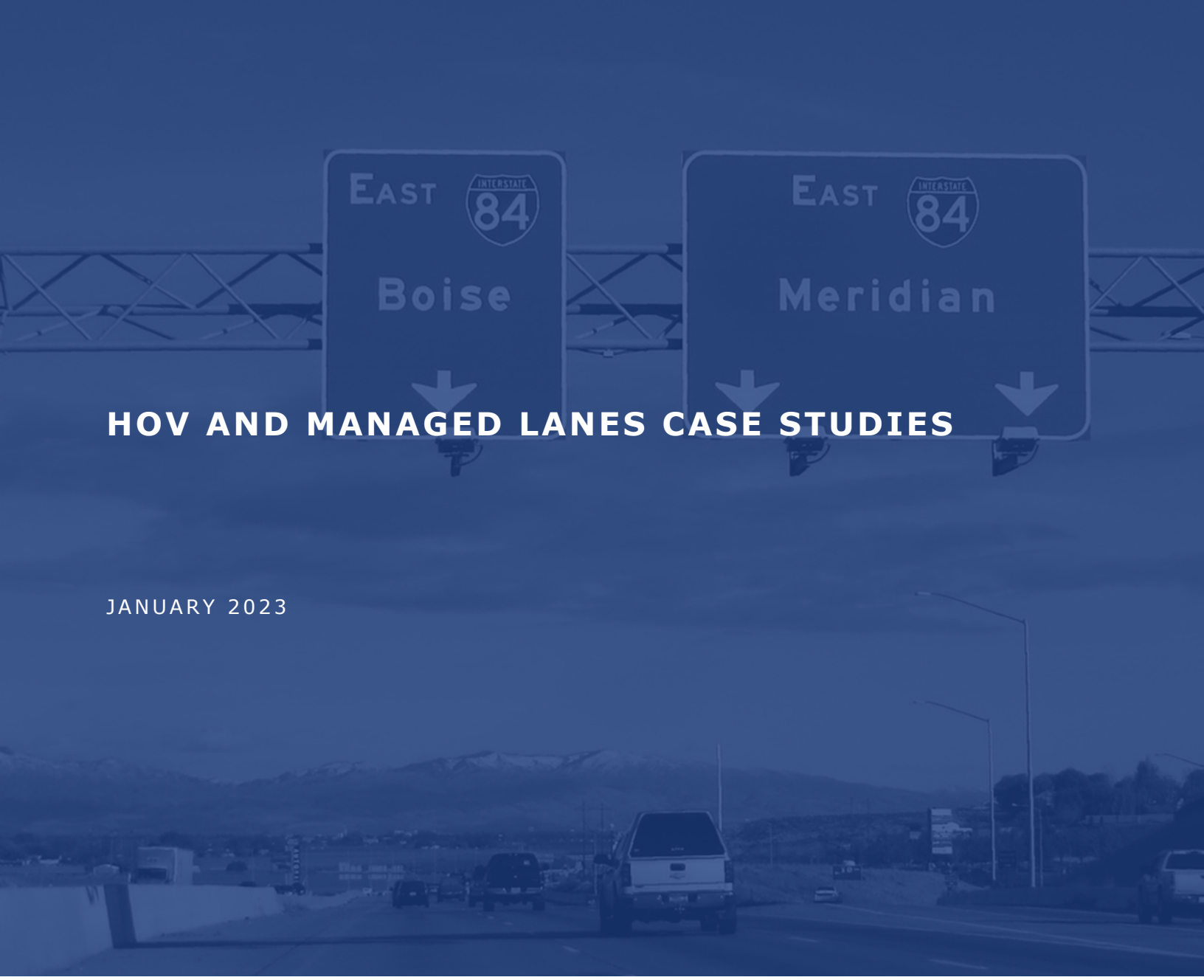

HOV AND MANAGED LANES CASE STUDIES

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COMPASS
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INTRODUCTION

This memorandum provides an overview of high-occupancy vehicles (HOV) lanes, reviews case studies, and provides guidance for further work related to policy, public information, and HOV lanes operation.

HOV facilities and operations were reviewed as case studies for comparison with the greater Boise area. The three case study locations are:

- Salt Lake City, Utah
- Minneapolis, Minnesota
- Phoenix, Arizona

These locations were chosen for regional similarity to the greater Boise area (Salt Lake City) or comparable traffic volumes on the freeway corridor with the HOV lane, and availability of data.

