

HOV SPEED COMPLIANCE ACTION PLAN



Prepared by
Arizona Department of Transportation
Multimodal Planning Division

Submitted to
Federal Highway Administration
Arizona Division
June 1, 2023

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Director's Office

Katie Hobbs, Governor
Jennifer Toth, Director

June 1, 2023

Karla S. Petty
AZ Division Administrator Federal Highway Administration
4000 N. Central Avenue Suite 1500
Phoenix, Arizona 85012

Dear Division Administrator Petty:

In compliance with the agreement between the Arizona Division Office of the Federal Highway Administration (FHWA) and Arizona Department of Transportation (ADOT) addressing the degradation of the High Occupancy Vehicle (HOV) Lanes per 23 USC 166 d (1) D, this action plan was prepared for submission by the established date of June 2023. This action plan identifies any and all segments of the currently operational HOV lanes within the metropolitan area freeway system that are not fully compliant with 23 USC 166 d (2). The action plan also addresses the actions established or planned by ADOT to bring the HOV lanes into compliance with the previously identified requirements. If you require further information or assistance with this matter, please contact Paul Patane, Multimodal Planning Division Director at (602) 712-7435.

Sincerely,

DocuSigned by:

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Jennifer Toth
Director



Multimodal Planning Division

Katie Hobbs, Governor
Jennifer Toth, Director
Gregory Byres, Deputy Director/State Engineer
Paul Patane, Division Director

June 1, 2023

Kieran Jordan, Operations Engineer
Federal Highway Administration (FHWA), Arizona Division
4000 North Central Avenue, Suite 1500
Phoenix, Arizona 85012-3500

RE: 2023 High Occupancy Vehicle Speed Compliance Update

Dear Mr. Jordan:

In accordance with FHWA guidance (23 USC 166) on High Occupancy Vehicle (HOV) facility operations, the responsible state agency will limit or discontinue the use of HOV facilities by non-HOV vehicles (low emission and energy efficient vehicles not meeting the occupancy requirement) if the presence of the vehicles contributes to degraded operation of the facility. The performance standard is based upon an agreement between ADOT and FHWA Division, as follows: maintain a 45 mph average speed in each morning and evening peak hour during the 180-day period ending in March of each year.

As requested we have provided an HOV Report Supplement summarizing the HOV lane speed compliance results for 2023.

Please let us know if you have any questions or concerns.

Thank you,

DocuSigned by:

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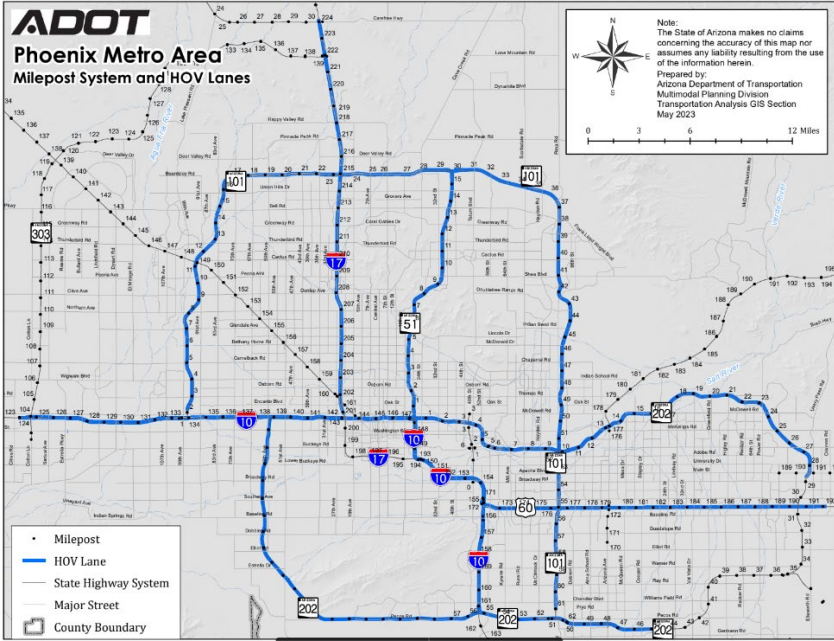
Paul V. Patane, P. E.
Multimodal Planning Division Director

