. REMEDIATION STRATEGIES

- The East San Fernando Valley Transit Corridor Project (ESFV, Los Angeles Metro) consists of a Light Rail Transit (LRT) system that will travel north of the Van Nuys Orange Line Station to the Sylmar/San Fernando Metrolink Station, a total of 9.2 miles and will operate in the median of Van Nuys Boulevard for 6.7 miles to San Fernando Road. Construction groundbreaking is scheduled to begin in 2022 and is expected to be completed in time for the 2028 Summer Olympic and Paralympic Games. $1.3 billion has been identified for the project, most coming from local Measure M, Measure R and State gas tax funds.

- Project 07-2332E will extend the HOV and truck lanes north of Route 14, which will ease traffic delay and absorb traffic growth due to increased population and surrounding communities – both residential and commercial. Construction began in 2020, and completion is expected in March 2025. The estimated construction cost is $525 million.

- Metrolink developed the Southern California Optimized Rail Expansion (SCORE) plan in partnership with freight and intercity rail operators as a roadmap to increased rail service to accommodate expected population and job growth in advance of 2028, when Los Angeles will host the Olympics. SCORE will fund the construction of a new station in Santa Clarita.

- Office of Corridor Management will study by June 2022, possible pavement delineation restriping to continue/widen to four lanes, after the truck lane branches off to a separate alignment and the GP lanes drop down from four to three lanes.

### 4.3.3 ACTION PLAN FOR HOV FACILITIES ON ROUTE 10

## A. ANALYSIS

*Alameda Street to Azusa Avenue*

- Morning peak period recurrent congestion in all lanes reduces westbound HOT lane performance and speed.

- The HOV lane was converted to HOT lanes by LA Metro on February 23, 2013. Vehicle volume has increased as a result of the addition of toll-paying vehicles and an increase in violation rates. LA Metro's Pricing Algorithm

cannot control demand, even under "HOV Only" mode due to high occupancy violations. The occupancy violation rate with the self-declaring FasTrak flex transponder has increased over time, as SOVs set the transponder to HOV to avoid paying toll. Approximately 30 to 60 percent of users are not setting the transponder correctly. Manual counts show over 70 percent of vehicles in the HOT lane are SOVs and only 15 percent carpools.

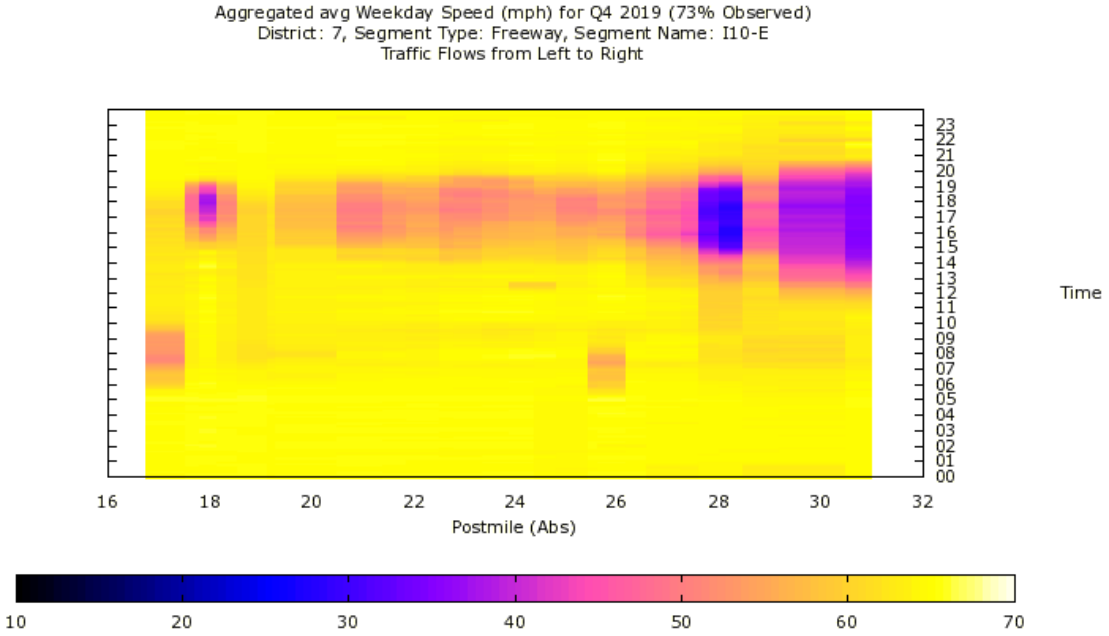
Figures 101 and 102 provide plots of eastbound HOV and GP lane speeds along the length of this HOV facility during the fourth quarter of 2019. Figures 103 and 104 provide plots of westbound HOV and GP lane speeds along the length of the HOV facility during the fourth quarter of 2019.

*Route 57 to San Bernardino County Line*

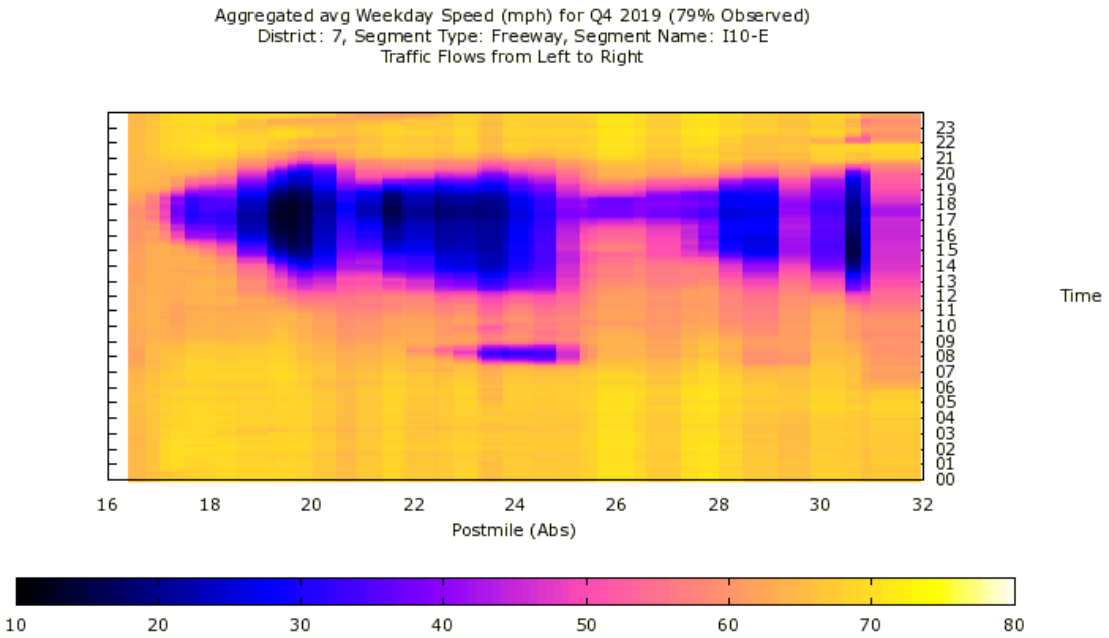
- Afternoon peak period recurrent congestion in all lanes reduces eastbound HOV lane performance and speed.
- High truck traffic volume. Truck volumes range from 4.5 percent to 8.0 percent. High truck volumes reduce the capacity of the freeway, especially the right two lanes; other vehicles tend to maneuver into and use the left most lanes of the freeway, increasing weaving and the friction factor with the HOV lanes.
- On-going construction activities to widen the freeway and construct a new HOV lane connecting the gap in the HOV lane network between Azusa Avenue and Route 57.

Figures 105 and 106 provide plots of eastbound HOV and GP lane speeds along the length of this HOV facility during the fourth quarter of 2019. Figures 107 and 108 provide plots of westbound HOV and GP lane speeds along the length of the HOV facility during the fourth quarter of 2019.

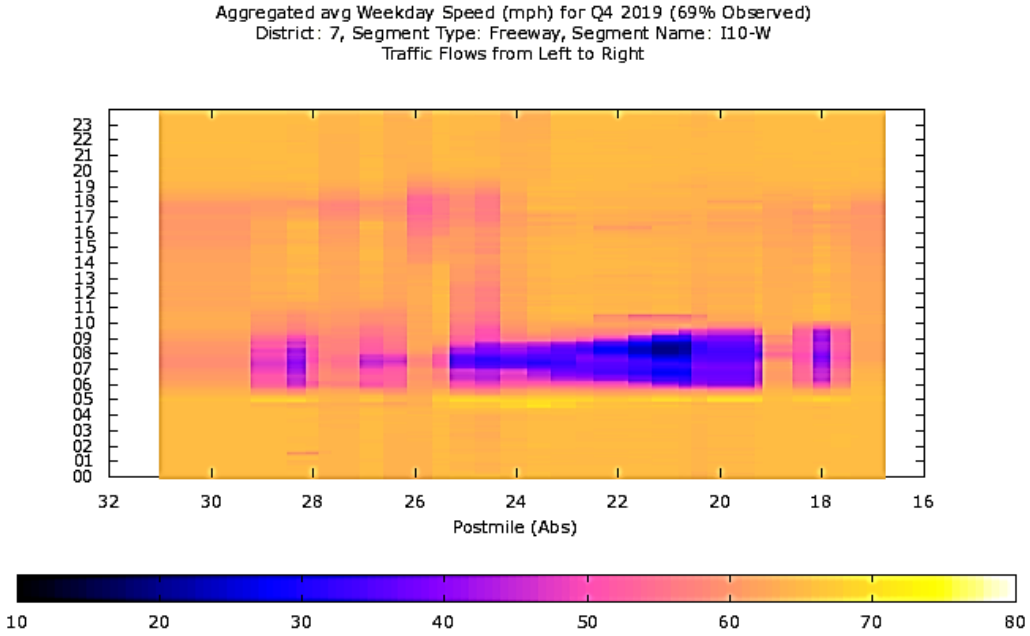
## FIGURE 101. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 10 (ALAMEDA ST TO AZUSA AVE), Q4 2019



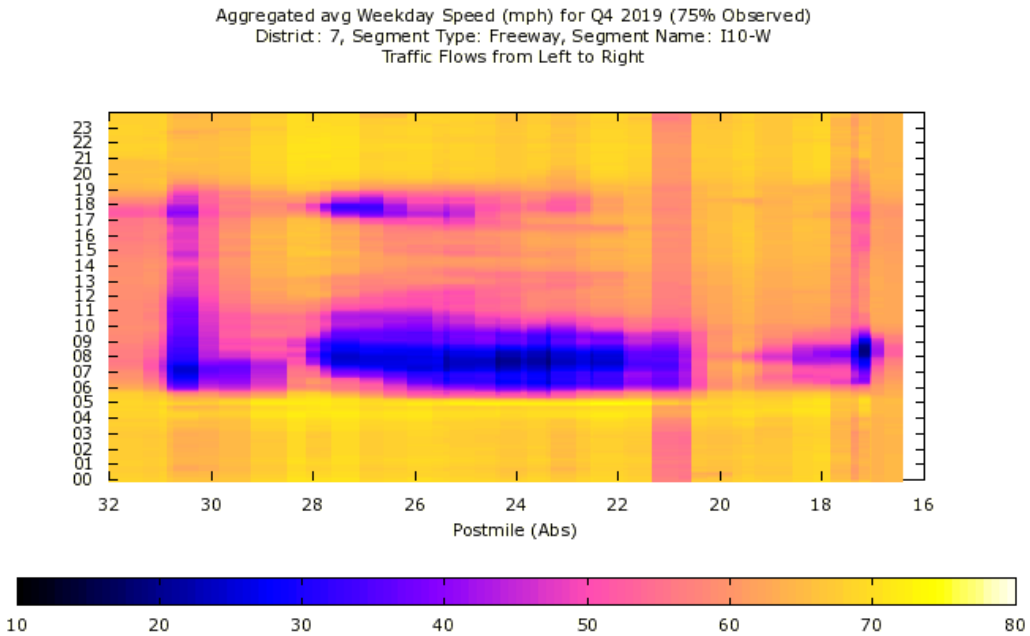

## FIGURE 102. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 10 (ALAMEDA ST TO AZUSA AVE), Q4 2019



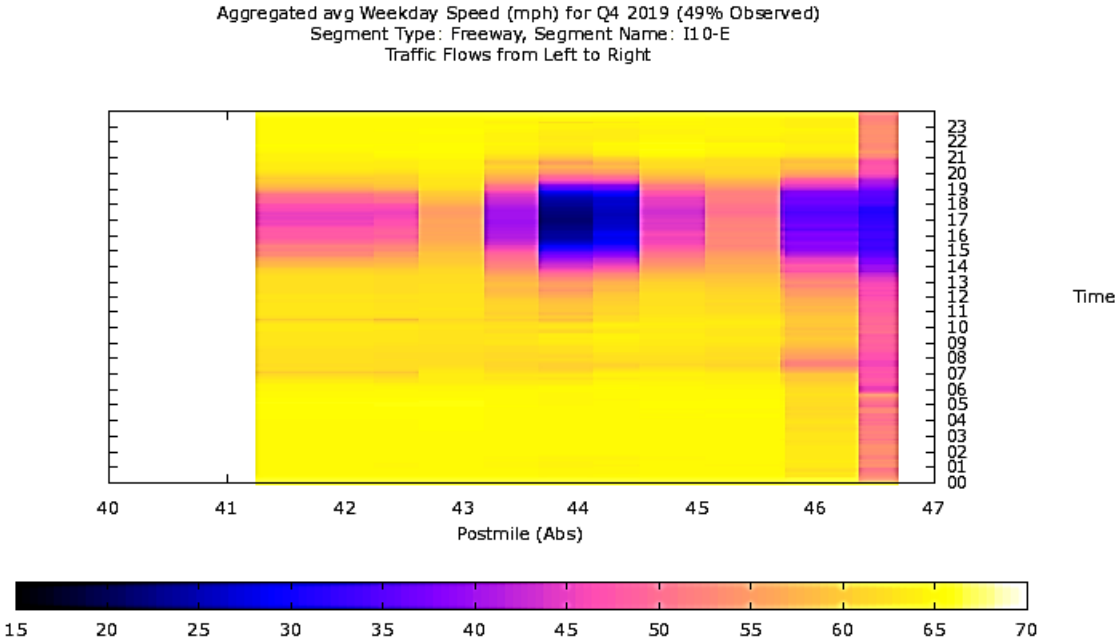
## FIGURE 103. AVERAGE HOV LANE SPEED – WESTBOUND ROUTE 10 (ALAMEDA ST TO AZUSA AVE), Q4 2019



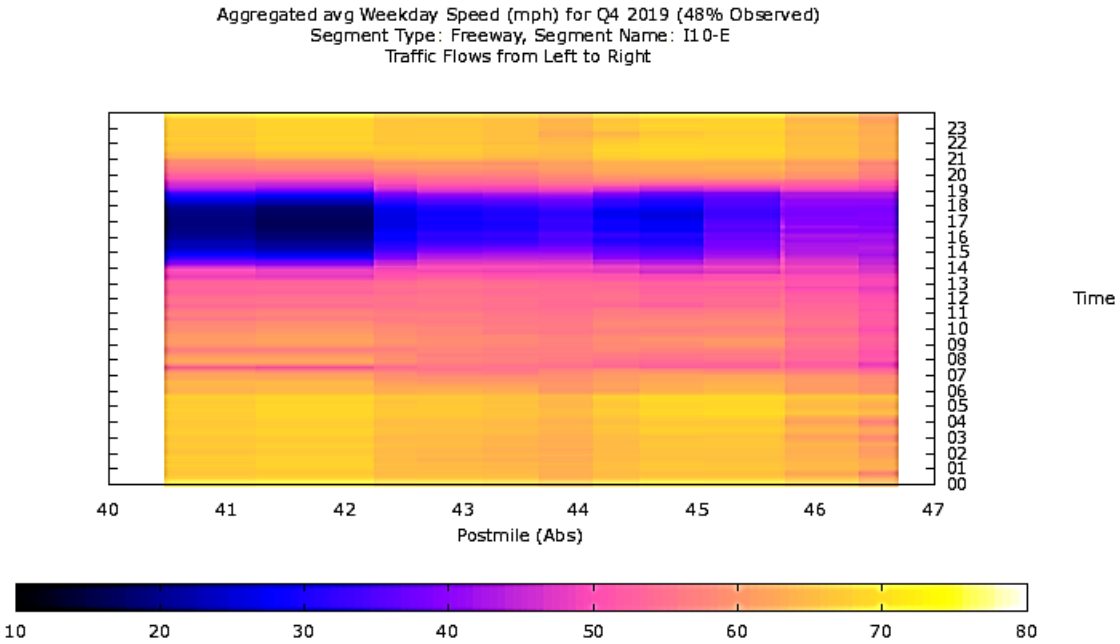

## FIGURE 104. AVERAGE GP LANE SPEED – WESTBOUND ROUTE 10 (ALAMEDA ST TO AZUSA AVE), Q4 2019



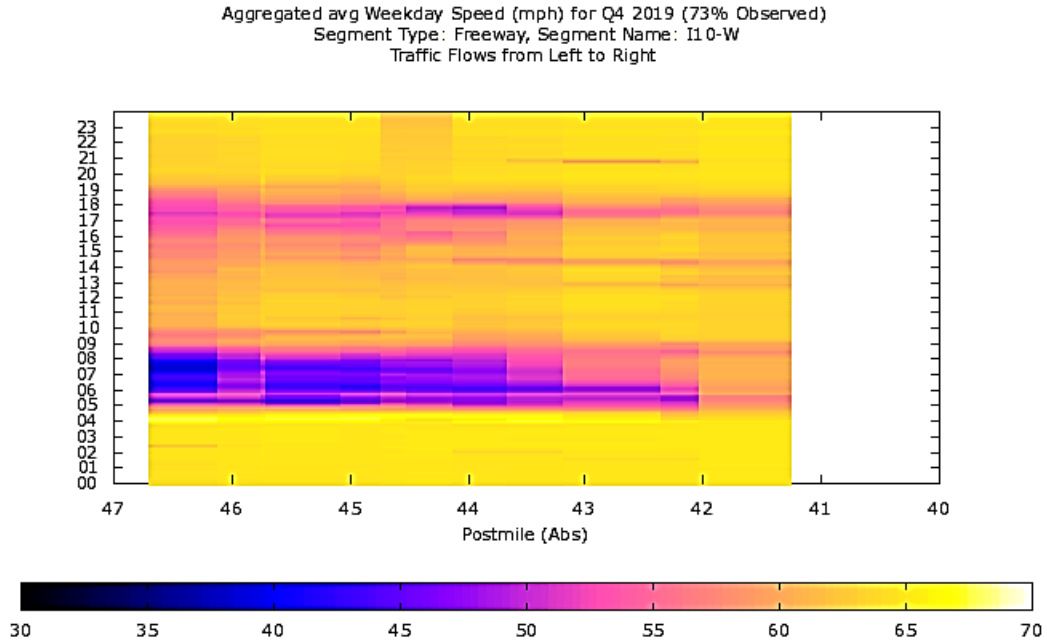
## FIGURE 105. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 10 (ROUTE 57 TO SAN BERNARDINO COUNTY LINE), Q4 2019



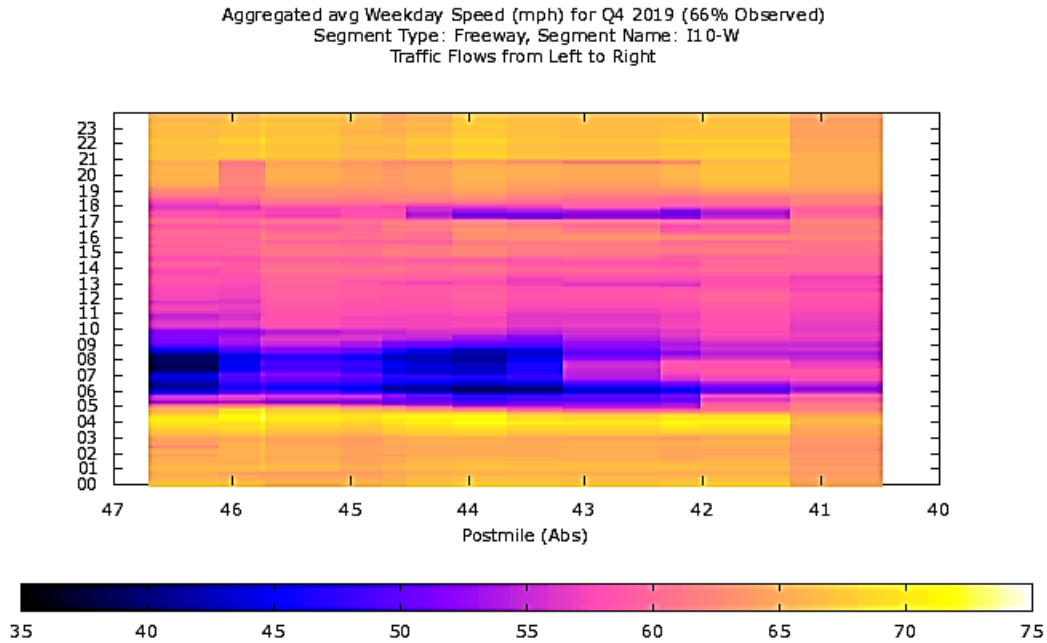

## FIGURE 106. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 10 (ROUTE 57 TO SAN BERNARDINO COUNTY LINE), Q4 2019



## FIGURE 107. AVERAGE HOV LANE SPEED – WESTBOUND ROUTE 10 (ROUTE 57 TO SAN BERNARDINO COUNTY LINE), Q4 2019




## FIGURE 108. AVERAGE GP LANE SPEED – WESTBOUND ROUTE 10 (ROUTE 57 TO SAN BERNARDINO COUNTY LINE), Q4 2019



## B. REMEDIATION STRATEGIES

*Alameda Street to Azusa Avenue*

- Caltrans, in partnership with the Los Angeles Metropolitan Transportation Authority (LA Metro), implemented the following strategies in 2019 to improve performance:
    - Modified the HOT lane operation by adding channelizers on the buffer striping. The channelizers were almost immediately hit and caused them to dislodge. This became a safety issue for motorists and the maintenance crew. As a result, all channelizers were removed.
    - Work is ongoing to repair and update the detector system to improve data collection.
    - LA Metro installed the Automatic Vehicle Occupancy Detection System (AVODS) in late 2019, based on Caltrans' violation data, and it has been in the testing phase since June 2020. LA Metro is still not using it for enforcement, which entails sending a letter indicating that transponder is set wrong, and in the future, the toll would be charged.
    - Digital occupancy sign panels that display the transponder setting to assist the CHP to enforce vehicle occupancy or toll violations, were installed in 2019 and can be seen from both sides of the display. CHP indicates that they are very helpful and more useful than the flashing white and blue lights on the transponder readers.
- LA Metro reports that the HOT lanes are degraded because of too many carpools and plans to implement a 5+ occupancy requirement Pilot on the Route 10 HOT lanes (ELs) in 2022. Manual occupancy counts show over 70 percent of EL vehicles are SOVs and only 15 percent carpools. LA Metro would require all 5+ to be registered vanpools in phase I during the peak hours. LA Metro plans to perform a before/after study.
- Enhanced, dedicated, and targeted CHP enforcement along HOT lanes, including the establishment of enforcement zones.
- LA Metro Gold Line Foothill Extension to Claremont (with ability to extend to Montclair) will be completed in 2025 and is expected to reduce traffic demand on Routes 10, 60, and 210. Carpooling has been touted as one of

the first steps in encouraging people to try and use higher-level ridesharing modes of transportation, therefore, off-system improvements should attract some of the current HOV lane users.

- Beginning next year, LA Metro will prepare the Route 10 HOT Lane Degradation Action Plan.

*Route 57 to San Bernardino County Line*

- Two projects are currently in construction to widen the freeway and construct a new HOV lane eliminating the gap in the HOV lane network. Caltrans will assess its effectiveness at reducing HOV lane degradation upon completion of the projects and traffic patterns normalize to the new facilities. The gap closure projects will be completed by December 2021,

- The Alameda Corridor-East (ACE) Project, funded by the San Gabriel Valley Council of Governments, will mitigate the impacts of significant increases in freight rail traffic on over 70 miles of mainline railroad in the San Gabriel Valley. The ACE Project consists of a comprehensive program of safety improvements and mobility upgrades at an estimated cost of $1.7 billion. This project will relieve truck traffic from Long Beach and San Pedro to Inland Empire region.

- The HOV facility between the Route 605 and the San Bernardino County Line, will be converted to HOT lanes by December 2026.

### 4.3.4 ACTION PLAN FOR HOV FACILITIES ON ROUTE 14

### A. ANALYSIS

- Peak period recurrent congestion in all lanes reduces HOV lane performance and speed, between Placerita Canyon Road and Sand Canyon Road (PM 3.3-8.7), southbound in the AM and northbound in the PM.

- An increase of violators using the continuous access portion of the HOV lane. The 2019 Manual Occupancy Data indicates up to an 8.6 percent violation rate.

- Lane drop at Newhall Avenue creates a bottleneck in the northbound direction.

- Demand exceeds capacity when three lanes drop to two on the route, causing friction between HOV and GP lanes. During the peak hour, the two GP lanes and one HOV lane reach 3,277 and 1,643 vehicles/hour respectively.
- Several lane-drops southbound close to Sand Canyon Road
- In the southbound direction non-metered on-ramps allow platoons of vehicles to enter the freeway.
- Merging to southbound Route 5 HOV lane causes delay in the southbound direction during morning peak traffic hours.

## B. REMEDIATION STRATEGIES

- Revert HOV striping back to limited access buffer, which existed prior to 2019. The limited access facility generated free-flow "green" speeds throughout the northern segment. Project to reinstall the limited access/buffer back to the original configuration on the Route 14 will be assigned to the Corridor Manager, with possible SHSMP/SHOPP funding.
- Office of Corridor Management will study by June 2022, possible pavement delineation restriping to eliminate the lane-drop configuration.
- Project 07-29890 includes widening the Route 14 mainline from Technology Drive to Palmdale Boulevard and widening northbound Rancho Vista Boulevard off-ramp after deceleration segment. Project plans also include realigning the off-ramp terminus, replacing signals at the ramp terminus, and synchronizing signal timing. The project is in the construction phase and is led by the City of Palmdale. Construction completion is expected in October 2025.
- Metrolink developed the Southern California Optimized Rail Expansion (SCORE) plan in partnership with freight and intercity rail operators as a roadmap to increase rail service to accommodate expected population and job growth in advance of 2028, when Los Angeles will host the Olympics. SCORE will fund the construction of a new station in Santa Clarita.
- Meter HOV preferential lanes at on-ramps. Work is in progress. Various routes are in different stages subject to project funding within the corridor. District 7 will receive approximately $8 million in the 2024 SHSMP/SHOPP funding.

District 7 has been entering HOV Degradation Mitigation into the Asset Management Tool for existing projects involving ramp work and estimates that about 15 percent of the total DVHD reduction would come from metering the HOV preferential lanes.

- Construction of HOV and truck lanes on Route 5 (project 07-2332E4) will ease traffic delay and absorb the growth of traffic due to increased population and surrounding communities – both residential and commercial. Construction began in 2020; construction completion expected in early 2025. The estimated construction cost is $525 million.

### 4.3.5 ACTION PLAN FOR HOV FACILITIES ON ROUTE 57

### A. ANALYSIS

- PM Peak period recurrent congestion in all lanes in northbound direction reduces HOV lane performance and speed.
- The 2019 Manual Occupancy Data indicates up to an 8 percent violation rate.
- High volume due to the merging of Route 57 to Route 60.
- Poor data quality. HOV degradation is over-estimated due to sensor misconfiguration and insufficient quality data. Only four out of the total seven detectors have usable data on northbound Route 57.
- No data was available for southbound Route 57. Total of five detectors are along southbound Route 57, and none of them are functional.

### B. REMEDIATION STRATEGIES

- Project 07-27912 proposes freeway improvements to Route 57/60 confluence at the Grand Avenue interchange in Los Angeles County. During the peak periods, demand exceeds the capacity for both routes in the vicinity of the interchange, resulting in delays with Level of Service (LOS) at 'F' for many hours. This project is led by LA Metro and should begin construction in 2022. The estimated construction cost is $263 million. Construction completion expected in 2027.
- The Office of ITS will be initiating projects to repair loop detection.

- The Office of Corridor Management will study by June 2022, possible pavement delineation restriping to eliminate the lane-drop configuration.

### 4.3.6 ACTION PLAN FOR HOV FACILITIES ON ROUTE 60

## A. ANALYSIS

- Afternoon peak period recurrent congestion in all lanes reduces eastbound HOV lane performance and speed. Morning peak period recurrent congestion in all lanes reduces westbound HOV lane performance and operating speeds.

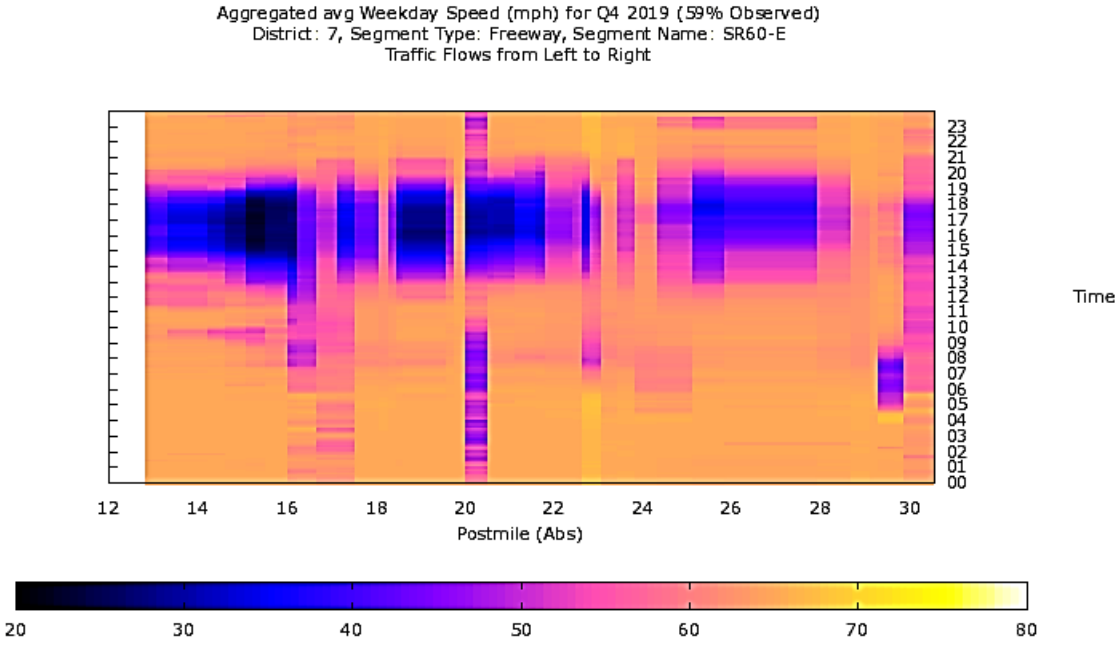
- High truck volume (12-15 percent average, 22 percent at Nogales Street (PM 20.4)) affecting HOV due to reduced freeway operating speeds and friction factor; truck congestion on uphill grades.

- High volume due to the merging of Route 57 and Route 60 together. Field occupancy counts provide visual observations of traffic patterns, whereby the right two lanes are congested with two continuous lines of trucks, leaving other vehicles with only the two left lanes to use. This results in increased violation rates in the HOV lane.

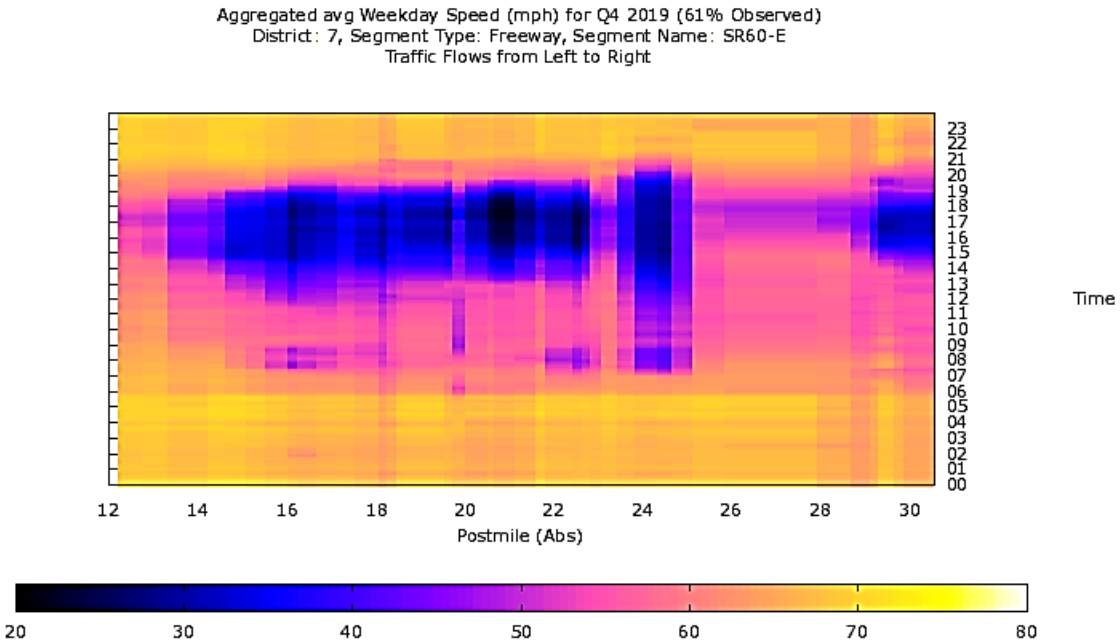
- Demand exceeds capacity, especially eastbound at Grand Avenue (HOV lane reaches 1,624 vehicles/hour during peak hour).

Figures 109 and 110 provide plots of eastbound HOV and GP lane speeds along the length of the HOV facility on Route 60 during the fourth quarter of 2019. Figures 111 and 112 provide plots of westbound HOV and GP lane speeds along the length of the HOV facility on Route 60 during the fourth quarter of 2019.

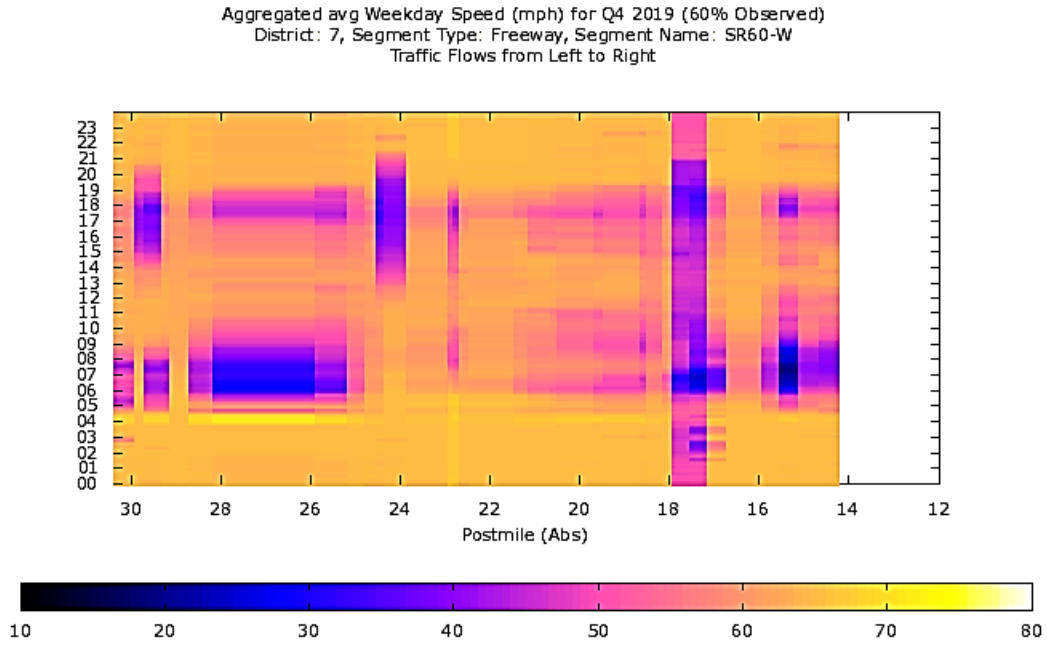
## FIGURE 109. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 60, Q4 2019



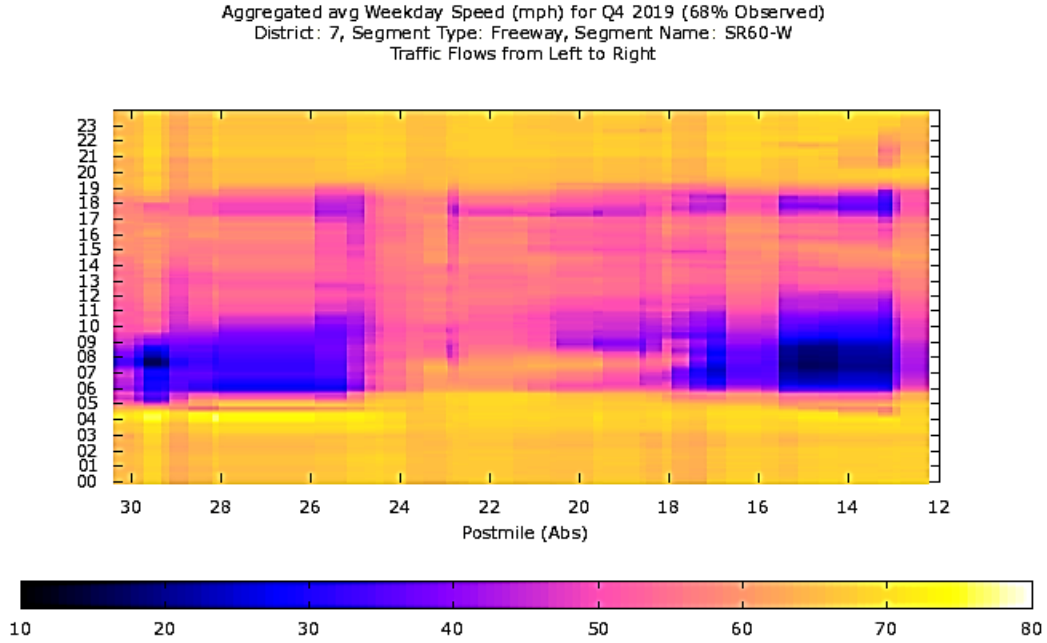

## FIGURE 110. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 60, Q4 2019



## FIGURE 111. AVERAGE HOV LANE SPEED – WESTBOUND ROUTE 60, Q4 2019




## FIGURE 112. AVERAGE GP LANE SPEED – WESTBOUND ROUTE 60, Q4 2019



## B. REMEDIATION STRATEGIES

- Project 07-3101U, Route 605/Route 60 Corridor Improvement Project (CIP), will make the following improvements:

    - Add through-lane at Route 605/Route 60 interchange on Route 60, add through-lane within the Route 605/Route 60 system interchange on Route 60- in the westbound direction

    - Add eastbound Route 60 auxiliary for Route 605 northbound and southbound connectors

    - Add eastbound Route 60 auxiliary lane from northbound Route 605 connector to the Crossroads Parkway off-ramp,

    - Existing eastbound Route 60 auxiliary lane from northbound Route 605 connector will be extended through the Crossroads Parkway interchange to 7th Avenue off-ramp,

    - An additional westbound Route 60 auxiliary lane is proposed from Hacienda Boulevard to 7th Avenue interchange where it joins an existing auxiliary lane (previously from 7th Avenue to Crossroads Parkway),

    - An additional westbound Route 60 auxiliary lane is proposed through Crossroads Parkway interchange until it reaches the northbound and southbound Route 605 connectors.

    Dates for this project: RTL 2025, construction to begin 2028, and completion 2031. The estimated construction cost is $2.8 billion.

- Project 07-27912 proposes freeway improvements to Route 57/60 confluence at the Grand Avenue interchange in Los Angeles County. During the peak periods, demand exceeds the capacity for both routes in the vicinity of the interchange, resulting in delays with Level of Service (LOS) at 'F' for many hours. This project is led by LA Metro and should begin construction in 2022. The estimated construction cost is $263 million. Construction completion expected in 2027.

- Project 07-30110 (PM 2.8R/11.8) includes pavement rehabilitation and stormwater treatment facilities that the Route 605 CIP team has been

coordinating. Anticipated completion in 2025. The estimated construction cost is $135 million

- Project 07-32780 proposes two dedicated truck lanes along the median of Route 60, freeway widening, interchange re-configurations, intersection re-configurations, ramp realignments, structure widening and replacement, retaining wall construction, and Right of Way acquisition. Anticipated completion in 2031.

- The Alameda Corridor-East (ACE) Project, funded by the San Gabriel Valley Council of Governments, will mitigate the impacts of significant increases in freight rail traffic on over 70 miles of mainline railroad in the San Gabriel Valley. The ACE Project consists of a comprehensive program of safety improvements and mobility upgrades at an estimated cost of $1.7 billion. This project will relieve truck traffic from Long Beach and San Pedro to the Inland Empire region,

### 4.3.7 ACTION PLAN FOR HOV FACILITIES ON ROUTE 91

### A. ANALYSIS

- Demand exceeds capacity. Volume reaches 1,630 vehicles/hour in the HOV lane during the peak period.

- Afternoon period recurrent congestion in all lanes reduces HOV lane performance and speed on eastbound. Morning and afternoon peak period recurrent congestion in all lanes reduces HOV lane performance and speed on westbound.

- GP lane drops at Route 710 interchange and Route 605 interchange reduce capacity resulting in a bottleneck.

- Vehicle weaving conflict at ingress/egress locations due to congestion in the GP lanes.

- High violation rates in the westbound direction (approximately 11 percent). Occupancy counts at Wilmington Avenue, (PM 9.16), 2-hour peak period AM westbound direction violation rate is 11 percent; PM eastbound 2-hour peak period violation is 4.2 percent.

Figures 113 and 114 provide plots of eastbound HOV and GP lane speeds along the length of the HOV facility on Route 91 during the fourth quarter of 2019. Figures 115 and 116 provide plots of westbound HOV and GP lane speeds along the length of the HOV facility on Route 91 during the fourth quarter of 2019.

**FIGURE 113. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 91, Q4 2019**

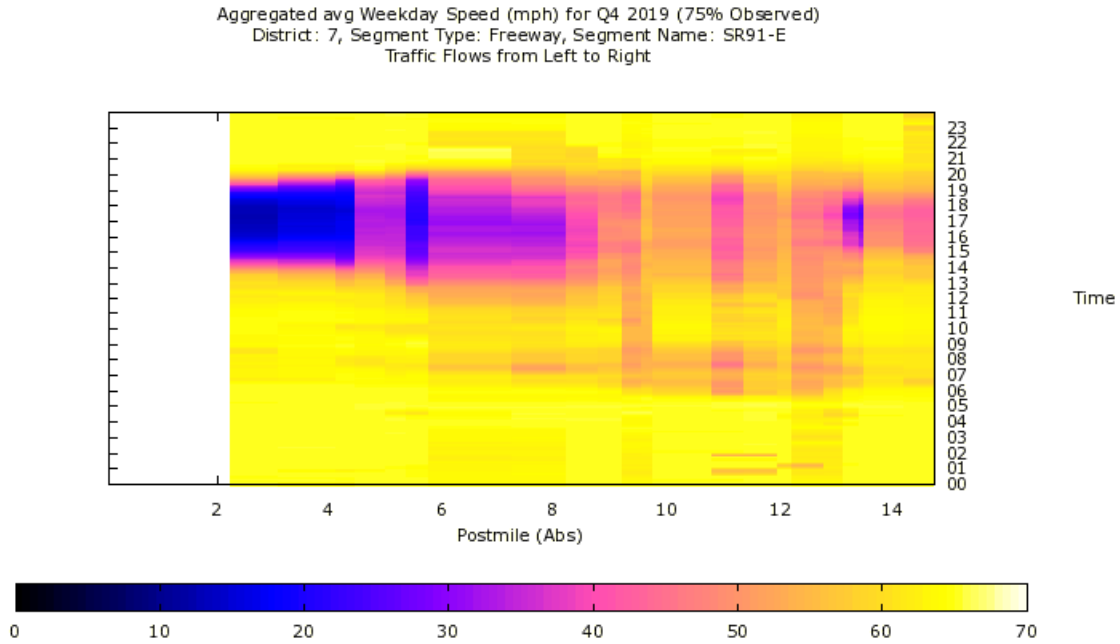
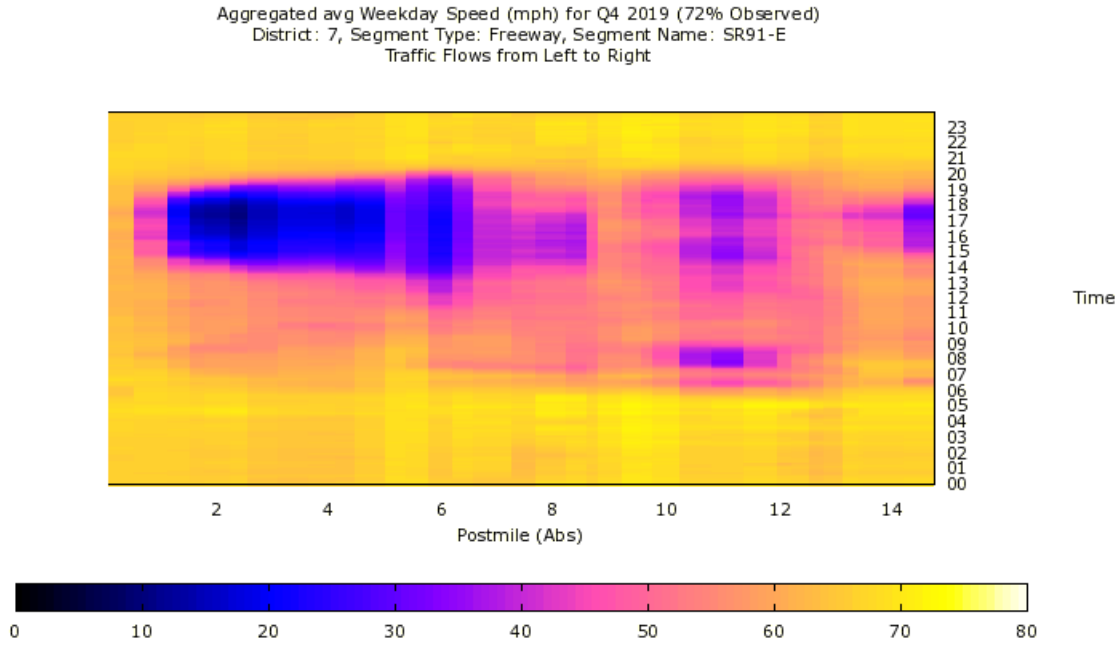
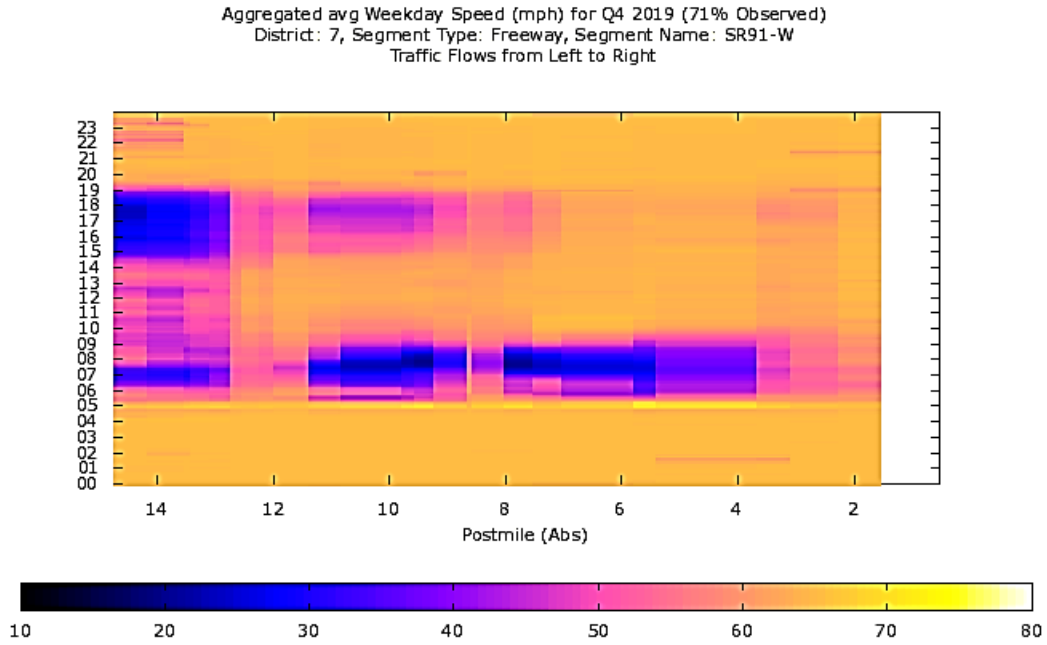


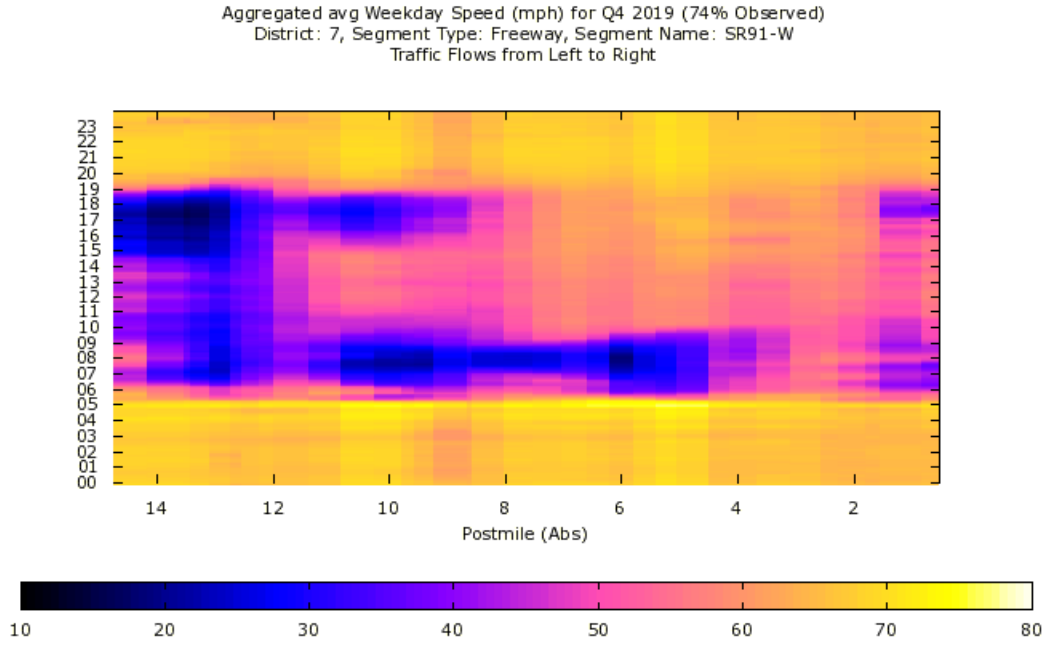

**FIGURE 114. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 91, Q4 2019**



## FIGURE 115. AVERAGE HOV LANE SPEED – WESTBOUND ROUTE 91, Q4 2019




## FIGURE 116. AVERAGE GP LANE SPEED – WESTBOUND ROUTE 91, Q4 2019



## B. REMEDIATION STRATEGIES

- Project 07-29810 will widen the freeway by adding one to two lanes along Route 91 from Paramount Boulevard to Shoemaker Avenue Construction will begin in 2021, with anticipated completion in 2025. The estimated project cost is $450 million.