WHY IS COMPASS STUDYING HOV LANES?

Boise is Idaho's largest city with approximately 235,000 residents. The greater Boise area is served by an interstate, I-84, and a spur, I-184, that provides access to downtown Boise. The other major cities in the COMPASS area, Caldwell, Meridian, and Nampa, were included in the top 15 fastest growing cities[1] in the United States with a growth of 5.0 percent from 2020 to 2021.

As the population of the region continues to grow, users of the transportation system will experience more congestion and other impacts to quality of life. Traditionally, adding additional lanes to highways and roadways has offered relief to increasing traffic volumes. In time, however, new lanes fill up as congestion catches up. Agencies must again consider more lanes to keep congestion at an acceptable level.

A method that is proven to proactively address this growth-widen-growth-widen cycle is to create "managed lanes." Managed lanes are designed to restrict the number of vehicles in the lane, typically by only allowing transit, motorcycle, and carpool traffic. There are many examples of managed lanes around the country, including freight lanes, high-occupancy vehicle lanes, toll lanes, and high-occupancy toll (HOT) lanes- where single-occupant vehicles (SOV) can use the HOV lane by paying a toll.

From a user perspective, managed lanes can offer reliable travel times and shorter commutes. When a managed lane is added to an existing roadway system, the additional capacity freed up by vehicles using the managed lane immediately improves travel times for all. Transit experiences benefits by being able to provide more reliable and efficient trips during congested periods, and in some cases, transit agencies can put more service on the road due to the savings. During

[1] https://www.census.gov/newsroom/press-releases/2022/fastest-growing-cities-population-estimates.html

congested periods, drivers in the general-purpose lanes may also be encouraged to carpool or take transit so that they can experience the same benefits of the managed lane.

Managed lanes can generate both interest and concern within the public and public officials prior to, and in the early stages of, opening. However, the increased adoption of HOV and HOT managed lanes across many metro areas is a testament to their value, acceptance, and multi-state support once operations are in place and experienced.

As with any capital investment, the COMPASS region is likely to experience concerns related to the best use of tax dollars, privacy, impacts to overall mobility and the economy, and the perception of a first project being a "gateway" to a slippery slope of control by agencies. For these reasons, COMPASS is evaluating HOV lanes to understand if the managed lane approach deserves consideration in the region's future investments to achieve regional goals.

HOW ARE HOV LANES OPERATED?

High-occupancy vehicle lanes are designated solely for non-single-occupancy vehicles and can be operated at all hours or during peak periods only. Traffic volumes in HOV lanes are often managed through vehicle eligibility and access control. Typically, vehicles are eligible if they carry 2 or more persons and, in some cases, motorcycles and/or alternative fuel vehicles (such as electric vehicles in Utah and Arizona) are also eligible. For example, when HOV lanes in Washington State were opened, the rules required a 2+ vehicle occupancy to use the lane. After approximately a decade the volumes in the HOV lanes increased to the point where the benefits were significantly reduced. At that time, the rules were changed to require 3+ occupancy, and remain at that requirement today. Limiting access to HOV lanes may include designating stretches as Express Ways with specific entrances and exits, and/or certain hours of use such as peak morning and evening times when a regular travel lane is designated HOV only for a specific timeframe.

VARIATIONS

Many states also use the addition of HOT leverage pricing with HOV lanes to create a greater impact. Tolling non-HOVs increases compliance, reduces congestion and emissions, while simultaneously benefitting the safety and function of the highway system through increased state revenue. Many states designate their HOT lanes as Express Lanes, including the highlighted case study cities Minneapolis and Phoenix, which further reduce congestion and increase economic output.

All three of the case studies discussed here use a form of HOT for their HOV lanes. Tolls are typically collected by dash-mounted devices which are registered with the respective state's Departments of Motor Vehicles (DMVs).

HOV BENEFITS

HOV lanes encourage a shift to carpooling and transit by providing a more reliable, faster travel time alternative during congested conditions. The Federal Highway Administration (FHWA) defines the minimum average operating speed within an HOV lane as 45 MPH, and not more than 10 MPH below the speed limit for a facility with a speed limit of less than 50 MPH[2]. This can result in a significant difference when general purpose lanes are bumper-to-bumper during peak traffic periods.