Executive Summary

Arizona Department of Transportation (ADOT) Multi-modal Planning Division (MPD) is tasked with updating the High Occupancy Vehicle (HOV) lanes report on an annual basis. The report is provided to the Federal Highway Administration (FHWA) every June 1st and includes 6-months worth of data (October through March). Analysis is performed to identify areas of congestion on the network. Compliance is defined for segments as speeds of 45 mph or faster for 90% of the time over a 180-day period during the weekdays rush hours (excluding holidays) which start from 6 am to 9 am and from 3 pm to 7 pm. For the 2023 collection cycle, there are six segments that are out of compliance. This report details the analysis methods used and the updates in ADOT's processes, and new initiatives to improve compliance on the roadway network. Reporting requirements include updates to countermeasures to show continuous improvement in travel time reliability.

HOV Lane Facilities

Figure 1. Overview map of HOV Segments



As of calendar year 2022, there are 437 lane miles of HOV lane in the state of Arizona, all of which reside within the Phoenix metropolitan area (see Figure 1 below). Currently, all of the HOV lanes are 1-lane HOV lanes. There are plans to add over 10 additional lane miles of 2-lane HOV lane on Interstate 10 via the [Broadway Curve project](#) that will be completed in 2024.

The predominant freeway striping that separates the

HOV lane from the general purpose lane is a wide solid single white lane line (shown below in figure 2.B).

A wide solid white line is appropriate to discourage, but not prohibit, crossing between the two lane types. Other types of preferential lanes also use solid wide lines, so drivers are accustomed to this treatment. Current striping allows for entering/exiting where there are available gaps between vehicles and no additional signage is needed.

There is a combination of overhead signing and ground mounted signing throughout the Phoenix-metro freeways showing the designated HOV preferential lane that would be easily recognizable to any visitors unfamiliar with the area. Violating the HOV lane restrictions in Arizona results in a fine of \$400.

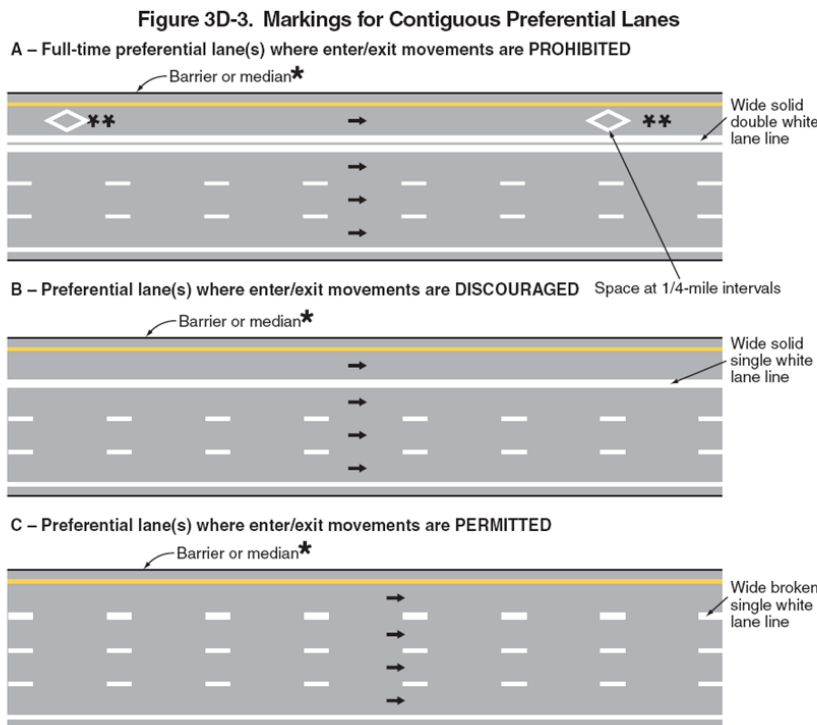
Currently, ADOT does not have any congestion pricing on any of the freeways in the state. If there is a time when this would be implemented, changing the striping at that time might be appropriate. There would be a significant change to the usage of the preferential lane and a change to the striping would make the public aware of this. Implementing this now would require significant stripe obliteration, which would result in significant costs. Please see countermeasure #6 for more details.