- The LA Metro West Santa Ana Branch Transit Corridor (WSAB) light rail transit (LRT) line will connect southeast LA County to downtown Los Angeles, serving the cities and communities along Route 5. The WSAB Project is a 19-mile corridor undergoing an Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) process. The current project cost is estimated to be $6.5-$6.6B (in 2018 dollars).

- Project 07-35460 will add one auxiliary lane in the eastbound direction, extending the outside #5 lane beyond the Atlantic Avenue eastbound off-ramp to Cherry Avenue then dropping it before the Cherry Avenue undercrossing, and widening the Orange Avenue and Walnut Avenue The estimated project cost is $6.7 million. Construction will begin in 2022, with anticipated completion in 2024.

- Project 07-35920 proposes to add two frontage road lanes mainly for trucks. This project will address the weaving issues caused by closely spaced on/off-ramp near the system interchange. Closely spaced ramps have created vehicle weaving conflict at ingress/egress locations due to congestion on the GP lanes and frontage road. The estimated project cost is $120 million. Construction will begin in 2024, with anticipated completion in 2025.

- District 7 shared vehicle occupancy count data with the CHP so they can prioritize their enforcement efforts. Enhanced, dedicated, and targeted HOV enforcement including the establishment of enforcement zones.

- HOT lanes are planned for Route 605 between the Orange County Line and Route 10 by 2027. Construction will be funded by Measure R funds and the forthcoming Transportation Strategic Plan-Phase II. The project would also be eligible for federal-aid funding.

- The future GP lane projects (07-29810, 07-35460, and 07-35920) create collector road arterials, eliminating multiple/close proximity of on/off ramps, which will reduce the weaving maneuvers between the HOV and GP lanes.

## 4.3.8 ACTION PLAN FOR HOV FACILITIES ON ROUTE 105

### A. ANALYSIS

- Demand exceeds capacity. During the peak period, the average volume is around 1,600 vehicle/hour. At some locations, the volume reaches between 1,700 and 1,850 vehicles/hour.
- High HOV violation rates from motorists entering/exiting Route 110 HOT lanes on both eastbound and westbound. District 7's 2019 Manual Occupancy Data at Long Beach Boulevard (PM 11.5), near the Route 110 HOT lanes, indicates that SOV's generate violation rates of 17.3 percent in the morning westbound and 13.5 percent in the afternoon eastbound. Further to the east, the violation rates are 11.1 percent in the morning and 10.7 percent in the afternoon eastbound,
- Afternoon peak period recurrent congestion in all lanes reduces HOV lane performance and speed on eastbound, and morning peak period recurrent congestion in all lanes reduces HOV lane performance and speed on westbound.
- Vehicle weaving conflict at ingress/egress locations due to congestion in the GP lanes on westbound.
- GP lane drops eastbound at Prairie Avenue, and South Vermont Avenue, cause bottlenecks on eastbound.
- Congestion in the GP lanes extends into the HOV lane at the end termini on eastbound.
- Possible non-metered on-ramps allowing platoons of vehicles entering the freeway.
- Many defective sensors. There is no data coverage at the end of eastbound between Paramount Boulevard to Carfax Avenue (PM 14.6-17.3) in 2019. In 2020, the segments without data coverage spread to the beginning and end of the HOV facilities in both directions.

### B. REMEDIATION STRATEGIES

- Shared vehicle occupancy count data with the CHP so they can prioritize their enforcement efforts.

- Enhanced, dedicated, and targeted HOV enforcement including the establishment of enforcement zones.
- Modified HOT lane signs in 2019 to include "SOVs must exit". Caltrans will perform a before/after evaluation, using the Fall 2021 occupancy data.
- Project 07-31450 will convert the existing HOV lanes to HOT lanes and add a second HOT lane in each direction. Construction is expected to begin in 2024, with anticipated completion in 2028. The estimated project cost is $600 million.
- The LA Metro West Santa Ana Branch Transit Corridor (WSAB) light rail transit (LRT) line will connect southeast LA County to downtown Los Angeles, serving the cities and communities along Route 5. The WSAB Project is a 19-mile corridor undergoing an Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) process. The current project cost is estimated to be $6.5-$6.6B (in 2018 dollars). This project is expected to relieve traffic congestion on Route 105.
- Project 07-30460 will add active traffic management and traffic monitoring system improvements along Route 105 between Route 605 and Route 1. Project construction began in November 2017; expected completion in June 2022.
- Implement Coordinated Adaptive Ramp Metering strategies. District 7 will receive approximately $8 million in the 2024 SHSMP/SHOPP funding. District 7 has been entering HOV Degradation Mitigation into the Asset Management Tool for existing projects involving ramp work and estimates that about 15 percent of the total DVHD reduction would come from metering the HOV preferential lanes.
- The information regarding defective sensors will be sent to the Office of ITS, which will begin initiating projects to repair defective sensors.

### 4.3.9 ACTION PLAN FOR HOV FACILITIES ON ROUTE 110

### A. ANALYSIS

- The HOV lane was changed to a HOT lane in 2012 by LA Metro. Vehicle volume has increased as a result of the addition of toll-paying vehicles and an increase in violation rates. LA Metro's Pricing Algorithm cannot control

demand, even under "HOV Only" mode due to high occupancy violations. The occupancy violation rate with the self-declaring FasTrak flex transponder has increased over time, as SOVs set the transponder to HOV to avoid paying toll. Approximately 30 to 60 percent of users are not setting the transponder correctly. Manual counts show over 70 percent of vehicles in the HOT lane are SOVs and only 15 percent carpools.

- The conversion of the Route 110 HOV lane into the HOT lanes increased the vehicle volume at the northbound terminus at Adams Boulevard The location was not upgraded to sustain the increase in traffic volumes. Adams Boulevard will continue to be a bottleneck because the release of vehicles depends on traffic signals.

- Congestion in the GP lanes extends into the HOT lane at the northbound terminus.

- Poor data quality. Route 110 northbound only has 6 functional sensors. Route 110 southbound only has 4 functional sensors.

- Southbound 110 HOT direct connect to the eastbound 105 HOV lane is congested during peak hours.

## B. REMEDIATION STRATEGIES

- Caltrans, in partnership with LA Metro, has implemented the following strategies to improve performance:

    - Modified the HOT lane operation by adding channelizers on the buffer striping. The channelizers were almost immediately hit and caused them to dislodge. This became a safety issue for motorists and for maintenance crews. District 7 is assessing the efficacy of the channelizers.

    - Work is ongoing to repair and update the detector system to improve data collection.

    - LA Metro installed the Automatic Vehicle Occupancy Detection System (AVODS) in late 2019, based on Caltrans' violation data, and it has been in the testing phase since June 2020. LA Metro is still not using it for enforcement, which entails sending a letter indicating that transponder is set wrong, and in the future, the toll would be charged.

  - Digital occupancy sign panels on the overhead toll transponder readers that display the transponder setting to assist CHP to enforce vehicle occupancy or toll violations were installed in 2019. These sign panels can be seen from both sides of the display. CHP indicates the sign panels are very useful and more effective than the flashing white and blue lights that were previously used.

  - Increase the minimum toll rate.

  - Place additional signs along the HOT lane to inform motorists of regulations and to deter violators. LA Metro has added additional signs notifying motorists that FasTrak transponders are required to access the HOT lane.

- LA Metro West Santa Ana Branch Transit Corridor (WSAB) light rail transit (LRT) line will connect southeast LA County to downtown Los Angeles, serving the cities and communities along LA-5. WSAB Project is a 19-mile corridor undergoing an Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) process. The current project cost is estimated to be $6.5-$6.6B (in 2018 dollars). This project is expected to relieve traffic congestion on Route 110.

- District 7 is assessing the viability of implementing Dynamic Active Traffic Management through the installation of Dynamic Message Signs above the freeway to display advisory speed limits and actively manage vehicle platoons.

- Caltrans requested that LA Metro repair all the defective sensors on northbound Route 110 HOT lanes. With the upcoming project of HOT lanes Corridors Incident Management Improvement (ECIM) on Route 10 and Route 110, Caltrans will have access to traffic data, cameras, and changeable message signs, expected to be completed by the end of 2021.

- Project 07-31450 will convert the existing HOV lanes on Route 105 to HOT lanes and add a second HOT lane in each direction. Construction is expected to begin in 2024, with anticipated completion in 2028. The estimated project cost is $600 million. This project will relieve congestion between southbound Route 110 HOT direct connect to eastbound Route 105 HOV.

- Beginning next year, LA Metro will prepare the Route 110 HOT Lane Degradation Action Plan.

- The information regarding defective sensors will be sent to the Office of ITS, which will begin initiating projects to repair defective sensors.

### 4.3.10 ACTION PLAN FOR HOV FACILITIES ON ROUTE 118

### A. ANALYSIS

- Afternoon peak period recurrent congestion in all lanes reduces HOV lane performance and speed on eastbound.

- Because the HOV lane ends, the added demand from the Route 405, and the motorists transitioning to Route 5 and/or continuing to Route 210 cause multiple vehicle weaving maneuvers across the freeway.

- Route 118 experiences slight degradation westbound between Route 405 and Route 5 due to:

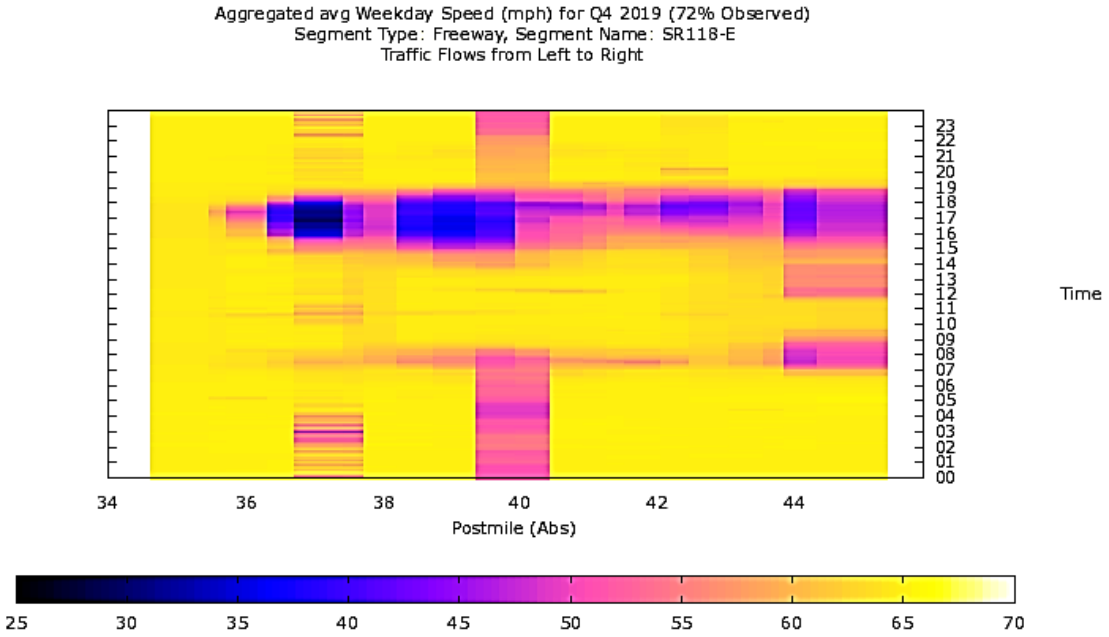
    - Two lane drops on GP lanes (on southbound Route 5) contribute to congestion on GP lanes and then cause the friction factor for the HOV lane.

    - Route 118 HOV lane ends and merges into the GP lane before Route 5.

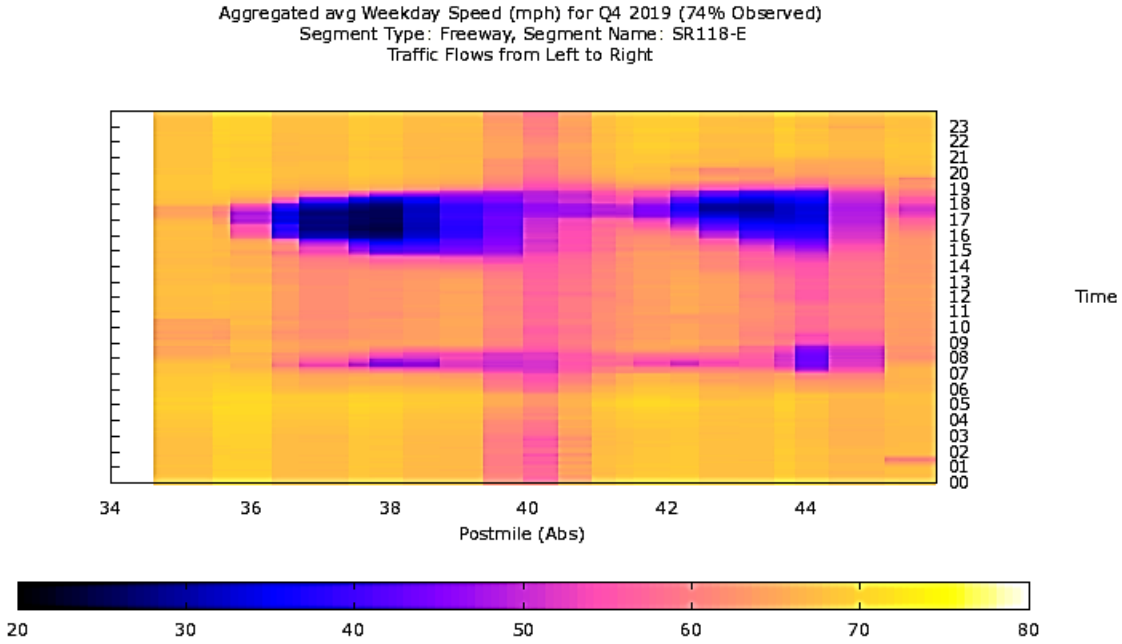
    - High weaving volumes from Route 405.

Figures 117 and 118 provide plots of eastbound HOV and GP lane speeds along the length of the HOV facility on Route 118 during the fourth quarter of 2019.

## FIGURE 117. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 118, Q4 2019




## FIGURE 118. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 118, Q4 2019



## B. REMEDIATION STRATEGIES

- Route 134 is seven miles south of Route 118. Remediation strategies applied to Route 134 will also relieve traffic congestion on Route 118.

- LA Metro is implementing the North Hollywood to Pasadena Bus Rapid Transit (BRT) Corridor, an 18-mile long BRT project which will be a key regional connection between the San Fernando and San Gabriel Valleys with connections to the Metro Red, Orange and Gold Lines, as well as Metrolink and other municipal bus lines. LA Metro has added an Route 134 route option in the Eagle Rock portion of the study area. This project is funded by Measure M and Senate Bill 1, which provide $267 million in funding. The Project has an anticipated opening date in 2024. This project is expected to relieve traffic congestion on Route 118.

- District 7 will review existing lane configuration by June 2022, of the Route 118 eastbound to Route 5 southbound connector ramp, to possibly eliminate the lane drops on the connector.

- The Office of Corridor Management will study by June 2022, possible pavement delineation re-striping to eliminate lane-drop configuration.

### 4.3.11 ACTION PLAN FOR HOV FACILITIES ON ROUTE 134

HOV facilities on Route 134 are split in two at the interchange with Route 5. These action plans cover the entire route.

## A. ANALYSIS

- Afternoon peak period recurrent congestion in all lanes reduces HOV lane performance and speed on eastbound.

- High violation rates (approximately 10 percent). District 7's 2019 Manual Occupancy Data indicates that the HOV violation rate is between 10 and 12 percent during AM/afternoon peak hours at the Pass Avenue (PM 1.82)

- Eastbound Route 134 has no direct freeway connector to northbound Route 5. Motorists must exit the freeway onto local streets to get onto northbound Route 5. Off-ramp back up, lane reduction, and end of HOV lane.

- Vehicle weaving conflict at Route 5 interchange.

- Westbound HOV lane ends at Route 101, and the number of lanes reduces from five lanes down to two causing traffic congestion.

Figures 119 and 120 provide plots of eastbound HOV and GP lane speeds along the length of the HOV facility on Route 134 during the fourth quarter of 2019. Figures 121 and 122 provides plots of the westbound HOV and GP lane speeds along the length of the HOV facility on Route 134 during this same period.

## B. REMEDIATION STRATEGIES

- LA Metro is implementing the North Hollywood to Pasadena Bus Rapid Transit (BRT) Corridor, an 18 mile long BRT project which will be a key regional connection between the San Fernando and San Gabriel Valleys with connections to the Metro Red, Orange and Gold Lines, as well as Metrolink and other municipal bus lines. LA Metro has added a Route 134 route option in the Eagle Rock portion of the study area. This project is funded by Measure M and Senate Bill 1, which provide $267 million in funding. The Project has an anticipated opening date in 2024. This project is expected to relieve traffic congestion on Route 134.

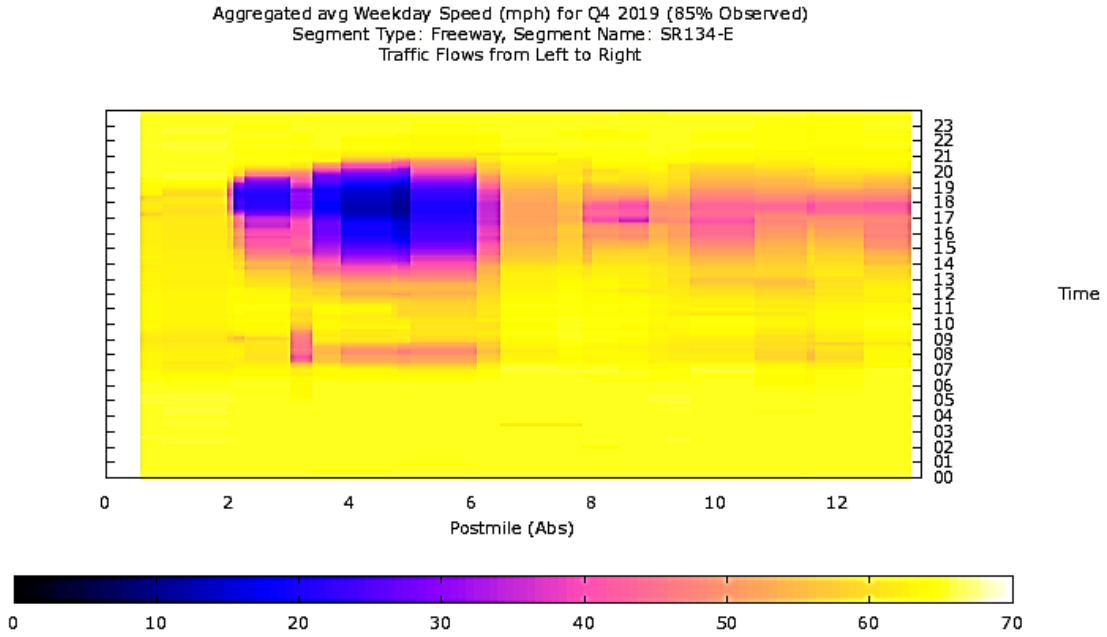
- Shared vehicle occupancy count and violation data with the CHP so they can prioritize their enforcement efforts.

- Enhanced, dedicated, and targeted HOV enforcement including the establishment of enforcement zones.

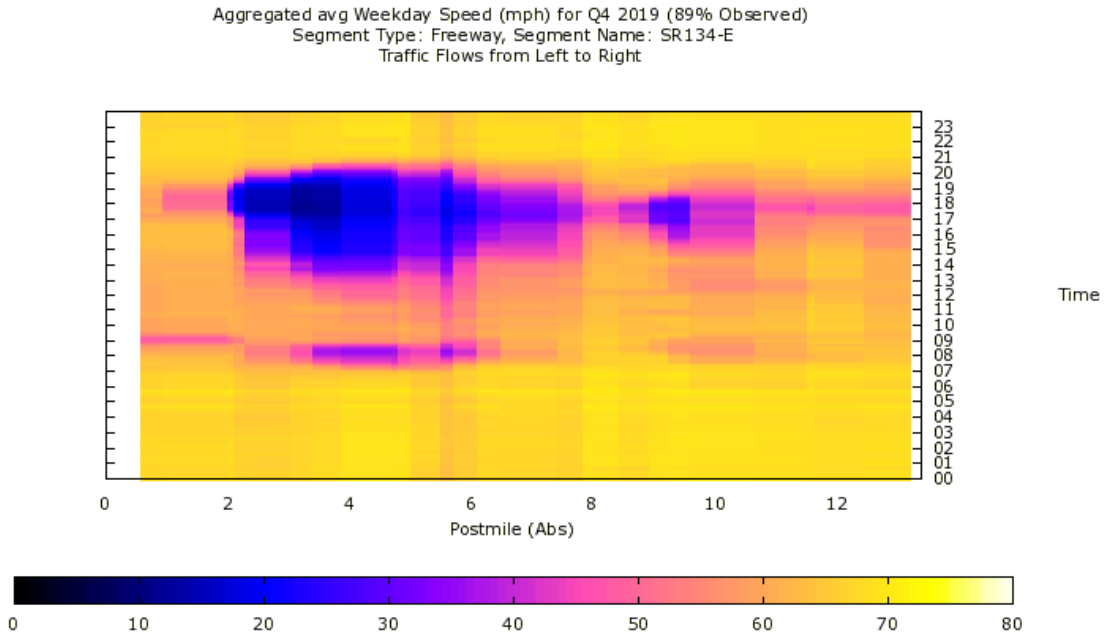
- Interchange improvements at Route 5 including, but not limited to, construction of direct HOV connectors, ramp widenings, or truck climbing lanes.

Interchange improvements at Route 101 including, but not limited to, the construction of direct HOV connectors.

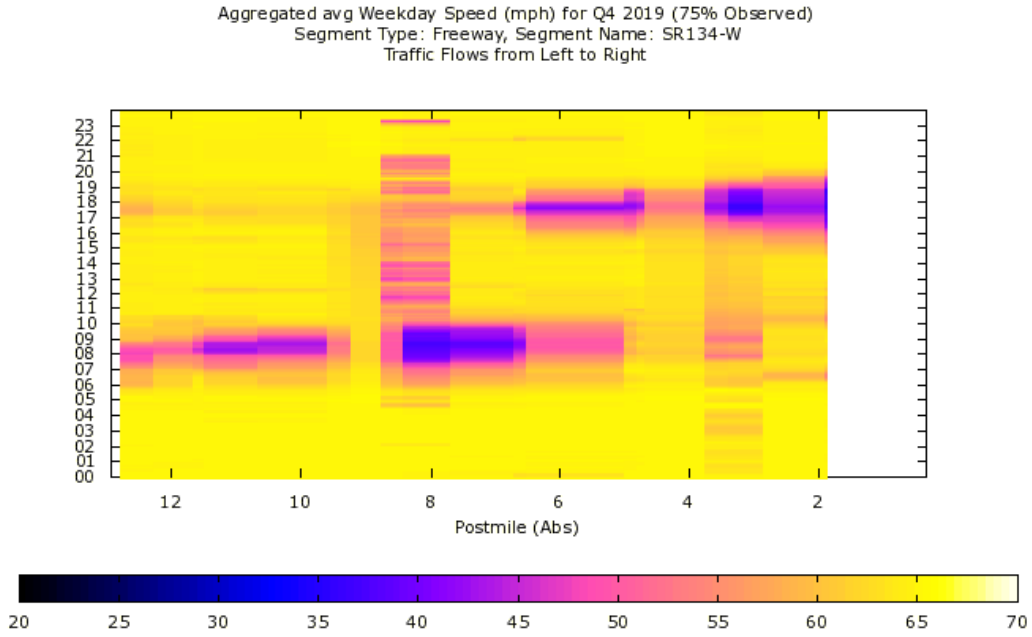
## FIGURE 119. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 134, Q4 2019



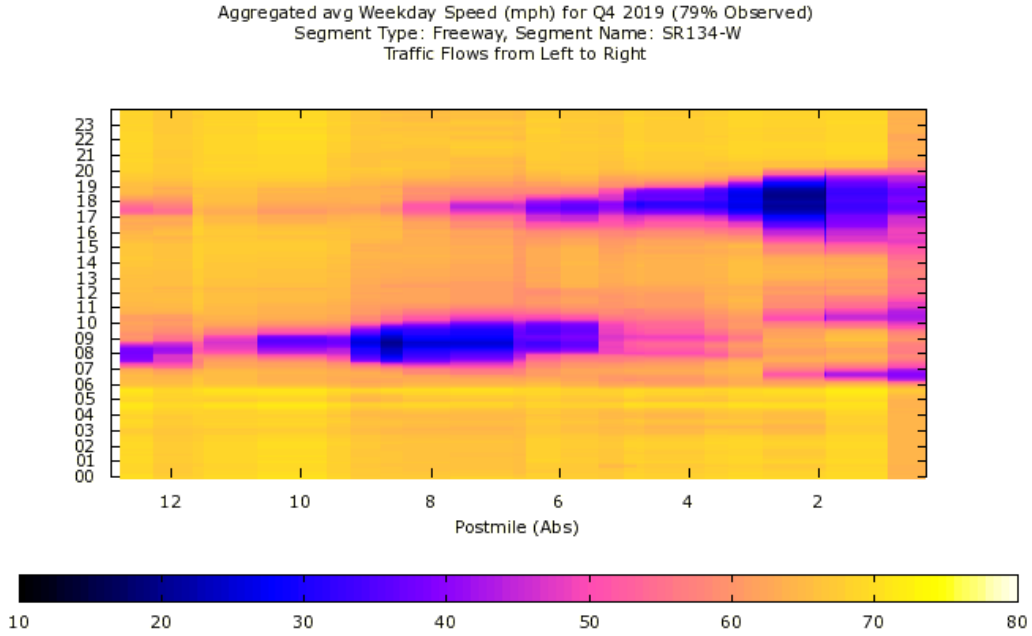

## FIGURE 120. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 134, Q4 2019



## FIGURE 121. AVERAGE HOV LANE SPEED – WESTBOUND ROUTE 134, Q4 2019




## FIGURE 122. AVERAGE GP LANE SPEED – WESTBOUND ROUTE 134, Q4 2019



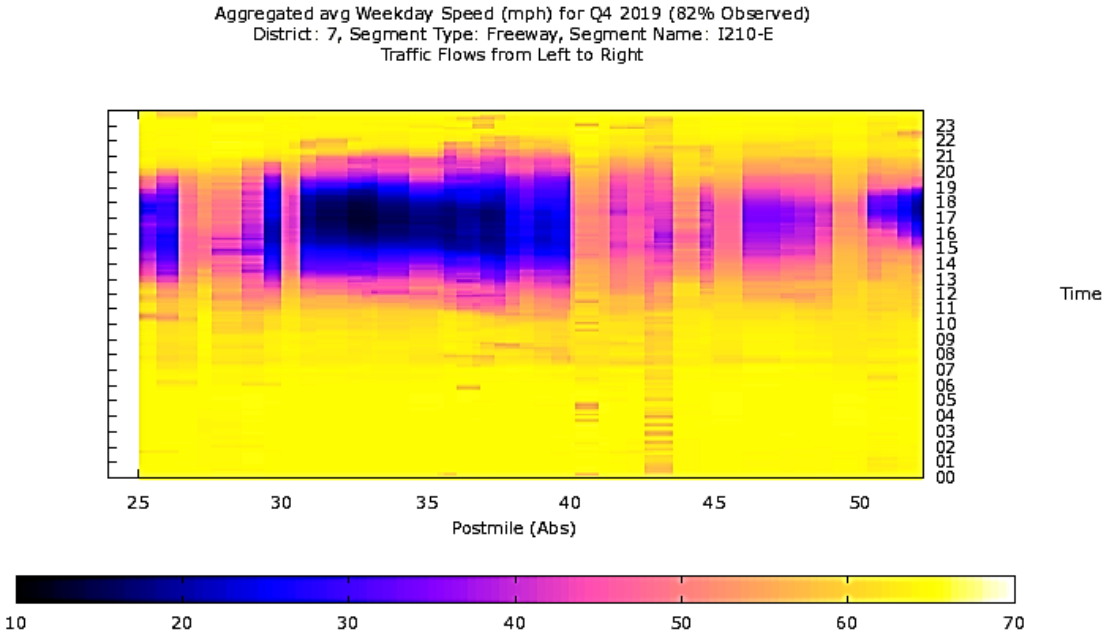
## 4.3.12 ACTION PLAN FOR HOV FACILITIES ON ROUTE 210

## A. ANALYSIS

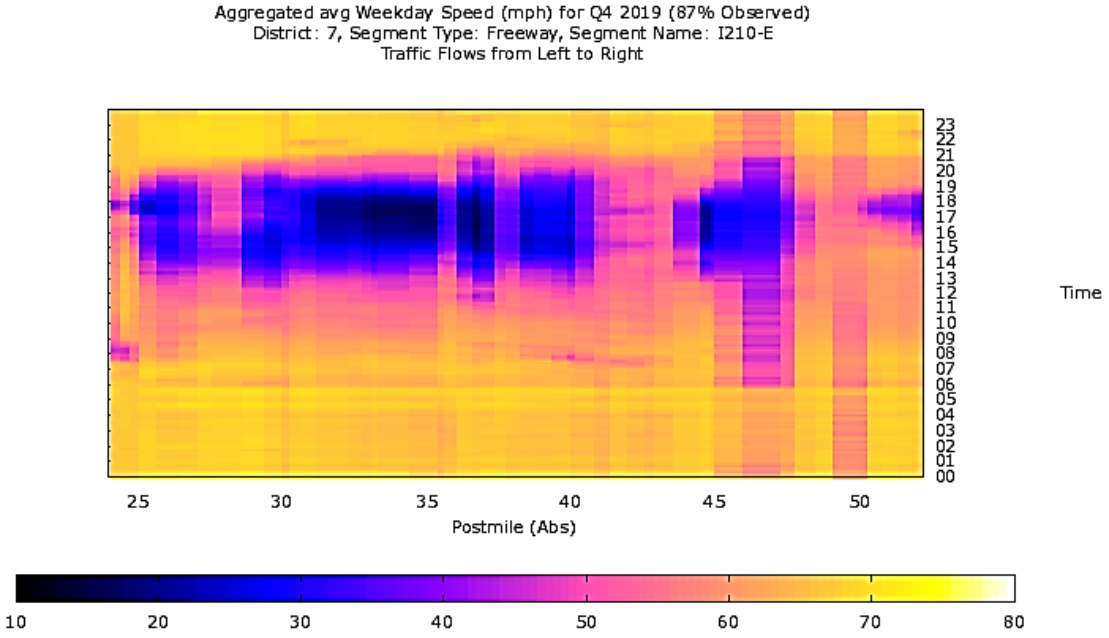
- Demand exceeds capacity. During the peak period, the average volume of the HOV lane reaches 1,525 vehicles/hour in congested locations.
- afternoon peak period recurrent congestion in all lanes reduces HOV lane performance and speed on eastbound, and morning peak period recurrent congestion in all lanes reduces HOV lane performance and speed on westbound.
- Eastbound GP lane drops at El Molino Avenue, Rosemead Boulevard, and San Dimas Avenue causing bottlenecks.
- Vehicle weaving conflicts at ingress/egress locations due to congestion in the GP lanes.
- Route 210 has a very high truck volume (approximately 6 percent) that connects the Port of Los Angeles to northern Los Angeles County.

Figures 123 and 124 provide plots of eastbound HOV and GP lane speeds along the length of the HOV facility on Route 210 during the fourth quarter of 2019. Figures 125 and 126 provide plots of westbound HOV and GP lane speeds along the length of the HOV facility on Route 210 during the fourth quarter of 2019.

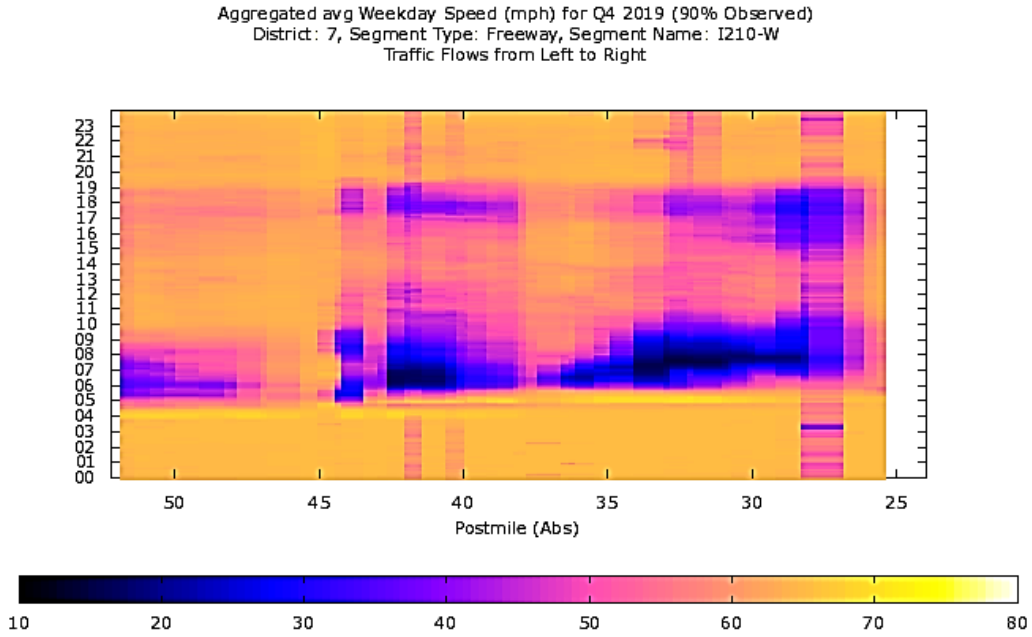
## FIGURE 123. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 210, Q4 2019



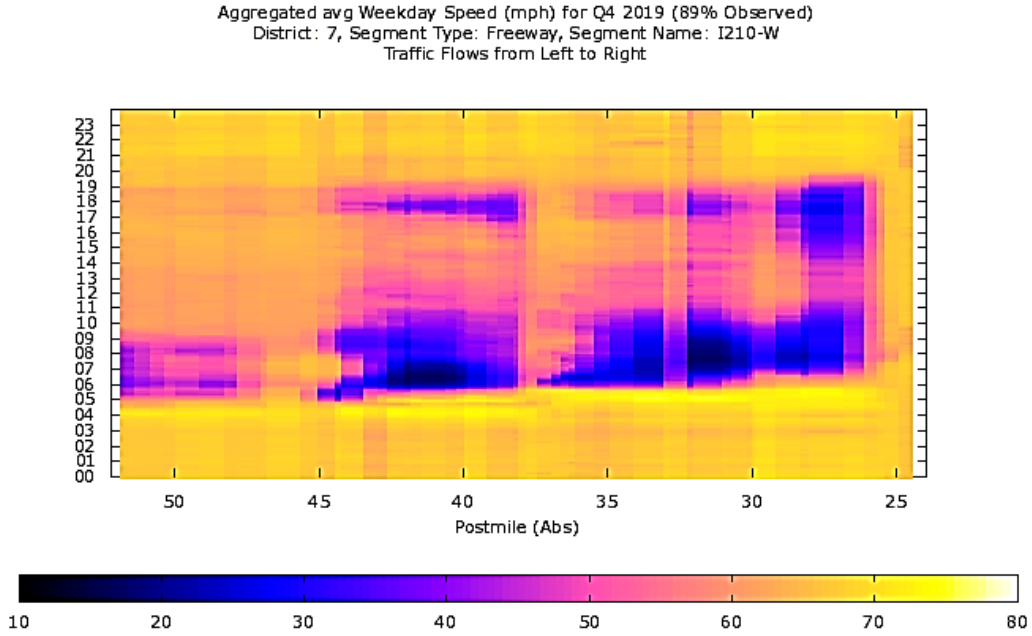

## FIGURE 124. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 210, Q4 2019



## FIGURE 125. AVERAGE HOV LANE SPEED – WESTBOUND ROUTE 210, Q4 2019




## FIGURE 126. AVERAGE GP LANE SPEED – WESTBOUND ROUTE 210, Q4 2019



## B. REMEDIATION STRATEGIES

- District 7 is establishing the Connected Corridor (Contract #74A0842). This will involve the coordination between Caltrans, local agencies, the CHP, first responders for incident management, construction activities, and special events. The project includes ramp metering synchronization, traffic signal synchronization, Transportation Management System, and Intelligent Transportation System. Implementation planned for 2022.

- Increase public awareness. Update HOV violation fine amount on the existing signs to the current value.

- The Foothill Gold Line project from Glendora to Montclair will extend the Metro Gold Line 12.3 miles and add stations in the cities of along LA-210. Major construction began in mid-July 2020 and is expected to be completed to Pomona in 2025 (and to Montclair in 2028, if funding is secured in time to move forward with the contract option). Completion of the Glendora to Montclair segment is now estimated to cost $2.1 billion. Gold Line Foothill Extension's (LA-210-36/53 (07-33120)) expanded transit service along the Interstate 210 corridor will address transportation problems, deficiencies and help relieve traffic congestion.

- Implement access strategies, including increasing the length of access area or frequency of access, continuous access, or modification/elimination of bottlenecks such as ingress/egress locations.

- Alameda Corridor-East (ACE) Project founded by The San Gabriel Valley Council of Governments (SGVCOG) will mitigate the impacts of significant increases in freight rail traffic on over 70 miles of mainline railroad in the San Gabriel Valley. The ACE Project consists of a comprehensive program of safety improvements and mobility upgrades at an estimated cost of $1.7 billion. This project will relieve truck traffic from Long Beach and San Pedro to Inland Empire region.

- Perform continuous analysis, keeping a record of sensors repeatedly detected as erroneous. Perform ongoing monitoring to detect misconfigurations before they are used in performance reporting. Explore a second data source to determine HOV speeds/degradation. In addition, the information regarding defective sensors will be sent to the Office of ITS, which will begin initiating projects to repair defective sensors.

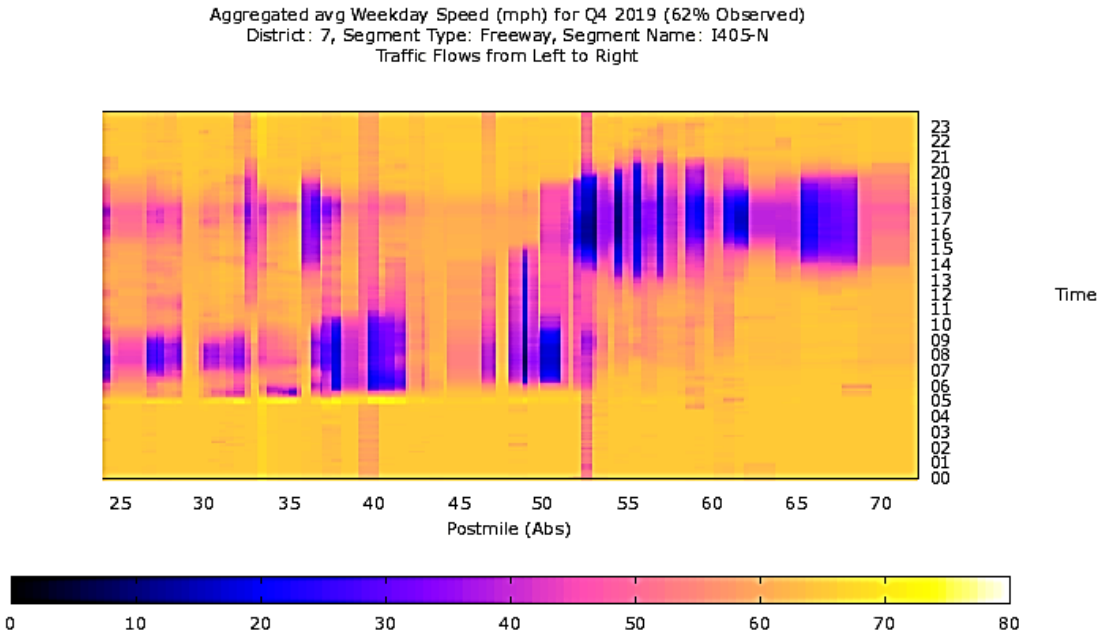
## 4.3.13 ACTION PLAN FOR HOV FACILITIES ON ROUTE 405

## A. ANALYSIS

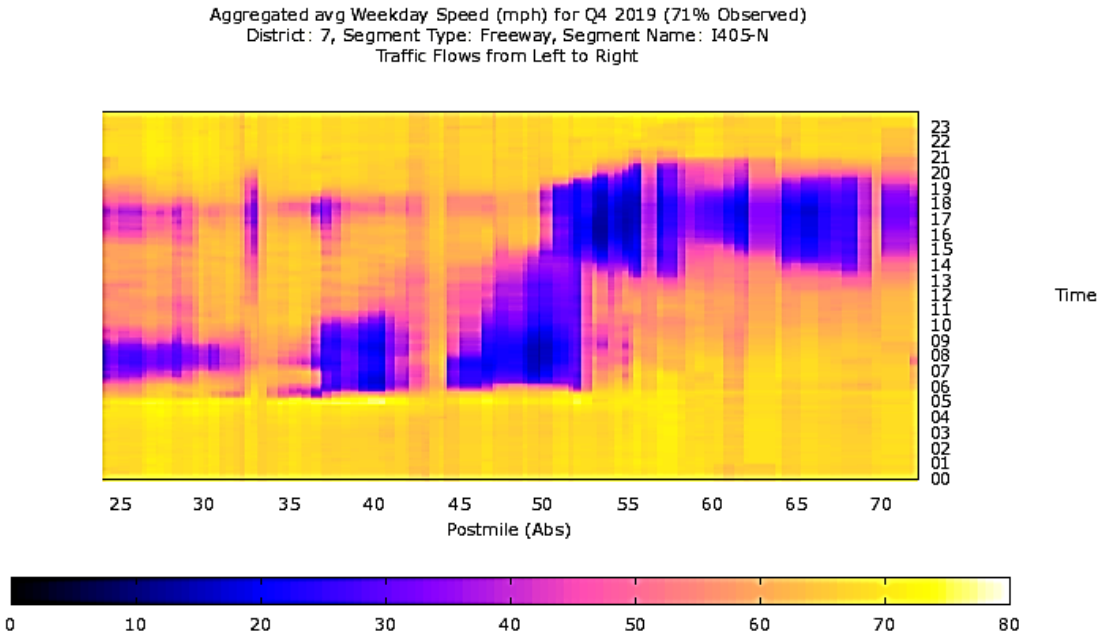
- Demand exceeds capacity. During the peak period, the average HOV lane volume is 1,600 vehicles/hour in congested locations. In some locations, the maximum HOV lane volume reaches 1,800-2,000 vehicles/hour.
- Peak period recurrent congestion in all lanes reduces HOV lane performance and speed. There are two extremely degraded segments. One is located between Route 10 and Victory Boulevard (PM 53-64) during the afternoon peak period on northbound and morning peak period on southbound. The other is between Wilmington Avenue and N. Yukon Avenue (PM 33.2-40.0) during the afternoon peak period on southbound.
- With narrow buffers between HOV/HOT and GP lanes, congestion or slow-down in GP lanes causes friction on HOV lanes. During the afternoon peak hour period, the average GP and HOV speeds on northbound are 25.4 mph and 31.9 mph respectively (PM 53-64).
- Vehicle weaving conflict at ingress/egress locations due to congestion in the GP lanes on southbound.
- GP lane drops approaching the Route 110 interchange, causing a bottleneck on southbound.
- Possible non-metered on-ramps allowing platoons of vehicles entering the freeway.
- High percentage of decal vehicles (exceeds 20 percent in some locations).