- HOV implementation increases capacity in regular lanes of travel by spreading peak demand over a longer period
- Preserves the capacity of new expansion by prescribing the use of the new facility
- Reduces the emission of air pollutants and greenhouse gases (GHGs) that are harmful to the environment and human health by encouraging reductions in SOV use
- Allows residents to make their own decisions regarding the trade-off between money and time

WHAT MAKES AN HOV LANE SUCCESSFUL?

HOV lanes have been in operation in the United States since the late 1960's, yielding a substantial pool of research to draw from. Key success factors include having supportive strategy, policy and laws, a benefit for users, enough potential users of the system, supportive policy and laws, public education, and enforcement.

SUPPORTIVE STRATEGY, POLICY, AND LAWS

HOV lanes need to be a strategy in an agency's approach to system management. Agencies implement HOV lanes for reasons including:

- Preserving capacity of new construction, especially where funding, geographical constraints, or environmental impacts prevent continuous widening
- Reducing harmful vehicle emissions, and to meet federal air quality standards

Currently, Idaho law allows HOV lane restrictions only in counties with a population less than 25,000 that contain a resort city (Idaho Statues 49-1421a) for example, Blaine County. Ada and Canyon counties each have a population much greater than 25,000. Therefore, for a future HOV lane and the related HOV restrictions in the greater Boise area the statue needs to change. Additional regulation of the HOV system may include:

- Direction to agencies to develop HOV policy (described below)
- Enforcement law and penalties, use of fines, and available resources for enforcement
- Funding sources available for HOV facilities

[2] https://ops.fhwa.dot.gov/freewaymgmt/hovguidance/chapter4.htm

With laws in place, agencies must develop policy for managing the HOV lane. Development of HOV lane policy should include all stakeholders including:

- City of Boise, City of Meridian, City of Nampa, City of Caldwell, and other appropriate local jurisdictions
- COMPASS metropolitan planning organization
- Idaho Transportation Department
- law enforcement
- freight providers
- school bus service
- transit agencies
- automobile driver representatives, such as AAA

Policies may include:

- **Guidance for the conditions** for when an HOV lane will be implemented such as congestion exceeding an established threshold
- **Eligible vehicles** such as HOV only, HOV plus electric vehicles (EV), HOV plus freight, HOV plus motorcycles, and HOV plus toll for non-HOV (HOT)
- **Conditions for changing eligibility** such as increasing the required vehicle occupancy from 2 to 3 which could be decided based on the total volume in the HOV lane e.g., Puget Sound region
- **Periods and direction of operation** such as the peak hour, peak direction, or always
- **Approach for addressing violations**

USER BENEFIT

HOV lanes were originally conceived as a way to increase person throughput on a freeway corridor, encouraging users to carpool to achieve that goal.[3] The travel time savings offered to users in the HOV lane incentivizes that change in behavior. Additional benefits include a more reliable travel time and an improvement in air quality.

A 5-minute travel time savings over an 8-10 mile commute is a recognized threshold for when commuters might consider options such as carpooling or transit.

[3] A Review of HOV Lane Performance and Policy Options in the United States - Final Report. https://ops.fhwa.dot.gov/publications/fhwahop09029/index.htm

AVOIDING "EMPTY LANE SYNDROME"

From an operator perspective, HOV lanes must have sufficient vehicle volume to avoid the perception of an "empty lane" to be worth the investment and to be acceptable to the public using the general-purpose lanes. The operation of the HOV system can be customized based on the unique behavior of drivers in the to reduce to likelihood of underutilization. Options for customization include policies for vehicle eligibility, hours of operation, and tolling.

PUBLIC INFORMATION AND EDUCATION

Agencies must develop an engaging public information and education program to highlight the benefits for all users and frame using the HOV system as a choice.

Source: Las Vegas Review

FIGURE 1. NEVADA DOT HOV LANE ENGAGEMENT

ENFORCEMENT

Enforcing HOV lane use is critical to the success of the system. The first step is creating laws to support the management of the system. Operating agencies must work with lawmakers to create equitable, enforceable laws that penalize HOV system violators. The laws must indicate which users are eligible to travel in the HOV lane.

Collaboration with law enforcement regarding the needs of officers is an important early step of developing an HOV system. For example, the Washington State Patrol educated engineers of the need for safe areas for enforcement, such as wide shoulders or pull-out areas. Often, operation agencies pay for additional officers to focus on enforcement of the HOV system. HOT lane revenues are sometimes applied to enforcement costs.