Figure 2. HOV Lane Striping

(Source: FHWA, 14 Sep. 2022)

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2009 Edition



Calculating Degradation

The calculation for a good or poor performing highway segment is expressed as a percentage. Morning peak period is from 6 am to 9 am and evening peak period is from 3 pm to 7 pm. For the purposes of speed performance monitoring, a segment is in compliance if the average speed is 45 mph or faster for 90 percent of the time over the 180 day period (October through March).

FHWA does not specify the speed data sources, only the analysis of the speed data. This is primarily because each state has different characteristics, and each agency responsible for operations has different resources to collect and analyze data.

Data Collection

The speed data used in the analysis is collected via Freeway Management System (FMS) detectors by direction on the metropolitan freeway system in an automated fashion. The speed data is gathered in 20-second intervals and is averaged into 5-minute intervals. The selected reporting period reduces the seasonality issues observed from some segments. However, ADOT monitors the monthly performance of the segments during the reporting period for possible compliance issues. Table 1 below shows the performance of all the segments during the 180 day period.

Table 1. HOV Corridor Speed Segments

FHWA Speed Compliance (for 180 day period ending March 31st of the Evaluation Year)				
Segment	Hov Segment	Evaluation Year		
		2021	2022	2023
1	I-10_EB_L101_to_I-17	91	83	80
2	I-10_EB_I-17_to_SR_51	91	94	97
3	I-10_EB_SR_51_to_I-17	100	100	100
4	I-10_EB_I-17_to_US_60	99	57	93
5	I-10_EB_US_60_to_L202	100	99	100
6	I-10_WB_L101_to_I-17	83	86	84
7	I-10_WB_I-17_to_SR_51	92	86	88
8	I-10_WB_SR_51_to_I-17	100	99	88
9	I-10_WB_I-17_to_US_60	100	97	97
10	I-10_WB_US_60_to_L202	100	97	100
11	I-17_NB_I-10_to_L101	91	89	90
12	I-17_SB_I-10_to_L101	99	95	88
13	L101_Pima_NB_SR_51_to_L202	100	94	98
14	L101_Pima_SB_SR_51_to_L202	98	91	92
15	L101_Price_NB_L202_Red_Mt_to_US_60	100	100	100
16	L101_Price_NB_US_60_to_L202_San_Ta	92	94	97
17	L101_Price_SB_L202_Red_Mt_to_US_60	100	93	89
18	L101_Price_SB_US_60_to_L202_San_Tan	100	100	100
19	L202_Red_Mt_EB_SR_51_to_L101_Pima	100	100	96
20	L202_Red_Mt_WB_SR_51_to_L101_Pima	98	95	93
21	SR_51_NB_L202_to_L101	100	100	99
22	SR_51_SB_L202_to_L101	94	99	97
23	US_60_EB_I-10_to_L101	100	96	100
24	US_60_EB_L101_to_SR_87	100	100	100
25	US_60_EB_SR_87_to_L202	100	99	99
26	US_60_WB_I-10_to_L101	100	100	100
27	US_60_WB_L101_to_SR_87	100	100	100
28	US_60_WB_SR_87_to_L202	100	99	97
29	L101_SB_BEARDSLEY_TO_THOMAS	98	91	93
30	L101_NB_THOMAS_TO_INDIAN_SCHOOL	99	100	100
31	L101_EB_75TH_AVE_TO_27TH_AVE	100	99	98
32	L101_WB_27TH_AVE_TO_67TH_AVE	100	97	93
33	L202_South_Mnt_WB_I-10_to_Bend	100	100	100
34	L202_South_Mnt_NB_Bend_to_Elliot	100	100	100
35	L202_South_Mnt_NB_Dobbins_to_I-10	100	100	100
36	L202_South_Mnt_EB_Bend_to_40th_St	100	100	100
37	L202_South_Mnt_SB_Elliot_to_Bend	100	100	100
38	L202_South_Mnt_SB_I-10_to_Dobbins	100	100	100

Notes: HOV Segments highlighted in red are out of compliance for the evaluation period.