Figures 127 and 128 provide plots of northbound HOV and GP lane speeds along the length of the HOV facility on Route 405 during the fourth quarter of 2019. Figures 129 and 130 provide plots of southbound HOV and GP lane speeds along the length of the HOV facility on Route 405 during the fourth quarter of 2019.

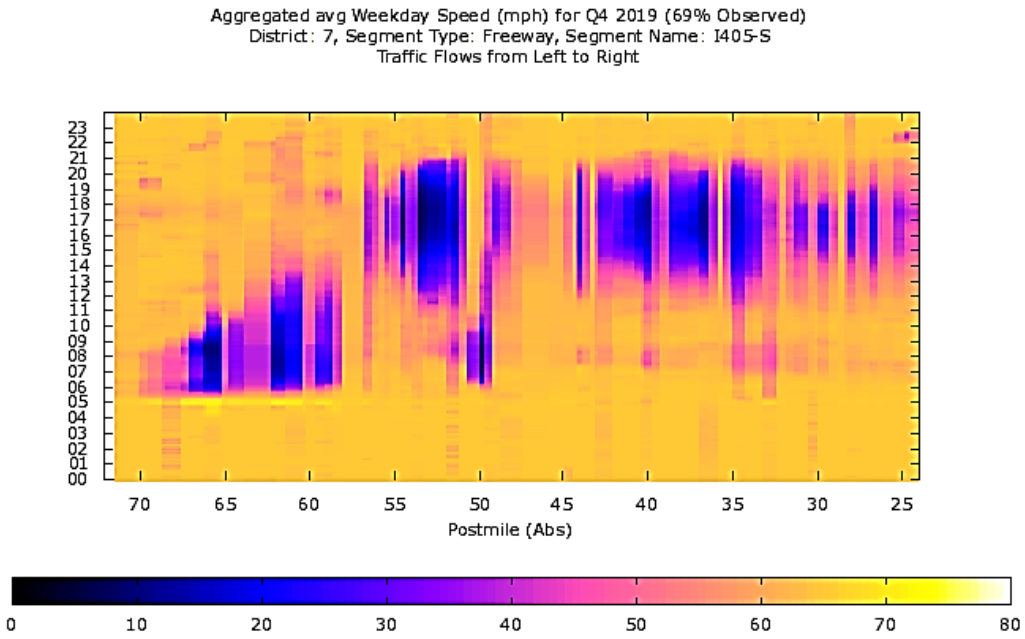
## FIGURE 127. AVERAGE HOV LANE SPEED – NORTHBOUND ROUTE 405, Q4 2019



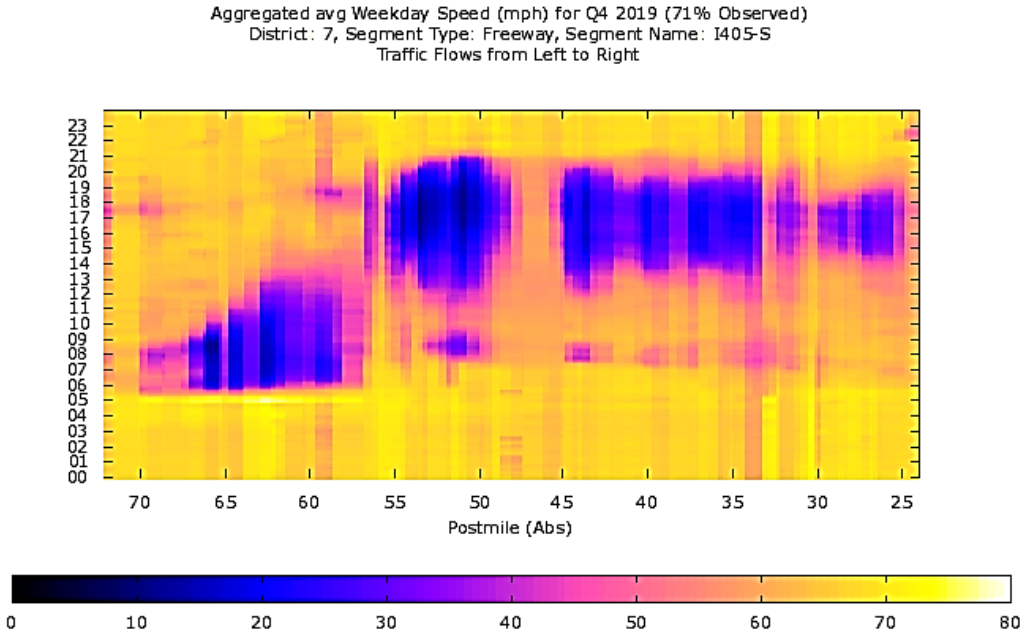

## FIGURE 128. AVERAGE GP LANE SPEED – NORTHBOUND ROUTE 405, Q4 2019



## FIGURE 129. AVERAGE HOV LANE SPEED – SOUTHBOUND ROUTE 405, Q4 2019




## FIGURE 130. AVERAGE GP LANE SPEED – SOUTHBOUND ROUTE 405, Q4 2019



## B. REMEDIATION STRATEGIES

- Project 07-35310K adds auxiliary lanes in both directions of Route 405 between the interchanges of Redondo Beach and Hawthorne Boulevard, Hawthorne Boulevard and Inglewood Avenue, and Inglewood Avenue and Rosecrans Avenue to improve traffic operations and enhance safety through the corridor. Project will be developed by LA Metro. Construction expected to begin late 2022; expected to end in 2025. The estimated construction cost is $120 million.

- Project 07-29360 will improve the Route 405/Crenshaw interchange. The northbound off-ramp backs up onto the mainline. The project will include improvements to on/off ramps plus widening and adding an auxiliary lane. (Construction expected to begin in late 2020; expected to end in 2024). The estimated construction cost is $70 million.

- Project 07-23400 will widen Route 405 at the Dominguez Channel (addition of auxiliary lane), includes the new addition of northbound Route 405 on-ramp at Wilmington Avenue, ramp modifications and widening of Wilmington Avenue from East 223rd Street to East 220th Street, a bridge retrofit over Dominguez Channel and traffic signal synchronization. Begin construction 2014; end construction 2021. The estimated construction cost is $20 million.

- Add connector metering and ramp metering between Route 105 to Route 90 interchanges. Meter HOV preferential lanes at on-ramps. Work is in progress. Various routes are in different stages subject to project funding within the corridor. District 7 will receive approximately $8 million in the 2024 SHSMP/SHOPP funding. District 7 has been entering HOV Degradation Mitigation into the Asset Management Tool for existing projects involving ramp work and estimates that about 15 percent of the total DVHD reduction would come from metering the HOV preferential lanes.

- Project 07-35070 provides active traffic management and related traffic management system upgrades along Route 405 near LAX/Route 105, RTL is projected for October 2023, PA&ED August 2021; contract completion is anticipated May of 2027.

- Improvements along the Route 405 South Bay Curve: LA Metro plans new auxiliary lanes to improve traffic flow at on- and off-ramps. Completion would be accelerated from 2027 to 2028.

- LA Metro plans to extend service on the Green and Crenshaw/LAX Lines 4.6 miles southward to a new transit center in Torrance. This South Bay Light Rail Extension project is part of the "28 by 28" initiatives. This project will relieve the congestion on Route 405.

- Project 07-35432 will convert the HOV lanes on Route 405 between the LA/Orange County Line and Route 10 to HOT lanes. Target completion 2035.

- Project 07-35433 will convert the HOV lanes on Route 405 between Route 10 and Route 101 to HOT lanes. Target completion 2028.

- District 7 is monitoring the impact that the decal program has on the level of degradation.

- The Office of Corridor Management will study by June of 2022, possible pavement delineation re-striping to eliminate lane-drop configuration.

- Perform continuous analysis, keeping a record of sensors repeatedly detected as erroneous. Perform ongoing monitoring to detect misconfigurations before they are used in performance reporting. Explore a second data source to determine HOV speeds/degradation. In addition, the information regarding defective sensors will be sent to the Office of ITS, which will begin initiating projects to repair defective sensors.

### 4.3.14 ACTION PLAN FOR HOV FACILITIES ON ROUTE 605

### A. ANALYSIS

- Demand exceeds capacity. During the peak period, the average HOV lane volume is above 1,600 vehicles/hour in congested locations. The maximum HOV lane volume reaches 2,405 vehicles/hour.

- Afternoon peak period recurrent congestion in all lanes reduces northbound HOV lane performance and speed between Rosecrans Avenue and Valley Boulevard (PM 9.0-20.8). AM and afternoon peak period recurrent congestion in all lanes reduces southbound HOV lane performance and speed for the same location. (37.9/28.6 mph GP vs. 40 mph HOV).

- When there is a narrow buffer between the HOV and GP lanes, congestion or slow-down in GP lanes causes friction on HOV lanes. During morning peak period, between Rosecrans Avenue and Valley Boulevard (PM 9.0-20.8), the

average GP and HOV speeds southbound are 37.9 and 40.0 mph respectively. During afternoon peak period for the same location and direction, the average GP and HOV speeds southbound are 23.8 and 27.6 mph respectively.

- High vehicle volumes from Route 5 cause congestion in the northbound GP lanes.
- GP lane drops southbound at Route 5 interchange cause a bottleneck.
- Vehicle weaving conflict at ingress/egress locations due to congestion in the GP lanes.
- Possible non-metered on-ramps allowing platoons of vehicles entering the freeway.
- There are many defective sensors, which cause no data coverage on some segments, especially on southbound. Two big gaps have been found. One is between Noyes Street and south of Route 60 (PM 16.942-19.152); the other is between Artesia Boulevard and Placia PI (PM 7.0-13)

## B. REMEDIATION STRATEGIES

- HOT lanes are proposed for Route 605 between the Orange County line and Route 10. Construction will be funded by Measure R funds and the forthcoming Transportation Strategic Plan-Phase II. The project would also be eligible for federal-aid funding. This project would be implemented in several stages:
    - Project 07-29821 will add one or two HOV or HOT lanes on Route 605 from Rosecrans Avenue to Slauson Avenue in the cities of Downey, Norwalk, and Santa Fe Springs. This project also includes the construction of new HOV or HOT direct connectors between the HOV/HOT lanes on Route 605 and Route 105. Begin construction February 2028; end construction January 2031. Construction cost estimate is $ 2.1billion.
    - Project 07-3101U will widen Route 605 to add one GP lane and one HOV or HOT lane in each direction between Slauson Avenue and Route 10. Begin construction February 2028; end construction January 2031. Construction cost estimate is $ 2.8 billion.

  - Project 07-29810 will widen Route 91 by adding one to two lanes along Route 91 from Paramount Boulevard to Shoemaker Avenue The project also includes capacity enhancement on Route 605 between Centralia Street to Rosecrans Avenue The project begins construction in August 2021 and ends construction in September 2025. Project cost is estimated at $450 million.

- Alameda Corridor-East (ACE) Project founded by The San Gabriel Valley Council of Governments (SGVCOG) will mitigate the impacts of significant increases in freight rail traffic on over 70 miles of mainline railroad in the San Gabriel Valley. The ACE Project consists of a comprehensive program of safety improvements and mobility upgrades at an estimated cost of $1.7 billion. This project will relieve truck traffic from Long Beach and San Pedro to the Inland Empire region.

- Implement access strategies, including increasing the length of access area or frequency of access, continuous access, or modification/elimination of bottlenecks such as ingress/egress locations.

- Meter HOV preferential lanes at on-ramps. Work is in progress. Various routes are in different stages subject to project funding within the area. District 7 will receive approximately $8 million in the 2024 SHSMP/SHOPP funding. District 7 has been entering HOV Degradation Mitigation into the Asset Management Tool for existing projects involving ramp work and estimates that about 15 percent of the total DVHD reduction would come from metering the HOV preferential lanes.

- Office of Corridor Management will study by June 2022, possible pavement delineation re-striping to eliminate lane-drop configuration.

- Perform continuous analysis, keeping a record of sensors repeatedly detected as erroneous. Perform ongoing monitoring to detect misconfigurations before they are used in performance reporting. Explore a second data source to determine HOV speeds/degradation. In addition, the information regarding defective sensors will be sent to the Office of ITS, which will begin initiating projects to repair defective sensors.

## 4.4. DISTRICT 8 DEGRADATION ACTION PLANS

### 4.4.1 SUMMARY OF DEGRADATION ON HOV FACILITIES IN DISTRICT 8

Table 36 provides the list of degraded facilities in District 8 that were identified in the 2019 California High Occupancy Vehicle Facilities Degradation Report and Action Plan. The speed and degradation profiles for each degraded facility are provided in Figures 131 through 145.

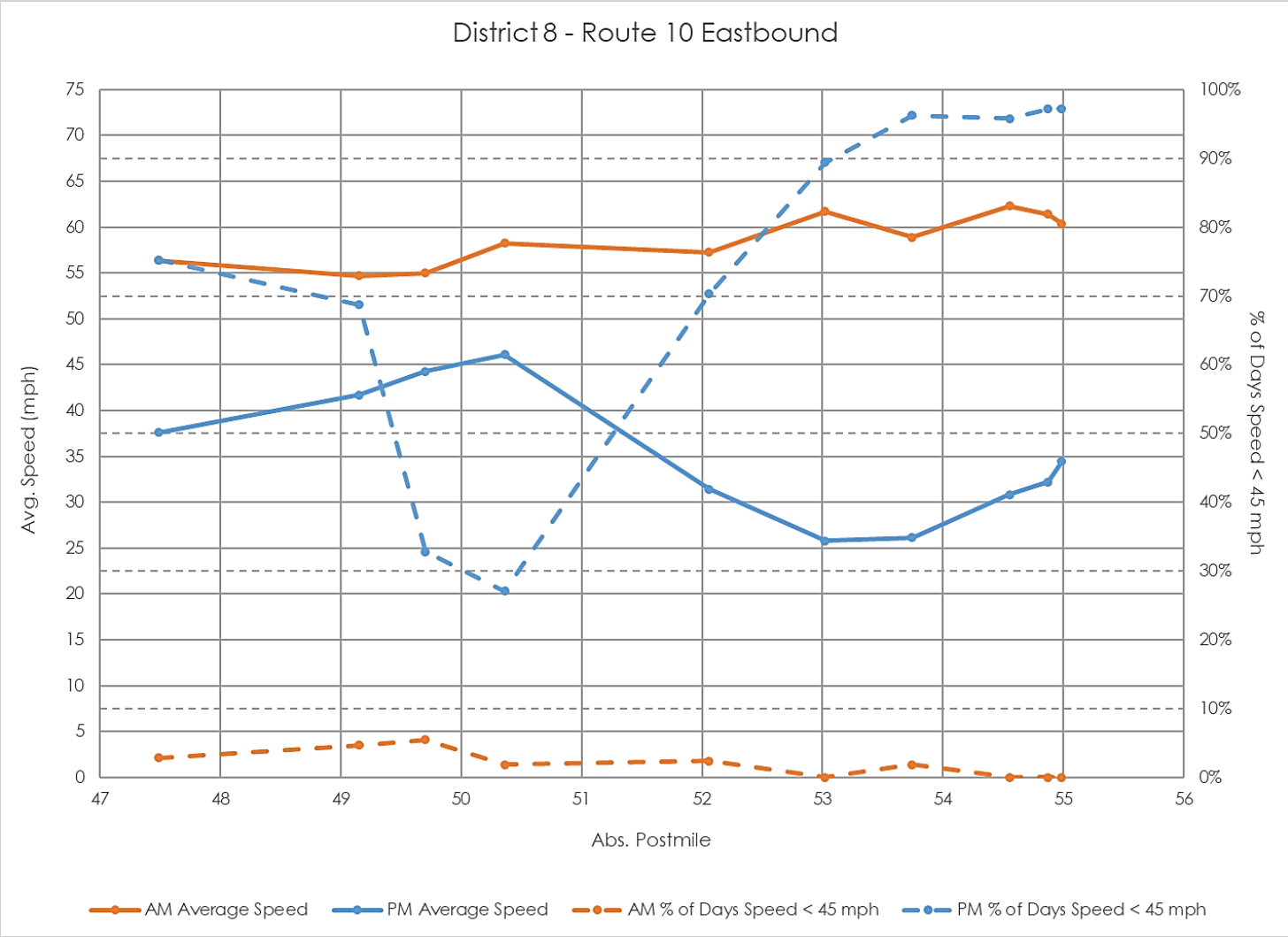
**TABLE 35. DISTRICT 8 LIST OF DEGRADED HOV FACILITIES**

| Route | Direction | Limits | Facility length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 10 | EB | Los Angeles County Line to Haven Ave | 8.3 | 6.4 | AM-6.4<br>PM-0.0 | AM-0.0<br>PM-1.5 | AM-0.0<br>PM-1.3 | AM-0.0<br>PM-3.6 |
| 10 | WB | Haven Ave to Los Angeles County Line | 8.5 | 6.0 | AM-0.6<br>PM-2.9 | AM-1.9<br>PM-2.0 | AM-3.5<br>PM-1.0 | AM-0.0<br>PM-0.1 |
| 60 | EB | Los Angeles County Line to West Jct Route 215 | 22.4 | 10.9 | AM-9.5<br>PM-3.0 | AM-0.5<br>PM-0.3 | AM-0.9<br>PM-0.5 | AM-0.0<br>PM-7.1 |
| 60 | EB | East Jct Route 215 to Redlands Blvd | 7.3 | 7.1 | AM-7.1<br>PM-4.8 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-2.3 |
| 60 | WB | Redlands Blvd to East Jct Route 215 | 8.1 | 6.9 | AM-4.2<br>PM-6.9 | AM-0.5<br>PM-0.0 | AM-1.0<br>PM-0.0 | AM-1.2<br>PM-0.0 |
| 60 | WB | West Jct Route 215 To Los Angeles County Line | 22.1 | 9.8 | AM-1.8<br>PM-5.9 | AM-4.1<br>PM-2.2 | AM-2.0<br>PM-1.3 | AM-1.9<br>PM-0.4 |
| 71 | SB | Los Angeles County Line to north of Butterfield Ranch Rd | 7.1 | 6.3 | AM-5.7<br>PM-5.7 | AM-0.6<br>PM-0.0 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.6 |
| 91 | EB | Orange County Line to Route 15 | 16.5 | 9.2 | AM-9.2<br>PM-7.6 | AM-0.0<br>PM-1.6 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 91 | EB | 1 mile east of Route 15 to Route 215 | 13.4 | 10.3 | AM-4.4<br>PM-3.0 | AM-4.0<br>PM-0.7 | AM-1.8<br>PM-2.4 | AM-0.0<br>PM-4.2 |
| 91 | WB | Route 215 to 0.7 mi east of Route 15 | 14.0 | 11.0 | AM-8.6<br>PM-2.5 | AM-2.3<br>PM-4.7 | AM-0.0<br>PM-2.4 | AM-0.0<br>PM-1.4 |

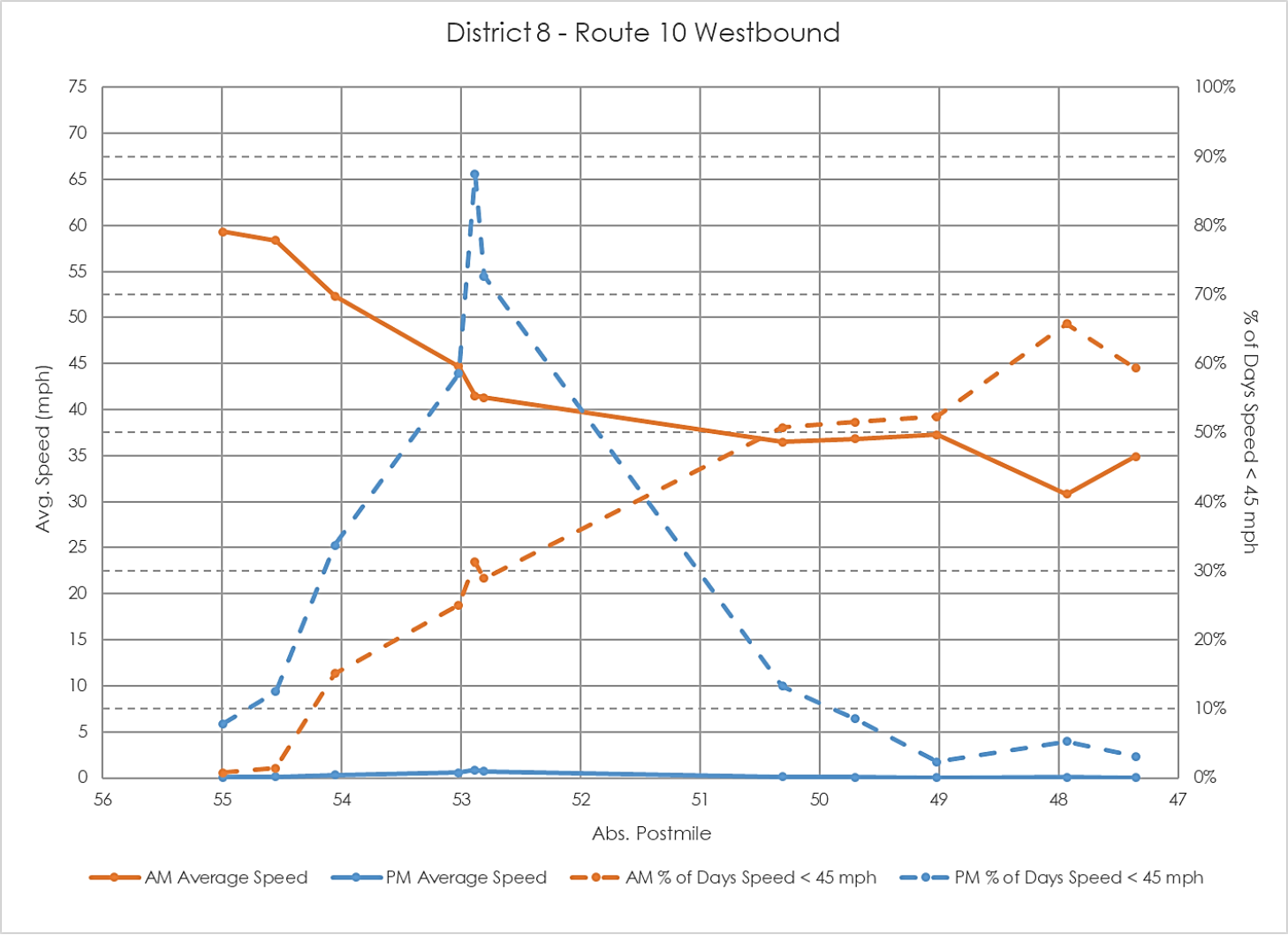
| Route | Direction | Limits | Facility length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 91 | WB | Route 15 to Orange County Line | 16.4 | 10.2 | AM-8.7<br>PM-10.2 | AM-1.4<br>PM-0.0 | AM-0.2<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 210 | EB | Los Angeles County Line to Route 215 | 21.3 | 20.3 | AM-19.8<br>PM-7.6 | AM-0.4<br>PM-3.5 | AM-0.0<br>PM-2.4 | AM-0.0<br>PM-6.8 |
| 210 | WB | Route 215 to SBD/LA County Line | 21.5 | 20.4 | AM-9.5<br>PM-14.7 | AM-4.8<br>PM-5.7 | AM-5.1<br>PM-0.0 | AM-1.0<br>PM-0.0 |
| 215 | NB | South Jct Route 60 to Route 210 | 16.3 | 15.0 | AM-10.5<br>PM-7.9 | AM-2.2<br>PM-3.2 | AM-0.0<br>PM-1.7 | AM-2.3<br>PM-2.2 |
| 215 | SB | Route 210 to South Jct Route 60 | 16.3 | 15.3 | AM-10.7<br>PM-8.0 | AM-2.3<br>PM-0.6 | AM-2.0<br>PM-0.3 | AM-0.3<br>PM-6.3 |

EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound
Lane-miles may not add up exactly due to rounding

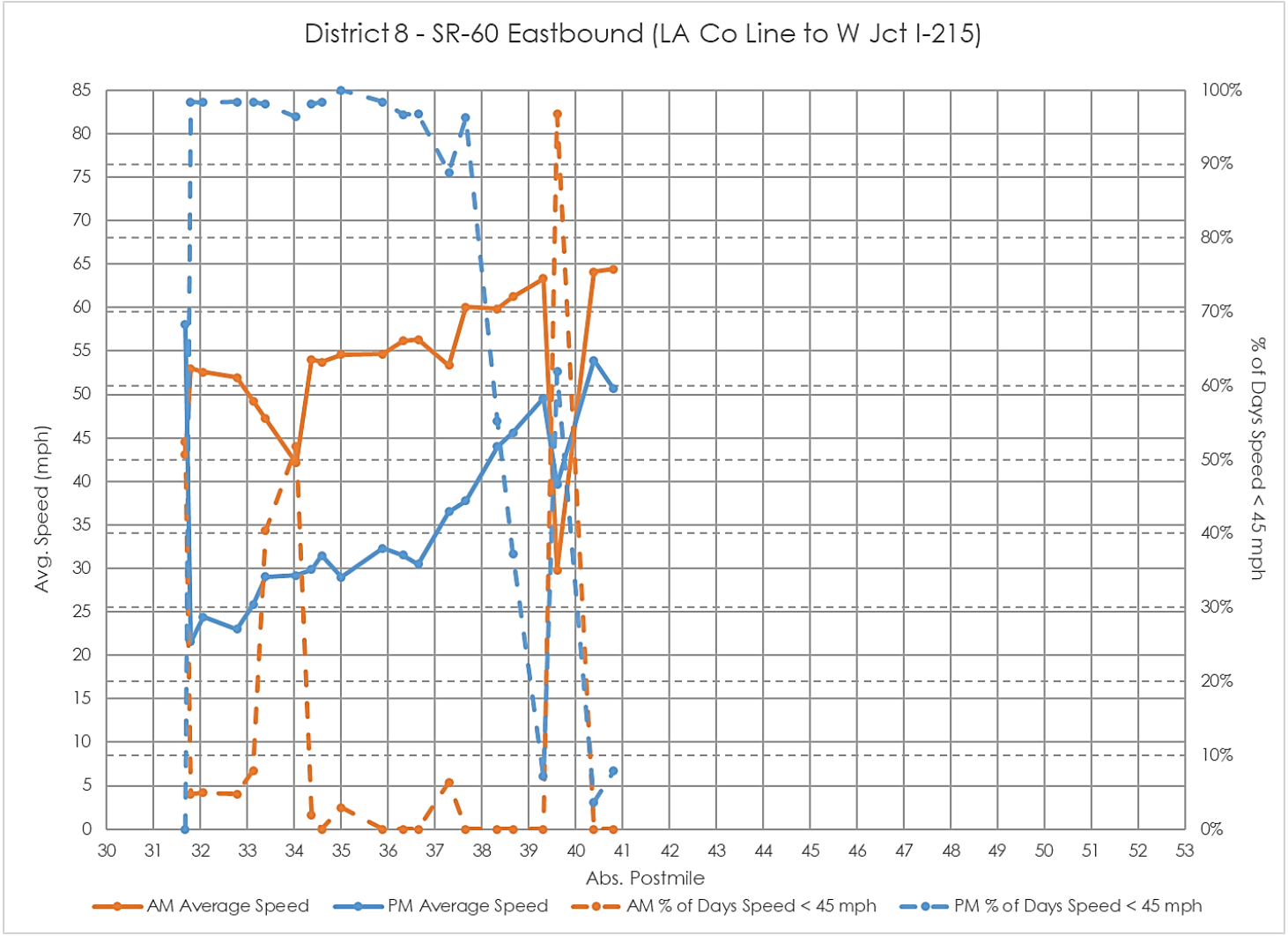
## FIGURE 131. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 10



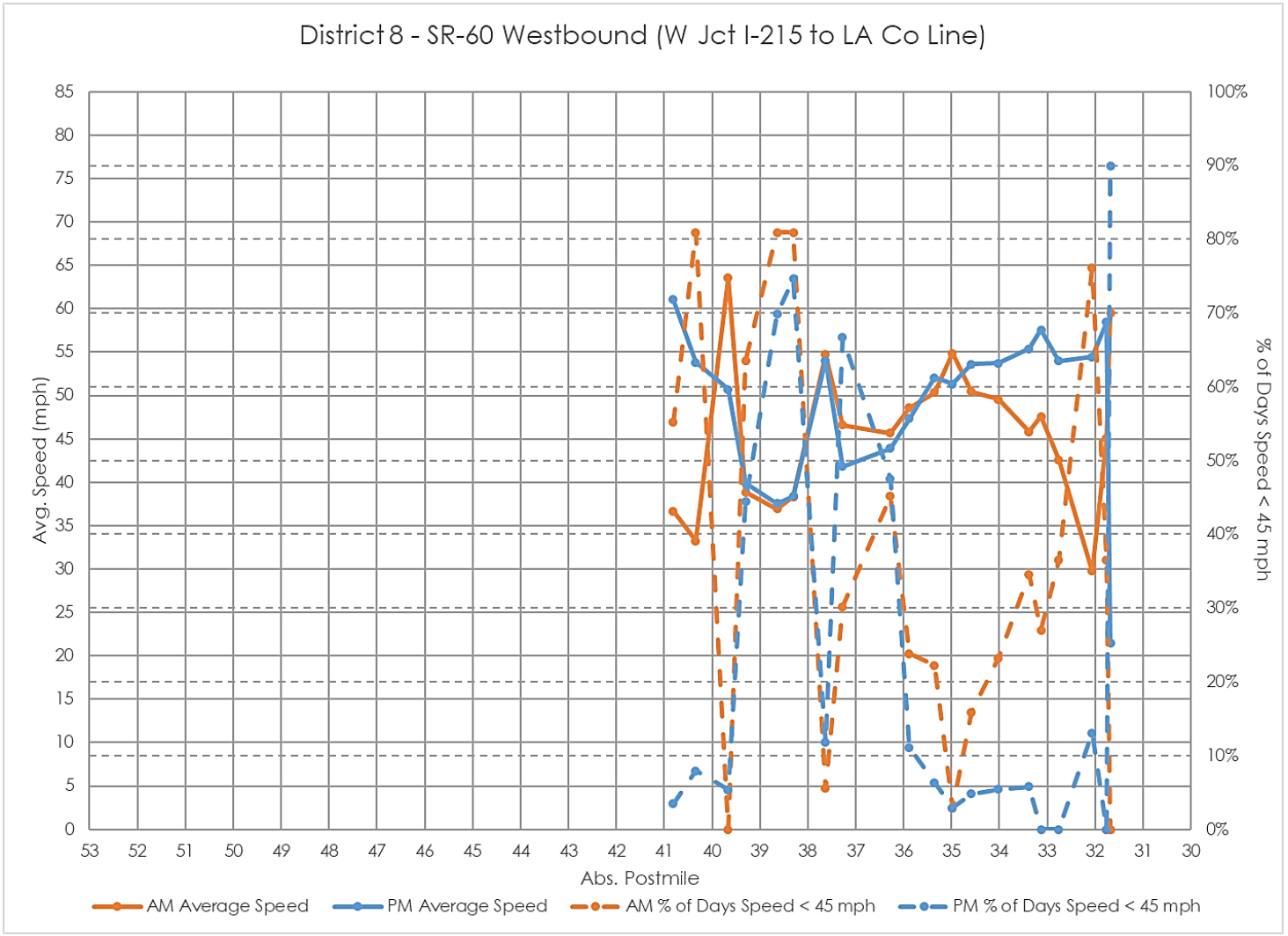
## FIGURE 132. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 10



## FIGURE 133. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 60 (LOS ANGELES COUNTY LINE TO JUNCTION ROUTES 60/91/215)



## FIGURE 134. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 60 (LOS ANGELES COUNTY LINE TO JUNCTION ROUTES 60/91/215)



## FIGURE 135. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 60 (JUNCTION ROUTES 60/215 TO REDLANDS BLVD)

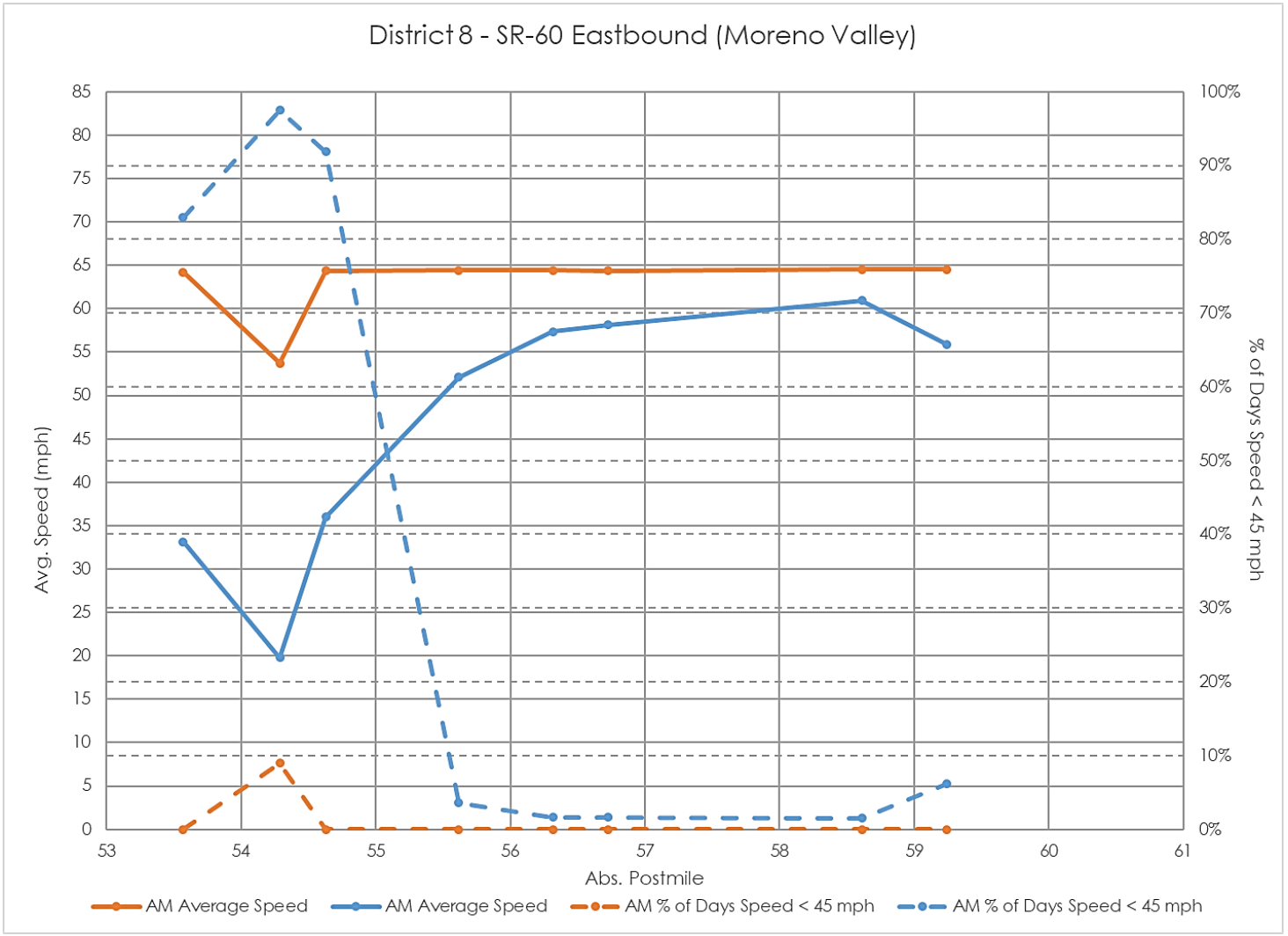
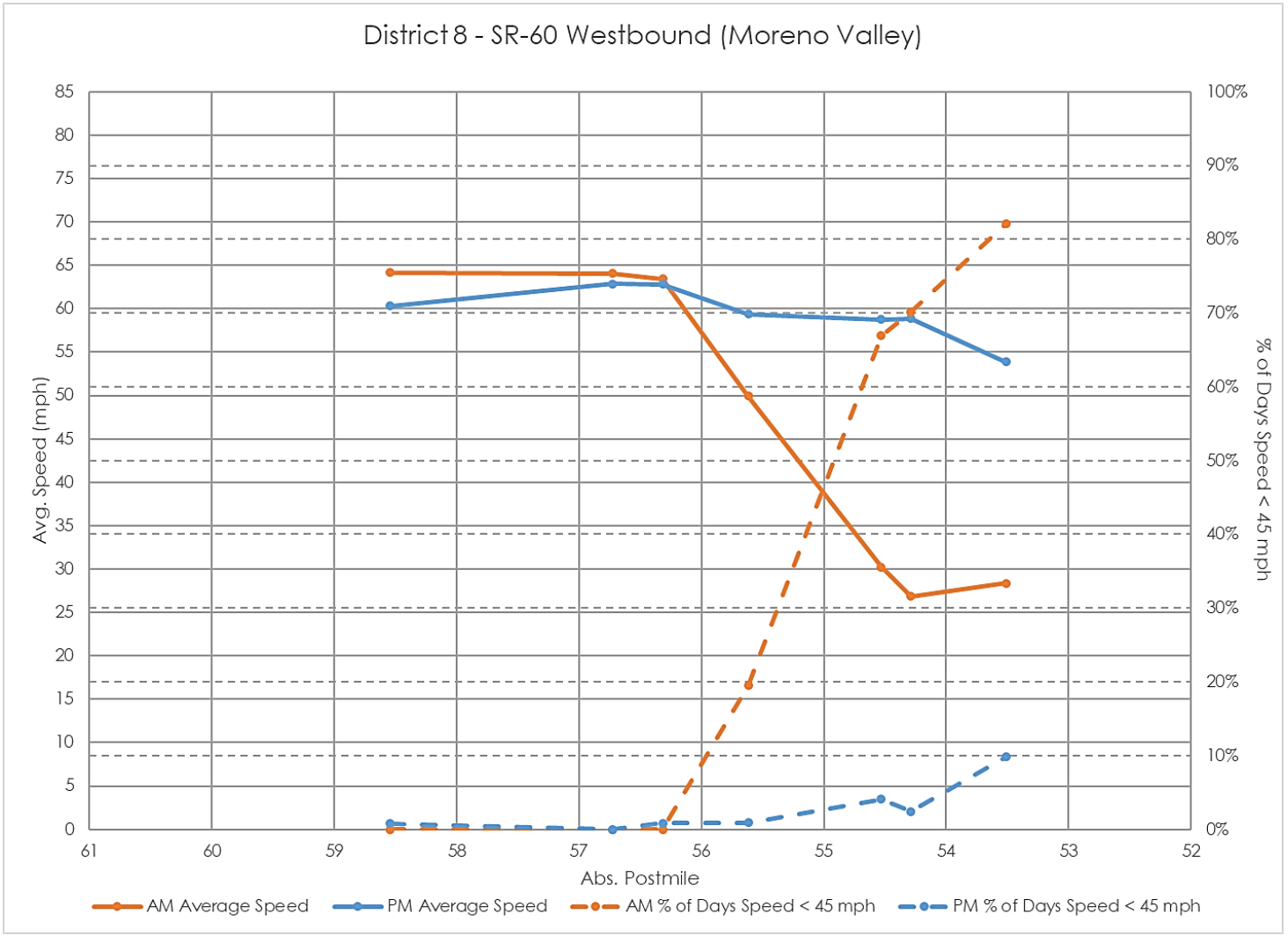