When HOV systems open, enforcement is a form of public education, and penalties are not given. This practice builds awareness and goodwill for system users.

HOV LANES CASE STUDIES

The average proportion of high occupancy vehicles in the fleet, measured from a selection of MPO areas across the United States, is 16-23% across peak periods.[4] In all three case studies, HOV enforcement is handled by respective State Patrol troopers. Violation estimates are about 13%.

Specific information about the decision to implement HOV lane management was not readily available for each of the case study areas. However, a selection of HOV facilities was reviewed by the Texas Transportation Institute[5] and found the following common features prior to the decision to implement HOV lanes:

- Corridor and areawide traffic congestion and growth in travel demand
- Lack of agreed upon fixed-guideway plan for the corridor
- Planned or scheduled highway improvements
- Project champion or champions in positions of authority
- Legislative direction and/or agency policy support

Table 1 below includes summary statistics of selected regional characteristics for the greater Boise area and the areas included in the case studies.

[4] https://ops.fhwa.dot.gov/publications/fhwahop09030/index.htm

[5] https://static.tti.tamu.edu/tti.tamu.edu/documents/925-3.pdf, accessed 10/12/22

TABLE 1: CASE STUDIES SUMMARY[6]

	BOISE CITY-MOUNTAIN HOME-ONTARIO	SALT LAKE CITY-PROVO-OREM	PHOENIX-MESA	MINNEAPOLIS-ST. PAUL
POPULATION (2020 CENSUS)	850,500	2,700,000	4,900,000	4,100,000
MEDIAN HOUSEHOLD INCOME	$65,000	$78,000	$67,000	$81,000
FIRST HOV LANE	-	1997 (I-15)[7]	1983 (I-10)[8]	1992 (I-394)[9]
AVERAGE TRAVEL TIME TO WORK	22 minutes	23 minutes	27 minutes	25 minutes
EMPLOYMENT RATE	62%	68%	60%	69%
CARPOOL PERCENTAGE OF AUTOMOTIVE TRIPS	9.72%	12.23%	12.74%	9.32%
LENGTH OF HOV SYSTEM	NA	38 miles	73 Miles	46 miles
AVERAGE HOV LANE UTILIZATION	NA	NA	12.9% AM 14.0% PM	19.5% AM 20.7% PM

[6] Population, employment and commuting characteristics data from US Census 2020 profiles of Combined Statistical Areas.

[7] https://www.fhwa.dot.gov/ipd/project_profiles/ut_i15_corridor.aspx, accessed 10/12/22

[8] https://www.azleg.gov/Briefs/Senate/HIGH%20OCCUPANCY%20VEHICLE%20LANE%20USAGE%202018.pdf, accessed 10/12/22

[9] https://ops.fhwa.dot.gov/publications/fhwahop09030/minnesota.htm, accessed 10/12/22

I-15, SALT LAKE CITY, UTAH

FIGURE 2. HOV LANE ON I-15 IN UTAH

Source: https://www.udot.utah.gov/connect/public/express-lanes/

Salt Lake City's HOV system is comprised of a single highway corridor of I-15, and the region is most like the Boise metropolitan area. Salt Lake City's metro area has the smallest population of the three case studies with a population of roughly 2,700,000. This metro includes the cities of Salt Lake, Provo, and Ogden. Characteristics of the HOV lane and operations are provided below.

TABLE 2. SALT LAKE CITY SELECTED[10] HOV STATISTICS – I-15 FROM 600 NORTH TO 14600 SOUTH

LANES (GENERAL / HOV)	LANE MILES	HOV ROUTE LENGTH	FACILITY HOURS	HOV (% OF TOTAL VEHICLES)	PEAK HOURS VIOLATION ESTIMATE
4 / 1	21.0	21.0	24 / 7	12.74%	13%