CFR Compliance Guidance: HOV lane speeds that fail to maintain 45 mph for 90 percent of the time over a 180 day period are non-compliant

The speed data in Table 1 (segments 33 through 38) suggests that the latest roadway construction design of the SR-202 South Mountain Freeway (SMF) can most likely be the cause of the superior performance for the three consecutive years 2021 - 2023.

Research studies indicate that improvements in roadway infrastructure elements such as lane width, road width, horizontal and vertical geometry, traffic flow conditions, and roadside environment impact travel speed considerably.

Phoenix Metro Degradation Summary

The data in Table 2 represents the percentage of time for each segment that is out of compliance and shows the real segment performance changes over the past 3 years.

Table 2. HOV Corridor Segments

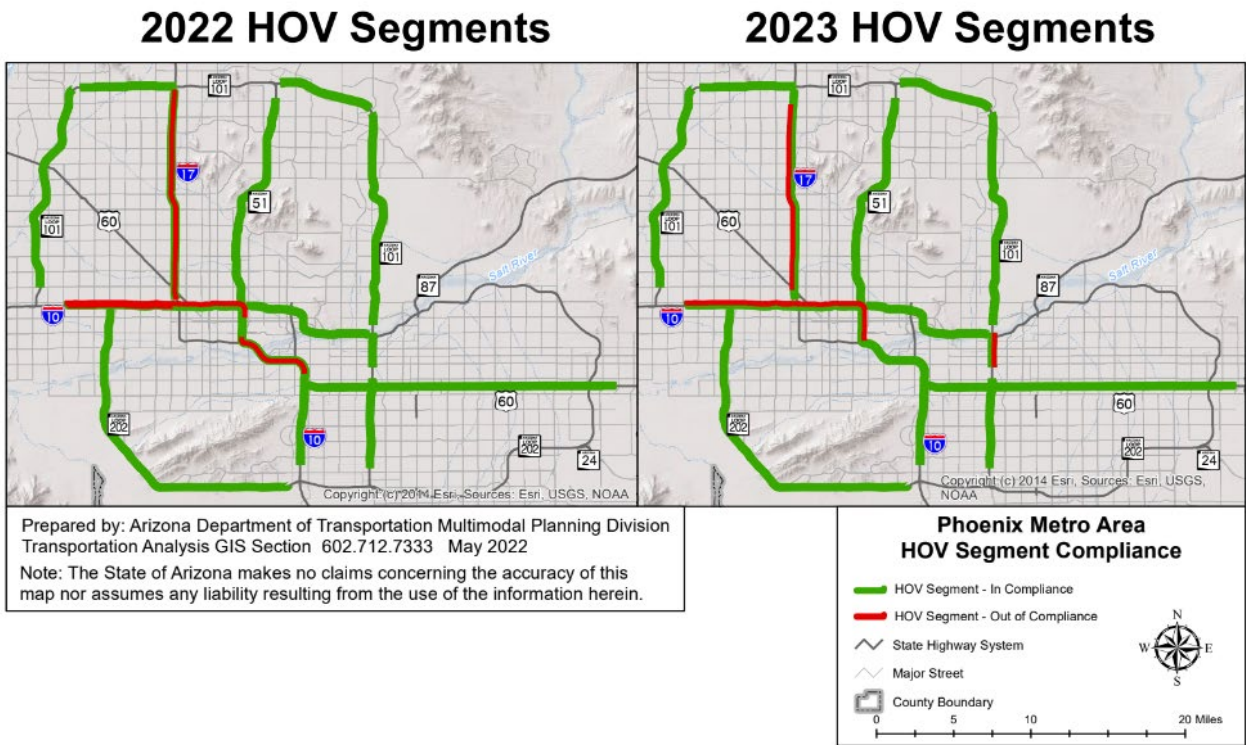
Segment Order	HOV Segment	Evaluation Year		
		2021	2022	2023
1	I-10_EB_L101_to_I-17	91	83	80
4	I-10_EB_I-17_to_US_60	99	57	93
6	I-10_WB_L101_to_I-17	83	86	84
7	I-10_WB_I-17_to_SR_51	92	86	88
8	I-10_WB_SR_51_to_I-17	100	99	88
11	I-17_NB_I-10_to_L101	91	89	90
12	I-17_SB_I-10_to_L101	99	95	88
17	L101_Price_SB_L202_Red_Mt_to_US_60	100	93	89
Total number of segments out of compliance		1	5	6