**FIGURE 136. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 60 (JUNCTION ROUTES 60/215 TO REDLANDS BLVD)**



## FIGURE 137. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 71

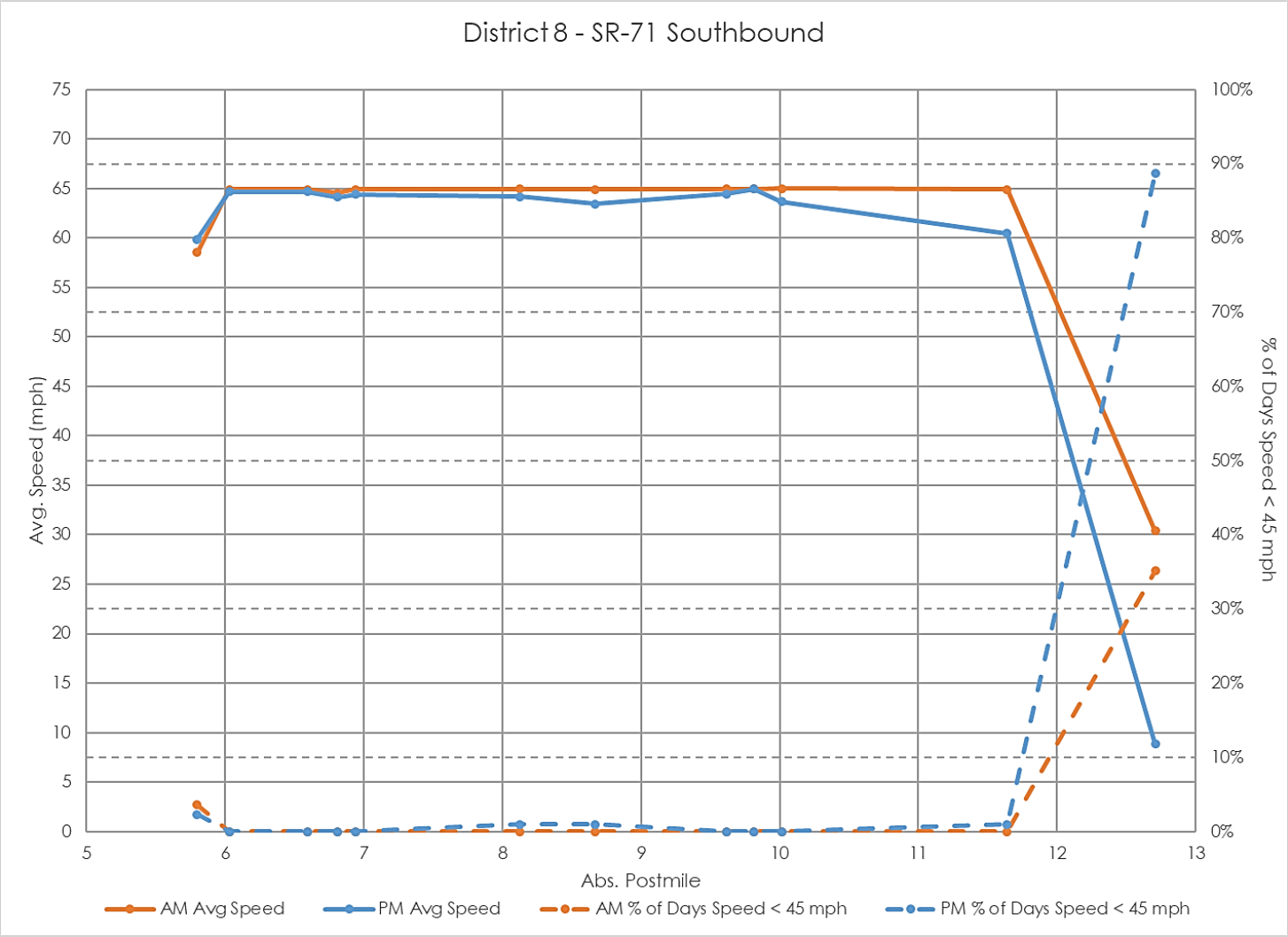


**FIGURE 138. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 91 (ORANGE COUNTY LINE TO ROUTE 15)**

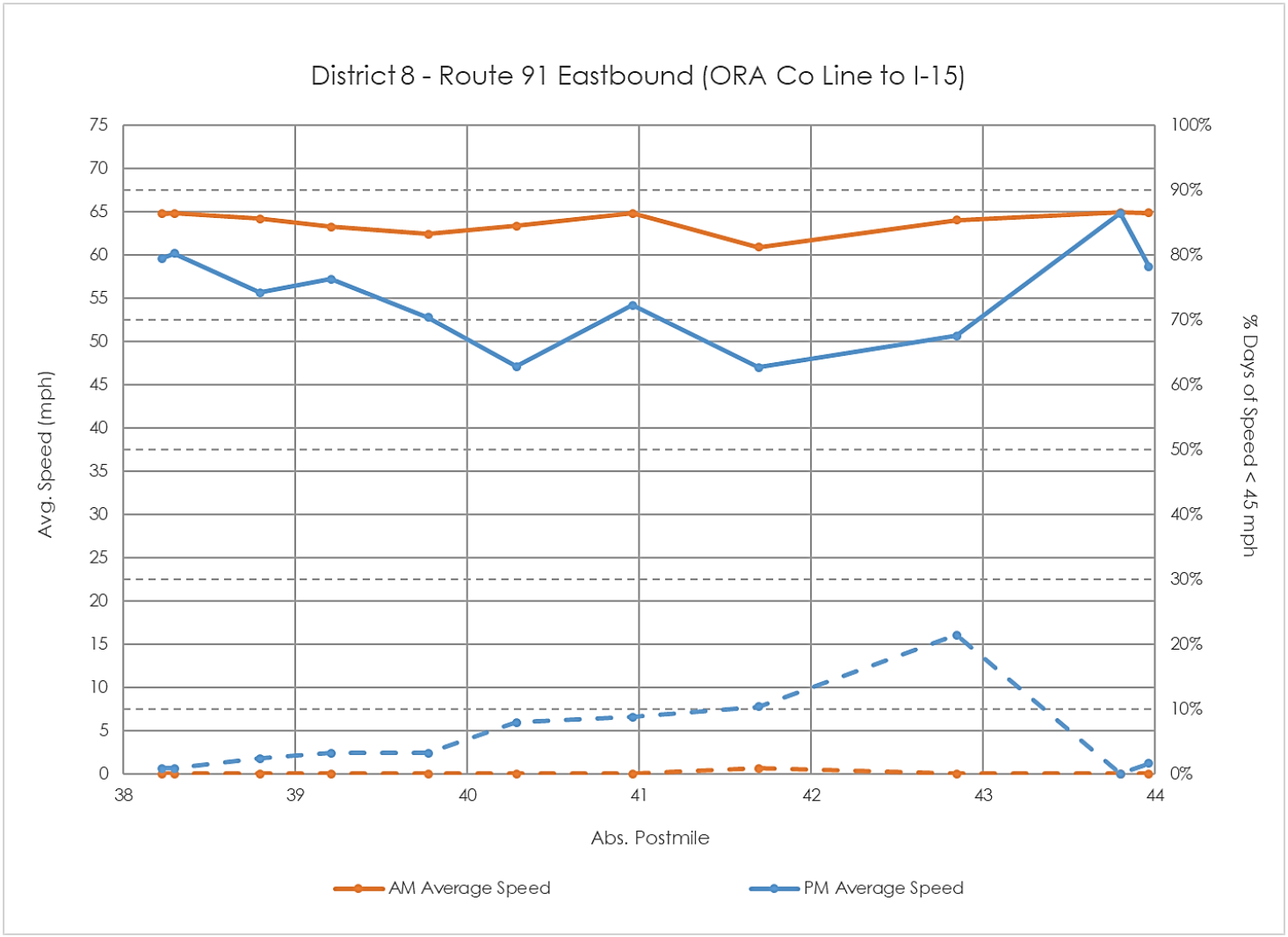


**FIGURE 139. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 91 (ORANGE COUNTY LINE TO ROUTE 15)**

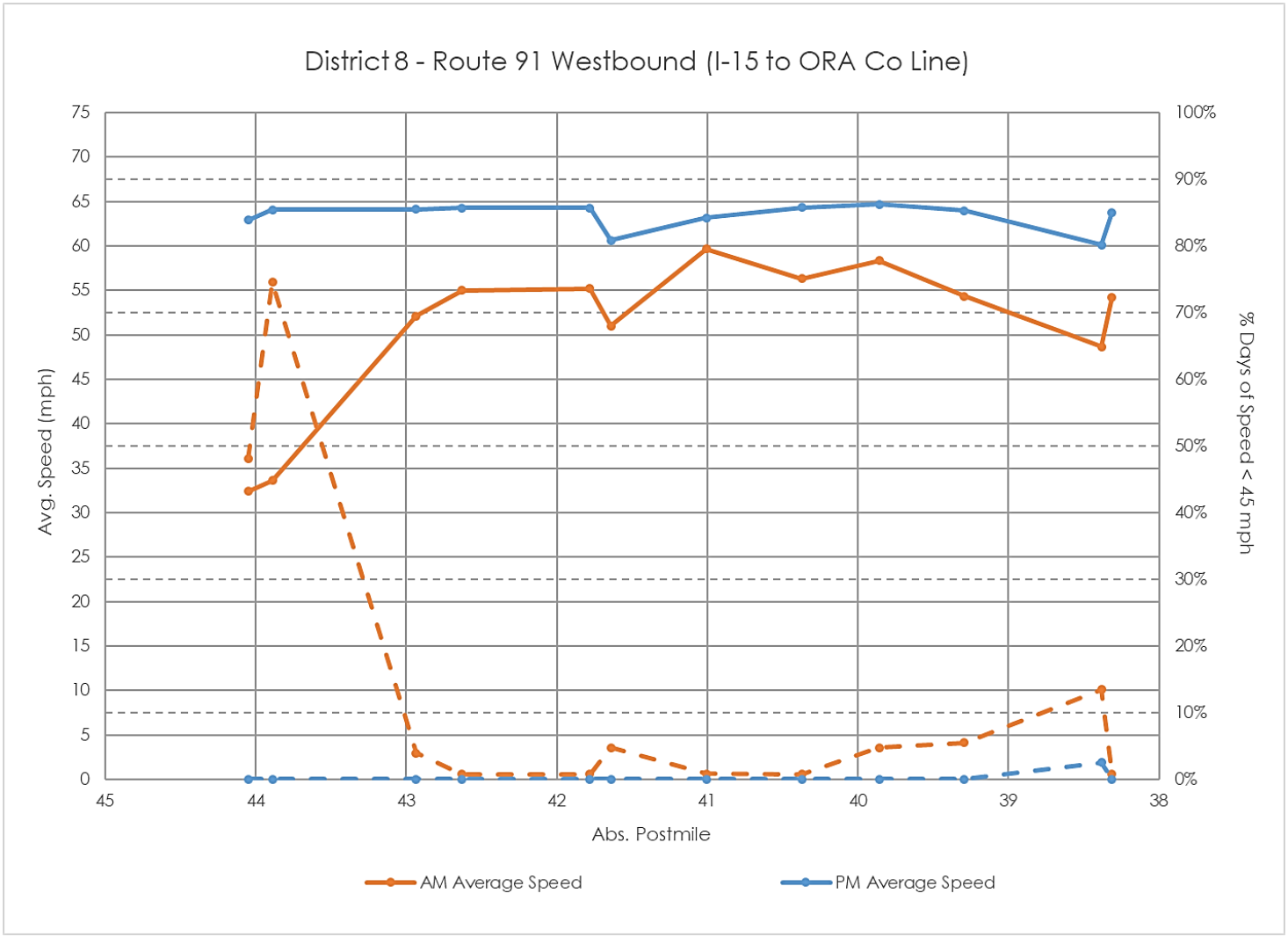
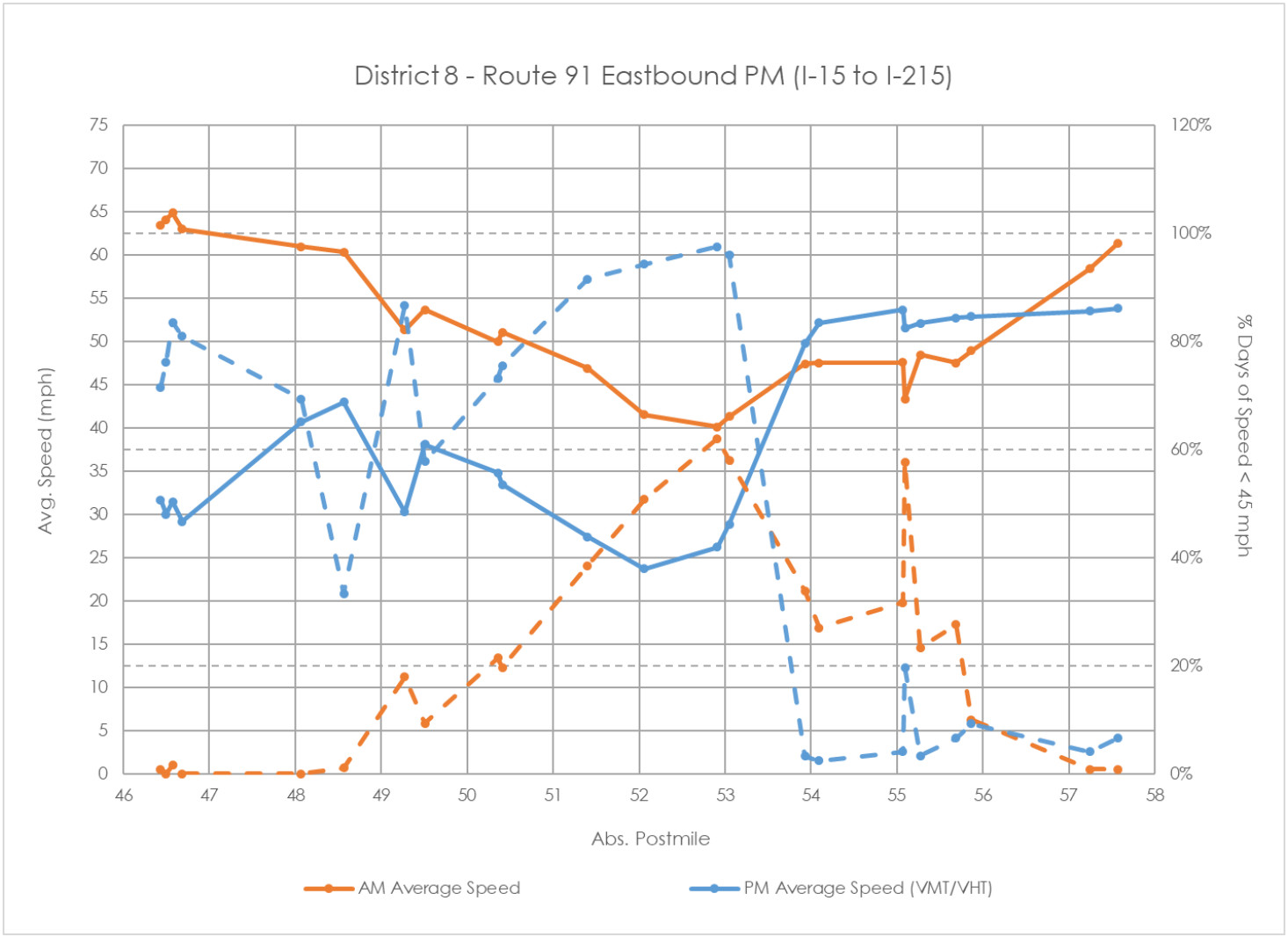
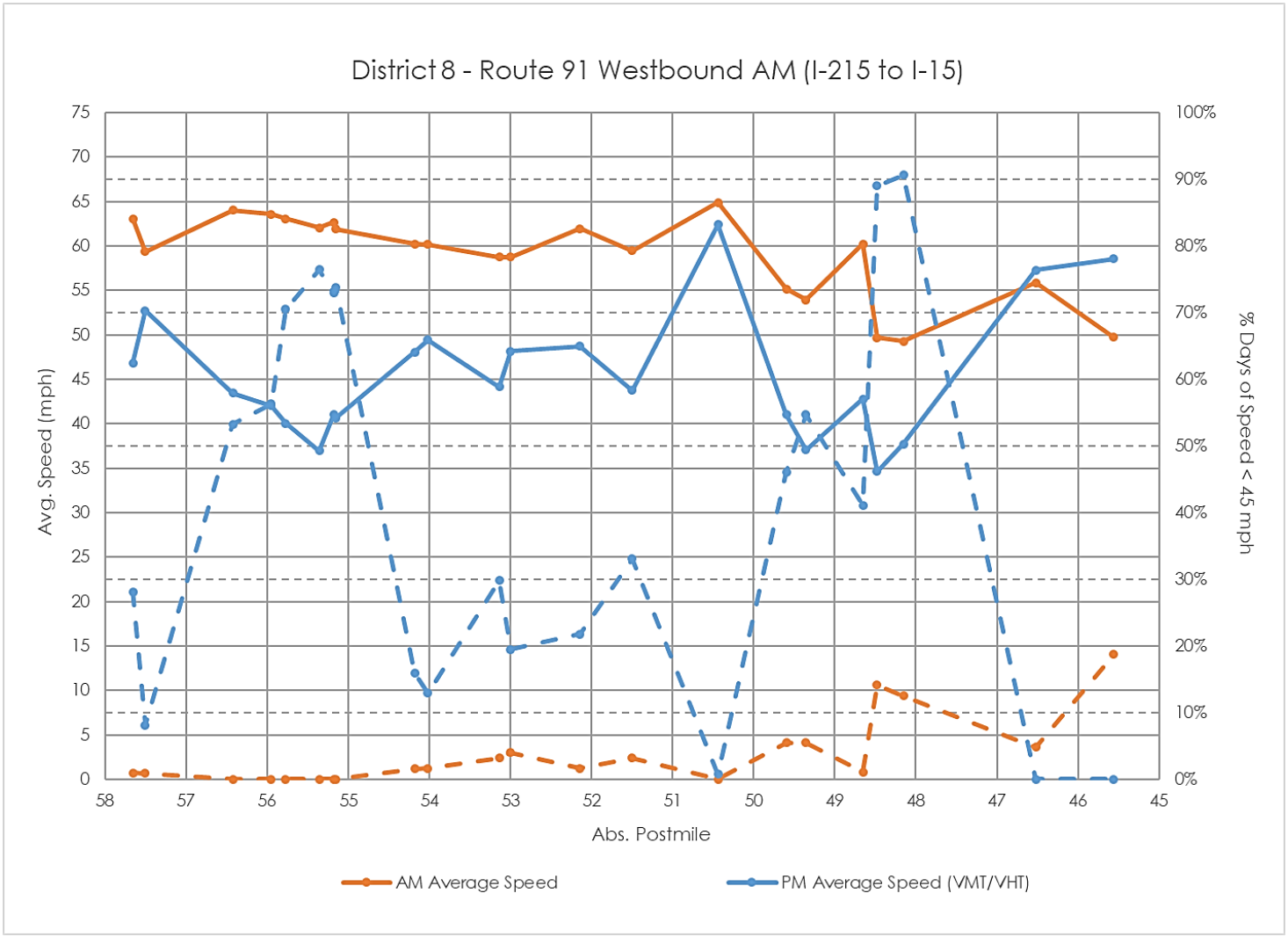


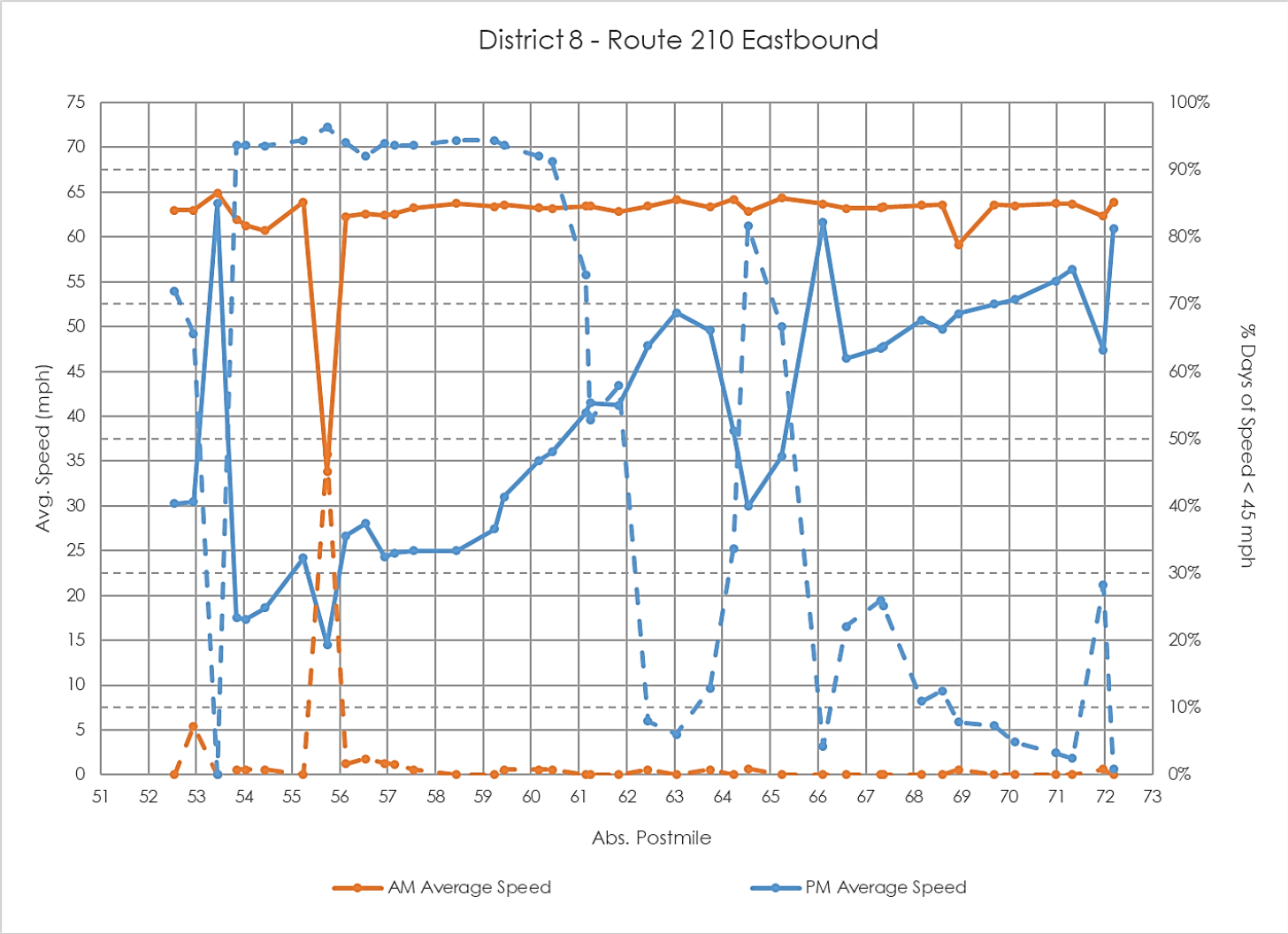
**FIGURE 140. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 91 (ROUTE 15 TO ROUTE 215)**



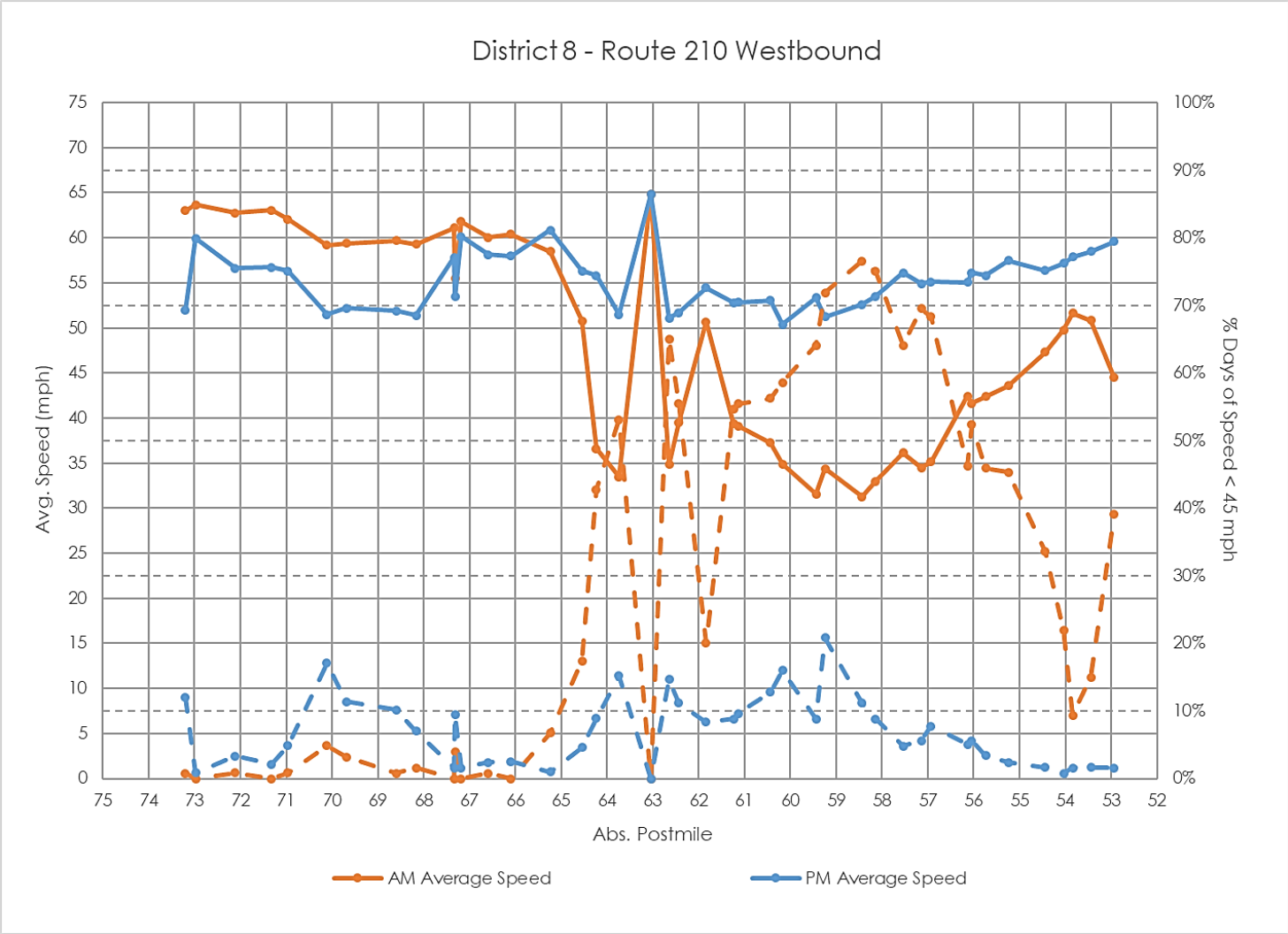
## FIGURE 141. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 91 (ROUTE 15 TO ROUTE 215)



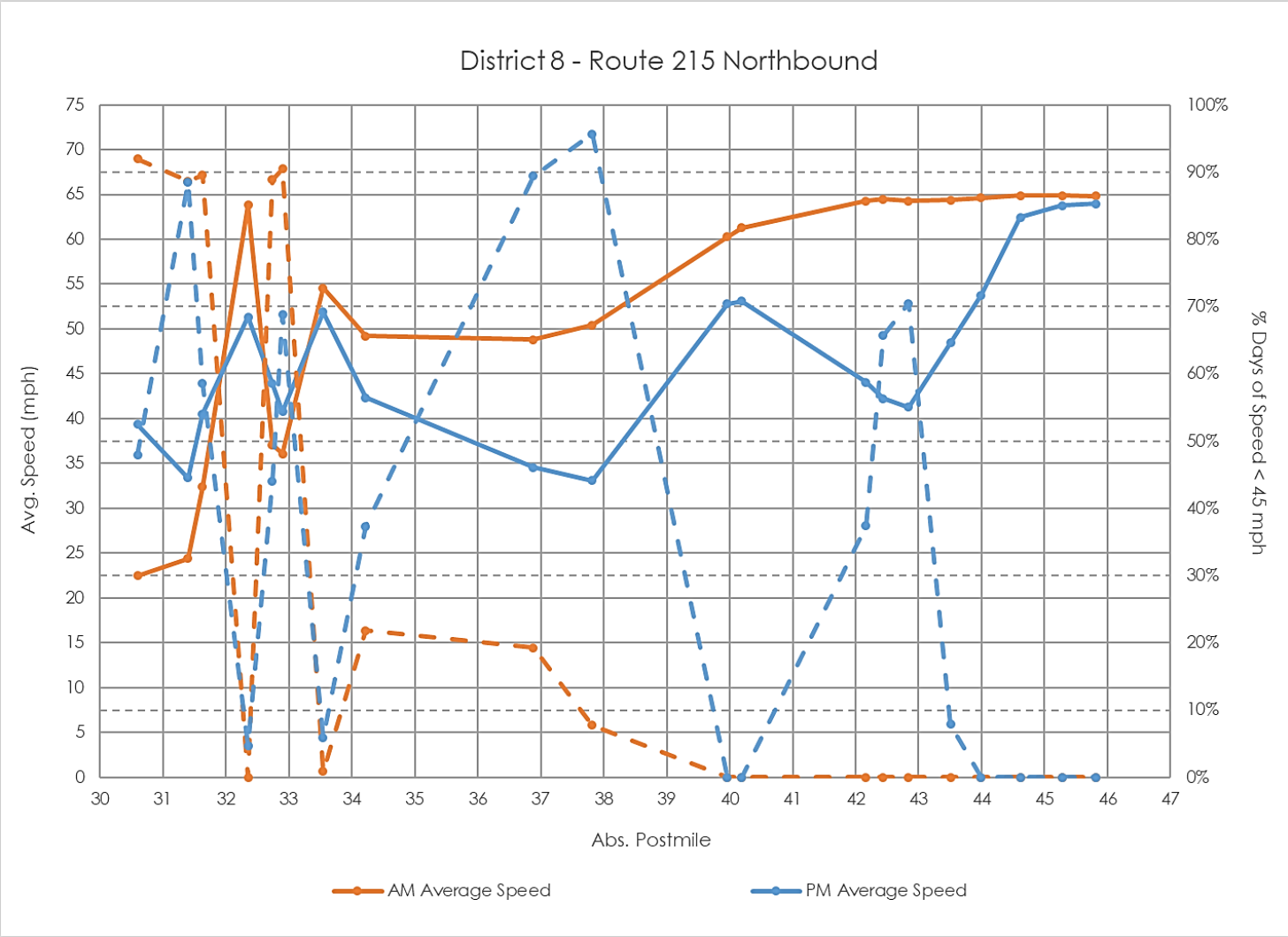
## FIGURE 142. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 210



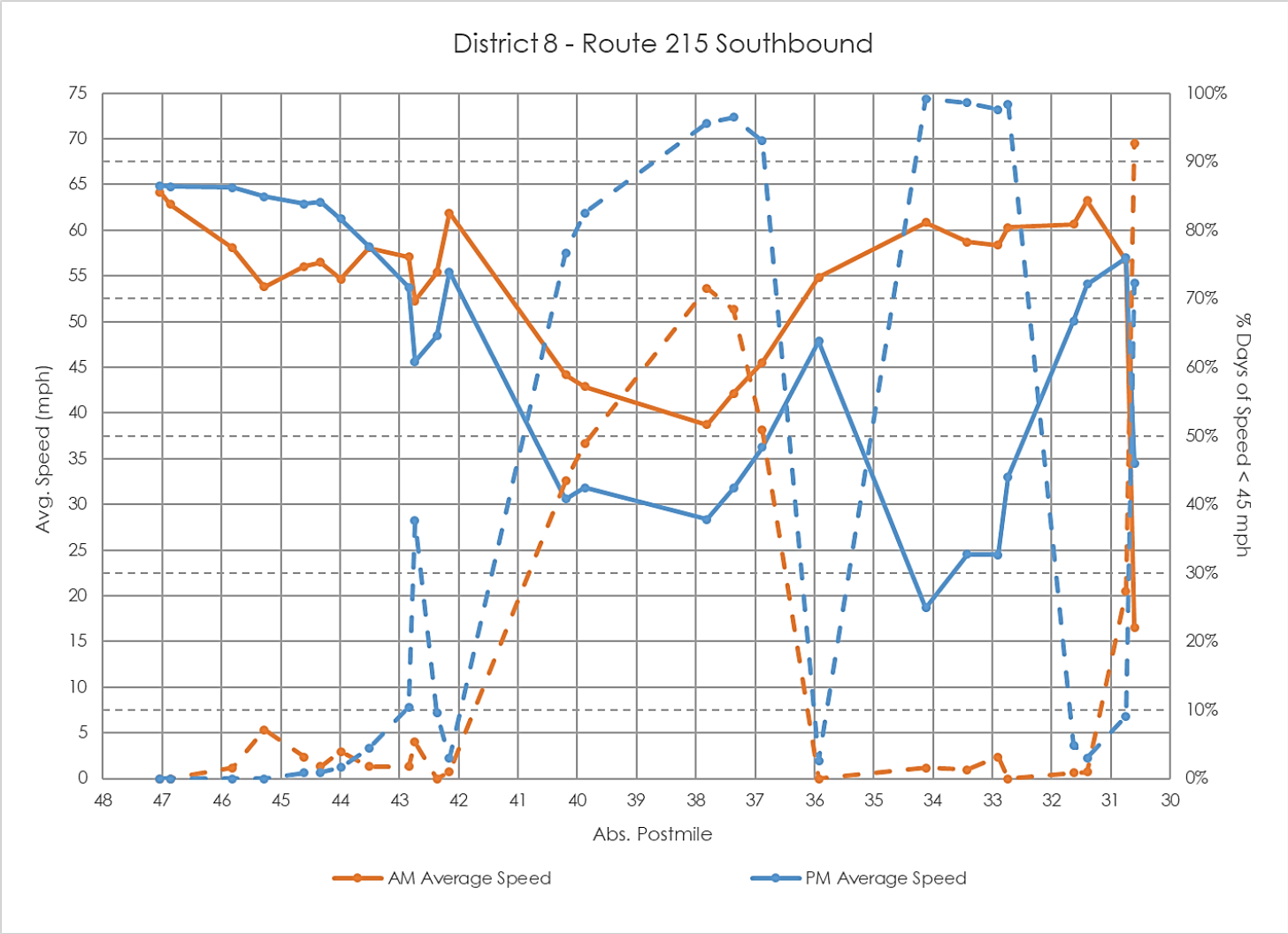
## FIGURE 143. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 210



## FIGURE 144. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 215



## FIGURE 145. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 215



### 4.4.2 DISTRICT-WIDE ACTIONS RELATED TO DEGRADATION

In February 2021, Caltrans, District 8, Division of Transportation Planning completed the initial Managed Lane Feasibility Study (MLFS). The purpose of this initial MLFS assessment is to identify potential managed lane concepts for Caltrans District 8 on corridors within the Inland Empire Region. This study is the steppingstone that will inform the development of a MLSP, providing a comprehensive framework for the continued planning and implementation of a connected system and cohesive network of managed lanes throughout District 8.

In May 2016, The San Bernardino County Transportation Authority (SBCTA) in cooperation with Caltrans proposed the addition of HOT lanes along both the Route 10 and the Route 15 freeway corridors as part of an overall long-term strategy of integrated initiatives to improve mobility, manage congestion, and increase vehicular and person throughput in San Bernardino County. Construction of Route 10 HOT lane project Phase I from LA County Line to Etiwanda Avenue (just east of Route 15) started in March 2019 and is scheduled for completion of December 2023. This project will convert existing the HOV lanes to HOT operation and add a second HOT lane in each direction to create dual lane facilities. Occupancy requirements on the HOV lanes are currently two or more per vehicle and upon conversion, at least three occupants will be required for toll-free travel. An extension of the HOT lanes, from Route 15 to Ford Street in Redlands, is currently projected to begin construction in 2025.

In March 2016, The Riverside County Transportation Commission (RCTC) in partnership with the California Department of Transportation (Caltrans) and the Federal Highway Administration (FHWA) proposed HOT lane projects to address current and future travel demand and improve traffic operations on the Route 15 corridor between Cajalco Road and the Route 15/Route 60 Interchange near the San Bernardino County line. Construction of Route 15 HOT lane project from Cajalco Road to (Just South of Route 60) started on April 2018 and was completed on April 2021. Direct connections from the southbound Route 15 HOT lanes to the Route 91 HOT lanes and from the Route 91 HOT lanes to the northbound Route 15 HOT lanes started construction on April 2021 and are scheduled to be completed on June 2023.

## 4.4.3 ACTION PLAN FOR HOV FACILITIES ON ROUTE 10

## A. ANALYSIS

The violation rate on HOV lane is above 23 percent (based on data collected in fall 2019 in both directions) which contributed to increased traffic volumes on the HOV facility.

The recurrent high demand and high truck traffic volume exceeds capacity which creates congestion in all lanes and thereby, reducing HOV lane performance including its speed. The speed differential between that on GP and HOV lanes will adversely affect the performance of the HOV lane, especially when the HOV lane is a continuous access HOV lane.

Eastbound, during morning peak hours: No degradation.

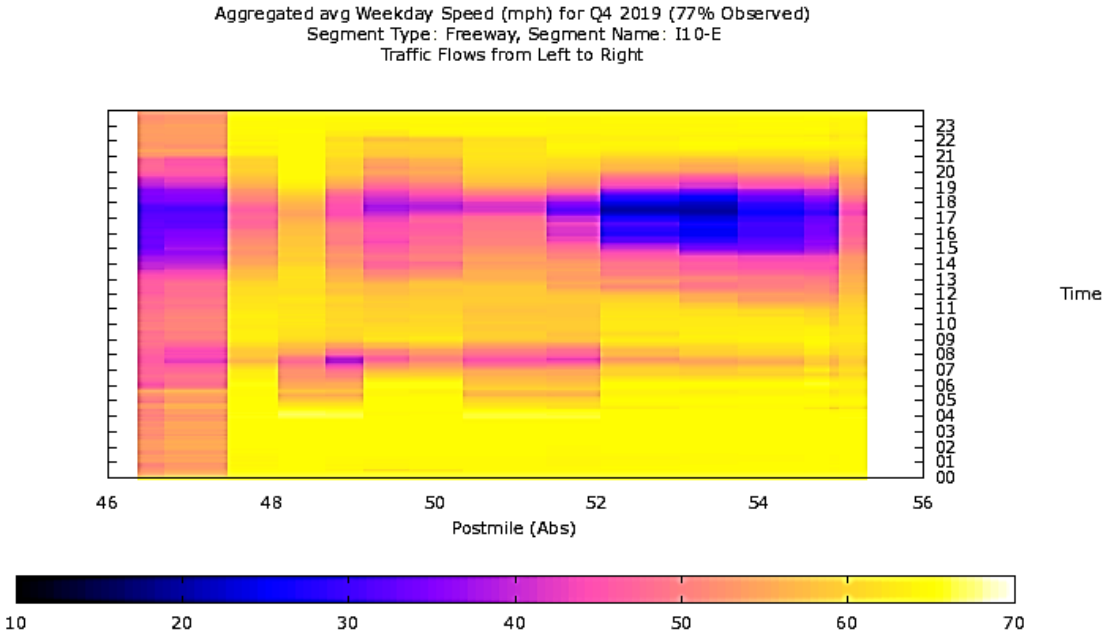
Eastbound, during afternoon peak hours: Traffic from Ontario International Airport enters eastbound Route 10 through Vineyard Avenue Interchange (IC). This additional traffic exacerbates the problem. As this traffic approaches Route 15 Junction (JCT), vehicle weaving creates congestion on all lanes including HOV lane.

Westbound, during Morning peak hour period: Commuter traffic to Los Angeles causes recurrent congestion as it accumulates westward from Route 15 JCT.

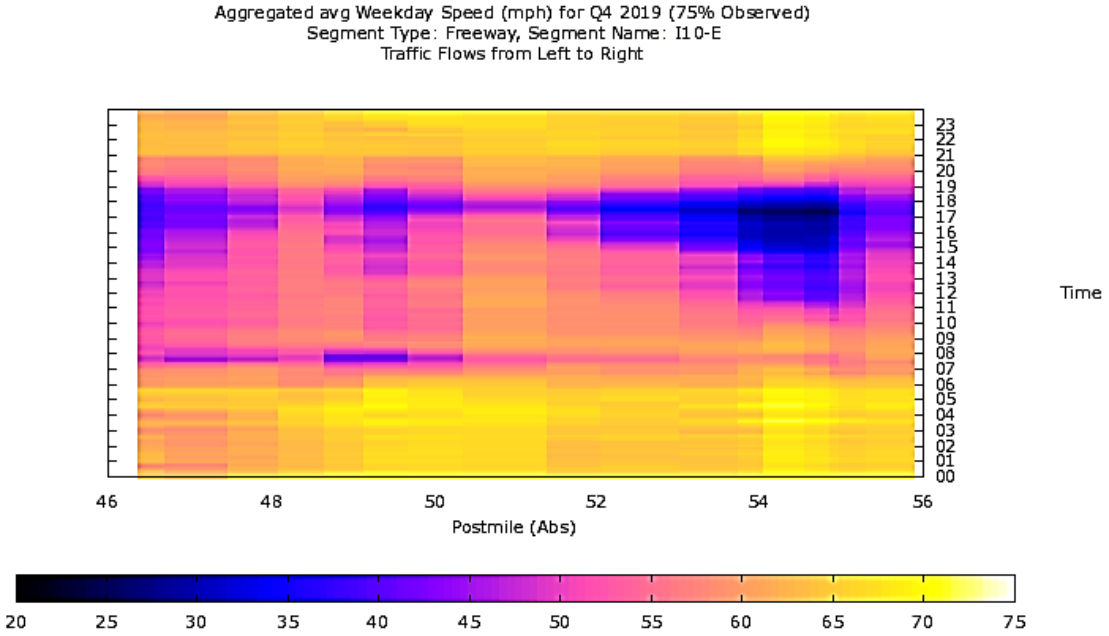
Westbound, during afternoon peak hours: Additional Traffic from Ontario International Airport through the Vineyard Avenue IC exacerbates the already congested westbound Route 10. This congestion started from Route 15 JCT westward toward Vineyard Avenue IC and dissipates gradually from the Vineyard Avenue IC westward toward Los Angeles.

Figures 146 and 147 provide plots of HOV and GP lane speeds along the length of the HOV facility on eastbound Route 10 during the fourth quarter of 2019. Figures 148 and 149 provide plots of HOV and GP lane speeds along the length of the HOV facility on westbound Route 10 during the fourth quarter of 2019.

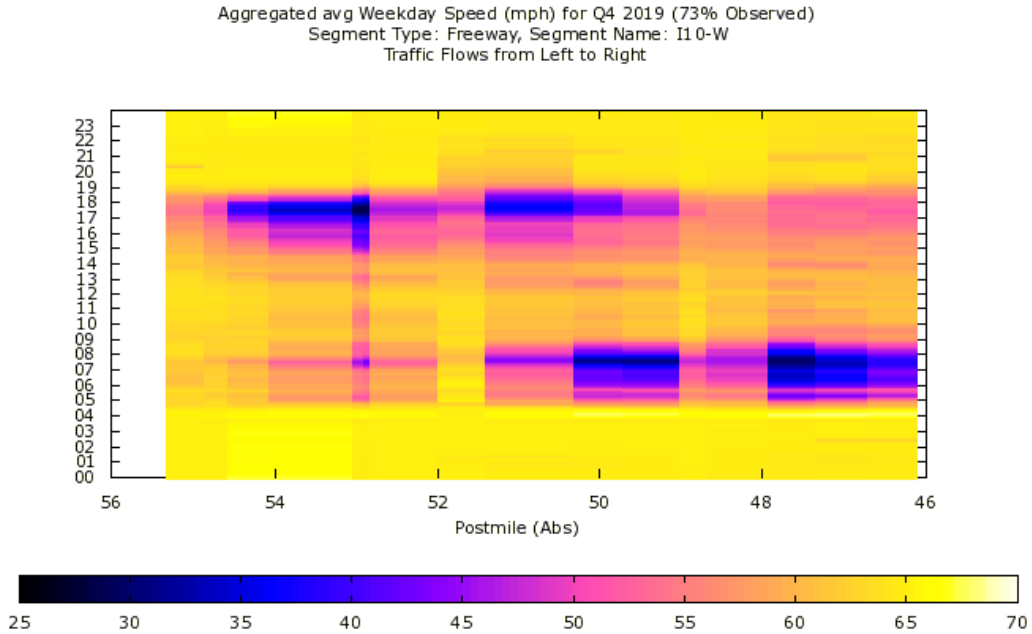
## FIGURE 146. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 10, Q4 2019



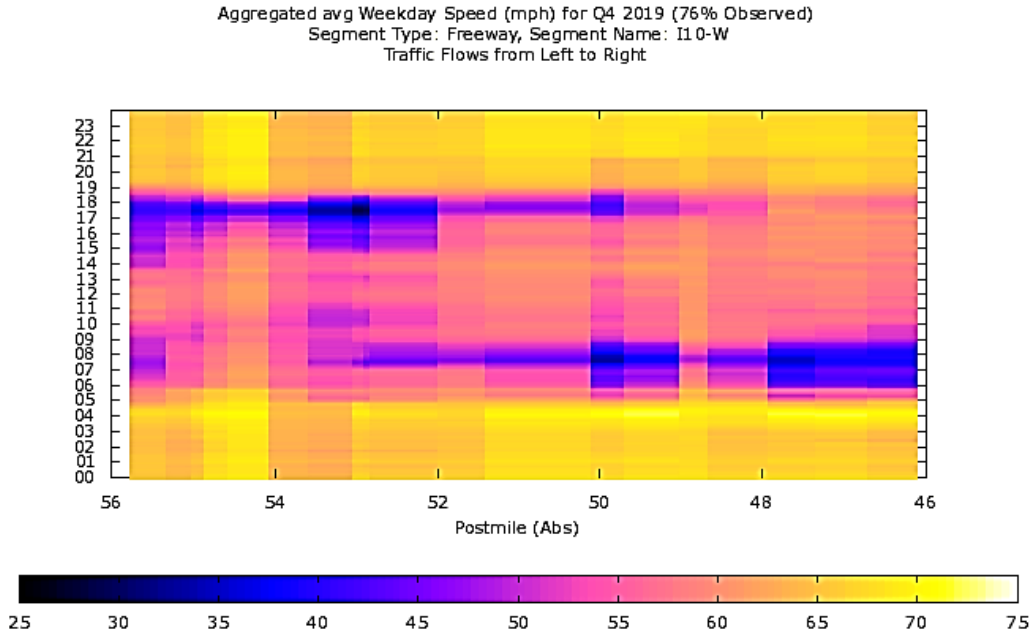

## FIGURE 147. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 10, Q4 2019



## FIGURE 148. AVERAGE HOV LANE SPEED – WESTBOUND ROUTE 10, Q4 2019




## FIGURE 149. AVERAGE GP LANE SPEED – WESTBOUND ROUTE 10, Q4 2019



## B. REMEDIATION STRATEGIES

- Installing Route Shield Pavement Markings (RSPMs) on eastbound Route 10 approaching Route 15 JCT. Strategically located Route Shield Pavement Markings will supplement the information provided by overhead or roadside signs that depict upcoming freeway interchange approaches. When motorist receive information on interchange approaches early, and in multiple ways, they are likely to make better driving decisions and change lanes farther upstream. *Desired Outcome*: Reducing late lane changes and thereby sudden weaving movement. It improves safety and reduces weaving conflict.

- Increasing the available capacity of the HOV facility by constructing an additional lane on Route 10 will improve the minimum operating speed as mandated by FHWA. 08-0C251 (phase 1), LA PM 44.9-48.3 & SBD PM 0.00-10.00 to convert from a single HOV-2+ lane in each direction to HOT-3+ lanes in each direction from East of Dudley Street in Los Angeles County to Route 15 in San Bernardino County. Project cost estimate is $929.2 million. Construction to begin in April 2020 until August 2023. *Desired Outcome*: This project is anticipated to increase the freeway capacity and thereby eliminating recurrent congestion both in HOV and GP lane.

- District 8 Traffic Management Center (TMC) operations' primary function is to clear non-recurrent congestion by monitoring traffic on our State Highway System (SHS) continuously and provides timely information to the public and partners pertaining to the current traffic conditions. It will affect the safe movement of traffic throughout our SHS. *Desired Outcome*: Clearing non-recurrent congestion on SHS safely and expediently.

- Activating Ramp Metering during re-current and non-recurrent congestion as needed to reduce congestion and increase safety on SHS by monitoring freeway operating speed. *Desired Outcome*: Maintaining an efficient freeway system by maximizing its operating speed at or near capacity. Thereby, avoiding all lane congestion including HOV lane.

- District 8 Traffic Ops is partnering with CHP to reduce violations on HOV lanes. Reduction in violations on HOV lanes will improve traffic flow on HOV lane and will help District 8 to improve in degradation. HQ Traffic Operations provided $4.3 million special fund to District 8 to initiate projects to reduce degradation on HOV lanes in District 8. District 8 Traffic Ops initiated (SHOPP

ID 23288) to use $250K for CHP enforcement from this special fund to reduce HOV violations on various routes in District 8. *Desired Outcome:* Reduced volumes in the HOV lanes due to fewer violators.

### 4.4.4 ACTION PLAN FOR HOV FACILITIES ON ROUTE 60

HOV lanes in Route 60 are covered in two segments. The first segment is from the Los Angeles/San Bernardino County Line to the junction of Routes 60, 91, and 215 in Riverside County. The second segment is from the junction of Routes 60 and 215 to Redlands Boulevard in City of Moreno Valley. There was no data for the portion between Route 15 and the junction of Routes 60, 91, and 215 due to construction.

### A. ANALYSIS

Eastbound traffic on the first segment in AM is slightly degraded from Benson Avenue to Mountain Avenue and extremely degraded at Haven Avenue due to additional traffic from Ontario International Airport. In PM, the traffic is extremely degraded from Los Angeles County Line to Haven Avenue due to heavy traffic from Los Angeles and additional traffic from Ontario International Airport.

Eastbound traffic on the second segment in AM is not degraded. In PM, the traffic is extremely degraded at JCT 60/215 caused by weaving conflict due to closely spaced on- and off-ramp gores.

Westbound traffic on the first segment in the AM is very degraded leaving Route 15 and changing to extremely degraded at Haven Avenue due to additional traffic from Ontario International Airport. In PM, the traffic is not degraded leaving Route 15 and changing to slightly to very degraded at Haven Avenue and Archibald Avenue

Westbound traffic on the second segment in AM is extremely degraded at JCT 60/215 caused by weaving conflict due to closely spaced on- and off-ramp gores. In PM, the traffic is not degraded.

The violation rate on HOV lane is above 14 percent (based on data collected in fall 2019 in both directions) which contributed to increased traffic volumes on the HOV facility.

The recurrent demand and high truck traffic volume creates congestion in all lanes and thereby, reducing HOV lane performance including its speed. The

speed differential between that on GP and HOV lanes will adversely affect the performance of the HOV lane, especially when the HOV lane is a continuous access HOV lane.

## B. REMEDIATION STRATEGIES

*Los Angeles County Line to Junction 60/91/215*

- Project 08-1F260, SBD PM R7.8/R7.9 to widen Archibald Avenue interchange. The project is under construction from December 2019 to November 2021. *Desired Outcome:* Improving the traffic mobility on all lanes in the vicinity of Archibald Avenue Interchange.

- Project 08-0E33U, SBD R7.3/R10.0 to add westbound Auxiliary lane and eastbound deceleration lane. Construction is scheduled to begin in January 2022 and end in March 2024. Current estimate is $43 million funded by SHOPP. *Desired Outcome:* Alleviating some weaving issues occurring in this segment and therefore enhancing traffic mobility on all lanes.

- Project 08-0C870 SBD PM R2.1/R2.6 to widen eastbound & westbound on-ramps & Central Avenue Construction was started in the April 2021 and will be completed in April 2023. *Desired Outcome:* Improving traffic operation at the interchange.

- Installing Route Shield Pavement Markings approaching Route 15 and JCT 60/91/215. Strategically located Route Shield Pavement Markings will supplement the information provided by overhead or roadside signs that depict upcoming freeway interchange approaches. When motorist receive information on interchange approaches early, and in multiple ways, they are likely to make better driving decisions and change lanes farther upstream. *Desired Outcome:* Reducing late lane changes and thereby sudden weaving movement. It improves safety and reduces weaving conflict.

*Junction 60/215 to Redlands Boulevard*

- Installing Route Shield Pavement Markings approaching JCT 60/215. Strategically located Route Shield Pavement Markings will supplement the information provided by overhead or roadside signs that depict upcoming freeway interchange approaches. When motorist receive information on interchange approaches early, and in multiple ways, they are likely to make better driving decisions and change lanes farther upstream. *Desired*

*Outcome*: Reducing late lane changes and thereby sudden weaving movement. It improves safety and reduces weaving conflict.

- District 8 Traffic Management Center (TMC) operations' primary function is to reduce congestion by monitoring traffic on our State Highway System (SHS) continuously and provides timely information to the public and partners pertaining to the current traffic conditions. It will affect the safe movement of traffic throughout our SHS. *Desired Outcome*: Clearing non-recurrent congestion on SHS safely and expediently.