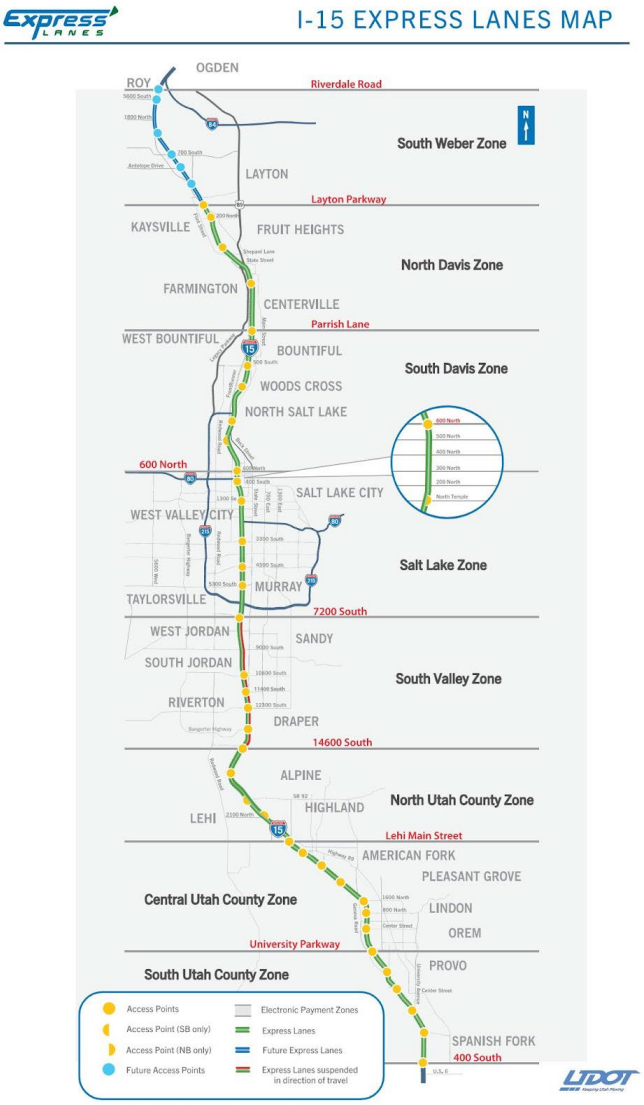
A few highlights of this system:

- Up to 260,000 average daily vehicles within this section of I-15[11]
- The HOT express lanes operate 24/7
- Tolling is based on congestion across multiple segments, ranging from $0.25 cents to $2.00 per zone

[10] The HOV characteristics in Table 2, Table 3, and Table 4 are selected from the Compendium of Existing HOV Lane Facilities in the United States (FHWA, 2008) but does not represent the entire HOV system as described in Table 1.

[11] https://www.udot.utah.gov/connect/docs/aadt-google-map/

- The Utah Department of Transportation (UDOT) received $1.9 million dollars in revenue from the system in 2017[12]. After expenses, UDOT netted $164,000 which went back into the budget to maintain the program. The system began as an HOV system with a pay-per-month flat fee for SOV use, but UDOT converted the HOV lanes to HOT at a capital outlay of $25 million in 2010 during an expansion project[13].



Source: https:/ /www.udot.utah.gov/connect/public/express-lanes/

FIGURE 3. SALT LAKE CITY HOT LANES (EXPRESS LANES)

[12] https://www.ksl.com/article/46149951/hov-lane-violations-on-the-rise-says-udot-official

[13] https://ops.fhwa.dot.gov/freewaymgmt/publications/documents/nrpc0610/workshop_materials/case_studies/salt_lake_city.pdf

MINNEAPOLIS, MINNESOTA

FIGURE 4. HOV EXPRESS LANE ON I-35 IN MINNESOTA

Source: https://www.dot.state.mn.us/ezpassmn/drive.html

The Minneapolis metro area is the largest metro of the case studies reviewed, with a population of roughly 4,100,000. This metro includes the cities of Minneapolis and St. Paul plus the surrounding urban areas. Data for the I-35 corridor are presented in Table 3, and system-wide characteristics are provided below.

TABLE 3. MINNEAPOLIS SUMMARY HOV STATISTICS – I-35 FROM BURNSVILLE PKWY TO 86TH ST

LANES (GENERAL / HOV)	LANE MILES	HOV ROUTE LENGTH	FACILITY HOURS	AM USAGE (% OF TOTAL VEHICLES)	PM USAGE (% OF TOTAL VEHICLES)	PEAK HOURS VIOLATION ESTIMATE
2 / 1	5.7	5.7	6 to 9 AM 3 to 6 PM	14%	22%	37%

A few highlights of the overall HOV system:

- 80% of the people using the HOT lanes (E-ZPass) are riding on buses or carpooling
- Single occupant vehicles represent 22% of *vehicles* in the lane but only 12% of the *people*
- Currently, vehicles in the E-ZPass lanes are traveling at speeds above 45 mph approximately 96% of the time.