It can be observed from the data in Table 2 the following:

- 13% of the total HOV segments are out of compliance in 2022
- 16% of the total HOV segments are out of compliance in 2023

The maps in Figure 3, illustrate the HOV segments in compliance (in green) and the HOV segments out of compliance (in red) for the years 2022 and 2023. There are more HOV segments in compliance in 2022 than there are in 2023.

Figure 3. Overview map of HOV Segme



There are a number of contributing factors for the increased degradation on the HOV lane network.

1. Maricopa County’s population grew 3 percent from the year 2020 to 2022 (Population - azcommerce.com, July 2022). With the population of the state increasing, the state highway system Level of Service (LOS) will be affected with increased travel times
2. Maricopa County experienced a 5 percent increase in employment from January 2020 to January 2023 (Labor market - azcommerce.com)
3. Impact of Covid 19 Pandemic on Degradation: On March 11, 2020, Governor Doug Ducey declared a statewide public health emergency (A.R.S. § 26-303) that enforced a ‘Stay at home’ order that affected all ‘in-person’ educational institutions and majority of ‘in-person’ employment. As a result, during the year 2020, majority of employees began to telework and the majority of students transitioned to online students.

This lead to a decrease in traffic congestion. As educational institutions and employees began to gradually transition to a hybrid mode, traffic congestion increased. On March 20th 2022, Covid-19 state of emergency ended with majority of employees returning to ‘in-person’ mode of work and educational

institutions allowing for 'in-person' classes. Traffic volumes have increased from pre-pandemic volumes and the state highway system capacity has not been able to support the demand.

Countermeasures

The countermeasures listed below are used to track progress with ADOT's compliance with 23 USC 166. Some of these countermeasures are works in progress and will take multiple years of data collection and analysis to complete.

Countermeasure #1: End Low Emission Efficient Vehicle (Hybrid) Program

Per 23 USC 166(b)(5)(B), earlier versions of hybrid vehicle technologies (non-plug-in-type) were to be removed from the occupancy requirements exemptions effective September 30, 2019.

Changes: Continue to track data.

Progress: ADOT implemented this countermeasure by issuing a letter dated December 23, 2019 and made the actions effective March 2, 2020. The letter informed Blue Sky hybrid plate holders of the Federal law ending the program for their specific vehicles. Blue Sky Hybrid Plates are being phased out through sales and attrition of the vehicles.

Results: As of January of 2023, there are 3,250 hybrid plates remaining on Arizona's roadways.

Countermeasure #2: Traffic Congestion Analysis

There are six segments identified that do not comply with the minimum speed requirements. These particular segments will be analyzed to determine factors that may be affecting upstream and downstream HOV lane volume and speed reductions.

Changes: Conduct analysis on out of compliance segments.

Progress: The analysis of the detector level data in the non-compliant segments is underway.

Results: TBD

Countermeasure #3: Technology

In 2008, Arizona Department of Transportation (ADOT) paired with Redflex Traffic Systems, an Australian based company, to install 42 mobile units and 36 stationary cameras in Phoenix. However, the cameras were taken down within 2 years due to the

public's reaction and claims that the placement of such cameras was a violation of constitutional rights (Mike Sakal, caranddriver.com, Nov 30th, 2010). Currently, ADOT has no HOV lane photo enforcement radars on its highway system.

Changes: None at this time.

Progress: Further research is being pursued. Caltrans Division of Research, Innovation and System Information and Nevada DOT have recently completed studies that will be evaluated to see if countermeasures have merit and can be used. This evaluation will be completed in December 2023.