- Activating Ramp Metering during re-current congestion and non-recurrent congestion as needed to reduce congestion and increase safety on SHS by monitoring freeway operating speed. Desired Outcome: Maintaining an efficient freeway system by maximizing its operating speed at or near capacity. Thereby, avoiding all lane congestion including HOV lane.

- District 8 Traffic Ops is partnering with CHP to reduce violations on HOV lanes. Reduction in violations on HOV lanes will improve traffic flow on HOV lane and will help District 8 to improve in degradation. HQ Traffic Operations provided $4.3 million special fund to District 8 to initiate projects to reduce degradation on HOV lanes in District 8. District 8 Traffic Ops initiated (SHOPP ID 23288) to use $250K for CHP enforcement from this special fund to reduce HOV violations on various routes in District 8. *Desired Outcome:* Reduced volumes in the HOV lanes due to fewer violators.

### 4.4.5 ACTION PLAN FOR HOV FACILITIES ON ROUTE 71

### A. ANALYSIS

The HOV lane on Route 71 spans between Riverside County Line and Los Angeles County Line with the length of approximately 7 (seven) miles. This segment of HOV lane is the last and only Buffer-Separated HOV lane in District 8. The postmiles of the route is decreasing instead of increasing as it goes northward.

Northbound during afternoon peak hours: Additional traffic due to commuter traffic from Chino Avenue IC causes traffic slow-down south of the interchange.

Southbound during AM & afternoon peak hours: Recurrent congestion due to commuter traffic at the south end of the HOV lane – by Euclid Avenue IC - causes by dropping the HOV lane at the location.

## B. REMEDIATION STRATEGIES

- District 8 Traffic Management Center (TMC) operations' primary function is to reduce congestion by monitoring traffic on our State Highway System (SHS) continuously and provides timely information to the public and partners pertaining to the current traffic conditions. It will affect the safe movement of traffic throughout our SHS. *Desired Outcome*: Clearing non-recurrent congestion on SHS safely and expediently.

- Activating Ramp Metering during re-current congestion and non-recurrent congestion as needed to reduce congestion and increase safety on SHS by monitoring freeway operating speed. *Desired Outcome*: Maintaining an efficient freeway system by maximizing its operating speed at or near capacity. Thereby, avoiding all lane congestion including HOV lane.

- To increase public awareness by updating HOV violation fine amount on the existing signs to the current value. *Desired Outcome*: Reducing violators

### 4.4.6 ACTION PLAN FOR HOV FACILITIES ON ROUTE 91

There are two different facilities on Route 91 in District 8. HOT lanes are located on the portion of Route 91 from the Orange County Line to Route 15, and HOV lanes operate on the portion from Route 15 to the junction with Routes 60 and 215 in Riverside.

## A. ANALYSIS

*Orange County Line to Route 15*

Degradation was observed during the morning peak hour period on westbound Route 91 at the Orange County line where there is an access point to the HOT lane. The primary causes of degradation at the entrance are:

- Weaving as drivers enter and exit the HOT lane

- Last minute lane changes at the end of the access point

- Drivers using the weave lane at the access opening to bypass congestion on the GP lane

- Lack of direct connections to the HOT lane for travelers coming from Route 15 north of Route 91. This is the first (and only) location for those motorists to access the westbound HOT lane.

Degradation was observed during the afternoon peak hour period on eastbound Route 91 towards the eastern end of the HOT lane. The primary cause of degradation at this location is heavy congestion on the direct connector to southbound Route 15.

*Route 15 to Junction Routes 60 and 215*

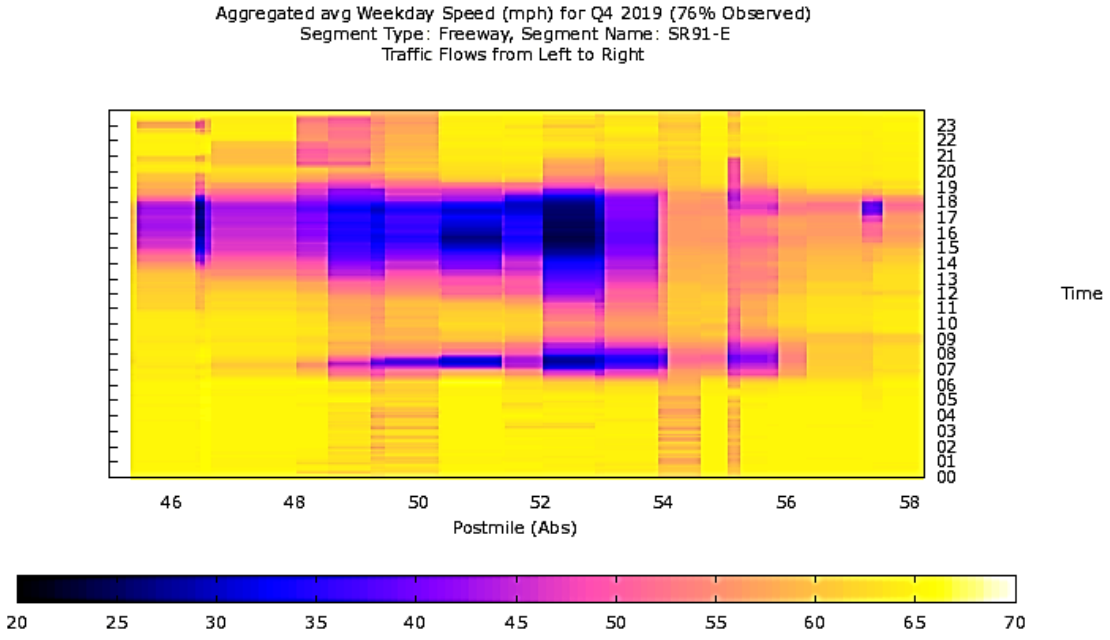
Eastbound traffic in AM is varies from slightly to very degraded between La Sierra Avenue to Central Avenue PM traffic is extremely degraded from Route 15 to Adam Street. Westbound traffic in AM is slightly degraded approaching Route 15 due to closely spaced interchanges that causes weaving conflict between on- and off-ramps. PM traffic is varying from slightly to extremely degraded along the whole segment due to heavy traffic commute from Orange County.

Violation rates on the HOV lanes are 37 percent based on fall 2019 traffic counts.

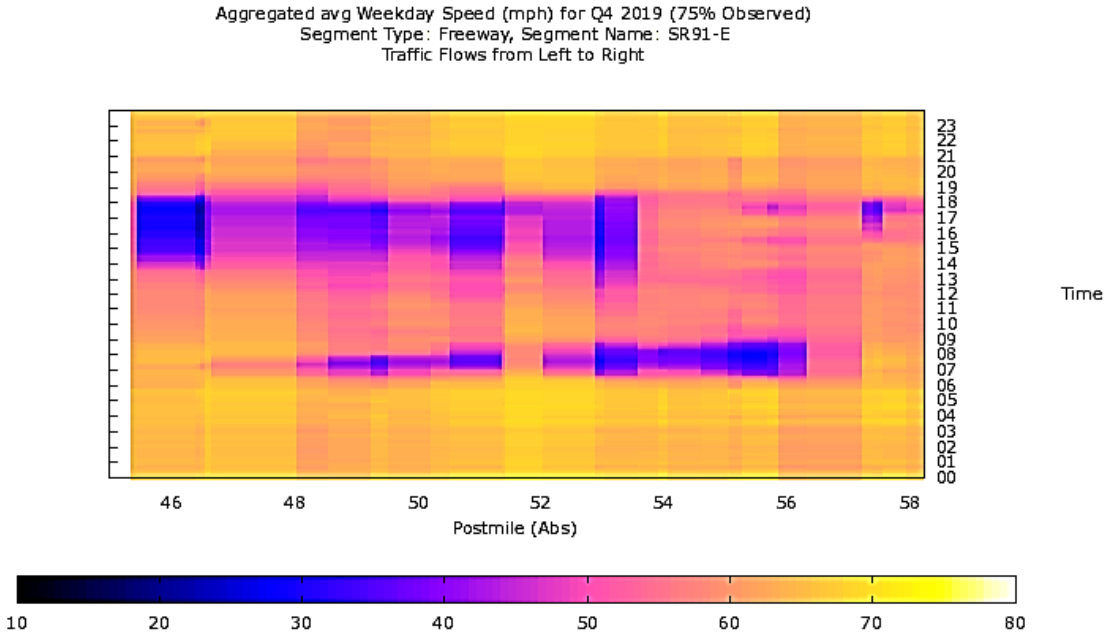
High peak hour volumes and high truck traffic volume creates congestion in all lanes and thereby reduces HOV lane performance including its speed. The speed differential between the GP lanes and HOV lanes will adversely affect the performance of the HOV lane, especially when the HOV lane is a continuous access HOV lane.

Figures 150 and 151 provide plots of HOV and GP lane speeds along the length of this HOV facility on eastbound Route 91 during the fourth quarter of 2019.

## FIGURE 150. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 91, Q4 2019




## FIGURE 151. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 91, Q4 2019



## B. REMEDIATION STRATEGIES

*Orange County Line to Route 15*

- In the westbound direction, additional signing has been proposed at the access opening at the Orange County line to alert motorists. This work can be completed within the next 4 years.
- A direct connector from southbound Route 15 to the westbound HOT lanes is currently in construction and is expected to open to traffic in 2023.
- Express toll lanes opened to traffic on Route 15 in 2020 which are expected to improve conditions at the connector to southbound Route 15. This will be examined in the 2021 degradation analysis.

*Route 15 to Junction Routes 60 and 215*

- Installing Route Shield Pavement Markings approaching Route 15 and JCT 215. Strategically located Route Shield Pavement Markings will supplement the information provided by overhead or roadside signs that depict upcoming freeway interchange approaches. When motorist receive information on interchange approaches early, and in multiple ways, they are likely to make better driving decisions and change lanes farther upstream. *Desired Outcome*: Reducing late lane changes and thereby sudden weaving movement. It improves safety and reduces weaving conflict.
- District 8 Traffic Management Center (TMC) operations' primary function is to reduce congestion by monitoring traffic on our State Highway System (SHS) continuously and provides timely information to the public and partners pertaining to the current traffic conditions. It will affect the safe movement of traffic throughout our SHS. *Desired Outcome*: Clearing non-recurrent congestion on SHS safely and expediently.
- Activating Ramp Metering during re-current congestion and non-recurrent congestion as needed to reduce congestion and increase safety on SHS by monitoring freeway operating speed. *Desired Outcome*: Maintaining an efficient freeway system by maximizing its operating speed at or near capacity. Thereby, avoiding all lane congestion including HOV lane.
- District 8 Traffic Ops is partnering with CHP to reduce violations on HOV lanes. Reduction in violations on HOV lanes will improve traffic flow on HOV lane

and will help District 8 to improve in degradation. HQ Traffic Operations provided $4.3 million special fund to District 8 to initiate projects to reduce degradation on HOV lanes in District 8. District 8 Traffic Ops initiated (SHOPP ID 23288) to use $250K for CHP enforcement from this special fund to reduce HOV violations on various routes in District 8. *Desired Outcome:* Reduced volumes in the HOV lanes due to fewer violators.

### 4.4.7 ACTION PLAN FOR HOV FACILITIES ON ROUTE 210

### A. ANALYSIS

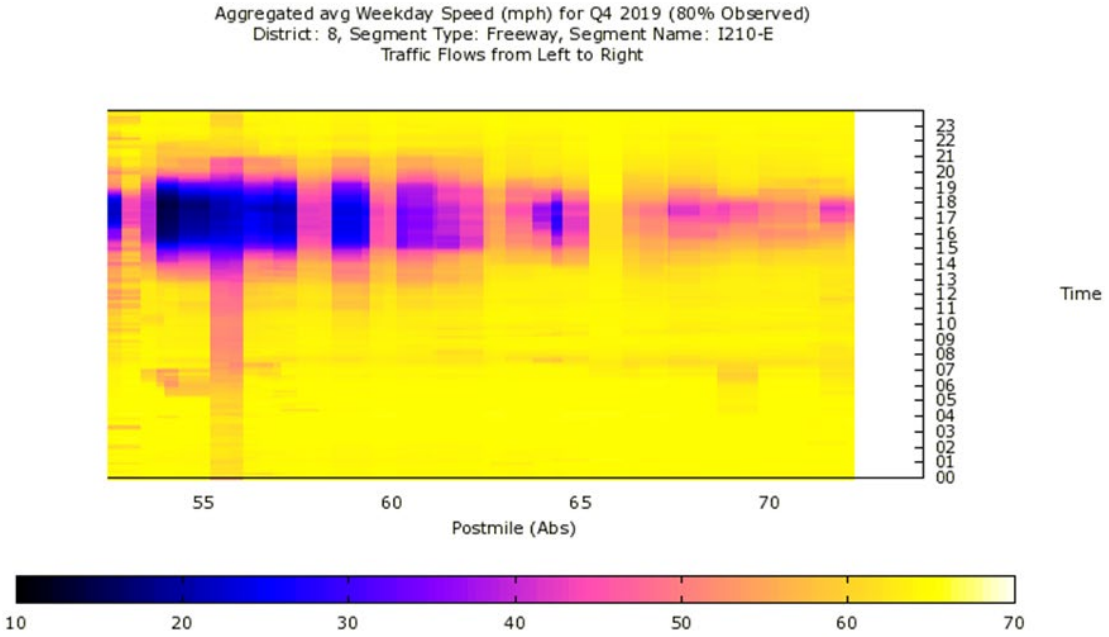
The eastbound HOV lane is extremely degraded from the Los Angeles county line to Route 15 in the afternoon peak hour period due to heavy traffic commuting from Los Angeles. In the westbound direction, the HOV lane is very/extremely degraded during the morning peak hour period from Route 15 to Campus Avenue due to heavy traffic commuting to Los Angeles.

Violation rates on the HOV lanes are 23 percent based on fall 2019 traffic counts.

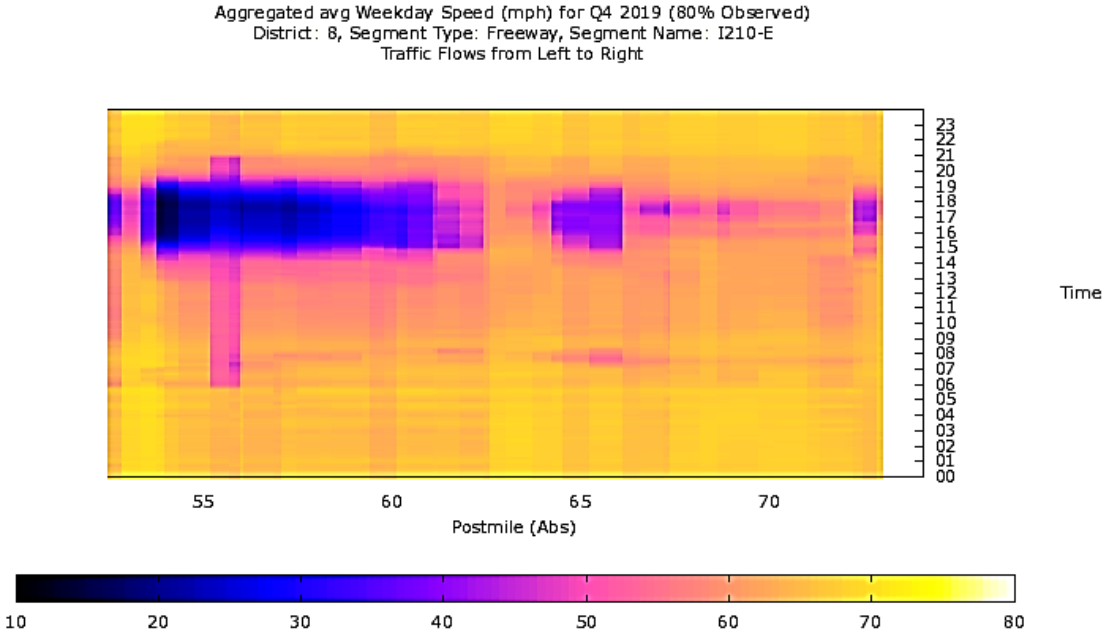
High peak hour volumes and high truck traffic volume creates congestion in all lanes and thereby reduces HOV lane performance including its speed. The speed differential between the GP lanes and HOV lanes will adversely affect the performance of the HOV lane, especially when the HOV lane is a continuous access HOV lane.

Figures 152 and 153 provide plots of HOV and GP lane speeds along the length of the HOV facility on eastbound Route 210 during the fourth quarter of 2019. Figures 154 and 155 provide plots of HOV and GP lane speeds along the length of the HOV facility on westbound Route 210 during the fourth quarter of 2019.

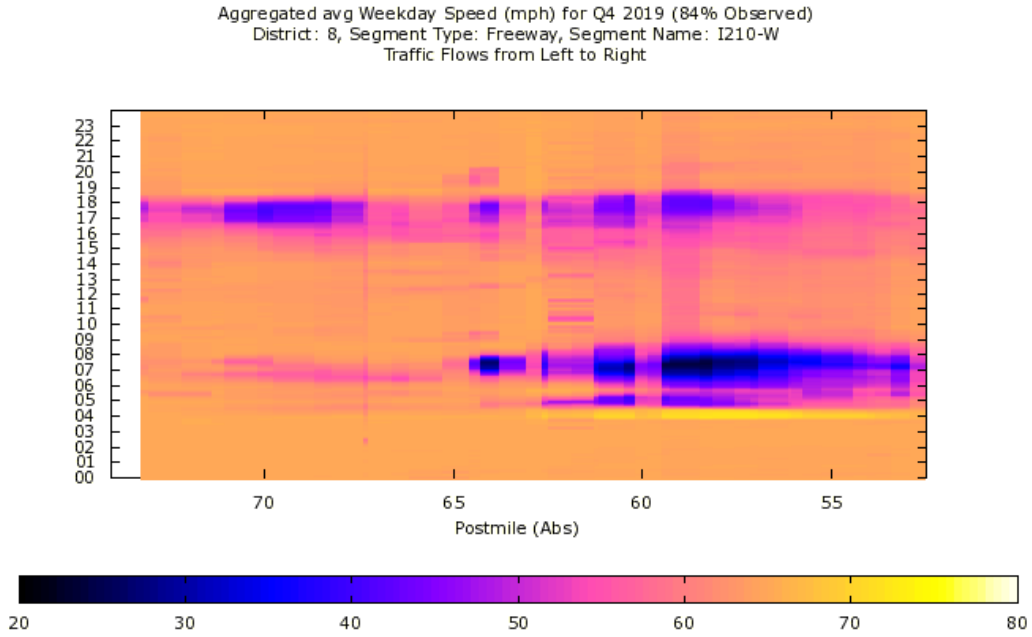
## FIGURE 152. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 210, Q4 2019



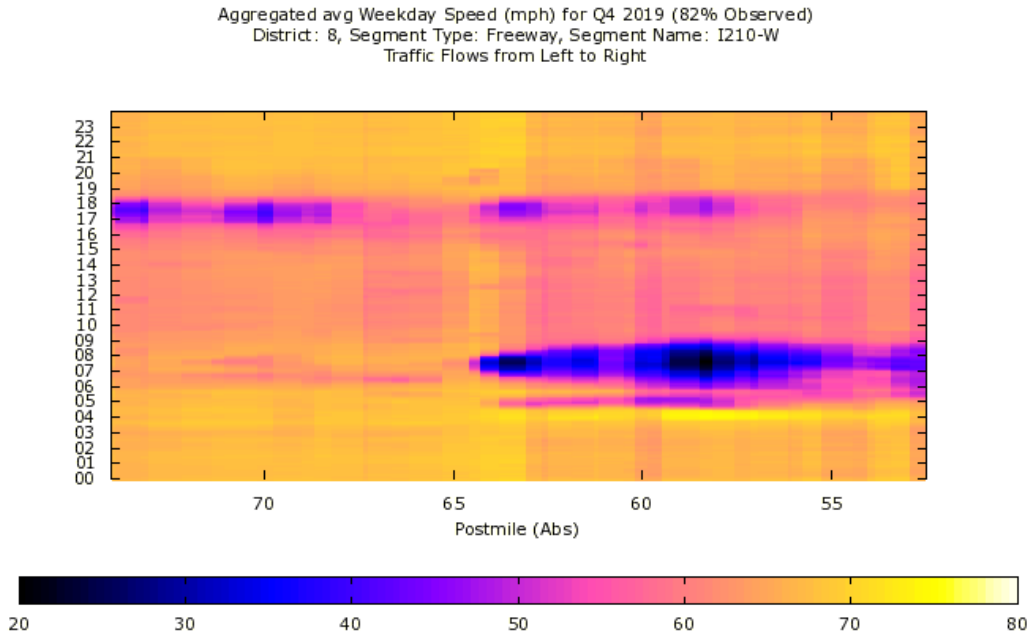

## FIGURE 153. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 210, Q4 2019



## FIGURE 154. AVERAGE HOV LANE SPEED – WESTBOUND ROUTE 210, Q4 2019




## FIGURE 155. AVERAGE GP LANE SPEED – WESTBOUND ROUTE 210, Q4 2019



## B. REMEDIATION STRATEGIES

- Project 08-1G210 PM 10.5/12.7 will install freeway to freeway ramp metering system at the junction of Routes 210 and 15. Project began construction on October 24, 2019 and scheduled to be completed on May 3, 2021. *Desired Outcome*: The project should improve traffic mobility on Route 210 as well as on Route 15.

- Project 08-1K600 PM 0.00/21.0 will convert HOV lanes HOT lanes in various cities from LA County Line to Highland Avenue Project will begin on September 27, 2022 and scheduled to be completed on March 24, 2023. *Desired Outcome*: This project is anticipated to increase the freeway capacity

- Installing Route Shield Pavement Markings approaching Route 15 and JCT 215. Strategically located Route Shield Pavement Markings will supplement the information provided by overhead or roadside signs that depict upcoming freeway interchange approaches. When motorist receive information on interchange approaches early, and in multiple ways, they are likely to make better driving decisions and change lanes farther upstream. *Desired Outcome*: Reducing late lane changes and thereby sudden weaving movement. It improves safety and reduces weaving conflict.

- District 8 Traffic Management Center (TMC) operations' primary function is to reduce congestion by monitoring traffic on our State Highway System (SHS) continuously and provides timely information to the public and partners pertaining to the current traffic conditions. It will affect the safe movement of traffic throughout our SHS. *Desired Outcome*: Clearing non-recurrent congestion on SHS safely and expediently.

- Activating Ramp Metering during re-current congestion and non-recurrent congestion as needed to reduce congestion and increase safety on SHS by monitoring freeway operating speed. *Desired Outcome*: Maintaining an efficient freeway system by maximizing its operating speed at or near capacity. Thereby, avoiding all lane congestion including HOV lane.

- District 8 Traffic Ops is partnering with CHP to reduce violations on HOV lanes. Reduction in violations on HOV lanes will improve traffic flow on HOV lane and will help District 8 to improve in degradation. HQ Traffic Operations provided $4.3 million special fund to District 8 to initiate projects to reduce

degradation on HOV lanes in District 8. District 8 Traffic Ops initiated (SHOPP ID 23288) to use $250K for CHP enforcement from this special fund to reduce HOV violations on various routes in District 8. *Desired Outcome:* Reduced volumes in the HOV lanes due to fewer violators.

### 4.4.8 ACTION PLAN FOR HOV FACILITIES ON ROUTE 215

### A. ANALYSIS

The violation rate on HOV lane is above 27 percent (based on data collected in fall 2019 in both directions) which contributed to increased traffic volumes on the HOV facility.

High peak hour volumes and high truck traffic volume creates congestion in all lanes and thereby reduces HOV lane performance including its speed. The speed differential between the GP lanes and HOV lanes will adversely affect the performance of the HOV lane, especially when the HOV lane is a continuous access HOV lane.

Northbound, during Morning peak hour period: The degradation started from 60/215 JCT continued to 60/91/215 JCT and dissipated approaching 10/215 JCT.

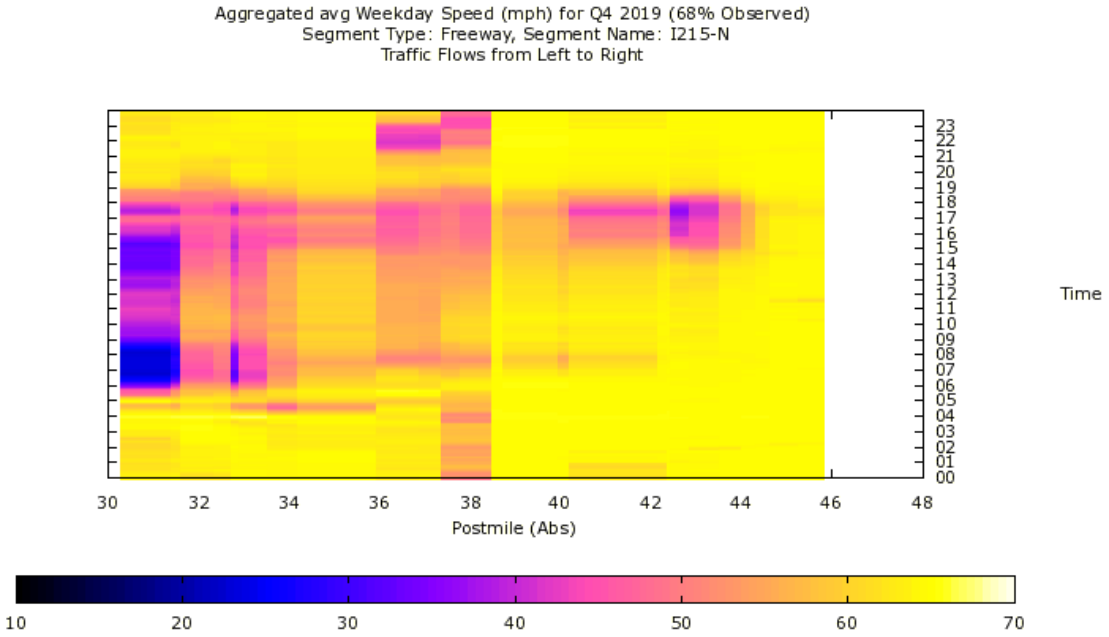
Northbound, during afternoon peak hours: The degradation started from 60/215 JCT continued to 60/91/215 JCT and to 10/215 JCT and dissipated approaching 10/215 JCT.

Southbound, during Morning peak hour period: The degradation occurred between 10/215 JCT and 60/91/215 JCT.

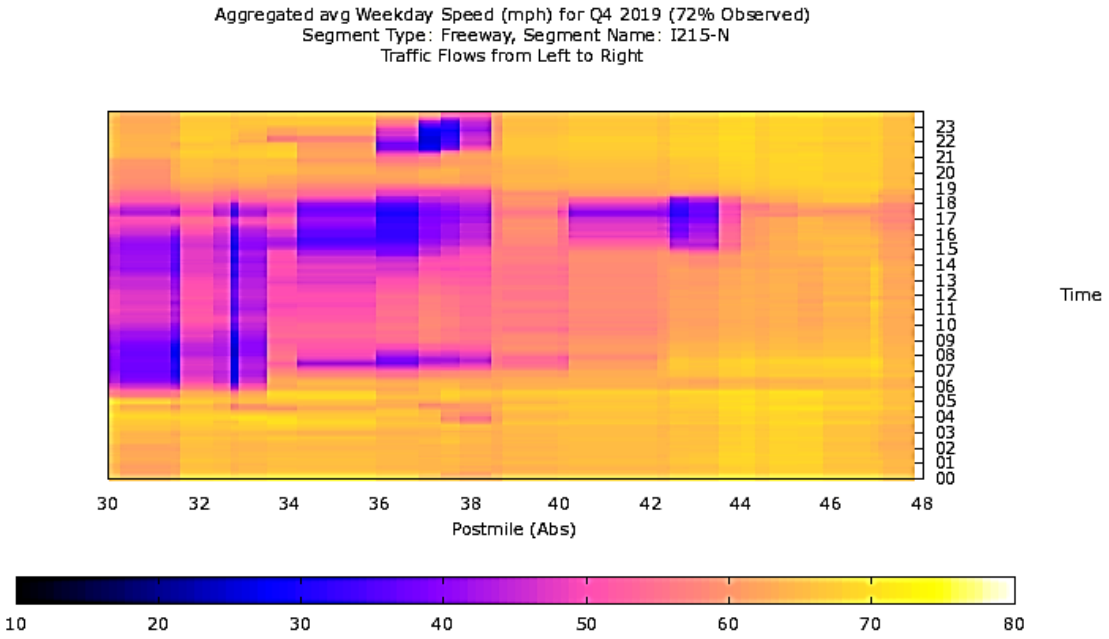
Southbound, during afternoon peak hours: The degradation started from 10/215 JCT continued to 60/91/215 JCT and dissipated approaching 60/215 JCT.

Figures 156 and 157 provide plots of HOV and GP lane speeds along the length of the HOV facility on northbound Route 215 during the fourth quarter of 2019. Figures 158 and 159 provide plots of HOV and GP lane speeds along the length of the HOV facility on southbound Route 215 during the fourth quarter of 2019.

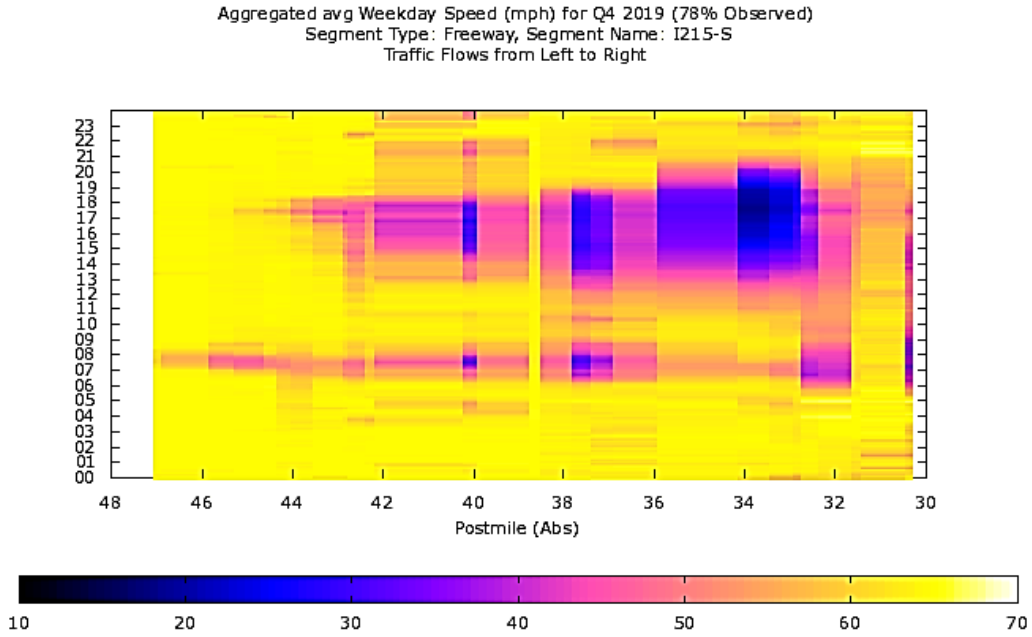
## FIGURE 156. AVERAGE HOV LANE SPEED – NORTHBOUND ROUTE 215, Q4 2019



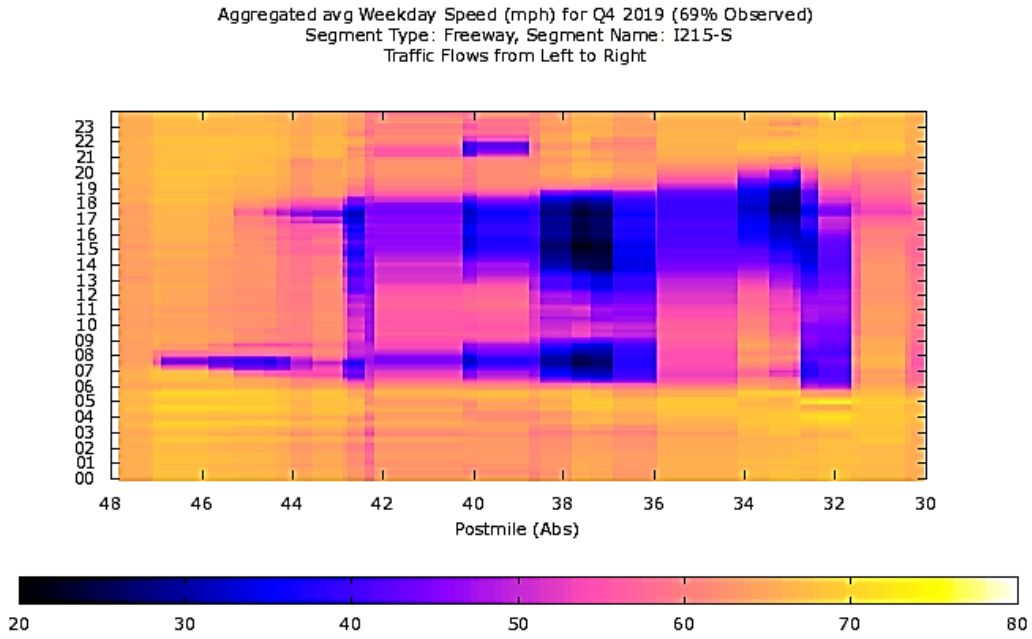

## FIGURE 157. AVERAGE GP LANE SPEED – NORTHBOUND ROUTE 215, Q4 2019



## FIGURE 158. AVERAGE HOV LANE SPEED – SOUTHBOUND ROUTE 215, Q4 2019




## FIGURE 159. AVERAGE GP LANE SPEED – SOUTHBOUND ROUTE 215, Q4 2019



## B. REMEDIATION STRATEGIES

- Project 08-0J070, SBD. PM 0.58-SBD. PM 1.66 will reconstruct Barton Road IC. Project cost estimate is $118.9 million. Construction to begin in November 2017 until June 2021. Desired Outcome: This project is anticipated to improve freeway traffic movement by the IC and thereby minimizing recurrent local congestion.

- 08-1F730, SBD. PM 2.40-SBD. PM 3.00 will replace Mt. Vernon/Washington Street OC. Project cost estimate is $34.4 million. Construction to begin in March 2021 until June 2023. *Desired Outcome*: This project is anticipated to improve freeway traffic movement by the IC and thereby minimizing recurrent local congestion.

- Project 08-1H770, SBD. PM 4.50-SBD. PM 5.80 is a Lane reconfiguration and pavement widening project. Project cost estimate is $11.12 million. Construction to begin in June 2020 until December 2021. *Desired Outcome*: This project is anticipated to improve freeway traffic movement and thereby minimizing congestion.

- 08-47642, SBD. PM 4.00-18.00 will install Traffic Management Systems (TMS) field elements. Project cost estimate is $12.43 million. Construction to begin in December 2020 until March 2022. *Desired Outcome*: By empowering commuters with information about travel options and information to avoid delays when possible, the traffic flow would be improved when traffic is at or beyond full capacity.

- Installing Route Shield Pavement Markings (RSPMs) on northbound Route 215 approaching 60/91/215 JCT and 215/10 JCT and on southbound Route 215 approaching 215/10 JCT, 60/91/215 JCT and 215/60 JCT. The installation would be completed in July 2023. Strategically located Route Shield Pavement Markings will supplement the information provided by overhead or roadside signs that depict upcoming freeway interchange approaches. When motorist receive information on interchange approaches early, and in multiple ways, they are likely to make better driving decisions and change lanes farther upstream. *Desired Outcome*: Reducing late lane changes and thereby sudden weaving movement. It improves safety and reduces weaving conflict.

- District 8 Traffic Management Center (TMC) operations' primary function is to reduce congestion by monitoring traffic on our State Highway System (SHS) continuously and provides timely information to the public and partners pertaining to the current traffic conditions. It will affect the safe movement of traffic throughout our SHS. *Desired Outcome*: Clearing non-recurrent congestion on SHS safely and expediently.

- Activating Ramp Metering during re-current congestion and non-recurrent congestion as needed to reduce congestion and increase safety on SHS by monitoring freeway operating speed. *Desired Outcome*: Maintaining an efficient freeway system by maximizing its operating speed at or near capacity. Thereby, avoiding all lane congestion including HOV lane.

- District 8 Traffic Ops is partnering with CHP to reduce violations on HOV lanes. Reduction in violations on HOV lanes will improve traffic flow on HOV lane and will help District 8 to improve in degradation. HQ Traffic Operations provided $4.3 million special fund to District 8 to initiate projects to reduce degradation on HOV lanes in District 8. District 8 Traffic Ops initiated (SHOPP ID 23288) to use $250K for CHP enforcement from this special fund to reduce HOV violations on various routes in District 8. *Desired Outcome:* Reduced volumes in the HOV lanes due to fewer violators.

## 4.5. DISTRICT 11 2020 DEGRADTION ACTION PLANS

### 4.5.1 SUMMARY OF DEGRADATION ON HOV FACILITIES IN DISTRICT 11

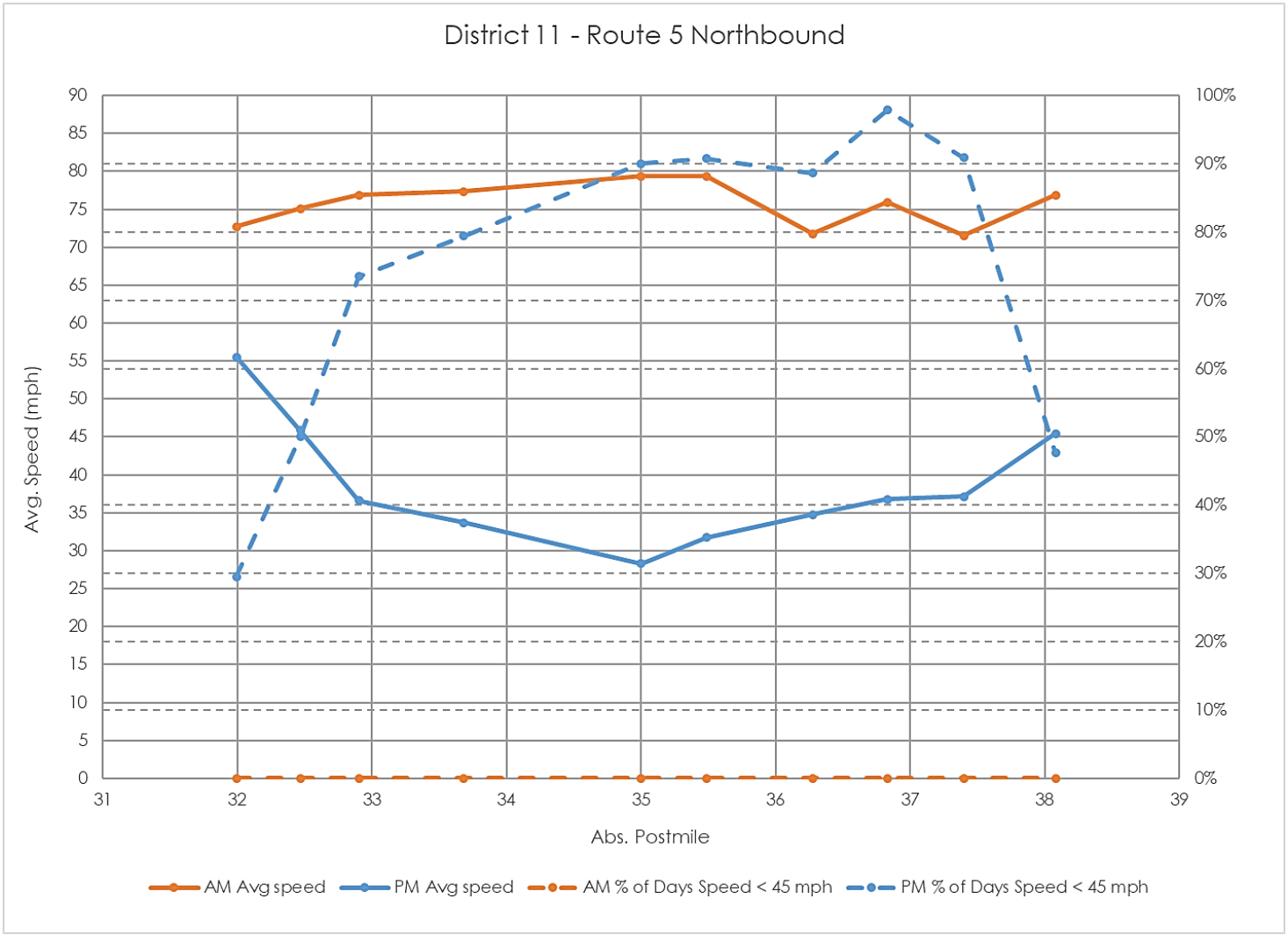
Table 37 provides the list of degraded facilities in District 11 that were identified in the 2019 California High Occupancy Vehicle Facilities Degradation Report and Action Plan. The speed and degradation profiles for each degraded facility are provided in Figures 160 through 165.