- Capital cost in 2010 dollars for ATM and E-ZPass equipment for six- to eight-lane freeway: $1.2 million to $1.6 million per mile (both directions). These costs include tolling equipment, signs, sign structures, and communications infrastructure.

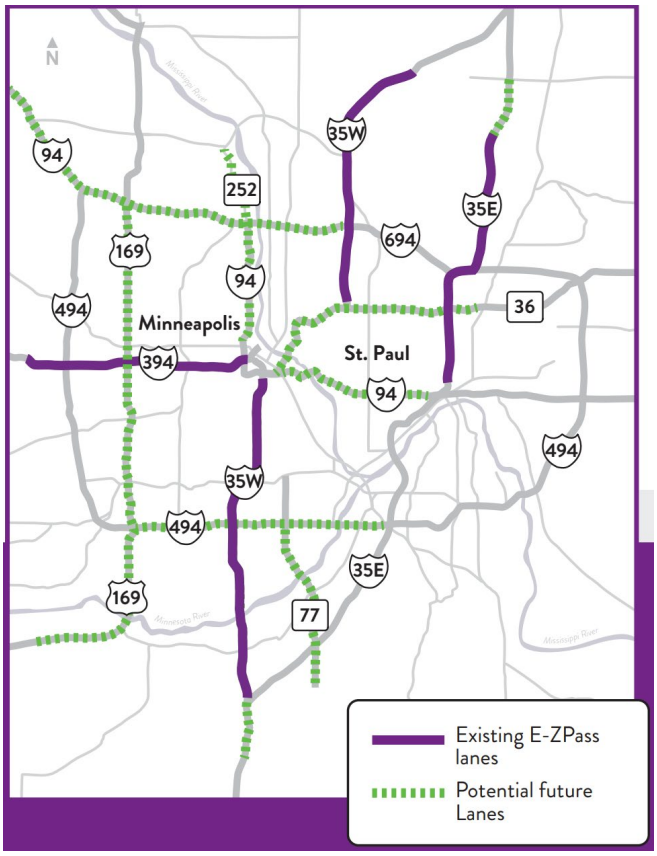


FIGURE 5. MINNEAPOLIS HOT LANE (EXPRESS LANES)

Source: https://edocs-public.dot.state.mn.us/edocs_public/DMResultSet/download?docId=19055390

PHOENIX, ARIZONA

FIGURE 6. HOV LANE ON US-60 IN ARIZONA

Source: https://azdot.gov/adot-news/lane-changes-enhance-safety-along-us-60-west-tempel

The Phoenix, Arizona metro has the largest system out of the three case study cities as well as a population of 4,900,000. Additionally, it is the only case study which does not currently use tolling[14]. This case study provides data on one facility, I-10, and operational characteristics of the system.