Results: Further research is necessary into newer technological advances and implementation is needed.

Countermeasure #4: Increased Signage

Evaluate if increased signage along the HOV facilities reinforcing the occupancy requirements and penalties for violations may discourage use of the HOV facilities by vehicles that do not meet the occupancy requirements.

Changes: No substantial changes at this time.

Progress: Planning staff meet with internal subject matter experts to understand the current state of HOV signage. ADOT is currently in compliance with MUTCD requirements. As new requirements come from FHWA, ADOT will be sure to make the necessary changes. A GIS analysis will be considered to associate increased signage and citations to see if there is a significant change in driver behavior in these corridors in the future. With increased signage, enforcement will also need to follow suit.

Results: N/A

Countermeasure #5: Increased Enforcement

Coordination with Arizona Department of Public Safety (DPS) on increasing enforcement activity of HOV lanes in sections where the data determines that the lanes are degraded.

Changes: Additional discussions with DPS will need to occur to help determine where enforcement efforts should focus on areas of noncompliance with HOV lane usage.

Progress: A new baseline was established for the number of citations issued and where those citations occur on the state highway system. Over the last 5 years, there have been HOV lane citations given within the Phoenix metro area.

- 2018: 7,525
- 2019: 6,689
- 2020: 3,225

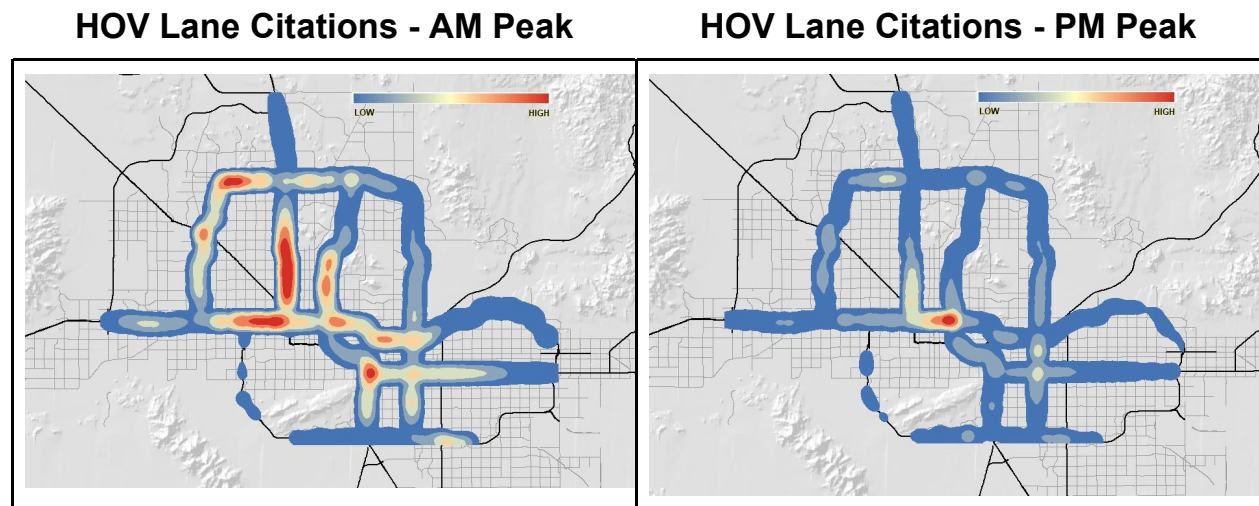
- 2021: 4,177
- 2022: 4,816
- 2023 Year to Date: 1,194

The Arizona Department of Public Service provided ADOT with a database of over 27,000 citations issued to drivers in single occupancy vehicles utilizing the HOV lane during rush hour traffic, which is a violation of Arizona Revised Statutes, Title 28-737A. The data is from January 2018, through April 2023.

With this baseline data, more informed metrics and decisions can be made to improve highway reliability and safety.