**TABLE 36. DISTRICT 11 LIST OF DEGRADED HOV FACILITIES**

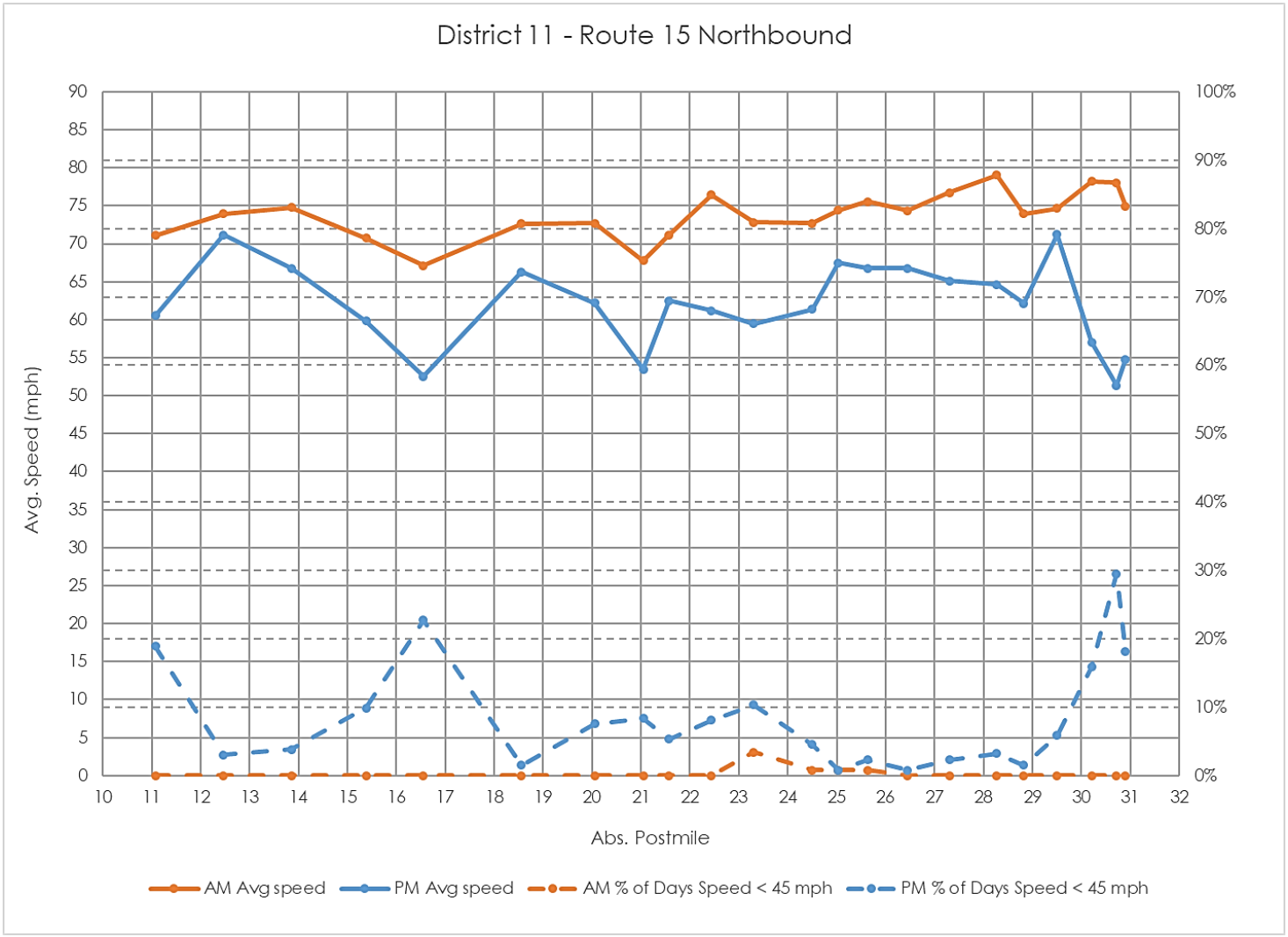
| Route | Direction | Limits | Facility length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 5 | NB | Route 805 to Manchester Avenue | 7.1 | 7.1 | AM-7.1<br>PM-0.0 | AM-0.0<br>PM-1.6 | AM-0.0<br>PM-1.1 | AM-0.0<br>PM-4.4 |
| 15S | NB | Route 163 to Route 78 | 39.7 | 39.6 | AM-39.6<br>PM-30.9 | AM-0.0<br>PM-8.7 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 15S | SB | Route 78 to Route 163 | 39.0 | 38.0 | AM-36.6<br>PM-38.0 | AM-1.4<br>PM-0.0 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 805 | NB | Telegraph Canyon Rd to Market Street | 7.9 | 7.2 | AM-3.9<br>PM-6.6 | AM-1.7<br>PM-0.6 | AM-1.7<br>PM-0.0 | AM-0.0<br>PM-0.0 |
| 805 | SB | Route 5 to Route 52 | 4.3 | 4.3 | AM-3.5<br>PM-4.3 | AM-0.0<br>PM-0.0 | AM-0.1<br>PM-0.0 | AM-0.7<br>PM-0.0 |
| 805 | SB | Route 94 to Palomar Street | 8.3 | 6.6 | AM-6.6<br>PM-6.0 | AM-0.0<br>PM-0.6 | AM-0.0<br>PM-0.0 | AM-0.0<br>PM-0.0 |

EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound
Lane-miles may not add up exactly due to rounding

## FIGURE 160. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 5



## FIGURE 161. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 15



## FIGURE 162. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 15

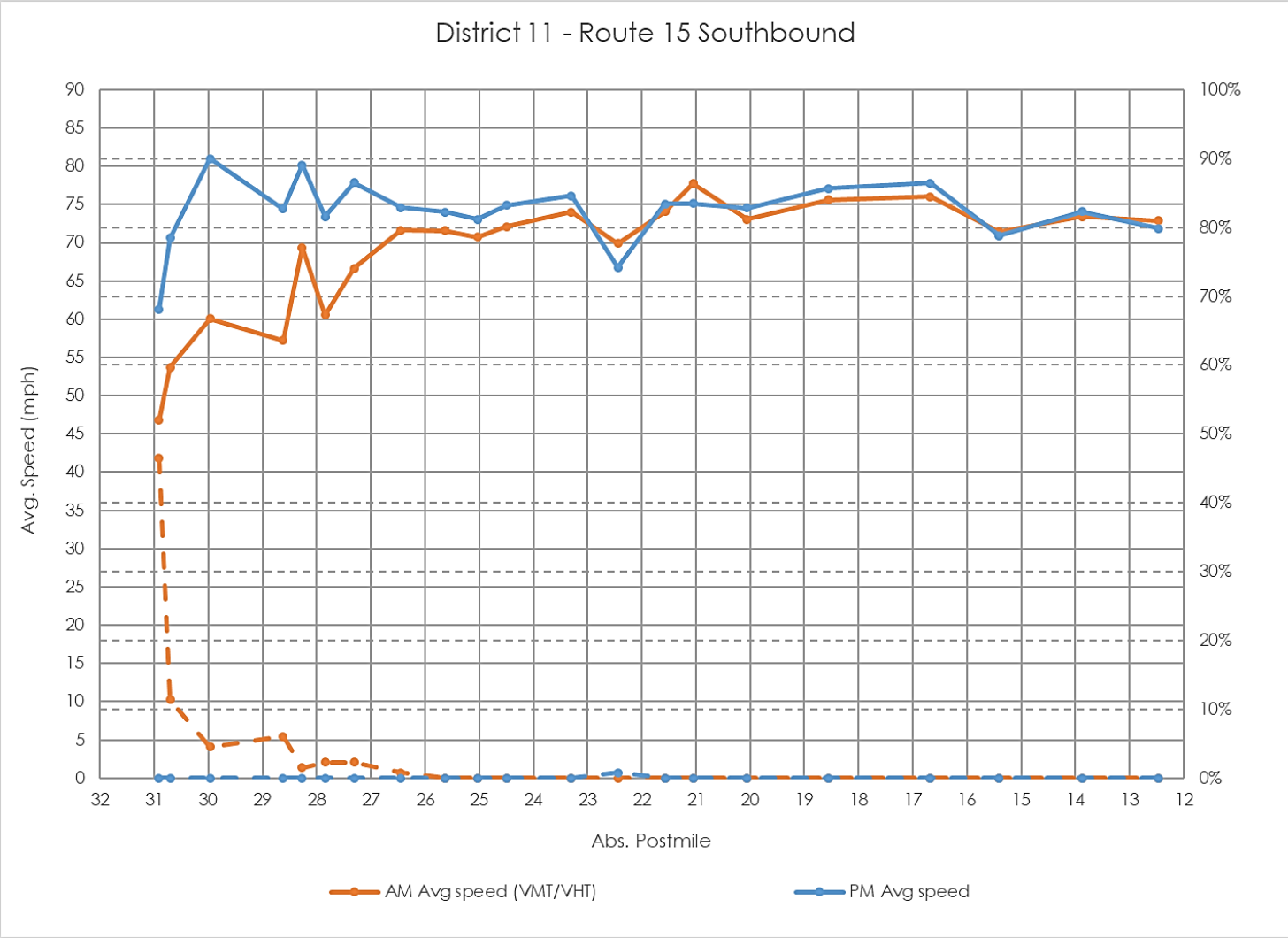


**FIGURE 163. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 805 (PALOMAR STREET TO ROUTE 94)**

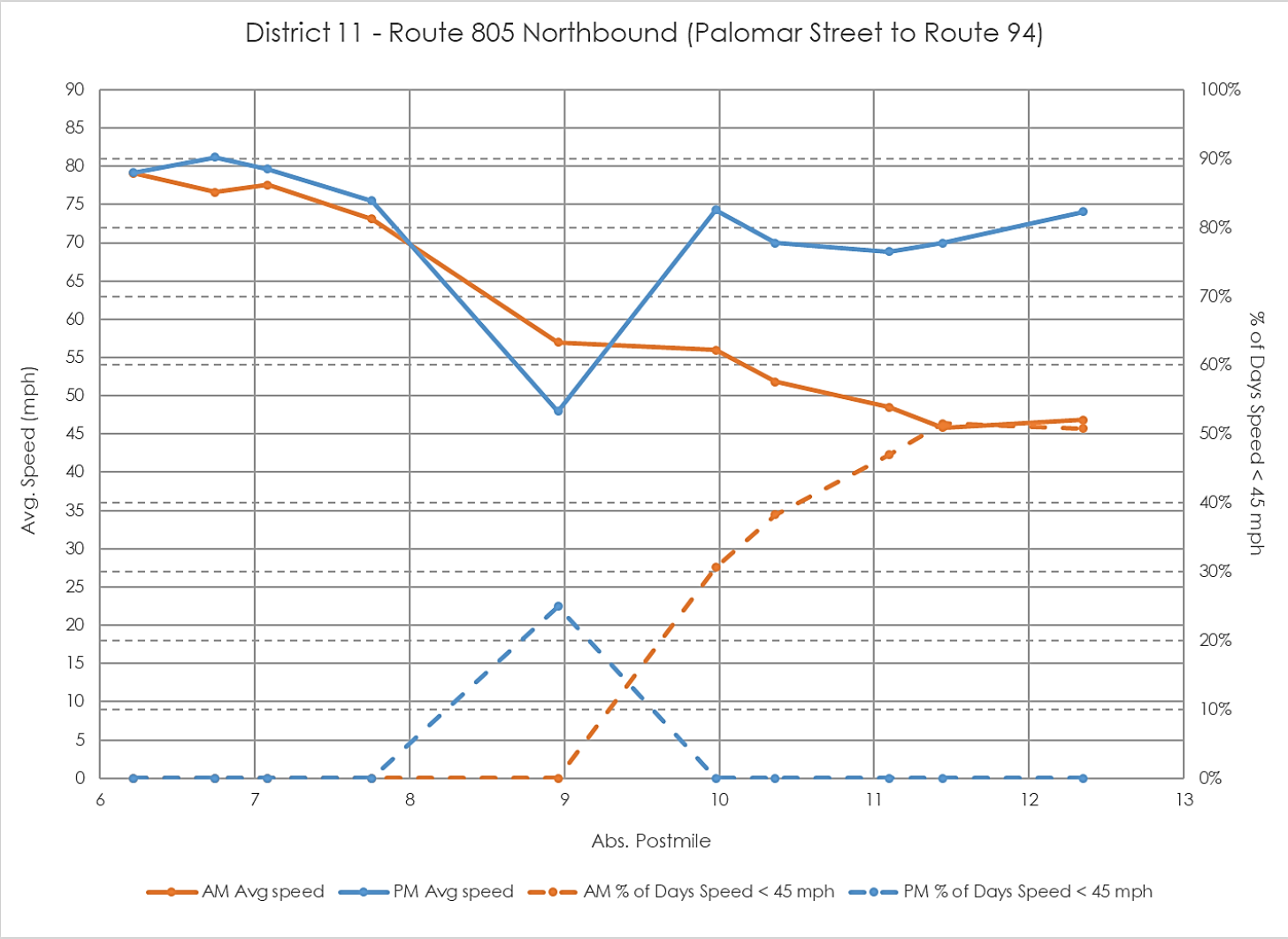


**FIGURE 164. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 805 (PALOMAR STREET TO ROUTE 94)**

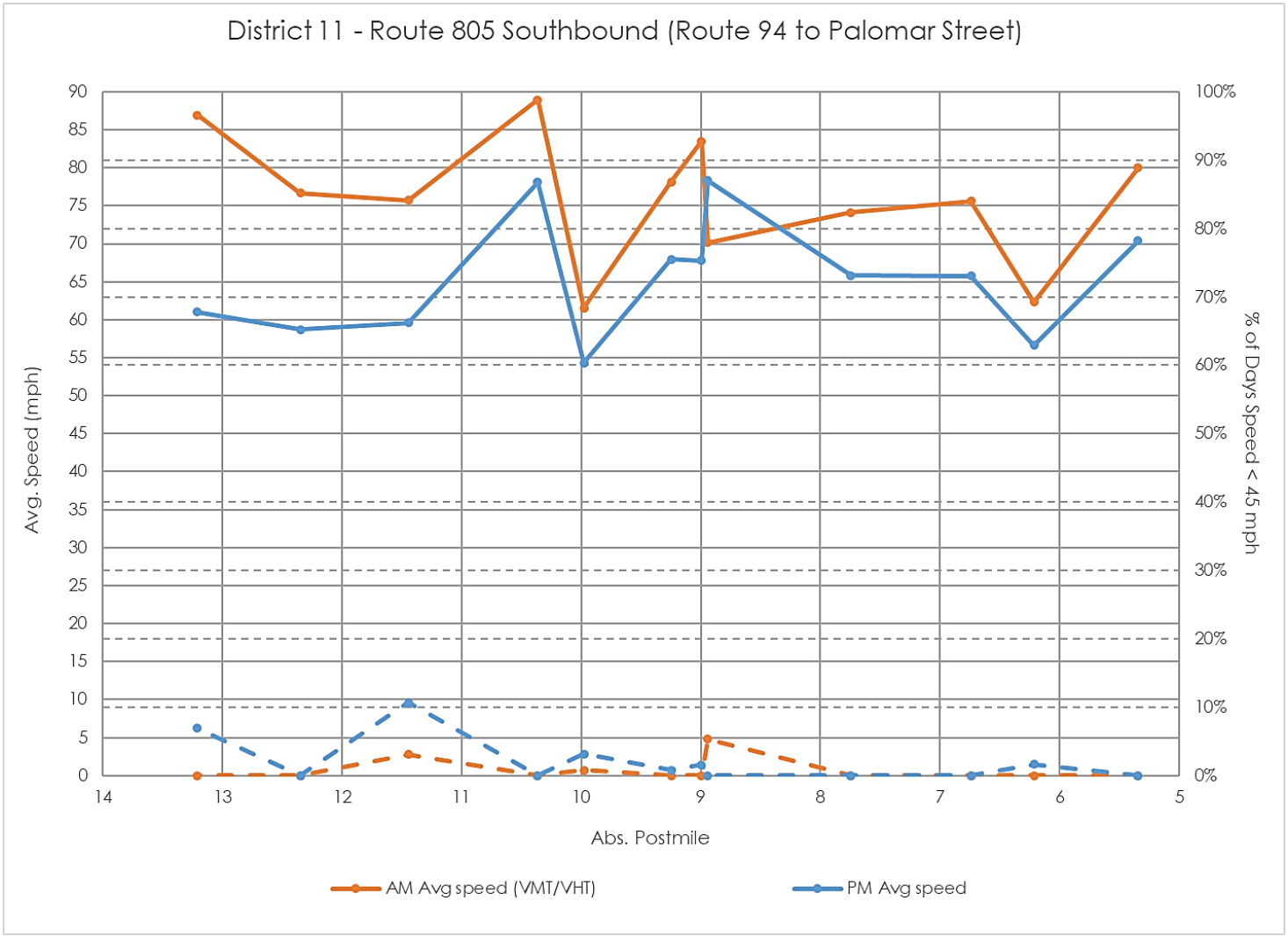
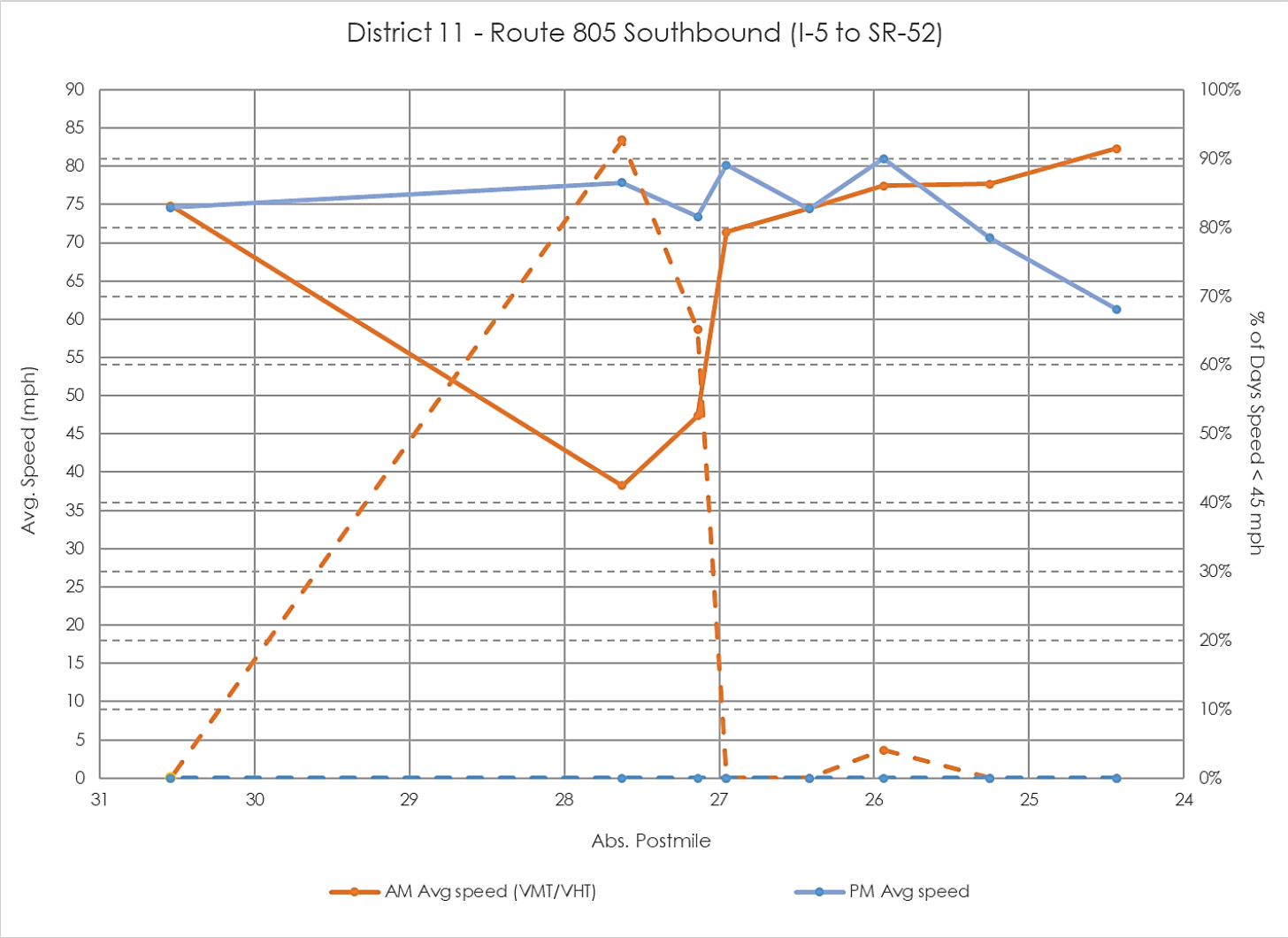


**FIGURE 165. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 805 (ROUTE 52 TO ROUTE 5)**



## 4.5.2 ACTION PLAN FOR HOV FACILITIES ON ROUTE 5

## A. ANALYSIS

Route 5 is a major north-south artery serving the San Diego metropolitan area and numerous surrounding cities. Northbound Route 5 experiences degradation in the afternoon peak period only. No degradation was observed on southbound Route 5 during either peak period.

Currently the northbound Route 5 HOV lane is an open access HOV lane from Route 56 to Via De La Valle where it converts to a limited access HOV lane ending at Manchester Avenue This location experiences recurrent congestion during the afternoon peak period. During the afternoon peak period, the HOV lane on northbound Route 5 experiences degradation ranging from slightly degraded to extremely degraded. The degradation occurs for approximately 7 miles from Carmel Mountain Road to Manchester Avenue

The North Coast Corridor (NCC) project is a $6.5 billion project which involves numerous rail and highway improvements stretching between the cities of La Jolla and Oceanside. As a part of the NCC Project, the HOV lane will be extended an additional nine miles to the north and through the degraded segment to the major interchange at Palomar Airport Road, eliminating the terminus of the HOV lane at Manchester Avenue and reducing or eliminating degradation.

Construction activities for the NCC greatly contribute to congestion in the GP lanes and this congestion extends into the HOV lane at the terminus.

## B. REMEDIATION STRATEGIES

Completion of the NCC new northbound and southbound HOV lanes from Manchester Avenue to Palomar Airport Road (9 miles) is scheduled for March 2022, it is expected to alleviate congestion for this segment.

New northbound and southbound HOV (2+) lanes began construction in 2021, from Palomar Airport Road to Route 78, this project is scheduled to open early 2023.

In 2021 Caltrans and the San Diego Association of Governments (SANDAG) began preliminary engineering activities on a 26-mile HOV to high occupancy toll (HOT) conversion for the Route 805 north (Route 52 to Route 5) and NCC

(Route 805 to Route 78). It is anticipated that the conversion will require increasing occupancy to 3+. This $170M project is anticipated to begin construction in 2026 and operational in 2028.

### 4.5.3 ACTION PLAN FOR HOV FACILITIES ON ROUTE 15

## A. ANALYSIS

Route 15 is the primary inland north-south transportation connector serving interregional travelers between Riverside County and downtown San Diego. It also is part of a major interregional goods movement corridor, connecting Mexico with Riverside and San Bernardino counties, as well as Las Vegas, Nevada. HOT lanes operate on Route 15 between Route 163 and Route 78.

Degradation was observed at the beginning of the HOT lanes in the southbound direction during the morning peak period, and in the northbound direction at the beginning and end of the HOT lanes during the afternoon peak hour period, Slight degradation was also observed at a couple of points along the HOT lanes in the northbound direction during the afternoon peak hour period.

The Route 15 HOT lanes have three challenges that regularly recur on the facility

- Extensive violations: Since transponders are not required and visual enforcement is difficult, many drivers take advantage and attempt to get a free ride. Surveys conducted by SANDAG over the past couple of years have indicated that 25-30 percent of users of the HOT lanes are violators—meaning, single-occupant vehicles driving through the HOT lanes without a transponder.

- Northbound HOT lane congestion: The evening commute is not as reliable as it once was, as the HOT lanes—congested in part by unauthorized users—frequently slow down. It is common to encounter speeds in the 25-30 miles per hour (mph) range during peak periods.

- Frequent HOV Only Operations: With some regularity, congested traffic conditions automatically force the HOT lanes into "HOV ONLY" mode which only allows vehicles with 2 or more occupants to enter the HOT lanes. During such periods, the HOT lanes no longer provide a reliable ride for single-occupant vehicles that wish to pay for the service.

## B. REMEDIATION STRATEGIES

Caltrans District 11, San Diego Metropolitan Transit Service and SANDAG have formed a multi-agency Corridor Management Team (CMT). The CMT meets quarterly to assess performance and develop strategies to remediate congestion.

In addition to these ongoing discussions, in July 2020, SANDAG completed an operational study of the Route 15 HOT lanes. This study documented existing operations and performance, identified and analyzed strategies for improving the operations and performance of the HOT lanes, and included a workplan for implementing the study's recommendations. The three strategies examined were as follows:

- Transponder for All. This strategy requires all users of the EL to have a transponder, regardless of the number of occupants. The new transponder requirement would be accompanied by enhanced video enforcement.
- Change HOV Eligibility. This strategy increases the required number of occupants (for toll-free travel) from HOV2+ to HOV3+.
- Increase Maximum Toll. This strategy permits the toll rate to increase above the current maximum of $8 per trip. It maintains the current per-mile maximum of $1 but allows the per-mile rate to be applied to the full length of the trip. Since a full-length trip is 20 miles, this strategy essentially increases the maximum toll from $8 to $20.

The CMT will explore these strategies further in 2021, with implementation occurring within the next year or 2 as traffic returns to pre-pandemic levels.

### 4.5.4 ACTION PLAN FOR HOV FACILITIES ON ROUTE 805

## A. ANALYSIS

Route 805 is a heavily traveled route serving the inland communities within the cities of San Diego, National City, and Chula Vista in San Diego County. The commuter freeway connects the Mexico border zone with the light industry of Sorrento Valley. There are two separate segments of Route 805 with HOV facilities; the south segment is from Palomar Street to Route 94 and the north segment is from Route 52 to the Route 5/Route 805 junction.

*Palomar Street to Route 94*

On the South segment, both the northbound and southbound HOV lanes are open access, the GP lanes in the northbound direction experience congestion during the morning peak period and this spills into the HOV lanes from Route 54 to Imperial Avenue Degradation on this segment is due to heavy traffic on the GP lanes causing friction to HOV users. Vehicles from GP lanes weave in and out of the HOV lane using it as a passing lane. In addition, there is a high percentage of HOV lane violators, which also contributes to the HOV lane degradation.

In the afternoon peak period, northbound Route 805 experiences a slight degradation at Sweetwater Road due to heavy traffic on the GP lanes. southbound Route 805 experiences a slight degradation at 47th street due to heavy traffic on the GP lanes.

*Route 52 to Route 5*

Both the northbound and southbound HOV lanes are open access. This segment presents degradation ranging from very degraded to extremely degraded in the southbound direction during the morning peak period for approximately 0.8 miles beginning at the southbound Sorrento Valley Road exit ramp. The cause of degradation is due to heavy traffic on the general-purpose lanes weaving in and out of the HOV lane and using it as a passing lane, and also that this section of the HOV lane is on an incline grade. The southbound direction is not degraded in the afternoon peak period. northbound Route 805 does not experience degradation during either peak period.

## B. REMEDIATION STRATEGIES

*Palomar Street to Route 94*

Additional law enforcement presence will be a priority in this segment. Due to heavy traffic on the GP lanes, the HOV lane is used as a passing lane, disrupting traffic flow in the HOV lane.

Violation rates are very high in this segment, for this reason there is a separate effort to install video analytics software with high-definition cameras for occupancy detection and alerting mechanism for law enforcement in the HOV lanes. This software will automate collection of occupancy data, generate a notification of the violation and vehicle speed. District 11 Traffic Operations is

working with local CHP to identify the strategic locations of occupancy detection for effective enforcement.

A Transit Only Lane (MTS busses on shoulder) project will begin operations on the south segment of northbound Route 805 in November of 2021. This segment stretches from Palomar Street to the Route 94 exit ramp and will be operational during the commute hours from 6:00 am to 9:00 am. During these hours the project will include enhanced CHP (2 patrol vehicles) to support the buses when travelling from the HOV lanes to the outside shoulder. This will also serve as an opportunity to evaluate how the presence of CHP will affect the number of violators on the HOV facility.

*Route 52 to Route 5*

District 11 Traffic Operations with support from the San Diego Association of Governments (SANDAG) is studying the feasibility of congestion pricing on the two existing HOV direct access ramps on Route 805, at Carroll Canyon Road and Palomar Street.

There is a current project planned to provide an auxiliary lane on Route 805 between Route 52 and Governor Drive in both the northbound and southbound directions that would alleviate main lane congestion caused by merging traffic to and from the connectors.

Additional law enforcement presence will be a priority in this segment. Due to heavy traffic on the GP lanes, the HOV lane is used as a passing lane, disrupting traffic flow in the HOV.

Violation rates are very high in this segment, for this reason there is a separate effort to install video analytics software with high-definition cameras for occupancy detection and alerting mechanism for law enforcement in the HOV lanes. This software will automate collection of occupancy data, generate a notification of the violation and vehicle speed. District 11 Traffic Operations is working with local CHP to identify the strategic locations of occupancy detection for effective enforcement.

## 4.6. DISTRICT 12 2020 DEGRADATION ACTION PLANS

### 4.6.1 SUMMARY OF DEGRADATION ON HOV FACILITIES IN DISTRICT 12

Table 38 provides the list of degraded facilities in District 12 that were identified in the 2019 California High Occupancy Vehicle Facilities Degradation Report and Action Plan. The speed and degradation profiles for each degraded facility are provided in Figures 166 through 178.

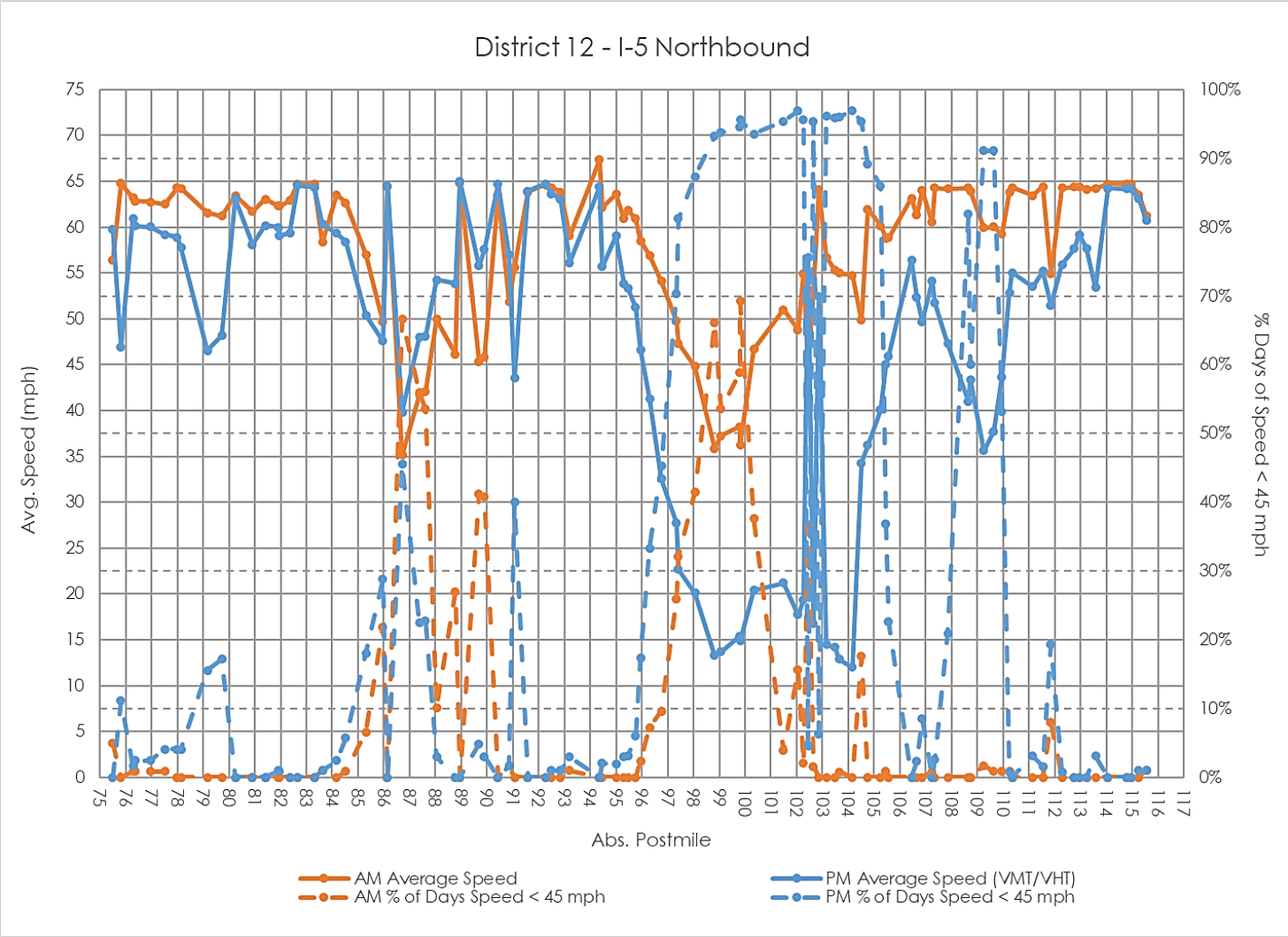
**TABLE 37. DISTRICT 12 LIST OF DEGRADED HOV FACILITIES**

| Route | Direction | Limits | Facility length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 5 | NB | Ave Pico to Beach Blvd | 42.0 | 41.4 | AM-33.0<br>PM-24.9 | AM-5.4<br>PM-7.2 | AM-3.1<br>PM-0.7 | AM-0.0<br>PM-8.6 |
| 5 | SB | Artesia Blvd to Ave Pico | 43.3 | 41.6 | AM-29.0<br>PM-33.9 | AM-5.8<br>PM-6.9 | AM-3.8<br>PM-0.2 | AM-3.0<br>PM-0.6 |
| 22 | EB | Route 405 to Grand Ave | 11.9 | 11.1 | AM-6.3<br>PM-5.4 | AM-3.3<br>PM-4.0 | AM-1.5<br>PM-0.9 | AM-0.0<br>PM-0.8 |
| 22 | WB | 0.8 mi w/of Route 55 to Route 405 | 12.9 | 10.7 | AM-10.7<br>PM-7.4 | AM-0.0<br>PM-2.0 | AM-0.0<br>PM-0.6 | AM-0.0<br>PM-0.8 |
| 55 | NB | Route 405 to 0.7 mi s/of Lincoln Ave | 10.7 | 10.0 | AM-10.0<br>PM-0.3 | AM-0.0<br>PM-0.8 | AM-0.0<br>PM-1.2 | AM-0.0<br>PM-7.8 |
| 55 | SB | 0.4 mi s/of Lincoln Ave to Route 405 | 10.3 | 10.8 | AM-4.2<br>PM-10.1 | AM-2.1<br>PM-0.8 | AM-0.0<br>PM-0.0 | AM-4.6<br>PM-0.0 |
| 57 | NB | Route 5 to Los Angeles County Line | 11.8 | 11.6 | AM-10.9<br>PM-4.0 | AM-0.7<br>PM-1.0 | AM-0.0<br>PM-2.0 | AM-0.0<br>PM-4.5 |
| 57 | SB | Los Angeles County Line to Route 5 | 11.8 | 9.7 | AM-1.9<br>PM-2.5 | AM-1.2<br>PM-4.5 | AM-1.3<br>PM-1.8 | AM-5.3<br>PM-0.9 |
| 91 | EB | Los Angeles County Line to Tustin Avenue | 11.8 | 11.7 | AM-3.5<br>PM-1.3 | AM-4.2<br>PM-2.0 | AM-4.0<br>PM-4.5 | AM-0.0<br>PM-3.9 |
| 91 | WB | Tustin Ave to Los Angeles County Line | 11.8 | 10.4 | AM-6.6<br>PM-2.5 | AM-3.8<br>PM-3.5 | AM-0.0<br>PM-1.6 | AM-0.0<br>PM-2.8 |
| 405 | NB | Route 5 to Los Angeles County Line | 26.5 | 20.3 | AM-16.0<br>PM-5.7 | AM-3.1<br>PM-5.5 | AM-1.2<br>PM-3.3 | AM-0.0<br>PM-5.9 |

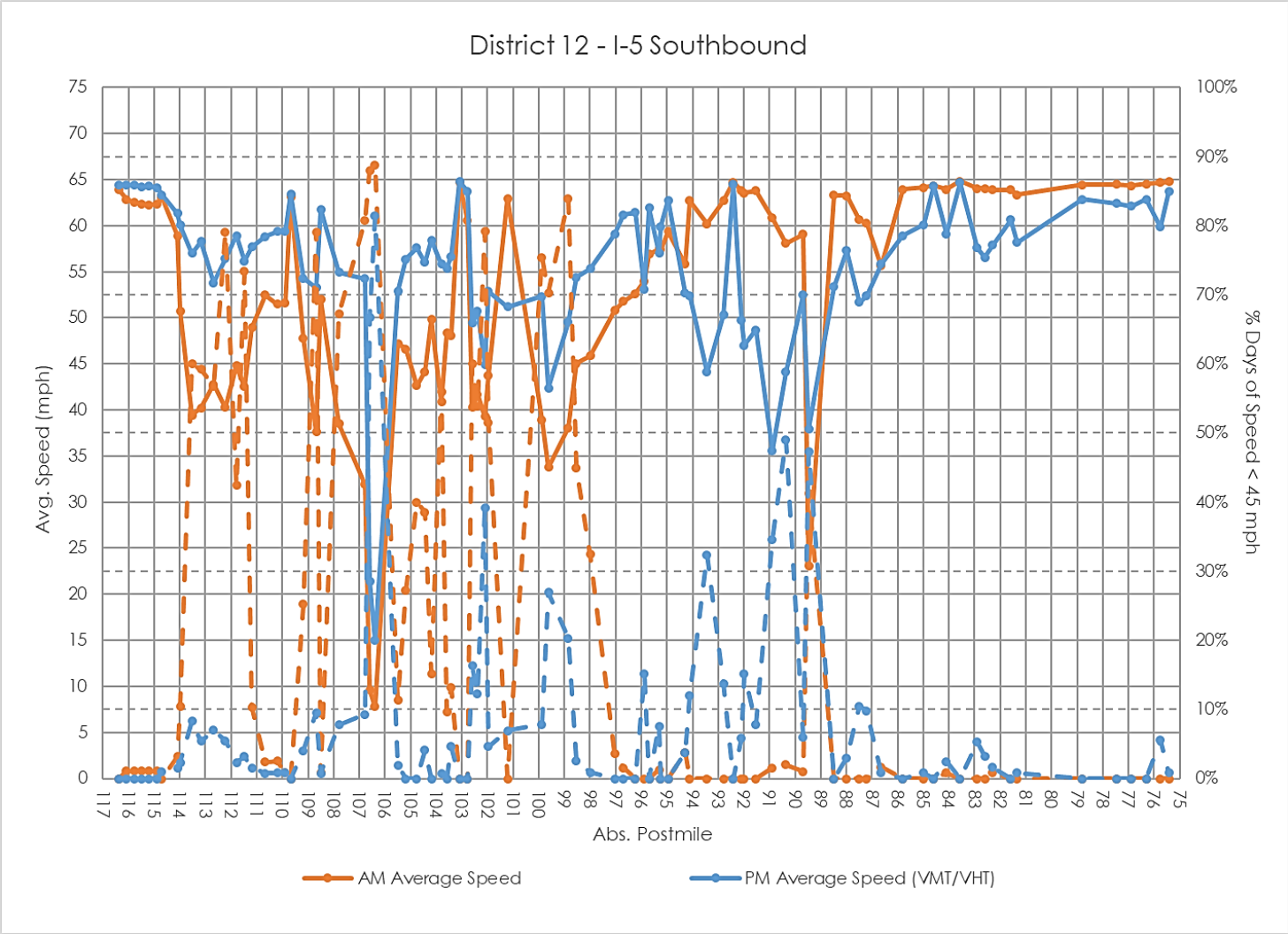
| Route | Direction | Limits | Facility length (Lane-Miles) | Lane-Miles Monitored | Not Degraded (Lane-Miles) | Slightly Degraded (Lane-Miles) | Very Degraded (Lane-Miles) | Extremely Degraded (Lane-Miles) |
|---|---|---|---|---|---|---|---|---|
| 405 | SB | Los Angeles County Line to Route 5 | 26.3 | 20.4 | AM-13.4<br>PM-8.1 | AM-3.2<br>PM-7.0 | AM-1.6<br>PM-1.1 | AM-2.2<br>PM-4.3 |
| 605 | NB | Route 405 to Los Angeles County Line | 2.4 | 2.1 | AM-2.1<br>PM-0.0 | AM-0.0<br>PM-1.8 | AM-0.0<br>PM-0.3 | AM-0.0<br>PM-0.0 |

EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound
Lane-miles may not add up exactly due to rounding

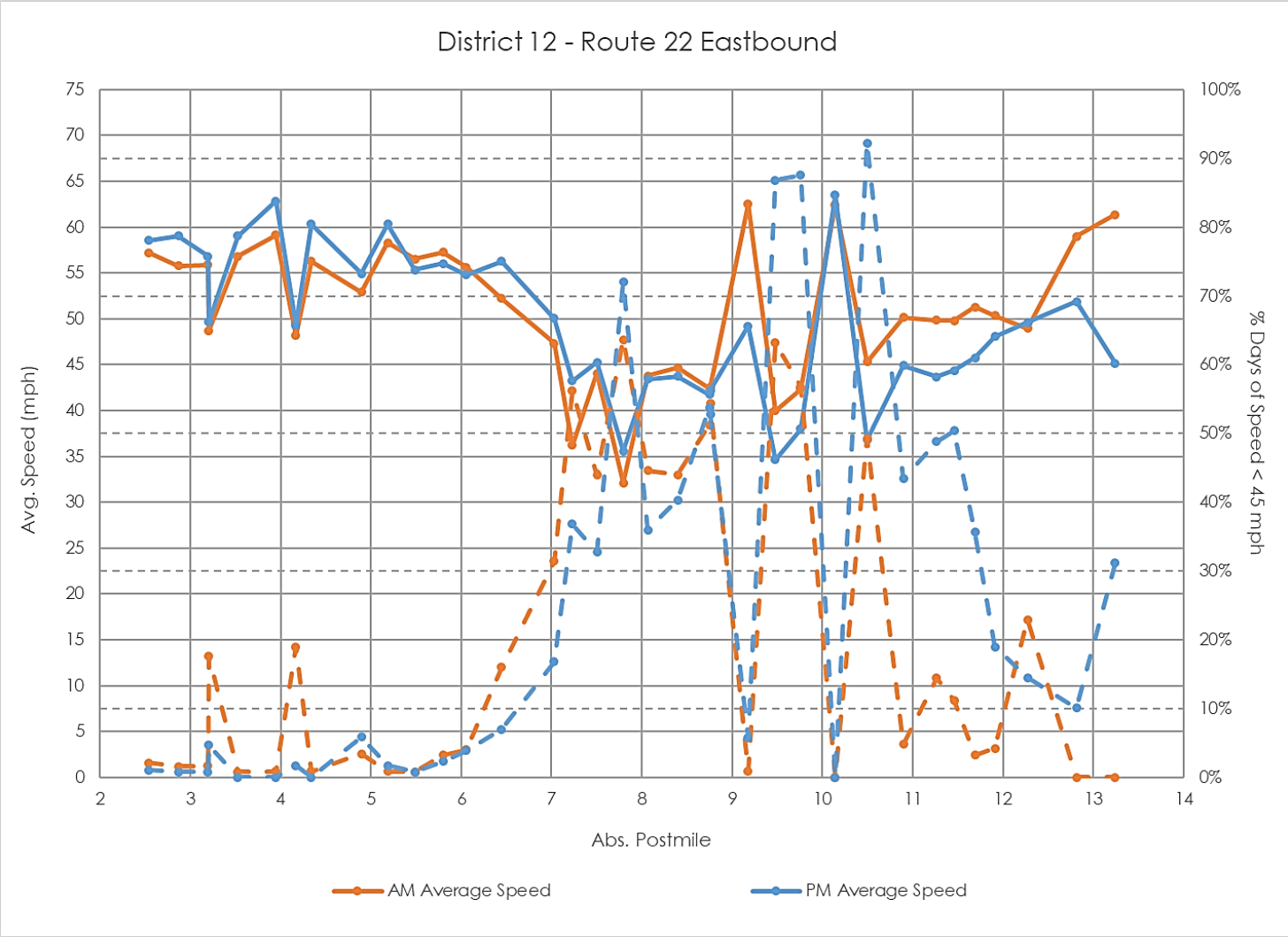
## FIGURE 166. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 5



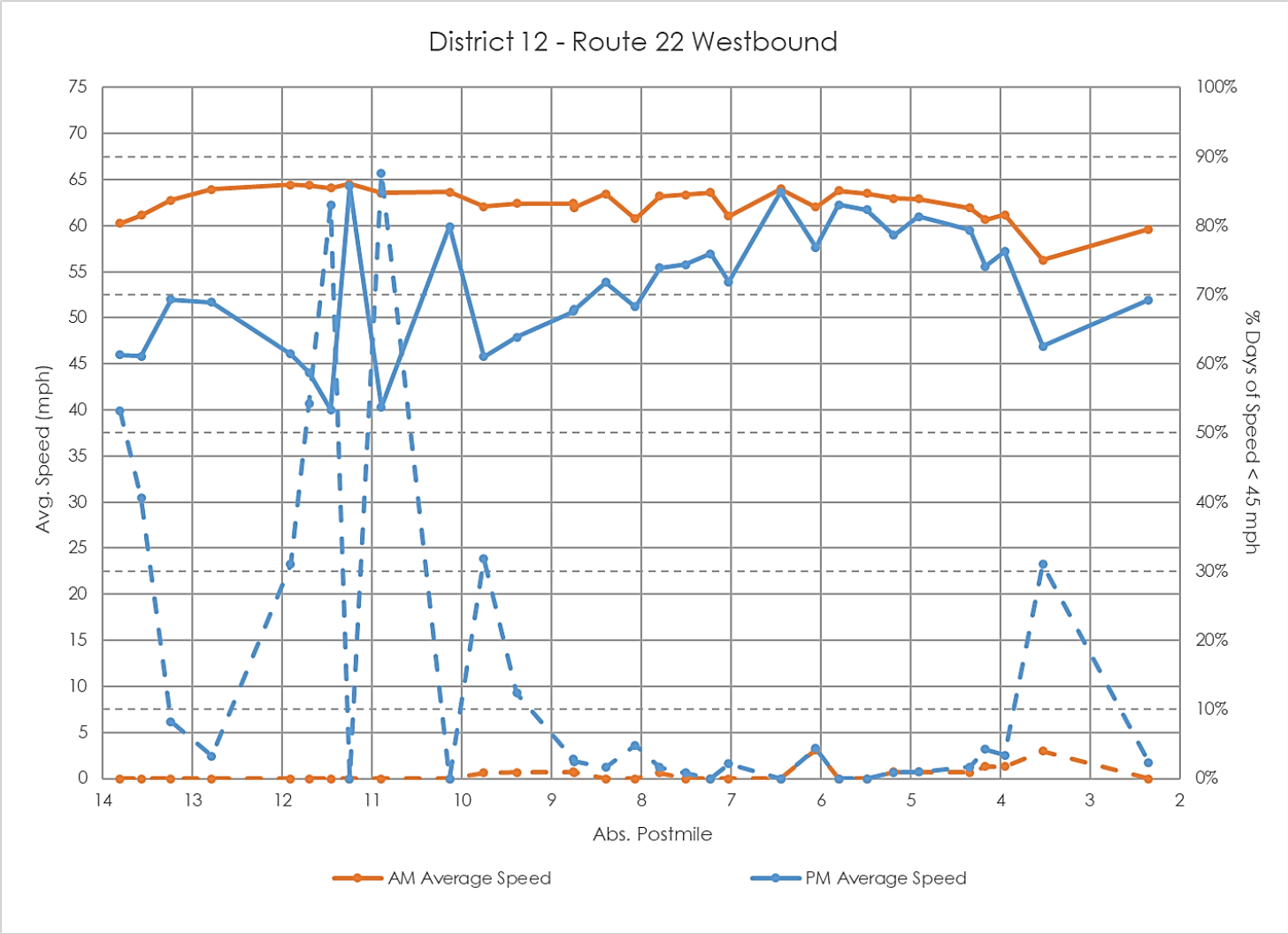
## FIGURE 167. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 5



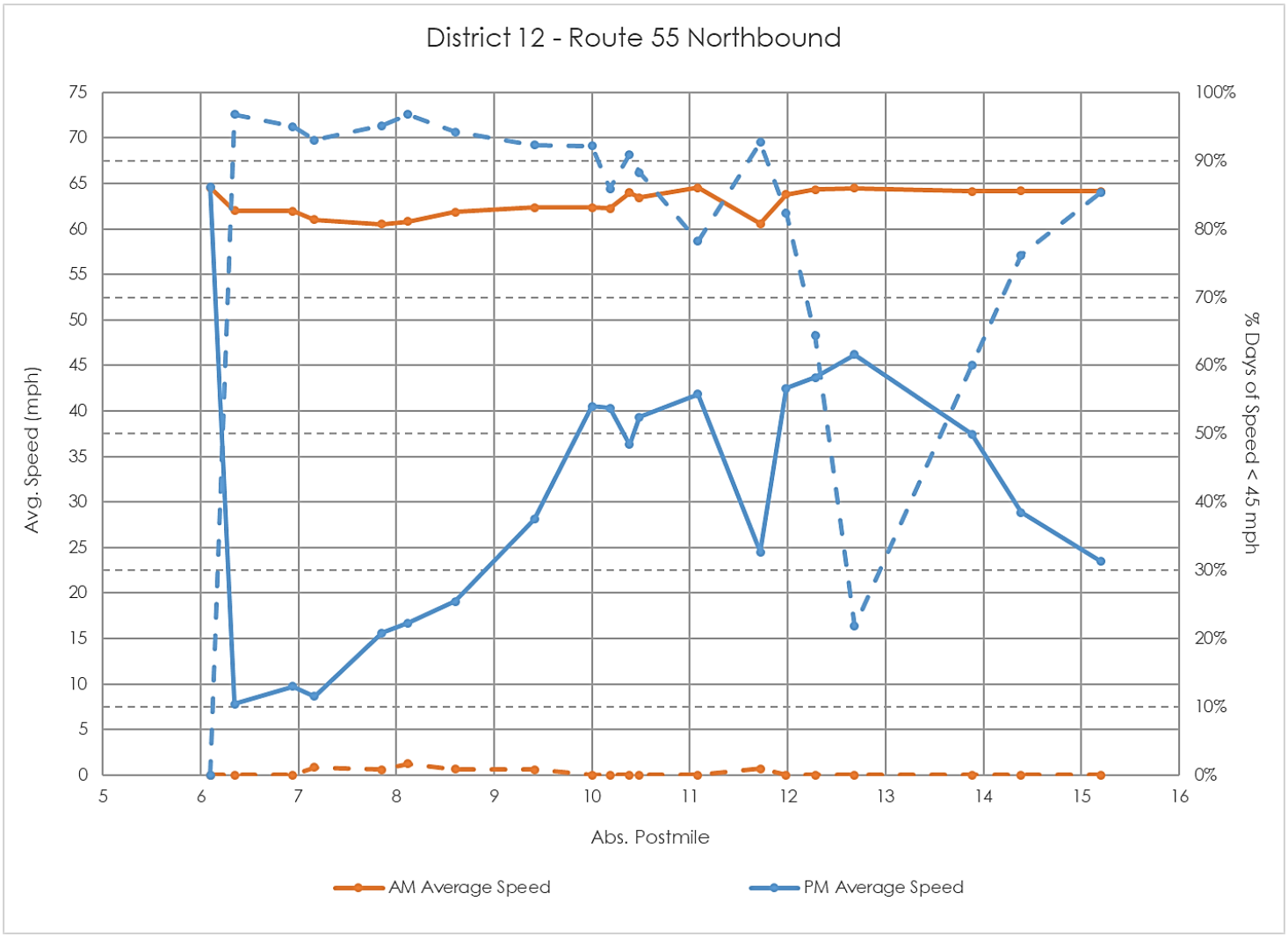
## FIGURE 168. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 22