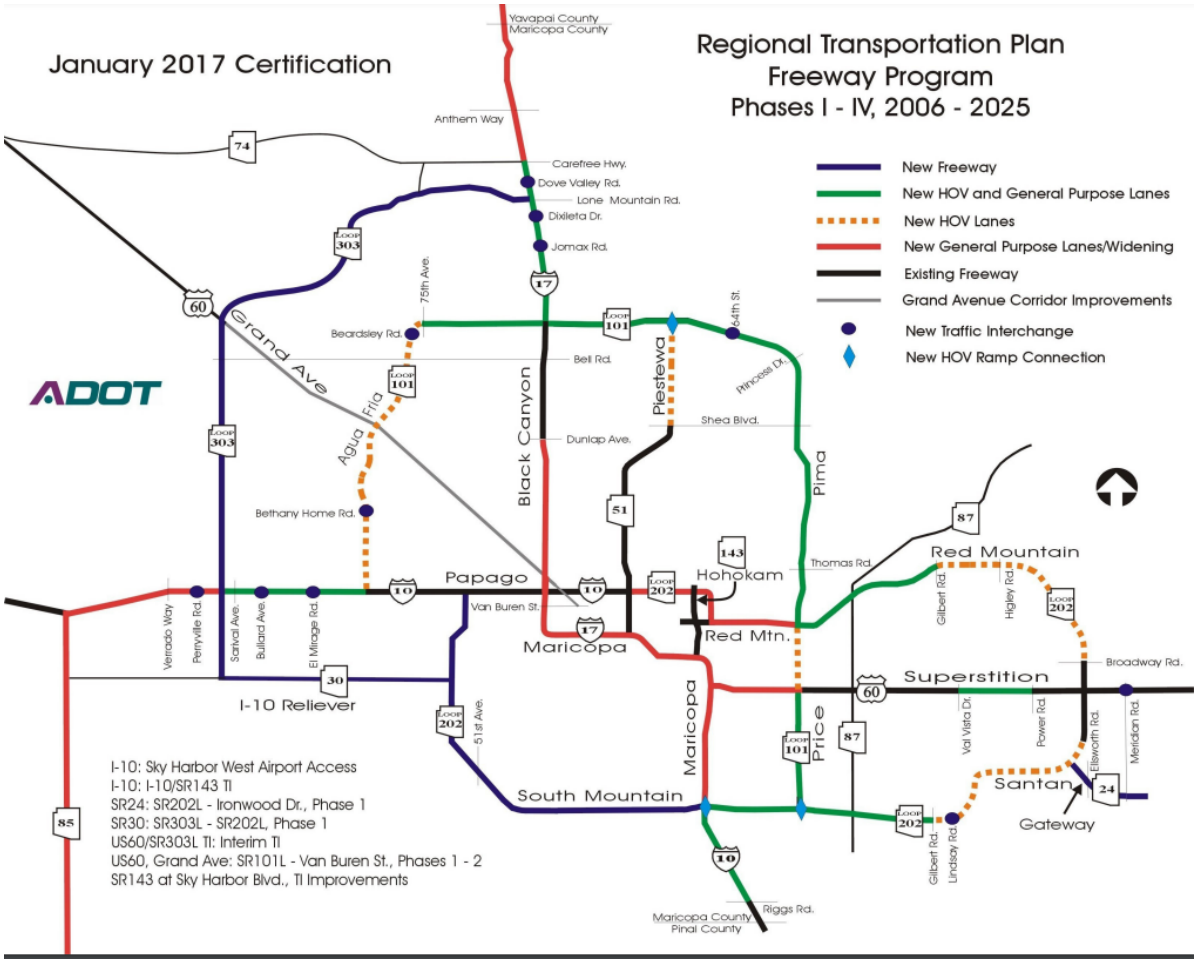
TABLE 4. PHOENIX SELECTED HOV STATISTICS – I-10 FROM LOOP 101 TO LOOP 202

LANES (GENERAL / HOV)	LANE MILES	HOV ROUTE LENGTH	FACILITY HOURS	AM USAGE (% OF TOTAL VEHICLES)	PM USAGE (% OF TOTAL VEHICLES)	PEAK HOURS VIOLATION ESTIMATE
4 / 1	28.5	28.5	6 to 9 AM 3 to 7 PM	12%	12%	9%

[14] Arizona Perspectives on Priced Managed Lanes and Toll Roads (2014-2015), Arizona Department of Transportation Research Center (2018), https://apps.azdot.gov/files/ADOTLibrary/publications/project_reports/pdf/spr707.pdf

The HOV system of lanes spans 190 miles across several state and federal highways within the Phoenix area, shown below. The HOV lanes on Arizona Route 51 operate 24/7[15]. All other HOV facilities operate Monday through Friday during peak travel hours; outside of those hours, the HOV lanes operate as general-purpose lanes[16].

The current planned 26-mile expansion of I-10 between Chandler and Casa Grande will include adding one HOV lane in each direction from Chandler to Riggs Road, about 6 miles[17] and may be the most like what the COMPASS region could expect for its own HOV planning.



Source: azdot.gov/maps

FIGURE 7. ARIZONA FREEWAY SYSTEM MAP

[15] https://azgeo-open-data-agic.hub.arcgis.com/datasets/azgeo::hov/explore?location=33.548364%2C-112.086145%2C10.89

[16] https://www.azleg.gov/ars/28/00737.htm

[17] https://www.fox10phoenix.com/news/i-10-expansion-project-chandler-casa-grande-reduce-congestion

SUMMARY

As the COMPASS region continues to grow and interstate and state highways become more congested managed lanes such as HOV lanes provide an opportunity for efficient capacity expansion. Work related to public education, policy development, and creating laws are early actions that often require substantial collaboration, and years to put in place. The forthcoming HOV analysis will shed light on the potential number of HOV system users and travel time benefits that will support this collaboration.

FIGURE 8. DOWNTOWN BOISE