Results: Baseline results will be used in determining the percentage of violators and where additional enforcement is needed. Analysis was performed on the past 5 years of data to determine hot spots for enforcement as well as areas where enhanced enforcement is needed. The deliverable from this analysis is shown in the maps below (Figure 4).

Figure 4, Violation 28-737A Citation Volume Distribution



The areas of high ticketing are on the I-10, I-17, SR-51 and SR-101 corridors. The maps also show where additional enforcement can be done such as the US-60 or SR-202.

Countermeasure #6: HOV-Lane Access Restrictions

The current configuration of HOV lanes allow ingress and egress at any point along the lane. Limiting the points of ingress and egress may limit traffic volumes in the HOV lanes within certain segments, particularly those currently degraded.

Changes: No implementations at this time.

Progress: Planning staff meet with subject matter experts on the topic. An analysis was done previously to update lane striping. It was determined that the cost outweighs the benefits. The designated ingress/egress locations would not affect congestion as desired. No lane restrictions are being considered by ADOT at this time.

Results: Not a viable solution at this time.

Countermeasure #7: Hours of Operation

The current hours of operation are from 6:00am-9:00am and 3:00pm-7:00pm. Due to the current AM peak and PM peak travel demand, extending the operation hours may relieve surges in HOV lanes.

Change: ADOT performed analysis using the 2022 data and changed the peak period from 3:00pm-7:00pm to 2:00pm-7:00pm. This update did not have an impact on the compliance results.

Progress: Evaluation of modified PM peak hour.

Results: No change in results.

Countermeasure #8: Human Factors Study

Examine and understand why commuters, despite the availability of other commute options, are choosing to drive alone by conducting a behavioral change assessment study being conducted by ADOA.

Change: Additional research is needed to understand human behavior and how to change this behavior that benefits the mobility of the HOV lane. No implementation at this time.

Progress: MPD staff met with ADOT safety teams to understand the use of human factor studies. A recent study from the Maricopa Association of Governments (MAG) has looked at [Interstate 10 and 17 corridors](#) and different alternatives including capacity increases and High Occupancy Toll (HOT) lanes. In the future, an analysis will be conducted on the number of crashes within the HOV lanes.

Results: N/A

Countermeasure #9: Additional Alternatives

Among the recommendations to address HOV lane speed degradation recommended by FHWA, Guidance (23 USC 166) is to increase the occupancy requirement for eligible HOVs. The current operation of Arizona's HOV lanes require carpools to have two or more persons.

Changes: No implementation at this time, but a communication plan would be needed to ensure the proper vision is communicated to the public.

Progress: N/A

Results: N/A

Conclusion

Progress continues to be made in improving the reliability of the HOV lanes throughout the Phoenix metropolitan area. As population increases within the state, new and innovative solutions for congestion mitigation will be needed. Continued analysis will help ADOT and its business partners make proactive decisions for planning for the challenges of the future. Further outreach with agency partners (MAG and DPS) will ensure all stakeholders are aware of changes.

Citations

- 1) "2009 Edition Part 3 Figure 3D-3. Markings for Contiguous Preferential Lanes." *FHWA*, United States Department of Transportation - Federal Highway Administration, 14 Sept. 2022, https://mutcd.fhwa.dot.gov/htm/2009/part3/fig3d_03_longdesc.htm
- 2) HOV Lane citation data from DPS for counter measure #5.
- 3) Population Estimates July 1 population estimates for the State of Arizona and its counties and incorporated places are published by December 15th each year. The latest estimates that are currently available are for July 1, 2022. View Estimates Population Projections

Population - azcommerce.com, Azcommerce.com,
- 4) Arizona Commerce Authority, July 22nd 2022, May 5th, 2023
<https://www.azcommerce.com/oeo/population/>,
- 5) Arizona's labor market - Azcommerce.com, Arizona Commerce Authority, www.azcommerce.com, May 5, 2023
<https://www.azcommerce.com/oeo/labor-market/>,
- 6) Arizona's Speed Cameras Come Down, www.caranddriver.com, Car and Driver, Mike Sakal, November 14, 2020

<https://www.caranddriver.com/features/a15124515/arizonas-speed-cameras-come-down/>

Contacts

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