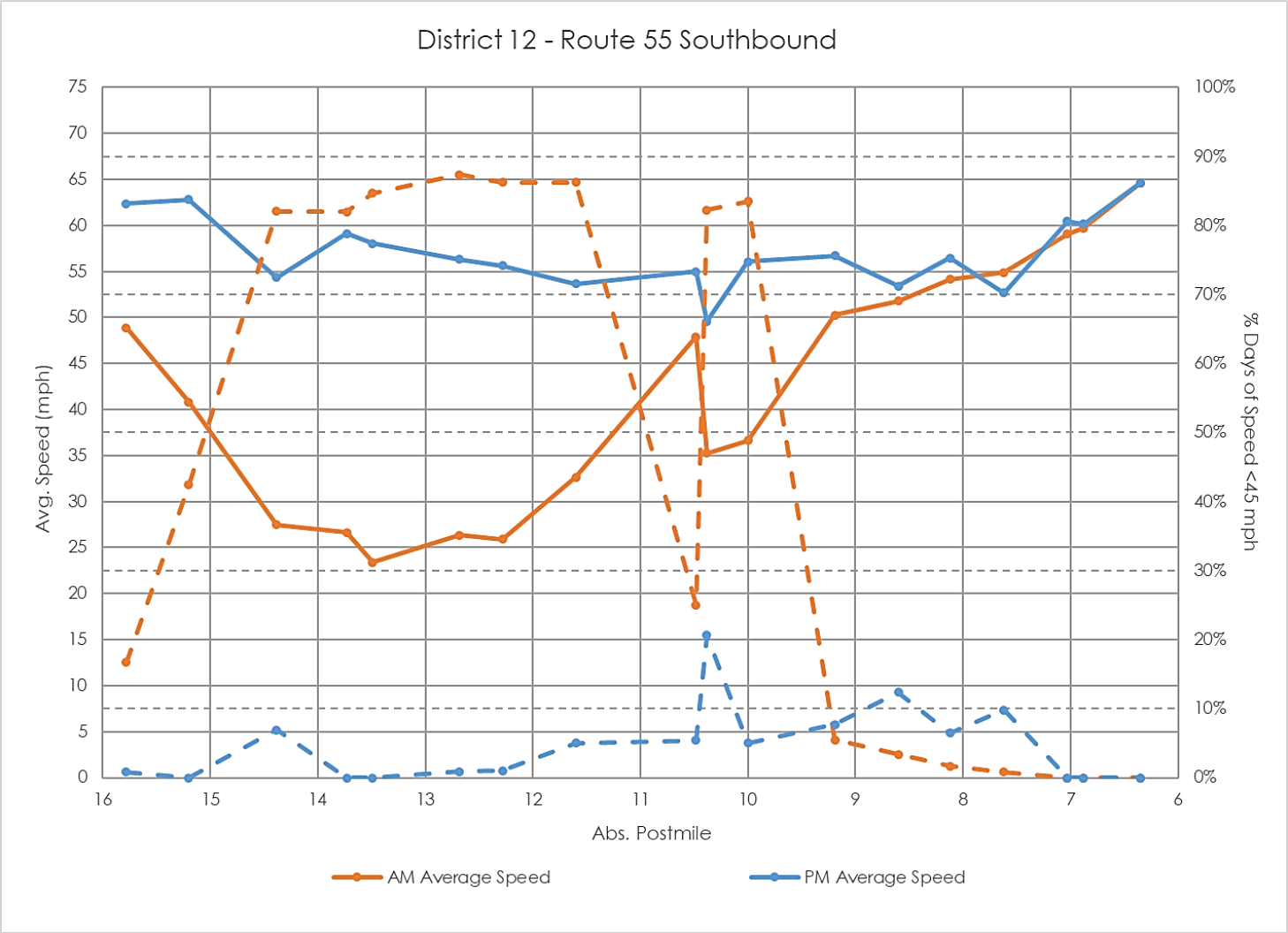
## FIGURE 169. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 22



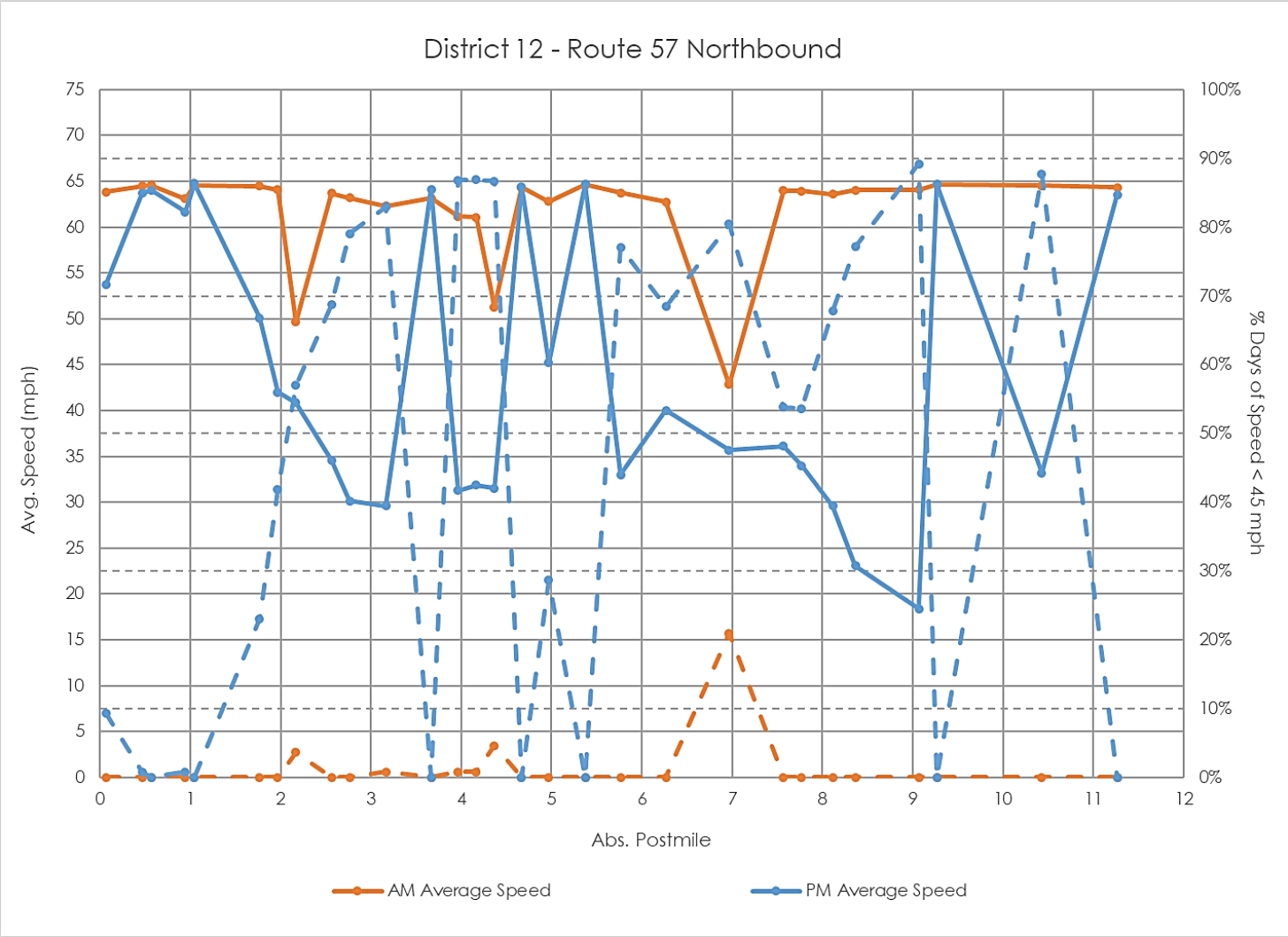
## FIGURE 170. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 55



## FIGURE 171. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 55



## FIGURE 172. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 57



## FIGURE 173. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 57

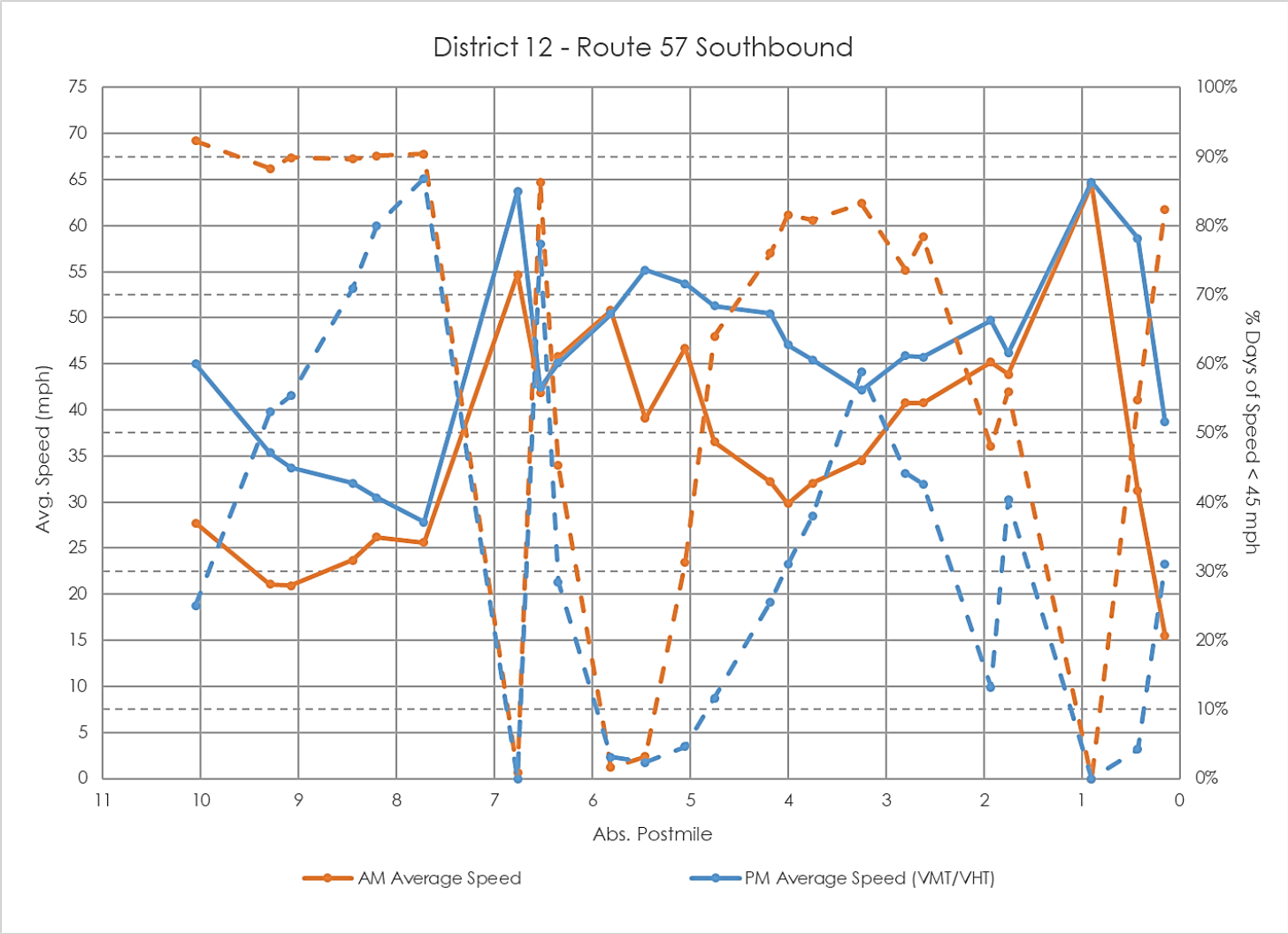


**FIGURE 174. SPEED AND DEGRADATION PROFILE – EASTBOUND ROUTE 91 (LOS ANGELES COUNTY LINE TO TUSTIN AVENUE)**

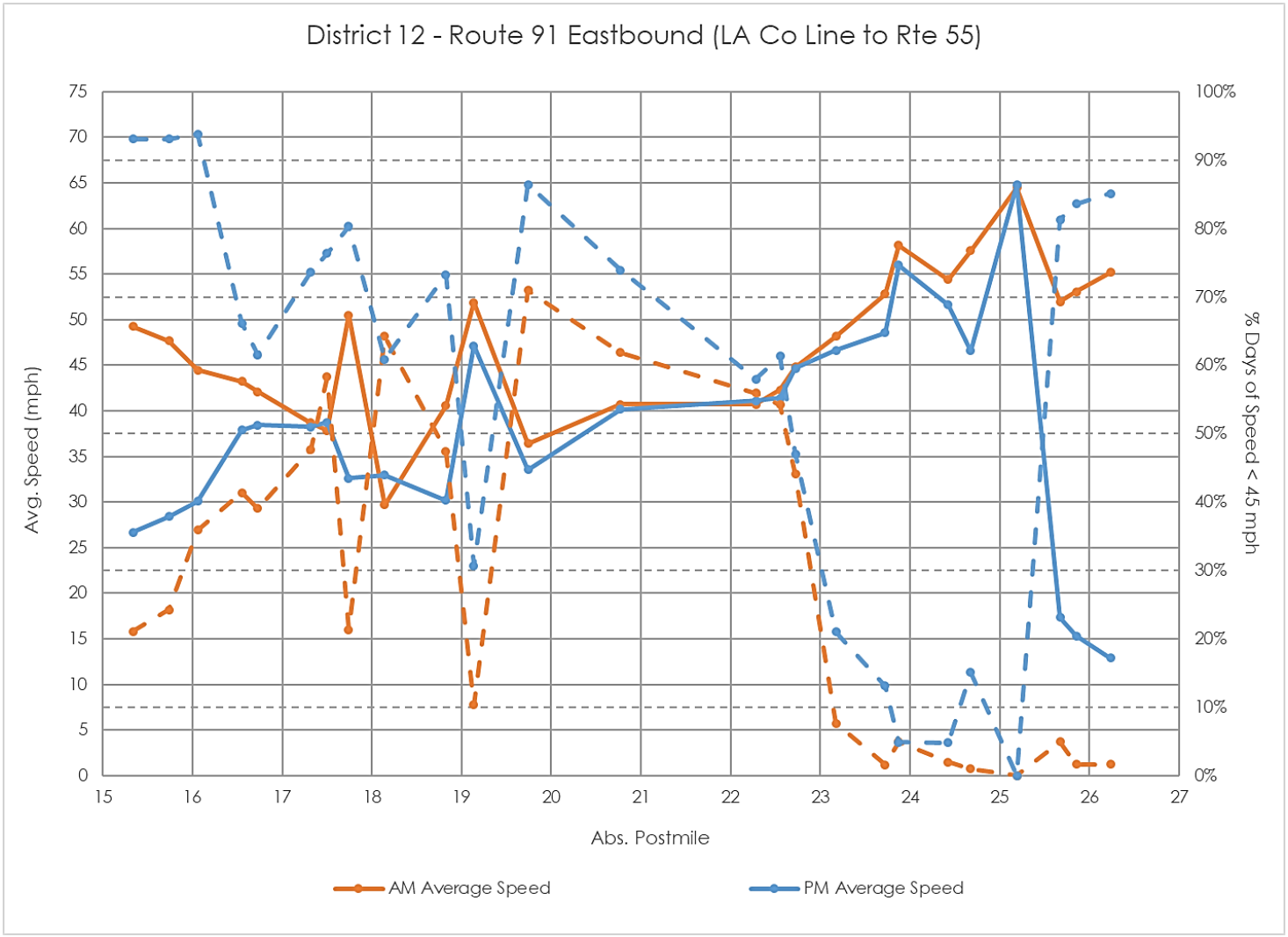
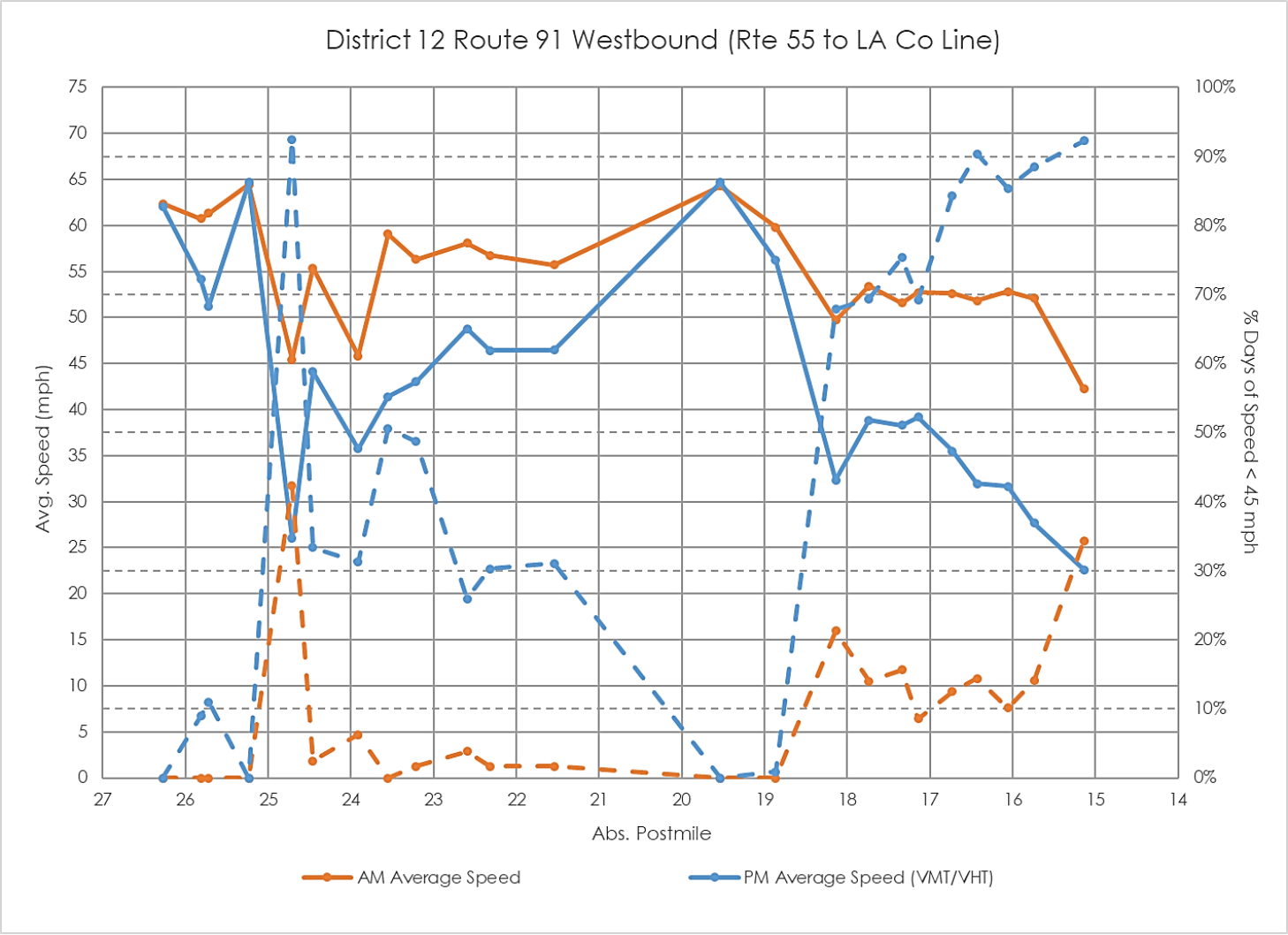
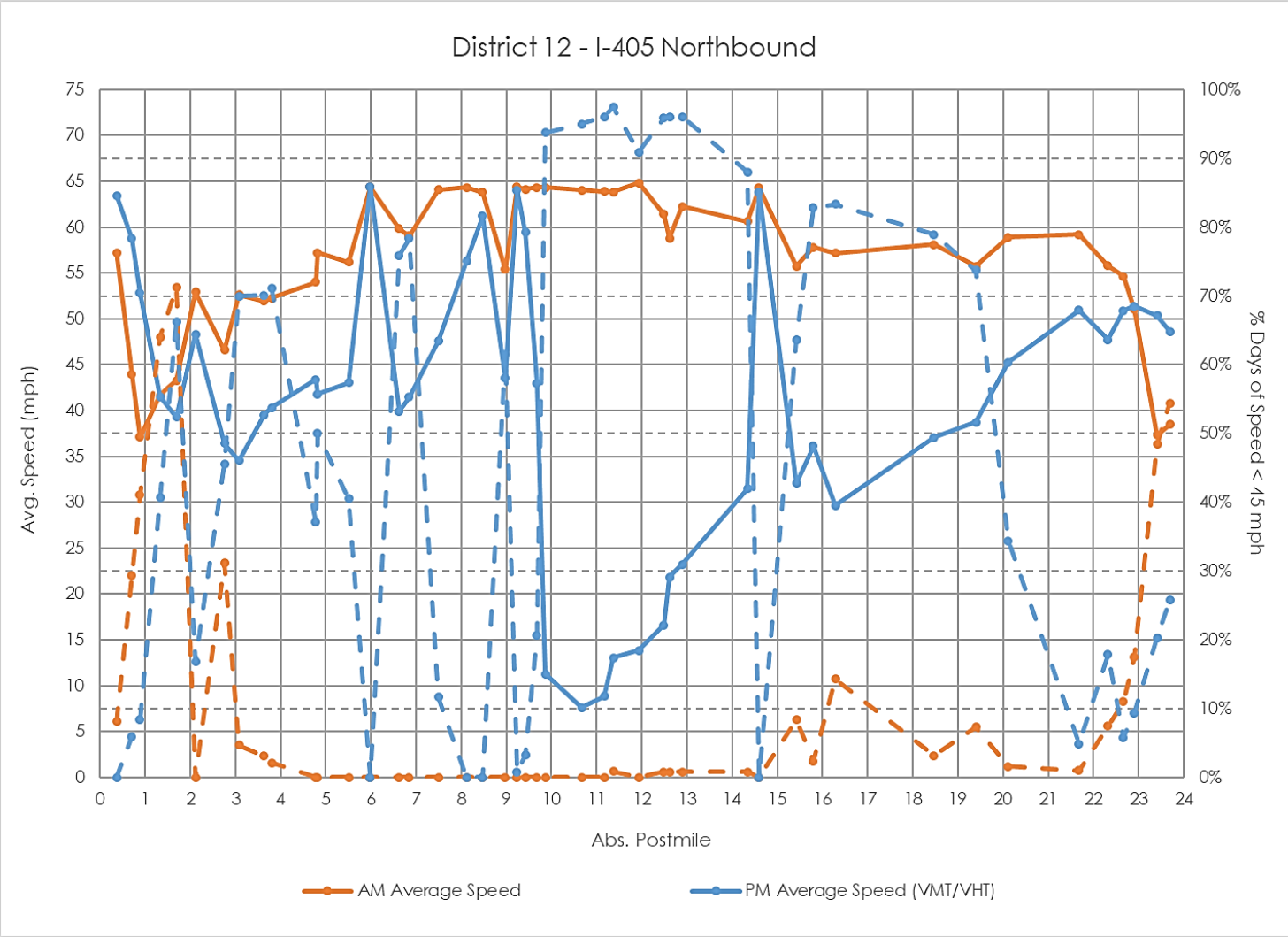


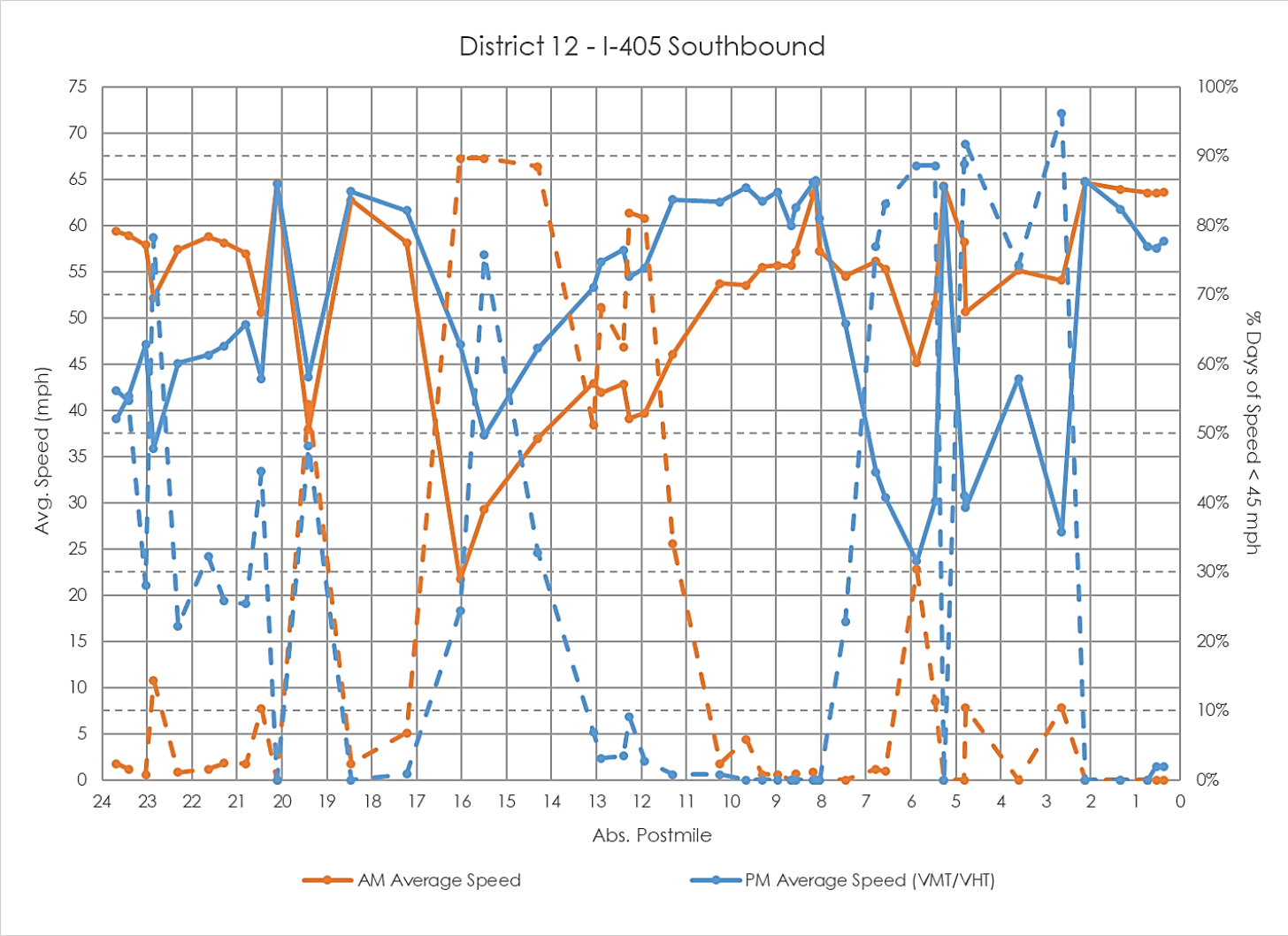
**FIGURE 175. SPEED AND DEGRADATION PROFILE – WESTBOUND ROUTE 91 (LOS ANGELES COUNTY LINE TO TUSTIN AVENUE)**



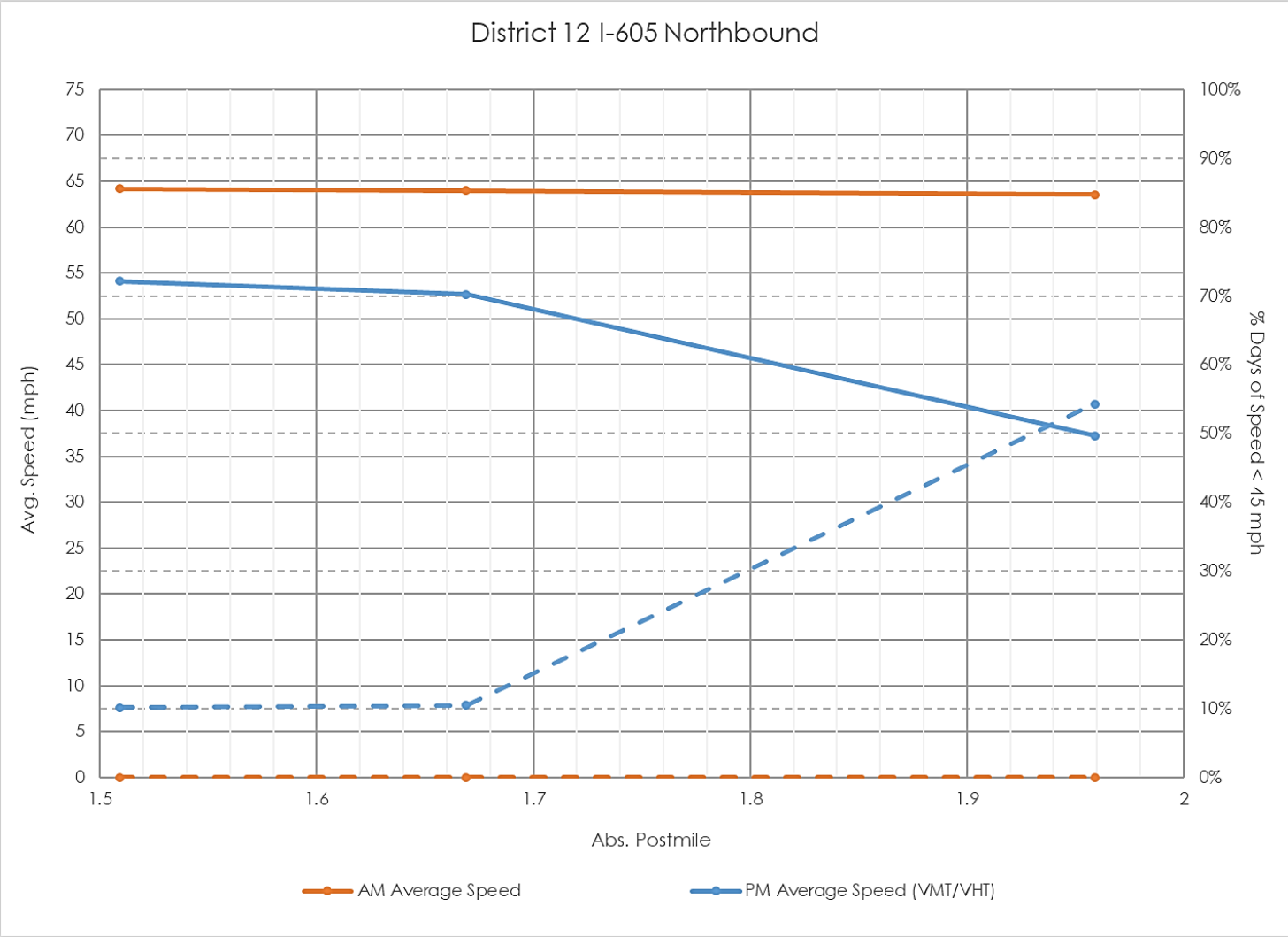
## FIGURE 176. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 405



## FIGURE 177. SPEED AND DEGRADATION PROFILE – SOUTHBOUND ROUTE 405



## FIGURE 178. SPEED AND DEGRADATION PROFILE – NORTHBOUND ROUTE 605



## 4.6.2 DISTRICT-WIDE ACTIONS RELATED TO DEGRADATION

Caltrans District 12 has been conducting three Managed Lanes Studies to implement Caltrans' mission, vision, goals, and values. These three studies and their goals are listed as follows:

- The Manage Lanes Feasibility Study (MLFS) - To replace the HOV lane network with a HOT lane network
- Priced Managed Lanes (PML) -To maximize system efficiency, increase mobility choices, improve the environment, and financially contribute to freeway corridor maintenance and operations and improvements
- Managed Lanes Network Study (MLNS) - To analyze the operational benefits of PML with planning-level traffic analysis

In early 2017, Caltrans District 12 conducted a study that analyzed the operational benefits of PML with planning-level traffic analysis. The MLFS concentrates on the feasibility of implementing a countywide PML network from a cost perspective.

## 4.6.3 ACTION PLAN FOR HOV FACILITIES ON ROUTE 5

## A. ANALYSIS

A second HOV lane in each direction was added between Route 55 and Route 57 to provide a dual HOV lane facility. Construction began in December 2018 and was completed in August 2020. This analysis predates that change.

*Northbound*

During the morning peak hour period, degradation was observed from Crown Valley (PM 86.72) to Alicia Parkway (PM 89.9) and from Jeffrey (PM 97.34) to 4th Street (PM 103.48).

During the afternoon peak hour period, degradation was observed at the start of the HOV facility, (PM 79.17), from Avery Parkway (PM 85.31) to Oso Parkway (PM 87.61), from Jeffrey (PM 97.34) to Main/ Broadway (PM 105.25) and from Gene Autry/ Disney Way (PM 107.85) to Harbor Boulevard (PM 109.95).

*Southbound*

During the morning peak hour period, degradation was observed from Route 91 (PM 114.09) to Euclid (PM 111.49) and from Katella (PM 108.67) to Culver (PM 98.86).

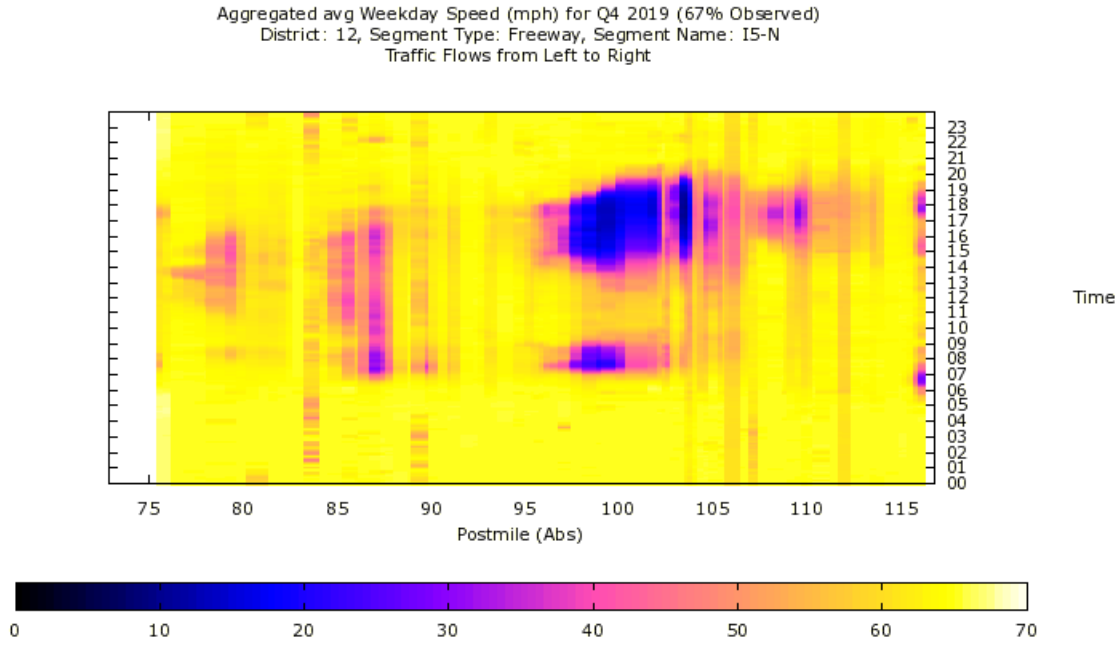
During the afternoon peak hour period, degradation was observed at the Route 5/Route 57/Route 22 interchange (PM 106.58), from Route 55 (PM 102.59) to Culver (PM 98.86), and from Alton Parkway (PM 94.1) to Oso Parkway (PM 87.50).

*Causes*

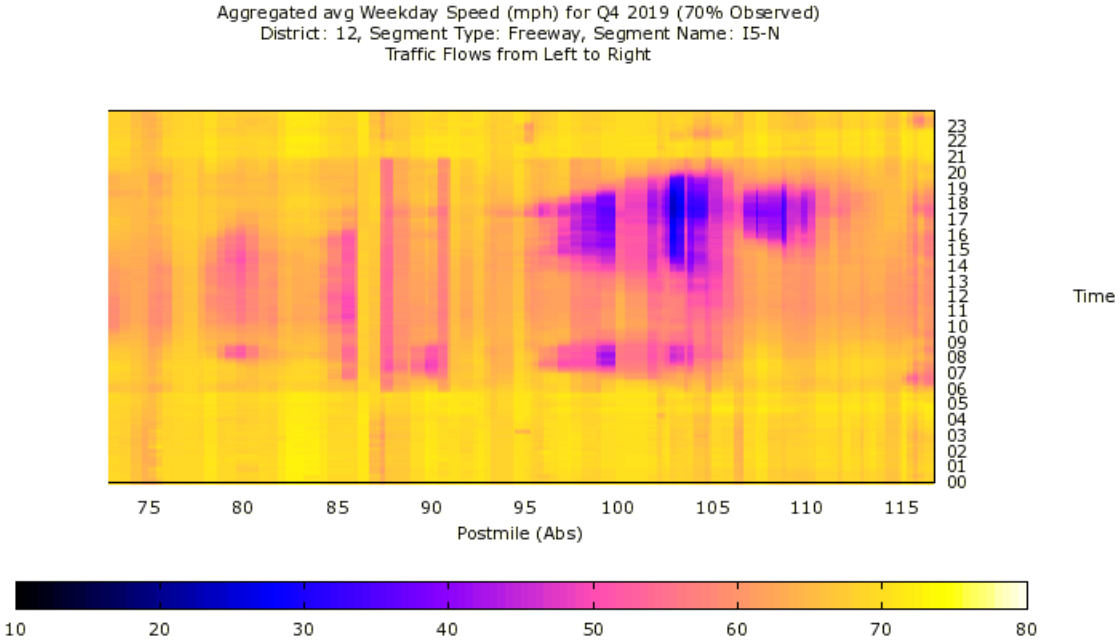
- Peak period recurrent congestion in all lanes reducing HOV lane performance and speed
- Vehicle weaving conflict at ingress/egress locations due to congestion in the general-purpose lanes. Friction factor has some effect in slowing down vehicles in HOV lanes due to substantial speed difference. We have been converting HOV buffer separated to continuous access to allow traffic to move in and out of the HOV lane at any point along the corridor. This flexibility would be a tradeoff for weaving distribution along the corridor.
- Bottlenecks at Route 5/Route 55 HOV direct connector and Route 5/Route 57 HOV direct connector
- Second HOV lane drop in the northbound direction at Los Alisos Boulevard creating a bottleneck
- High volumes of low or zero emission vehicles in HOV lanes, 33.8 percent at Los Alisos Boulevard (2019 Managed Lanes Report)

Figures 179 and 180 provide plots of HOV and GP lane speeds along the length of the northbound HOV facility on Route 5 during the fourth quarter of 2019. Figures 181 and 182 provide plots of HOV and GP lane speeds along the length of the southbound HOV facility on Route 5 during the fourth quarter of 2019.

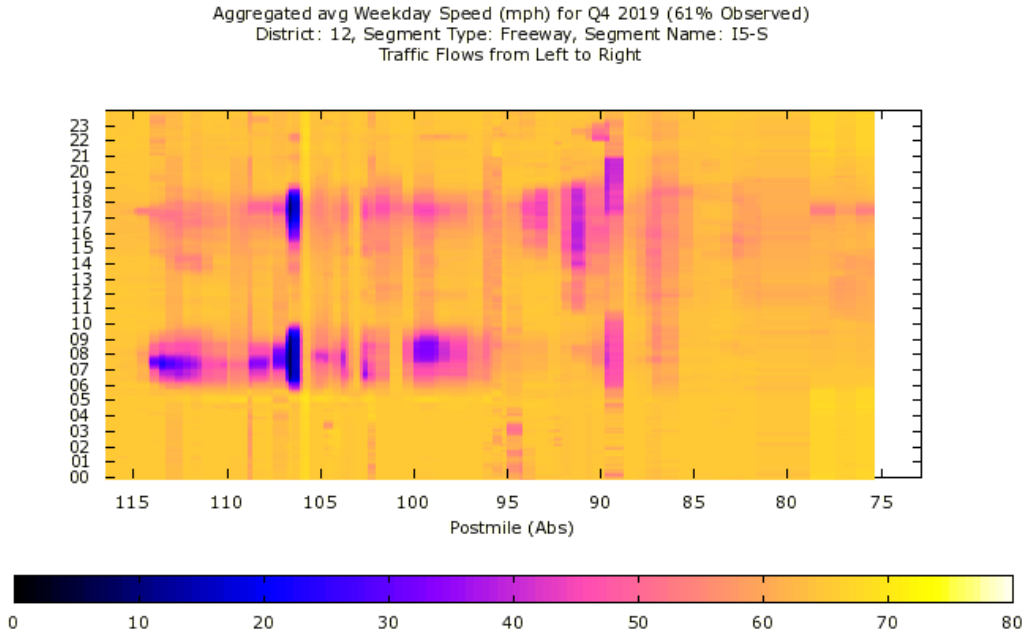
## FIGURE 179. AVERAGE HOV LANE SPEED – NORTHBOUND ROUTE 5, Q4 2019



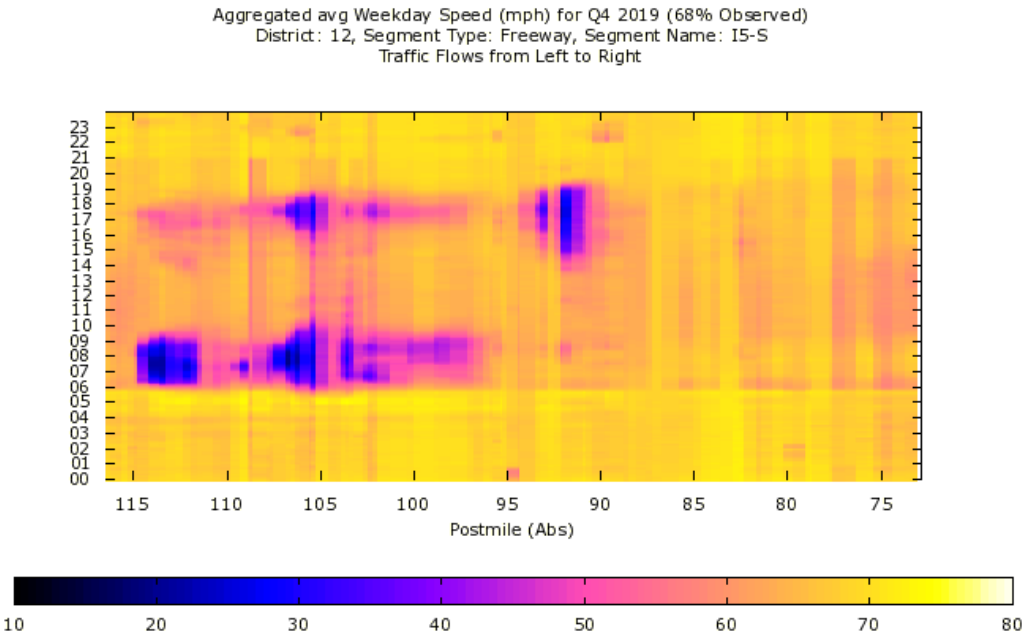

## FIGURE 180. AVERAGE GP LANE SPEED – NORTHBOUND ROUTE 5, Q4 2019



## FIGURE 181. AVERAGE HOV LANE SPEED – SOUTHBOUND ROUTE 5, Q4 2019




## FIGURE 182. AVERAGE GP LANE SPEED – SOUTHBOUND ROUTE 5, Q4 2019



## B. REMEDIATION STRATEGIES

- A second HOV lane was added between Route 55 and Route 57 to provide a dual HOV lane facility. Construction began in December 2018 and was completed in August 2020. Project cost was estimated at $42 million, funded by Measure M2, CMAQ, and STBG. The impacts of these changes will be monitored and any observations will be noted in the 2021 degradation report.

- A second HOV lane is currently under construction in both directions between El Toro Road and Alicia Parkway. Construction began in October 2020 and will be completed in October 2024. Project cost for three segments, including 12-0K021 and 12-0K022, is funded by Measure M2, STBG, and STIP/SB-1, and is estimated at $565 million.

## 4.6.4 ACTION PLAN FOR HOV FACILITIES ON ROUTE 22

## A. ANALYSIS

*Eastbound*

During the morning peak hour period, degradation was observed from Magnolia (PM 6.4) to Bristol (PM 12.3).

During the afternoon peak hour period, degradation was observed from Brookhurst (PM 7.0) to Glassell/ Grand (PM 13.2).

*Westbound*

Degradation was only observed in the afternoon peak hour period from Tustin (PM 13.8) to Harbor Boulevard (PM 9.4).

*Causes*

- Demand exceeding capacity. Peak period recurrent congestion in all lanes reducing HOV lane performance and speed

- Vehicle weaving conflict due to congestion in the general-purpose lanes

- Geometric constraints and a major bottleneck at Route 22/Route 5/Route 57 interchange. The median which separated GP lanes and Collector Distributor lanes from Route 22 to Route 5 and Route 57 created a gridlock at GP lanes.

The gridlock created major weaving from onramp to GP lanes and queue jumping from GP lanes to connectors. Car braking in GP lanes created a friction between HOV and GP lanes due to 2-mile gridlock.

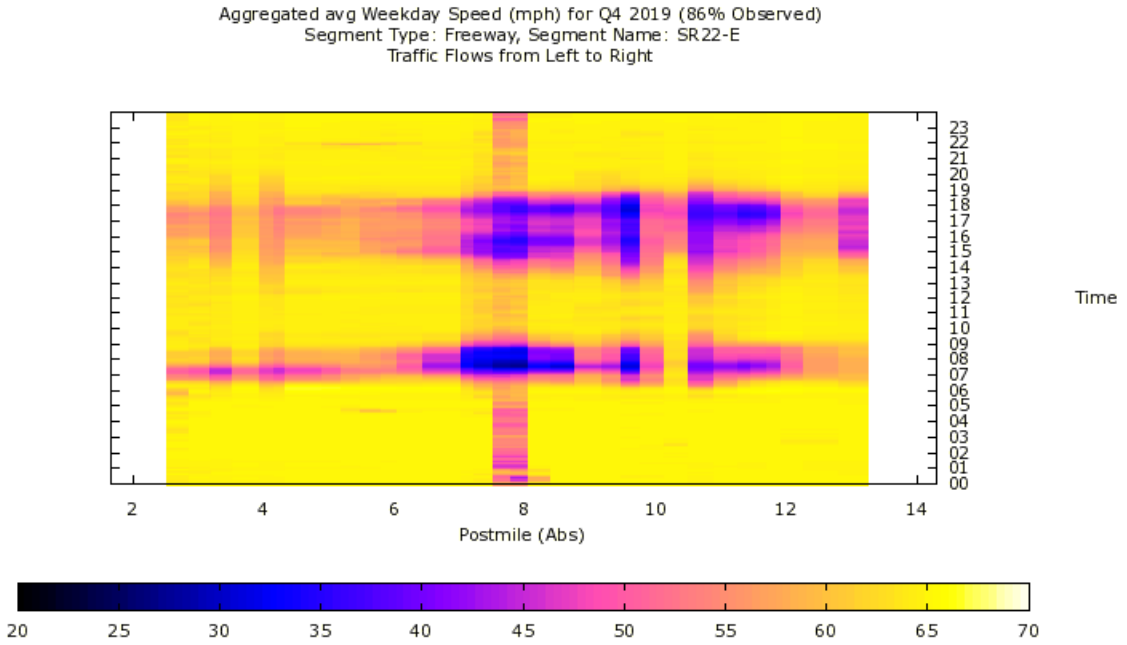
- Queue jumpers to avoid bottleneck at collector-distributor roads
- High HOV violation rates (approximately at 30 percent at Pearce Street POC during Fall of 2019)

Figures 183 and 184 provide plots of HOV and GP lane speeds along the length of the eastbound HOV facility on Route 22 during the fourth quarter of 2019.

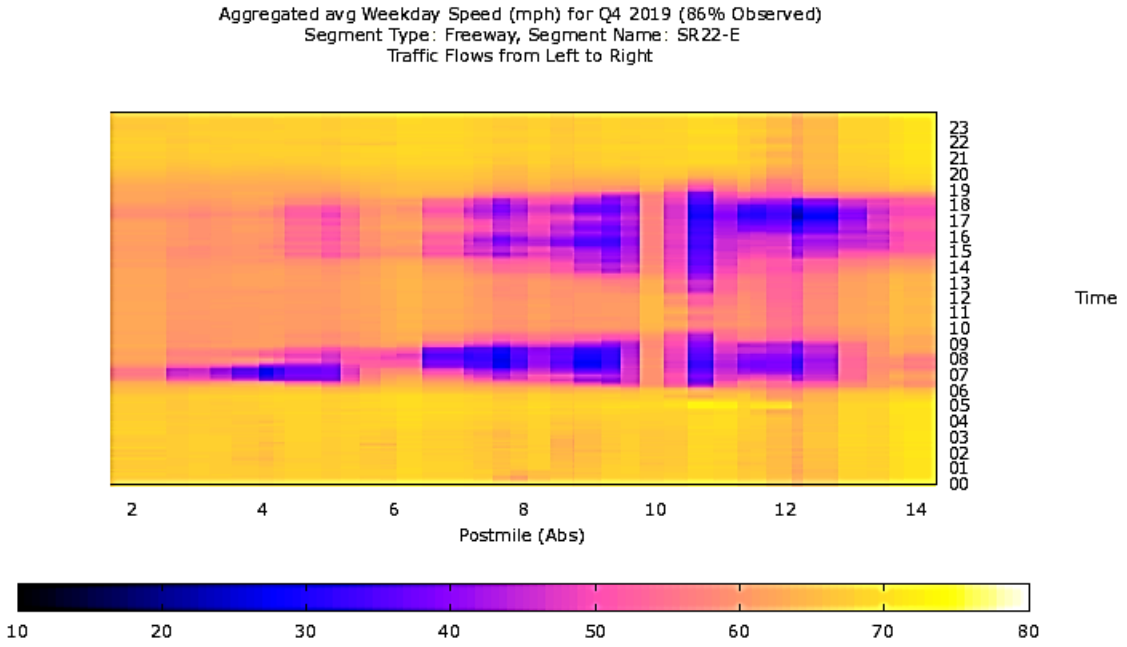
## B. REMEDIATION STRATEGIES

- Shorten the existing collector distributor roads' concrete barrier and relocate the point of divergence easterly to the North Bristol Street interchange; reconfigure eastbound Route 22 mainline by striping to add one auxiliary lane. This project would improve weaving maneuvers between GP and HOV lanes, thus reducing HOV violation. The queue in the GP lane in eastbound direction has been reduced from Fairview Street to Bristol Street (1/2 mile).
- Extend and add Auxiliary Lane at Valley View Street Offramp on westbound Route 22 from Bolsa Chica Road to near Springdale Street Over Crossing. This will reduce the capacity and braking phenomenon in GP lanes to avoid weaving that can cause slowing down in managed lanes since this is the beginning of merging point from westbound Route 22 to northbound Route 405.
- Install Route Shield Pavement Marking at various locations (22/5/57). Route Shield Pavement Marking will be a strategy to ensure commuters decide to change lanes in advance before interchanges to minimize weaving disruption and improve traffic flow especially at HOV direct connectors. It has been done by project 0R910 and helped improving traffic condition.
- Update minimum HOV fine violation on existing signs ($490) to support the enhanced HOV enforcement effort

## FIGURE 183. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 22, Q4 2019




## FIGURE 184. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 22, Q4 2019



## 4.6.5 ACTION PLAN FOR HOV FACILITIES ON ROUTE 55

## A. ANALYSIS

*Northbound*

Degradation was only observed during the afternoon peak hour period, from John Wayne Airport (PM 6.35) to Katella Avenue (PM 15.382).

*Southbound*

During the morning peak hour period, degradation was observed from Katella Avenue (PM 15.782) to Edinger Street (PM 9.19).

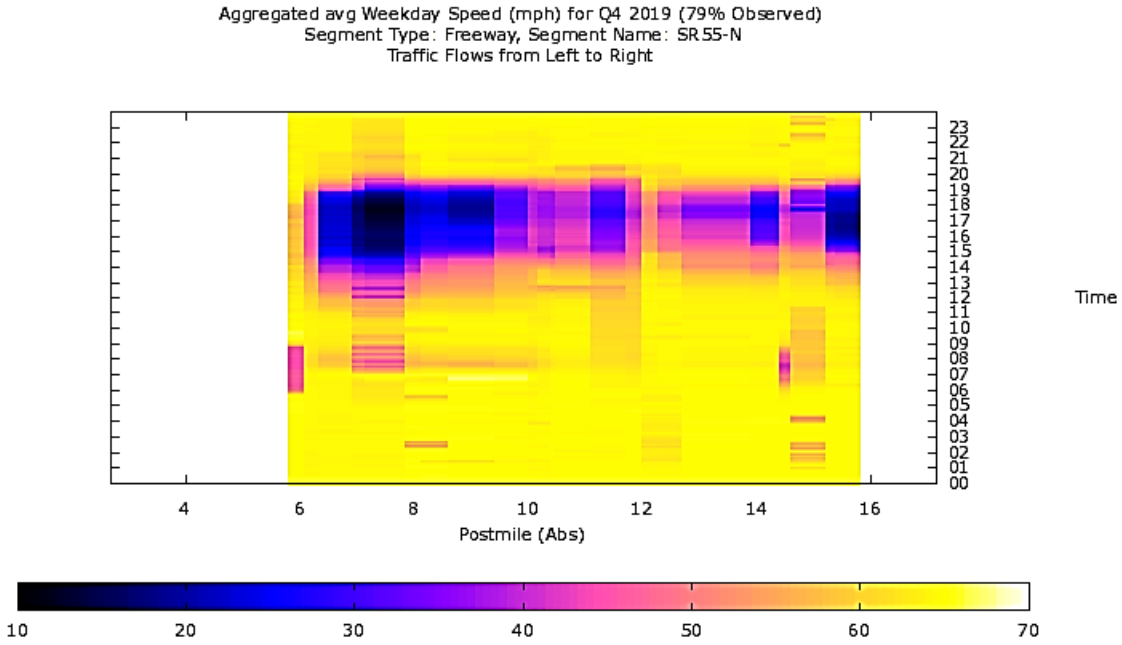
During the afternoon peak hour period, degradation was observed at Route 5 (PM 10.48) and at Warner Avenue (PM 8.6).

*Causes*

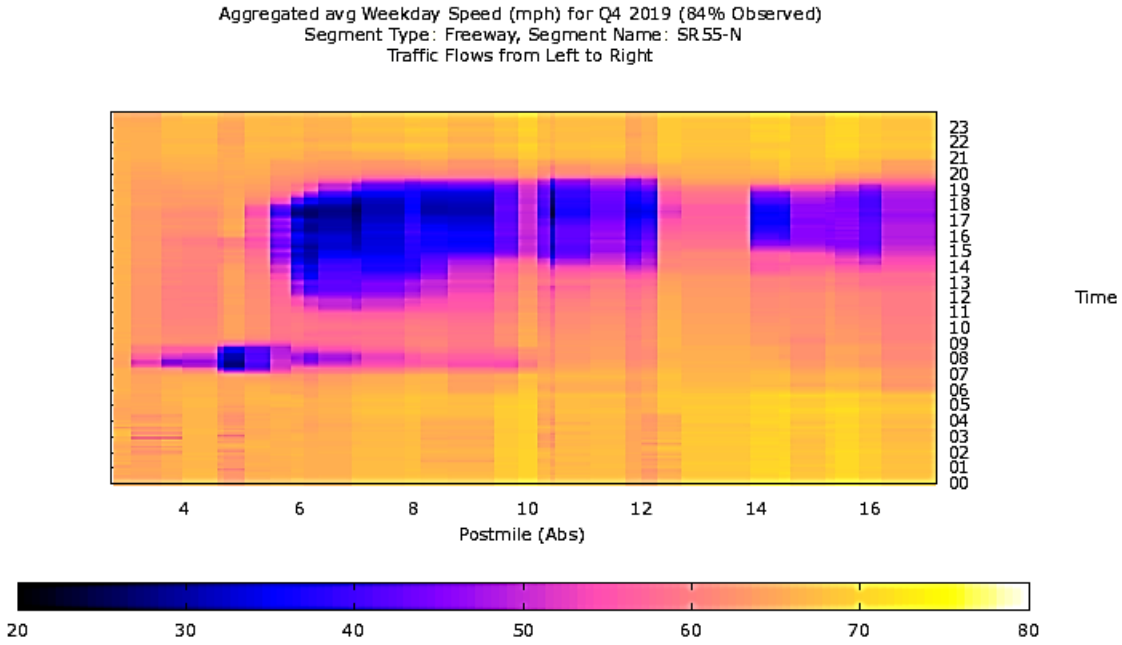
- Demand exceeding capacity. Data collected in the spring of 2019 showed that the violation rate on Route 55 northbound during the morning peak hour period was 30.12 percent and the violation rate during the afternoon peak hour period was 20.22 percent.
- Bottlenecks at Route 55/Route 405 HOV direct connector and Route 5 HOV direct connector. Mainline bottlenecks at Route 55/Route 22 interchange and Route 55/Route 91 interchange. Peak period recurrent congestion due to these conditions reduced HOV lane performance and speed.
- Northbound HOV lane ending and transitioning into a general-purpose lane prior to joining the Route 91 express toll lane. At this point, several vehicles exit the HOV lane to avoid the toll lane and merge to GP lanes. This effect made both HOV and GP lanes slowing down. Specially during peak hours, this weaving created an extreme backlog at Route 55/Route 91 interchange.

Figures 185 and 186 provide plots of HOV and GP lane speeds along the length of the northbound HOV facility on Route 55 during the fourth quarter of 2019.

## FIGURE 185. AVERAGE HOV LANE SPEED – NORTHBOUND ROUTE 55, Q4 2019




## FIGURE 186. AVERAGE GP LANE SPEED – NORTHBOUND ROUTE 55, Q4 2019



## B. REMEDIATION STRATEGIES

- 12-0J340 proposes to add one HOV lane, one general-purpose lane, and auxiliary lanes in both directions between Route 405 and Route 5. Design is completed (April 2020). Construction is scheduled to begin (May 2022). Project cost is estimated at $411 million with funding by Measure M2, SHOPP, CMAQ, STBG, and STIP funding. Project is anticipated for completion in November 2025.

- Install Route Shield Pavement Marking at various locations (55/405 and 55/5). Route Shield Pavement Marking will be a strategy to ensure commuters decide to change lanes in advance before interchanges to minimize weaving disruption and improve traffic flow especially at HOV Direct Connectors. The PIP will be initiated by Traffic Operation Branch and programmed in Asset Management Tool in FY 2021-2022.

### 4.6.6 ACTION PLAN FOR HOV FACILITIES ON ROUTE 57

## A. ANALYSIS

*Northbound*

During the morning peak hour period, degradation was observed at Nutwood Avenue (PM 6.97).

During the afternoon peak hour period, degradation was observed from Katella Avenue (PM 1.766) to Lambert Road (PM 10.426).

*Southbound*

During the morning peak hour period, degradation was observed from Lambert Road (PM 10.051) to the Route 57/Route 5/Route 22 interchange (PM 0.151).

During the afternoon peak hour period, degradation was observed from Route 57/Route 5/Route 22 interchange (PM 0.151) to Lambert Road (PM 10.051).

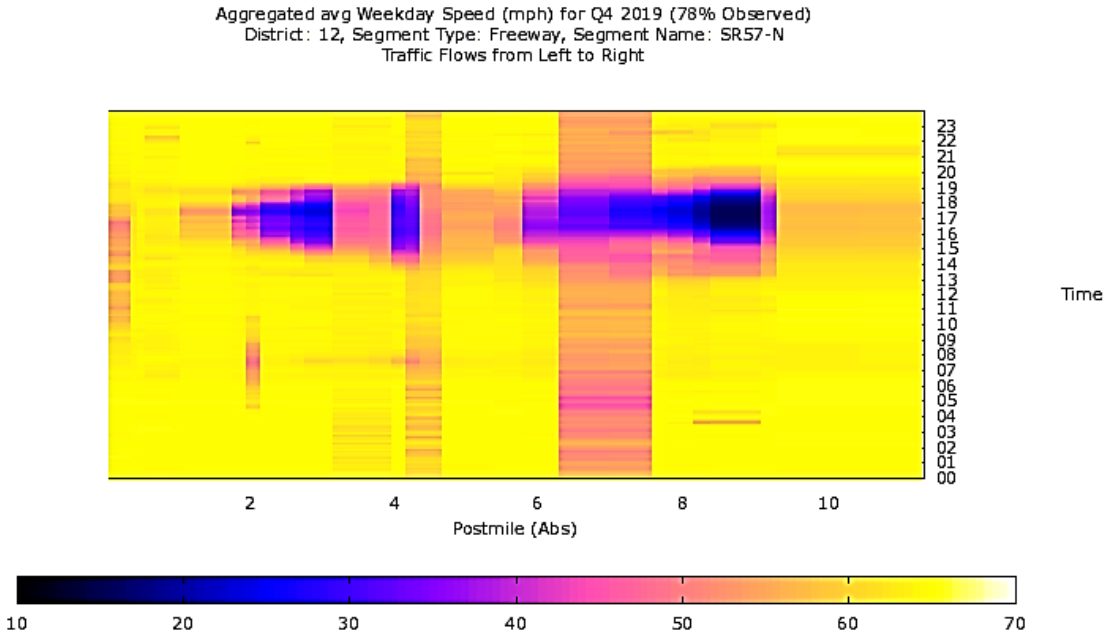
*Causes*

- Due to high speed differential between general-purpose and HOV lanes with no buffer separation, HOV traffic tends to reduce speed in preparation for sudden emergence of traffic from a general-purpose lane with low speeds due to continuous access striping

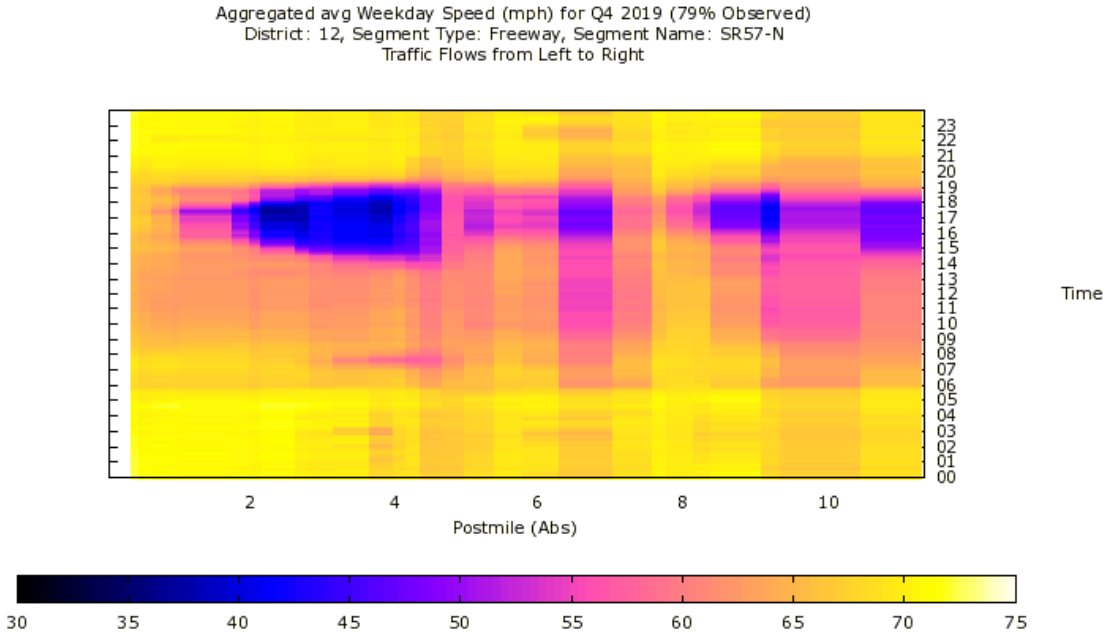
- Problems with merging from eastbound Route 91 to northbound Route 57 and traffic exiting HOV lanes weaving over multiple GP (GP) lanes to get to the offramp
- Termination of Route 57 at the Route 5/Route 22 interchange resulting in major weaving for traffic either going to Route 5 or Route 22 resulting queuing of vehicles from southbound Route 57 HOV lane onto southbound I-5 at the interchange
- It appears that the peak hour degradation was heavily concentrated in the single-hour peak prior to 2018, and degradation over three-hour peak periods during July–December of 2018 averaged above 45 miles per hour

Figures 187 and 188 provide plots of HOV and GP lane speeds along the length of the northbound HOV facility on Route 57 during the fourth quarter of 2019. Figures 189 and 190 provide plots of HOV and GP lane speeds along the length of the southbound HOV facility on Route 57 during the fourth quarter of 2019.

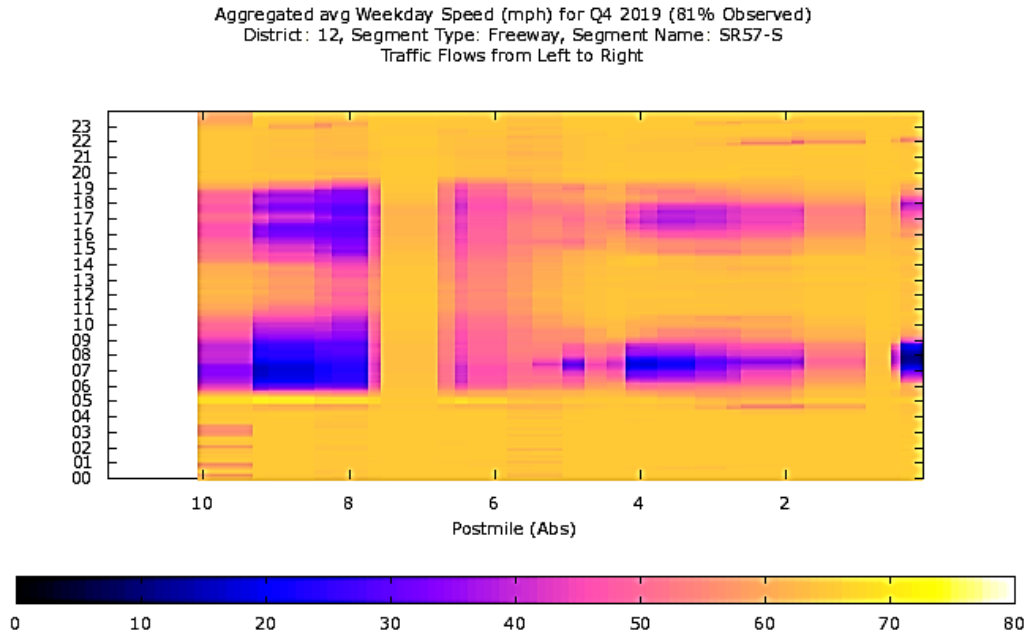
## FIGURE 187. AVERAGE HOV LANE SPEED – NORTHBOUND ROUTE 57, Q4 2019



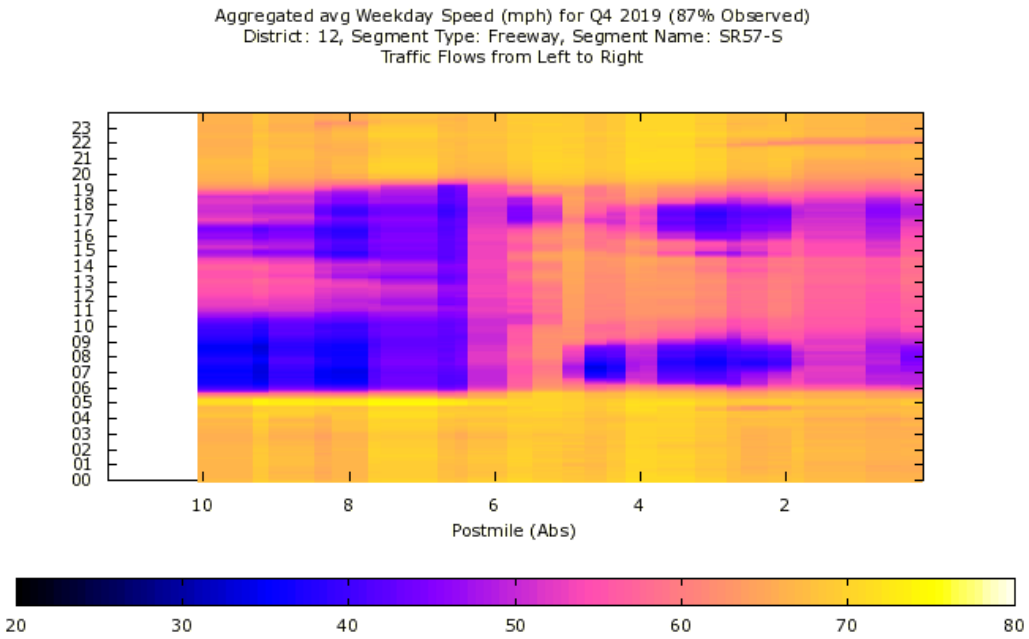

## FIGURE 188. AVERAGE GP LANE SPEED – NORTHBOUND ROUTE 57, Q4 2019



## FIGURE 189. AVERAGE HOV LANE SPEED – SOUTHBOUND ROUTE 57, Q4 2019




## FIGURE 190. AVERAGE GP LANE SPEED – SOUTHBOUND ROUTE 57, Q4 2019



## B. REMEDIATION STRATEGIES

- Project 12-0M970, between Orangewood Avenue to Katella Avenue, in the City of Anaheim, proposes geometric improvements to increase capacity and improve congestion. Construction will begin in early January 2025 and will be completed in early March 2027. This is a major OCTA project to mitigate gridlock on Route 55 and it will cost around $30 million.

- Installation of Route Shield Pavement Marking at various locations (57/22, 57/5). Route Shield Pavement Marking will be a strategy to ensure commuters decide to change lanes in advance before interchanges to minimize weaving disruption and improve traffic flow, especially at HOV Direct Connectors. The PIP will be initiated by Traffic Operation Branches and programmed in Asset Management Tool in FY 2021-2022.

- Updating minimum HOV fine violation on existing signs to support the enhanced HOV enforcement effort. PIP initiation will be done by Traffic Operation.

- Utilize ramp metering on HOV preferential lanes by controlling the discharge of vehicles merging with freeway traffic while limiting weaving movements and helping reduce friction in the degraded HOV lane in this segment. However, this remediation strategy may encounter disagreements from the public and other agencies on the effectiveness of this strategy at certain onramps and may affect onramps with heavy truck usages on the Route 57. Traffic Operation Branches will initiate PIP to implement this project in FY 2021-2022.

## 4.6.7 ACTION PLAN FOR HOV FACILITIES ON ROUTE 91

## A. ANALYSIS

*Eastbound*

During the morning peak hour period, degradation was observed from Orangethorpe (PM 15.33) to East/ Raymond (PM 22.72).

During the afternoon peak hour period, degradation was observed from Orangethorpe (PM 15.33) to Tustin Avenue (PM 26.23).

*Westbound*

During the morning peak hour period, degradation was observed from Orangethorpe (PM 15.33) to Route 5 (PM 0.562).

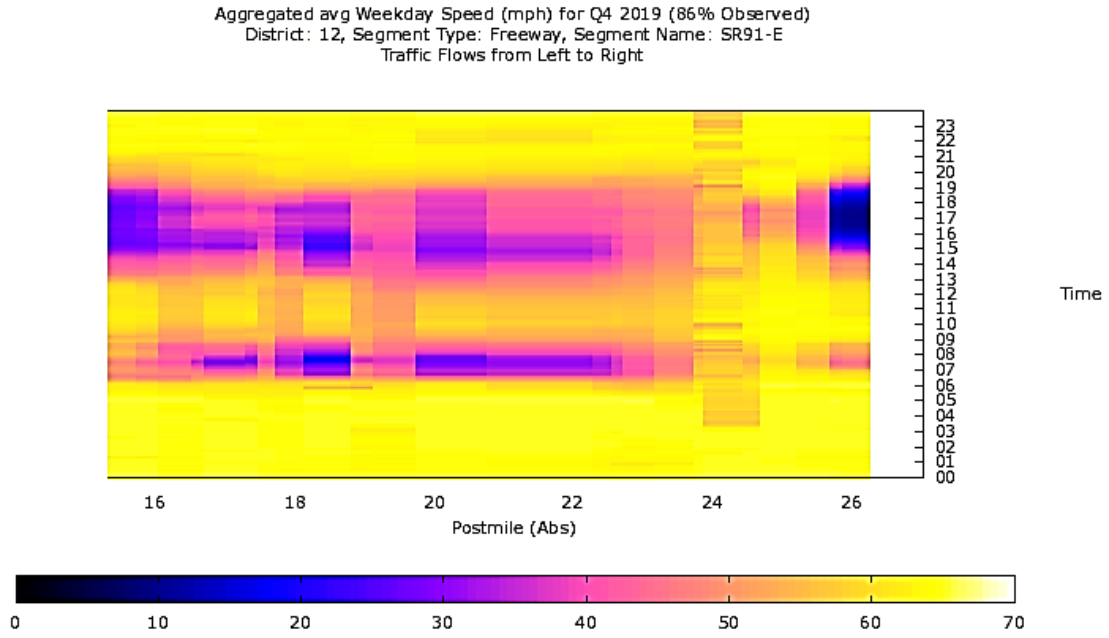
During the afternoon peak hour period, degradation was observed from Orangethorpe (PM 15.33) to Route 57 (PM 0.385).

*Causes*

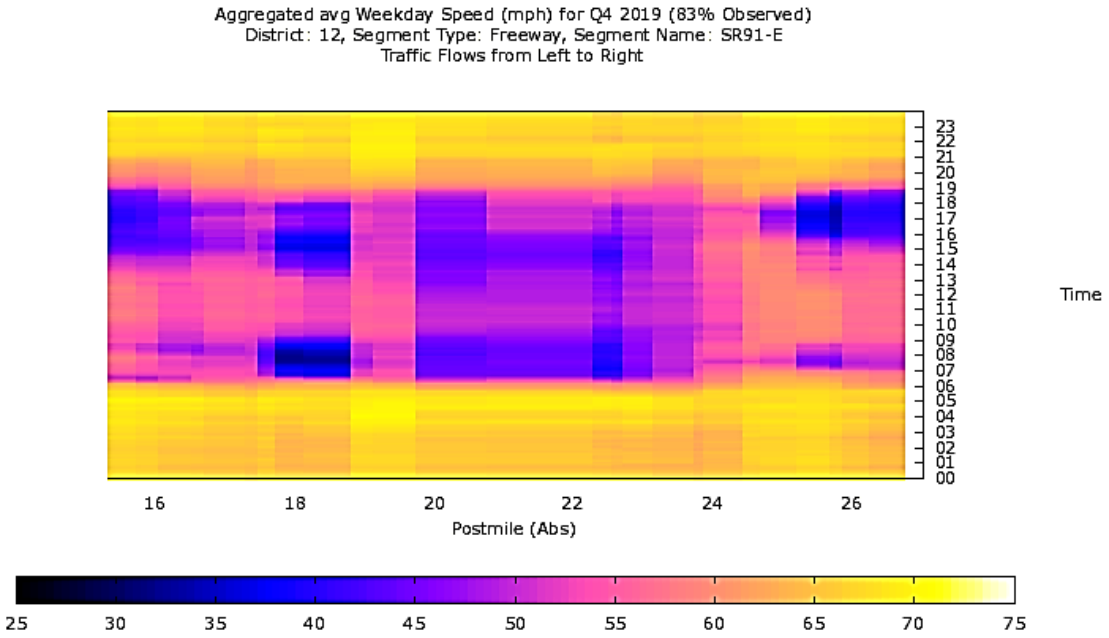
- Peak period recurrent congestion in all lanes reducing HOV lane performance and speed
- Major bottlenecks at the Route 5 and Route 57 interchanges contributing to congestion due to lane changing/merging problems when drivers compete for available gaps in the traffic stream.
- Weaving conflicts occurring where the eastbound Route 91 HOV lane transitions to an HOT lane near Tustin Avenue in the City of Anaheim. A primary cause of the congestion is the existing demand to access the express toll lane facility, which exceeds capacity during afternoon peak periods.
- High HOV violation rate; AM violation was 16.52 percent and PM violation was 31.66 percent at westbound Route 91, Kraemer Boulevard (PM 7.4).

Figures 191 and 192 provide plots of HOV and GP lane speeds along the length of the eastbound HOV facility on Route 91 during the fourth quarter of 2019. Figures 193 and 194 provide plots of HOV and GP lane speeds along the length of the westbound HOV facility on Route 91 during the fourth quarter of 2019.

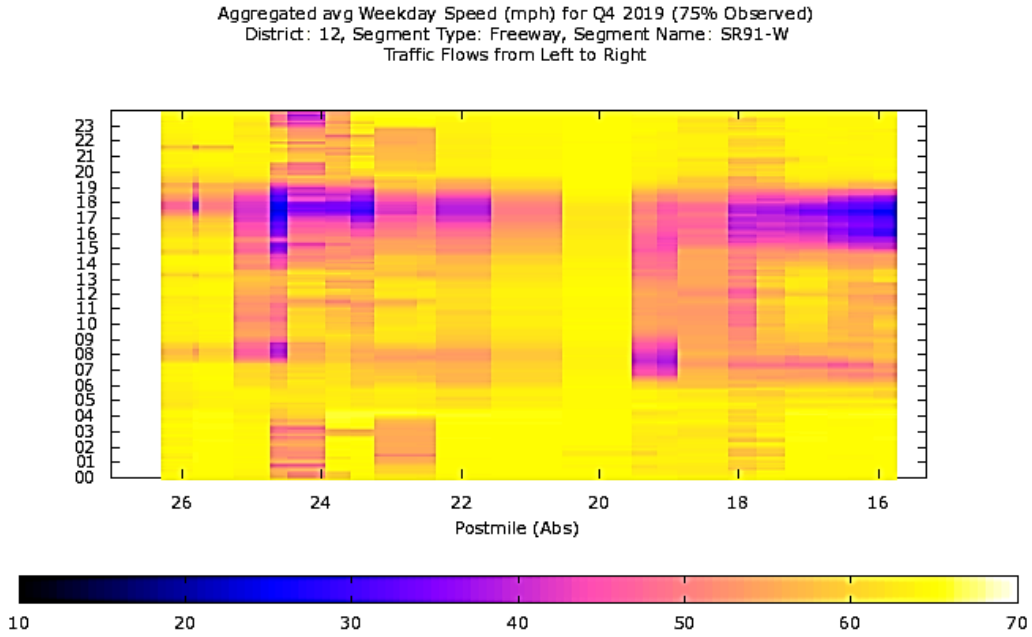
## FIGURE 191. AVERAGE HOV LANE SPEED – EASTBOUND ROUTE 91, Q4 2019



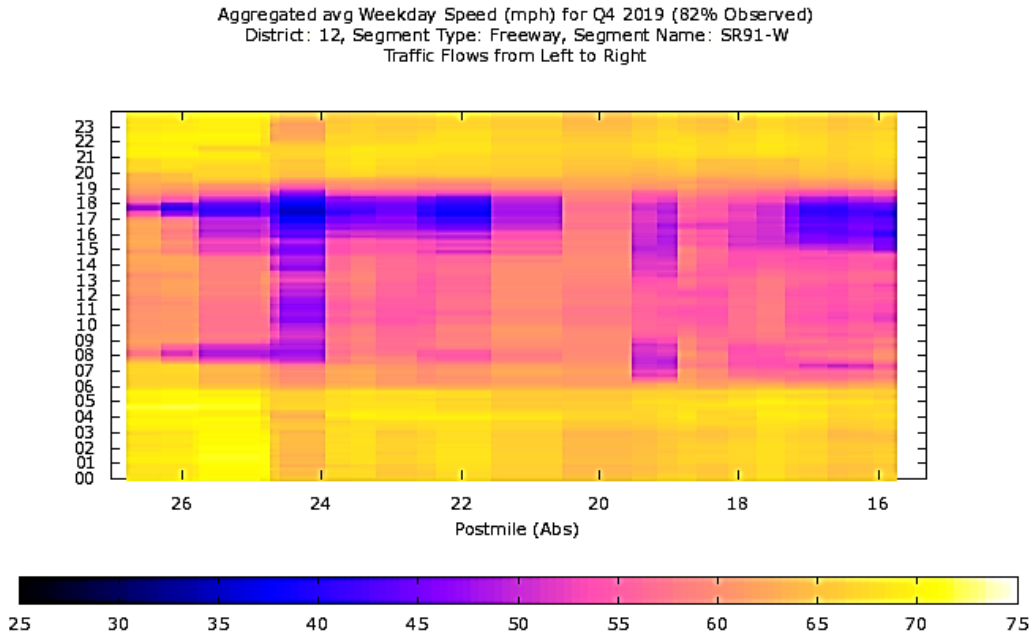

## FIGURE 192. AVERAGE GP LANE SPEED – EASTBOUND ROUTE 91, Q4 2019



## FIGURE 193. AVERAGE HOV LANE SPEED – WESTBOUND ROUTE 91, Q4 2019




## FIGURE 194. AVERAGE GP LANE SPEED – WESTBOUND ROUTE 91, Q4 2019



## B. REMEDIATION STRATEGIES

Based on the analysis in the previous section, the following remediation strategies for Route 91 in both directions will be implemented for the studied facilities:

- Installation of Route Shield Pavement Marking at various locations (91/5, 91/57, 91/55 and 91/241). Route Shield Pavement Marking will be a strategy to ensure commuters decide to change lanes in advance before interchanges to minimize weaving disruption and improve traffic flow--especially at HOV Direct Connectors. The PIP will be initiated by Traffic Operation and programmed in Asset Management Tool in FY 2021-2022.

- Updating the minimum HOV fine violation on existing signs to support the enhanced HOV enforcement effort. There are no projects currently, but Traffic Operations can initiate a PIP to update the minimum HOV fine violation in Orange County. Future meeting between CHP Border Division (Santa Ana, Westminster, and San Juan Capistrano) and Caltrans to discuss HOV violation and increased enforcement.

## 4.6.8 ACTION PLAN FOR HOV FACILITIES ON ROUTE 405

## A. ANALYSIS

*Northbound*

During the morning peak hour period, degradation was observed from Route 5/ Bake Parkway (PM 0.37) to Route 133 (PM 1.7) and from Seal Beach Boulevard (PM 22.7) to Route 605 (PM 23.7).

During the afternoon peak hour period, degradation was observed from Irvine Center Drive (PM. 1.34) to MacArthur Boulevard (PM. 7.5), from Route 55 (PM 8.47) to Route 22 (PM 20.1), and near Route 605 (PM 23.7).

*Southbound*

During the morning peak hour period, degradation was observed from Route 605 (PM 23.69) to Westminster Avenue (PM 18.5), from Beach Boulevard (PM 16.37) to Harbor Boulevard (PM 10.97), and from Jamboree Road (PM 5.87) to Sand Canyon Avenue (PM. 2.7).

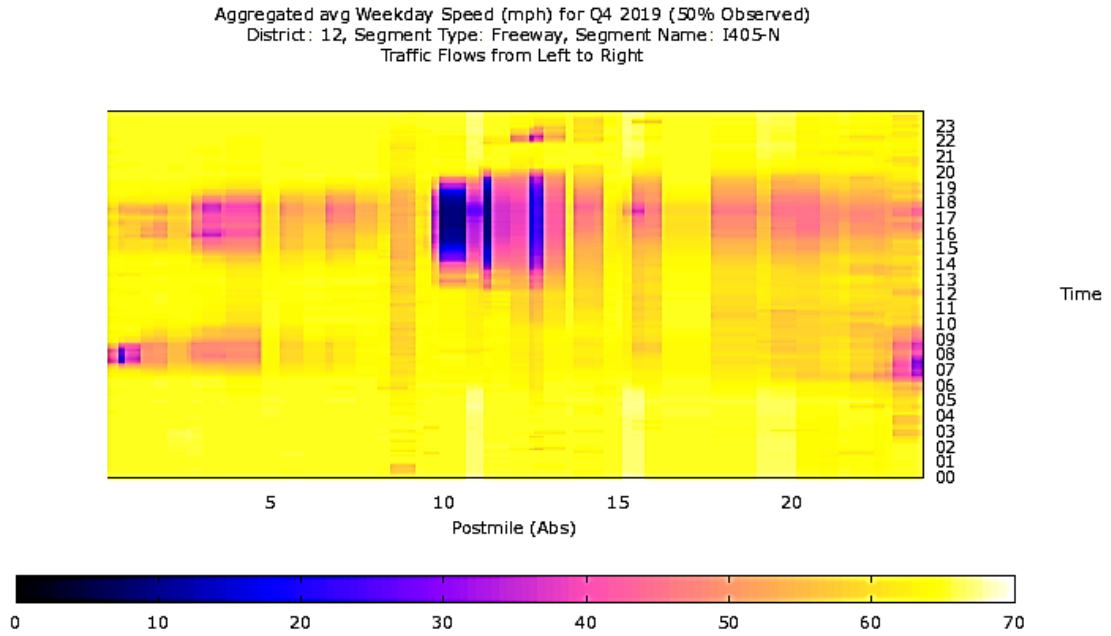
During the afternoon peak hour period, degradation was observed from Route 605 (PM. 23.7) to Westminster Boulevard (PM 18.82), from Beach Boulevard (PM 16.37) to Brookhurst Street (PM 14.3), and from MacArthur Boulevard (PM 7.5) to Sand Canyon Avenue (PM 2.7).

*Causes*

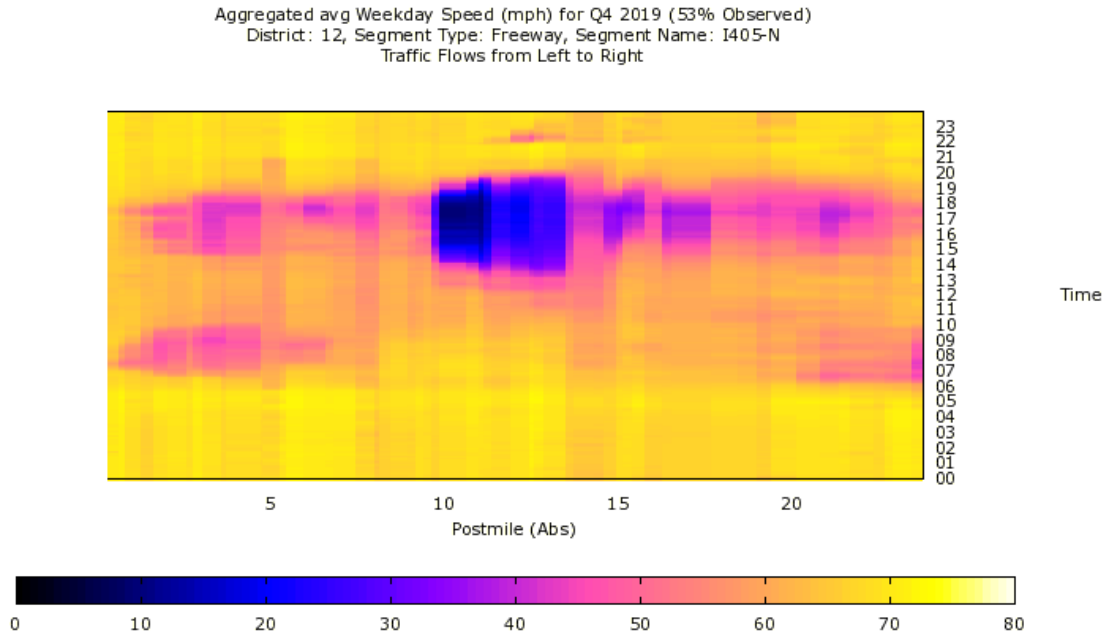
- This freeway is currently under construction; therefore, all traffic data are abnormal for degradation study until the project is completed.
- Peak period recurrent congestion in all lanes reducing HOV lane performance and speed. Congestion in the general-purpose lanes at Route 55 interchange and Route 22 interchange, and through Irvine. Geometric changes at Route 405/ Route 55 and Route 405/ Route 22 interchanges. The bending HOV lanes at both interchanges reduced car speed and weaving from GP lanes to HOV during peak hours created a speed delay in HOV lanes.
- High traffic volume and demand from the John Wayne Airport and the South Coast Metro Center
- Bottleneck at Route 405/Route 55 HOV direct connector
- High volumes of low or zero emission vehicles in HOV lanes (approximately at 25 percent at Von Karman Avenue during Fall of 2019)

Figures 195 and 196 provide plots of HOV and GP lane speeds along the length of the eastbound HOV facility on Route 91 during the fourth quarter of 2019. Figures 197 and 198 provide plots of HOV and GP lane speeds along the length of the westbound HOV facility on Route 91 during the fourth quarter of 2019.

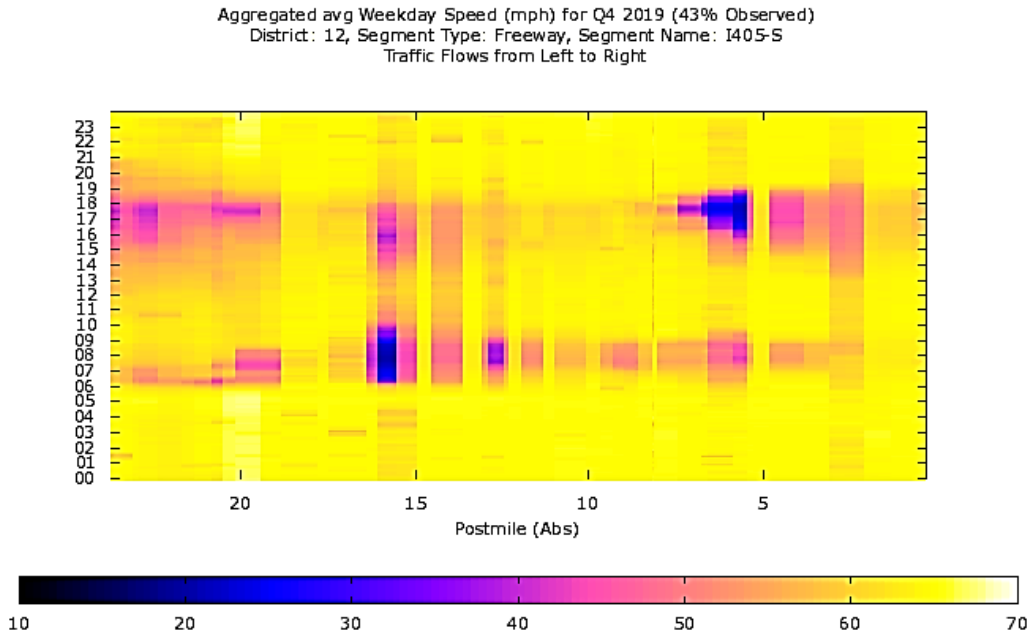
## FIGURE 195. AVERAGE HOV LANE SPEED – NORTHBOUND ROUTE 405, Q4 2019



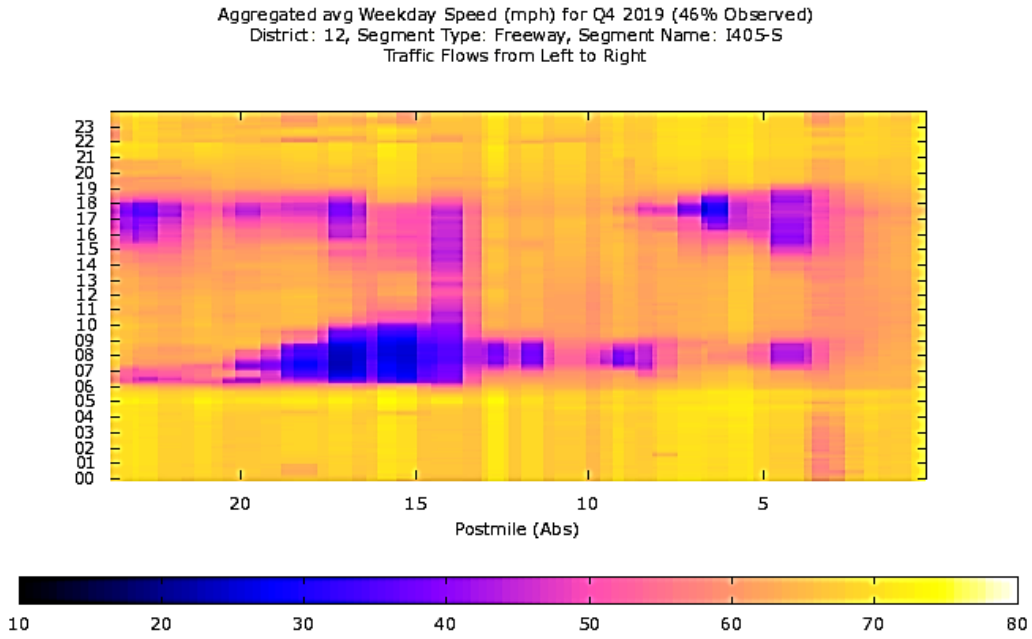

## FIGURE 196. AVERAGE GP LANE SPEED – NORTHBOUND ROUTE 405, Q4 2019



## FIGURE 197. AVERAGE HOV LANE SPEED – SOUTHBOUND ROUTE 405, Q4 2019




## FIGURE 198. AVERAGE GP LANE SPEED – SOUTHBOUND ROUTE 405, Q4 2019



## B. REMEDIATION STRATEGIES

Based on the analysis in the previous section, the following remediation strategies for Route 405 in both directions will be implemented for the studied facilities:

- Design-Build widening project on Route 405 between Route 73 and I-605. This is currently in construction to convert the existing HOV lane to an HOT lane and add one HOT lane to create dual HOT lanes in each direction. The project is scheduled to finish on February 28, 2024.
- CCTV cameras to monitor the HOT lanes and toll equipment will be installed for Route 405. The cameras will have pan, tilt, and zoom capabilities to allow the TOP and Caltrans to monitor freeway incidents and the toll facilities.
- New SR50-2(CA) sign that identify fines for occupancy violations will be installed concurrently with Design-Build widening project to help reduce occupancy violations.
- Auxiliary lanes addition at the following locations on Route 405 will reduce friction between HOV and GP lanes due to weaving and exceeding capacity:
    - Northbound direction: from the Euclid Street off-ramp to a point 1200 feet south of the off-ramp
    - Northbound direction: from Seal Beach Boulevard to Route 22 Westbound/ 7th Street off-ramp
    - Northbound direction: between Route 133 merging branch connector and the Sand Canyon Avenue off-ramp
    - Southbound direction: from Euclid Street to Harbor Boulevard
    - Southbound direction: between the Jeffrey Road off-ramp and the Culver Drive direct onramp